DRYER MASTER

M^2

Moisture Manager

USER'S GUIDE

Dryer Master M²

Product Manual

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Dryer Master Inc.

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To Our Customer

Thank you for purchasing the Dryer Master® M² (Moisture Monitor) System. The Dryer Master M² is a robust system which is simple to use and can be applied to most if not all grain moisture measurement applications.

The M² is part of the Dryer Master family of moisture monitoring and moisture control systems that have at their heart Dryer Master's stainless steel fin type capacitance based moisture sensors. These sensors were initially developed to drive Dryer Master's industry leading computerized drying control systems, where they are placed at the inlet and the outlet of the dryer. With over 30 years of field proven experience the sensors are now being offered as part of the M² moisture monitoring solution.

We trust that you will be pleased with the operation of the M² and that you will enjoy benefits similar to those provided by the world renowned *Dryer Master®* moisture control system.

Dryer Master Inc.

1 Introduction

This document provides the operational specification for a moisture 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 computerized drying control systems.

2 System Overview

The system is comprised of 2 key elements.

1. The Display unit is the information provider. Product moisture, product temperature as well as alarms and moisture trends is 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.

Figure 1. – Information display

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 2. – Moisture Sensor

3. The Enhanced System 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.

Figure 3. – Enhanced System

4. The optional industrial grade point of sale terminal dot matrix printer provides hard copy records of operation printed every 10 minutes.

Figure 4. – Optional Printer

5. A calibration push button may also be used. This illuminated push button, when installed and configured and assist moisture calibration by automating this function. When so configured the system will gather and average the moisture of product passing the sensor during the period the button lamp is flashing. Then remain lit until the calibration is entered.

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 start up 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 site 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).

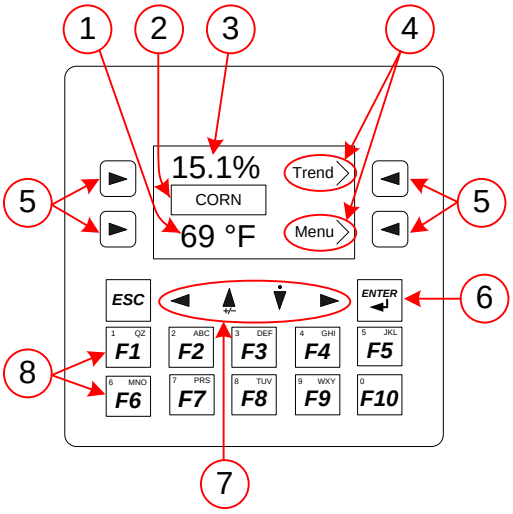


Figure 5. –System display items description

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

Start up 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

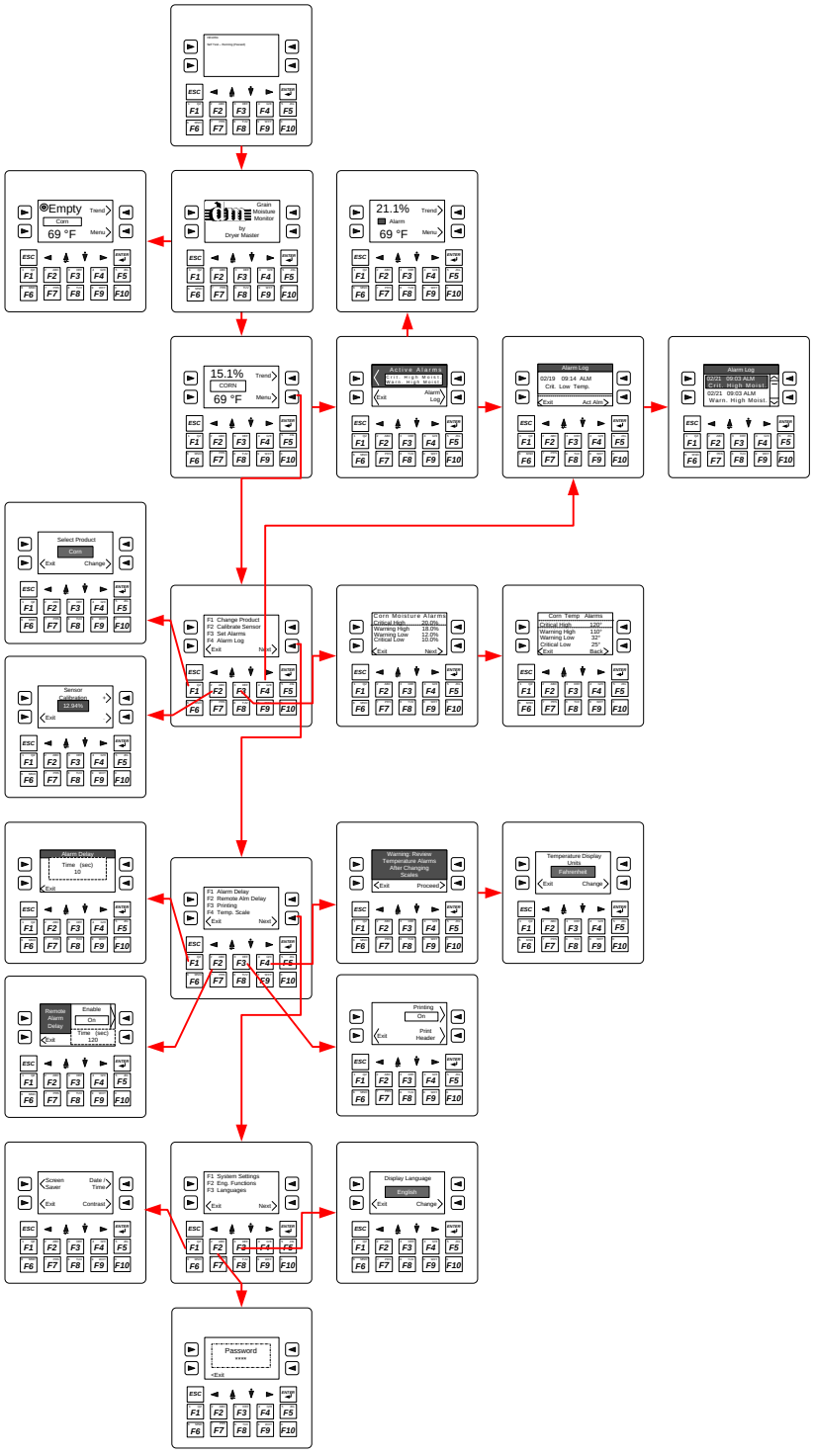
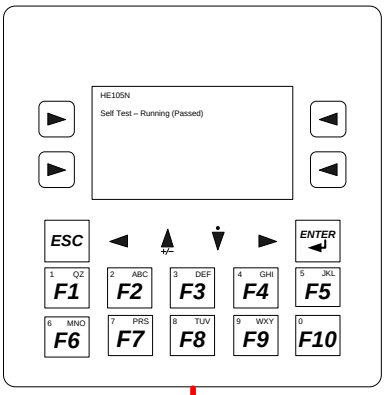


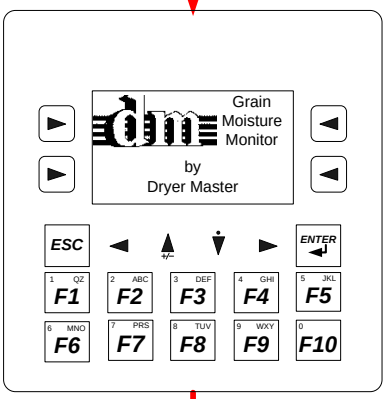
Figure 6. –Screen map

3.3 System start displays



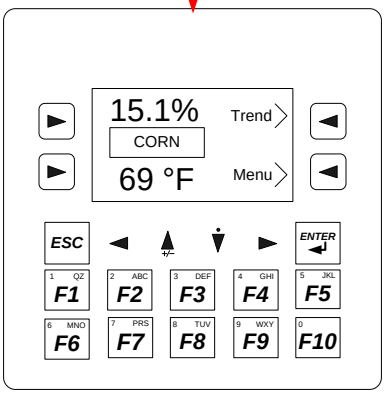
At System start the unit will display the start-up diagnostic screen.

Figure 7. –Start up diagnostics display



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

Figure 8. –Product information display



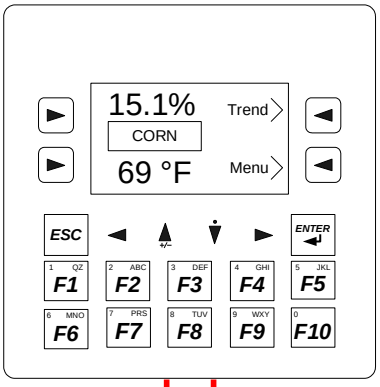
The Main Operations screen displays product moisture, product name, and product temperature.

Press the **"Trend>"** Action Key to display the moisture Trend display

Press the "**MENU>"** Action Key to display the additional functions Menu screen

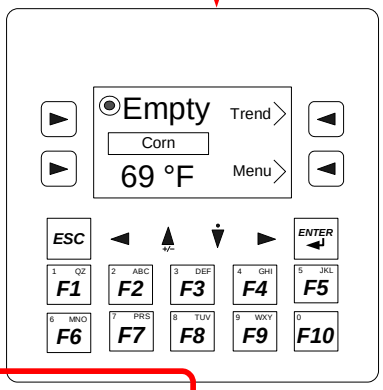
Figure 9. –Main Display

3.4 Main operations displays



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

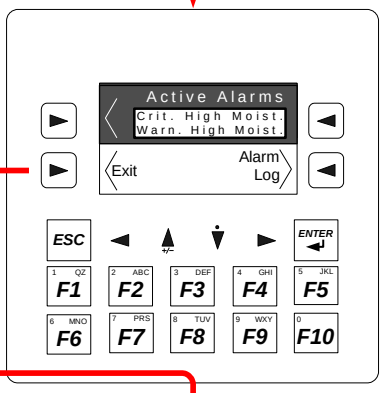
Figure 10. –Main Display



The Main Operations screen will display "**Empty**" under the following conditions

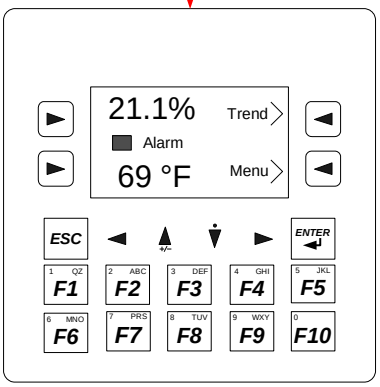
1) If the moisture sensor is partially or completely empty
2) The product is flowing too quickly.
3) The product moisture is below the sensors reading threshold
4) The sensor is not sending a signal
5) The sensor is not connected

Figure 11. –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 12. –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

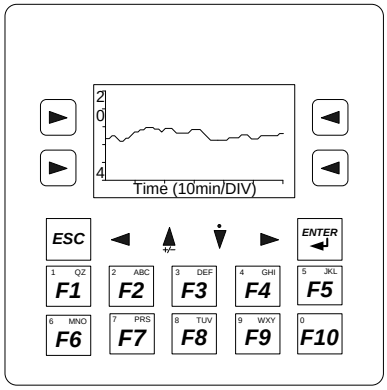
See section "Alarm settings" for information on setting the alarm limits.

Figure 13. –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.

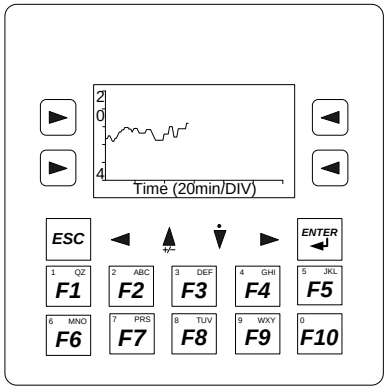
Note trending is an integrated function of the displays firmware. The information and display scaling is limited.



One (1) hour moisture trend

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

Figure 14. –One (1) hour Moisture Trend

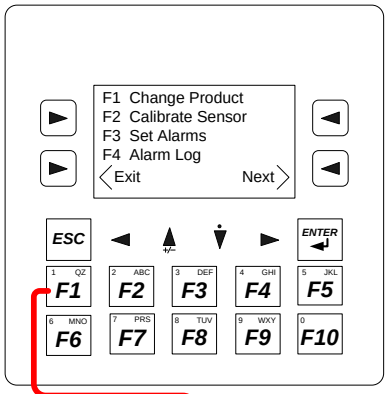


Two (2) hour moisture trend

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

Figure 15. –Two (2) hour Moisture Trend

3.6 Change Product

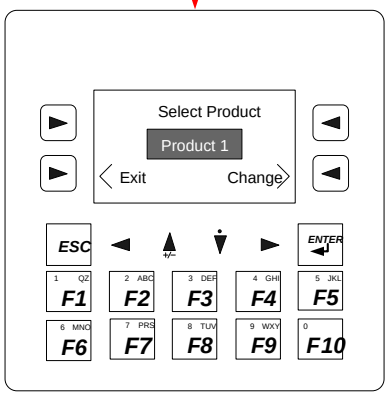


Press the "**Menu >**" Action Key on the main display

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

Press the **"<Exit"** Action Key to exit

Figure 16. –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 17. –Select Product screen

The M² is set up to have 4 product slots configured by default. The products are not specifically labeled and will display Product 1, Product 2, Product 3, and Product 4 as one switches through the products. Each product can be set up with its own sensor settings. Tests will need to be performed to determine the best start up values.

The GM² by comparison has four (4) products configured by default: Corn, Beans, Wheat, and Canola/Rapeseed. It is possible to measure products other than the 4 listed. Barley & Rice will work with the wheat settings, mustard seed will work under the canola settings as will most pea and white beans under the bean settings.

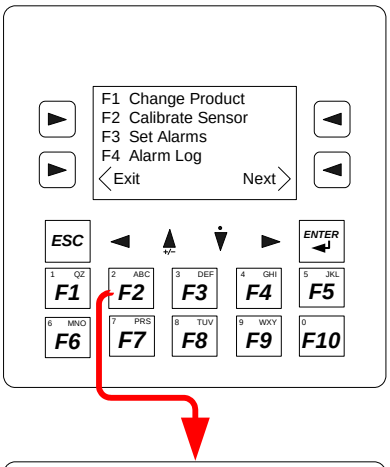
3.7 Calibrate Sensor (Standard Method)

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.

