



# DM 100



# Product Manual

# Dryer Master Model: DM100

## Product Manual

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**Prepared by: Dryer Master Inc.**

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## 1. Introduction

The standard Dryer Master DM100 configuration includes a micro plc and colour touch screen display unit along with a Dryer Master 2220 series real time moisture sensor and an inline or bypass rotary feed sensor chute. The system is capable of displaying product moisture and product temperature in real time with moisture control being accomplished using a state logic approach.

### 1.1 Moisture Measurement Technology

The Dryer Master 2220 series 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 using the rotary feed chute 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 either by heating or cooling but not limited to either. The sensor's robust construction and conservative installation specifications ensure long product life. The Dryer Master moisture sensor calibration software embedded in this device provides the same reliability and accuracy available in other Dryer Master dryer control systems.

### 1.2 Moisture Control Technology

The Dryer Master DM100 state logic control technology employs a 3-state model triggered by user settable moisture targets, time delays and speed set points for continuous flow dryers. Instead of constantly switching between a high and low discharge speed as used in many smaller on farm drying systems the system switches between higher discharge speed triggered by drier product to normal speed, to lower speed triggered by higher moisture product. Depending on the operating mode the 3 speeds can be either individually set manually, set as a % of the normal operating speed, or as a specific deviation from the normal speed. The trigger points are actual moistures measured by the moisture sensor and delays to activation are user settable from 1 second to 999 seconds or 16.65 minutes.

### 1.3 Information Display and Access

The information display is a micro PLC (Programmable Logic Controller) with an integrated graphics touch screen display and keypad with data being stored internally on a micro sd card. The display unit also has a built in USB port to enable a simple download of operations history in .csv format for use in a standard spreadsheet program. In addition, the DM100 can be connected to a local network to allow remote wireless access on a smartphone.

## 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.

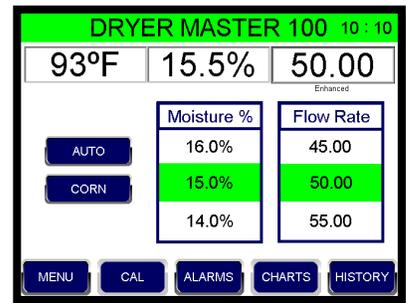


Figure 1 - Main Screen

### 2.2 Moisture Sensor(s)

The DM100 uses a 2200 series Dryer Master moisture sensor. The 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 version

### 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 DM100. 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 DM100 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. Operation Overview

The DM100 user interface uses a color touch screen display. Touchable buttons are used to access settings and to move through menu options.

The Main Screen will look slightly different in the three different modes that can be used with the DM100 (**AUTO**, **MANUAL** or **LOCAL**).

In **AUTO** mode, the Main Screen displays:

- the mode (AUTO)
- the product being dried (CORN)
- product temperature (93F)
- product moisture (15.5%)
- discharge rate (50.00)
- state logic moisture/rate settings in table form.
- Colored blocks to show the state being used for control. The green blocks in the example show that the current moisture is within the main zone (14% to 16%).
- Menu buttons:
  - **MENU** – to access an extended menu (see section 4)
  - **CAL** – to calibrate the moisture sensor (see section 7)
  - **ALARMS** – to see active and historical alarms
  - **CHARTS** – to see graphs for moisture and discharge rate
  - **HISTORY** – to see historical 10-minute averages

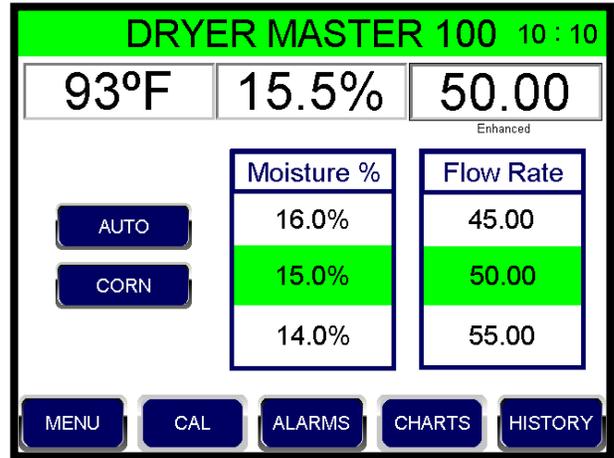
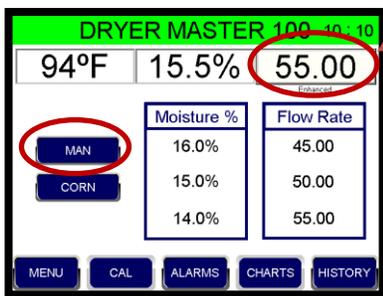
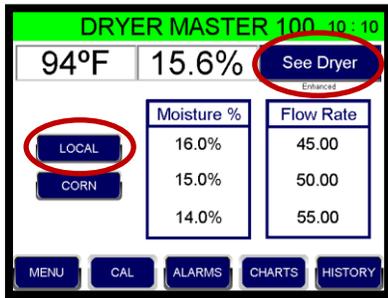


Figure 4 - Main Screen - Auto mode



In **MANUAL** mode the same information is displayed as in Auto mode, with the exception that the control blocks are no longer colored. The discharge rate is set by the operator from the DM100 display. The discharge rate only changes when the operator makes a change from the display. To change the discharge rate the operator touches the Rate area. This brings up an entry keypad used to enter a new rate.

Figure 5 - Main Screen - Manual mode



In **LOCAL** mode the DM100 panel acts only as a display device for product moisture and temperature. It does not display or control the dryer discharge rate. In this mode any discharge rate adjustment needs to be made from the dryer panel.

Figure 6 - Main Screen - Local mode

### 3.1 Alarms

Press the **ALARMS** key to access an Alarm History. Press the Active Alarms key to see a list of active alarms.

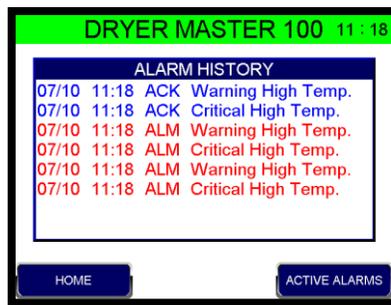


Figure 7 - Alarm History

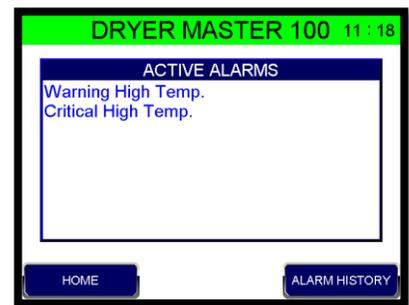


Figure 8 - Active Alarms

### 3.2 Charts

Press **CHARTS** to bring up the chart of recent moistures. On the Moisture Chart, press **RATE** to bring up a rate chart. Press **CHARTING OPTIONS** to go to the charting options page (see section 4.3).

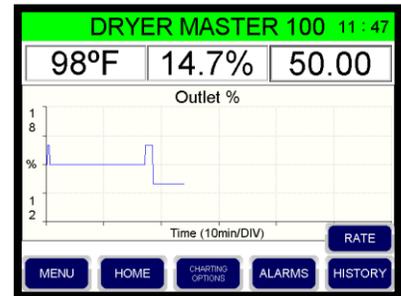


Figure 9 - Moisture Graph

### 3.3 History

Press the **HISTORY** key to get a listing of recent activity summarized in 10-minute intervals. Use the arrow key to scroll through the screens.

Timestamp	Temp	Outlet	Rate
2020 / 7 / 10 11:30	97°F	16.1%	55.00
2020 / 7 / 10 11:20	136°F	15.6%	55.00
2020 / 7 / 10 11:10	147°F	15.5%	50.00
2020 / 7 / 10 11:00	95°F	15.6%	55.00
2020 / 7 / 10 10:50	94°F	15.6%	55.00

Figure 10 - History - 10 minute averages

## 4. Menu Button

Press the **MENU** button on the Main Screen to access the extended settings menu. From this screen the operator can access all the key settings used in daily operations. In addition, the **SYSTEMS SETUP** key provides password protected access to parameters usually only changed infrequently. The USB key brings up a menu to guide the download of historical information to a USB drive.



Figure 11 - Extended Settings Menu

<b>Auto Mode Setup</b>	Set-up or change the parameters for automatic operation (see section 5)
<b>Change Product</b>	Select the product you are drying. Each product will have its own settings.
<b>Set Alarm Limits</b>	Set the levels where you want to be notified of unexpected process conditions.
<b>Charting Options</b>	Select and set chart/trend options.
<b>System setup</b>	Password protected systems settings. These settings are typically only adjusted infrequently. They include settings for remote access, calibration, and network access. (see section 6)
<b>USB Menu</b>	Access the download page to save process history to a USB

### 4.1 Change Product:

Each product being dried has its own settings. These settings primarily relate to calibration and alarm settings. In order to change the product, press the **MENU** key and then select the product from the list displayed.

If the product being dried is not listed, you can change the name of one of the products you are not using to match your product.

*For instructions on changing product names see section 6.2.*



Figure 12 - Change Product Menu

### 4.2 Set Alarm Limits

Each product has its own alarm limits. To set or change the alarm limits for a product, first make sure the product name on the main screen is the one you want to adjust. Then press **MENU** on the Main Screen and then **SET ALARM LIMITS** on the Extended menu.

There are alarm limits for product moisture and for product temperature.

The alarm limits are set at 4 levels; critical high, warning high, warning low, and critical low. The critical/warning determines how the alarm is displayed on the Main Screen. Warning alarms are displayed in solid orange text. Critical alarms are displayed as flashing red text.

Pressing the Alarms Key on the Main Screen allows you to see both active alarms and an alarm log.

