DRYER MASTER

AM3

Mini Moisture Manager

USER'S GUIDE

Dryer Master AM^3

Product Manual

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Dryer Master Inc.

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To Our Customer

Thank you for purchasing the Dryer Master® AM³ (Automatic Mini Moisture Manager) System. The Dryer Master AM³ is a robust system that employs state logic for control. It is simple to use and can be applied to most if not all grain moisture measurement applications.

The AM³ 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 moisture control systems, where they are placed at the inlet and the outlet of the dryer. With over 30 years of field proven experience they are now being offered as part of the AM³ moisture monitoring and state logic control solution.

We trust that you will be pleased with the operation of the AM³ 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 an on-line moisture display system with a single sensor; product moisture and product temperature are displayed. Moisture control is achieved using state logic. 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.

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 either by heating or cooling but not limited to either. The sensor's robust construction and conservative installation specifications ensure long product life.

Moisture control technology

The Dryer Master® AM³ state control technology employs a 3 state model triggered by user settable moisture targets, time delays and speed set points for continues dryers. Instead of constantly switching between a high and low discharge speed as used in many smaller on farm drying systems the system switches between higher discharge speed triggered by drier product to normal speed, to lower speed triggered by higher moisture product. Depending on the operating mode the 3 speeds can be either individually manually set, set as a % of the normal operating speed, or a specific deviation from the normal speed. The trigger points are actual moistures measured by the moisture sensor and delays to activation are user settable from 1 second to 999 seconds or 16.65 minutes. The system can also be configured for recirculation batch type dryers. Where the product is re- circulated in the dryer until a specific moisture target is reached and the dryer is unloaded.

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 2 key elements, the industry proven Dryer Master Moisture sensor and a Micro PLC with integrated touch screen information display.

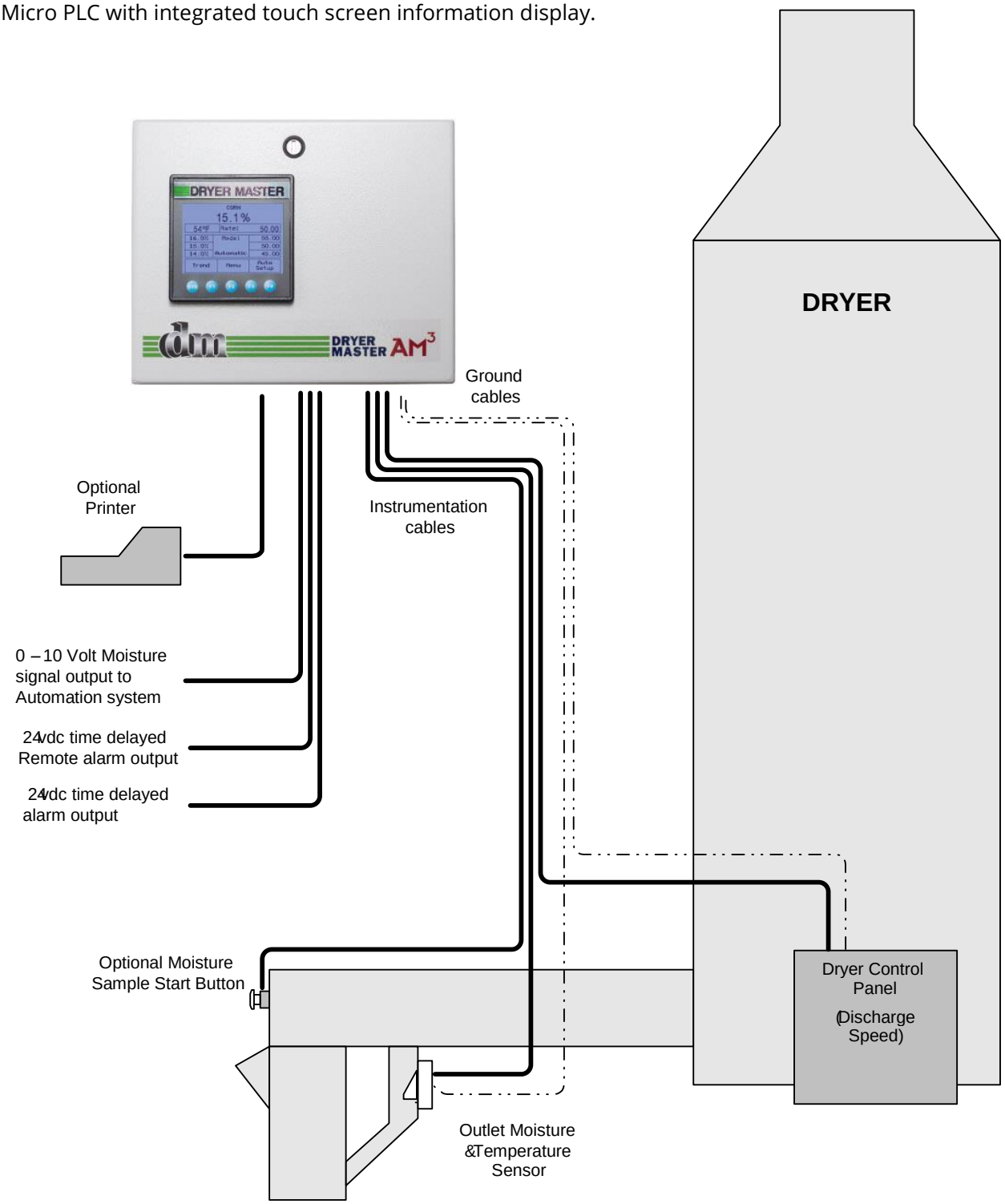


Figure 1. – Typical System with enhanced display and options

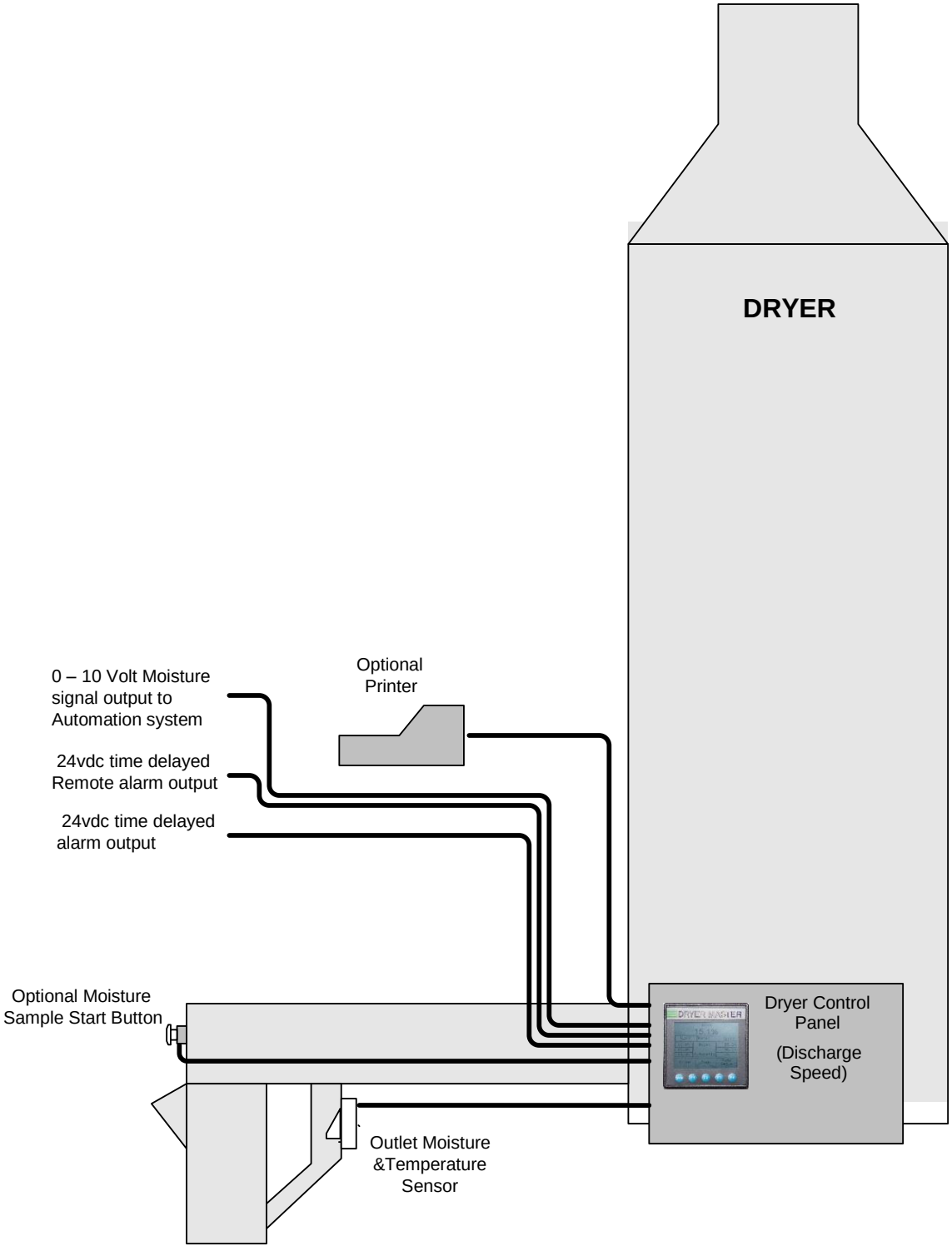


Figure 2. – Typical System with standard display mounted in Dryer Control panel and options

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, Discharge Rate settings, 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 3. – 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 4. – Fin 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 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 5. – Information display in enclosure

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

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

6. Alarm outputs with time delay settings can be used sound alarm devices and or trigger events.

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

This is a Touch screen system. Throughout this document there may be references to "**Touch Keys**" or "**Touch areas**" which refer to values or text on the LCD display. These "**Touch Keys**" or "**Touch areas**" will access 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).

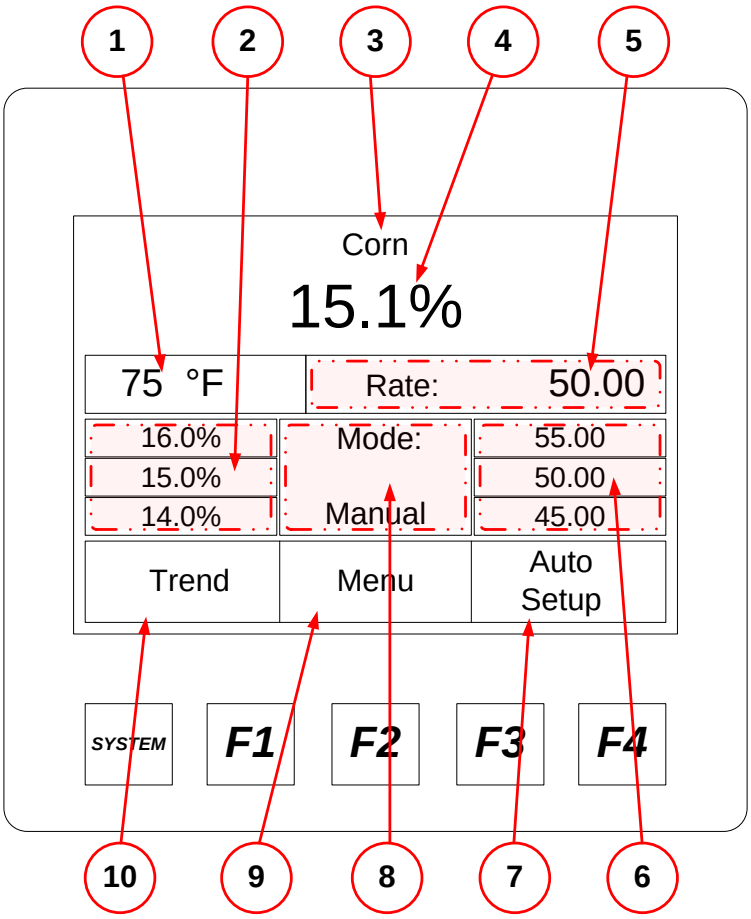


Figure 6. –System display items description.

1. **Product Temperature:** Actual temperature of product as detected by the Moisture sensor temperature probe.

2. **Moisture targets:** Indicates, top to bottom "**High**" moisture trip point, "**Target**" moisture, "**Low**" moisture trip point. This is an active touch area. Press to change values.

3. **Product Name:** This is the currently selected product. The text is replaced by an alarm indicator in the event either the product temperature or product moisture is in alarm.

4. **Product Moisture** display: Actual moisture of the product as detected by the Dryer Master Moisture sensor. Note this will indicate "**Empty**" when the sensor output is below critical trigger threshold either by being empty, not connected or moisture so low that reading is not possible.

5. **Rate:** Discharge Rate Set point. This is the speed signal sent to the Dryers Discharge system. This value is displayed when the dryer speed selection is switched to the AM³ (Manual or Automatic). This is an active touch area. Press to change values.

6. **Rate Targets:** Indicates, top to bottom "**High**" rate value triggered by low moisture trip point, "**normal**" Rate, "**Low**" rate value triggered by high moisture trip point. This is an active touch area. Press to change values.

7. **Auto Setup** Touch key: Use to set operating limits and Auto modes.

8. **Mode:** Operating Mode, choices are "**Local**", Speed set at the Dryers Speed potentiometer or display, "**Manual**" Speed is set manually at the AM³, "**Automatic**" Speed set point is Automatic via the programmed settings.

9. **Menu:** Product selection, Sensor calibrations, Alarms and others are available through the Menu screens.

10. **Trend:** Switches to current operation trend graph**.**

3.2 System Screens Map

This screens map shows the first layer screens available from the Main display. In-depth description and navigation is detailed in the document.

Start-up "Self Test"
System Information

Main Operations Screens

Main Operations Screen, setting discharge rate while in MANUAL mode.

Main Operations Screen, changing operations modes

Main Operations Screen, changing Moisture targets and trip points as well as operating speeds

Main Operations Screen, navigating Auto Setup.

Main Operations Screen, navigating the Menu.

Main Operations Screen, selecting the Trend displays

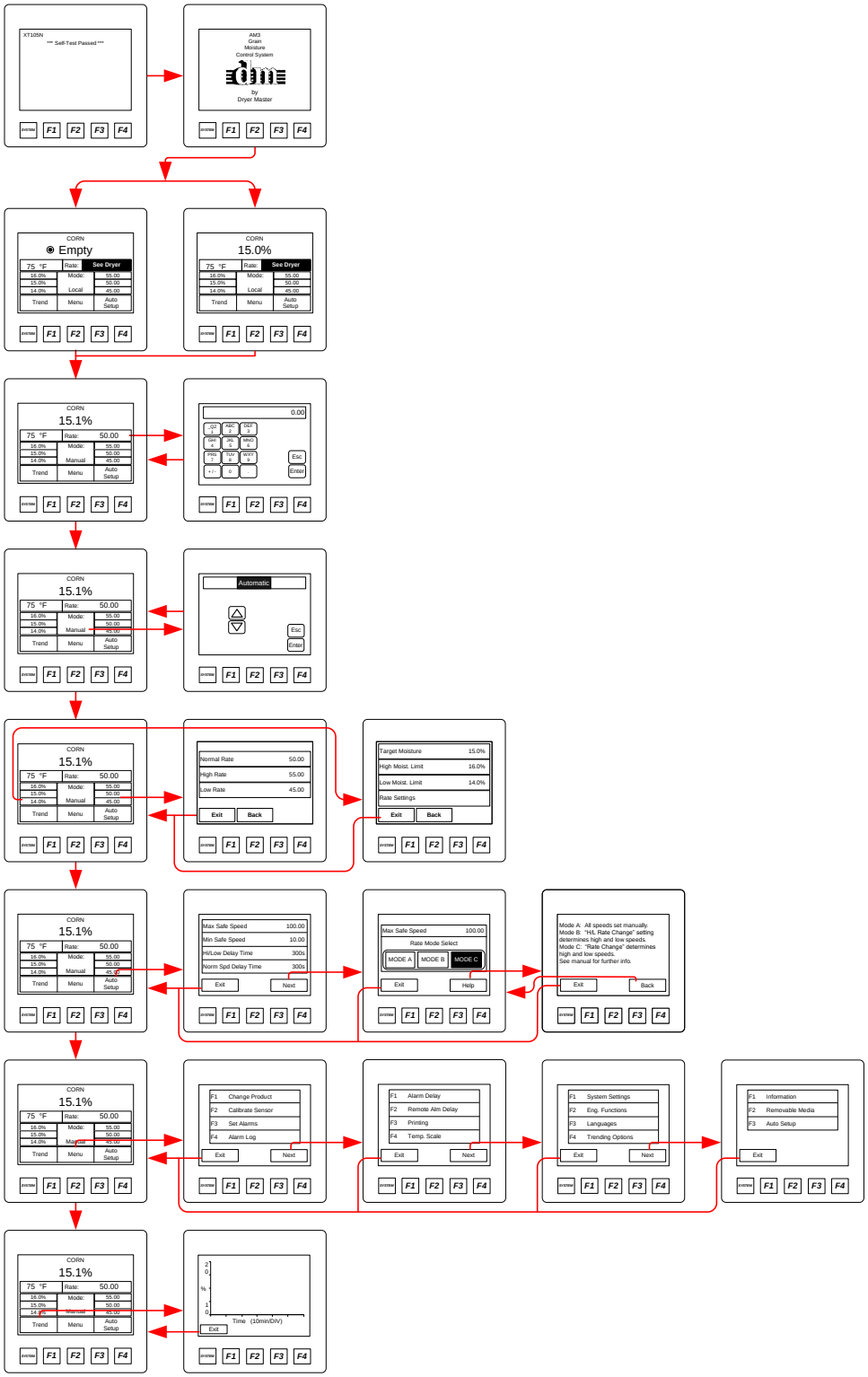
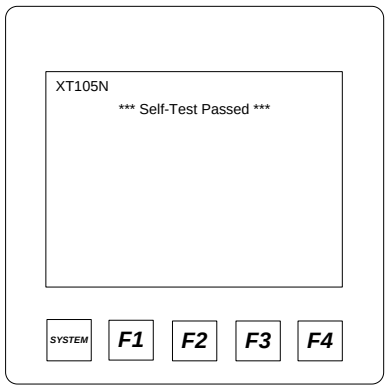