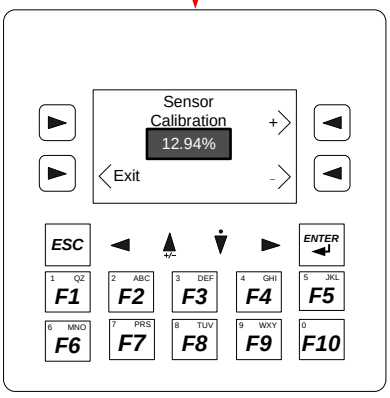


Press the "**Menu >**" Action Key on the main display

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

Press the **"<Exit"** Action Key to exit this screen

Figure 18. –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 19. –Sensor Calibration screen

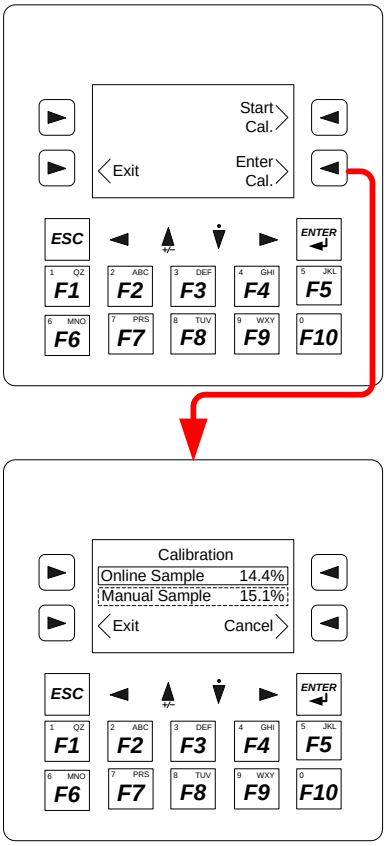
3.8 Calibrate Sensor (Advanced Method)

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

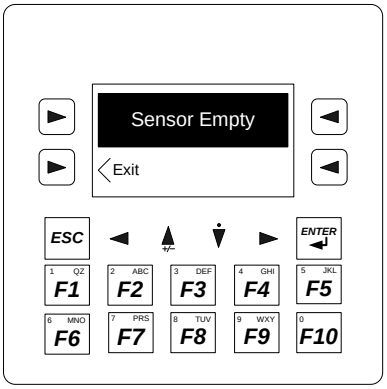
Figure 20. –Sensor Calibration sample Start & Entry screen

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 21. –Sensor Calibration Entry screen (Advanced Method)

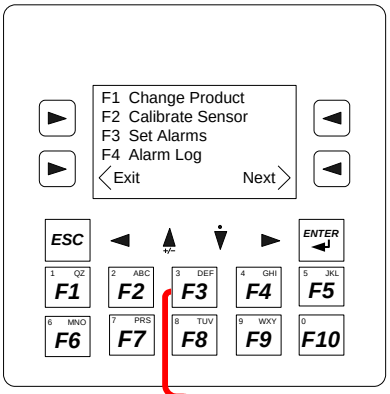


Pressing the sample button while the sensor is empty will display this warning. The calibration procedure will not be initiated.

Press the **"<Exit"** Action Key to exit this screen

Figure 22. –Calibration start on empty Sensor warning.

3.9 Set Alarms



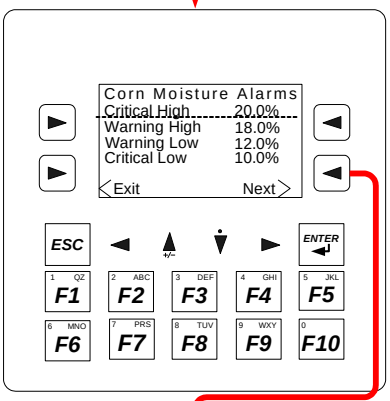
Press the "**Menu >**" Action Key on the main

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

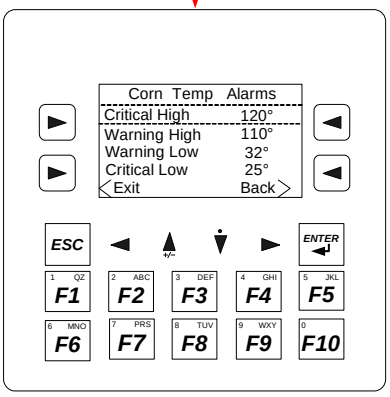
Figure 23. –Menu screen 1



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 24. –Moisture Alarms settings



To Set/ Change Temperature Alarms:

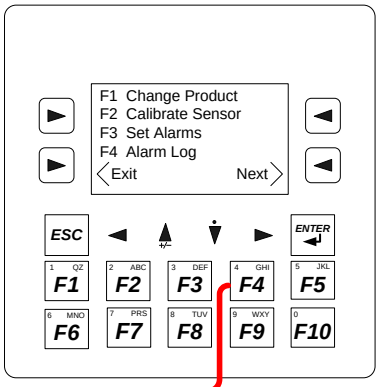
Use the up / down arrow buttons to select the item to change.
1) Press the **<ENTER>** key to highlight the value
5) Use the number keys to type in the new value.
6) The up arrow key selects the "-" minus symbol, the down arrow key selects the "." decimal point
7) Press the **<ENTER>** key to accept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

Press the **"Back>"** Action Key to return to the previous screen
Press the **"<Exit"** Action Key to exit this screen

Figure 25. –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

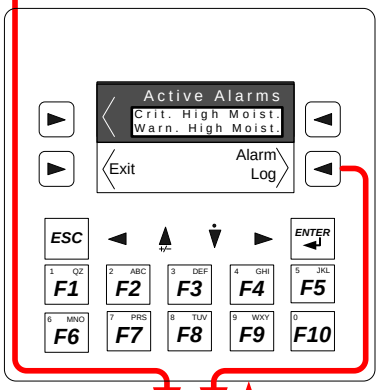


Press the "**Menu >**" Action Key on the main display

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

Press the **"<Exit"** Action Key to exit this screen

Figure 26. –Menu screen 1

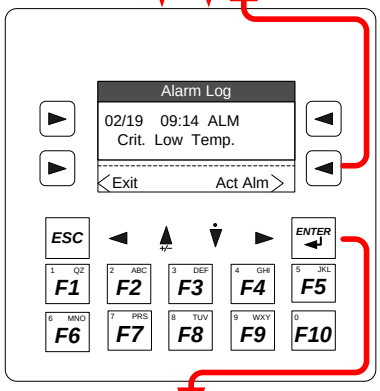


This Active Alarms screen showing the current alarm is displayed whenever an alarm occurs.
Press the "**< Active Alarms**" Action Key to display the active alarms.

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 27. –Active Alarms screen

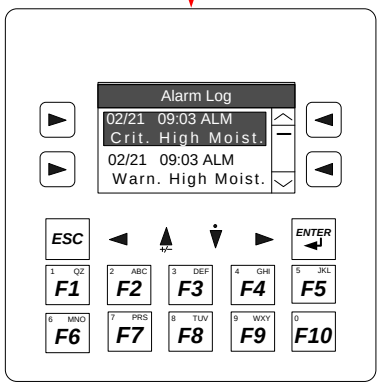


Press the **"<ENTER>"** Key to enable scrolling

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

Press the **"<Exit"** Action Key to exit this screen

Figure 28. –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 29. –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.

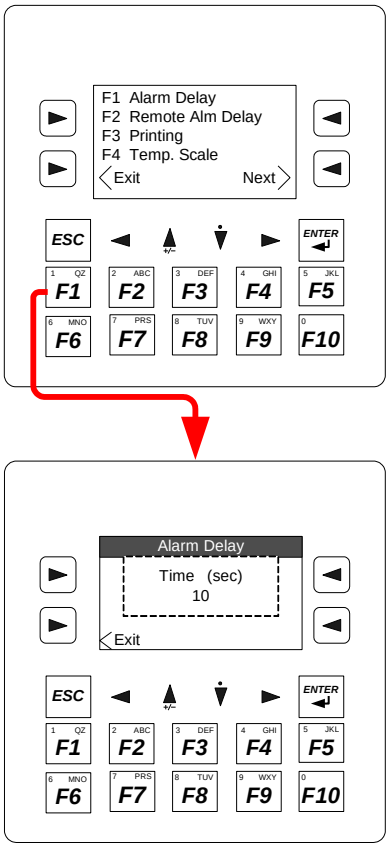


Figure 31. –Alarm Delay screen

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 30. –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:

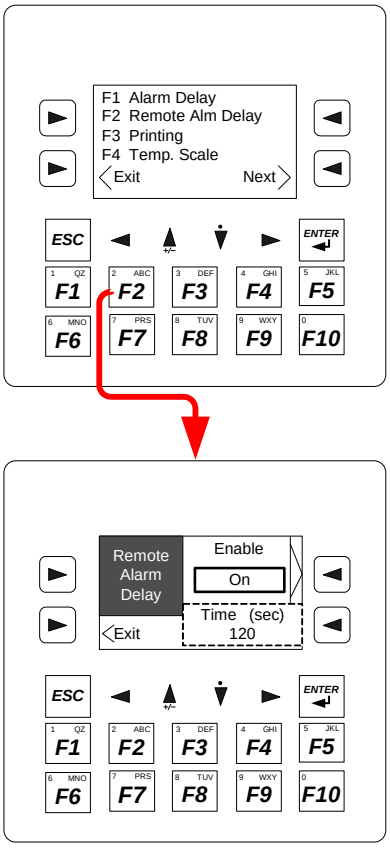
1) Press the **<ENTER>** key to highlight the value
2) Use the number keys to type in the new value.
3) Press the **<ENTER>** key to accept the value

Press the "<**Exit"** Action Key to exit this screen

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 32. –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:

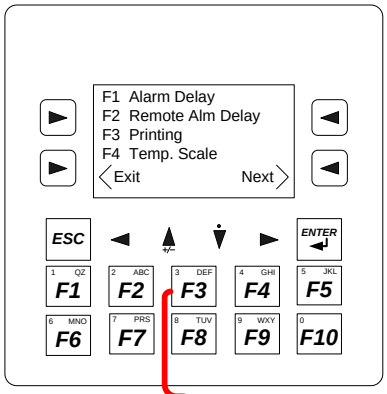
1) Press the **<ENTER>** key to highlight the value
2) Use the number keys to type in the new value.
3) Press the **<ENTER>** key to accept the value

Press the "<**Exit"** Action Key to exit this screen

Figure 33. –Remote Alarm Delay screen

3.13 Printing

Printing is only available on systems with software version 2.0 and newer. The system is able to send operations data at 10 minute intervals to a serial receipt printer. The items printed will include the date, time, product moisture, and product temperature,. Alarms are identified with (W) for warnings and (C) for critical alarms. ID number and column headers are printed on request only. See Appendix A for printout description.



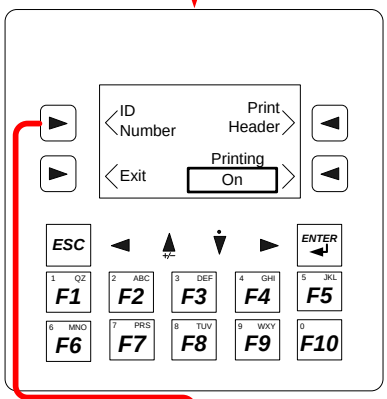
Press the "**Menu >**" Action Key on the main display

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 34. –Menu screen 2



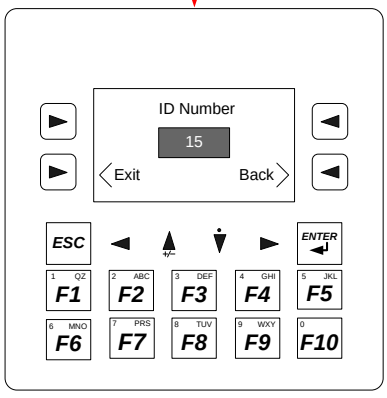
Press the "**Printing>"** Action Key to toggle the function **ON** or **OFF**.

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

Press the "**ID Number>"** Action Key to print a batch identification number on the printout

Press the "<**Exit"** Action Key to exit this screen

Figure 35. –Printing enable /disable screen

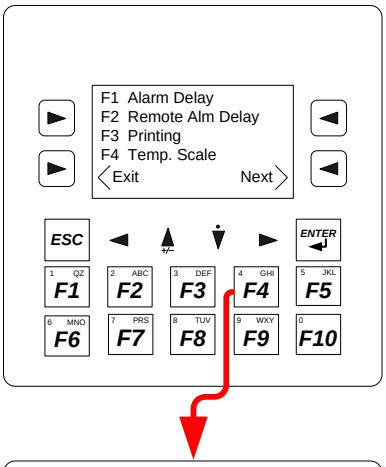


It is possible to enter a 2 digit batch identification number to the printout. Enter a value from 0 -99 to identify the batch being tracked.

Figure 36. –Printing ID Number entry 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.



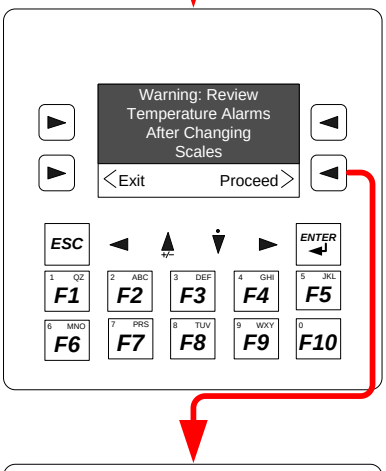
Press the "**Menu >**" Action Key on the main display

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 37. –Menu screen 2

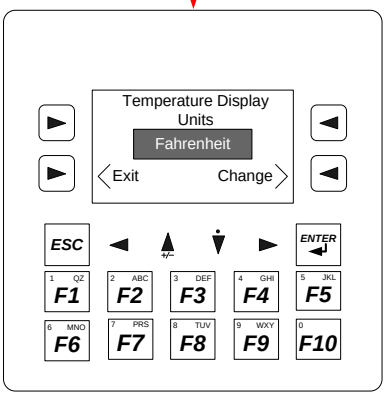


Note: Alarm values do not automatically convert when changing scales. Review the alarm values and reset as needed.

Press the "**Proceed>"** Action Key to continue

Press the "<**Exit"** Action Key to exit this screen

Figure 38. –Temperature scale change warning screen.



