

**Dryer Moisture Systems Inc.**

# **Dryer Master GM<sup>2</sup>**

**Product Manual**

**Revision 1.0**  
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Prepared by:

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**To Our Customer**

Thank you for purchasing the Dryer Master® GM<sup>2</sup> (Grain Moisture Monitor) System from Dryer Moisture Systems Inc. You may or may not be aware that Dryer Moisture Systems Inc. is the manufacturer of *Dryer Master®*, the most recognized grain dryer control solution in the world and the world-wide market leader for moisture control systems for the past twenty-five years.

We are extremely pleased that you have chosen the Dryer Master® GM<sup>2</sup> moisture measurement solution designed specifically for you. The Dryer Master GM<sup>2</sup> is a robust system which is simple to use and can be applied to most if not all grain measurement applications.

Thank you again for purchasing the Dryer Master® GM<sup>2</sup>. We know that you will be pleased with its operation and you will enjoy similar benefits to those provided by the world renowned *Dryer Master®* moisture control system.

Dryer Moisture Systems Inc...

## 1 Introduction

This document provides the operational specification for a moisture display system with a single sensor; product moisture and product temperature are displayed. The system consists of a display unit and a moisture sensor. Both the display unit and the sensor 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 purchased 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 LCD display and 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 previously once only available in the Dryer Master dryer control systems.

## 2 System Overview

The system is comprised of 3 key elements.

- 1) The Display unit is the information provider. Product moisture, product temperature as well as alarms and moisture trends are information continuously displayed. Product selection as well as sensor calibration, alarm function and system setup are all functions accomplished through menus accessed via the key pad and Action Keys. The display has a screen saver that shuts down the back lighting to prolong lamp life.
- 2) The Moisture sensor is the heart of the system. The sensor is located in what is called a compacted product flow situation. This is a chute where the product is slowed and allowed to compact. The sensor measures the free water in the product in this chute. Even and consistent product flow is key to obtaining stable moisture readings.



Figure 1 – System Components

- 3) This adds an enclosure for the display unit, easy to connect terminals and a universal voltage system power supply to power both the Display and Moisture sensor. The supply may also be used to activate alarm low voltage low current alarm devices or alarm contacts. On systems equipped with a Dryer Master Power supply the unit is capable of supplying 24Volts DC at up to 1 Amp and is current limited and designed to shut down in the event of a short circuit.

### 3 System Operation

This section will deal with the most common items needed to operate the unit. Included is a screen map of the various screens displayed during startup and operation when alarm conditions occur, continuing on to product selection and sensor calibration. Also included in this section are common setup functions such as alarm limit settings, alarm action settings and common system settings. The detailed Engineering and device setup functions will be described in another section.

#### 3.1 System displays

Throughout this document there will be references to “**Action Keys**” which refers to the programmable buttons on either side of the LCD display. These buttons take on various functions as you navigate through the screens & menus. The Display may also be referred to as a PLC (Programmable Logic Controller) or an OCS (Operator Control Station).

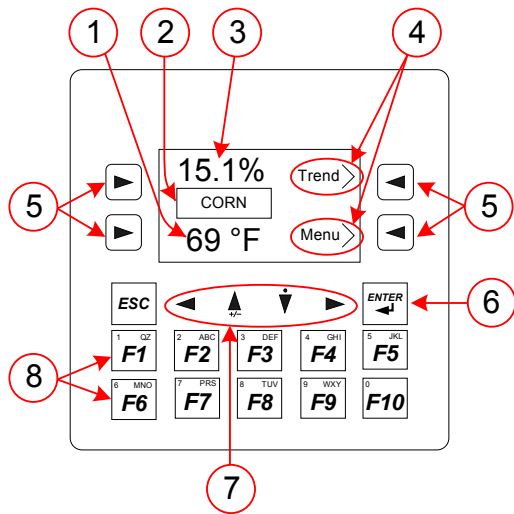
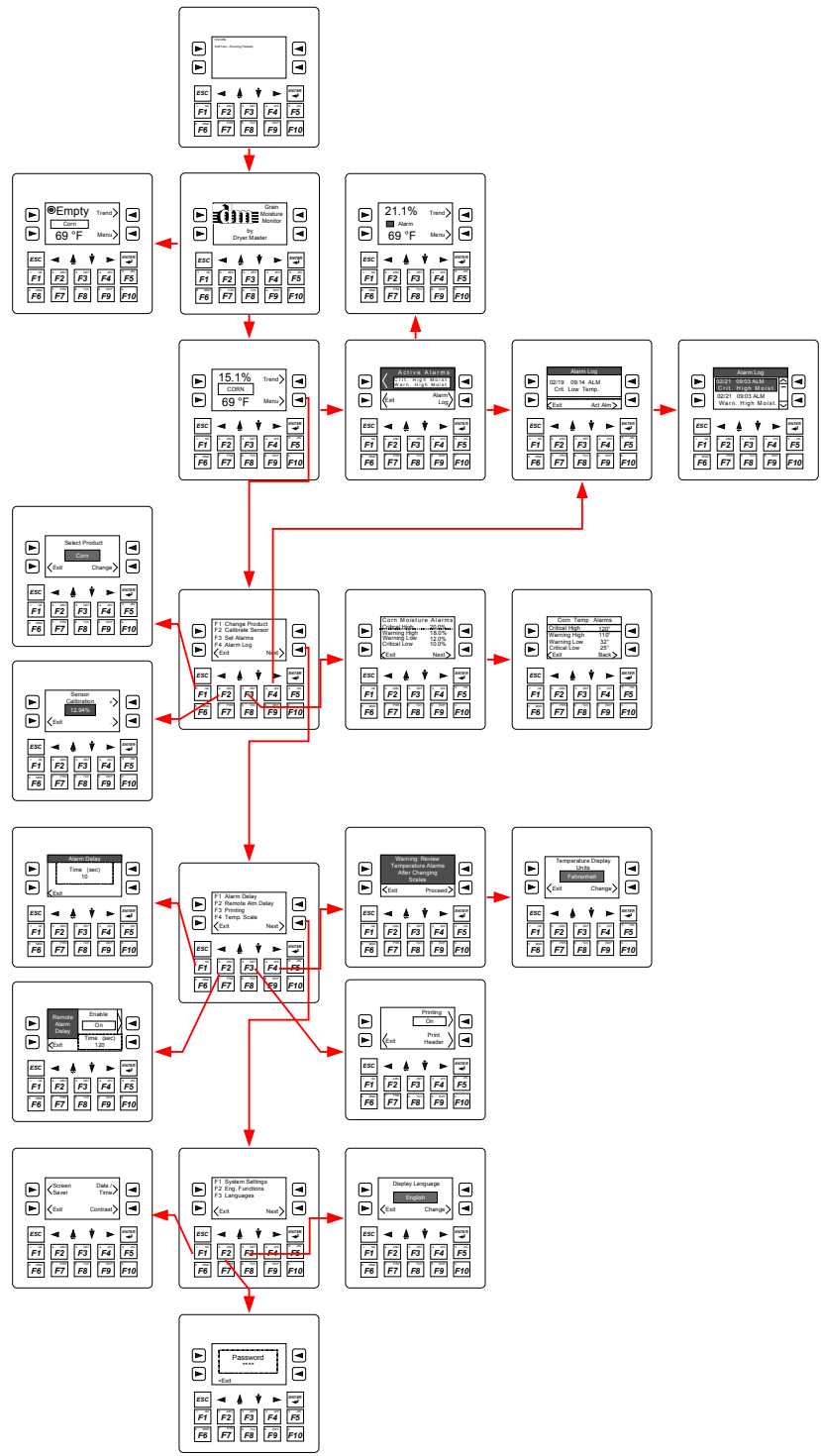


Figure 2 –System display items description.

- 1 **Product Temperature.** Actual temperature of product as detected by the Moisture sensors temperature probe.
- 2 **Product Name.** This is product currently selected for measurement. The text is replaced by an alarm indicator in the event either the product temperature or product moisture is in alarm.
- 3 **Product Moisture display.** Actual moisture of the product as detected by the Moisture sensor.
- 4 **Function** assigned to the programmable keys.
- 5 **Programmable keys,** these are referred to as “**Action**” keys in the document.
- 6 **Enter key.** Used in various screens to select the item to be changed then pressed again to accept the change.
- 7 **Navigation keys,** the down key serves as the decimal place (.) when entering numeric data, the up key serves as the plus (+) and minus (-) key when entering data.
- 8 **Function keys,** F1 through F10 are referred to in various menus. These also serve as the **numbers keys** used for data entry.

### 3.2 System Screens Map



This screens map shows the screens available and the navigation to the various screens

Startup and main operations screens

Viewing and acknowledging alarms

Product selection  
Moisture calibration

Setting Alarms and limits

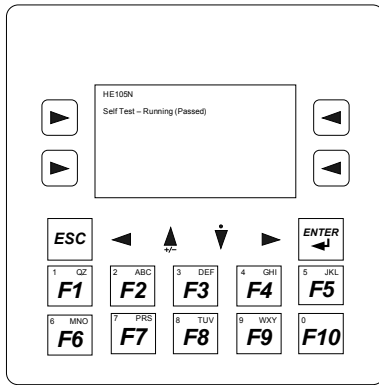
Setting alarm actions  
Printing and data storage actions  
Temperature display mode.

System settings  
Engineering functions  
Language settings

Engineering password entry to gain access to Engineering functions

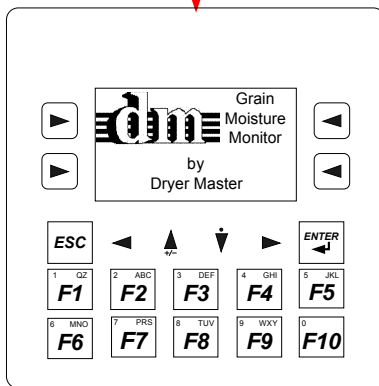
Figure 3 –Screen map

### 3.3 System start displays



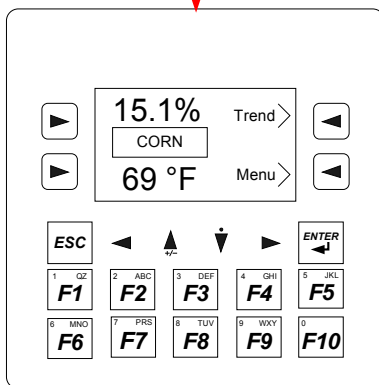
At System start the unit will display the startup diagnostic screen.

Figure 4 –Startup diagnostics display



Once the diagnostics are complete the unit will execute the installed program, during this time the product information screen will display.

Figure 5 –Product information display



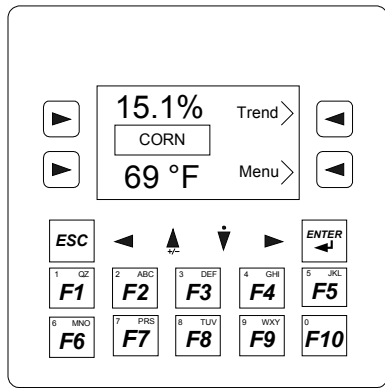
The Main Operations screen displays product moisture, product name, and product temperature.

Press the “Trend>” Action Key to display the moisture Trend display

Press the “MENU>” Action Key to display the additional functions Menu screen

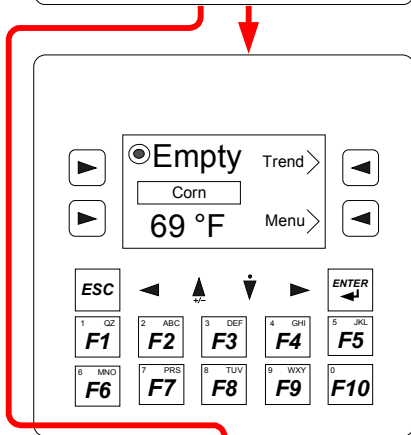
Figure 6 –Main Display

### 3.4 Main operations displays



The Main Operations screen displays product moisture, product name, and product temperature.

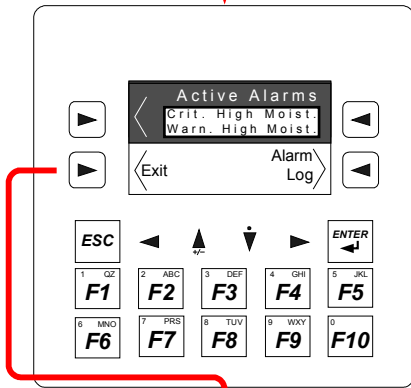
Figure 7 –Main Display



The Main Operations screen will display “Empty” under the following conditions

- 1) If the moisture sensor is partially or completely empty
- 2) The product is flowing too quickly.
- 3) The product moisture is below the sensors reading threshold
- 4) The sensor is not sending a signal
- 5) The sensor is not connected

Figure 8 –Main Display – Empty



The Alarm screen will display when the displayed moisture or product temperature is in alarm.

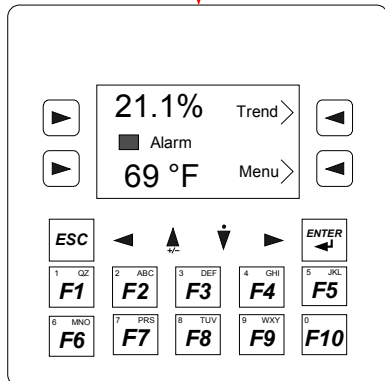
Press the “<Active Alarms>” Action Key To Acknowledge an alarm.

- a) Press the <ENTER> key to bring up the Alarm actions menu.
- b) Press the <F1> key to acknowledge the alarm or
- c) Press the <F3> key to acknowledge all alarms

Press the “<Alarm Log>” Action Key to view the alarm history. See section “Alarm settings” for additional information.

Press the “<Exit>” Action Key to exit

Figure 9 –Alarm screen



The Main Operations screen with active Alarm

The product label is replaced with an alarm event indicator. The alarm Indicator will stay active until the condition clears

See section “Alarm settings” for information on setting the alarm limits.