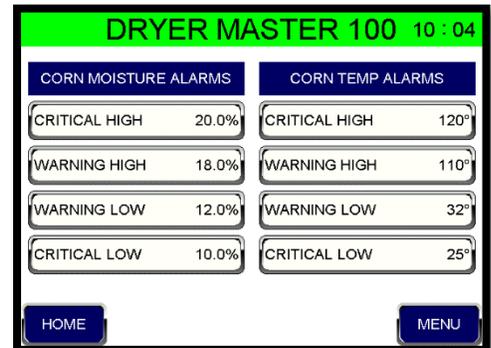


Figure 13 - Set Alarm Limits

### 4.3 Charting Options

To access Charting Options, press the MENU key and then CHARTING OPTIONS from the Extended menu.

To change the ranges on the graphs for either moisture or temperature, press SELECT RANGES. Then select the Range you want to change. Use the arrow keys to scroll through the available options then save and exit.

To choose either a one-hour graph or a two-hour graph, press SELECT TIME SCALE.

To clear data from the current graphs, select CLEAR TREND DATA.



Figure 14 - Chart Options



Figure 16 - Select Moisture or Rate Range



Figure 15 - Select Time Scale



Figure 17 - Clear Chart Data

### 4.4 Saving Data to a USB

From the Main Screen, press the MENU button. From the Extended Menu Screen, press USB Menu. Insert a USB drive into the bottom of the DM100 panel in the slot labelled USB.



Figure 18 - Save to USB Options

From the USB screen select the type of data you want to save to the USB. Data is downloaded in .csv format for easy entry into a spreadsheet program.

Daily History: History saved by day

Monthly history: A month's worth of history, broken down by day.

All History: Download all the history files.

Calibration: Download the calibration history.

## 5. Auto Mode Overview and Setup

Let's start by going over what is meant by "state logic" control. Under automatic state logic control the discharge rate that the DM100 runs at is determined by the current "state" of the moisture reading. If the state changes the discharge rate will change. If the state does not change the discharge rate will stay at its current level.

### 5.1 Basic Example:

In the example to the right, there are three possible moisture states. The moisture can be over 16%, it can be between 14% and 16% or it can be below 14%. For each state there is a corresponding discharge rate.

Because the current moisture is between 14% and 16%, the discharge rate is set at 50 (green blocks).

If the moisture were to go above 16% then this would be a new state and the discharge rate would now change to 45. Similarly, if the moisture fell below 14% this would also be a new state and the discharge rate would change to 55.

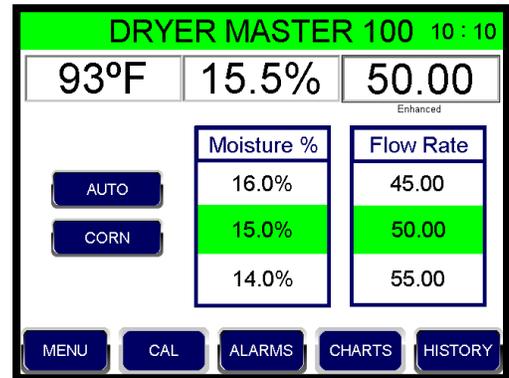


Figure 19 - Auto Mode - Basic Example

### 5.2 Setting Moisture Trigger Points:

The **AUTO MODE SETUP** button brings up the configuration screen.

As a first step, set the moisture levels at which the DM100 should change the discharge rate. These will depend upon a number of factors specific to your operation including the product being dried, and the expected variation in outlet moisture.

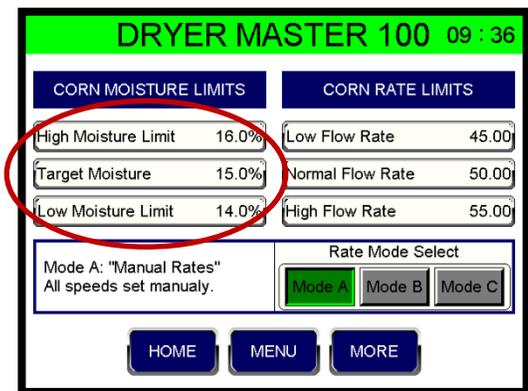
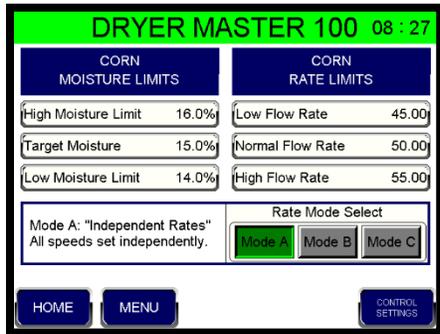


Figure 20 - Setting Moisture Trigger Points

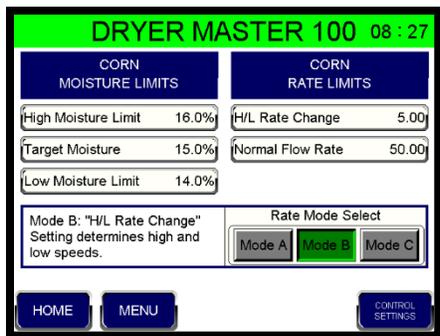
### 5.3 Setting Flow Rates (Discharge Rates):

There are three ways to set the three flow rates. The Mode is selectable by pressing the corresponding button.



**Mode A:** Individual. Each of the three rates is set individually. In the example the values are set proportionately, but they can be set in any configuration.

Figure 21 - Mode A Example



**Mode B:** High/Low. First set the Normal Flow rate. Then set the H/L Rate Change. This is the amount above and below the normal flow rate that will be used to set the Low and High Flow rates. In this example the Normal flow rate is 50 and the H/L Change is 5.0, so the High rate will be 55 and the low rate 45.

Figure 22 - Mode B Example

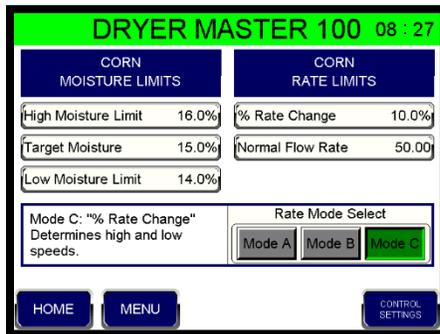


Figure 23 - Mode C Example

**Mode C:** % Rate Change. First set the Normal Flow rate. Then set the % Rate Change. This is the percentage above and below the Normal flow rate that will be used to set the Low and High Flow rates. In this example the Normal Flow Rate is 50 and the % Change is 10%. Since 10% of 50 is 5, the High rate will be 55 and the low rate 45.

All modes will require some tuning to optimize the system operation. Different dryers and different products will require slightly different operating parameters. The default parameters should allow the system to operate and provide good results. Adjusting the moisture targets and limits and finding the optimum speed offsets for your application should allow the system to maintain very good moisture control.

The key is to maintain the normal running rate settings where it needs to be and provide a sufficient window with the high and low rate change settings to allow the system to operate effectively.

To access additional control settings, press the **CONTROL SETTINGS** button.

## 5.4 Setting State Logic Control Timers

Let's take an example where the moisture triggers are 14%, 15% and 16%. If the moisture is currently 14.5%, the discharge rate will be 50. If the moisture drops to 13.8%, we want to see the rate increase to 55.

### Going above or below the Normal moisture range.

But, how long should the moisture have to be below 14% before the rate changes? It is possible that the moisture fluctuates between 14.1% and 13.9%, and so could continuously be changing the rate.

To stop this you can use the **Hi/Lo delay time (Press Control Settings)**. This is the period of time that the moisture has to stay above the upper moisture, or below the lower moisture before a rate change is made (in seconds). So a value of 300 means that the moisture in our example would have to be below 14% for 5 minutes (300 seconds) before a rate change is made. On the Main Screen a counter below the Product button shows the time until a rate change is made.

### Returning to the Normal moisture range

If the moisture is below the Normal range, and then moves into the Normal range, there are two ways to handle the timing (Normal Speed Delay Time). (To access, press **Control Settings** from the Timer Settings page).

**Enhanced Mode:** In the Enhanced mode it is not enough for the moisture to go back to the Normal range. It must also go past the Normal range moisture level. So if the moisture was 13.8, it would have to go to above 15% for the Normal Speed Delay Time, before a rate change occurs. (If it was say 16.3%, it would have to go below 15% for the delay time before a rate change occurs).

**Standard Mode:** Once the moisture passed the trigger moisture, the Normal Speed Delay Time starts counting down. The moisture does not first have to pass the Normal moisture. So, in our example, if the moisture was 13.8%, then a move to 14.2% (back over 14%) for the delay time would cause a rate change to occur.

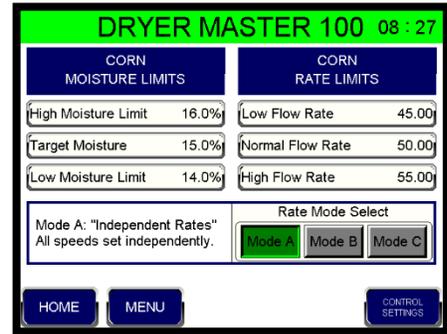


Figure 24 - Mode A Settings Example

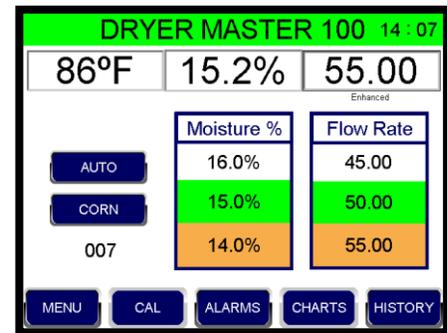


Figure 25 - Transition to New State Example



Figure 26 - Control Settings

## 6.0 System Setup

Press the SYSTEM SETUP key to bring up the password screen. System setup features are password protected to help avoid accidentally changing values that are rarely adjusted.

At the password screen, enter the password **6853**, followed by Enter.



Figure 28 - Password Entry Screen



Figure 27 - System Set-Up Screen

### 6.1 Discharge Settings

The rate scale values determine the maximum and minimum displayed values for discharge rate. Different systems have different indicators of speed. These values are typically set to mimic the systems current values.