To Change the temperature scale

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

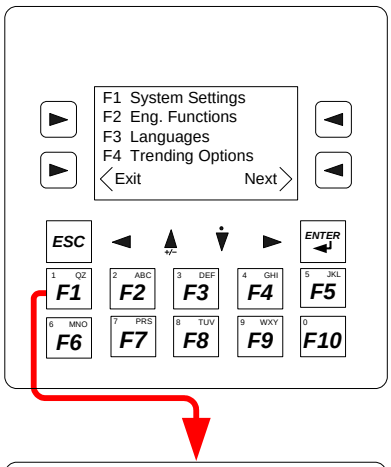
Press the "<**Exit"** Action Key to exit this screen

Figure 39. –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

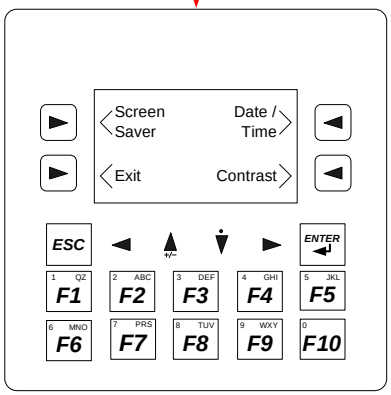
Press the "**Next>"** Action Key to display menu screen 2

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 40. –Menu screen 3



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

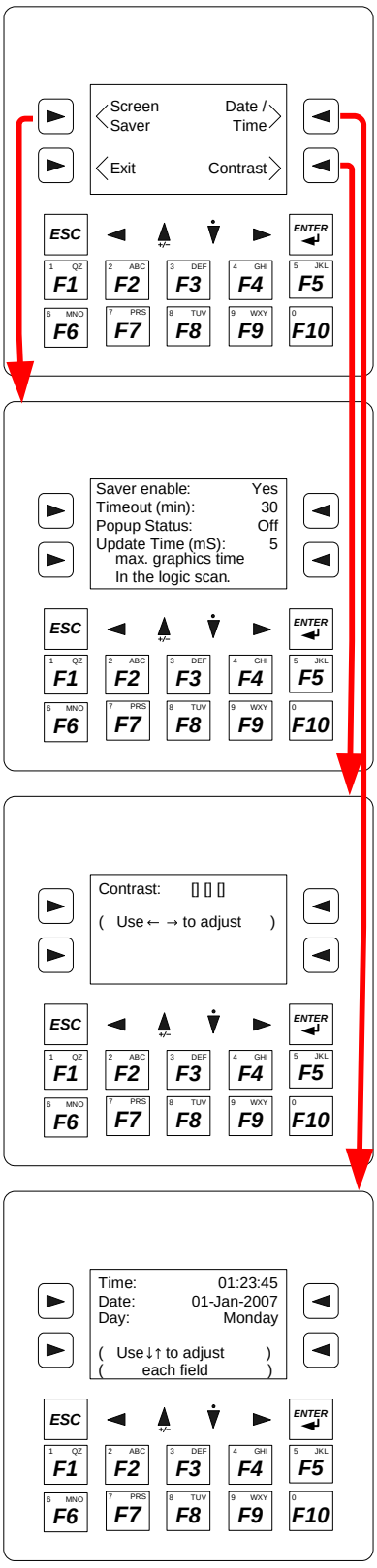
Press the "**Screen Saver>"** Action Key to display the screen saver setup screen

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 41. –System Setup display



System Settings continued

Press the **"<Exit"** Action Key to exit this screen

Figure 42. –System Setup display

Screen Saver

Saver Enable – No = backlight **On**, Yes = **OFF** after timeout
Timeout (min) – Backlight 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 43. –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 44. –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

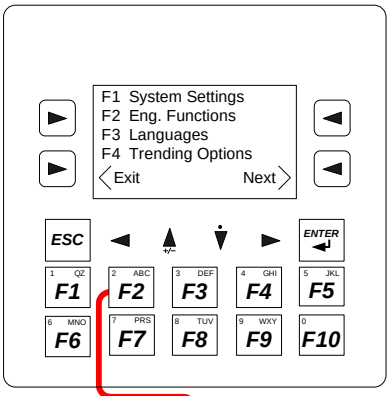
4) Press the **"<ENTER>"** key to accept the change

Press the **"<ESC>"** Key to exit to the previous screen

Figure 45. –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

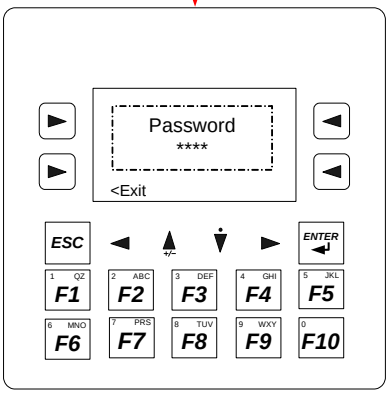
Press the "**Next>"** Action Key to display menu screen 2

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 46. –Menu screen 3



Engineering Password

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

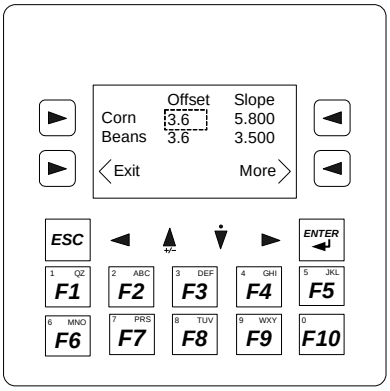
1) Use the number keys to type in the new value.

2) Press the **<ENTER>** key to accept the entry

Press the **"<Exit"** Action Key to exit this screen

Figure 47. –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

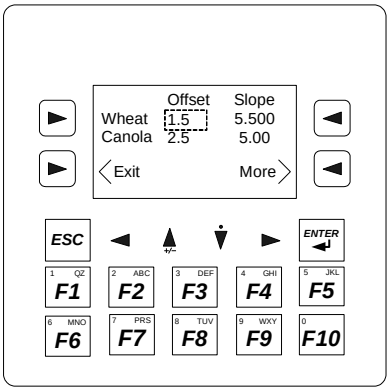


Slope and offset values for the products Corn & Beans.

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 48. –Engineering Slope & offset , Corn & Beans

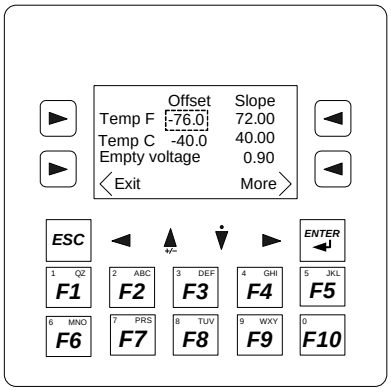


Slope & Offset values for Wheat & Canola (Rapeseed)

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

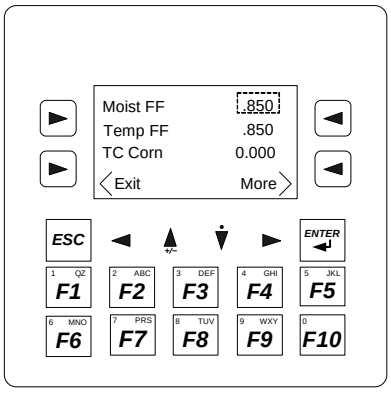
Figure 49. –Engineering Slope & offset, Wheat & Canola



Slope & Offset values for Temperature

Sensor Empty trigger voltage

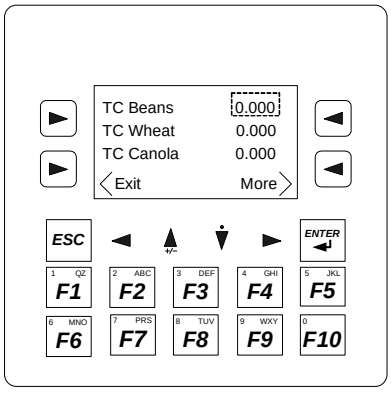
Figure 50. –Engineering Slope & offset, Temperature



Moisture, Temperature Filter Factors

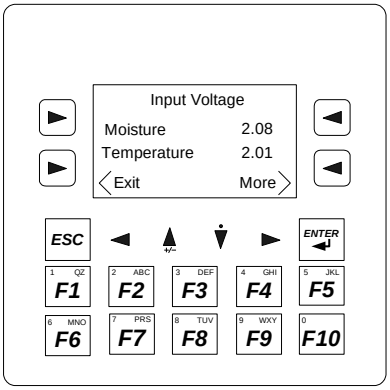
Temp correction for corn

Figure 51. –Engineering Filters & TC



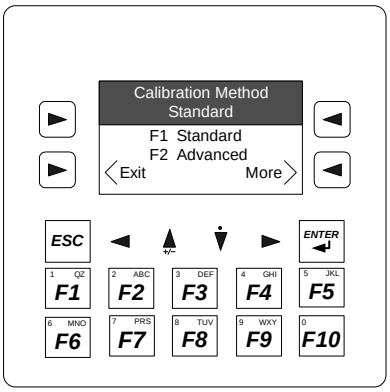
Temp correction for Beans, Wheat, Canola (Rapeseed)

Figure 52. –Engineering TC



Diagnostics display, Input voltages

Figure 53. –Engineering, Input voltage

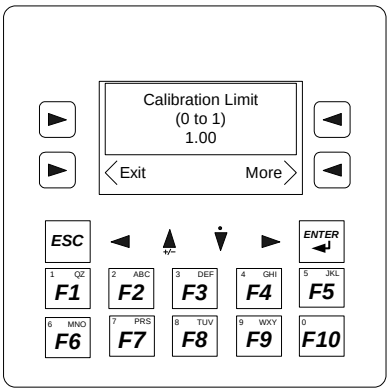


Calibration method selection screen

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 54. –Engineering, calibration selection screen

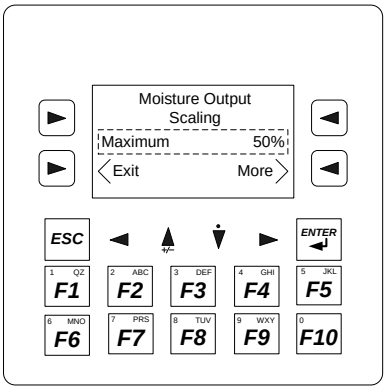


Calibration change limit screen

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 55. –Engineering, calibration change limit screen

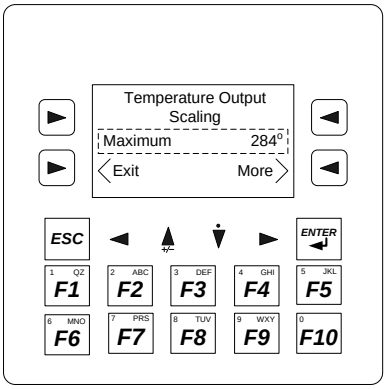


Moisture Output Scaling

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 56. –Engineering, Moisture Output Scaling.

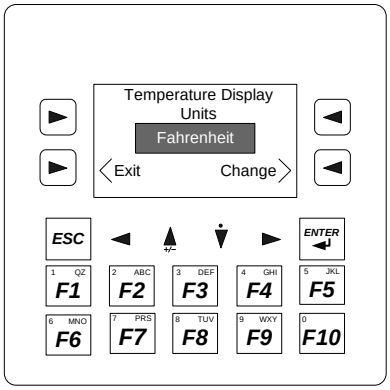


Temperature Output Scaling

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 57. –Engineering, Temperature Output Scaling.



Temperature Scale

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

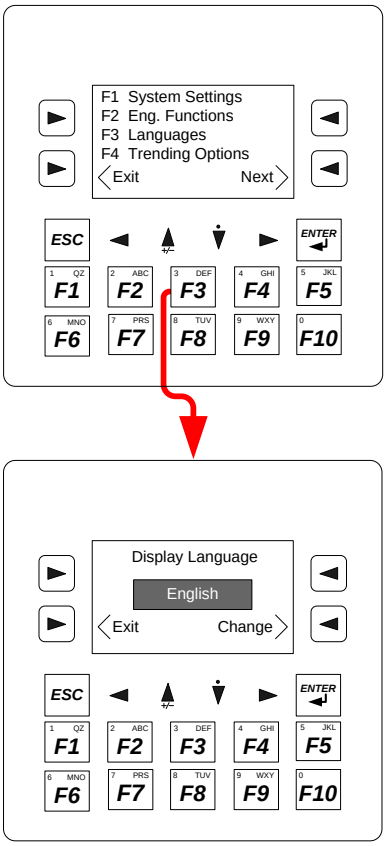
Press the **"<ESC>"** Key to return to the previous screen

Press the "<**Exit"** Action Key to exit this screen

Figure 58. –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 59. –Menu screen 3

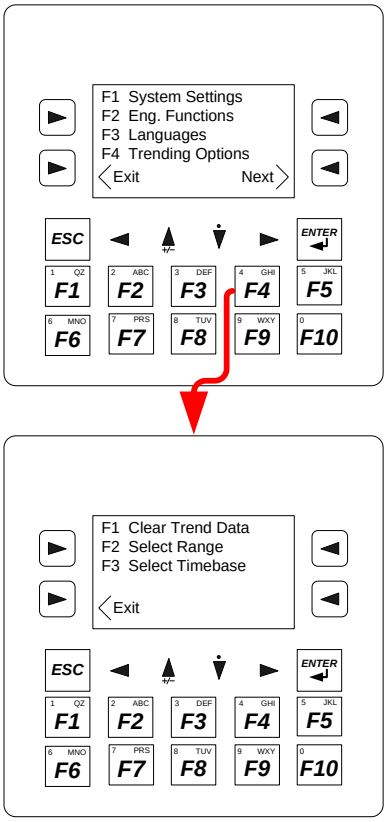
Display Languages

Press the **"<Change"** Action Key to reach the desired language

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

Figure 60. –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 61. –Menu screen 3

Trending Options Menu

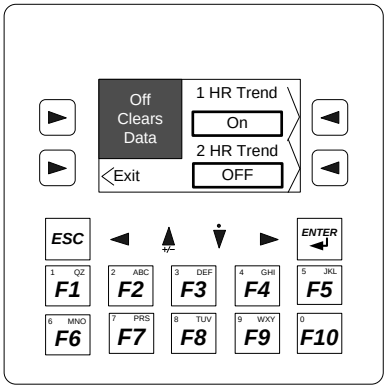
Press the **"F1"** Key to reach the Trend Enable Menu display

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 62. –Trending Options Menu



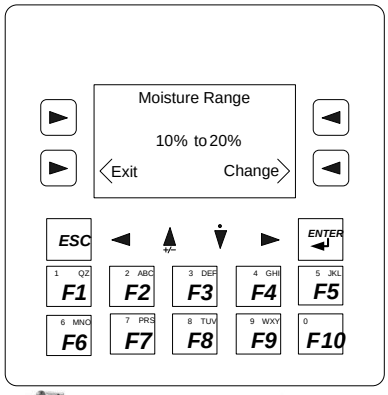
Clear Trend Data

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 63. –Trend Enable Menu display



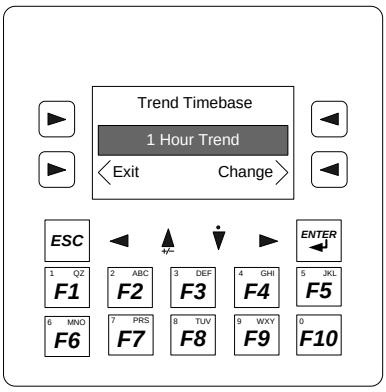
Trending Moisture Range Selection

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 64. –Moisture Range (Trending)



Trend Timebase

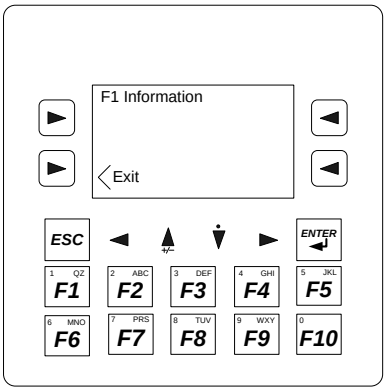
Press the "**Change>"** Action Key to select the Trend Time base

Due to display restrictions only 1 hour and 2 hour trend graphs are available

Press the **"<Exit"** Action Key to exit this screen

Figure 65. –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

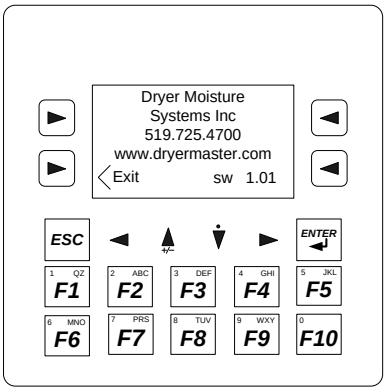
Press the "**Next>"** Action Key to display menu screen 3

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 66. –Menu screen 4



Product Information & System Software version

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

Figure 67. –Product information & System version screen

5 Display unit Installation

5.1 Panel Mount (self install)

This section covers basic installation of the IMO i3A12X/13C14-SOHF (Operator Control Station) in an existing control panel. Refer to the included IMO Start-up Guide in Appendix C for additional information. Additional information is also available at the following links:
"http://imopc01.imostatic.net/technical/i3a%20datasheet.pdf " and
http://www.imopc.ca/pages/zisk_products_automation