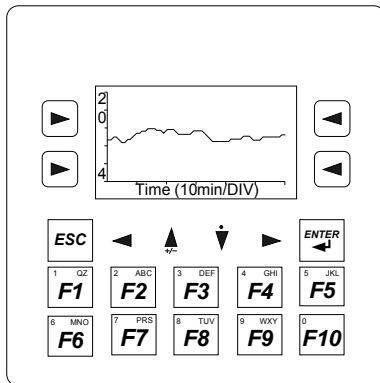
Figure 10 –Main Display – Active Alarm

### 3.5 Moisture trend displays

One (1) hour or two (2) hour moisture trends in 3 moisture ranges are available for display, 0-10%, 10%-20% and 20%-40%.. Trending must be enabled and configured before this function becomes active. See the section on [Trending Options](#) to enable and configure moisture trending.

Note trending is an integrated function of the displays firmware. The information and display scaling is limited.

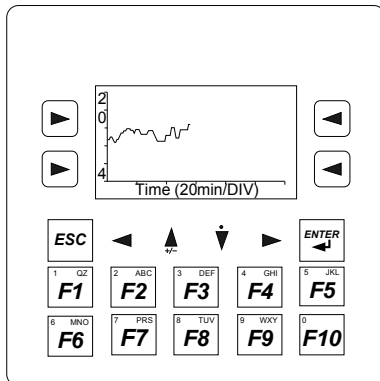
One (1) hour moisture trend



Press the <ESC> or <ENTER>key to return to the main screen

Figure 11 –One (1) hour Moisture Trend

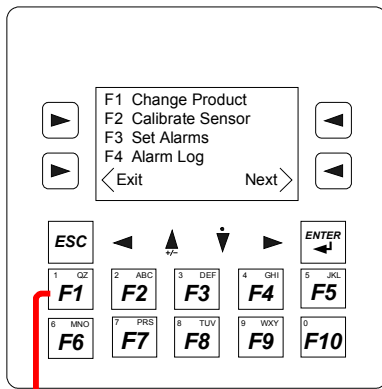
Two (2) hour moisture trend



Press the <ESC> or <ENTER>key to return to the main screen

Figure 12 –Two (2) hour Moisture Trend

### 3.6 Change Product

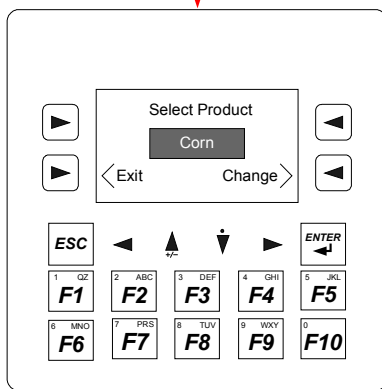


Press the “**Menu >**” Action Key on the main display

Press the <F1> key to open the product change screen

Press the “<Exit>” Action Key to exit

Figure 13 –Menu screen 1



**To change product:**

Press the <ENTER> key to highlight the product.

Press the “**Change >**” Action Key to toggle through the product list..

Press the “<Exit>” Action Key to exit

Figure 14 –Select Product screen

Four (4) Products are available by default, Corn, Beans, Wheat, and Canola/Rapeseed. It is possible to measure products other than the 4 listed. Barley will work well with the wheat settings, mustard seed will work under the canola settings as will most pea and white beans under the bean settings.

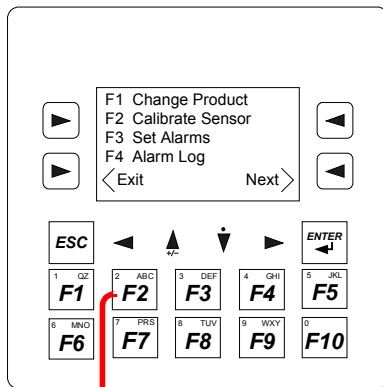
### 3.7 Calibrate Sensor (Standard Method)

The Standard calibration method permits quick adjustment of the displayed moisture by directly adjusting the displayed moisture. For best results only calibrate when the displayed reading has been stable for at least as much time as it takes to gather the sample, return and run the manual test and make the adjustment.

- 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. At the very least minimum of 3 manual tests should be taken and averaged together.
- 4) Again note the displayed moisture. If the change in displayed is less than 0.5%
- 5) Adjust the value in the calibration screen to reflect the test average.
- 6) If the difference in moisture between step 1 and step 4 is greater than 0.5% use discretion in adjusting.

Repeat this as necessary.

For best results with variable product moisture enable the Advanced Calibration in [Engineering Functions](#).

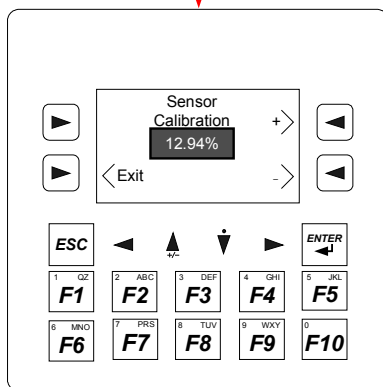


Press the “**Menu >**” Action Key on the main display

Press the “**<F2>**” key to open the Sensor Calibration screen

Press the “**<Exit**” Action Key to exit this screen

Figure 15 –Menu screen 1



**To calibrate the sensor:**

Note: this is the current moisture value as displayed on the main screen.

Press the “**+>**” Action Key to increase the value.

Press the “**->**” Action Key to decrease the value

Press the “**<Exit**” Action Key to exit

Figure 16 –Sensor Calibration screen

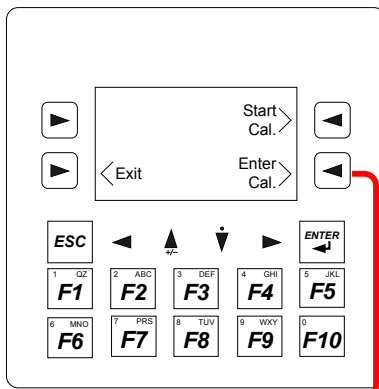
### 3.8 Calibrate Sensor (Advanced Method)

The Advanced calibration method automates the calibration procedure and takes the guess work out of adjusting the moisture reading. This method is generally coupled with a calibration sample start button near the moisture sensor.

**Procedure to taking moisture samples:**

- 1) Press the sample button by the moisture sensor.
- 2) The Sample in progress lamp in the button will flash for 30 seconds during which time the OCS will collect and average the moisture for the 30 second period.
- 3) The manual sample collection must coincide with this test period by taking a number of small product samples over the period the lamp flashes.
- 4) Mix this large product sample and perform a number of off-line manual tests. At the very least minimum of 3 manual test should be taken and averaged together.
- 5) Enter the result in the calibration entry screen.

Repeat this as necessary.

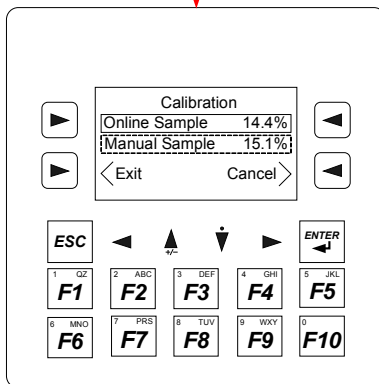


Calibration sample Start & Entry selection menu. This menu is displayed when “Menu” “F2 calibrate sensor” is selected and a calibration has **not** been started with the press of the sample button.

Press the “Start Cal.>” Action Key performs to start a calibration. This is the same function as pressing the sample button. Whenever possible use the sample start button at the sensor to initiate a test.

Press the “<Enter Cal.” Action Key to switch to the Calibration data entry screen.  
Press the “<Exit” Action Key to exit this screen

Figure 17 –Sensor Calibration sample Start & Entry screen



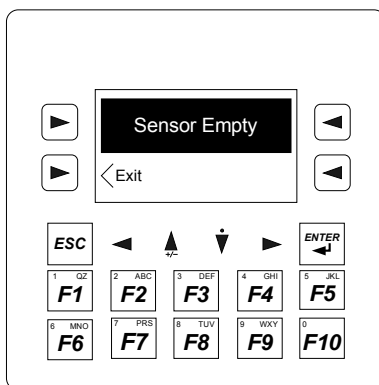
To enter the manual moisture test result  
Press the “Menu >” Action Key on the main display  
Press the <F2> key to open the Calibration entry screen

The Calibration Entry screen displays the 30 seconds averaged **Online Sample** value  
**To enter the manual test result:**

- 1) Press the <ENTER> key to highlight the manual sample value
- 2) Use the number keys to type in the new value.
- 3) The up arrow key selects the “-“ minus symbol, the down arrow key selects the “.” decimal point
- 4) Press the <ENTER> key to accept the new value

Press the “Cancel>” Action Key to cancel a calibration in progress  
Press the “<Exit” Action Key to exit this screen

Figure 18 –Sensor Calibration Entry screen (Advanced Method)

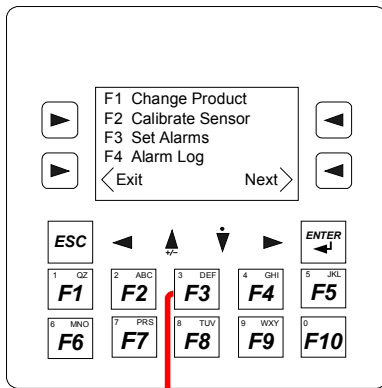


Pressing the sample button while the sensor is empty will display this warning. The calibration procedure will not be initiated.

Press the “<Exit” Action Key to exit this screen

Figure 19 –Calibration start on empty Sensor warning.

### 3.9 Set Alarms



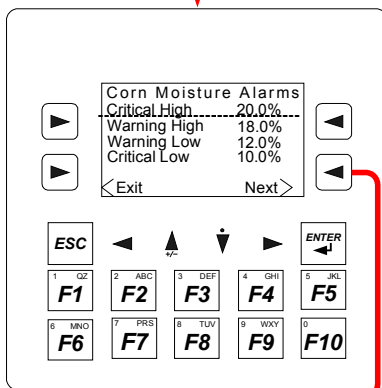
Press the “**Menu >**” Action Key on the main

Press the <**F3**> key to open the Moisture Alarms screen

Note alarms are product specific and will only be set for the current product. To set alarms for the other products select each and return to this screen.

Press the “<**Exit**>” Action Key to exit this screen

Figure 20 –Menu screen 1



#### To Set/ Change Moisture Alarms:

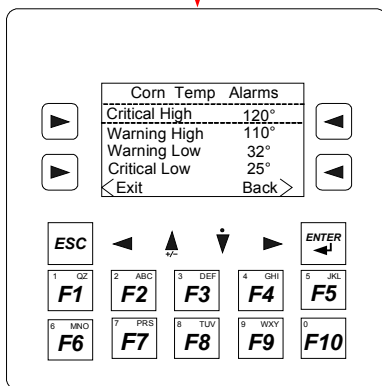
Use the up / down arrow buttons to select the item to change.

- 1) Press the <**ENTER**> key to highlight the value
- 2) Use the number keys to type in the new value.
- 3) The up arrow key selects the “-“ minus symbol, the down arrow key selects the “.” decimal point
- 4) Press the <**ENTER**> key to accept the new value

Press the “**Next>**” Action Key to continue to the next screen

Press the “<**Exit**>” Action Key to exit this screen

Figure 21 –Moisture Alarms settings



#### To Set/ Change Temperature Alarms:

Use the up / down arrow buttons to select the item to change.

- 1) Press the <**ENTER**> key to highlight the value
- 5) Use the number keys to type in the new value.
- 6) The up arrow key selects the “-“ minus symbol, the down arrow key selects the “.” decimal point
- 7) Press the <**ENTER**> key to accept the new value

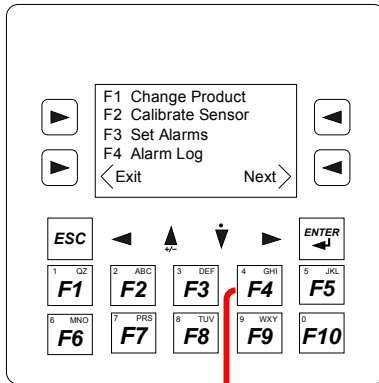
Press the “**Back>**” Action Key to return to the previous screen

Press the “<**Exit**>” Action Key to exit this screen

Figure 22 –Temperature Alarms settings

Note: If you do not wish to use the alarm features set the alarm values out of range.

### 3.10 Alarm Log

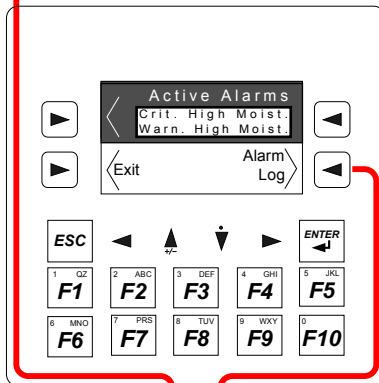


Press the “**Menu >**” Action Key on the main display

Press the <**F4**> key to open the Alarm Log screen

Press the “<**Exit**” Action Key to exit this screen

Figure 23 –Menu screen 1



This Active Alarms screen showing the current alarm is displayed whenever an alarm occurs.

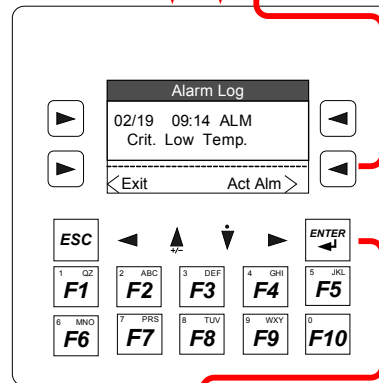
Press the “< **Active Alarms**” Action Key to display the active alarms.

- 1) Press the up / down arrow keys to highlight any specific alarm.
- 2) Press any one of the 4 Action Keys to display the Alarm acknowledge menu.
- 3) Press “<**F1**>” to acknowledge the selected alarm, press “<**F3**>” to acknowledge all the alarms, press “<**ESC**>” to exit without acknowledging the alarm(s).
- 4) Press “<**ESC**>” to return to this screen

Press the “<**Alarm Log**” Action Key to display the alarm log screen

Press the “<**Exit**” Action Key to exit this screen

Figure 24 –Active Alarms screen

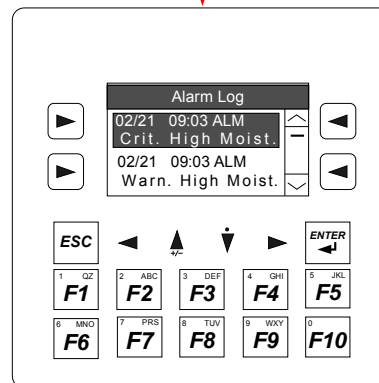


Press the “<**ENTER**>” Key to enable scrolling

Press the “<**Act Alm**>” Key to return to the active alarms screen.