By default, the maximum output voltage is 10 volts and the minimum output voltage is 0 volts. The output voltage needs to be scaled to give the correct discharge rate reading on the screen.

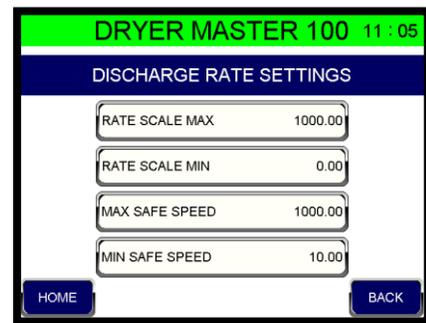


Figure 29 - Discharge Rate Configuration

For Example:

Suppose we have the following application

The maximum displayed value = 100 and the voltage we need = 8 volts

The minimum displayed value = 0 and the voltage we need = 2 volts

For a range of 0 to 100 we have a voltage change of 2 to 8 volts or span of  $(8-2=6)$  6.

This means we have  $(100 / 6) = 16.67$  speed units per volt

The minimum displayed value = 0 and the voltage is 2 volts. Therefore, we will need to subtract  $(2 * 16.67 = 33.34)$  from the 0 value. "Rate Scale Min" becomes -33.34

The maximum display value of 100 is reached at 8 volts. Therefore at 10 volts we would see  $(10 * 16.67 = 166.70)$ . So, the "Rate Scale Max" value will need to be set to  $(166.70 - 33.34 = 133.36)$ .

## 6.2 Product Settings

Each product has its own specific settings that are used to convert the moisture sensor signal to a moisture reading.

If the product being dried is not listed, it is possible to change the name of one of the current products. Press the name of one of the products you are not using. This will bring up a keypad. Enter the name you want to use, and press **Enter**. The new name will replace the old name.



Figure 30 - Product Specific Settings

The most important number is the product slope. Products with different densities will require different starting slopes. Section 8.3 has a list of different products and suggested starting slope values. **If you change the name of a product, make sure to verify that the slope value being used is correct for that product.**

Unless specifically instructed to do so by the Dryer Master Support Center, the TC (temperature compensation) values should be left at 0. Temperature compensation is done on board the sensor.

When doing sensor calibrations, it is the offset value that is adjusted. As a result, this number will change over time as you enter calibrations.

## 6.3 Calibration Settings

For a description of the two calibration methods see Section 7.0.

The sensor **calibration factor** is used in advanced calibration. If there is a difference between the manual test reading and the DM100 reading, and adjustment is made. Using a factor of .5 (recommended), means that  $\frac{1}{2}$  of the difference will be adjusted for.

The **calibration return time** is the delay before the calibration entry screen appears after a calibration is initiated.

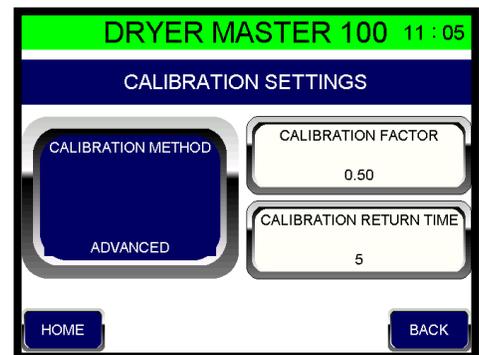


Figure 31 - Calibration Configuration

### 6.4 Sensor Settings

The values on this screen are rarely adjusted, but this screen can sometimes be used for diagnostic purposes.

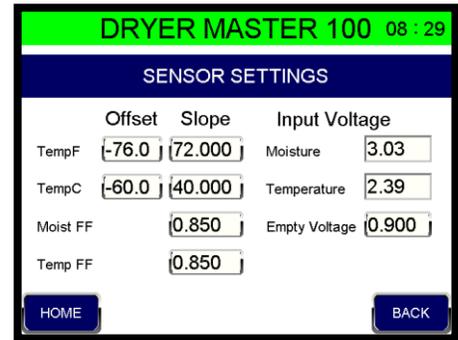


Figure 32 - Sensor Settings

### 6.5 Alarm Setup

**Local Time Delay:** Time between when an alarm condition occurs and when the audible alarm is initiated.

**Remote Alarm:** A remote alarm can also be wired to provide an audible signal away from the unit. If one is being used, this setting should be **ON**.

**Remote Time Delay:** Time between when an alarm condition occurs and when the audible alarm for the remote alarm is initiated.



Figure 33 - Alarm Settings

### 6.6 General Settings

The following general settings are available.

**Language:** Currently only English is available

**Temperature scale:** Choose Fahrenheit or Celsius

**Date/Time:** Set date and time

**Screen Saver:** To turn on screen saver and set delay time.

**System Info:** Software version and the screen used to load system updates. (Note the phone number for Customer Support in North America is toll free – 1-888-318-0009)



Figure 34 - General Settings

## 6.7 Output Scaling

The DM100 is able to output an analog signal for the moisture and temperature readings of each sensor. It is also able to output a signal for the set discharge rate.

This menu section allows for the analog outputs to be scaled to an output range that works with your outside system.

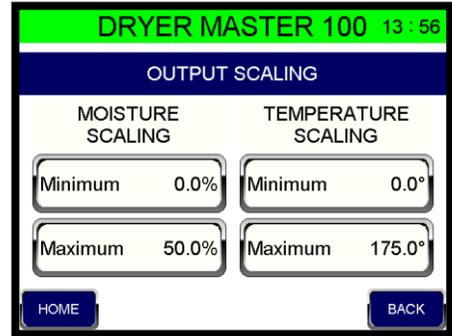


Figure 35 - Scaling Outputs

## 6.8 Network Settings

To set up the DM100 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 the sensor.

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.

See Appendix 1 for detailed instructions on setting up the smartphone app.

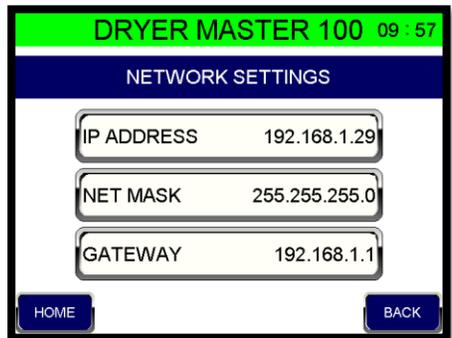


Figure 36 - Network Access Setup Screen

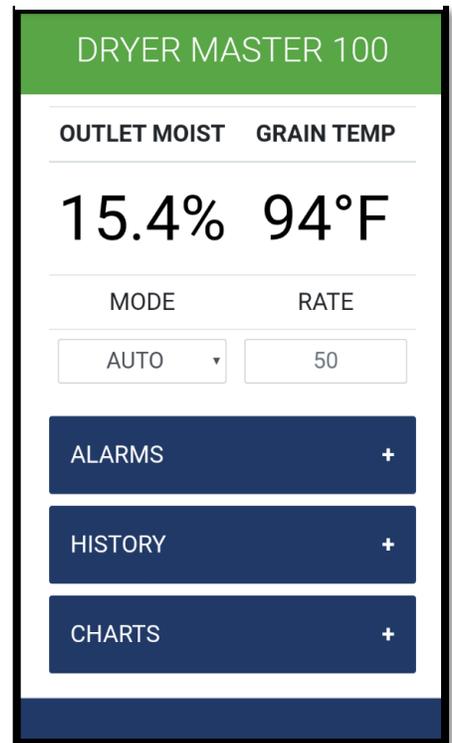


Figure 37 - Smartphone Access Layout

## 7.0 Sensor Calibration

There are two sensor calibration methods: basic and advanced. With “standard” calibration the operator adjusts the sensor reading directly. With “advanced” calibration the DM100 takes a 30 second average moisture reading which is then compared to the moisture sample taken by the operator over the same time period.

To select the method, press **MENU** followed by **SYSTEM SETUP**. Enter the password 6853, then Enter. Next press **CALIBRATION SETTINGS**. Press the **CALIBRATION METHOD** button to change the method.

### 7.1 Standard Calibration

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. (The **EXIT** key changes to a **SAVE** key once you make an adjustment.)
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 38 - Standard Calibration Adjustment



Figure 39 - Calibration Complete Button

## 7.2 Advanced Calibration Method

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

Without the calibration button:

1. Press **CAL** on the Main Screen.
2. Press **START**. The DM100 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, gradually take a number of small product samples at the sensor and put them into a container.
5. After mixing the contents of the container together 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 DM100 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 5, 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 **HOME**. 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 SETUP**, go to **CALIBRATION SETTINGS**, and enter a value for Calibration 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 40 - Start Calibration (Advanced)



Figure 41 - Sample Entry Screen



Figure 42 - Calibration Complete Button

With the calibration button

1. Press the calibration button at the sensor.
2. The button lamp will flash for 30 seconds and the DM100 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 and put them into a container.
4. After mixing the contents in the container together 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 DM100 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.