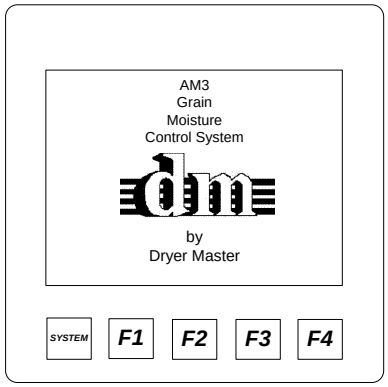
Figure 7. –Screen map

3.3 System start displays



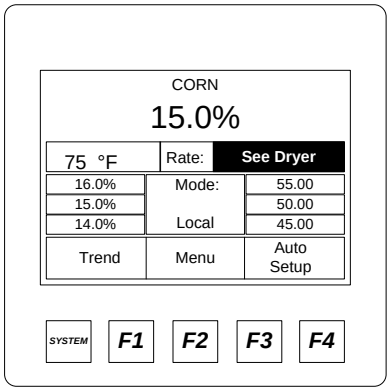
At System start the unit will display the start-up diagnostic screen.

Figure 8. –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 9. –Product information display



The Main Operations screen displays product moisture, product name, product temperature, and Dryer discharge rate when in Manual or Auto Mode.

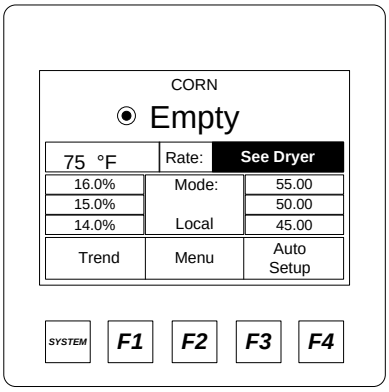
Depending on the system state, different information may be displayed

Figure 10. –Main Display

3.4 Main operations displays

3.4.1 Main Display – Local Mode - Sensor Empty

The Main Operations screen displays product moisture, product name, product temperature and the dryer discharge rate while in Manual or Automatic mode. It is shown here with the Sensor Empty and the dryer rate set at the dryer.

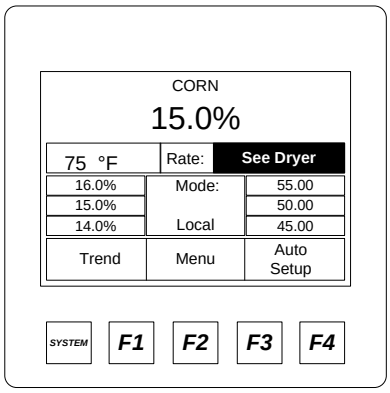


The Main Operations screen will display "**Empty**" under the following conditions

- The moisture sensor is partially or completely empty
- The product is flowing too quickly.
- The product moisture is below the sensors reading threshold
- The sensor is not sending a signal
- The sensor is not connected

Figure 11. –Main Display – Sensor Empty,

3.4.2 Main Display – Local Mode



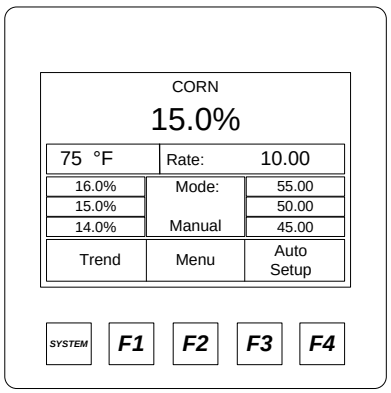
Note the Moisture is displayed as well as the product name.

The system is in "**Local**" mode; dryer discharge rate is set at the dryer thus there is no rate display.

> Press the "**Touch Area**" <**Rate :**> or the text <**See Dryer>** to display the rate entry screen and set a rate value prior to switching modes.

Figure 12. –Main Display – Local Mode

3.4.3 Main Display – Manual Mode



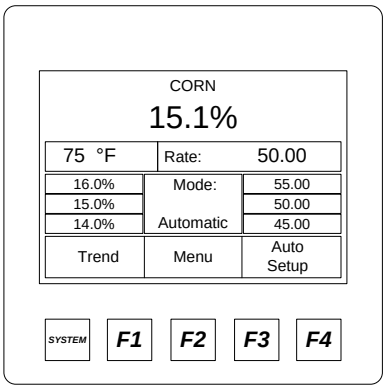
The system is in "**Manual**" mode; dryer discharge rate is set here at the display.

Press the "**Touch Area**" <**Rate :**> or the rate value <**10.00>** to display the rate entry screen.

Figure 13. –Main Display – Manual Mode

3.4.4 Main Display – Automatic Mode

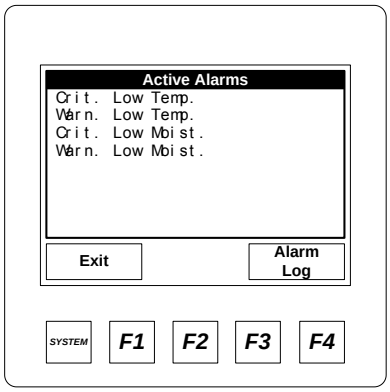
The system is in "**Automatic**" mode; dryer discharge rate is set here at the display. Depending on the product moisture the system will switch between the 3 rates displayed. The rate values can be set by pressing the Rate values touch area or in the "**Auto setup**" section. The Main rate will continue to need periodic manual adjustment to maintain the operating window.



Press the "**Touch Area**" <**Rate :**> or the rate value <**50.00>** to display the rate entry screen.
Press the "**Touch Area**" <**Rate Values**> to display the rate entry screen.
Press the "**Touch Area**" **<Moisture targets>** to display the moisture target and moisture trigger point entry screen.

Figure 14. –Main Display – Automatic Mode

3.4.5 Alarm screen



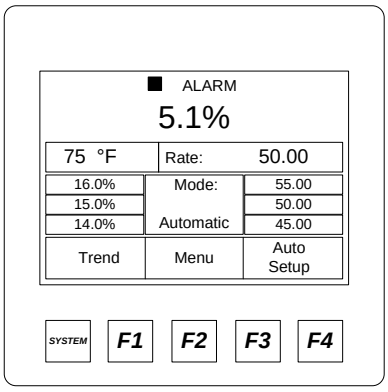
The Alarm screen will display when the displayed moisture or product temperature is in alarm. The active alarms will flash.

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Alarm Log>** to view the alarm history. See section "**Alarm settings**" for additional information.

Figure 15. –Alarm screen

3.4.6 Main Display – Active Alarm



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.

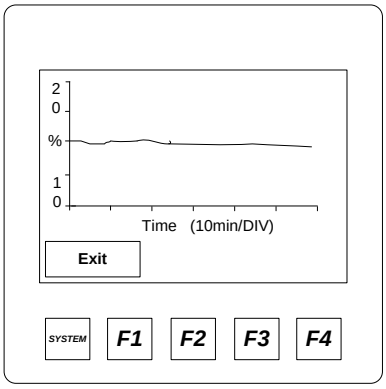
Figure 16. –Main Display – Active Alarm

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.

3.5.1 One Hour Moisture trend display

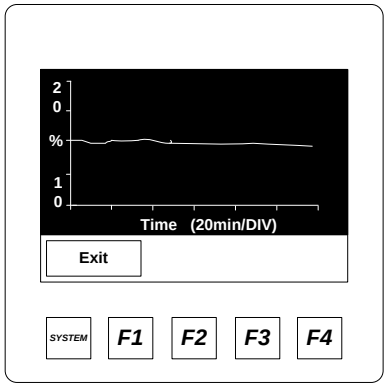


One (1) hour moisture trend

Press the "**Touch area**" **<Exit>** to return to the main screen

Figure 17. –One (1) hour Moisture Trend

3.5.2 Two Hour Moisture trend display



Two (2) hour moisture trend

Press the "**Touch area**" **<Exit>** to return to the main screen

Figure 18. –Two (2) hour Moisture Trend

4 Operating the Dryer from the AM³

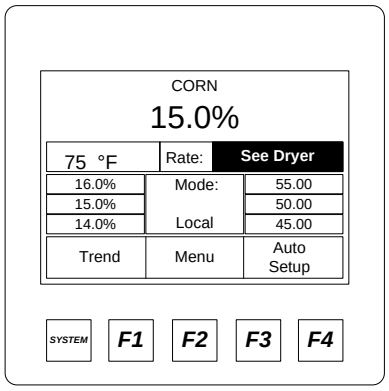
This section will describe how to operate the dryer from the AM³. The modes of operation are reviewed as well as an in-depth description of the 3 modes of Automatic. This section assumes the AM³ has already been calibrated and set up to work with your dryer. Refer to the section "The Menu Tree" to set up the various alarm settings and especially the rate output setup in the engineering section.

4.1 Operating the System

At start-up the system will boot to this current operation or main screen. While in manual mode the rate set point will display whether the dryer is running or not.

4.1.1 Main Display – Local Mode

With the dryer running and discharging product you will see a moisture reading, the product temperature, and the rate is displayed if in "Manual" or Automatic" mode. There is no feed back so we do not know what the rate is in "Local" mode.



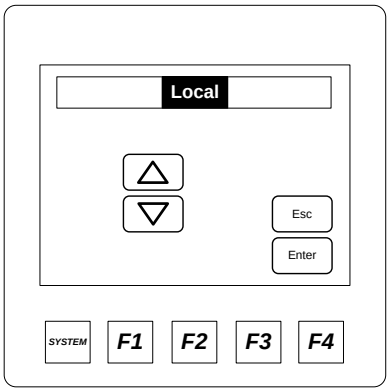
Press the "**Touch area**" **<Mode: >** to display the Mode change screen.

Press the "**Touch area**" **<Rate: >** to display dryer discharge speed "Rate" entry screen.

Press the "**Touch area**" **<Auto Setup>** to adjust or modify the Automatic operation settings.

Figure 19. –Main Display

4.1.2 Operating Mode Select Screen



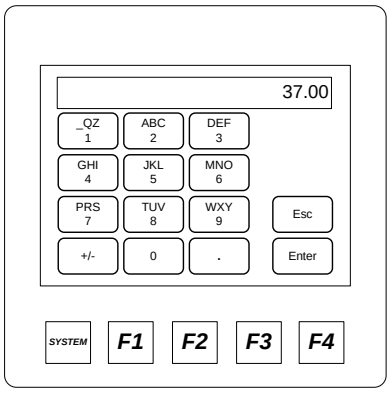
Press the "**Touch area**" Up ⧋ or down ⧊ arrow to toggle between the modes "Local", "Manual", and "Automatic"

Press the "**Touch area**" <**Enter>** to select the item and return to the main screen.

Press the "**Touch area**" **<Esc >** to return to the Main screen.

Figure 20. –Mode Select screen

4.1.3 Setting Drying Rate



Press the "**Touch area**" Keypad to type a dryer discharge rate.

Press the "**Touch area**" <**Enter>** to select the item and return to the main screen.

Press the "**Touch area**" **<Esc >** to return to the Main screen.

Figure 21. –Drying rate setting screen

How setting the Rate works:

There are 3 modes of operation:

1. "Local" – Speed is set at the dryers speed potentiometer or keypad. This is manual mode and the operator will need to decide what speed needs to be selected. The Moisture and product temperature display is available so even this manual mode is enhanced with continuous moisture information.

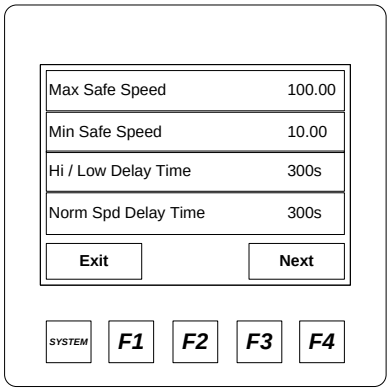
2. "Manual" – The speed is set from the Dryer Master AM³. This is also a manual mode and the operator still needs to decide what speed needs to be selected. The advantage is the speed is now set digitally from the AM³ panel. Speeds are recorded and printed if the printer and compact flash option where ordered as part of the system.

3. "Automatic" – The normal or primary speed is also set from the Dryer Master AM³. This is a semi automatic mode. The operator adjusts the speed so that the target moisture is achieved. The system will then switch between normal running or primary speed and the high speed set point or the low speed set point. Depending on the product moisture and trigger targets. Periodic adjustment of the normal speed is required if the system deviates from target significantly.

4.2 Auto Setup

There are various features available in Automatic mode. These should be reviewed and set up to best reflect your operation and needs. The setup can be changed at any time should the need arise.

4.2.1 Auto Setup – Setting Speed Limits and Delay time



Press the "**Touch area**" <Max safe Speed> to display the numeric touch pad data entry screen for setting the maximum speed.

Press the "**Touch area**" <Min safe Speed> to display the numeric touch pad data entry screen for setting the minimum speed.
Press the "**Touch area**" <Hi/low delay Time> to display the numeric touch pad data entry screen to set the delay before changing the speed. Time is in seconds.
Press the "**Touch area**" <Norm Spd. delay Time> to display the numeric touch pad data entry screen to set the delay before changing the speed back to normal speed. Time is in seconds.
Press the "**Touch area**" <Exit > to return to the Main screen.
Press the "**Touch area**" <Next > to continue to the next menu screen.

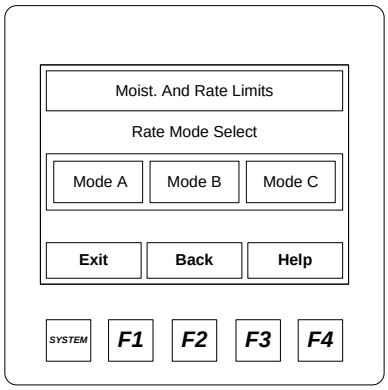
Figure 22. – Auto Setup – Speed limits and delay time

How the speed limits and delay time work:

The Speed limits and delay times serve as constraints to ensure safe and reliable operation. These should be set with care and possibly experimentation to ensure optimum performance

1) Max Safe Speed – This is the maximum speed your drying system can operate at. Before setting this speed consider the takeaway and feed systems to ensure this setting will not overload the equipment. Also look at the real operation. If you know your dryer should never operate above 70 for any reason this should be set to 70 or possibly less.
2) Min Safe Speed – This is the minimum speed your drying system can operate. Same as before there is a minimum speed below which the system should never need to operate.
3) Hi /Low Delay Time – This is the time in seconds the moisture has to be either above the "high limit moisture target" or below the "low limit moisture target" before the speed will change to either the "low speed setpoint" or the "high speed setpoint". Time is in seconds, 300 seconds is 5 minutes. 999 seconds or about 16 minutes 39 seconds is the maximum delay available.
4) Norm Spd Delay Time – (Normal Speed Delay Time) This is the time in seconds the moisture has to have returned to normal (the window between the "high and low moisture target") or have moved to the other side of the target moisture (mode dependent) before the speed is again returned to normal mode. 999 seconds or about 16 minutes 39 seconds is the maximum delay available.