Press the “<**Exit**” Action Key to exit this screen

Figure 25 –Alarm Log screen



Press the up / down arrow keys to scroll this screen. Hold the buttons for fast scroll.

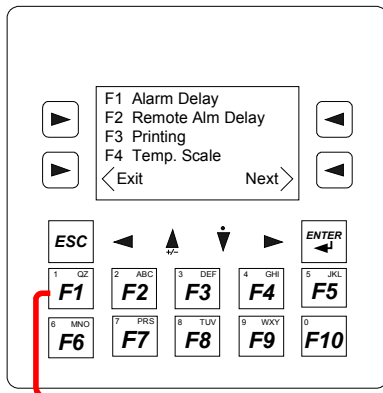
Press the “<**ESC**>” Key to disable scrolling and return to the previous screen.

Press the “<**Exit**” Action Key to exit this screen

Figure 26 –Alarm Log screen scrolling.

### 3.11 Alarm Delay

The purpose of the alarm delay function is to reduce the instances of repeated alarms when either the product moisture or product temperature is moving back and forth over the alarm threshold. This delay ensures the alarm is active for the assigned period. The unit provides signal outputs for audible alarm. Consult the wiring section for connection instructions.

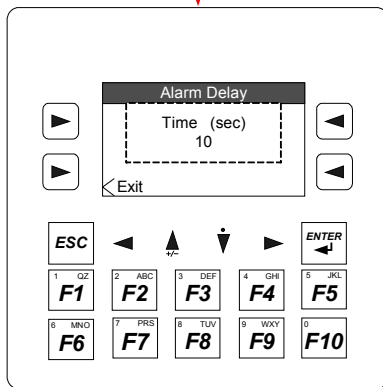


Press the “Menu >” Action Key on the main  
 Press the “Next>” Action Key to display menu screen 2

Press the <F1> key to open the Alarm delay setup screen

Press the “<Exit” Action Key to exit this screen

Figure 27 –Menu screen 2



**To set / change Alarm Delay:**

The default alarm delay is 10 seconds. This means that an alarm condition has to be active for 10 seconds before an alarm message is displayed or the output is activated. The value is in seconds, maximum delay is 999 seconds or 16 minutes 39 seconds.

To change this value:

- 1) Press the <ENTER> key to highlight the value
- 2) Use the number keys to type in the new value.
- 3) Press the <ENTER> key to accept the value

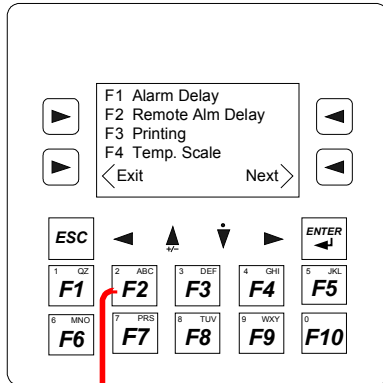
Press the “<Exit” Action Key to exit this screen

Figure 28 –Alarm Delay screen

Note: If you do not wish to use the alarm features set the alarm values out of range.

### 3.12 Remote Alarm Delay

The system has provisions for a remote alarm. The purpose of the remote alarm delay function is to delay the activation of an external alarm device. The remote alarm is triggered if the local alarm has not been acknowledged and remote alarm delay has expired. The remote alarm output can be used to trigger an external alarm device such as an alarm system or a remote dialer. Consult the wiring section for connection instructions.



Press the “**Menu >**” Action Key on the main display  
 Press the “**Next>**” Action Key to display menu screen 2

Press the **<F2>** key to open the Remote Alarm delay setup screen

Press the “**<Exit>**” Action Key to exit this screen

Figure 29 –Menu screen 2

#### To set / change Remote Alarm Delay

The default alarm delay is 120 seconds. This means that an alarm condition has to be active for 120 seconds before the output is activated. The value is in seconds, maximum delay is 9999 seconds or 166 minutes 39 seconds.

Press the “**Enable>**” Action Key to toggle the function ON or OFF.

To change this value:

- 1) Press the **<ENTER>** key to highlight the value
- 2) Use the number keys to type in the new value.
- 3) Press the **<ENTER>** key to accept the value

Press the “**<Exit>**” Action Key to exit this screen

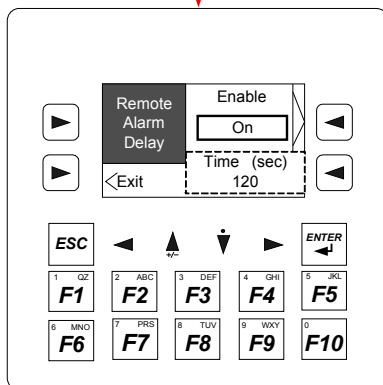
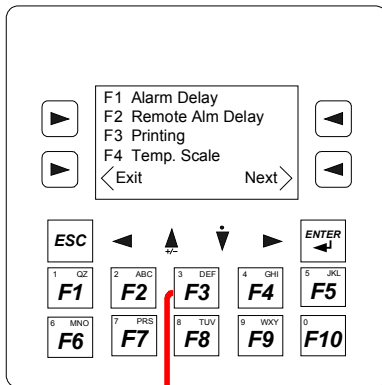


Figure 30 –Remote Alarm Delay screen

### 3.13 Printing

The system will have provisions to send operations data to a serial receipt printer once developed. At the printing of this manual the feature has not been fully developed and as such the printing layout has not been finalized.



Press the “**Menu >**” Action Key on the main display  
Press the “**Next>**” Action Key to display menu screen 2

Press the <**F3**> key to open the printing setup screen

Press the “<**Exit**” Action Key to exit this screen

Figure 31 –Menu screen 2

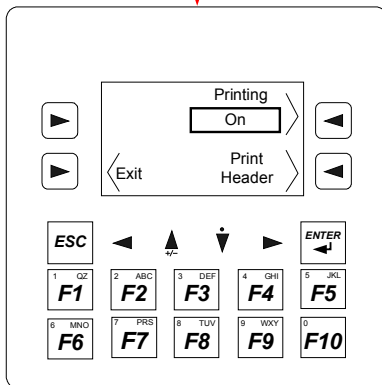
**NOTE: Printing is not available**

Press the “**Printing>**” Action Key to toggle the function ON or OFF.

Press the “**Print Header>**” Action Key to print a column description header

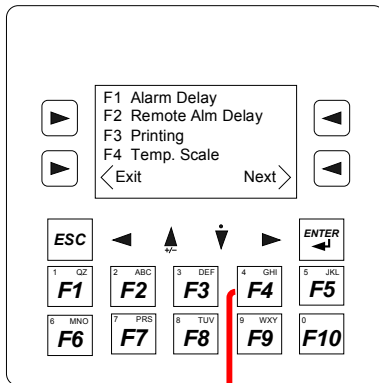
Press the “<**Exit**” Action Key to exit this screen

Figure 32 –Printing enable /disable screen



### 3.14 Temperature Scale

The system has provisions to operate in degrees Fahrenheit and degrees Celsius. The change from one to the other does **NOT** reset any previously modified temperature alarm settings. Please reset the temperature alarm limits.

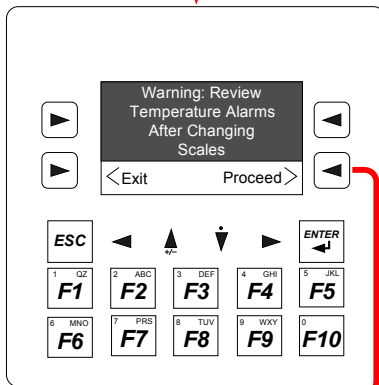


Press the “**Menu >**” Action Key on the main display  
 Press the “**Next>**” Action Key to display menu screen 2

Press the **<F4>** key to open the Temp Scale Warning screen

Press the “**<Exit**” Action Key to exit this screen

Figure 33 –Menu screen 2



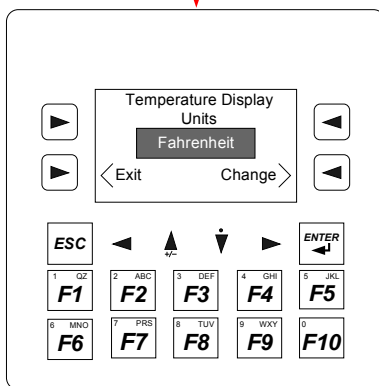
:Note: Alarm values do not automatically convert when changing scales. Review the alarm values and reset as needed.

Press the “**Proceed>**” Action Key to continue

Press the “**<Exit**” Action Key to exit this screen

Figure 34 –Temperature scale change warning screen.

#### To Change the temperature scale



Press the “**Change>**” Action Key to toggle between Fahrenheit & Celsius

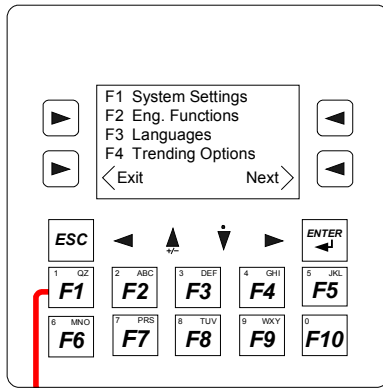
Press the “**<Exit**” Action Key to exit this screen

Figure 35 –Temperature scale change screen.

## 4 System Setup

The system setup screens are typically not used in day to day operations and include menus and functions to set up the instrument. In many cases nothing needs to be changed in these screens.

### 4.1 System Settings

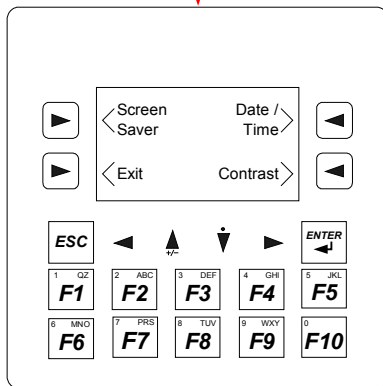


Press the “**Menu >**” Action Key on the main display  
 Press the “**Next>**” Action Key to display menu screen 2  
 Press the “**Next>**” Action Key to display menu screen 3

Press the <F1> key to access the Systems Settings menu screen

Press the “<Exit” Action Key to exit this screen

Figure 36 –Menu screen 3



**To set / change OCS (Operator Control Station) System functions:**

Press the “**Screen Saver>**” Action Key to display the screen saver setup screen

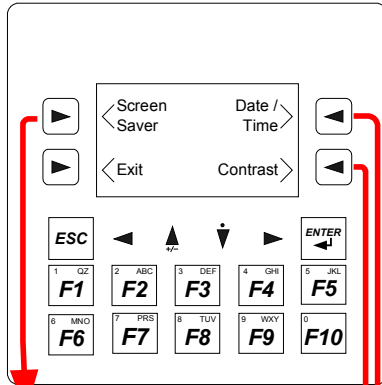
Press the “**Date / Time>**” Action Key to display the Date/Time setting screen

Press the “**Contrast >**” Action Key to display the Contrast setting screen

Press the “<Exit” Action Key to exit this screen

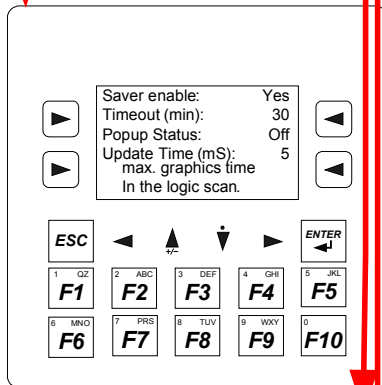
Figure 37 –System Setup display

**System Settings continued**



Press the “<Exit>” Action Key to exit this screen

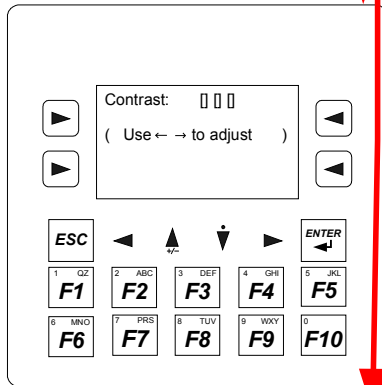
Figure 38 –System Setup display



- Screen Saver**
- Saver Enable** – No = backlight **On**, Yes = **OFF** after timeout
  - Timeout (min)** – Backlite off after XXXX minutes
  - Popup Status** – Turn backlight on with Alarm
  - Update Time (ms)** – Screen refresh time in milli seconds.

- Press the **up / down** arrow keys to select the item to change
- 1) Press the “<ENTER>” key to highlight the value
  - 2) Press the **up / down** arrow keys to change the item
  - 3) Press the “<ENTER>” key to accept the change
- Press the “<ESC>” Key to exit to the previous screen

Figure 39 –Screen Saver Setup

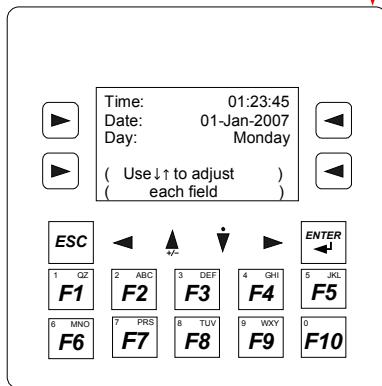


**Contrast**

- Press the “<ENTER>” key to highlight the intensity bar
- 1) Press the **left / right** arrow keys to change
  - 2) Press the “<ENTER>” key to accept the change

Press the “<ESC>” key to the previous screen

Figure 40 –Contrast Setup



**Date / Time**

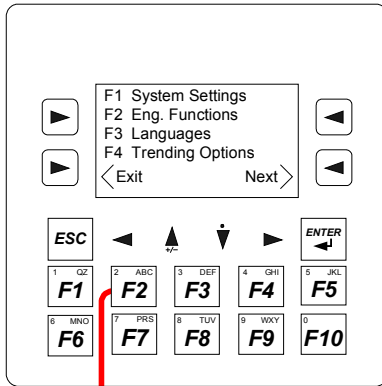
- Press the **up /down** arrow keys to select the item to change
- 1) Press the “<ENTER>” key to highlight the first value
  - 2) Press the **left /right** arrow keys to highlight other items
  - 3) Press the **Up / down** arrow keys to change the item
  - 4) Press the “<ENTER>” key to accept the change

Press the “<ESC>” Key to exit to the previous screen

Figure 41 –Date / Time Setup

## 4.2 Engineering Functions

The Engineering functions screens give access to a specific group of parameters for setting up the moisture sensor for each product. In normal operation these may change during day to day operations. These should not be changed without explicit instructions.