5.1.1 Display Dimensions

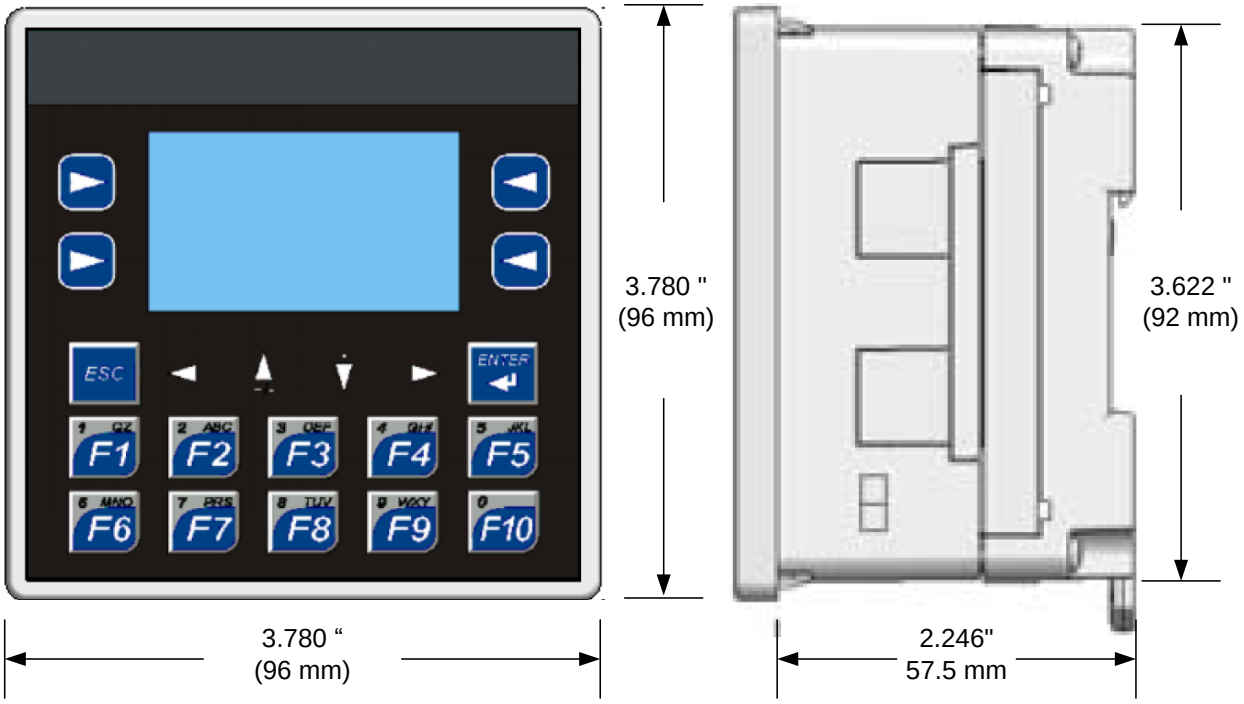


Figure 68. –Display Dimensions

5.1.2 Display Panel cut out

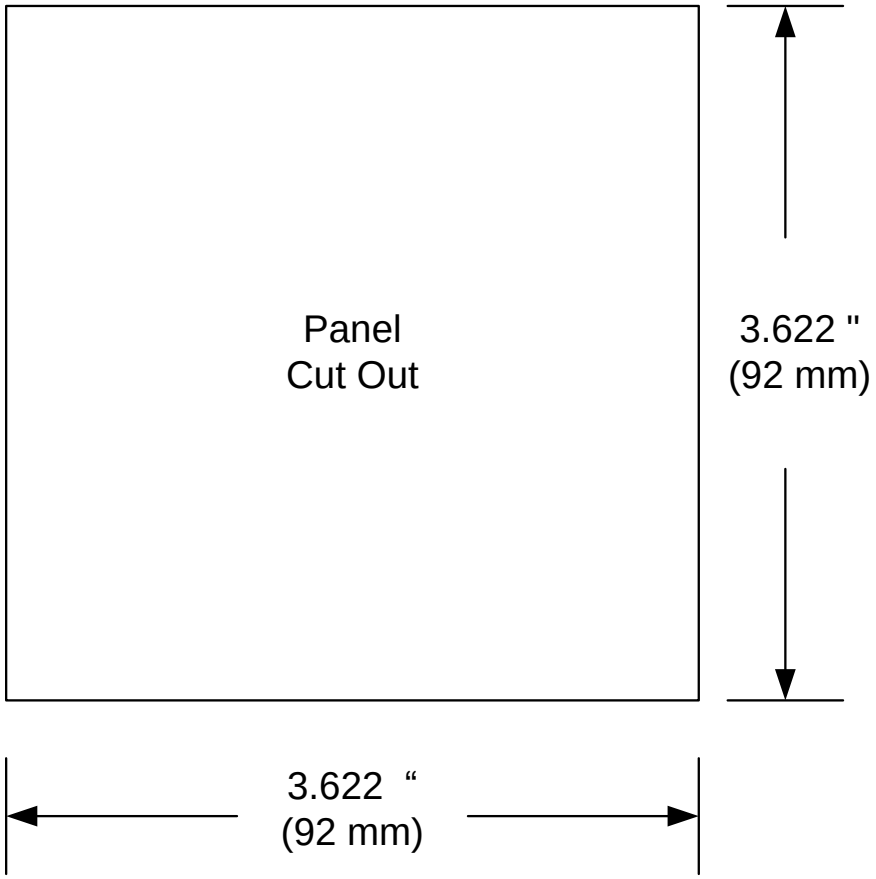


Figure 69. –Display Panel cut-out

5.1.3 Display (PLC) Electrical Connections

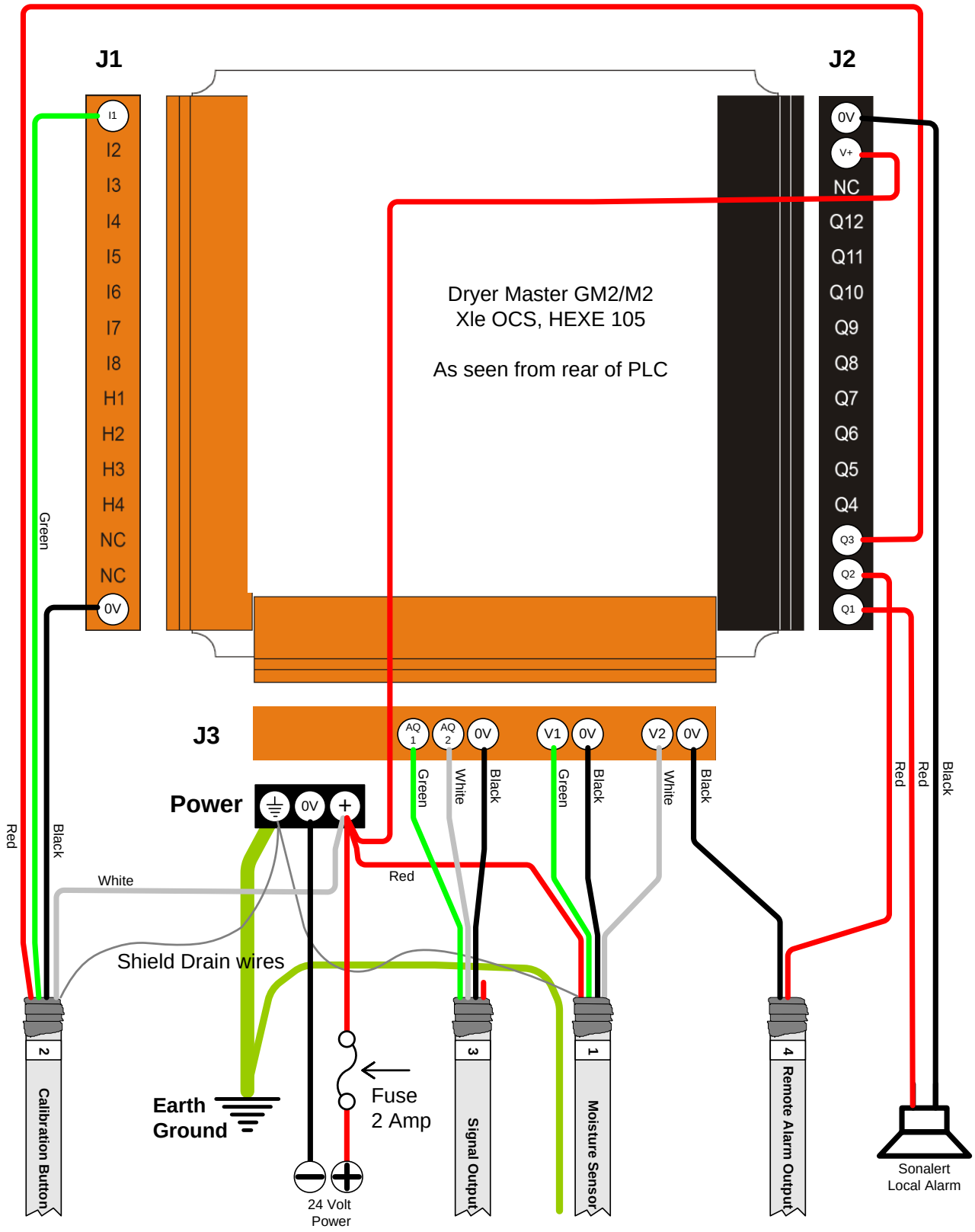


Figure 70. –Display Electrical connections

5.1.4 Field Electrical Connections

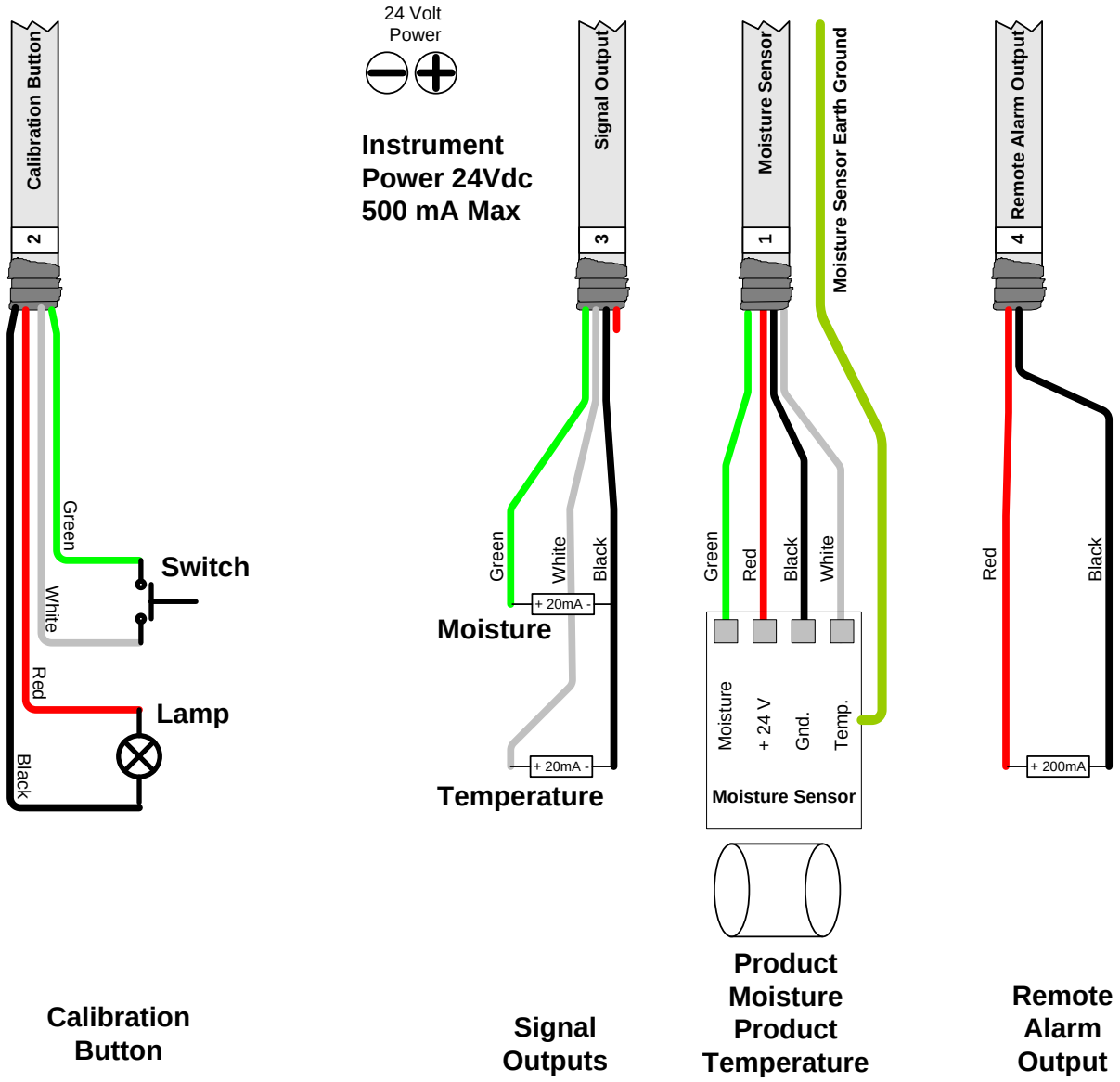


Figure 71. –Electrical connections Field devices

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 M2 Enhanced System Panel

The M2 Enhanced System 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 Enhanced System In Panel Electrical Connections

Figure 72. –M2 Enhanced System, In Panel connection terminal strip

5.2.2 Field Electrical Connections

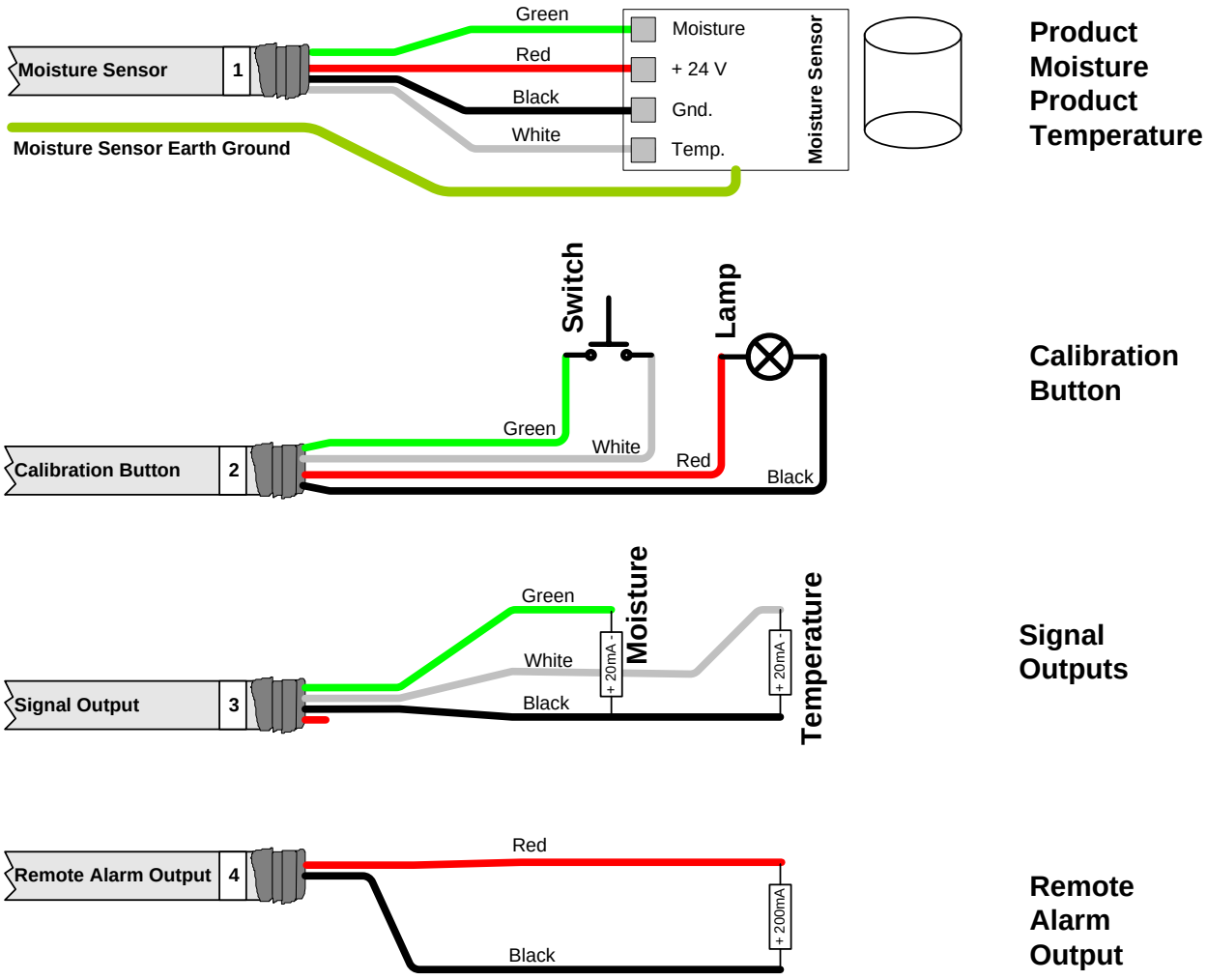


Figure 73. –Electrical connections Field devices

5.3 Printing Option

The printing option includes an adapter cable 'MJ2-RS232-9pinD' which connects into the jack labeled MJ2. This adapter is able to connect to a standard serial printer using a standard serial cable. There are no other configuration options available to the user.