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 **HOME**. 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 SETUP**, go to **CALIBRATION SETTINGS**, and enter a value for Calibration 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 43 - Sample Entry Screen



Figure 44 - Calibration Complete Button

## 8 Electrical connections

### 8.1 Device Connections

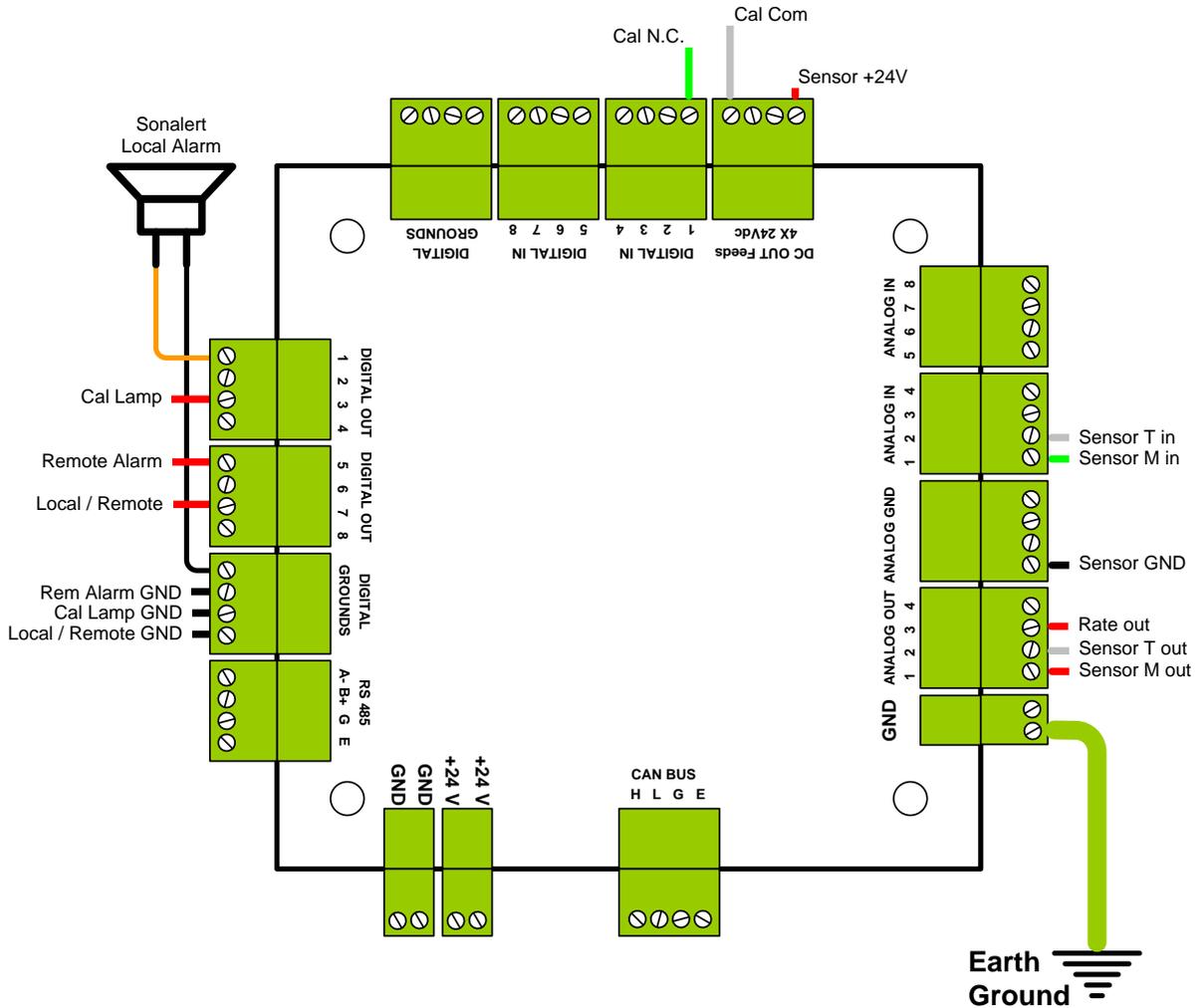


Figure 45 - Connections

**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.**

## 8.2 Device Connections, Sensors & Calibration Buttons

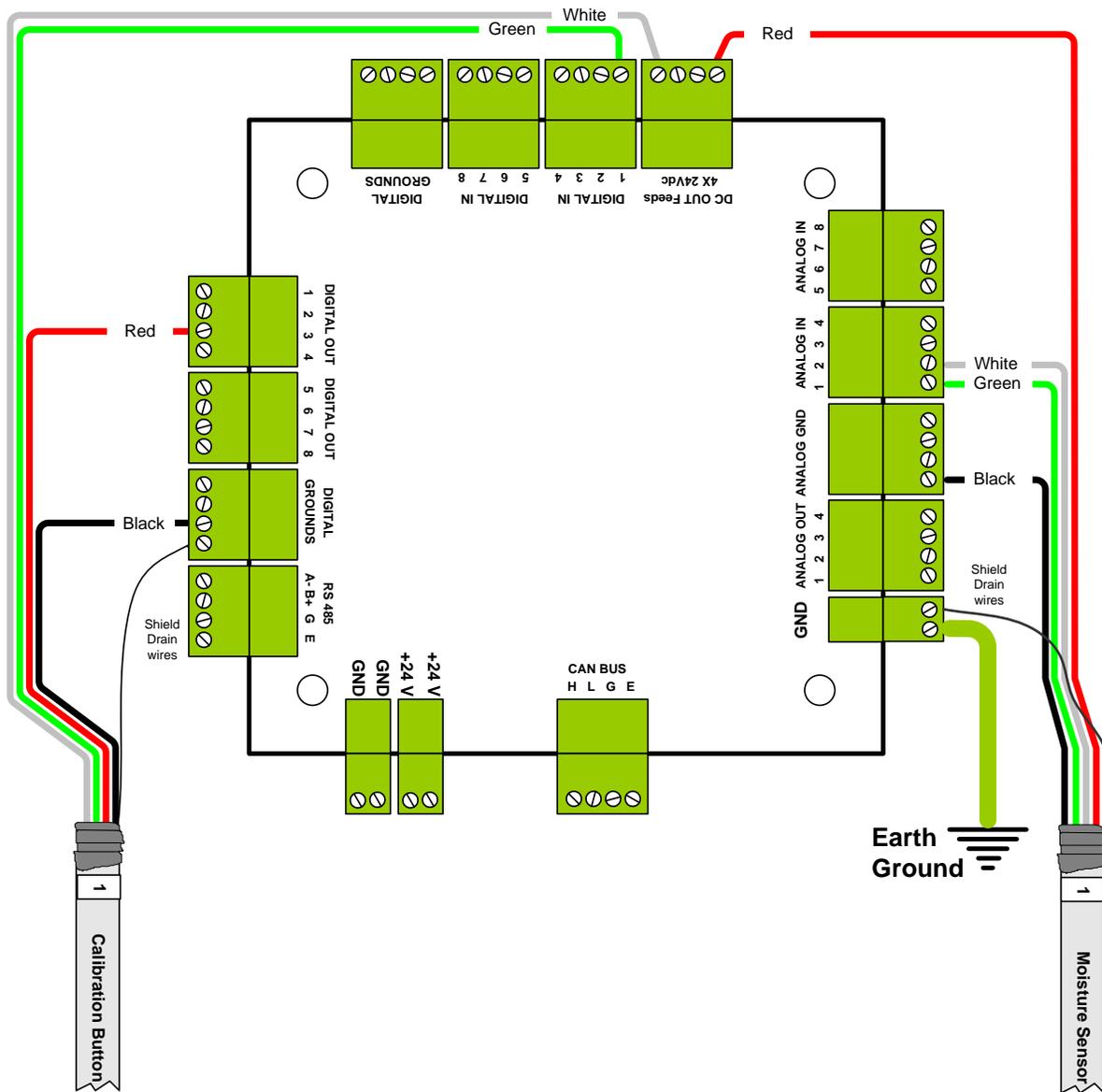


Figure 46 - Device connections, sensors & calibration button

### 8.3 Device Connections, Alarm Output & Analog Output

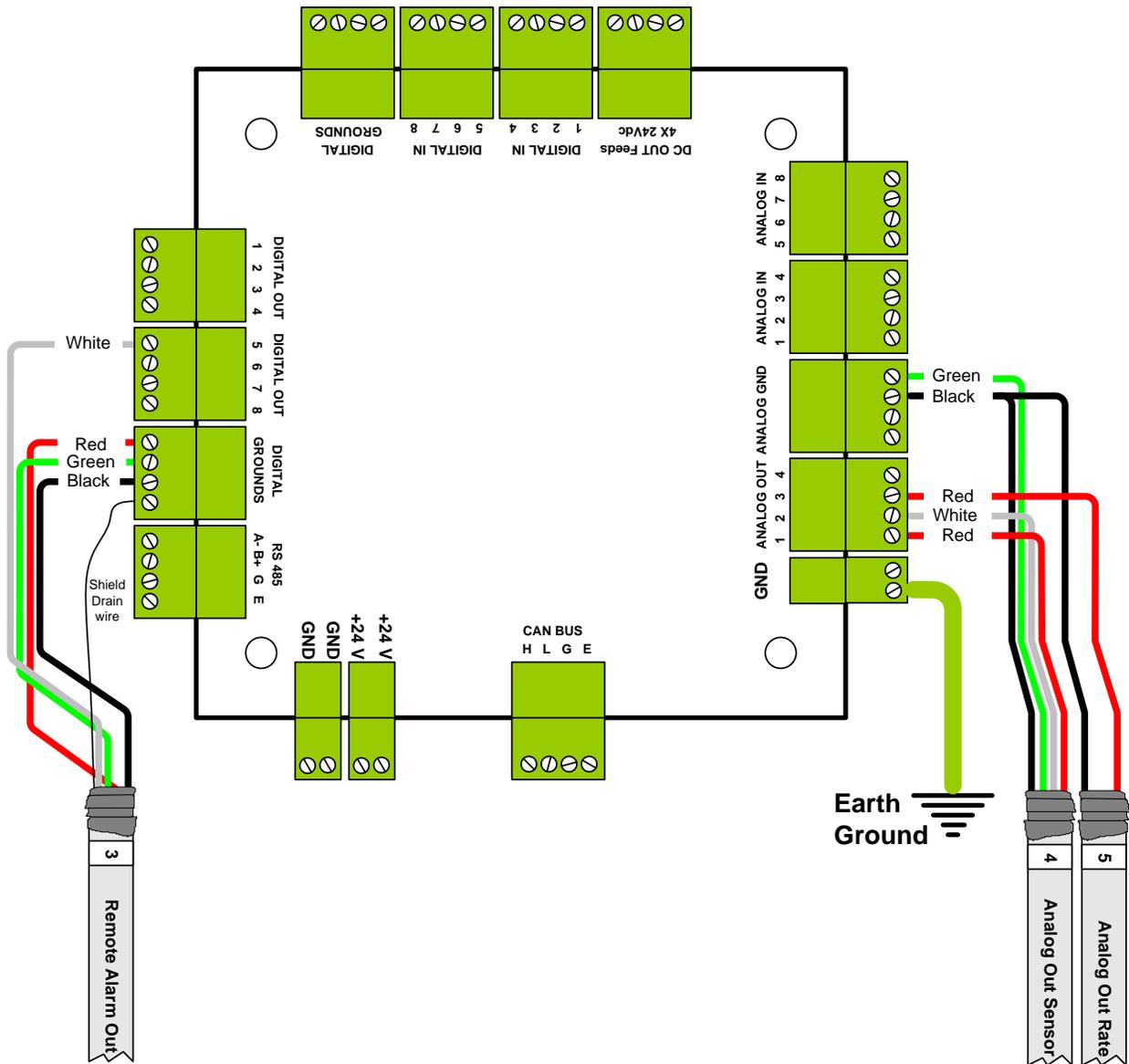


Figure 47 - Device connections, Alarm Output & Analog Output

### 8.4 Field Connections

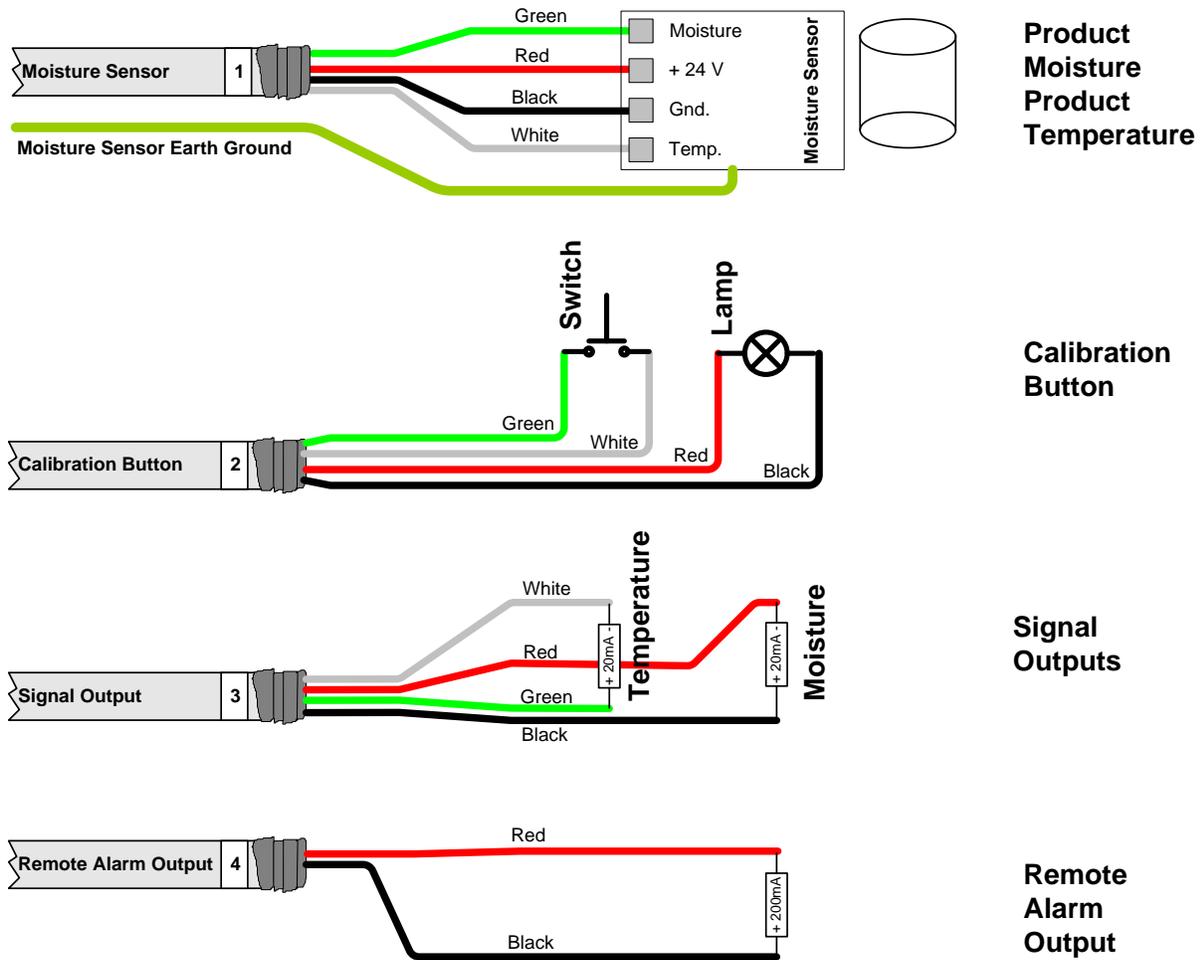


Figure 48 - Field connections.