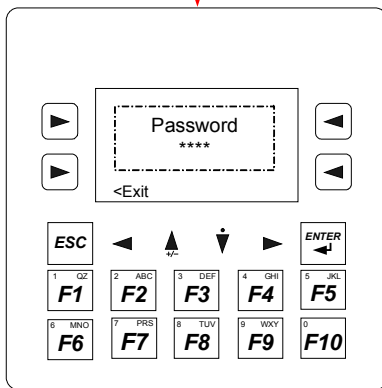


Press the “**Menu >**” Action Key on the main display  
 Press the “**Next>**” Action Key to display menu screen 2  
 Press the “**Next>**” Action Key to display menu screen 3

Press the <**F2**> key to access the Eng. Functions password screen

Press the “<**Exit**” Action Key to exit this screen

Figure 42 –Menu screen 3



### Engineering Password

Press the <**ENTER**> key highlights the password entry field

- 1) Use the number keys to type in the new value.
- 2) Press the <**ENTER**> key to accept the entry

Press the “<**Exit**” Action Key to exit this screen

Figure 43 –Engineering Password entry screen

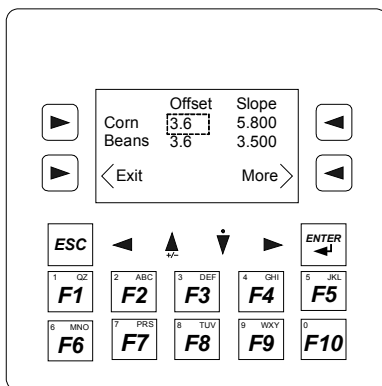
For most of the following screens:

Press the “<**More**” Action Key to go to the next screen

Press the “<**Exit**” Action Key to exit the screen and returns to the main screen

Press the “<**ESC**>” Key to return to the previous screen

Press the “<**ESC**>” Key to cancel a change and leave the value field

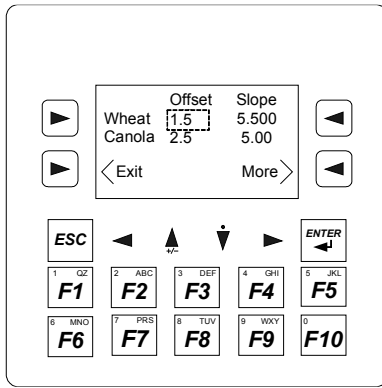


### Slope and offset values for the products Corn & Beans.

To change the values

- 1) Press the left /right, up / down arrow keys to highlight the item
- 2) Press the “<**ENTER**>” key to highlight the value
- 3) Use the number keys to enter the new value.
- 4) The up arrow key selects the “-” minus symbol, the down arrow key selects the “.” decimal point
- 5) Press the “<**ESC**>” key to cancel the change
- 6) Press the “<**ENTER**>” key to accept the change

Figure 44 –Engineering Slope & offset , Corn & Beans

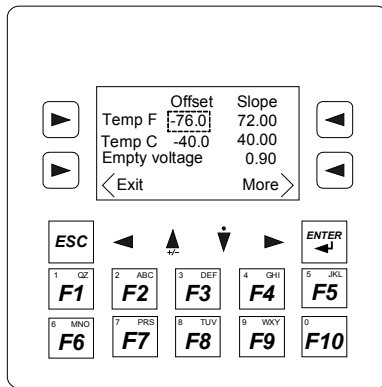


**Slope & Offset values for Wheat & Canola (Rapeseed)**

To change the values in all the following screens

- 1) Press the left /right, up / down arrow keys to highlight the item
- 2) Press the “<ENTER>” key to highlight the value
- 3) Use the number keys to enter the new value.
- 4) The up arrow key selects the “-“ minus symbol, the down arrow key selects the “.” decimal point
- 5) Press the “<ESC>” key to cancel the change
- 6) Press the “<ENTER>” key to accept the change

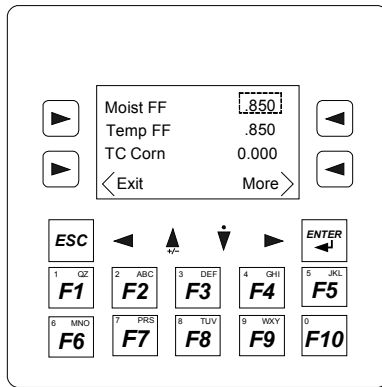
Figure 45 –Engineering Slope & offset, Wheat & Canola



**Slope & Offset values for Temperature**

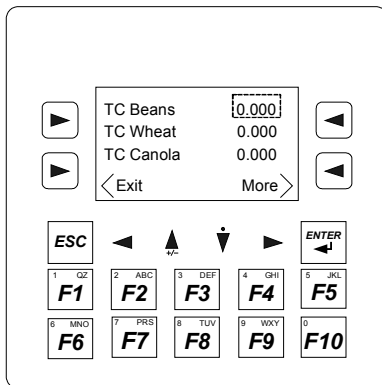
**Sensor Empty trigger voltage**

Figure 46 –Engineering Slope & offset, Temperature



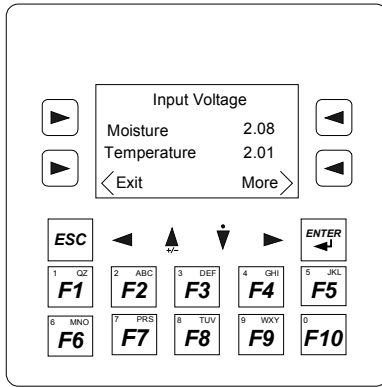
**Moisture, Temperature Filter Factors  
Temp correction for corn**

Figure 47 –Engineering Filters & TC



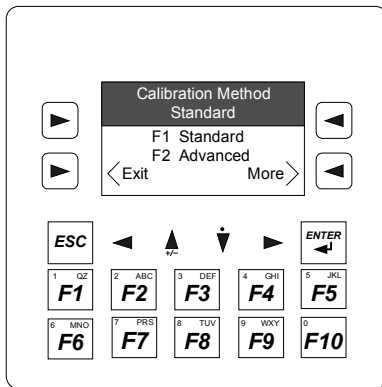
**Temp correction for Beans, Wheat, Canola (Rapeseed)**

Figure 48 –Engineering TC



**Diagnostics display, Input voltages**

Figure 49 –Engineering, Input voltage

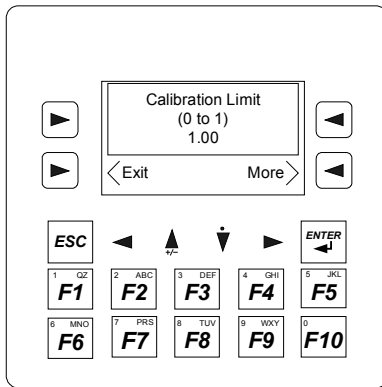


**Calibration method selection screen**

Press the “<F1” Key to select the standard (default) calibration method. The standard method expects the user to judge the moisture and make the adjustment to the displayed moisture value directly.

Press the “<F2” Key to select the Automated Advanced calibration method. This method uses a calibration sample start button to take a snapshot of the moisture for 30 seconds after its pressed. At a later time the manual moisture result is entered into the unit. The Dryer Master Calibration software determines and applies the calibration correction if required.

Figure 50 –Engineering, calibration selection screen



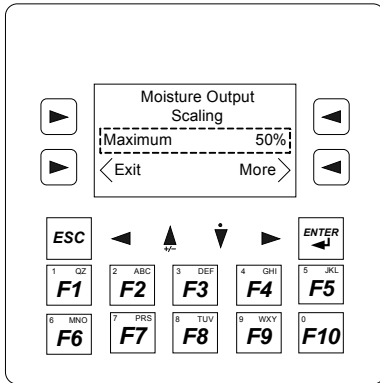
**Calibration change limit screen**

With the advanced calibration method enabled the system will make calibration adjustments limited to 50% of the difference between the On-line and manual entry up to maximum value defined here.

To change the value

- 1) Press the “<ENTER>” key to highlight the value
- 2) Use the number keys to enter the new value.
- 3) The up arrow key selects the “-“ minus symbol, the down arrow key selects the “.” decimal point
- 4) Press the “<ESC>” key to cancel the change
- 5) Press the “<ENTER>” key to accept the change

Figure 51 –Engineering, calibration change limit screen



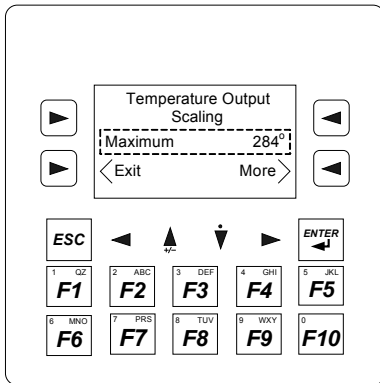
**Moisture Output Scaling**

This value defines the moisture at maximum output, 20 mA or 10 volts  
The minimum value is always 0% moisture at 0 mA or 0 volts.

To change the value

- 1) Press the “<ENTER>” key to highlight the value
- 2) Use the number keys to enter the new value.
- 3) The up arrow key selects the “-“ minus symbol, the down arrow key selects the “.” decimal point
- 4) Press the “<ESC>” key to cancel the change
- 5) Press the “<ENTER>” key to accept the change

Figure 52 –Engineering, Moisture Output Scaling.



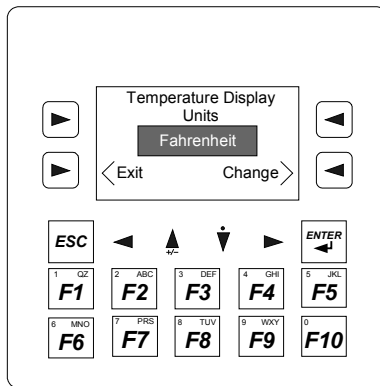
**Temperature Output Scaling**

This value defines the moisture at maximum output, 20 mA or 10 volts  
The minimum value is always 0% moisture at 0 mA or 0 volts.

To change the value

- 1) Press the “<ENTER>” key to highlight the value
- 2) Use the number keys to enter the new value.
- 3) The up arrow key selects the “-“ minus symbol, the down arrow key selects the “.” decimal point
- 4) Press the “<ESC>” key to cancel the change
- 5) Press the “<ENTER>” key to accept the change

Figure 53 –Engineering, Temperature Output Scaling.



**Temperature Scale**

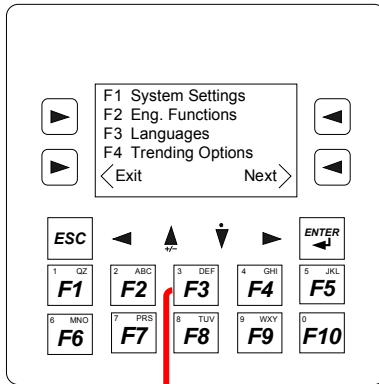
Press the “<Change>” Action Key to toggle between Fahrenheit & Celsius

Press the “<ESC>” Key to return to the previous screen  
Press the “<Exit>” Action Key to exit this screen

Figure 54 –Temperature scale change screen.

### 4.3 Languages

English, Francais & Espanol are available display languages. **This feature is under development. Only English is available on systems with software version 1.01.**

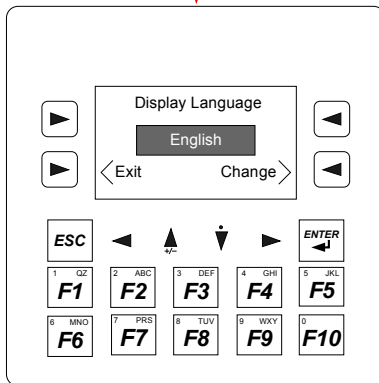


Press the “**Menu >**” Action Key on the main display  
Press the “**Next>**” Action Key to display menu screen 2  
Press the “**Next>**” Action Key to display menu screen 3

Press the <**F3**> key to access the Languages screen

Press the “<**Exit**” Action Key to exit this screen

Figure 55 –Menu screen 3



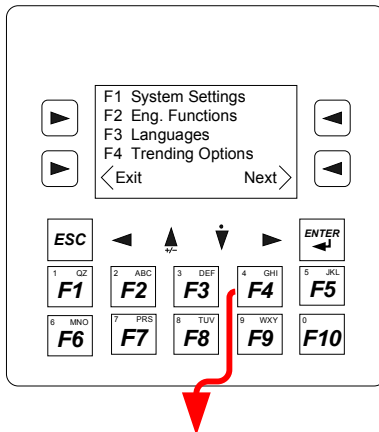
#### Display Languages

Press the “<**Change**” Action Key to reach the desired language

Press the “<**Exit**” Action Key to exit this screen and accept the changes

Figure 56 –Display Languages

### 4.4 Trending Options



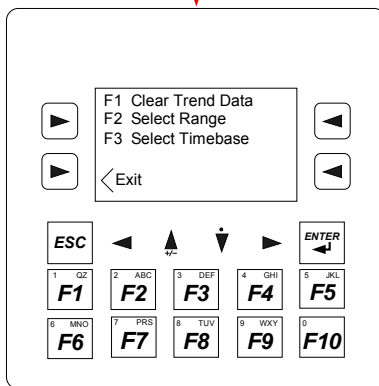
#### Trending Options

Press the “Menu >” Action Key on the main display  
 Press the “Next>” Action Key to display menu screen 2  
 Press the “Next>” Action Key to display menu screen 3

Press the <F4> key to access the Trending Options screen

Press the “<Exit” Action Key to exit this screen

Figure 57 –Menu screen 3

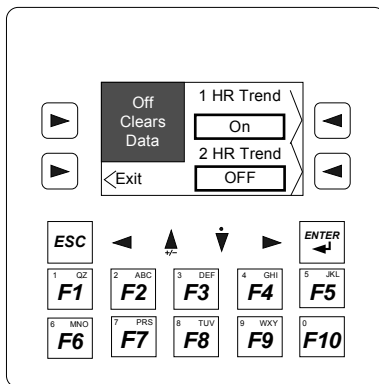


#### Trending Options Menu

Press the “F1” Key to reach the Trend Enable Menu display  
 Press the “F2” Key to reach the Trending Moisture Range Selection screen  
 Press the “F3” Key to reach the Trending Time Axis Setup screen

Press the “<Exit” Action Key to exit this screen

Figure 58 –Trending Options Menu

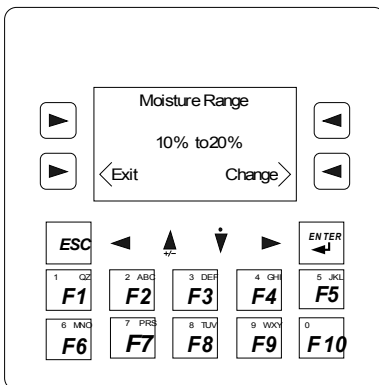


#### Clear Trend Data

Clearing the trend data is achieved in the Trend Enable Menu display  
 Press the “1 Hour Trend>” and/or “2 Hour Trend>” to disable data collection for trending. Then Press again to turn back on. This action clears the trend graph.