4.2.2 Auto Setup –Limits and Rate Mode selection



Press the "**Touch area**" <**Moist. And Rate Limits**> to display the moisture target, moisture limits and Rate Settings selection menu screen
Press the "**Touch area**" <**Mode A, Mode B,** or **Mode C**> to select the Automatic operating mode.

Press the "**Touch area**" <**Exit** > to return to the Main screen.
Press the "**Touch area**" <**Back** > to return to the previous menu screen.

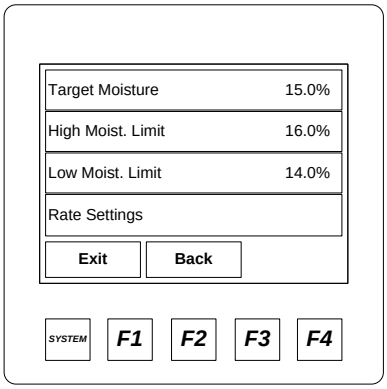
Figure 23. – Auto Setup – Limits and Rate mode selection

How Control works:

There are 3 Automatic modes: This is a state machine. Control is achieved by triggering 1 of 3 speed set points using target moisture, moisture limits and delay times. All these items are user settable and may require periodic adjustment for optimum performance. The operator decides which mode bests suits the operation. Automatic modes can de changed at any time.

1) Mode A – This mode requires input from the operator for all 3 speed settings. The normal running speed as well as the high and low default speeds need to be set. If the normal speed is adjusted the high and low speed settings must also be reviewed and adjusted if need be.
2) Mode B – This mode once set up requires input from the operator with occasional adjustments of the normal or primary running speed. The high speed set point and low speed set point track the normal or primary speed to maintain a constant operating window.
3) Mode C – This mode once set up also only requires input from the operator with occasional adjustments of the normal or primary running speed. The high speed set point and low speed set point track the normal or primary speed to maintain a operating window as a percentage of the primary speed.

4.2.3 Auto Setup – Moisture Targets, Moisture Limits and Rate Settings selection



Press the "**Touch area**" <**Target Moisture** > to set the moisture target
Press the "**Touch area**" <**High Moist Limit**> to set the High Moisture trigger point for Automatic operating mode.
Press the "**Touch area**" <**Low Moist Limit**> to set the Low Moisture trigger point for Automatic operating mode.
Press the "**Touch area**" <**Rate Setup**> to continue to the rate setup screen.
Press the "**Touch area**" <**Exit** > to return to the Main screen.
Press the "**Touch area**" <**Back** > to return to the previous menu screen.

Figure 24. – Auto Setup – Moisture targets, Moisture Limits and Rate settings selection

How to set up Control:

This section will explain what happens.

In all Automatic modes it is prudent for the operator to operate the dryer manually to attain the desired moisture, before selecting Automatic. It is important to monitor the operation and adjust the settings to permit the dryer and Dryer Master AM³ to operate effectively.

4.2.4 Auto Setup –Rate Selection Mode A

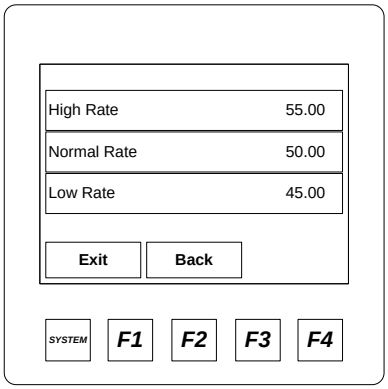


Figure 25. – Auto Setup –Rate selection Mode A

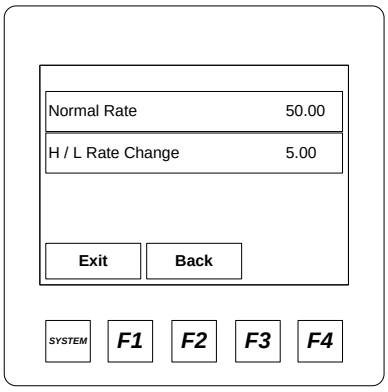
Press the "**Touch area**" <**Normal Rate** > to display the numeric touch pad data entry screen for setting the "Normal" running speed.
Press the "**Touch area**" <**High Rate** > to display the numeric touch pad data entry screen for setting the High Rate speed. This is the speed the system will run will moisture is below the "Low Moist. Limit"
Press the "**Touch area**" <**Low Rate** > to display the numeric touch pad data entry screen for setting the Low Rate speed. This is the speed the system will run will moisture is above the "High Moist. Limit"

Press the "**Touch area**" <**Exit** > to return to the Main screen.
Press the "**Touch area**" <**Back** > to return to the previous menu screen.

1) Mode A:
    a. An event happens and the moisture drifts away from target.
    b. The moisture goes high. The moisture goes above the High limit target occasionally but nothing happens. Note, there is a timer that is triggered anytime the moisture goes above the high limit target or low limit target.
    c. Once the moisture stays above the High limit target for the programmed length of time (default is 300 seconds = 5 minutes). The low speed setting is activated.
    d. The system will now operate at this slower speed setting until the moisture is once again below the High limit target.
    e. When the moisture has been below the High moisture target for the programmed length of time (default is 300 seconds = 5 minutes) system will return to the normal or primary speed.
    f. A second event happens and the moisture again drifts away from target
    g. This time the moisture goes dry. The moisture goes below the Low limit target. Again the moisture has to stay below the Low limit target for the programmed length of time (default is the same 300 seconds = 5 minutes)
    h. Once the moisture stays below the Low Limit target for the programmed length of time (default is 300 seconds = 5 minutes). The high speed setting is activated.
    i. The system will now operate at this higher speed setting until the moisture is once again above the Low limit target.
    j. When the moisture has been above the Low moisture target for the programmed length of time (default is 300 seconds = 5 minutes) system will return to the normal or primary speed.

The system will cycle between the speed settings triggered by the moisture target and limits. In Mode A all 3 speeds are manually set, as well as the moisture target and limits, and the delay time.

4.2.5 Auto Setup –Rate Selection Mode B



Press the "**Touch area**" <**Normal Rate** > to display the numeric touch pad data entry screen for setting the "Normal" running speed.
Press the "**Touch area**" <**H / L Rate** > to display the numeric touch pad data entry screen for setting the "High Rate speed". This the difference value from the "Normal Rate".
In this example, "Normal rate" + "H/L rate" = "High Rate", 50 + 5 = 55 and "Normal rate" - "H/L rate" = "Low Rate", 50 - 5 = 45

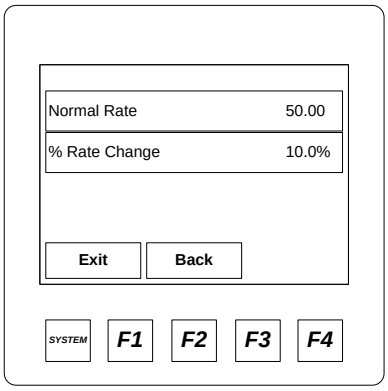
Press the "**Touch area**" <**Exit** > to return to the Main screen.
Press the "**Touch area**" <**Back** > to return to the previous menu screen.

Figure 26. – Auto Setup –Rate selection Mode B

2) Mode B:
   a. Events are identical to Mode A. An event happens and the moisture drifts away from target.
   b. The moisture goes high. The moisture goes above the High limit target.
   c. Once the moisture stays above the High limit target for the programmed length of time (default is 300 seconds = 5 minutes). The low speed setting is activated.
   d. The system will now operate at this slower speed setting until the moisture is once again below the High limit target.
   e. Only in Mode B the slower as well as the higher speed settings are a fixed value change, an offset from the normal or primary speed. This is a parameter settable by the user.
   f. If an adjustment is require to the normal or primary operating speed the High and Low speed settings will also change by the programmed offset.

The system will cycle between the speed settings triggered by the moisture target and limits. In Mode B the normal or primary speed is manually set, as well as the moisture target and limits, and the delay time and possibly an occasional tweak of the speed offset.

4.2.6 Auto Setup –Rate Selection Mode C



Press the "**Touch area**" <**Normal Rate** > to display the numeric touch pad data entry screen for setting the "Normal" running speed.
Press the "**Touch area**" <**% Rate Change**> to display the numeric touch pad data entry screen for setting the % Rate Change. This the difference value from the "Normal Rate" as a percent of the normal rate.
In this example, "Normal rate" + "% Rate Change" = "High Rate", 50 + (50/100*10) = 55 and "Normal rate" - "% Rate Change" = "Low Rate", 50 – (50/100*10) = 45
Press the "**Touch area**" <**Exit** > to return to the Main screen.

Figure 27. – Auto Setup –Rate selection Mode C

Press the "**Touch area**" <**Back** > to return to the previous menu screen.

3) Mode C:

   a. Events are identical to Mode A. and B

   b. If an adjustment is require to the normal or primary operating speed the High and Low speed settings will also change by the programmed offset. In this case this offset is dynamic because it is a percentage of the normal or primary running speed. Therefore the amount of change will be smaller at lower speeds and larger for higher speeds thus reducing the input required by the user.

The system will cycle between the speed settings triggered by the moisture target and limits. In Mode C the normal or primary speed is manually set, as well as the moisture target and limits, and the delay time and possibly a tweak of the speed offset percentage.

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

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

5 The Menu Tree

This section describes the various menus and screens and details functions, such as changing product, adjusting the moisture sensor calibration, setting alarms, reviewing the alarm log and others are all available by pressing the "**Touch area**" **<Menu>**. Each item will be covered in detail in the following pages. We have attempted to place the more used functions to the front and the progressively less used items to the rear.

5.1 Main Menus

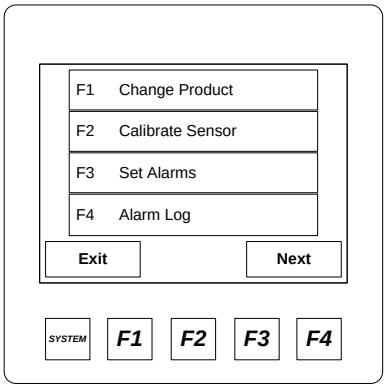


Figure 28. –Menu One (1)

5.1.1 Menu – Screen 1

Press the "**Touch area**" **<F1 Change Product>** or the <**F1**> button to enter the Product selection screen.
Press the "**Touch area**" **<F2 Calibrate Sensor>** or the <**F2**> button to enter the Sensor Calibration adjustment screen.
Press the "**Touch area**" **<F3 Set Alarms>** or the <**F3**> button to enter the Product moisture and Product Temperature Alarms adjustment screen.
Press the "**Touch area**" **<F4 Alarm log>** or the <**F4**> button to review a recent history of alarm occurrences.
Press the "**Touch area**" **<Exit>** to return to the main screen
Press the "**Touch area**" **<Next >** to move to the next screen

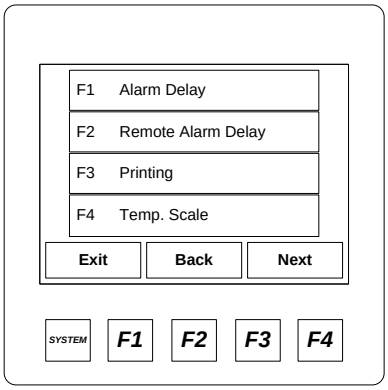


Figure 29. –Menu Two (2)

5.1.2 Menu – Screen 2

Press the "**Touch area**" **<F1 Alarm Delay>** or the <**F1**> button to enter the Local alarm activation delay screen.
Press the "**Touch area**" **<F2 Remote Alarm Delay>** or the <**F2**> button to enter the Remote alarm activation delay screen.
Press the "**Touch area**" **<F3 Printing >** or the <**F3**> button to enter the Printing setup and enable screen.
Press the "**Touch area**" **<F4 Temp. Scale>** or the <**F4**> button to enter the screen to switch the temperature display from degrees Fahrenheit to degrees Celsius
Press the "**Touch area**" **<Exit>** to return to the main screen
Press the "**Touch area**" **<Back>** to return to the previous screen
Press the "**Touch area**" **<Next >** to move to the next screen

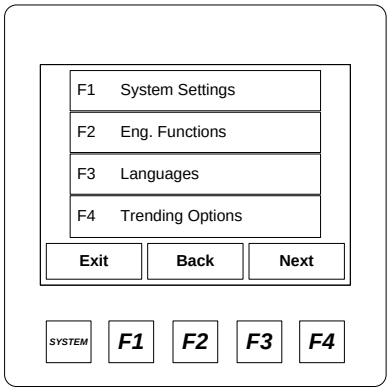
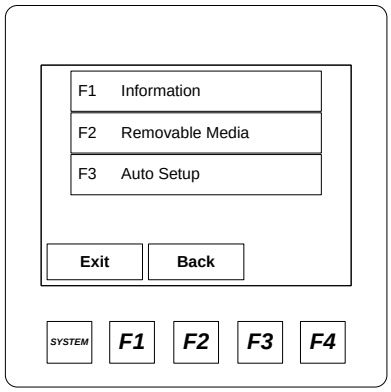


Figure 30. –Menu Three (3)

5.1.3 Menu – Screen 3

Press the "**Touch area**" **<F1 System Settings>** or the <**F1**> button set various device related items. Date & time, contrast and the screen saver
Press the "**Touch area**" **<F2 Eng. Functions>** or the <**F2**> button to enter the Engineering setup screens. Password protected. _____
Press the "**Touch area**" **<F3 Languages >** or the <**F3**> button to change the displayed language.
Press the "**Touch area**" **<F4 Trending Options>** or the <**F4**> button to enter the screen to Trending moisture scaling and time.
Press the "**Touch area**" **<Exit>** to return to the main screen
Press the "**Touch area**" **<Back>** to return to the previous screen
Press the "**Touch area**" **<Next >** to move to the next screen



5.1.4 Menu – Screen 4

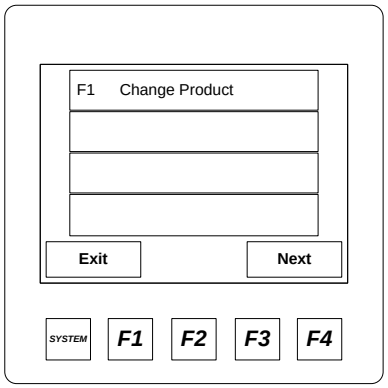
Press the "**Touch area**" **<F1 Information>** or the <**F1**> button to obtain manufacturers information and system version.
Press the "**Touch area**" **<F2 Removable Media>** or the <**F2**> button to review the status of the data storage module
Press the "**Touch area**" **<F3 Auto Setup >** or the <**F3**> button to enter Automatic operation configuration. This function is also accessible from the main screen.
Press the "**Touch area**" **<Exit>** to return to the main screen
Press the "**Touch area**" **<Back>** to return to the previous screen

Figure 31. –Menu Four (4)

5.2 Change Product

Four choices are available, Corn, Beans, Wheat, and Canola, each with their own unique moisture setup. The product names cannot be changed. It is however possible to copy the calibration parameters form any one product and enter those into any of the others. This is accomplished by copying the slopes and offset from one product to the others while in the Engineering parameters. Refer to the Engineering parameters section for more details.

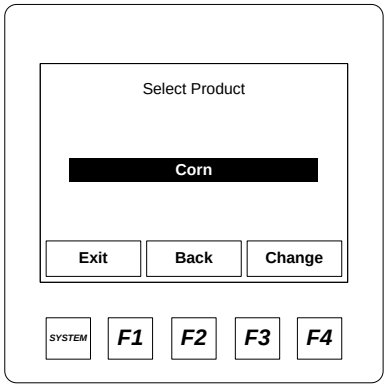
5.2.1 Menu – Screen 1 – Change Product



Press the "**Touch area**" **<F1 Change Product>** or the <**F1**> button to enter the Product selection screen.