The printer option kit includes all the components:

One MJ2-Rs232-9pinD adapter
One RS232 serial cable
One Serial terminal printer c/w universal voltage power supply.

For those wishing to supply their own printer you will need the following:

One Dryer Master MJ2-Rs232-9pinD adapter
Your printer must be a serial printer and you will need to set your printer for Baud =9600, parity = None, data bits = 8, and stop bits =1. Your printer must support the standard IBM ASCII character set.

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^3 (10 lbs/foot^3) to 1.5 g/cm^3 (95 lbs/foot^3), 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 = ^{o}C

For degrees Fahrenheit (Volts * 72) – 76 = ^{o}F

6.4 Dryer Master 2200-11-series, Fin Sensor

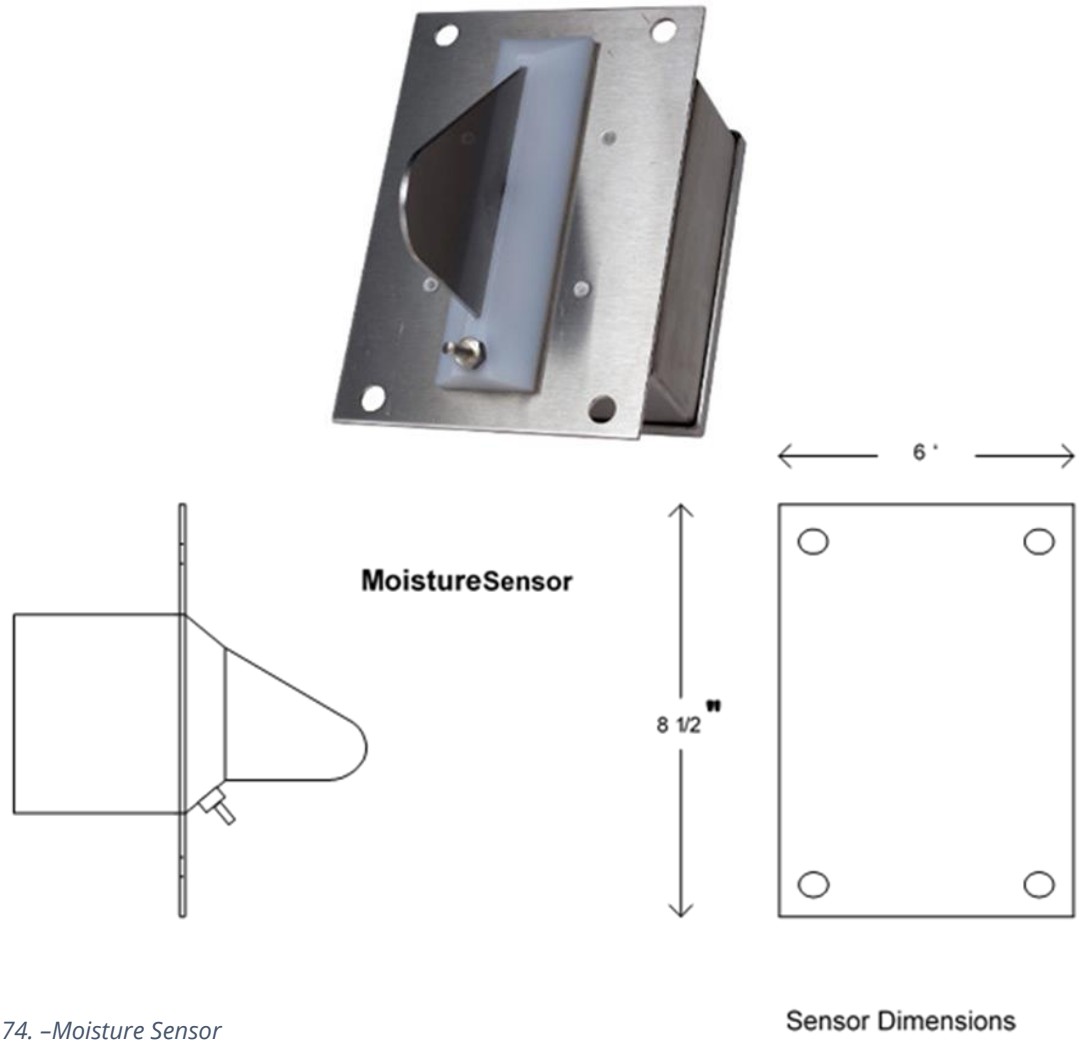


Figure 74. –Moisture Sensor

Caution:

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

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

---

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.