Press the “<Exit” Action Key to exit

Figure 59 –Trend Enable Menu display

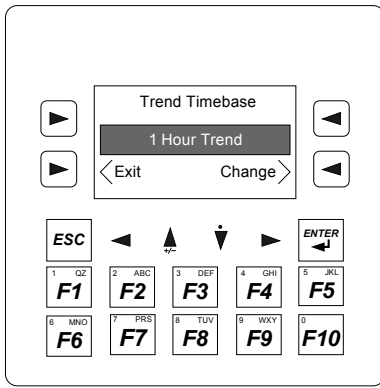


#### Trending Moisture Range Selection

Press the “Change>” Action Key to select the moisture range  
 3 ranges are available, 0 to 10%, 10 to 20%, and 20 to 40%

Press the “<Exit” Action Key to exit this screen

Figure 60 –Moisture Range (Trending)



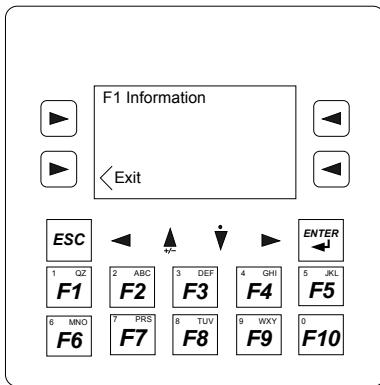
**Trend Timebase**

Press the “Change>” Action Key to select the Trend Time base  
 Due to display restrictions only 1 hour and 2 hour trend graphs are available

Press the “<Exit” Action Key to exit this screen

Figure 61 –Trend Time Base selection

**4.5 Product Information**

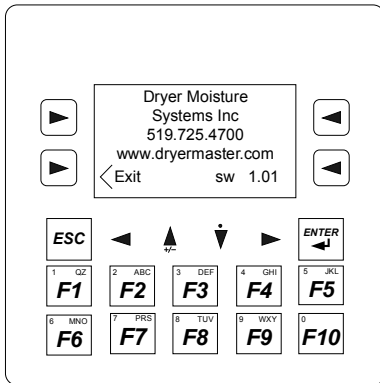


Press the “Menu >” Action Key on the main display to reach the **Menu** screen  
 Press the “Next>” Action Key to display menu screen 2  
 Press the “Next>” Action Key to display menu screen 3  
 Press the “Next>” Action Key to display menu screen 4

Press the <F1> key to access the Product Information Screen

Press the “<Exit” Action Key to exit this screen

Figure 62 –Menu screen 4



**Product Information & System Software version**

Press the “<Exit” Action Key to exit this screen and accept the changes

Figure 63 –Product information & System version screen

## 5 Display unit Installation

### 5.1 Panel Mount (self install)

This section covers basic installing of the HE-XE105 OCX (Operator Control Station) in an existing control panel. Refer to the included specification in Appendix A for additional information. Or go to the following web page to download the current version “ <http://www.heapg.com/OcsManuals/XLE/HE-XE105/MAN0810-06.pdf> “

Refer to Horner Specification Man0805 for detailed information. This document is available for down load at <http://www.heapg.com/OcsManuals/XLE/Manual/>

#### 5.1.1 Display Dimensions

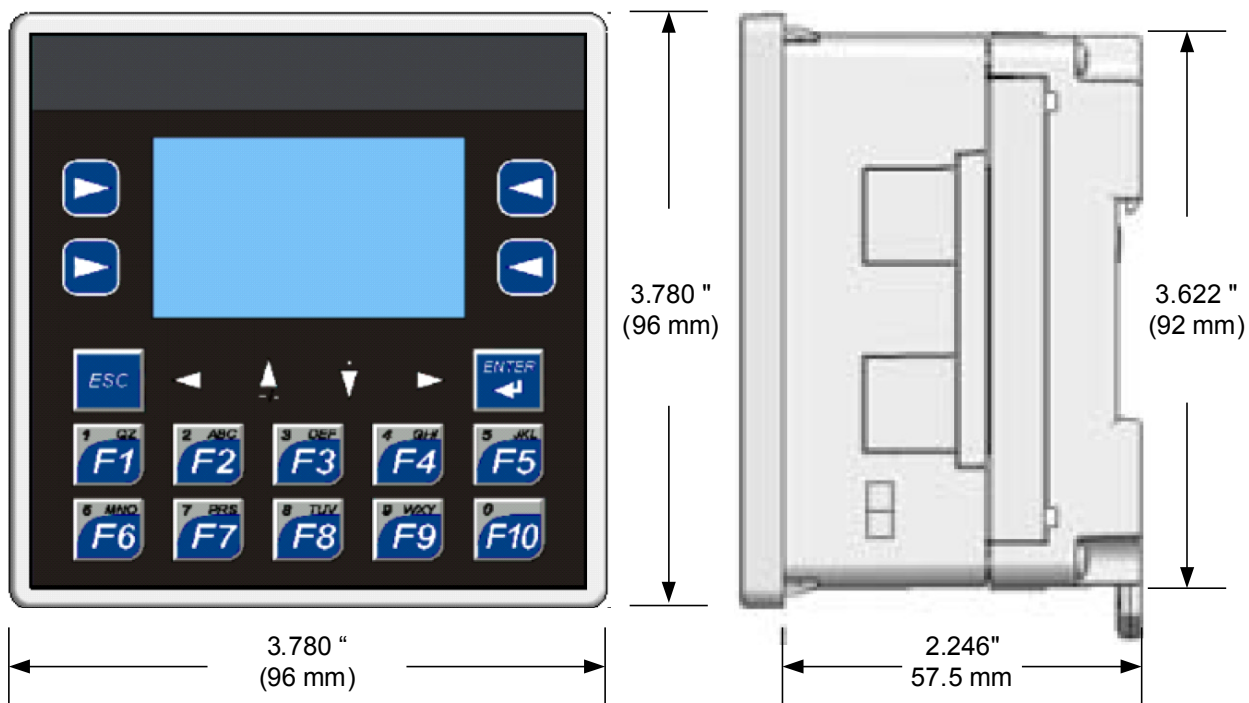


Figure 64 –Display Dimensions

5.1.2 Display Panel cut out

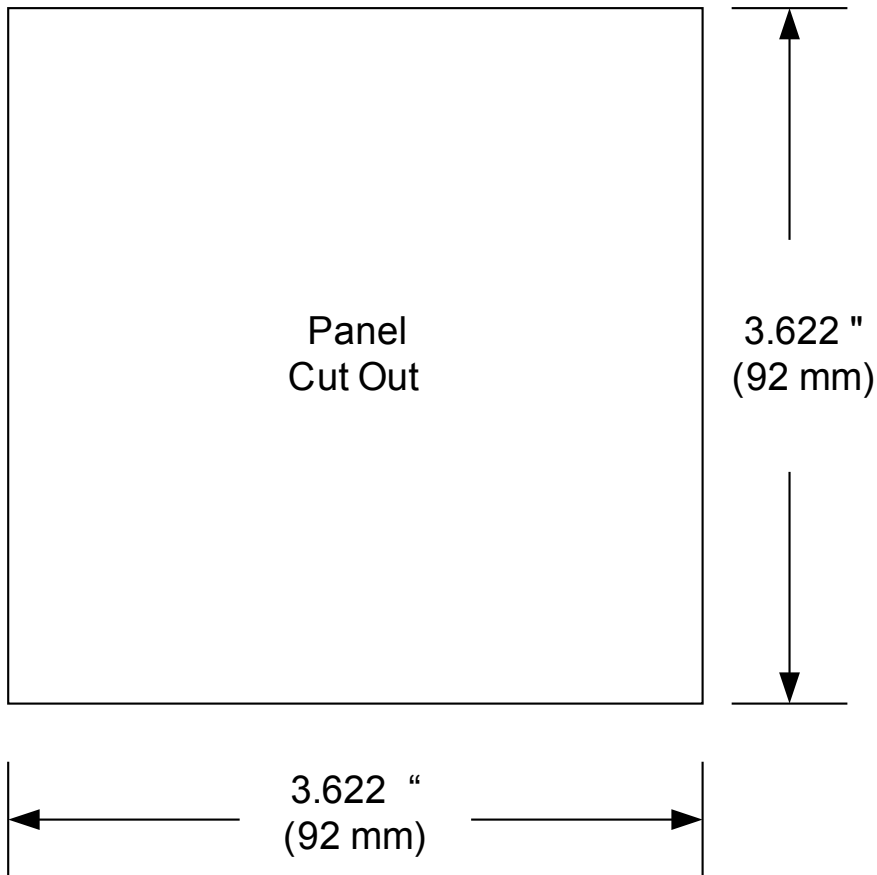


Figure 65 –Display Panel cutout



5.1.4 Field Electrical Connections

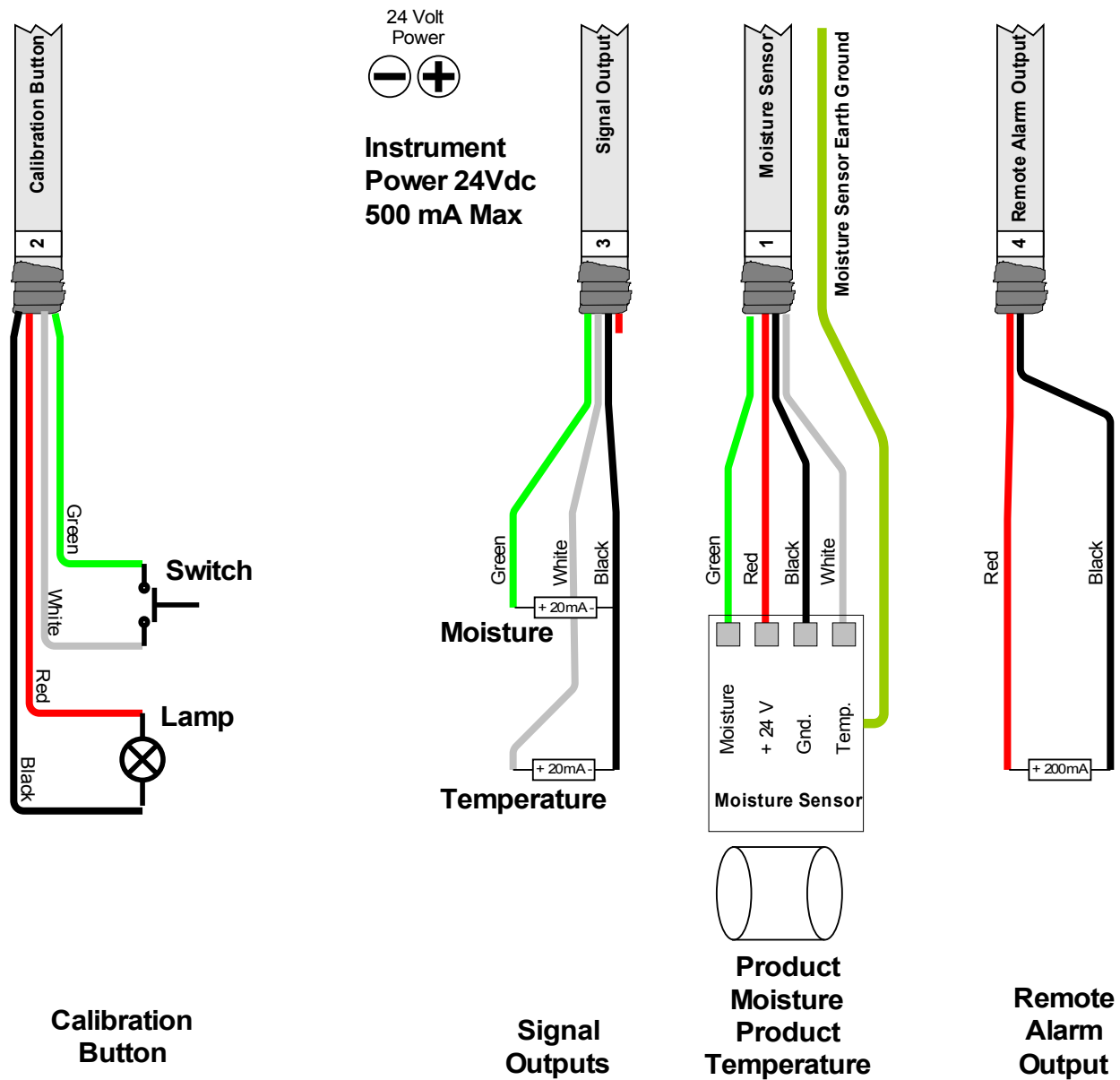


Figure 67 –Electrical connections Field devices

**Caution:**

*System Grounding is critical. Ensure the equipment is properly grounded. Long cable runs between the display and field devices increases the danger of damage by electrical storms. Use of metal conduit and ground cable is recommended.*

### 5.2 GM2 Panel

The GM2 Panel is a complete system and includes the HE-XE105 PLC Operator Control Station in an enclosure, a universal voltage switching power supply, and a terminal connections strip for the field connections.