Figure 32. –Menu One (1) – Change Product

5.2.2 Change Product



Press the "**Touch area**" **<Exit>** to return to the main screen
Press the "**Touch area**" **<Back>** to return to the previous screen

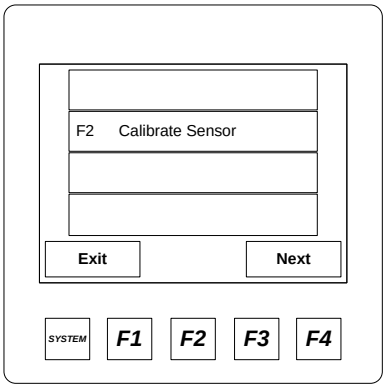
Press the "**Touch area**" **<Change >** to toggle to the next product. Four choices are available Corn, Beans, Wheat, and Canola, each with their own unique moisture setup. The product names can not be changed. It is however possible to copy the calibration parameters form any one product and enter those into any of the others.

Figure 33. – Change Product

5.3 Calibrate Sensor

Two methods of adjusting the moisture sensors displayed moisture reading are provided. This is referred to as sensor calibration. In actual fact the sensor rarely requires any form of calibration. Calibration involves adjusting settings to permit the signal from the sensor to be scaled to display the correct moisture. The default setup is the "Standard" method

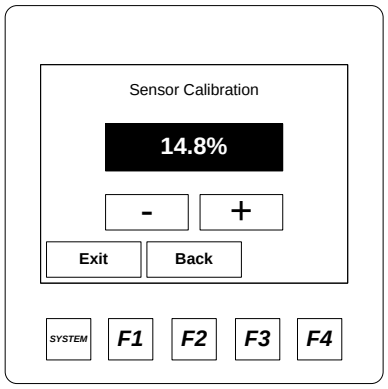
5.3.1 Calibrate Sensor – Menu Selection



Press the "**Touch area**" **<F2 Calibrate Sensor>** or the <**F2**> button to enter the Sensor Calibration screen.

Figure 34. – Calibrate Sensor

5.3.2 Calibrate Sensor – Standard Method



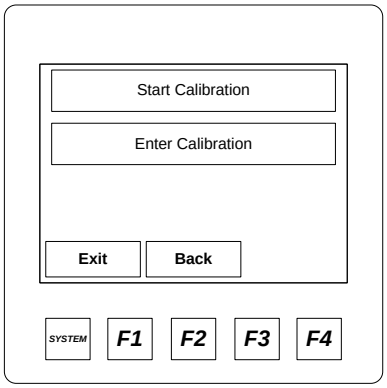
If the Default "**Standard** "method is configured this screen will display.
The displayed moisture is the same "live" value displayed on the main screen.

Press and hold the "**Touch area**" <**+>** or <**->** to adjust the displayed value to the correct moisture.

Press the "**Touch area**" **<Exit>** to return to the main screen
Press the "**Touch area**" **<Back>** to return to the previous screen

Figure 35. – Calibrate Sensor (Standard method)

5.3.3 Calibrate Sensor – Enhanced Method – Start Calibration – Enter Calibration



If the "**Enhanced**" method is configured this screen will display. You will be prompted to begin a calibration or a calibration may have been started with the optional Calibration button mounted near the moisture sensor.

Once the calibration is in progress, approximately 30 seconds after the "**Touch area**" **< Start Calibration>** or the <Calibration Button> has been pushed. The system is ready to accept your manual test result.

Return to this screen.

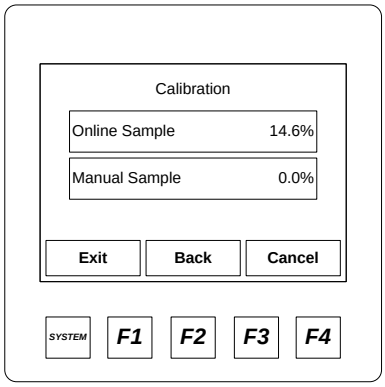
Press the "**Touch area**" **<Enter Calibration>** to move to the entry screen.

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the previous screen

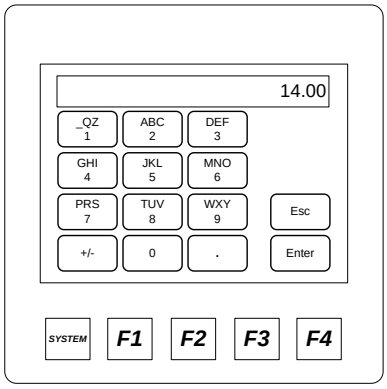
Figure 36. – Calibrate Sensor (Enhanced method) Start & Enter

5.3.4 Calibrate Sensor – Enhanced Method – Online Sample value display



If no value is displayed for the "Online Sample" No calibration is in progress. Or the 30 second sample period has not yet elapsed. Or you have been returned to this screen after completing a calibration entry.
Press the "**Touch area**" **< Manual Sample>** to display the Sample entry screen
Press the "**Touch area**" **<Cancel>** to cancel a calibration in progress.
Press the "**Touch area**" **<Exit>** to return to the main screen
Press the "**Touch area**" **<Back>** to return to the previous screen

Figure 37. – Calibrate Sensor (Enhanced method) Sample Display



5.3.5 Calibrate Sensor – Enhanced Method – Sample entry

Press the "**Touch area**" **<keypad>** to enter the manual test value.
Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.

Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen.

Figure 38. – Calibrate Sensor (Enhanced method) Sample Entry

How calibration works:

The purpose of calibration is to allow the Dryer Master moisture reading to easily mimic the manual tester. Periodic checks against a manual device ensure both are in approximate agreement. Please be sure the product moisture and product temperature are within the specification range for your manual tester. Many of the grain moisture testers have specific moisture and temperature ranges. Testing product outside of these ranges can severely impact the device accuracy. The Dryer Master Moisture sensor is able to measure moisture from well below freezing to just below the boiling point of water. Therefore the Dryer Master sensor may well give you a correct moisture reading but your manual tester can not.

1) Standard method:
   The standard calibration method transfers you to a screen which displays the current moisture. While on this screen you will press the "**+**" or "**-**" "**Touch keys**" to adjust the displayed reading to best mimic the manual test you took previously. Please note there is may be some time difference between the sample you tested and the currently displayed moisture. Care must be taken when adjusting the displayed moisture reading to ensure it is corrected for the moisture at the time the sample was taken.

2) Enhanced method:
The enhanced method takes the guess work out of doing calibrations. With this method there is usually a Calibration Start push button located near the Dryer Master Moisture sensor where manual samples are taken. When this button is pressed a lamp will flash for the next 30 seconds. While this lamp is flashing a small sample of product is taken every few seconds and put into a sample container. When the lamp stops flashing and the light remains on solid the Dryer Master Moisture sensor has completed its calibration test. This composite sample should now be mixed and tested. It is best to take 3 or more tests from this composite sample and average them. Enter the result as the "**Manual Sample**" into the Dryer Master Calibration entry screen. At this point the System will show you the "**Online Sample**". The "**Online sample**" is average moisture for the 30 seconds the calibration lamp was flashing.

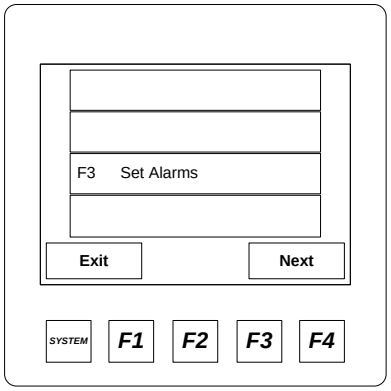
This method has some additional safeguards built in and may require a few samples initially to bring the sensor in line.

a) By default this method will only make a maximum change of **0.5%** moisture. For example if the "**Online Sample**" was **14.1%** and the "**Manual Sample**" was **15.1%** or more the change would be the maximum and the displayed moisture reading would increase by **0.5%** moisture. Thus if the displayed reading is still **14.1%** to would increase to **14.6%.** The change is always retroactive to the time the button was pushed. If the reading is now different the value of the change will still be applied but the reading may be different.
b) Calibration will many times only change **50%** of the difference. For example if the "**Online Sample**" was **14.1%** and the "**Manual Sample**" was **14.8%** the change would be the difference **0.7%** times **0.5** or **0.35%** the displayed moisture reading would increase by **0.35%** moisture. Thus if the displayed reading is still **14.1%** to would increase to **14.45%**. Again the change is always retroactive to the time the button was pushed. If the reading is now different the value of the change will still be applied but the reading may be different.
c) There are additional tests performed such as are the readings valid, Sensor empty or above or below the threshold signal.
d) See the Engineering parameters for setting the maximum change.

5.4 Set Alarms

Alarms for product moisture and product temperature are able to be set. These are product specific so each product will have its own specific values. These settings are used to initiate alarms if installed, provide on screen indications as well as indication in the printer and stored data history.

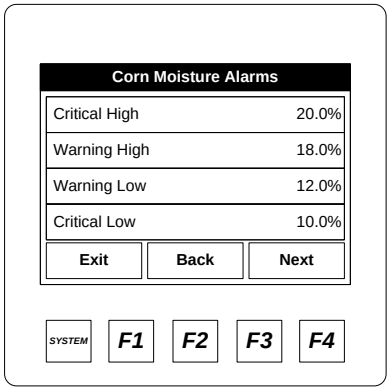
5.4.1 Set Alarms – Menu selection



Press the "**Touch area**" **<F3 Set Alarms>** or the <**F3**> button to enter the Alarms screen.

Figure 39. – Set Alarms

5.4.2 Set Alarms – Moisture Alarm values selection



Press the "**Touch area**" be taken to the value entry screen.

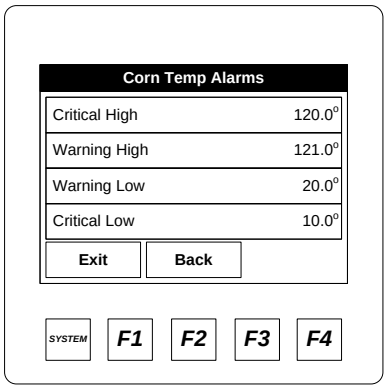
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the previous screen

Press the "**Touch area**" **<Next >** to move to the next screen

Figure 40. – Set Alarms – Moisture Alarms values selection

5.4.3 Set Alarms – Temperature Alarms values selection



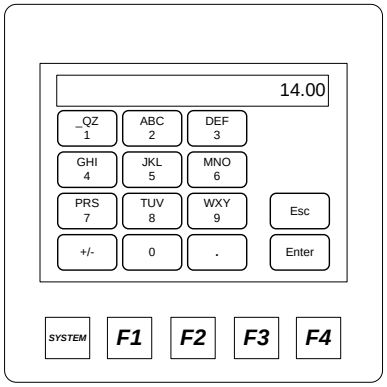
Press the "**Touch area**" to move to the value entry screen.

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the previous screen

Figure 41. – Set Alarms – Temperature Alarms

5.4.4 Set Alarms – Values Entry



Press the "**Touch area**" **<keypad>** to enter the value. Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.

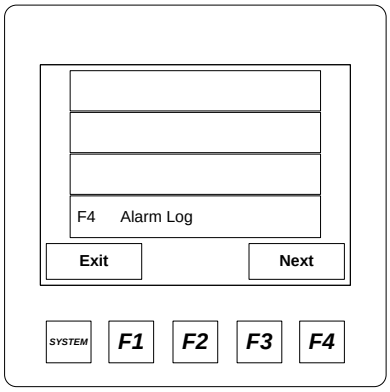
Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

Figure 42. – Set Alarms – Value Entry

5.5 Alarm Log

The alarm log provides a screen of the last 8 alarm events. This screen is also accessible from the "Alarm screen" which appears when an alarm occurs and after the alarm delay.

5.5.1Alarm Log – Menu selection



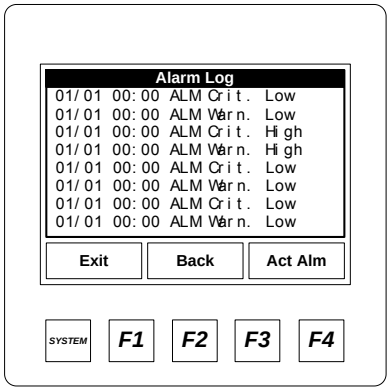
Press the "**Touch area**" **<F4 Alarm Log >** to display the alarms log screen

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 43. – Alarm Log

5.5.2 Alarm Log – Data screen



Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the previous screen

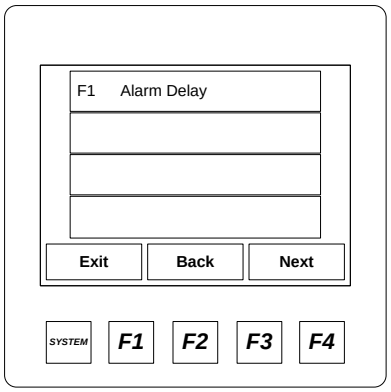
Press the "**Touch area**" **<Act Alm >** to display the active alarms screen

Figure 44. – Alarm Log – Data screen

5.6 Alarm Delay

A settable alarm delay has been incorporated into the system. This delay is intended to reduce the occurrences of intermittent repeating alarms when the value in question toggles around the alarm threshold value. By setting a delay of a few seconds the signal in question would have to be in the alarm state for at least the amount of time defined before the alarm message is displayed and the local alarm is activated, if so equipped.

5.6.1 Alarm Delay – Menu selection



Press the "**Touch area**" **<F1 Alarm Delay >** to display the alarm delay screen

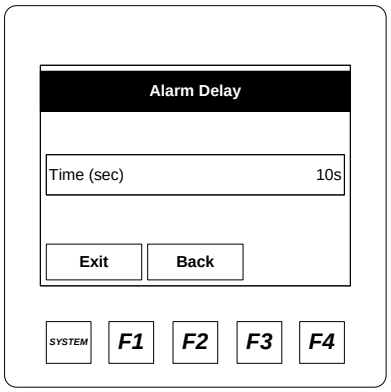
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 45. – Alarm Delay

5.6.2 Alarm Delay – Data Entry selection



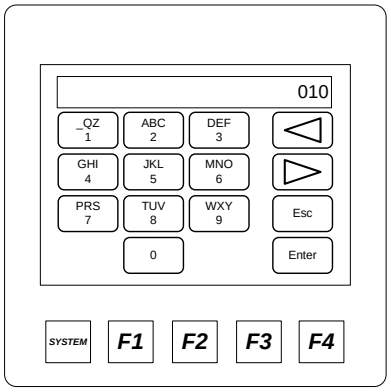
Press the "**Touch area**" **<Time (sec) 10s >** to display the data entry screen.

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Figure 46. – Alarm Delay –Entry selection

5.6.3 Alarm Delay – Value entry



Press the "**Touch area**" **<keypad>** to enter the value. Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.

Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

Figure 47. – Alarm Delay – Value Entry

How the Alarm delay works:

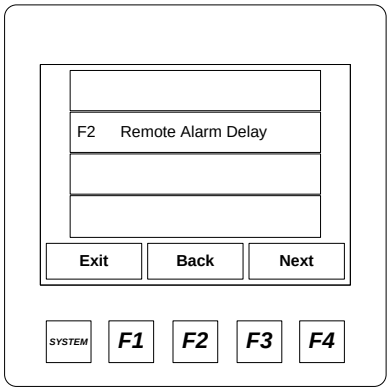
The purpose of the alarm delay is to reduce repeated alarm activations as moisture or temperature signals toggle around the alarm values set. The delay ensures that the signal is in alarm for the total time period set as the delay value. It is possible to set this value to "**0**" seconds which will allow instantaneous activation of the alarm as it occurs.

1) Values form "**0**" to "**999**" seconds are settable. 999 seconds is 16 minutes and 39 seconds.
2) Do not set this value to "0". In cases where repeated alarms can occur in less then a second. The repeating alarm may trigger the Alarm Screen at a rate that prevents reaching this "Value Entry" screen to reset the value.
3) In the event that the value has been set to "**0**", and continuous alarms are occurring, momentarily disconnect the Moisture sensor. With the sensor disconnected no more alarms will occur. Once the Alarm Screen stops reappearing return to this screen and reset the time to a few seconds.

5.7 Remote Alarm Delay

5.7.1 Remote Alarm Delay – Menu selection

A settable Remote alarm delay has also been incorporated into the system.



Press the "**Touch area**" **<F2 Remote Alarm Delay >** to display the Remote Alarm Delay screen

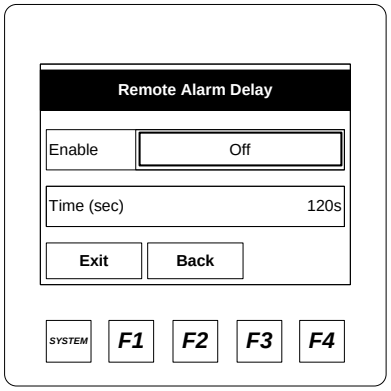
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 48. – Remote Alarm Delay

5.7.2 Remote Alarm Delay – Enable & Delay entry selection



Press the "**Touch area**" **<Time (sec) 120s >** to display the data entry screen.