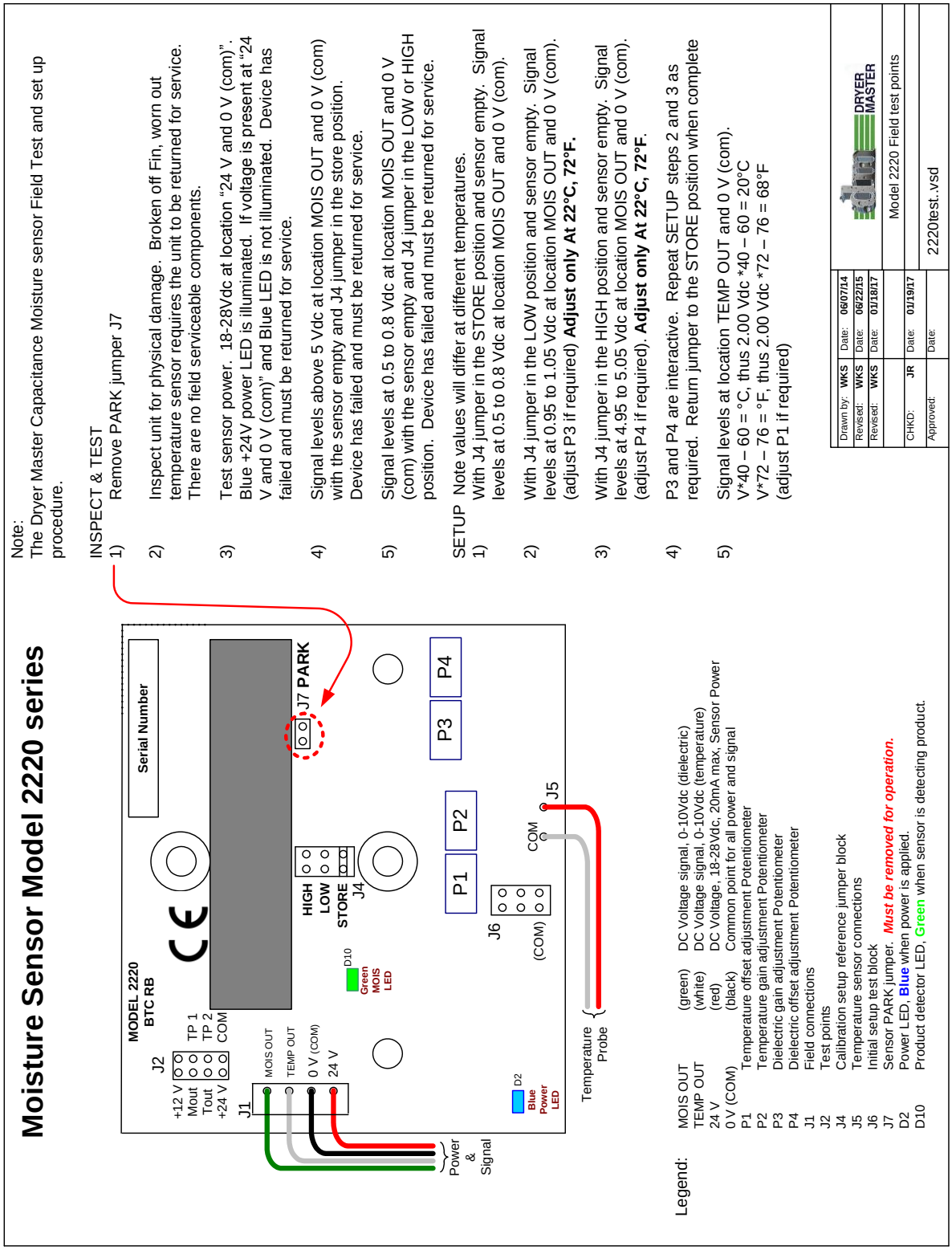


Figure 75. –Sensor Setup & diagnostics

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

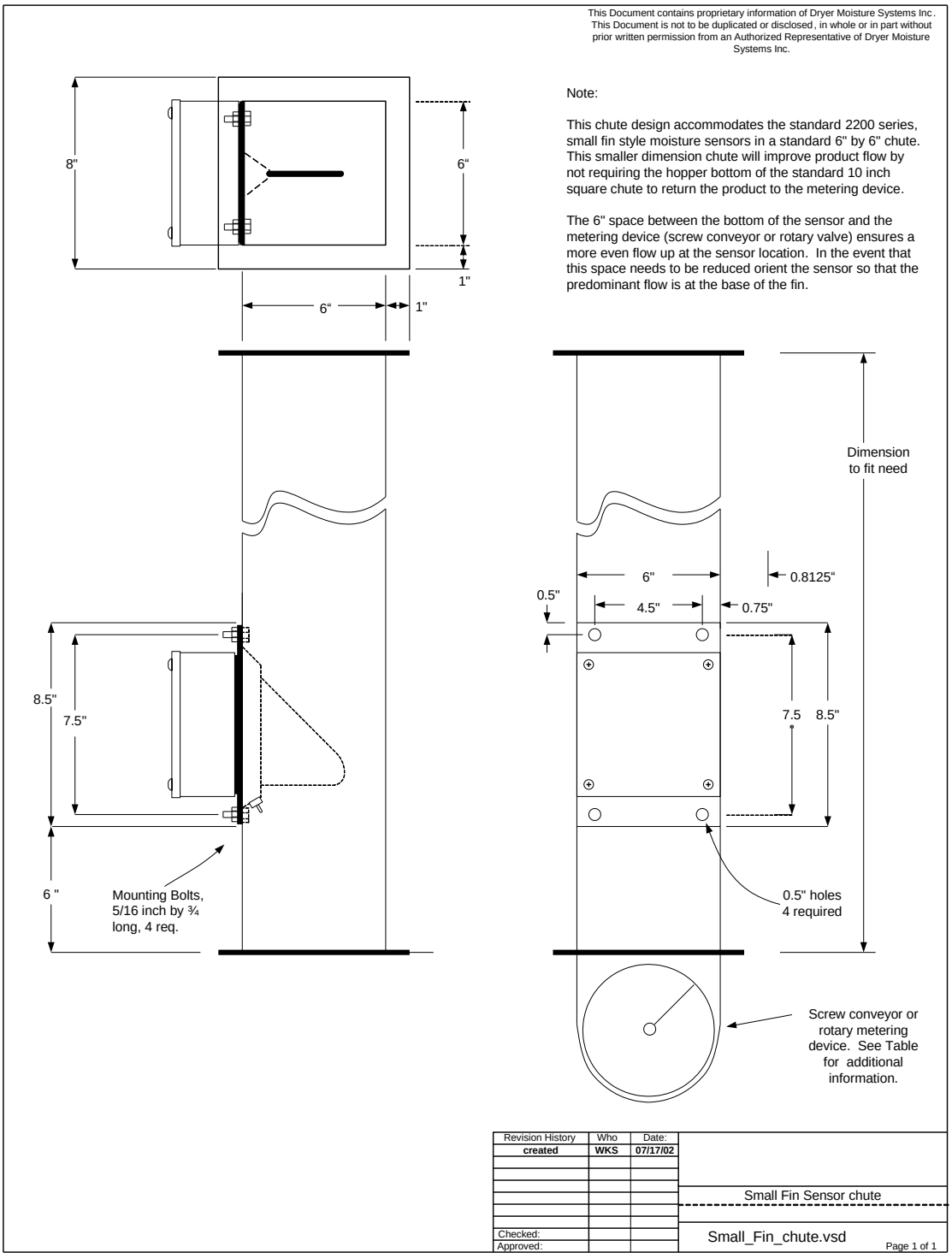


Figure 76. –Moisture Sensor Bypass Chute design #1 square pipe

7.1.2 Bypass Chute Installation round chute with screw metering

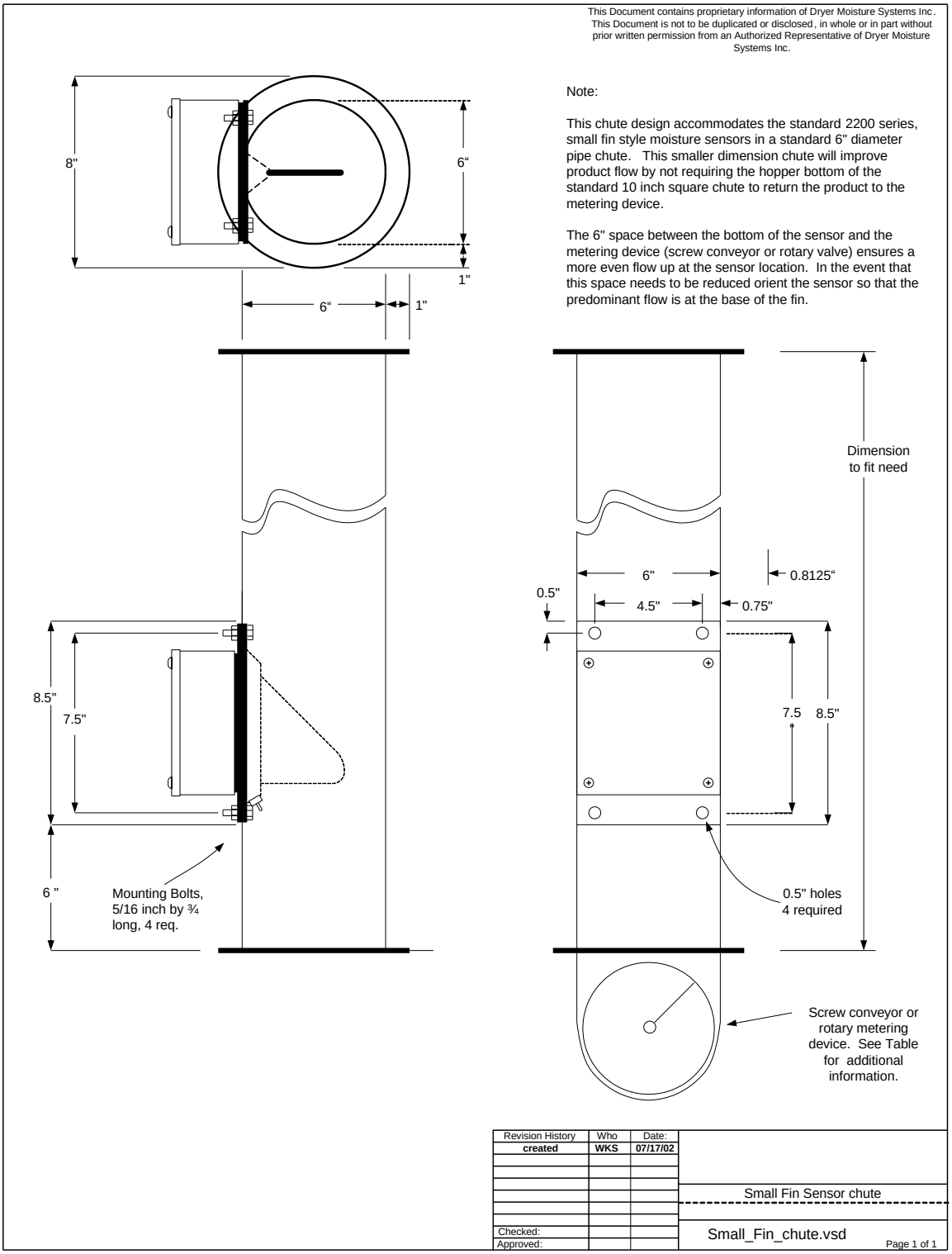


Figure 77. –Moisture Sensor Bypass Chute design #2 round pipe

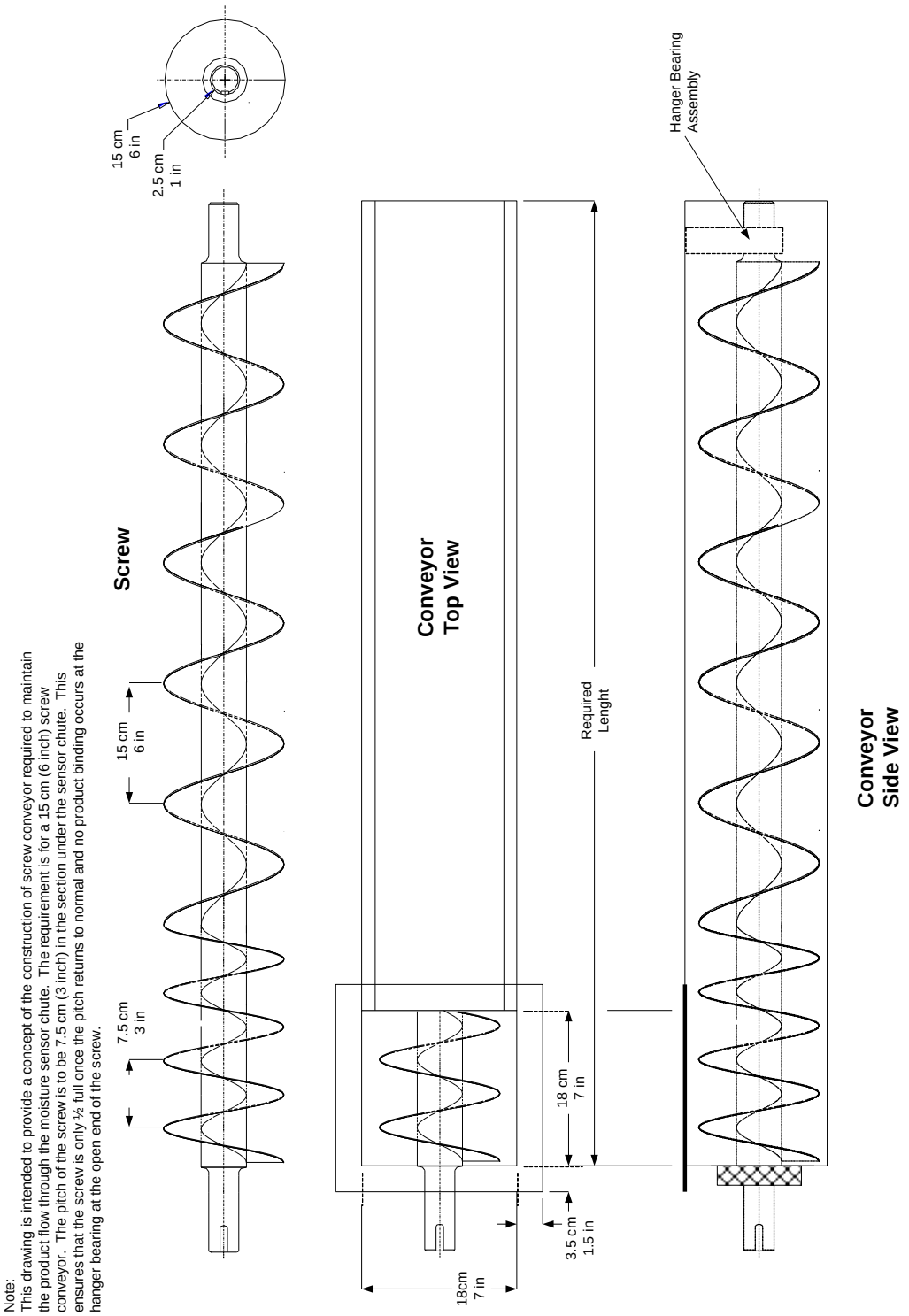


Figure 78. –Moisture Sensor Bypass Chute conceptual metering screw design

Metering Device	*Approximate rpm.*	*Gear Reduction for 1750 rpm Motor*
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 79. – 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

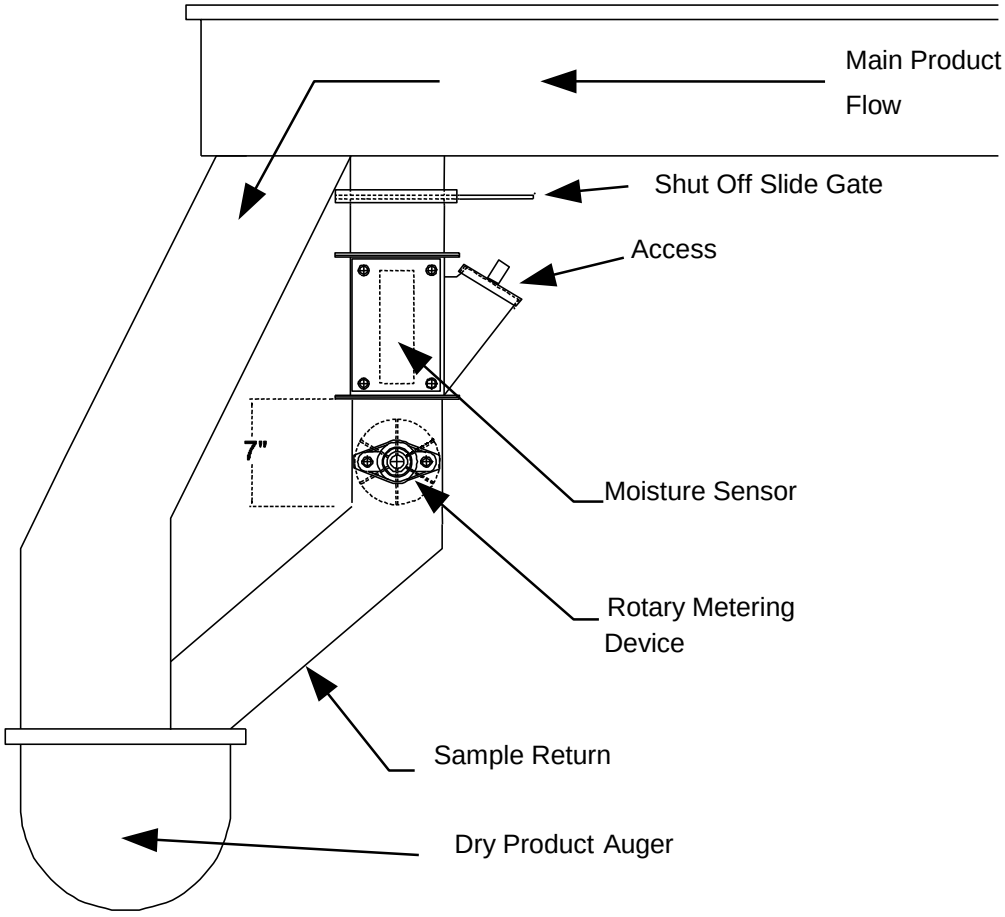


Figure 80. –Moisture Sensor, Example of a Sample Bypass Installation

Metering Device	*Approximate rpm.*	*Gear Reduction for 1750 rpm Motor*
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 81. –Table of metering device RPM – rotary airlock or rotary valve.

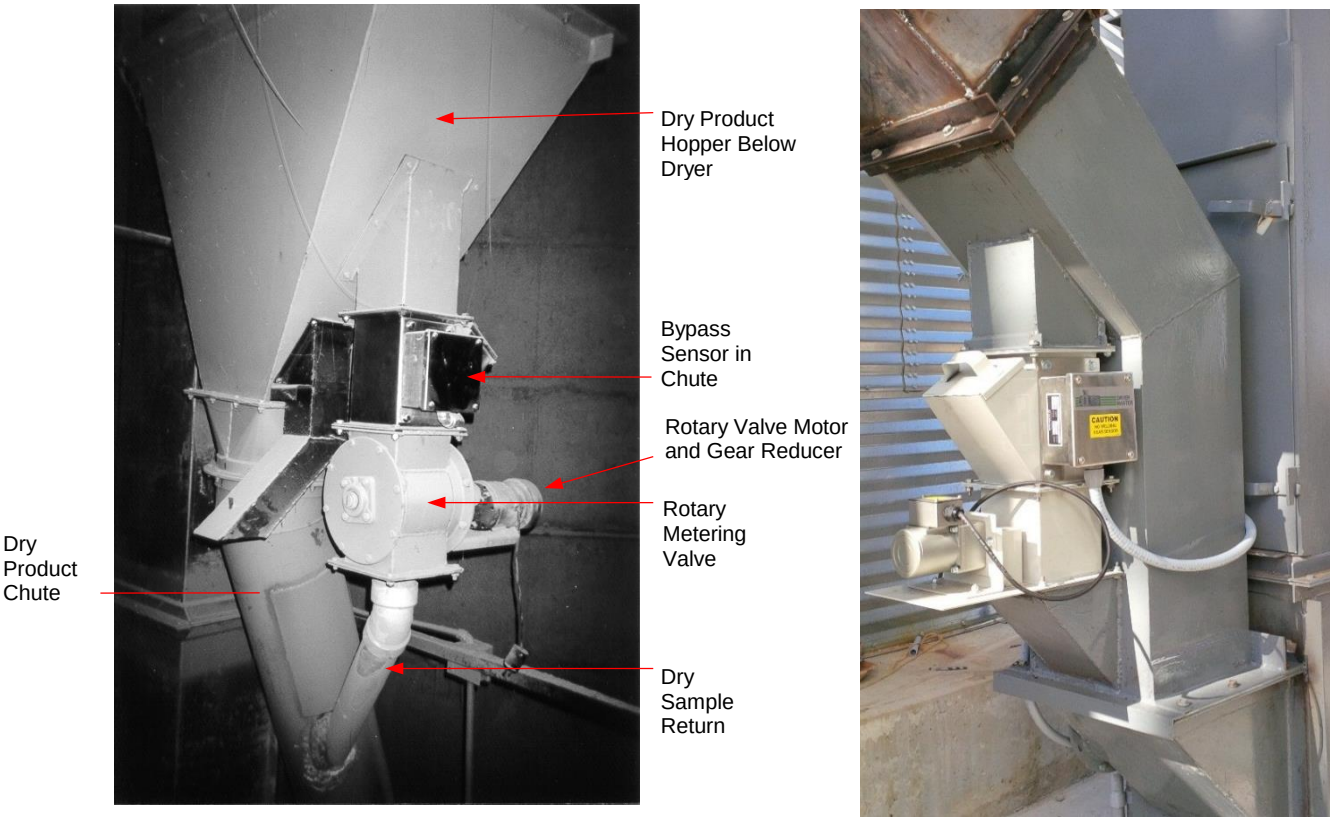


Figure 82. –Moisture Sensor, Examples of a bypass Chute Installation

Dryer Master also offers a moisture sensor chute w/rotary feed, pictured above right. See Appendix D for more details.

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 83. –Bypass Chute Example

7.1.5 Bypass Chute Example: Dimensions

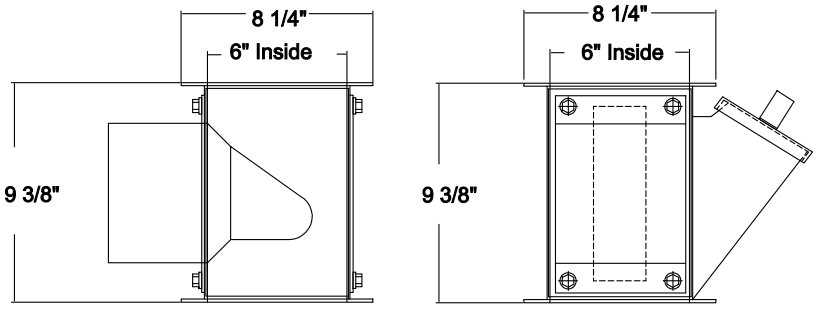
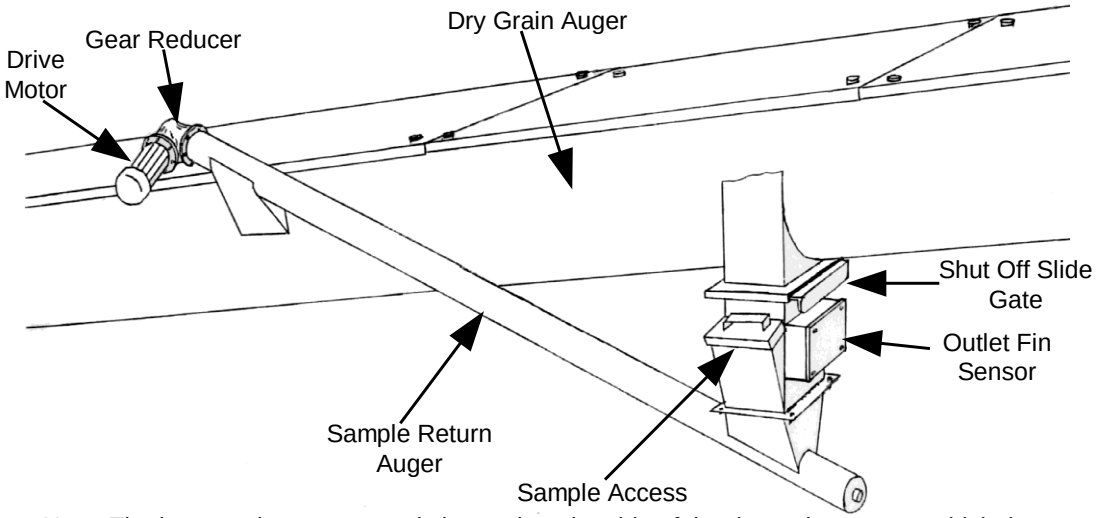


Figure 84. –Bypass Chute Example: Dimensions

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 85. –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 does 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.