### 8.5 DM100 to Generic VFD Connection (0-10 vdc input)

Note: To achieve the most flexibility and still maintain the use of a manual speed potentiometer for the just in case scenario the speed setting signal is wired into the same terminal as the manual speed setting potentiometer. The relay serves to connect either the speed potentiometer or the PLC speed signal to the input terminal of the speed control is now routed through the relay. With the relay **not** energized the Speed Potentiometer is in control.

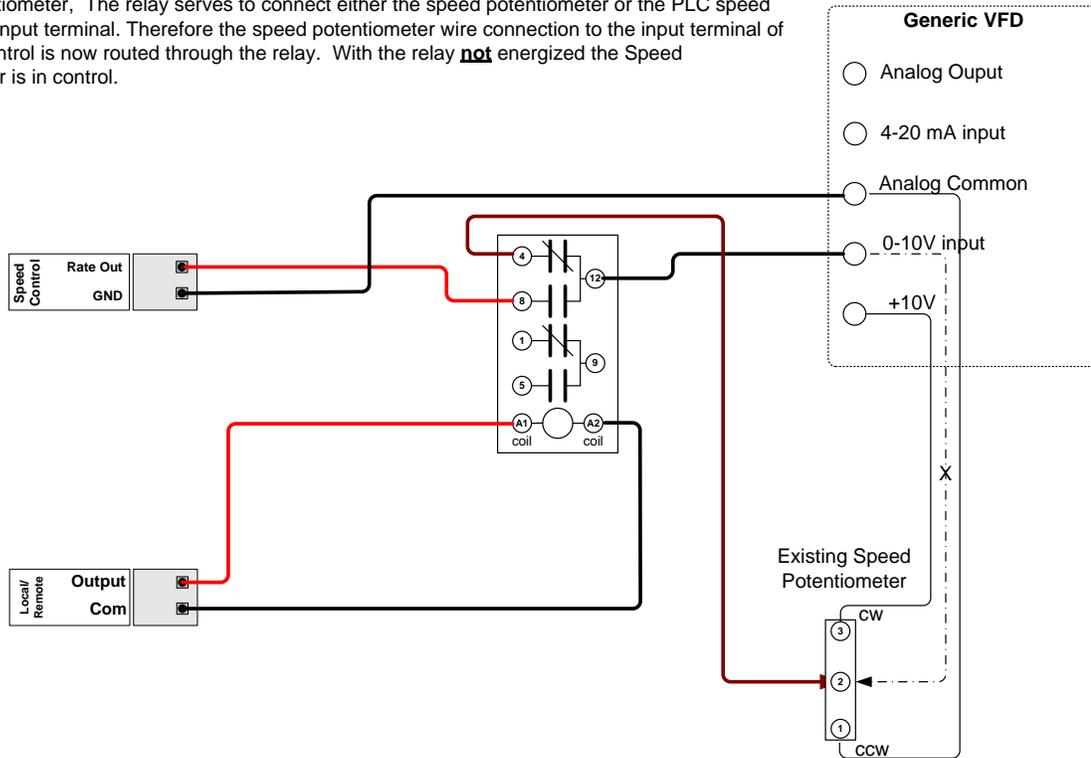


Figure 49 - DM100 to Generic VFD (0-10 vdc)

## 9 Moisture Sensor General Specifications

### 9.1 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.

### 9.2 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/cm<sup>3</sup> (10 lbs/foot<sup>3</sup>) to 1.5 g/cm<sup>3</sup> (95 lbs/foot<sup>3</sup>), and product temperatures from (negative) -25 to (plus) + 95 degrees Celsius (-13 to 200 degrees Fahrenheit).

### 9.3 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 DM100 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 below gives suggested starting slopes based upon the density of the product for which moisture is being measured.