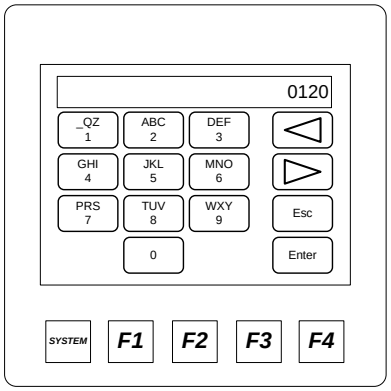
Press the "**Touch area**" **<Off>** or <**On**> to switch this feature On or Off.

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Figure 49. – Remote Alarm Delay – Enable & Entry selection

5.7.3 Remote Alarm Delay – Value entry



Press the "**Touch area**" **<keypad>** to enter the value. Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.

Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

Figure 50. – Remote Alarm Delay – Value Entry

How the Alarm delay works:

The purpose of this alarm function is similar to the "Alarm Delay" and is intended to activate a second alarm device or trigger an action in case no one is around to acknowledge an alarm event. When enabled, a second timer is activated on the unacknowledged alarm. If at any time before the timer expires the alarm is acknowledged the timer is reset.

1) Values form "**0**" to "**9999**" seconds is settable. 9999 seconds is 2 hours 46 minutes and 39 seconds.

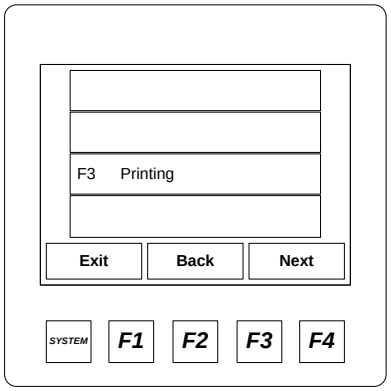
2) Do not set this value to "0" in cases where repeated alarms can occur in less then a second. The repeating alarm may trigger the Alarm Screen at a rate that prevents reaching this "Value Entry" screen to reset the value.

3) In the event that the value has been set to "**0**", and continuous alarms are occurring, momentarily disconnect the Moisture sensor. With the sensor disconnected no more alarms will occur. Once the Alarm Screen stops reappearing return to this screen and reset the time to a few seconds.

5.8 Printing

This is an optional function and will output information to a standard point of sale terminal serial printer.

5.8.1 Printing – Menu selection



Press the "**Touch area**" **<F3 Printing >** to display the Remote Alarm Delay screen

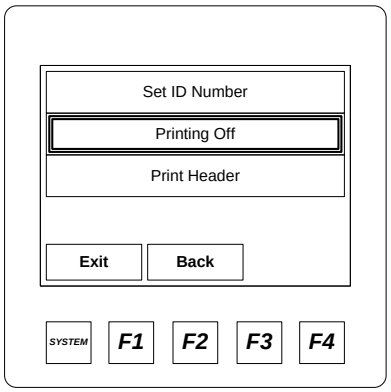
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 51. – Printing

5.8.2 Printing – Select ID – Printing On, Off – Print Header functions

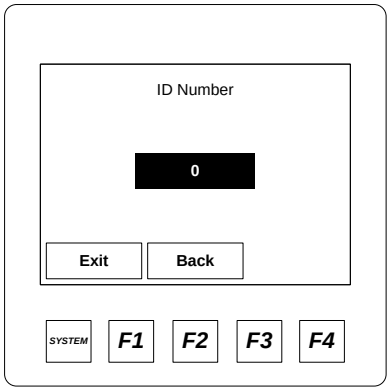


Press the "**Touch area**" **<Set ID Number >** to display the data entry screen.

Press the "**Touch area**" **<Printing Off>** or <**Printing On**> to switch this feature On or Off.
Press the "**Touch area**" **<Print Header >** to print an ID label header.
Press the "**Touch area**" **<Exit>** to return to the main screen
Press the "**Touch area**" **<Back>** to return to the main screen

Figure 52. – Printing – Enable, Set ID & Print Header selection

5.8.3 Printing – View ID number



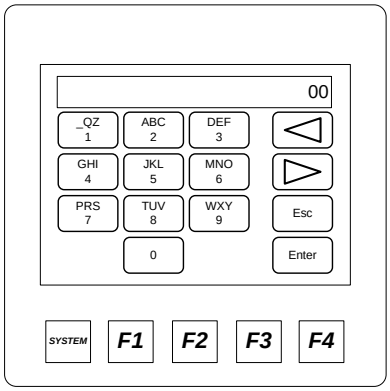
Press the "**Touch area**" <**0** >to display the data entry screen

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Figure 53. – Printing – Set ID

5.8.4 Printing – Set ID number – Value entry



Press the "**Touch area**" **<keypad>** to enter the value. Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.

Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

Figure 54. – Printing – ID Value Entry

How Printing works:

The printing function provides a hardcopy of the operation. This feature can be turned on and off to not print information during times when not running.

1) The history printout will display Operating information such as the date and time, moisture and product temperature, dryer discharge rate while in manual and automatic as well as alarm states.
2) It is possible to attach a numeric ID to a printed section. Values of 0 to 99 are possible and can represent a bin number or some form of ID to identify a batch. Just select the "Set ID Number" and enter a value to have it printed ahead of the information. Select "Print Header" to print this ID Number header.
3) The Column headings are printed with ID header.

5.8.5 Printing – Printout sample

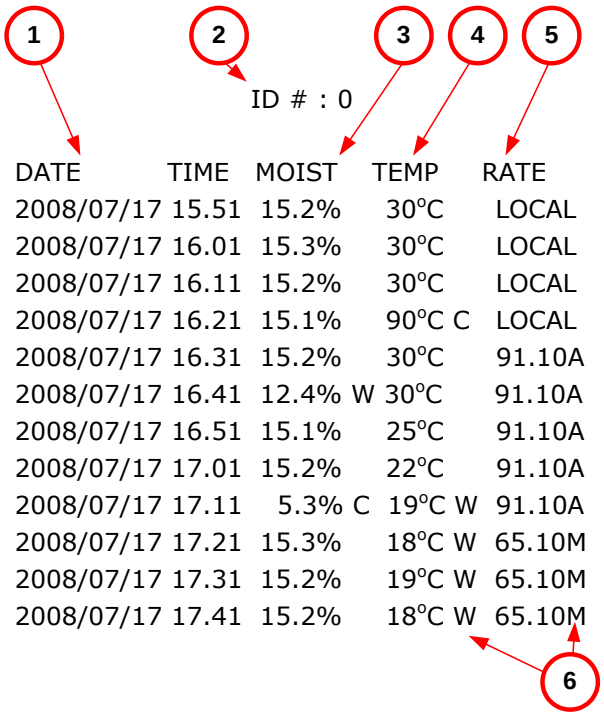


Figure 55. – Printing – Information example and explanation.

1 **Date / Time:** Date and time for the record. Date format = YYYY (Year), MM (Month), DD (day). Time is in 24 hour clock format. HH:MM.

2 **ID header:** Displays the numeric ID header for batch tracking purposes.

3 **Moisture:** Average product moisture for the 10 minute record.

4 **Temp.:** Average product temperature for the 10 minute record. Degrees C or Degrees F are configured in the "Temperature Scale" setup.

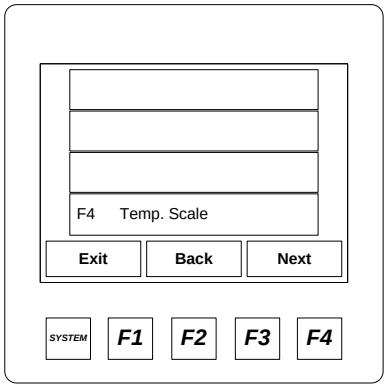
5 **Rate:** Discharge Rate Set point. This is the speed signal sent to the Dryers Discharge system. This value is displayed when the dryer speed selection is switched to the AM³ (Manual or Automatic). The word **LOCAL** is displayed when the speed is set at the dryer.

6 **Alarm Indicators**: The letters "C" and "W" may be displayed immediately behind the Moisture, and Temperature values. "C" indicates a critical high or low alarm. "W" indicates a warning high or low alarm. Values can be set, changed in the "Set Alarms" menu. Also displayed directly following the rate value will be "M" for manual speed set point operation and "A" for automatic operation.

5.9 Temperature Scale

Switching displayed temperature between degrees Celsius and degrees Fahrenheit.

5.9.1 Temperature Scale – Menu selection



Press the "**Touch area**" **<F4 Temp Scale >** to change the temperature scale between Celsius and Fahrenheit degrees.

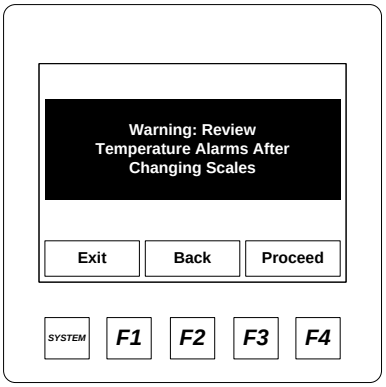
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 56. – Temperature Scale

5.9.2 Temperature Scale – Scale Change Warning



Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Proceed>** to change the temperature scale

Figure 57. – Temperature Scale change Warning

How Temperature scale change works:

The purpose is to allow easy switching from the Fahrenheit temperature scale to the Celsius temperature scale.

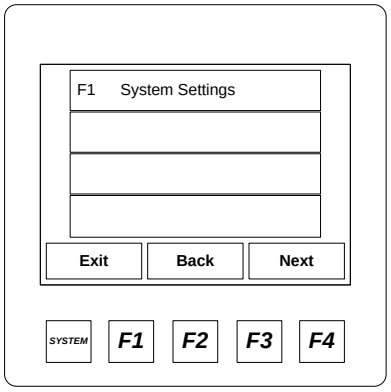
1) Note changing between scales will "NOT" switch the temperature alarm settings. You will need to review the alarm settings and make the necessary changes manually. Each product will need to be selected and the appropriate adjustments made.

2) You will "NOT" be able to change the temperature scale while an alarm condition exists. Review the alarm settings, make the necessary changes to the alarms, change the temperature scale, and then return to the alarm settings and adjust the values as needed.

5.10 System Settings

System settings are items such as the "Screen saver, display contrast and the date and time.

5.10.1 System Settings – Menu selection



Press the "**Touch area**" **<F1 System Settings >** to change System settings

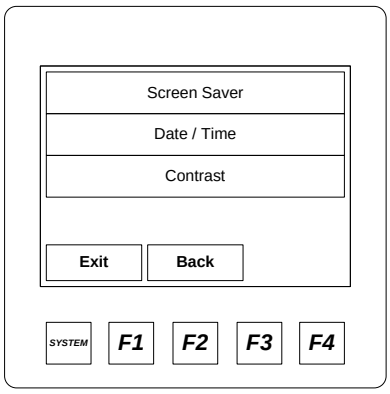
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 58. – System Settings

5.10.2 System Settings – Screen Saver – Data / Time – Contrast selection



Press the "**Touch area**" **<Screen Saver>** to change settings

Press the "**Touch area**" **<Date / Time>** to change settings

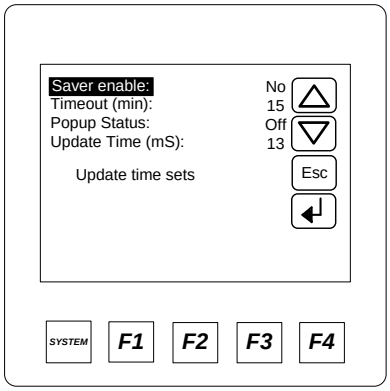
Press the "**Touch area**" **<Contrast>** to change settings

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Figure 59. – System Settings – Items Selection

5.10.3 System Settings – Screen Saver – Items selection



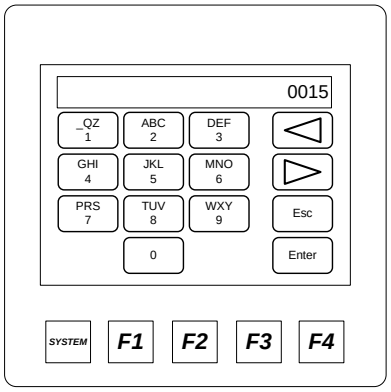
Press the "**Touch area**" Up ⚠ or down ▽ arrow to highlight and select the item

Press the "**Touch area**" Enter ↵ to select the item and Press the "**Touch area**" Up ⚠ or down ▽ arrow to toggle the state or open the value entry screen.

Press the "**Touch area**" **<ESC>** to return to the previous screen

Figure 60. – System Settings – Screen Saver – Items Selection

5.10.4 System Settings –Screen Saver – Timeout



Press the "**Touch area**" **<keypad>** to enter the value. Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.

Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

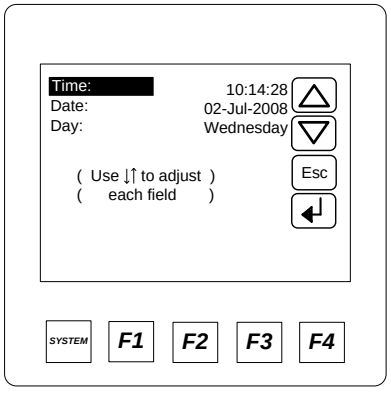
Figure 61. – System Settings – Screen Saver – Time delay entry

How Screen Saver settings work:

The Screen saver feature turns OFF the back lighting to reduce power consumption and preserve display life.

1) Highlight "Saver Enable" press the Enter ↵ key toggle to the No or Yes, press the △ or down ▽ arrow to toggle between "No" and "Yes".
2) Press the Enter ↵ key toggle back to the text "Saver Enable"
3) Set the time for the display to shut down the back light after the last touch.
4) Popup Status: When enabled "ON" turns on a system status information screen. A popup message appears when a system event occurs such as a power failure or program fault. The default is "OFF".
5) Update time: Is the time delay for either a screen touch or a screen change event to turn on the back light. Default is "13" ms.

5.10.5 System Settings – Selecting Date & Time



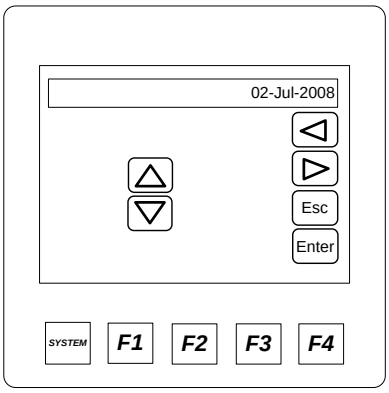
Press the "**Touch area**" Up △ or down ▽ arrow to highlight and select the item

Press the "**Touch area**" Enter ↵ to select the item and Press the "**Touch area**" Up △ or down ▽ arrow to toggle the state or open the value entry screen.

Press the "**Touch area**" **<ESC>** to return to the previous screen

Figure 62. – System Settings – Date / Time – Items Selection

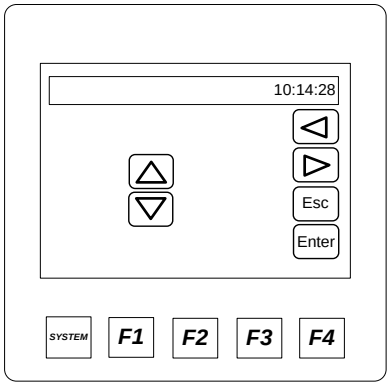
5.10.6 System Settings – Setting Date



Press the "**Touch area**" Left ◁ or Right ▷ arrow to highlight and select the item.
Press the "**Touch area**" Up △ or down ▽ arrow to change the value.
Press the "**Touch area**" **<ESC>** to return to the previous screen
Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.
Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

Figure 63. – System Settings – Date / Time – Change date.

5.10.7 System Settings – Setting Time



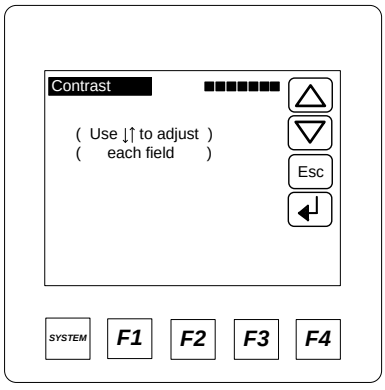
Press the "**Touch area**" Left ◁ or Right ▷ arrow to highlight and select the item.
Press the "**Touch area**" Up △ or down ▽ arrow to change the value.
Press the "**Touch area**" **<ESC>** to return to the previous screen
Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.
Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

Figure 64. – System Settings – Date / Time – Change time.