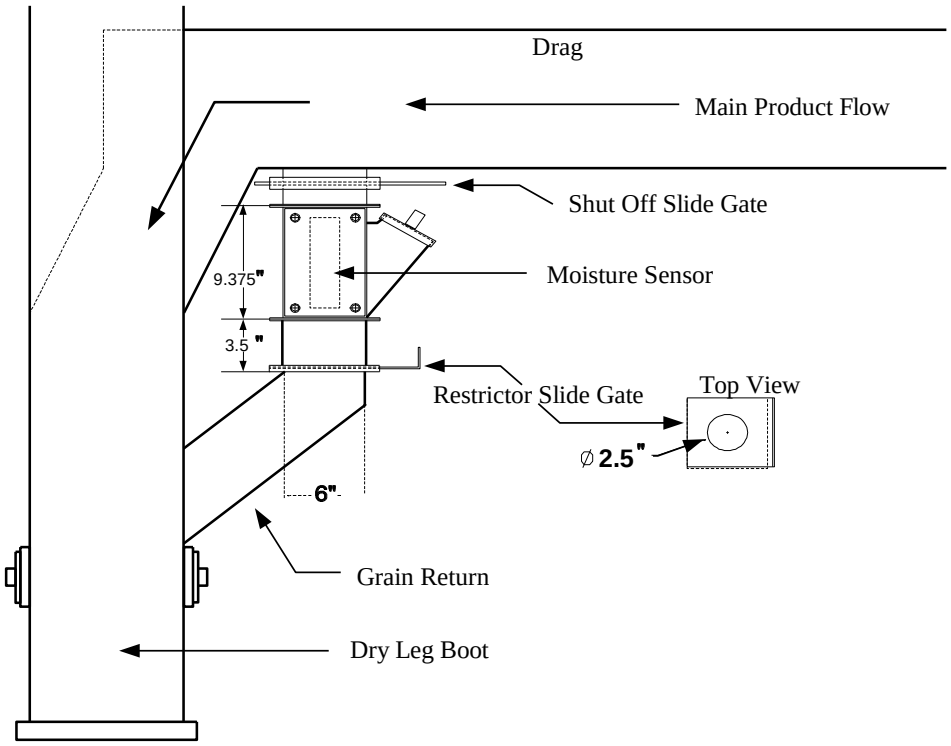


Figure 86. –Bypass Chute under Drag with mechanical flow restrictor metering.

Caution:

This chute design is inexpensive and an easy to design solution that should work for everything. In reality, Dryer Master in its 25 year history has seen many attempts of mechanical flow control not work. This metering method does however 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

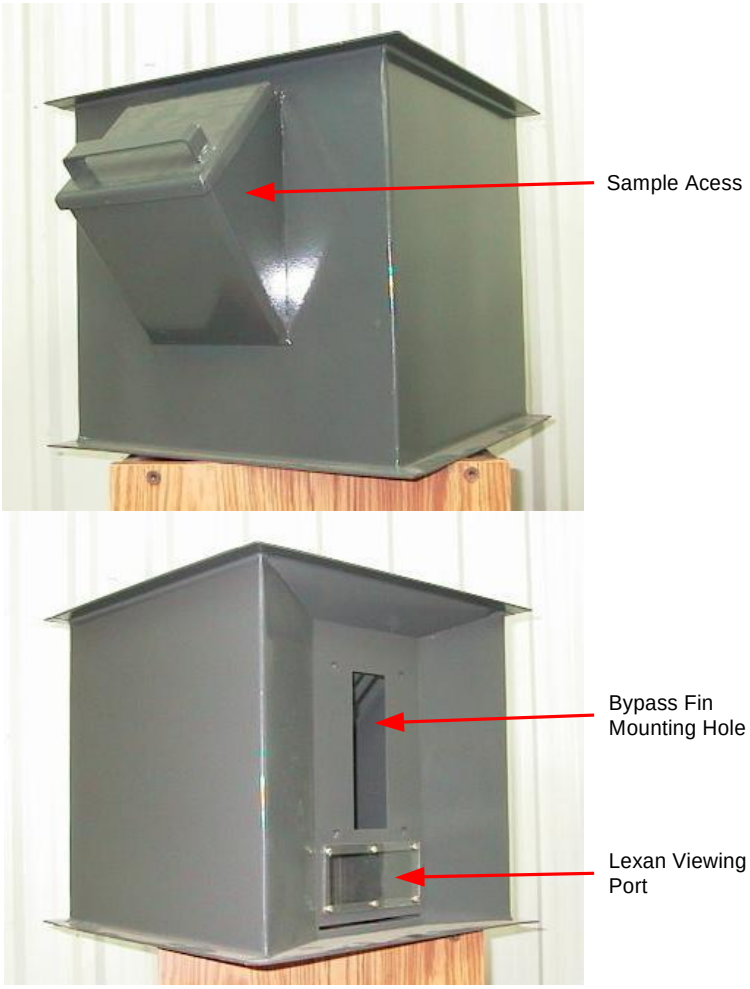


Figure 87. –In Line Chute Example

7.1.9 In Line Chute Example: Dimensions

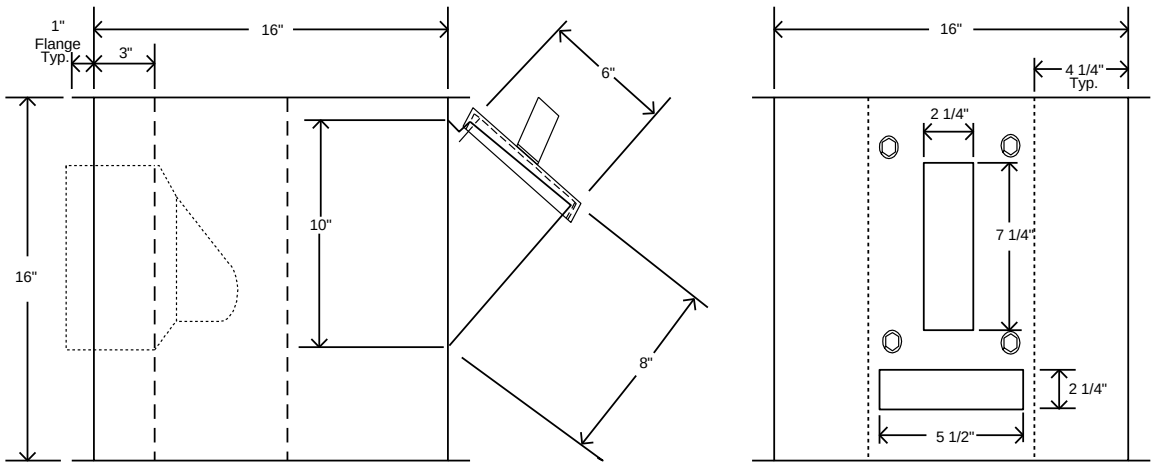


Figure 88. –In Line Chute Example: Dimensions

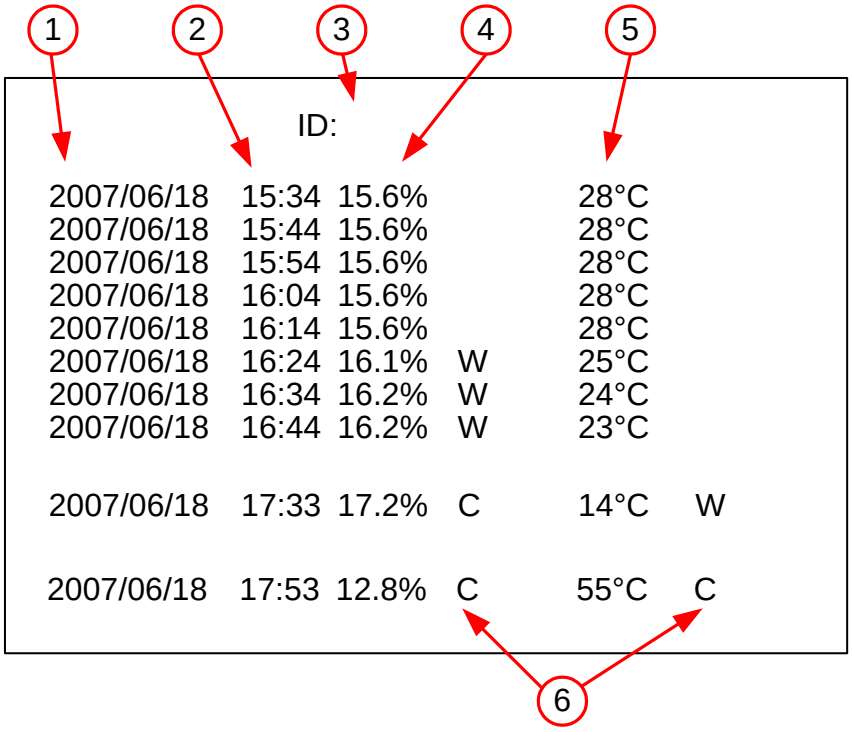
Caution:

This chute design is inexpensive and an easy to design solution that should work for everything. In reality, Dryer Master in its 25 year history 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.

8 Appendix A

8.1 Printing Data format

Printing is available on systems with software version 2.0 and newer. The system is able to send operations data at 10 minute intervals to a serial receipt printer.



1) Date, Year/Month/Day universal format

2) Time, 24 hour clock format

3) ID, User entered numeric ID tag for tracking purposes. Printed each time "Print header" is selected.

4) Moisture %, Average moisture for the preceding 10 minute period.

5) Product Temperature degrees, Degrees **C** or **F** is selected in Engineering Functions under Temperature scale setup.

6) Alarm Indicator, **C** = critical alarm, **W** = warning alarm. See Set Alarms to change.

Figure 89. –Printed page data format

9 Appendix B

9.1 History & Calibration files Data format

History Data collection on "micro SD" flashcard is available on systems with software version 2.21 and newer. The system is able to send operations data at 1 minute intervals and calibration entries to a "micro SD" flash memory card. The data is stored in a .CSV (Comma, Separated, Values) format for easy recognition by most spread sheet programs. A 500 meg memory card is able to store 30 years of history and calibration data.

When reading the "micro SD" flash card you will find 2 folders. The operations history is stored in the "DATA" folder, calibration entries are stored in the "CAL" folder. Note the files in these folders will have the same name so take appropriate precautions when transferring the files to your computer system.

The files will be labeled with the date in the format "070719.CSV". The format is YYMMDD.CSV where YY = year, MM = Month, DD = day. One file is created each day in the DATA folder. Files in the CAL folder are only created on days when calibration entries have taken place.

9.1.1 History data example

Date	Time	Moisture	Moisture_Alarm	Temperature	Temperature_Alar	Moisture_Signal	Temperature_Sign
19/07/2007	15:13	15.1415		77.0365		2.48991	2.12546
19/07/2007	15:14	15.1417		77.0365		2.48991	2.12546
19/07/2007	15:15	15.1418		77.0365		2.48991	2.12546
19/07/2007	15:16	15.1408		77.0365		2.48841	2.12546
19/07/2007	15:17	15.1406		77.0365		2.48991	2.12546
19/07/2007	15:18	15.1418		77.0365		2.48991	2.12546
19/07/2007	15:19	15.1419		77.0365		2.48991	2.12546
19/07/2007	15:20	15.1415		77.0365		2.48991	2.12546
19/07/2007	15:21	15.141		77.043		2.48841	2.12546
19/07/2007	15:22	15.1412		77.043		2.48991	2.12546
19/07/2007	15:23	15.1412		77.043		2.48991	2.12546
19/07/2007	15:24	15.1415		77.043		2.48991	2.12546
19/07/2007	15:25	15.1405		77.043		2.48991	2.12546
19/07/2007	15:26	15.1409		77.043		2.48991	2.12546
19/07/2007	15:27	15.1398		77.043		2.48991	2.12546
19/07/2007	15:28	15.1405		77.043		2.48991	2.12546

Figure 90. –History file data format

Note, the columns "Moisture Alarm" and "Temperature Alarm" will display "W" for warning alarms and "C" for critical alarms.

9.1.2 Calibration data example

Date	Time	Online_Sample	Manual_Sample	T_Voltage	Slope	Offset	Product
23/07/2007	11:57:12	16.3305	16.4	2.13023	3	3.5	1
23/07/2007	13:30:06	16.3741	15.5	2.13023	5.5	1.5	0
23/07/2007	13:31:28	14.8068	15.9	2.13149	5.5	1.06293	0
23/07/2007	13:32:25	15.3068	15.9	2.13023	5.5	1.56293	0
23/07/2007	13:33:25	15.6034	14.9	2.13023	5.5	1.85953	0
23/07/2007	13:34:36	15.2517	16.1	2.13023	5.5	1.85953	0
23/07/2007	13:35:35	15.6758	14.8	2.13023	5.5	1.93197	0

Figure 91. –Calibration file data format

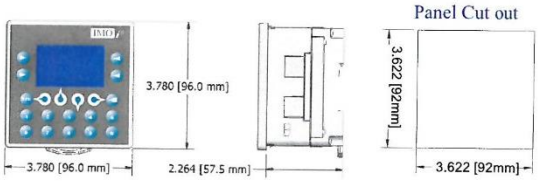
10 Appendix C: IMO Start-Up Guide

i^3 User Start-up Guide

IMO The World's Finest

Getting Started:

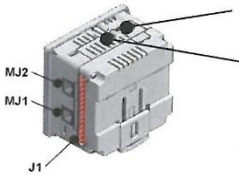
1. Connect the 24VDC power as shown on the connector below.
2. Install i^3 Configurator onto your PC.
3. Connect serial programming cable into port MJ1 port.
4. If using a USB to serial convertor (PC501), please check in Window Device Manager which com port has been assigned. Then enter menu Tools->Editor Options-> Communications port->Configure, and set accordingly.
5. Press the up and down arrows simultaneously on the front of the unit and check Network ID. Then press the target sign in the Configurator and make the Target ID match that of the i^3



Panel Cut out

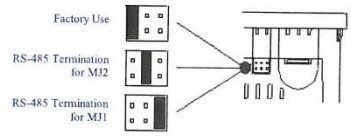
1 3 A 1 2 X /	128x64 Display, 14 programmable keys
1 0	12 Digital Inputs (4 HSC)
A	1 Analogue Input (10-bit)
0	0 Analogue Outputs (12 bit)
1	6 Relay Outputs
- S O O	2 Serial Ports, 0 CAN port
F	MicroSD Card

WARNING: Please ensure power is ON and i^3 is in Idle mode before inserting SanDisk™ MicroSD.