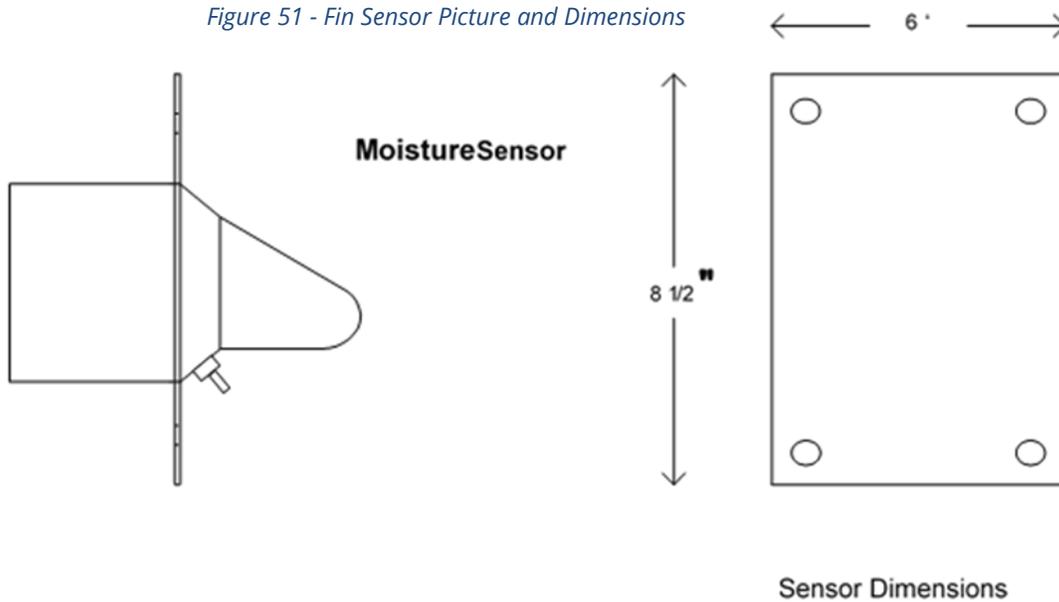
Material	(lb/ft <sup>3</sup> )		lbs/bu		(kg/m <sup>3</sup> )		recommended starting slope	recommended starting offset
	from	to	from	to	from	to		
Peanuts, unshelled	15	24	18.67	29.87	240.28	384.44	8	-2
Sunflower, unshelled	18	26	22.40	32.36	288.33	416.48		
Cat food	20	25	24.89	31.11	320.37	400.46	7	
Coffee bean, roasted	22	30	27.38	37.33	352.41	480.56		
Beans, coffee	22	40	27.38	49.78	352.41	640.74	-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 50 - Recommended Initial Slope Values

### 9.4 Dryer Master 2220-11-series, Fin Sensor



Figure 51 - Fin Sensor Picture and Dimensions



**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

## 9.5 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.

## 9.6 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.

## 9.7 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.

## 9.8 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 moisture 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).
- Potentiometers:** P1, P2, P3, P4.
- Jumpers:** J7 PARK (highlighted with a red dashed circle).
- Other:** MODEL 2220, BTC RB, Serial Number label.

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

**INSPECT & TEST**

- 1) Remove PARK jumper J7
- 2) 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.
- 3) 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.
- 4) 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.
- 5) 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.

- 1) 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).
- 2) 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.**
- 3) 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.**
- 4) P3 and P4 are interactive. Repeat SETUP steps 2 and 3 as required. Return jumper to the STORE position when complete.
- 5) 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:**

- MOIS OUT (green) DC Voltage signal, 0-10Vdc (dielectric)
- TEMP OUT (white) DC Voltage signal, 0-10Vdc (temperature)
- 24 V (red) 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.

Drawn by: WKS	Date: 06/07/14	
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

Figure 52 - 2220 Series Moisture Sensor Inspect and Test

## 9.9 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.

### 9.10 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.

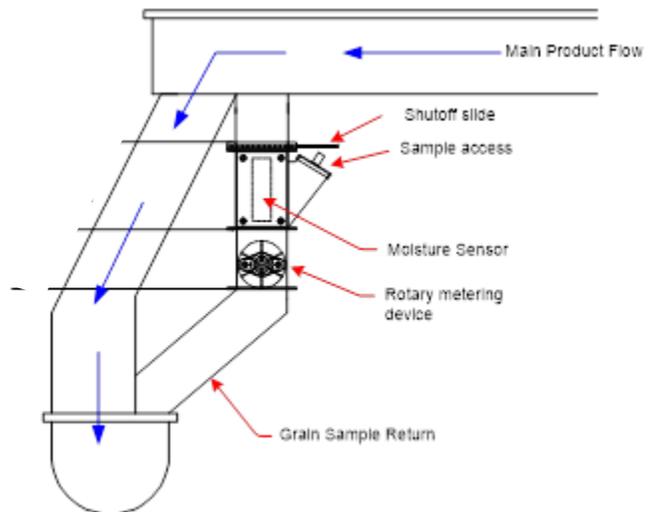


Figure 53 - Bypass type installation

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 to 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)

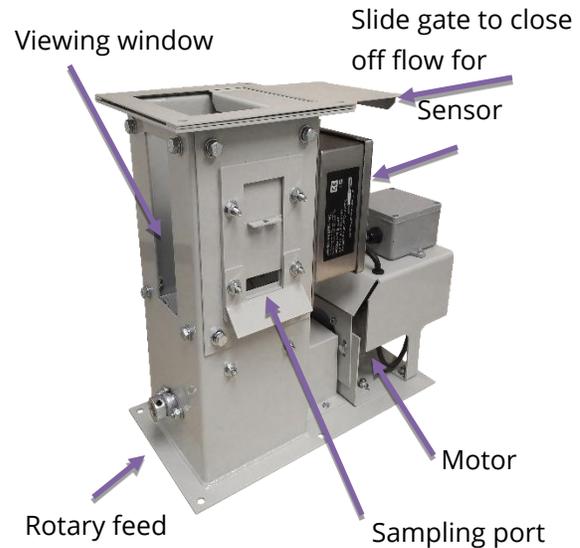


Figure 54 - Outlet Fin in bypass chute

### 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 55 - 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 56 - Example installations of bypass chute with rotary metering

### 9.11 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 past 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

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

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. 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.

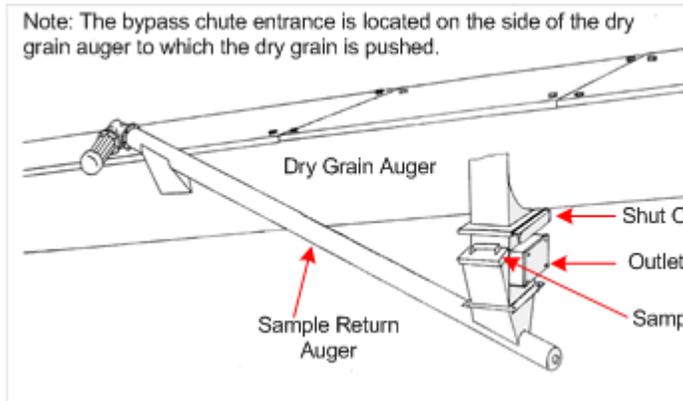
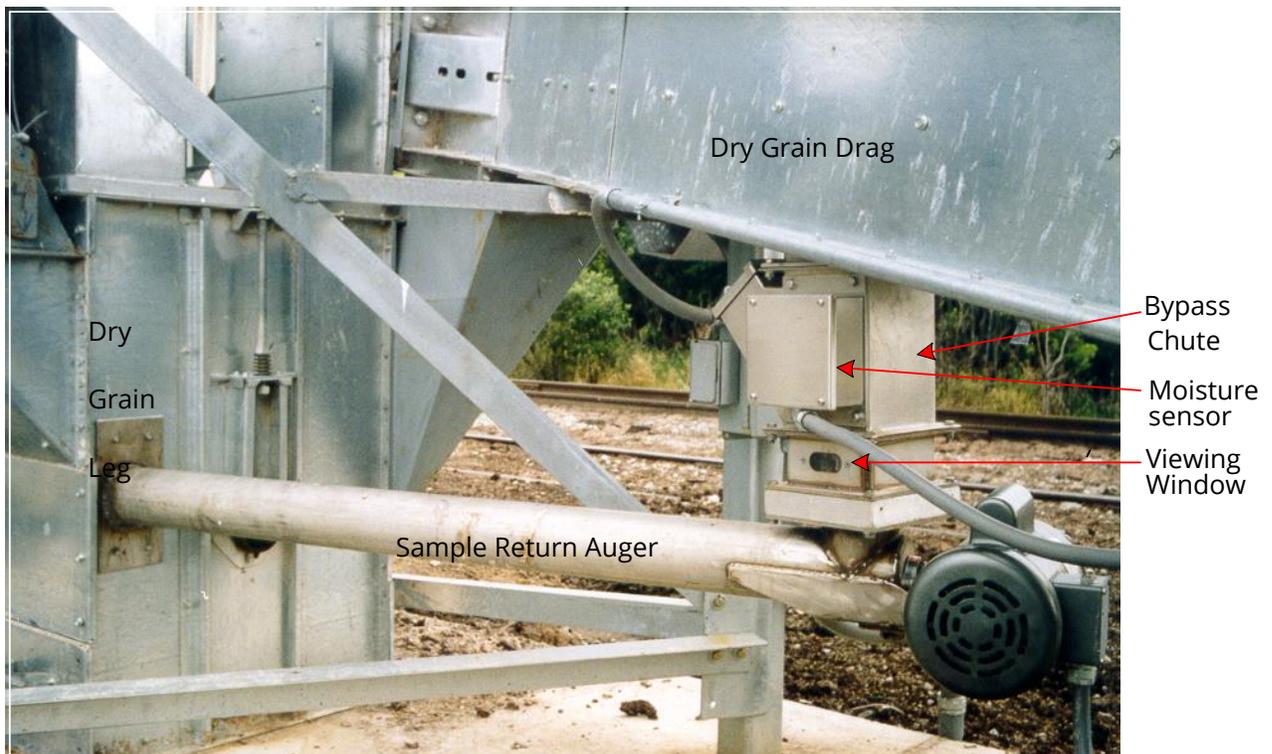