How Date / Time settings work:
The Date Time is very important for accurate record keeping. Once set verify the time is correct occasionally.

1) Only the items Time and Date are selectable.
2) Highlight the desired item, press the Enter ↵ key to display the data change screen, Select the item using the left right arrow touch areas, use the up down touch arrows to change the value. Press the Enter touch button when done.

5.10.8 System Settings – Changing Display Contrast



Press the "**Touch area**" Up △ or down ▽ arrow to change the value.
Press the "**Touch area**" **<ESC>** to return to the previous screen
Press the "**Touch area**" **<Enter>** to accept the value and return to the previous screen.
Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

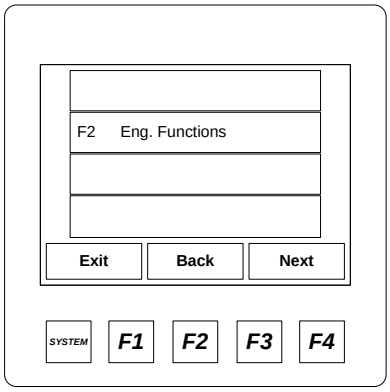
Figure 65. – System Settings – Display Contrast

How Contrast settings work: The Contrast adjustment sets the intensity of the back lighting. Set to the desired intensity. To set, use the up down touch arrows to change the value. Press the Enter touch button when done

5.11 Eng. Functions

Engineering Function settings include system settings such as scaling, operation limits, and settings which dictate how the systems functions. These should not be adjusted without specific intent. In most situations the default values are those needed to operate.

5.11.1 Engineering Functions – Menu selection



Press the "**Touch area**" **<F2 Eng. Functions>** to enter the Engineering Functions password entry screen.

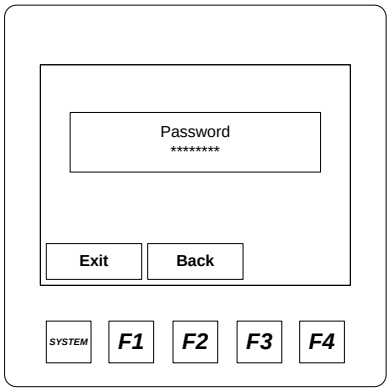
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 66. – Engineering Functions

5.11.2 Engineering Functions – Password Entry

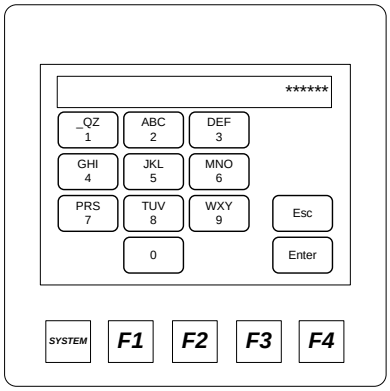


Press the "**Touch area**" **<Password ****>** to enter the password entry screen.

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the previous screen

Figure 67. – Engineering Functions – Password

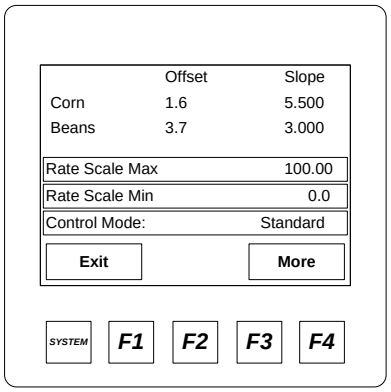


Press the "**Touch area**" **<keypad>** to enter the numeric password value. Press the "**Touch area**" **<Enter>** to accept the value and enter the engineering screens.

Or press the "**Touch area**" **<Esc>** to cancel and return to the previous screen

Figure 68. – Engineering Functions – Password Entry

5.11.3 Engineering Functions 1 – Slope, Offset entry



Press the "**Touch area**" **<values>** to display the value entry numeric keypad screen. Enter the desired value on the "Touch" keypad.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

Press the "**Touch area**" **<More>** to move to the next screen

Figure 69. – Engineering Functions 1 – Slope, Offset entry

How Slope and Offset values work:

The Slope and offset values are used to scale the voltage signals returned from the sensor. In the case of the 4 products different scaling values can be applied for each product. Although the moisture sensor output is not exactly linear it can be considered linear over the typical measurement range. The "slope" values are factory set based on the sensor type and the product measured. This value needs no adjustment. The offset value is a bias value and directly influences the displayed moisture readings and will change with adjustments and calibration.

1) Adjusting the "Offset" to bring a sensor in line. In the event there is a significant difference between the manual moisture test and the displayed value and adjustment to the offset value can bring the displayed value in line. There is a direct relationship between the offset and the displayed value. Note the manual test value and the displayed moisture.
2) Calculate the difference. If the Dryer Master sensor was higher than the manual test. The offset value will need to be reduced by the calculated difference. If the Dryer Master sensor was lower than the manual test. The offset value will need to be increased by the calculated difference.
3) For example:
    a) Dryer Master reading = 16.7, Manual test = 15.4
    b) Difference 16.7 – 14.4 = 1.3
    c) The offset value = 1.6
    d) The offset value changes to 1.6 - 1.3 = 0.3
    e) So the new value for offset becomes 0.3

Note the offset value can be a negative value, depending on the product values from -5 to +8 are well within normal operation.

How Rate Scale values work:

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

1) In voltage mode, the default setting, the Maximum output voltage is 10 volts and the Minimum output voltage is 0 volts.
2) For Example:
   Suppose we have the following application
   a) The maximum displayed value = 100 and the voltage we need = 8 volts
   b) The minimum displayed value = 0 and the voltage we need = 2 volts
   c) For a range of 0 to 100 we have a voltage change of 2 to 8 volts or s span of (8-2=6) 6.
   d) This means we have (100 / 6) = 16.67 speed units per volt
   e) The minimum displayed value = 0 and the voltage is 2 volts. Therefore we will need to subtract (2 * 16.67 = 33.34) from the 0 value. "**Rate Scale Min**" becomes -33.34
   f) The maximum display value of 100 is reached at 8 volts. Therefore at 10 volts we would see (10 * 16.67 = 166.70). So the "**Rate Scale Max**" value will need to be set to (166.70 - 33.34 = 133.36)

The display will drive 4 to 20 mA into a 250 ohm load with the voltage setting.
For 0 to 100 scale and 1 to 5 volts or 4 to 20 Ma output into a **250 ohm load** while in default voltage output mode:

1) Still in voltage mode the Maximum output voltage is 10 volts or 40 mA and the Minimum output voltage is 0 volts or 0 mA.
2) For Example:
   Suppose we have the following application
   a) The maximum displayed value = 100 and the voltage we need = 5 volts = 20 mA
   b) The minimum displayed value = 0 and the voltage we need = 1 volt = 4 mA
   c) For a range of 0 to 100 we have a voltage change of 1 to 5 volts or s span of (5 – 1 = 4) 4 or a current change of 4 to 20 mA or s span of (20 – 4 = 16) 16
   d) This means we have 100 / 4 = 25 speed units per volt or 100 / 16 = 6.25 speed units per mA.
   e) The minimum displayed value = 0 and the voltage is 1 volt or 4 mA. Therefore we will need to subtract (1 * 25 = 25 if voltage or (4 * 6.25 = 25) from the 0 value. "**Rate Scale Min**" becomes -25
   f) The maximum display value of 100 is reached at 5 volts or 20 mA. Therefore at 10 volts or 40 mA we would see (10 * 25 = 250) for volts or (40 * 6.25 = 250) so the "**Rate Scale Max**" value will need to be set to (250 -25 =225).

See the Appendix to change the jumpers for milliamp current loop output. The same formula applies for milliamp signals in which case the total range is 0 to 20 mA. The display will drive 0 to 20 mA into a 500 or lower ohm load.
For 0 to 100 scale and 4 to 20 Ma output into a load of any value equal too or less than 500 ohm:

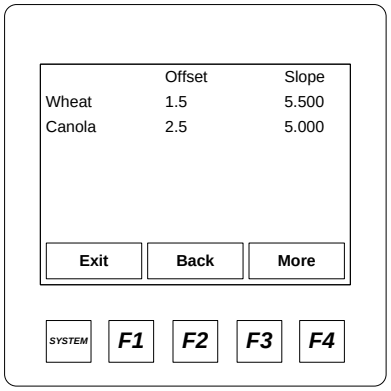
3) In current mode the Maximum output current 20 mA and the Minimum output current is 0 mA.
4) For Example:
   Suppose we have the following application
   a) The maximum displayed value = 100 and the voltage we need = 20 mA

b) The minimum displayed value = 0 and the current we need = 4 mA
c) For a range of 0 to 100 we have a voltage change a current change of 4 to 20 mA or s span of (20 – 4 = 16) 16
d) This means we have 100 / 16 = 6.25 speed units per mA.
e) The minimum displayed value = 0 and the current is 4 mA. Therefore we will need to subtract (4 * 6.25 = 25) from the 0 value. "**Rate Scale Min**" becomes -25
f) The maximum display value of 100 is reached at 20 mA. Therefore at 20 mA we would see (20 * 6.25 = 125) so the "**Rate Scale Max**" value will need to be set to (125 -25 = 100).

How Control Mode works:
Two different methods for Automatic operation are available.

Standard – Timer to return to normal speed is triggered when moisture crosses either the upper moisture trigger point or the lower moisture trigger point on its way to the target moisture.
Enhanced – Timer to return to normal speed is triggered when moisture crosses the target moisture after returning from either the upper moisture trigger point or the lower moisture trigger point.

5.11.4 Engineering Functions 2 – Slope, Offset entry



Press the "**Touch area**" **<values>** to display the value entry numeric keypad screen. Enter the desired value on the "Touch" keypad.

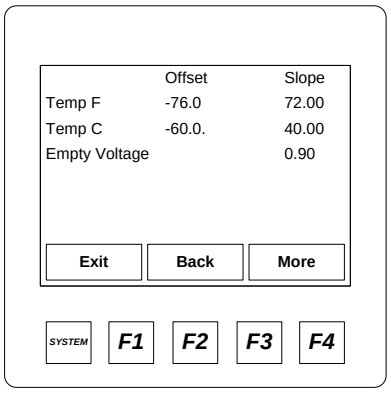
Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

Press the "**Touch area**" **<More>** to move to the next screen.

Figure 70. – Engineering Functions 2 – Slope, Offset entry

5.11.5 Engineering Functions 3 – Slope, Offset entry



Press the "**Touch area**" **<values>** to display the value entry numeric keypad screen. Enter the desired value on the "Touch" keypad.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

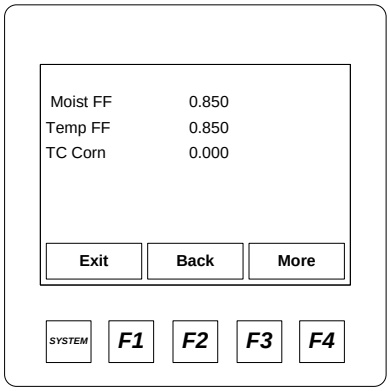
Press the "**Touch area**" **<More>** to move to the next screen.

Figure 71. – Engineering Functions 3 – Slope, Offset entry

How Empty Voltage works:

The Empty voltage value determines the minimum acceptable signal from the moisture sensor for scaling to a moisture value. Once the signal from the sensor falls below this value the moisture display on the main screen will default to displaying "Empty".

5.11.6 Engineering Functions 4 – FF&TC Corn value entry



Press the "**Touch area**" **<values>** to display the value entry numeric keypad screen. Enter the desired value on the "Touch" keypad.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

Press the "**Touch area**" **<More>** to move to the next screen

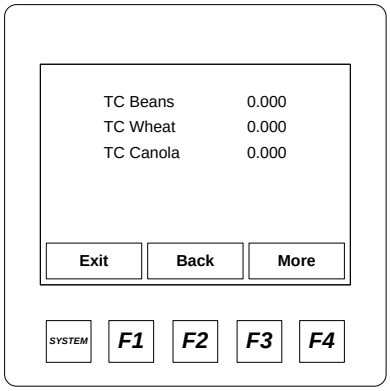
Figure 72. – Engineering Functions 4 – FF & TC Corn value entry

How the Moist FF and Temp FF works:

The Moist FF and Temp FF are logarithmic filters applied to the Moisture and Temperature voltage signals from the sensor. A value of zero (0) means no filter and value of one (1) will result in an infinite filter where the value will no longer change.

1) A value of 0.85 is the default.
2) If the moisture display jumps around significantly increase the value to 0.9 or even 0.95.
3) To get a feel for the effect of this filter have someone block the flow of product to the sensor and observe the speed at which the sensor reading drops to "Empty".

5.11.7 Engineering Functions 5 – TC value entry



Press the "**Touch area**" **<values>** to display the value entry numeric keypad screen. Enter the desired value on the "Touch" keypad.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

Press the "**Touch area**" **<More>** to move to the next screen

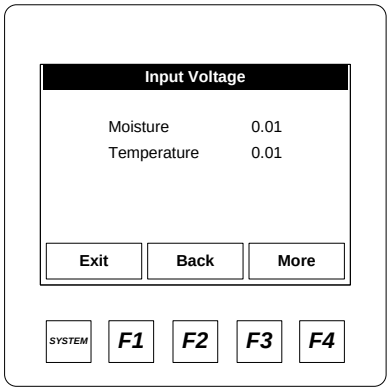
Figure 73. – Engineering Functions 5 – TC value entry

How the TC Corn, Beans, Wheat, Canola works:

TC stands for Temperature Correction for each of the products. This value is typically set to "0". The standard sensor has temperature compensation correction for the product moisture built into the

electronics of the moisture sensor. In the event a 3rd party sensor is used this system can accommodate temperature compensation by adjusting the TC Com value.

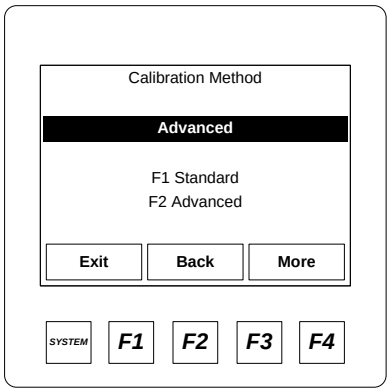
5.11.8 Engineering Functions 6 – Input Voltage Diagnostics display



This is a diagnostics screen
The Moisture and Temperature values are the "input voltages from the sensors".
0-10 volts DC is the permissible range for both.
Press the "**Touch area**" **<Exit>** to cancel and return to the main screen
Press the "**Touch area**" **<Back>** to cancel and return to the previous screen
Press the "**Touch area**" **<More>** to move to the next screen

Figure 74. – Engineering Functions 6 – Input Voltage diagnostics display

5.11.9 Engineering Functions 7 – Moisture sensor calibration method selection



Press "**F1**" to display and use the "Standard" Moisture calibration method.

Press "**F2**" to display and use the "Advanced" Moisture calibration method.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

Press the "**Touch area**" **<More>** to move to the next screen.

Figure 75. – Engineering Functions 7 – Calibration Method screen

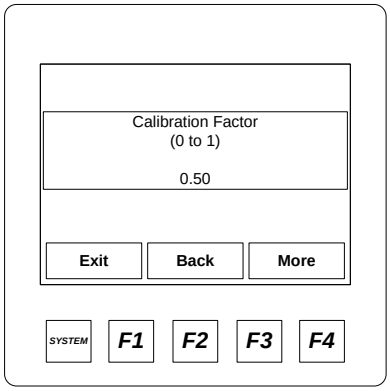
How the Calibration Method works:
Two methods for moisture sensor calibration have been provided, Standard and Advanced method. Both allow for easy adjustment of the displayed value to a bench top standard device.

1) Standard: With this method the user is presented with a screen where they adjust the displayed value.
    a) The user is actually adjusting the Sensor offset using this method.
2) Advanced: This method in conjunction with a calibration push button permits the calibration to be automated.
    a) The user presses the calibration button and gathers samples while the calibration button is flashing.
    b) The user then takes 3 or more tests from the gathered sample, averages the tests.
    c) Enter the average value back into the system.

d) The system will determine what and how much of a correction to apply.
e) A few calibrations will be required if there is a significant error.