MicroSD Card slot on SOOF Models only.

External Jumper Configuration.
As seen when looking at the top of the i^3 unit



Serial Ports
MJ1 / MJ2

Back cover screws. Remove the 4 screws and back plate to access the Internal jumpers.

WARNING: Do not Over-tighten screws.

Power Connector

Power Up:
Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.

1 - Positive
2 - Negative
3 - Ground

MJ1 Serial Port Pin Assignments

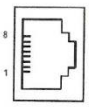
Pin	Signal	Signal Description	Direction
8	TD[1]	RS-232 Transmit Data	Out
7	RD[1]	RS-232 Receive Data	In
6	0V	Ground	-
5	+5	+5 VDC 60mA max	Out
4	RTS[1]	RS-232 Request to Send	In
3	CTS[1]	RS-232 Clear to Send	Out
2	RX/TX-	Receive/Transmit Negative	In/Out
1	RX/TX+	RS-485 Receive/Transmit Positive	In/Out

MJ2 Serial Port Pin Assignments

Pin	Signal	Signal Description	Direction
8	TD[1]	RS-232 Transmit Data	Out
7	RD[1]	RS-232 Receive Data	In
6	0V	Ground	-
5	+5	+5 VDC 60mA max	Out
4	TX-	RS-485 Transmit Negative	In
3	TX+	RS-485 Transmit Positive	Out
2	RX-	RS-485 Receive Negative	In
1	RX+	RS-485 Receive Positive	In

[1]Signals are labeled for connection to a DTE device
* +5 on i^3 H/W Rev E and later

MJ2 RS485 Connection Examples:



MJ2 - Full Duplex Mode

Pin	MJ2 Pins Signal	MJ2 Pins Direction
8	-	-
7	-	-
6	0V	Ground
5	-	-
4	TX-	OUT
3	TX+	OUT
2	RX-	IN
1	RX+	IN

MJ2 - Half Duplex Mode

Pin	MJ2 Pins Signal	MJ2 Pins Direction
8	-	-
7	-	-
6	0V	Ground
5	-	-
4	-	-
3	-	-
2	TX-/RX-	IN/OUT
1	TX+/RX+	IN/OUT

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or Non-hazardous locations only

WARNING: EXPLOSION HAZARD – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DECONNECTOR L'EQUIPMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: EXPLOSION HAZARD – Substitution of components may impair suitability for Class I, Division 2
AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIAL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE 1, DIVISION 2

WARNING: EXPLOSION HAZARD - BATTERIES MUST ONLY BE CHANGED IN AN AREA KNOWN TO BE NON-HAZARDOUS
AVERTISSEMENT - RISQUE D'EXPLOSION - AFIN D'EVITER TOUT RISQUE D'EXPLOSION, S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX AVANT DE CHANGER LA BATTERIE

WARNING: Battery May Explode If Mistreated. Do Not Recharge, Disassemble or Dispose Of In Fire

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- 1 -

i3A_IBD1F REV4_0909

I/O Register Map

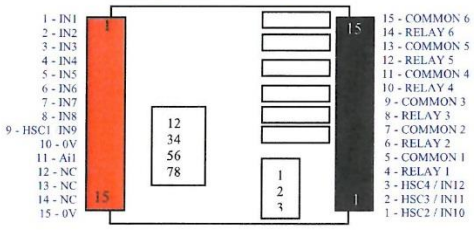
Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max – 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 3 Reset to max – 1
%Q21 to %Q32	Reserved
%AI1 to %AI4	Analogue inputs
%AI5, %AI6	HSC1 Accumulator
%AI7, %AI8	HSC2 Accumulator
%AI9, %AI10	HSC3 Accumulator
%AI11, %AI12	HSC4 Accumulator
%AQ1, %AQ2	PWM1 Duty Cycle
%AQ3, %AQ4	PWM2 Duty Cycle
%AQ5, %AQ6	PWM Prescale
%AQ7, %AQ8	PWM Period
%AQ9 to %AQ14	Analogue outputs

Note: Not all i^3 units contain the I/O listed in this table.

Wiring Specifications

- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm²) or larger.
- For shielded Analogue I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm²) or larger.

Analogue I/O and Digital I/O



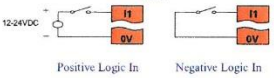
Internal Jumper Configuration

I/O Jumper settings are located internally. Remove the 4 screws on the back and lift casing off to access. **Only access when power is removed from the i^3.** Care must be taken to avoid over tightening the case screws.

Digital Input

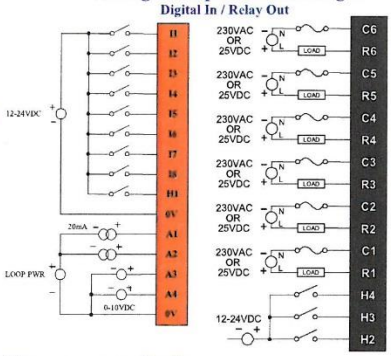
Positive Logic vs. Negative Logic Wiring

The i^3 can be wired for Positive Logic inputs or Negative Logic inputs depending on the position of JP1.



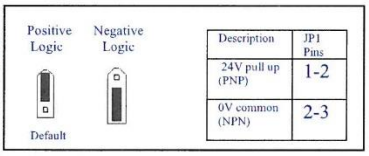
Wiring Example: Positive Logic

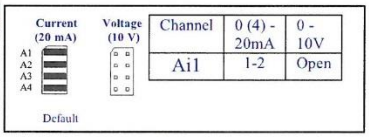
Digital In / Relay Out



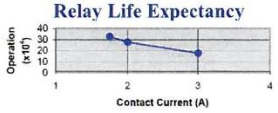
WARNING: Do not short loop power source directly to analogue inputs, more than 35mA load can damage input circuit.

Registers	PWM	HSC	Stepper
%AQ1	PWM1 Duty Cycle (32 bit)	HSC1 Preset Value	Start Frequency
%AQ2			Run Frequency
%AQ3	PWM2 Duty Cycle (32 bit)	HSC2 Preset Value	Accel Count (32 bit)
%AQ4			
%AQ5	PWM Prescale (32 bit)		Run Count (32 bit)
%AQ6			
%AQ7	PWM Period (32 bit)		Decel Count (32 bit)
%AQ8			
%Q1			Run
%I30			Ready/Done
%I31			Error

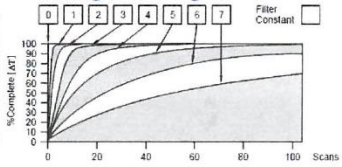




Relay Life Expectancy



Analogue Filtering



Expansion I/O Modules

All i^3 controllers can have extra analogue and digital I/O added by connecting expansion modules to either MJ1 or MJ2 ports.

iCAN based expansion I/O is also available on special request. Please inquire at IMO technical support. automation@imopc.com

Basic Options

Input - 4 Channel RTD (0-2000ohm, 0-500ohm, PT100, Ni100, PT1000, Ni1000)	iOS / M 4 I P X - D1
Input - 8 Channel DC Current (-20mA to +20mA)	iOS / M 8 I C X - D1
Input - 8 Channel DC Voltage (-10V to +10V)	iOS / M 8 I V X - D1
Input - 8 Channel Thermocouple (J, K, R, S, B, E, T, N, -/+ 50mV, -/+100mV)	iOS / M 8 I T X - D1
Output - 4 Channel DC Voltage / Current (0-20mA, 0-10V)	iOS / M 4 O X A - D1
16 Digital Input, 16 Transistor output (0.1A / Channel, 2A / Common)	GSL - D T 4 A
16 Relay Output (2A / Channel, 5A / Common)	GSL - R Y 2 A
32 Digital Input	GSL - D 2 4 A

Note: Other I/O configurations and Fieldbus options are available. Please inquire at IMO. automation@imopc.com

For further information on Remote I/O please consult the Remote I/O datasheet, and the i^3 Remote I/O tutorial in the downloads section of the IMO website. www.imopc.com/manuals

Technical Specifications		
Digital DC Inputs		
Inputs per Module	12 including 4 configurable HSC inputs	
Commons per Module	1	
Input Voltage Range	12 VDC / 24 VDC	
Absolute Max. Voltage	35 VDC Max.	
Input Impedance	10 kW	
Input Current	Positive Logic	Negative Logic
Upper Threshold	0.8 mA	-1.6 mA
Lower Threshold	0.3 mA	-2.1 mA
Max Upper Threshold	8 VDC	
Min Lower Threshold	3 VDC	
OFF to ON Response	1 ms	
ON to OFF Response	1 ms	
HSC Max. Switching Rate	10 kHz Totalizer/Pulse, Edges 5 kHz Frequency/Pulse, Width 2.5 kHz Quadrature	
Digital Relay Outputs		
Outputs per Module	6 relay	
Commons per Module	6	
Max. Output Current per Relay	3 A at 250 VAC, resistive	
Max. Total Output Current	5 A continuous	
Max. Output Voltage	275 VAC , 30 VDC	
Max. Switched Power	1250 VA, 150 W	
Contact Isolation to i3 ground	1000 VAC	
Max. Voltage Drop at Rated Current	0.5 V	
Expected Life **(See Derating section for chart.)**	No load: 5,000,000 Rated load: 100,000	
Max. Switching Rate	300 CPM at no load 20 CPM at rated load	
Type	Mechanical Contact	
Response Time	One update per ladder scan plus 10 ms	
Analogue Inputs Medium Resolution		
Number of Channels	1	
Input Ranges	0 - 10 VDC 0 – 20 mA 4 – 20 mA	
Safe input voltage range	-0.5 V to +12V	
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	Current Mode: 100 W	Voltage Mode: 500 k W
Nominal Resolution	10 Bits	
%AI full scale	32,000 counts	
Max. Over-Current	35 mA	
Conversion Speed	All channels converted once per ladder scan	
Max. Error at 25°C **(excluding zero)** ***can be made tighter (~0.25%) by adjusting the digital filter setting to 3.**	4-20 mA 1.00% 0-20 mA 1.00% 0-10 VDC 1.50%*	
Additional error for temperatures other than 25°C	TBD	
Filtering	160 Hz hash (noise) filter 1-128 scan digital running average filter	

General Specifications	
Required Power (Steady State)	130 mA @ 24 VDC
Required Power (Inrush)	30 A for 1 ms @ 24 VDC – DC Switched
Primary Power Range	10 – 30 VDC
Relative Humidity	5 to 95% Non-condensing
Clock Accuracy	+/- 35 ppm maximum at 25° C (+/- 1.53 Minutes per Month)
Operating Temperature	-10°C to +60°C
Terminal Type	Screw Type, 5 mm Removable
Weight	12 oz. (340.19 g)
CE **UL**	Approved

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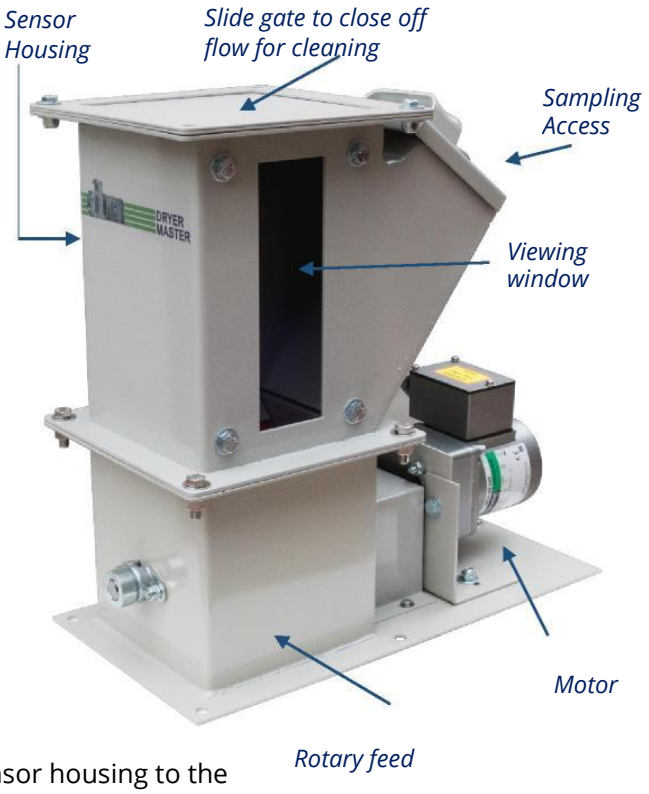
Tel: +44 (0) 208 452 6444,
Fax: +44 (0) 208 450 2274,
Web: www.imopc.com

For further technical information and a full specification, please consult the Hardware Manual

11 Appendix D Sensor Chute w/ Rotary Feed

The sensor chute is designed to be used in a bypass type installation of the outlet moisture sensor. In a bypass type installation only a portion of the total product flow passes by the sensor (See pages 28-29).

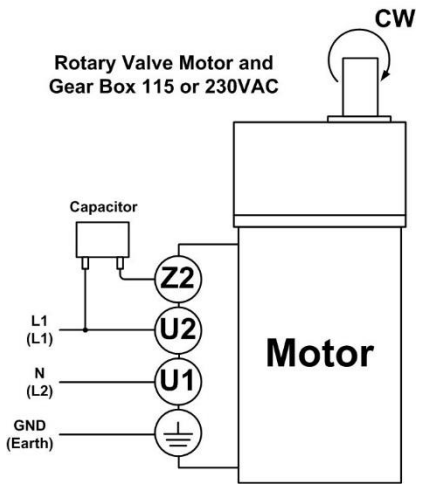
- Dimensions: 16 1/2" L x 8 1/2" W x 16 1/2" H Upper mounting flange 8 1/2" x 8 1/2"
- Built in sampling access
- Motor is IP65, 25W, 115VAC single phase, 0.43FLA reversible motor with 180:1 gear reduction (230VAC also available if required)
- Sensor housing can be mounted in any direction without impacting flow (must be vertical)

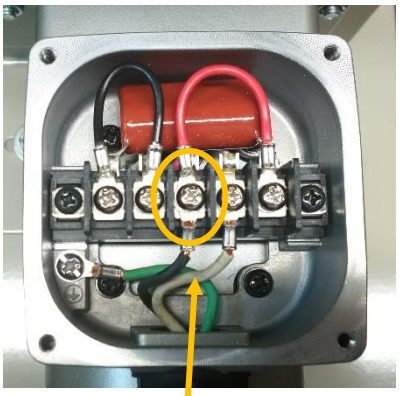


11.1 Installation Considerations:

1. The sensor housing (top portion of the assembly) can be mounted in any direction. You can unbolt the four bolts attaching the sensor housing to the rotary feed, then rotate the housing to the desired direction, and then bolt back together. The sensor can also be mounted where the viewing window is located (and then move the viewing window to the previous sensor location).
2. 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 will usually accomplish this
3. 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").

The motor can run either clockwise (CW) or counter clockwise (CCW).





Move the black wire to change the direction of rotation

Move the black wire to change the direction of rotation