Figure 57 - By-Pass auger installation

Figure 58 - By-Pass auger installation



## 9.12 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 60 - Inline Chute installation

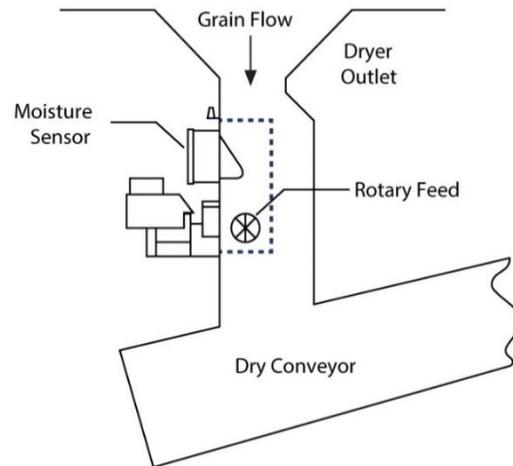


Figure 59 - Inline Chute Graphic

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

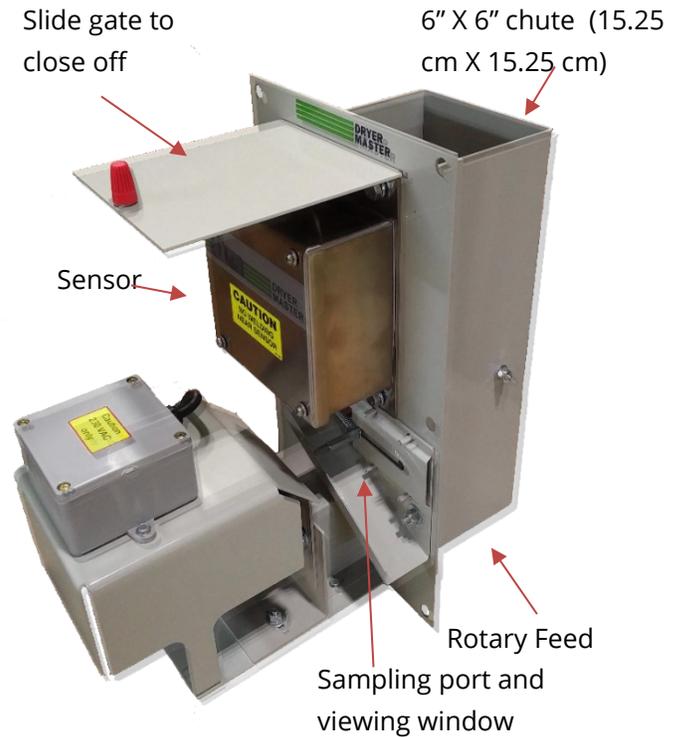


Figure 61 - In-line Chute

# Appendix 1: Connecting to the Web App

## Preface

The tutorial will provide step-by-step direction on Connecting to the Web App for the DM100.

## Requirements

- DM100
- Ethernet cable (to connect the DM100 to the local network)
- A device (such as a: tablet / phone / laptop) connected to the local network by Wi-Fi or Ethernet

## Connect the DM100 to the Local Network

- Use an Ethernet cable to connect the DM100 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 *see page 36*
- Android Device – Connect to local network via Wi-Fi *see page 36*
- Windows Laptop – Connected to local network via Wi-Fi *see page 37*
- Windows Laptop – Connected to local network via Ethernet *see page 37*

### 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., 192.168.1.125)
- 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., 192.168.1.125)
- 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 and Subnet Mask of the Local Network has been obtained by one of the previously outlined methods.
- **PRESS 'MENU' on the main screen of the DM100**
- **PRESS 'SYSTEM SETUP' on the Extended Menu**
- ENTER the password **(6853)**
- **PRESS 'NETWORK SETTINGS' on the SYSEYEM SETUP Menu**
- SELECT 'IP ADDRESS' and enter the address according to the instruction below.

The IP Address you previously wrote down has four numbers separated by dots.

- It will look similar to this: 192.168.1.113

ENTER the first three numbers based on what you wrote down and REPLACE the fourth with the number 29.

- For example: 192.168.1.29

*Note for Advanced Network Users – any private static IP Address can be used here. Just ensure that the address is reserved/unused and restricted from DHCP assignment. Adjust the default Gateway to reflect the chosen IPv4 subnet scheme.*

- Once the IP ADDRESS has been entered, SELECT 'NET MASK'

ENTER the Subnet Mask you recorded in the previous section.

- For example: 255.255.255.0

- Once the NET MASK has been entered, PRESS 'Enter'
- SELECT 'GATEWAY'

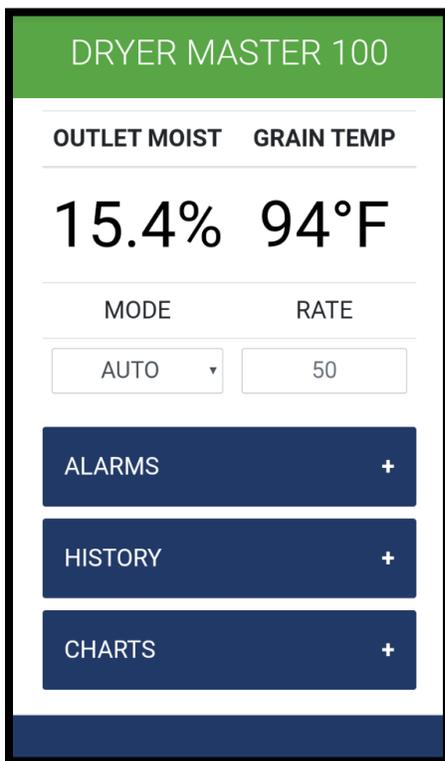
ENTER the first three numbers of the IP Address you entered above and REPLACE the fourth with the number 1.

- For example: 192.168.1.1

- Once the GATEWAY has been entered, press BACK and then HOME to return to the main screen.

## 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 DM100, followed by: /dm100.html
  - Referring to the previous example, the URL would be: **192.168.1.29/dm100.html** . If you get an error after login, it may be because you did not add the “/dm100.html” after the IP address.
- A login screen will appear and then enter your login and password.
  - **Username: dm100**
  - **Password: dryermaster**
- The Web App should now be visible on the device:



## Using the Web App

**DRYER MASTER 100**

OUTLET MOIST    GRAIN TEMP

**15.4%    94°F**

MODE                  RATE

AUTO    ▾                  50

ALARMS                  +

HISTORY                  +

CHARTS                  +

**DRYER MASTER 100**

OUTLET MOIST    GRAIN TEMP

**15.4%    115°F**

MODE                  RATE

AUTO    ▾                  50

ALARMS                  +

HISTORY                  +

CHARTS                  +

ALARMS                  +

ALARM	STATUS
CRITICAL HIGH MOISTURE	OFF
WARNING HIGH MOISTURE	OFF
WARNING LOW MOISTURE	OFF
CRITICAL LOW MOISTURE	OFF
CRITICAL HIGH TEMPERATURE	OFF
WARNING HIGH TEMPERATURE	OFF
WARNING LOW TEMPERATURE	OFF
CRITICAL LOW TEMPERATURE	OFF

ALARMS                  +

ALARM	STATUS
CRITICAL HIGH MOISTURE	OFF
WARNING HIGH MOISTURE	OFF
WARNING LOW MOISTURE	OFF
CRITICAL LOW MOISTURE	OFF
CRITICAL HIGH TEMPERATURE	OFF
WARNING HIGH TEMPERATURE	ON
WARNING LOW TEMPERATURE	OFF
CRITICAL LOW TEMPERATURE	OFF

**HISTORY** +

**HISTORY**

DATE	TIME	MOIST
10-07-2020	10:10	15.6
10-07-2020	10:00	15.5
10-07-2020	09:50	15.5
10-07-2020	09:30	15.5
10-07-2020	09:20	15.6

PREV PAGE 1 OF 11 NEXT  
5 ROWS

**CHARTS** +



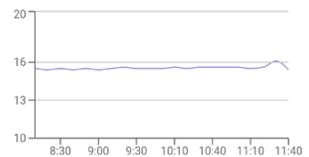
**HISTORY**

DATE	TIME	MOIST	TEMP	RATE
10-07-2020	10:10	15.6	95	55
10-07-2020	10:00	15.5	94	50
10-07-2020	09:50	15.5	94	50
10-07-2020	09:30	15.5	94	55
10-07-2020	09:20	15.6	96	25

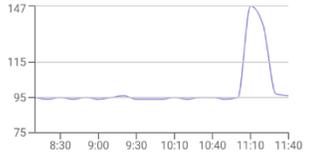
PREV PAGE 1 OF 11 NEXT  
5 ROWS

**CHARTS** +

**MOISTURE**



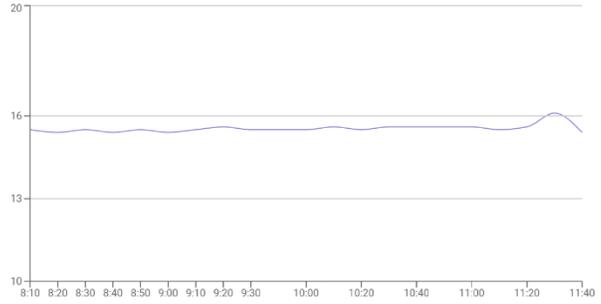
**TEMPERATURE**



**RATE**



**MOISTURE**



## Appendix 2: 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

- DM100
- Ethernet cable (to connect the DM100 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 DM100 to the Local Network

- Use an Ethernet cable to connect the DM100 to a local network router.
- On the DM100: **MENU > SYSTEM SETUP > NETWORK SETTTINGS**
- 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).