#### 5.2.1 In Panel Electrical Connections

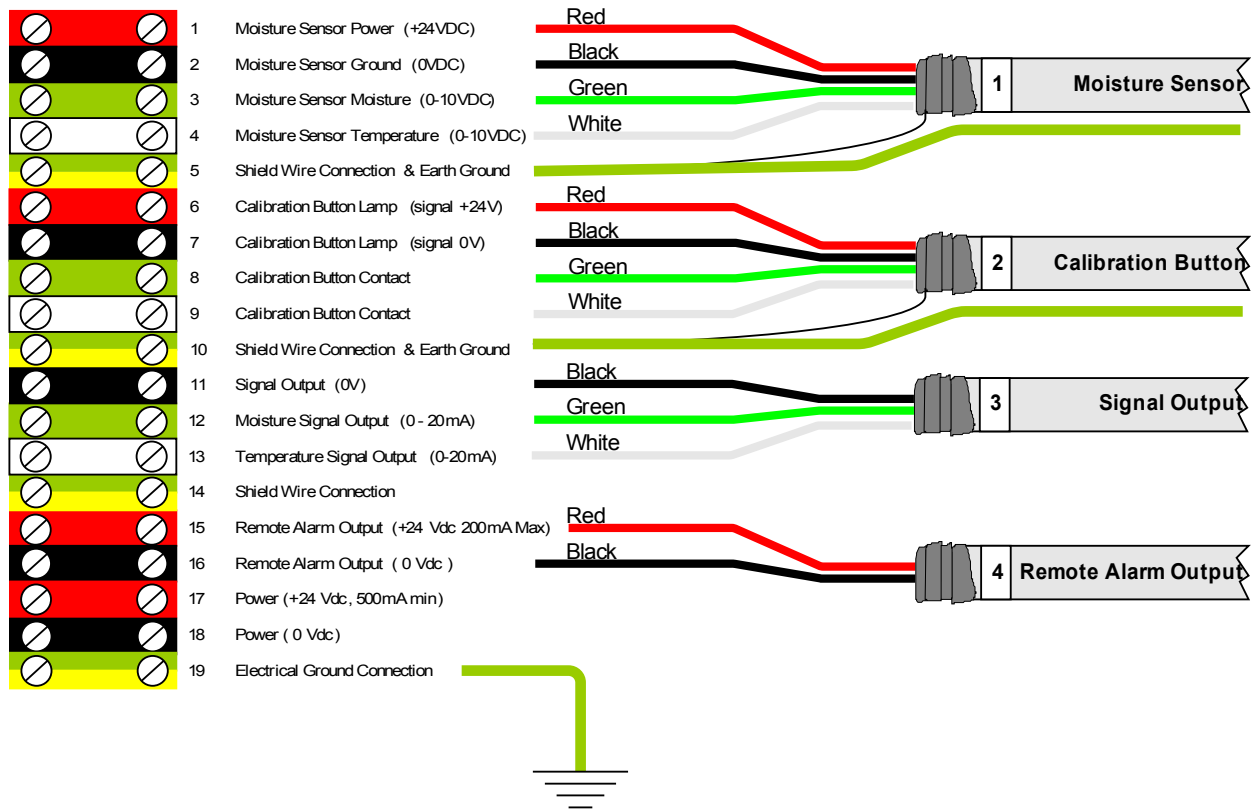


Figure 68 –GM2 In Panel connection terminal strip

Caution:

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

5.2.2 Field Electrical Connections

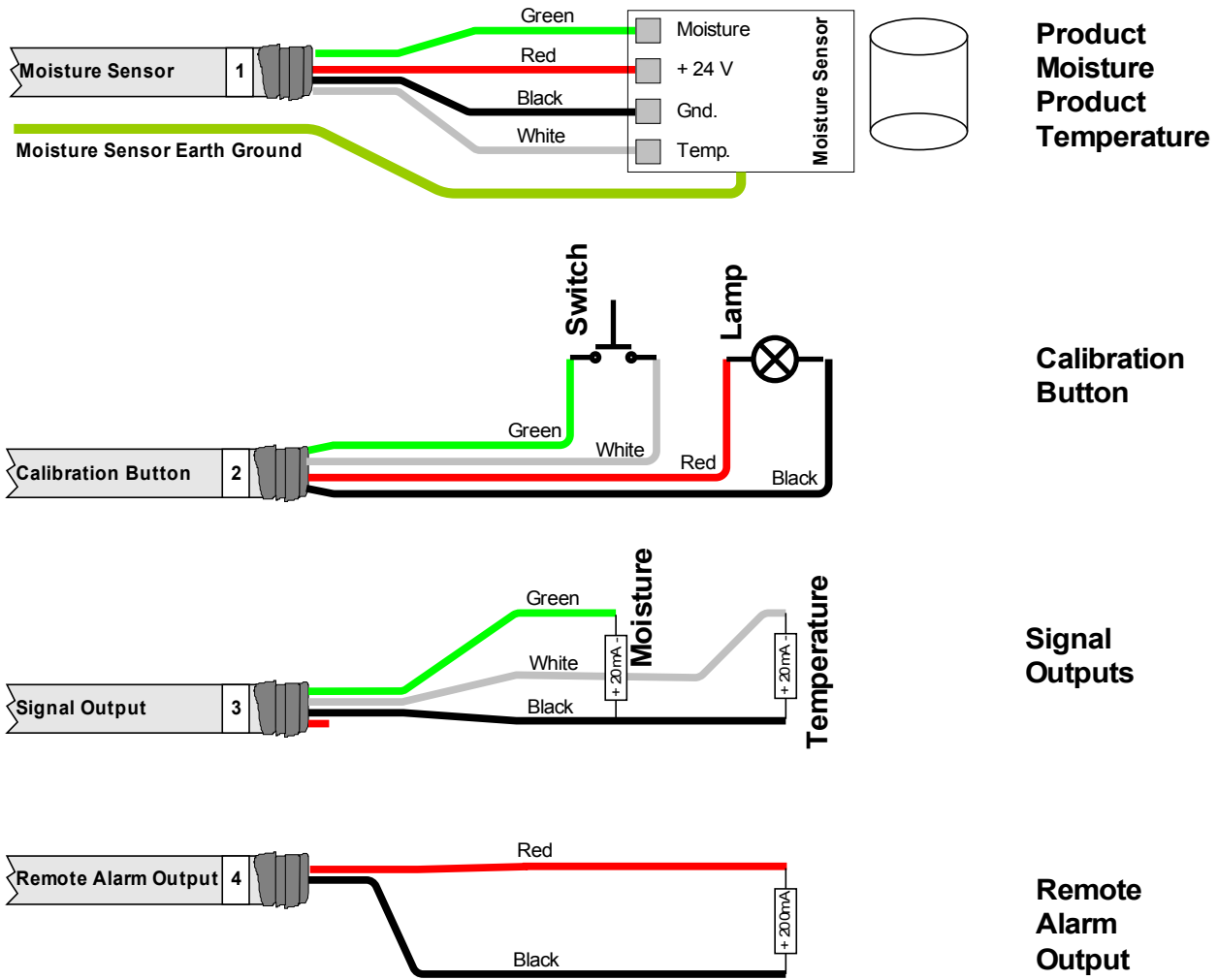


Figure 69 –Electrical connections Field devices

## 6 Moisture Sensor General Specifications

### 6.1 Moisture Sensor Installation

The moisture sensor, typically a Fin-style design, needs to be installed 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 dimension of the pipe is not critical provided a good flow cross section is achieved. This pipe is completely full of compacted product during operation. The product is metered out of this pipe with either a screw conveyor or a rotary valve. The speed of the conveyor or rotary valve is 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.

### 6.2 Moisture Range & Temperature range.

The sensors 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).

### 6.3 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. Dryer Moisture Systems will provide a starting formula for the specific sensor on request. This formula will provide a starting place for converting the dielectric voltage signal to an actual moisture value.

The temperature conversion formula:

For degrees Celsius      (Volts \* 40) – 60 = °C

For degrees Fahrenheit    (Volts \* 72) – 76 = °F

#### 6.4 2200-10-LTSM, Fin 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 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

Figure 70 –Moisture Sensor

## 6.5 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 in 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.

## 6.6 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.

## 6.7 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.

## 6.8 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 2200 series

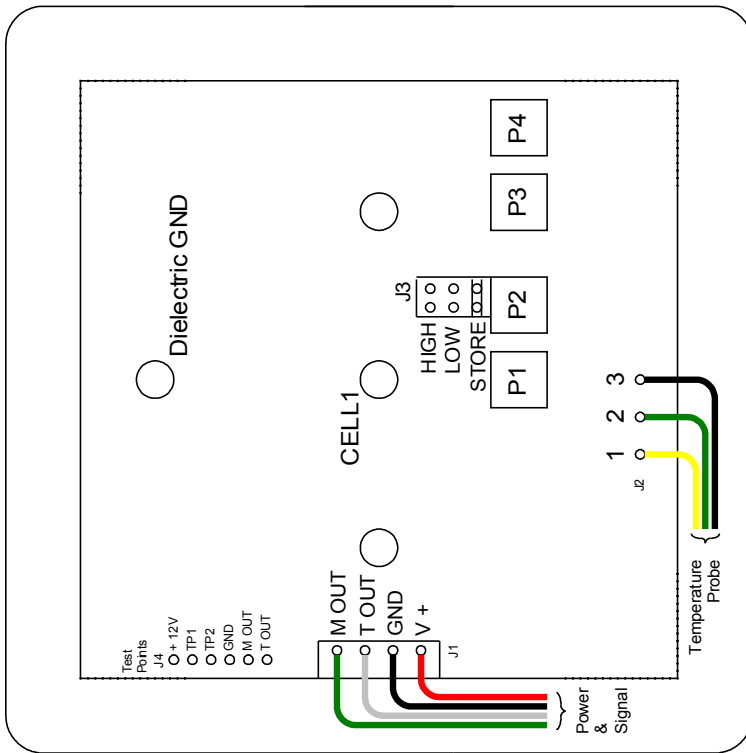


Figure 1 Printed Circuit board view

**Legend:**

- M OUT (green) DC Voltage signal, 0-10Vdc (dielectric)
- T OUT (white) DC Voltage signal, 0-10Vdc (temperature)
- V + (red) DC Voltage, 18-28Vdc 20mA max, Sensor Power
- GND (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 Temperature sensor connections
- J3 Calibration reference jumper block
- J4 Test points

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

- 1) Inspect unit
- 2) Test sensor power. 18-28Vdc at location V+ and GND.
- 3) Signal levels above 5 Vdc at location M OUT and GND with the sensor empty and J3 in the store position suggest a failed unit
- 4) With J3 jumper in STORE position and sensor empty. 0.6-0.8 Vdc at location M OUT and GND.  
With J3 jumper in LOW position and sensor empty 0.95-1.05 Vdc at location M OUT and GND. (adjust P4 if required)  
With J3 jumper in HIGH position and sensor empty. 4.95-5.05 Vdc at location M OUT and GND. (adjust P3 if required)
- 5) P3 and P4 are interactive. Therefore the adjustment steps should be repeated.  
Signal levels at location T OUT and GND  
V\*40 - 60 = °C, thus 2.00Vdc \*40 - 60 = 20°C  
V\*72 - 76 = °F, thus 2.00Vdc \* 72 - 76 = 68°F (adjust P1 if required).
- 6) Return sensor into product stream. The sensor should yield a signal magnitude in the 1 to 9 Vdc range at location M OUT and GND.

Drawn By	WKS	Date:	04/03/87
Revised	WKS	Date:	02/04/03
CHKD.		Date:	
Approved		Date:	
			Model 2200 Field test points
			2200test.t. vsd

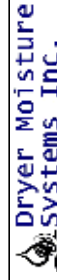


Figure 71 –Sensor Setup & diagnostics

## 7 Installation Requirements & Specifications

The moisture sensor is installed in a bypass section into which a portion of the product is directed. The product is metered out of the chute with a small rotary feeder, rotary valve or conveyor. Make the necessary changes to the conveying system so that there is room for the moisture sensor chute installation

- 1) Install the chute so that there will be a continuous flow of product and the chute will remain full.
- 2) Ensure that the product flowing through the chute is a good representative sample of the product flow.
- 3) Locate the sensor so it can be **safely** accessed for cleaning and taking product samples
- 4) Install bars across the opening to the sensor in the direction of product flow. This will prevent large objects from entering the sensor chute
- 5) If needed install a shut off slide gate above the sensor to shut off the flow to the sensor to allow cleaning out and or servicing the sensor