3) The advanced method determines how and what to adjust. This method also stores entries to the micro SD Flash card if that option has been included.
4) With either calibration methods it is possible to adjust the moisture offset for the product in use at any time. The offset is a direct relationship to moisture. Increasing the existing offset by adding 1.0 will increase the displayed value by 1.0. Decreasing the existing offset by subtracting 1.0 will decrease the displayed value by 1.0. It is possible to have negative numbers for the offset.

5.11.10 Engineering Functions 8 – Calibration Factor



Press "**Calibration Factor**" "**Touch area**" to display the value entry numeric keypad screen. Enter the desired value on the "Touch" keypad.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

Press the "**Touch area**" **<More>** to move to the next screen.

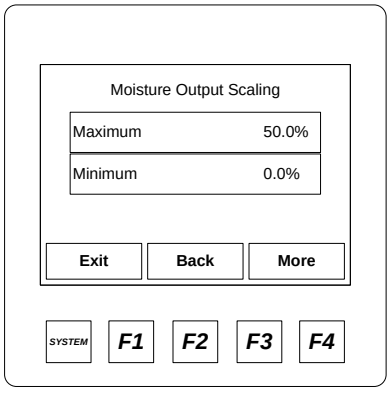
Figure 76. – Engineering Functions 8 – Calibration Factor screen

How the Calibration Factor works:

The Calibration Factor is the amount of change applied with each calibration entry while using the "Advanced" method.

The Logic limits the maximum difference between the online reading and the manual sample to 1%. The calibration factor limits the change to the offset to a percentage of the difference. A calibration factor of 0.5 means the offset will change by 50% of the difference and a calibration factor of 0.75 limits the offset change to 75% of the difference, etc.

5.11.11 Engineering Functions 9 – Moisture Output scaling



Press "**Maximum or Minimum**" "**Touch area**" to display the value entry numeric keypad screen. Enter the desired value on the "Touch" keypad.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

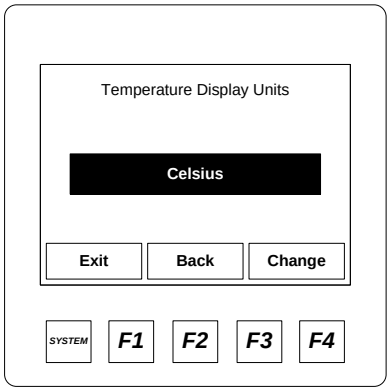
Press the "**Touch area**" **<More>** to move to the next screen.

Figure 77. – Engineering Functions 9 – Moisture Output Scaling

How the Output Scaling works:

The displayed moisture is output as a voltage or current signal for use by an external system. This analog signal can be sent to a PLC or other reading instrument. The maximum and minimum values reflect on what moisture values would equate to the minimum or maximum signal. The default output configuration 0 to 10 volts. 0 – 20 mA is Jumper settable, refer to the appendix for information.

5.11.12 Engineering Functions 10 – Changing Temperature Scale "deg F" "deg C"



Press "**Change**" "**Touch area**" to toggle between degrees Celsius or degrees Fahrenheit.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

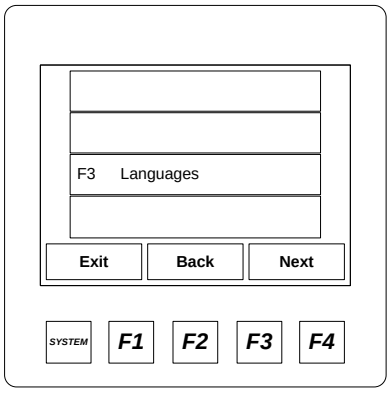
Press the "**Touch area**" **<Change>** to change between degrees F and C…

Figure 78. – Engineering Functions 10 – Temperature Display Units selection.

5.12 Languages

The system is configured to support the displayed test in 3 languages, English, French and Spanish.

5.12.1 Languages – Menu selection



Press the "**Touch area**" **<F3 Languages>** to display the Language toggle screen.

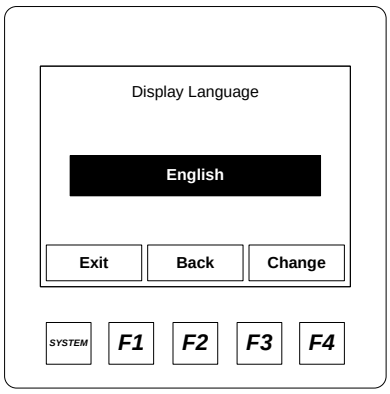
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 79. – Languages

5.12.2 Languages – Changing display language, English, French, Spanish



Press "**Change**" "**Touch area**" to toggle between English, French and Spanish.

Press the "**Touch area**" **<Exit>** to cancel and return to the main screen

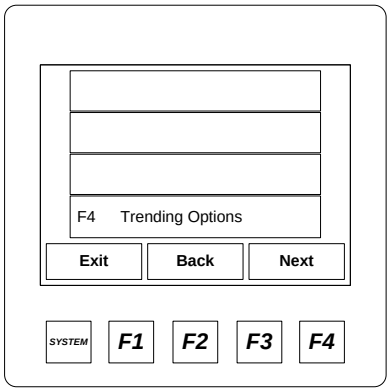
Press the "**Touch area**" **<Back>** to cancel and return to the previous screen

Press the "**Touch area**" **<Change>** to change between degrees F and C…

Figure 80. – Languages – change language

5.13 Trending Options

5.13.1 Trending Options – Menu selection



Press the "**Touch area**" **<F4 Trending Options>** to display the Trending functions and setup.

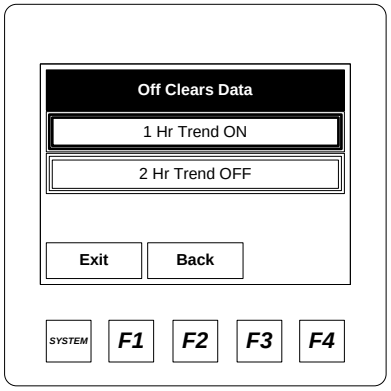
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the main screen

Press the "**Touch area**" **<Next>** to move to the next screen

Figure 81. – Trending Options

5.13.2 Trending Options – Clearing data



Press the "**Touch area**" **<1 Hr Trend On>** to turn the 1 hour trending on of off.

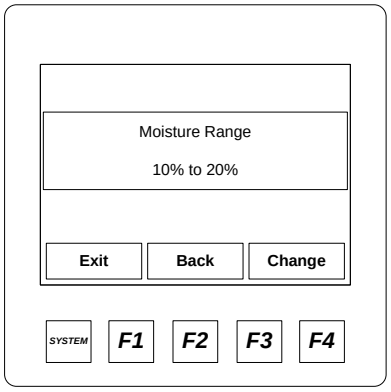
Press the "**Touch area**" **<2 Hr Trend On>** to turn the 1 hour trending on of off.

Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the previous screen

Figure 82. – Trending Options – clearing data

5.13.3 Trending Options – Changing Moisture range



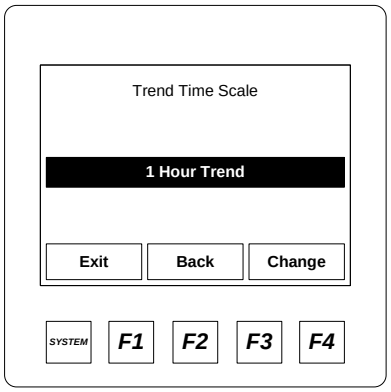
Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the previous screen

Press the "**Touch area**" **<Change>** to toggle between 0% to 10%, 10% to 20% and 20% to 40% scale options.

Figure 83. – Trending Options – Changing Moisture range

5.13.4 Trending Options – Changing trend time scale



Press the "**Touch area**" **<Exit>** to return to the main screen

Press the "**Touch area**" **<Back>** to return to the previous screen

Press the "**Touch area**" **<Change>** to toggle between 1 hour trend and 2 hour trend

Figure 84. – Trending Options – Changing trend time scale

5.14 Information

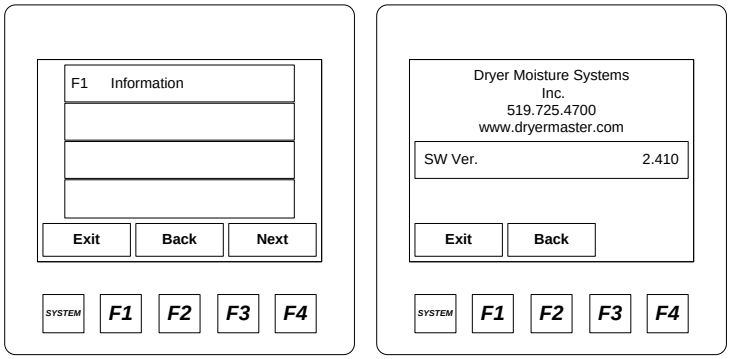


Figure 85. – Information – Contact info & system version information.

5.15 Removable Media

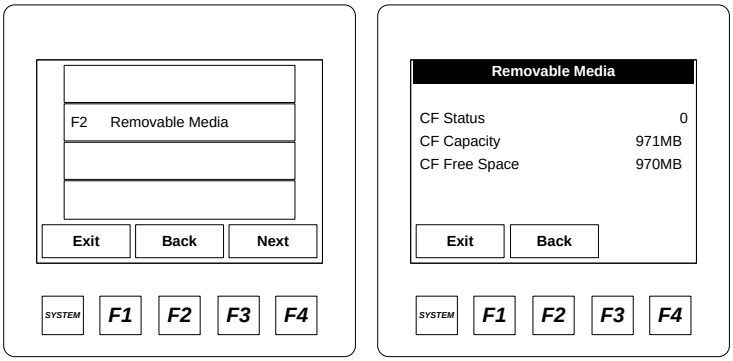


Figure 86. – Removable Media – Information and status of the micro SD Compact Flash card

What the status numbers mean.
0 = Memory card present and formatted?
1= Memory card present – Unknown format
2= No memory card present
3= Memory card present but not supported
4= Memory card swapped before operation complete
5= Unknown error

5.16 Auto Setup

This function is available from 2 locations. "Auto setup" from the main display and the last item in Engineering functions. Refer to the section Automatic operation and setup for information.

6 Display unit Installation

6.1 Panel Mount (self-install)

This section covers the basic installation of the IMO i3B12Y/13C14-SCHF (Operator Control Station) in an existing control panel. The IMO Start-Up Guide is available in Appendix C of this manual. You can also refer to the IMOPC documentation on the web at "http://imopc01.imostatic.net/technical/i3b%20datasheet.pdf "

6.1.1 Display Dimensions

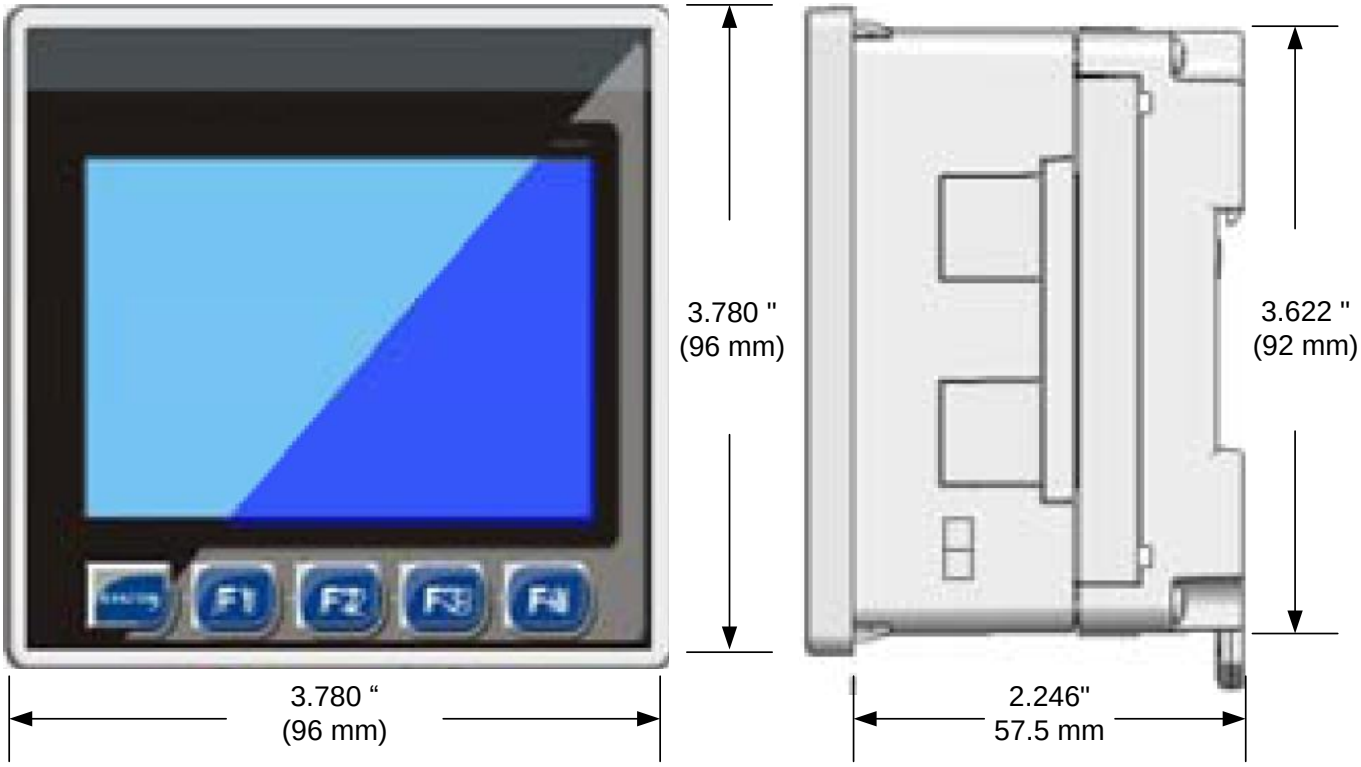


Figure 87. –Display Dimensions

6.1.2 Display Panel cut out

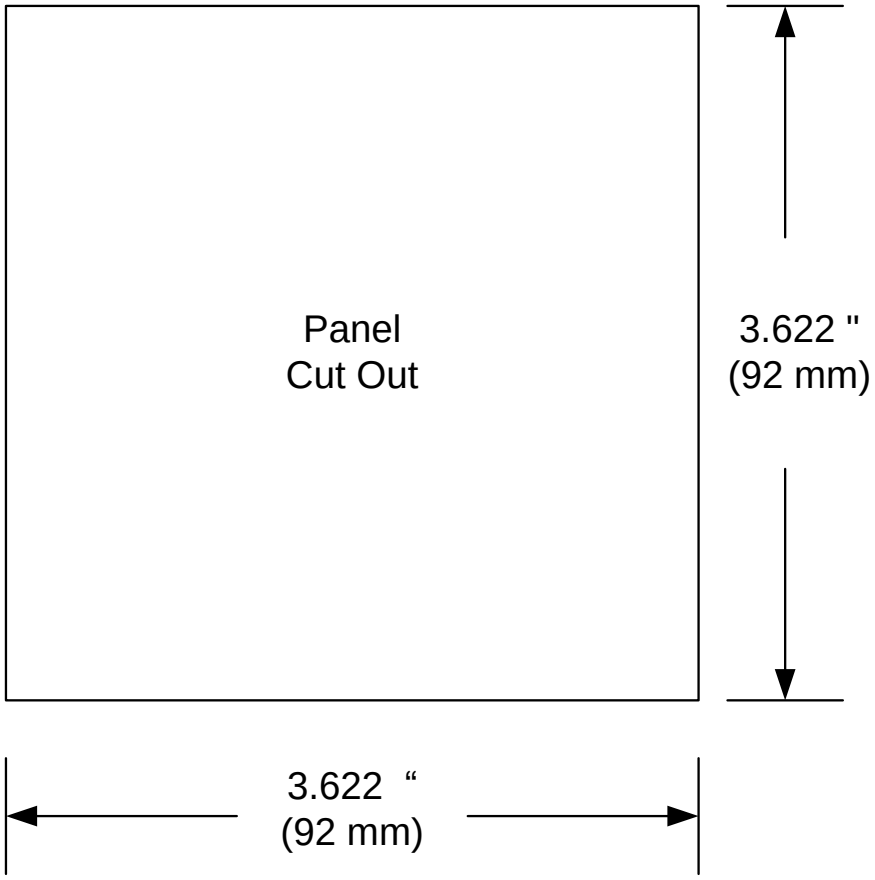


Figure 88. –Display Panel cut out

6.1.3 Display (PLC) Electrical Connections

This section describes the connections directly to the display unit (PLC) for those intending to install the unit into an existing control panel. Continue to section 6.2 for wiring to the enhanced system with the display (PLC) already installed in the Dryer Master provided AM³ panel.