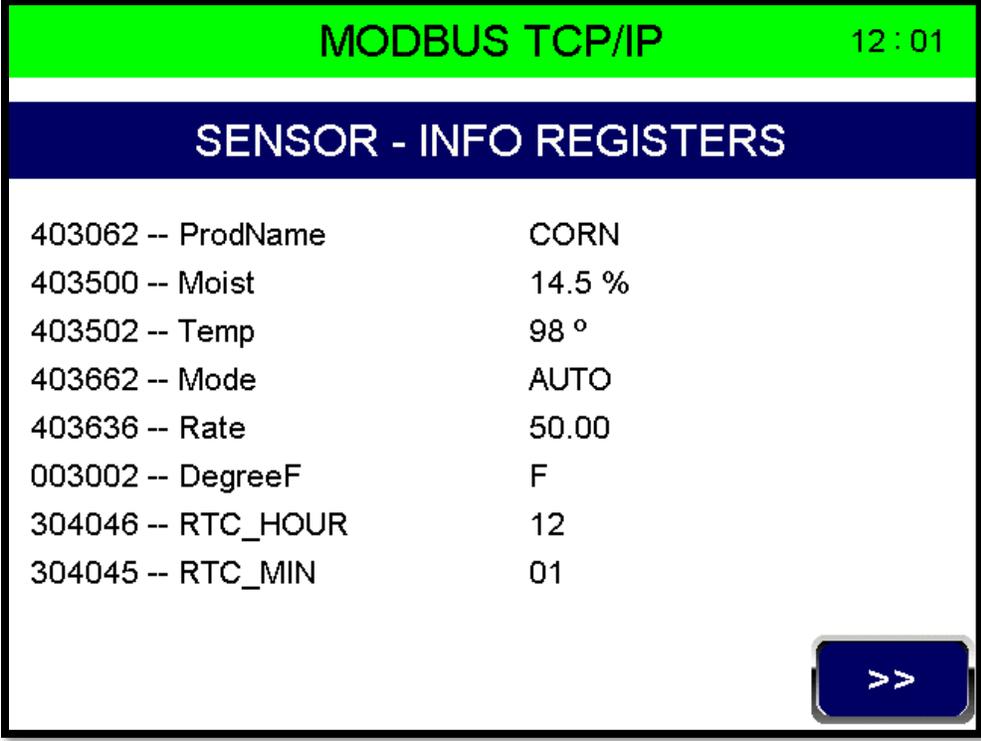
### Step 4: Setup Client-Side Control of Mode

The Client PLC can be setup to control the mode of the DM100. To accomplish this the Mode address specified in Address mapping table can be monitored and controlled by a Client PLC. To implement a safe control structure, it is recommended that two measures are added in the client programming:

- The client should not continuously write to the Mode address. Rather it should only be written to when the client intends to change to the mode (e.g., to either: LOCAL, MAN, or AUTO). To do so, setup a trigger that will activate a single write command to the DM100 server. A trigger could be as simple as a button labelled as “SEND” or a more advanced construct could be something such as an event monitor on a local client register that triggers the write command upon its change in state.
- Secondly, after the write command has been sent to the DM100 server, the Mode register should be monitored to ensure that the transition occurred.

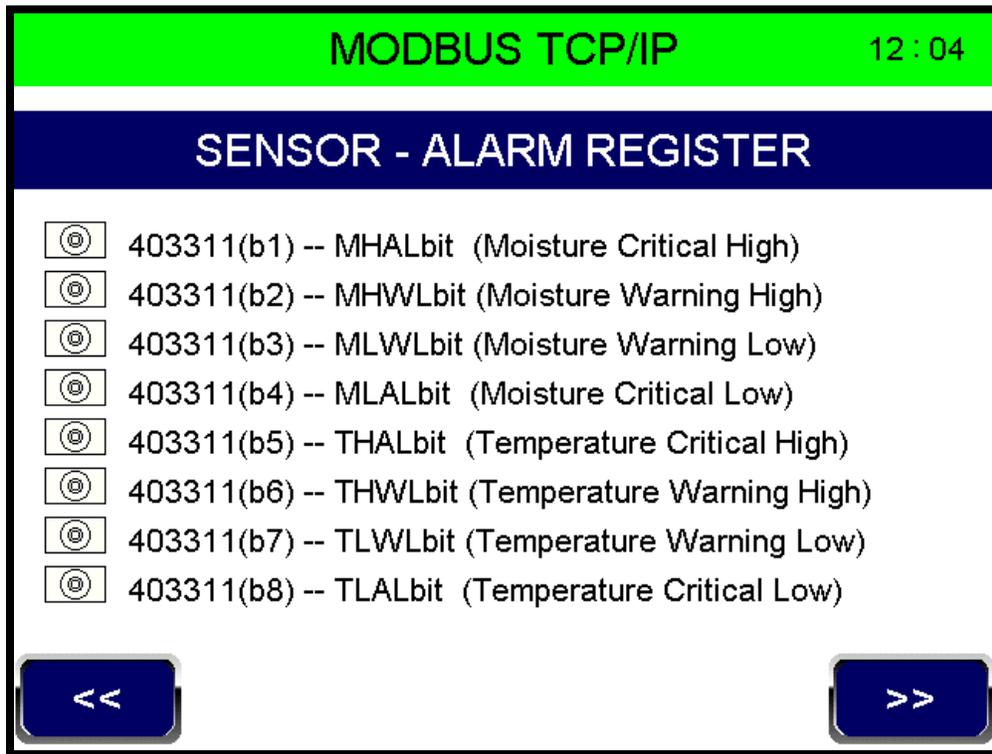
## Basic Example of a Client PLC Program

### Example Screen 1: Info Registers

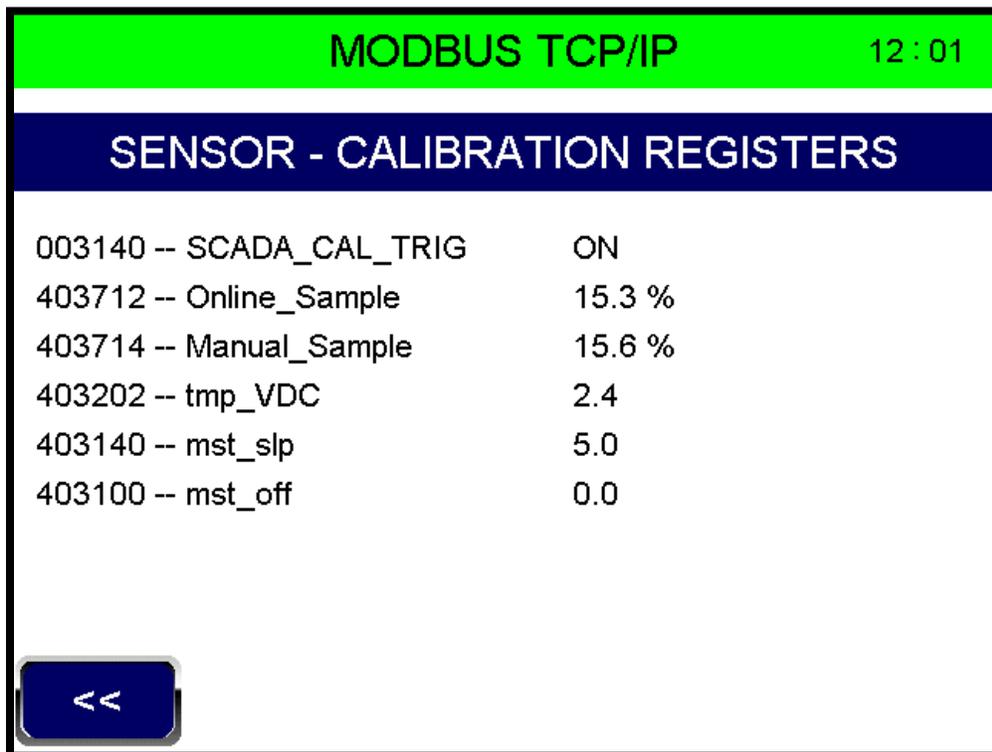


MODBUS TCP/IP		12:01
SENSOR - INFO REGISTERS		
403062 -- ProdName		CORN
403500 -- Moist		14.5 %
403502 -- Temp		98 °
403662 -- Mode		AUTO
403636 -- Rate		50.00
003002 -- DegreeF		F
304046 -- RTC_HOUR		12
304045 -- RTC_MIN		01

### Example Screen 2: Alarm Register



### Example Screen 3: Calibration Registers



## Appendix 3: MODBUS TCP / IP Server Address Mapping

MODBUS TCP / IP MAPPING										
Modicon 6-Digit Addressing	Decimal Addressing	Hexadecimal Addressing	Address Name	Address Description	Data Size	Bit Length	Live Data	Live Control	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 - Product Number 0 = Corn 1 = Beans 2 = Wheat 3 = Canola	WORD	16	✓		✓	✓
403500	RWR 03499	RWR 0DAB	Moist_S1	Sensor - Moisture Percentage	DOUBLE-WORD	32	✓		✓	-
403502	RWR 03501	RWR 0DAD	Temp_S1	Sensor - Temperature Degree	DOUBLE-WORD	32	✓		✓	-
403662	RWR 03661	RWR 0E4D	Mode	Mode 0 = LOCAL 1 = MAN 2 = AUTO	WORD	16	✓	✓	✓	-
403636	RWR 03635	RWR 0E33	Rq_Rate	Discharge Rate	DOUBLE-WORD	32	✓		✓	-
003002	RWB 03001	RWB 0BB9	DegreeF	Temperature Symbol 0 = C 1 = F	BIT	1	✓		✓	-
403311	RWR 03310	RWR 0CEE	MHALbit MHWLbit MLWLbit MLALbit THALbit THWLbit TLWLbit TLALbit	Sensor - Moisture - Critical High Sensor - Moisture - Warning High Sensor - Moisture - Warning Low Sensor - Moisture - Critical Low Sensor - Temperature - Critical High Sensor - Temperature - Warning High Sensor - Temperature - Warning Low Sensor - Temperature - Critical Low	WORD	16	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓		- - - - - - - -	- - - - - - - -
003140	RWB 03139	RWB 0C43	SCADA_CAL_TRIG	Sensor - Calibration In-Progress 0 = OFF 1 = ON	BIT	1	-		-	✓
403712	RWR 03711	RWR 0E7F	Online_Sample	Sensor - Online Sample	DOUBLE-WORD	32	-		-	✓
403714	RWR 03713	RWR 0E81	Manual_Sample	Sensor - Manual Sample	DOUBLE-WORD	32	-		-	✓
403202	RWR 03201	RWR 0C81	tmp_VDC	Sensor - Temperature Voltage	DOUBLE-WORD	32	-		-	✓
403140	RWR 03139	RWR 0C43	mst_slp	Sensor - Moisture Slope	DOUBLE-WORD	32	-		-	✓
403100	RWR 03099	RWR 0C1B	mst_off	Sensor - Moisture Offset	DOUBLE-WORD	32	-		-	✓