### 7.1 Bypass Chute Installation Examples

#### 7.1.1 Bypass Chute Installation square chute with screw metering

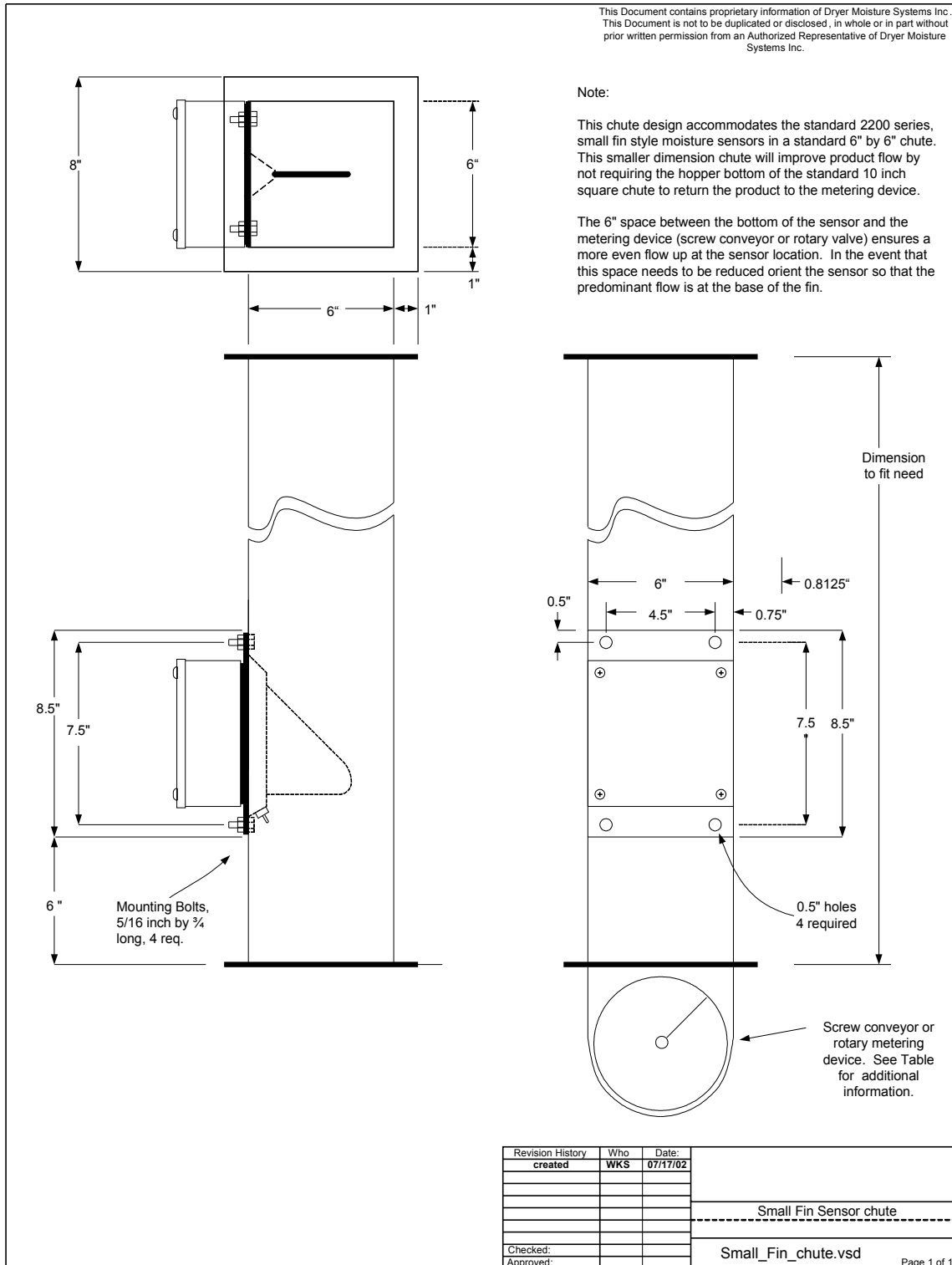


Figure 72 –Moisture Sensor Bypass Chute design #1 square pipe

7.1.2 Bypass Chute Installation round chute with screw metering

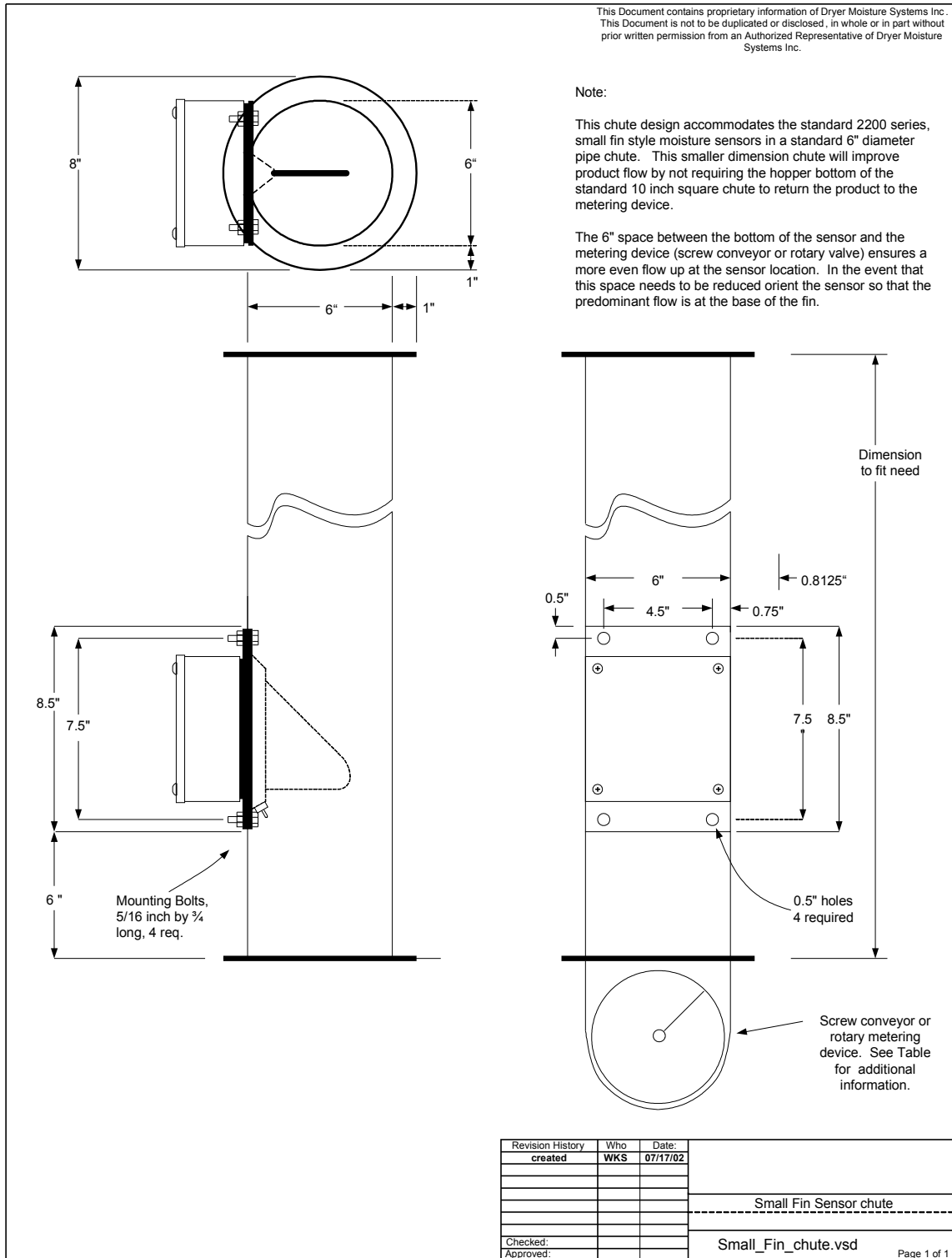


Figure 73 –Moisture Sensor Bypass Chute design #2 round pipe

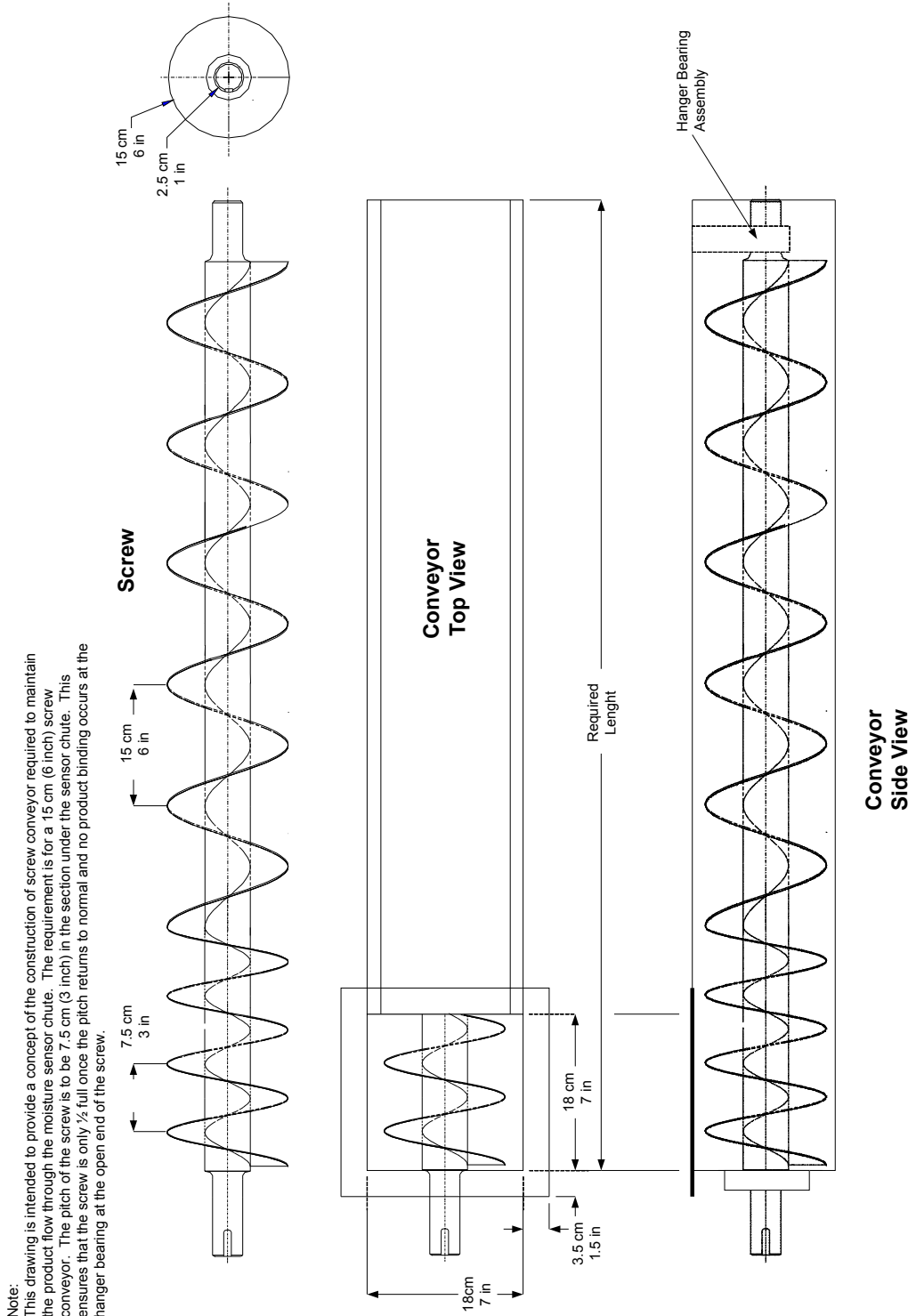




Figure 74 –Moisture Sensor Bypass Chute conceptual metering screw design

<i>Metering Device</i>	<i>Approximate rpm.</i>	<i>Gear Reduction for 1750 rpm Motor</i>
6" screw conveyor standard pitch	6.5	270:1
6" screw conveyor ½ pitch	13	135:1
4" screw conveyor standard pitch	20	88:1
4" screw conveyor ½ pitch	40	44:1
4" flex screw conveyor	20	88:1

Figure 75 – Table of metering device RPM – screw conveyor

Note: When using a screw conveyor as the product-metering device it is recommended that the screw section under the moisture sensor chute be made ½ pitch. This ensures the conveyor is only ½ full once the screw returns to normal pitch reducing mechanical wear, product damage and motor/gearbox load requirements.



**Note:** 

*Placement at the feed end ensures maximum product flow at the sensor. Leave sufficient space between the conveyor and the sensor to ensure a plug flow at the sensor.*

7.1.3 Bypass Chute Installation rotary valve or airlock metering

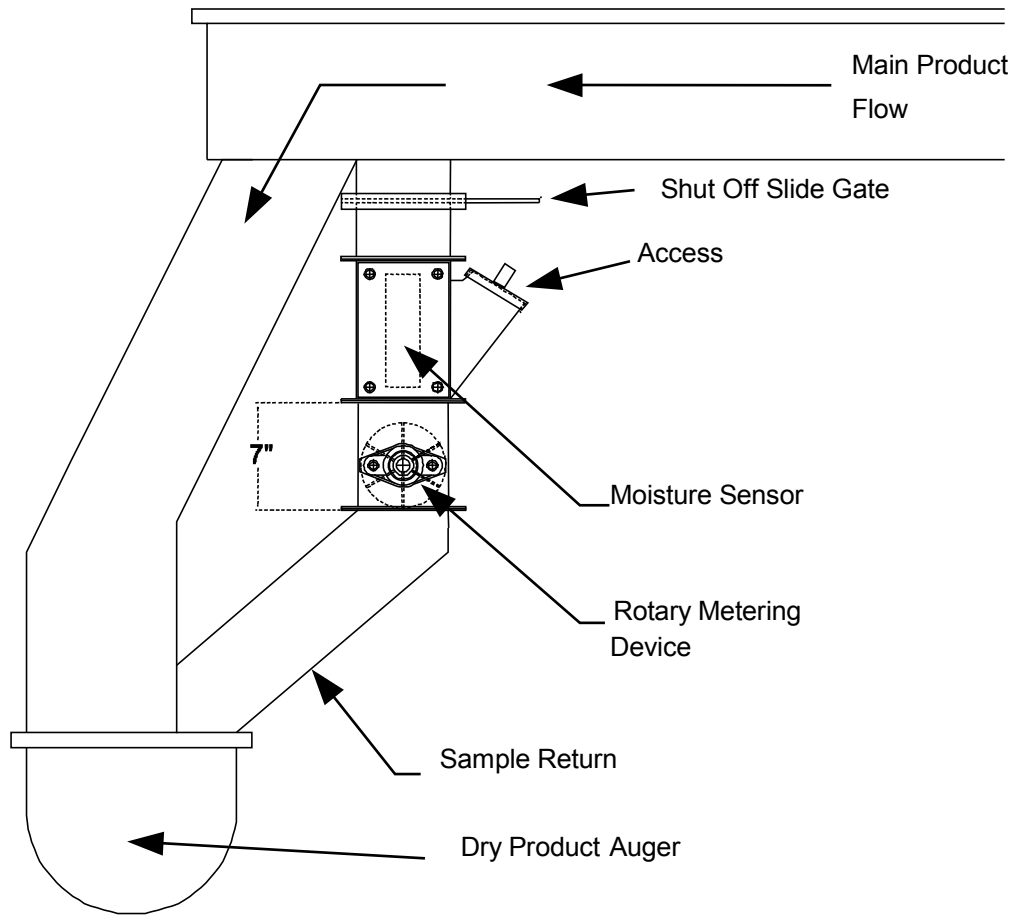


Figure 76 –Moisture Sensor, Example of a Sample Bypass Installation

<i>Metering Device</i>	<i>Approximate rpm.</i>	<i>Gear Reduction for 1750 rpm Motor</i>
6” Rotary valve or metering device	6	280:1
5” Rotary valve or metering device	9	192:1
4” Rotary valve or metering device	14	120:1

Verify the flow and gear box required. The table is an approximate guideline.

Figure 77 –Table of metering device RPM – rotary airlock or rotary valve.

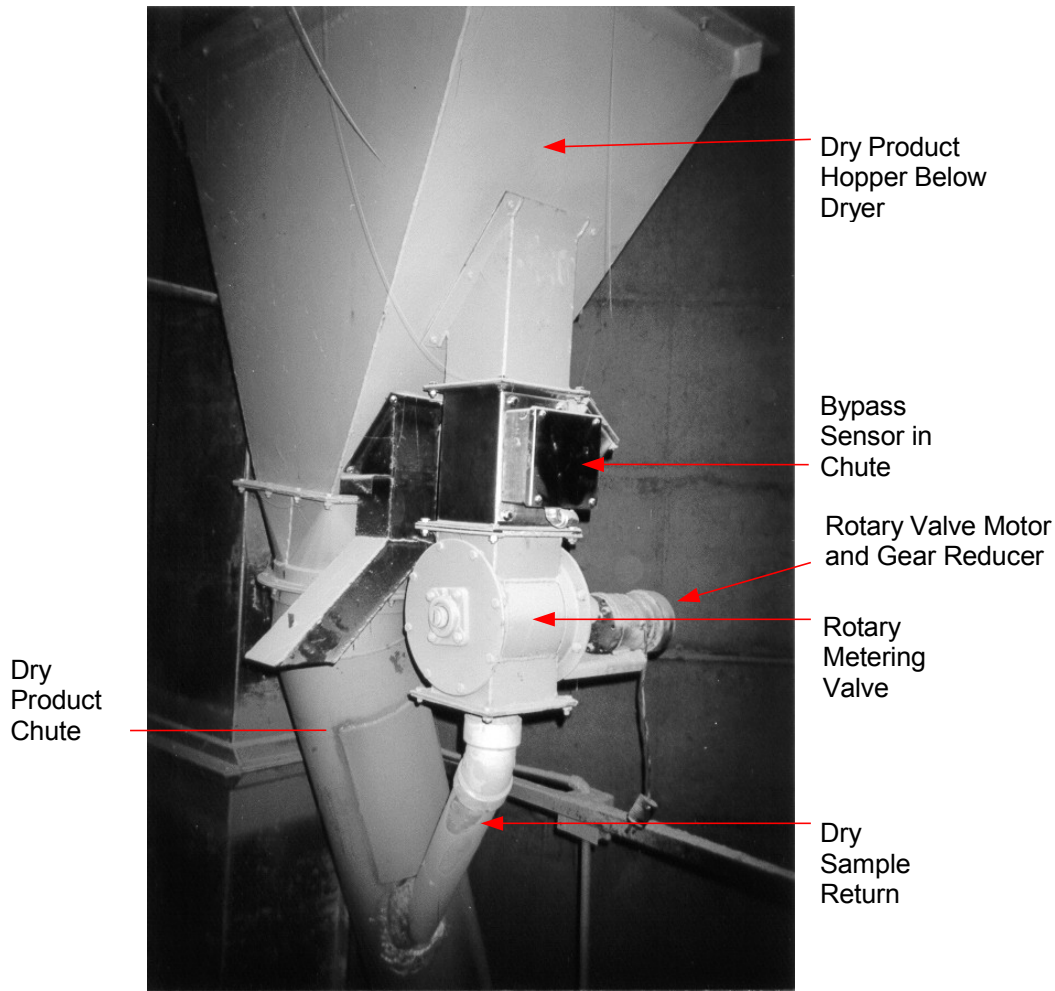




Figure 78 –Moisture Sensor, Example of a bypass Chute Installation



**Caution:** 

*Placing the sensor in a location where it will not get the full flow may cause an excess of fines or trash to pass through the sensor and will contribute to errors or false readings.*

### 7.1.4 Bypass Chute Example



Figure 79 –Bypass Chute Example

### 7.1.5 Bypass Chute Example: Dimensions

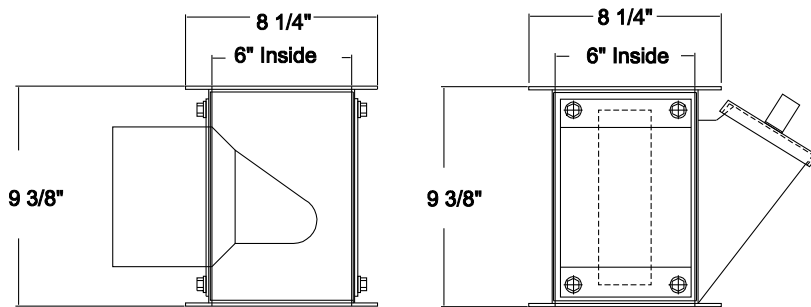
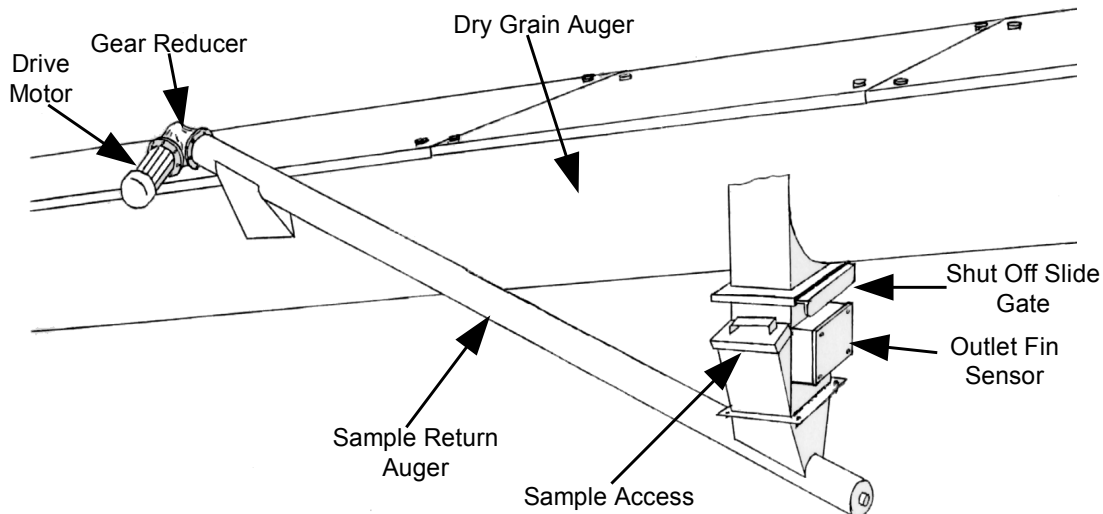


Figure 80 –Bypass Chute Example: Dimensions

### 7.1.6 Bypass Chute Example feeding back on itself

The moisture sensor is installed in a by-pass whereby a portion of the product is directed through the bypass and then back into the system. This method of installation is only recommended in systems where the product flow through the sensor is less than 10% of the total product flow. In this method a screw conveyor is used to meter the product through the moisture sensor instead of the rotary feeder or rotary valve. A four-inch sampling conveyor is recommended. Several other options are available; see figure below. 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 conveyor flow and gear box required. The table is an approximate guideline.



Note: The bypass chute entrance is located on the side of the dry grain auger to which the dry grain is pushed.

Figure 81 –Moisture Sensor, Example of a bypass Chute Installation, product feeding back on itself

### 7.1.7 Bypass Chute Example mechanical metering

**Please note:**

This chute is included for your information. Product metering by this method will work for a limited number of products. Natural products such as Corn, and Beans provide good results with this metering system. Dryer Moisture Systems & Dryer Master do not recommend this flow metering method beyond the products listed.

Manufactured products such as pellets will not work. Milled products and meal will also not work. These products tend to cling to each other causing irregular flow. Opening the hole in the flow restrictor to where product flows increases the flow rate beyond the 1 inch, 25mm resulting in voids and irregular product flow resulting in irregular product moisture readings.

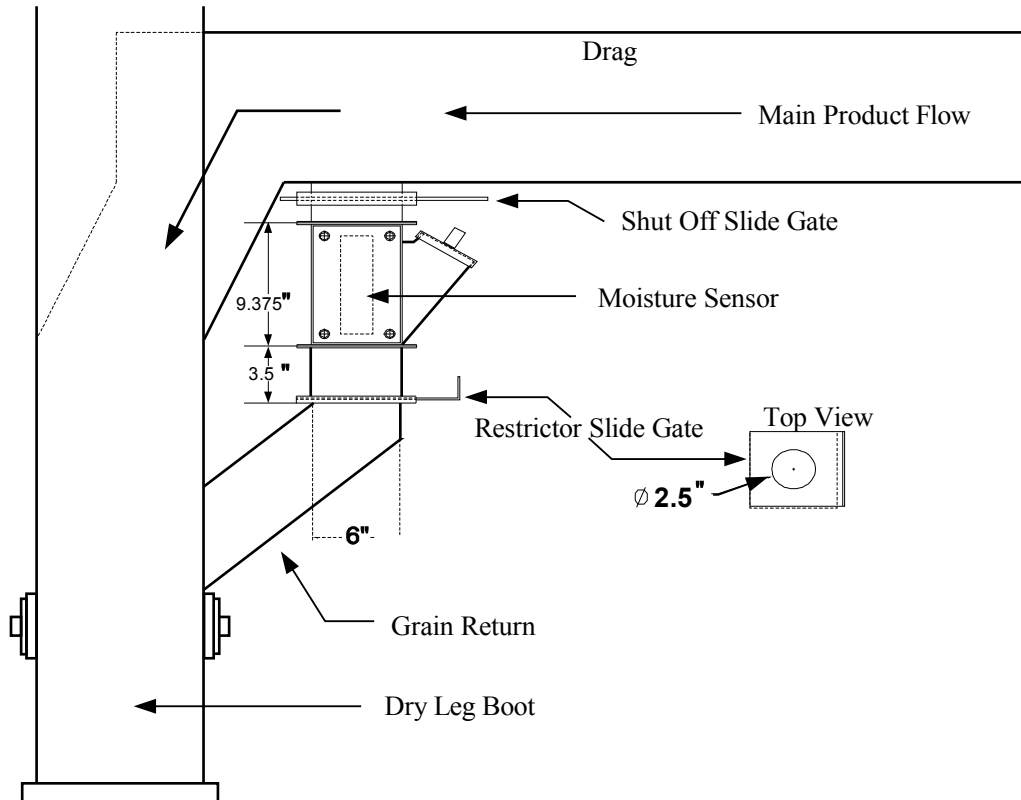


Figure 82 –Bypass Chute under Drag with mechanical flow restrictor metering.

**Caution:**

*It may seem that this chute design is inexpensive and an easy to design solution that should work for everything. In reality, Dryer Master in its 25 year life has seen many attempts of mechanical flow control not work. This metering method however does work very well for the Corn and Beans and some others natural products. What most attempts at mechanical metering do not consider is the low speed, 25mm, 1 inch per second or slower and the need for constant, even product flow. If you are considering this chute design for other than the afore mentioned products be prepared to replace it. It will not work.*



7.1.8 In Line Chute Example mechanical metering



Figure 83 –In Line Chute Example

7.1.9 In Line Chute Example: Dimensions

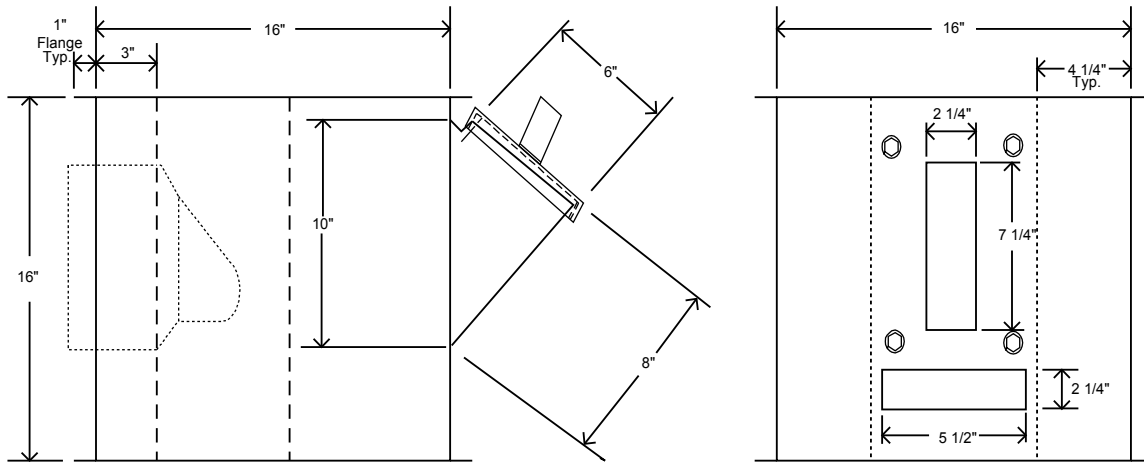




Figure 84 –In Line Chute Example: Dimensions



**Caution:**



*It may seem that this chute design is inexpensive and an easy to design solution that should work for everything. In reality, Dryer Master in its 25 year life has seen many attempts of mechanical flow control not work. This metering method however does work very well for the Corn and Beans and some others natural products. What most attempts at mechanical metering do not consider is the low speed, 25mm, 1 inch per second or slower and the need for constant, even product flow. If you are considering this chute design for other then the afore mentioned products be prepared to replace it. It will not work.*