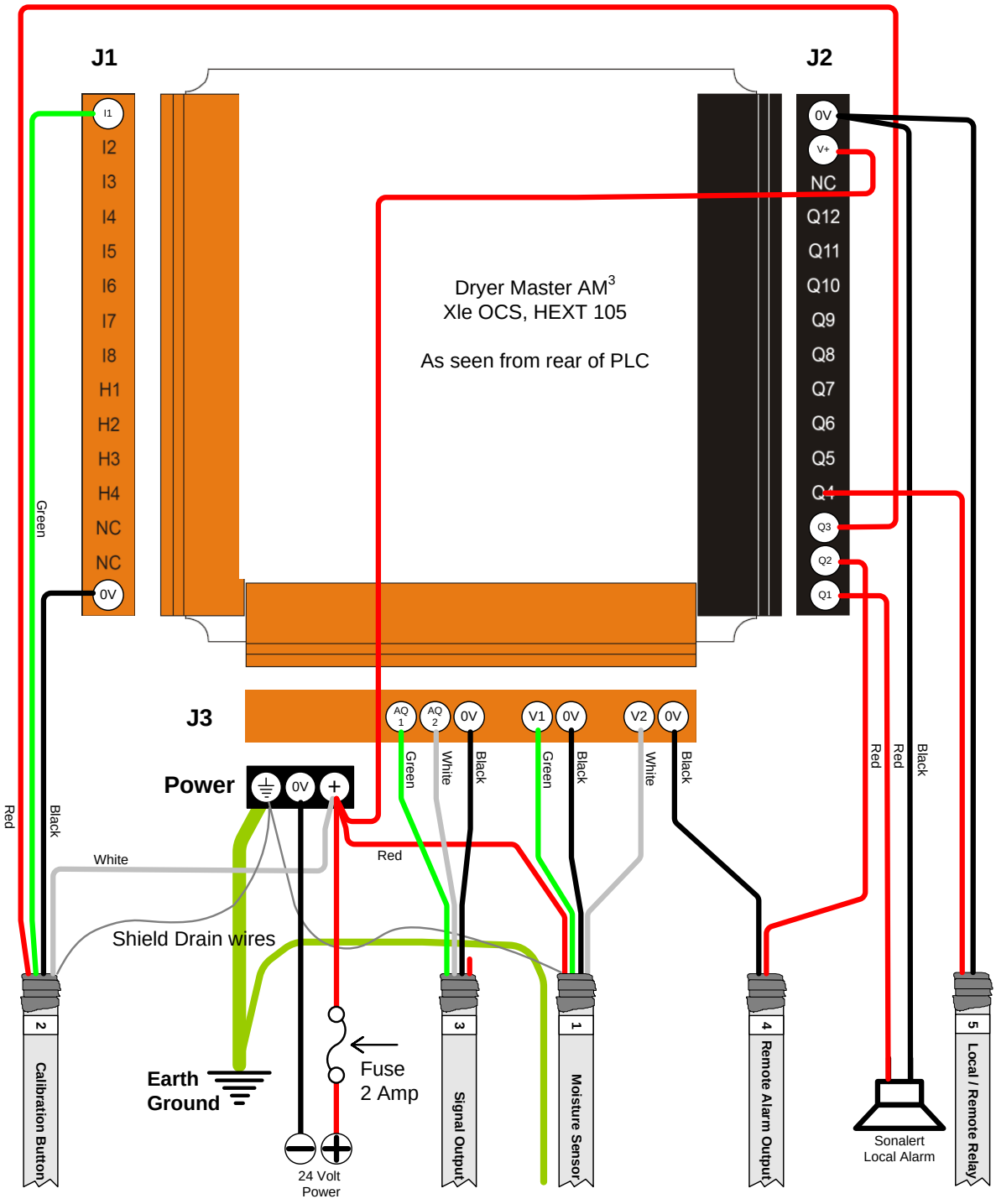


Figure 89. –Display Electrical connections

6.1.4 Field Electrical Connections

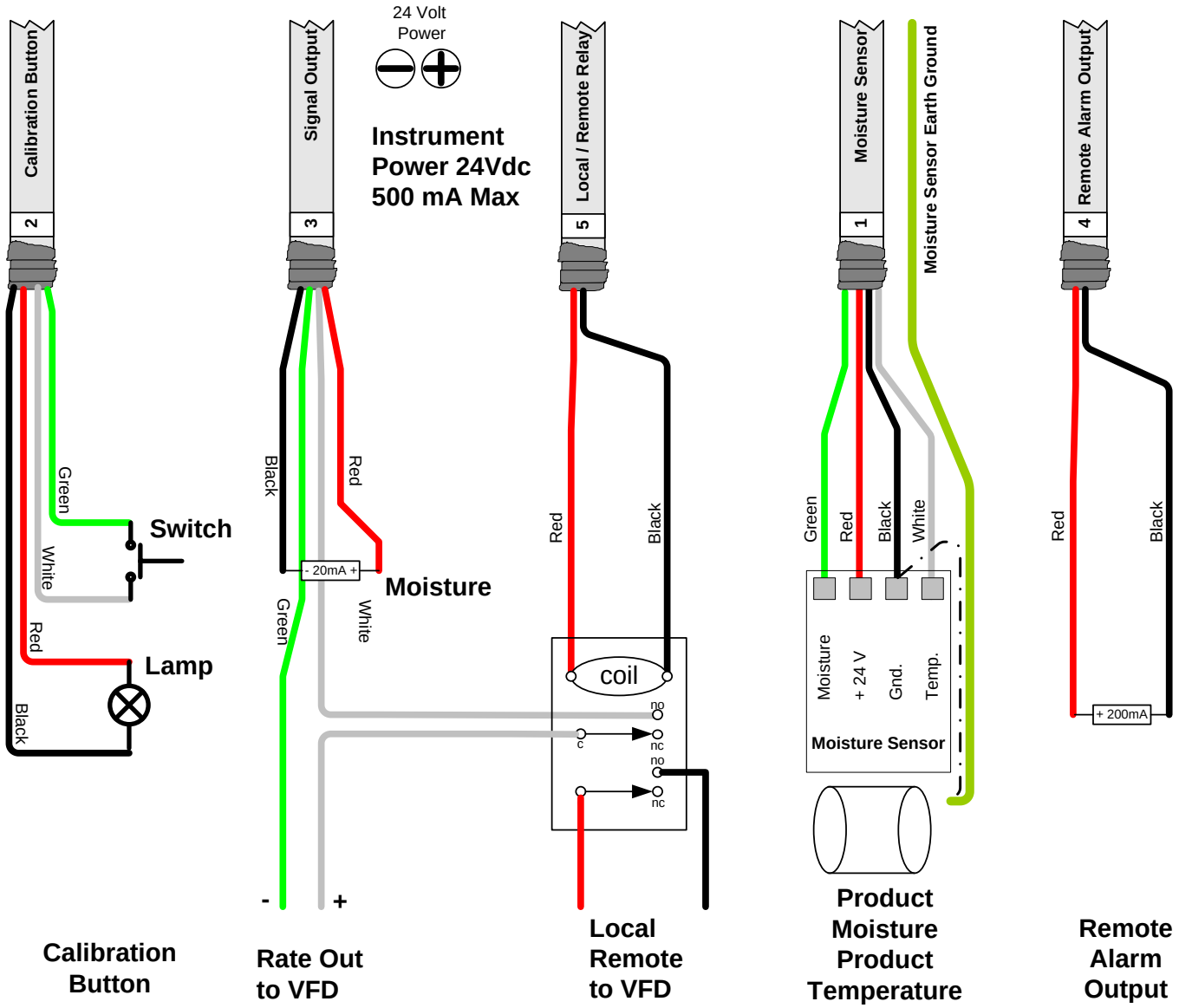


Figure 90. –Electrical connections Field devices

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 instrumentation cable in metal conduit with a ground wire or Tech cable is recommended.

6.2 AM³ Panel

The AM³ Panel is a complete system and includes the HE-XT105 PLC Operator Control Station in an enclosure, a universal voltage switching power supply, and a terminal connections strip for the field connections.

6.2.1 In Panel Electrical Connections

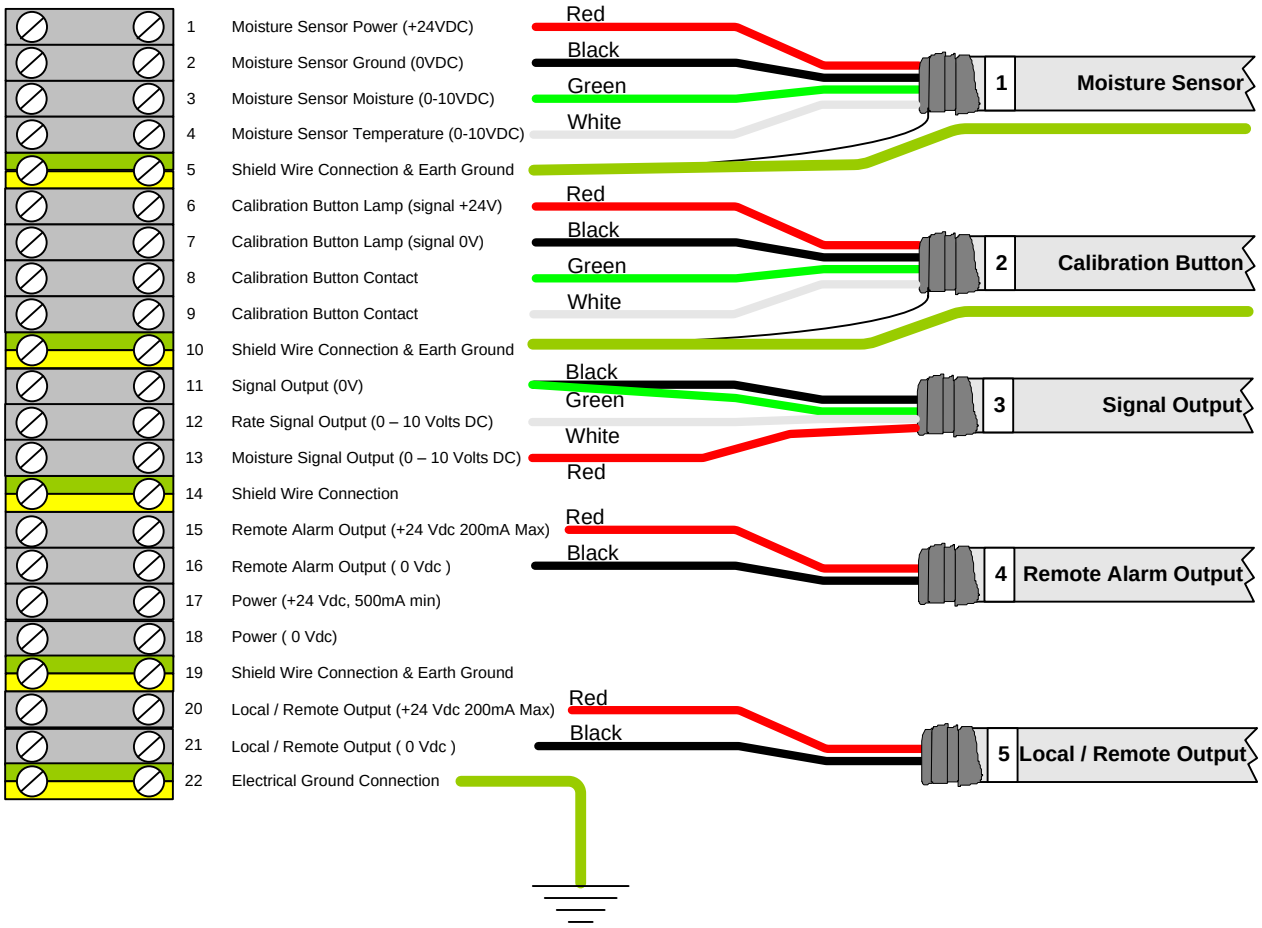


Figure 91. –AM³ In Panel connection terminal strip

6.2.2 Field Electrical Connections

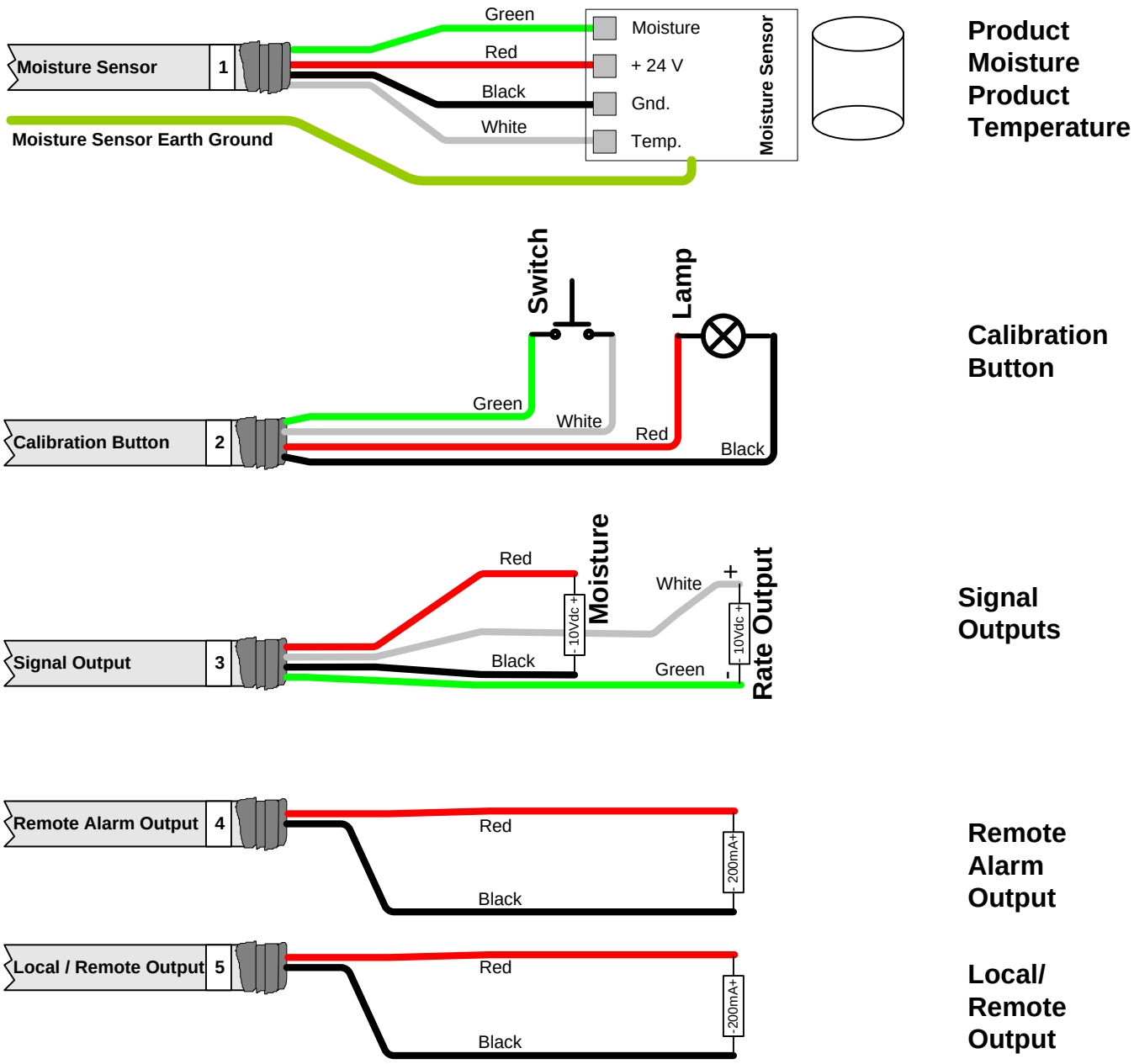


Figure 92. –Electrical connections Field devices

6.3 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.

7 Moisture Sensor General Specifications

7.1 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.

7.1.1 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).

7.1.2 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

7.2 2200-11-BTC-RB, Fin Sensor

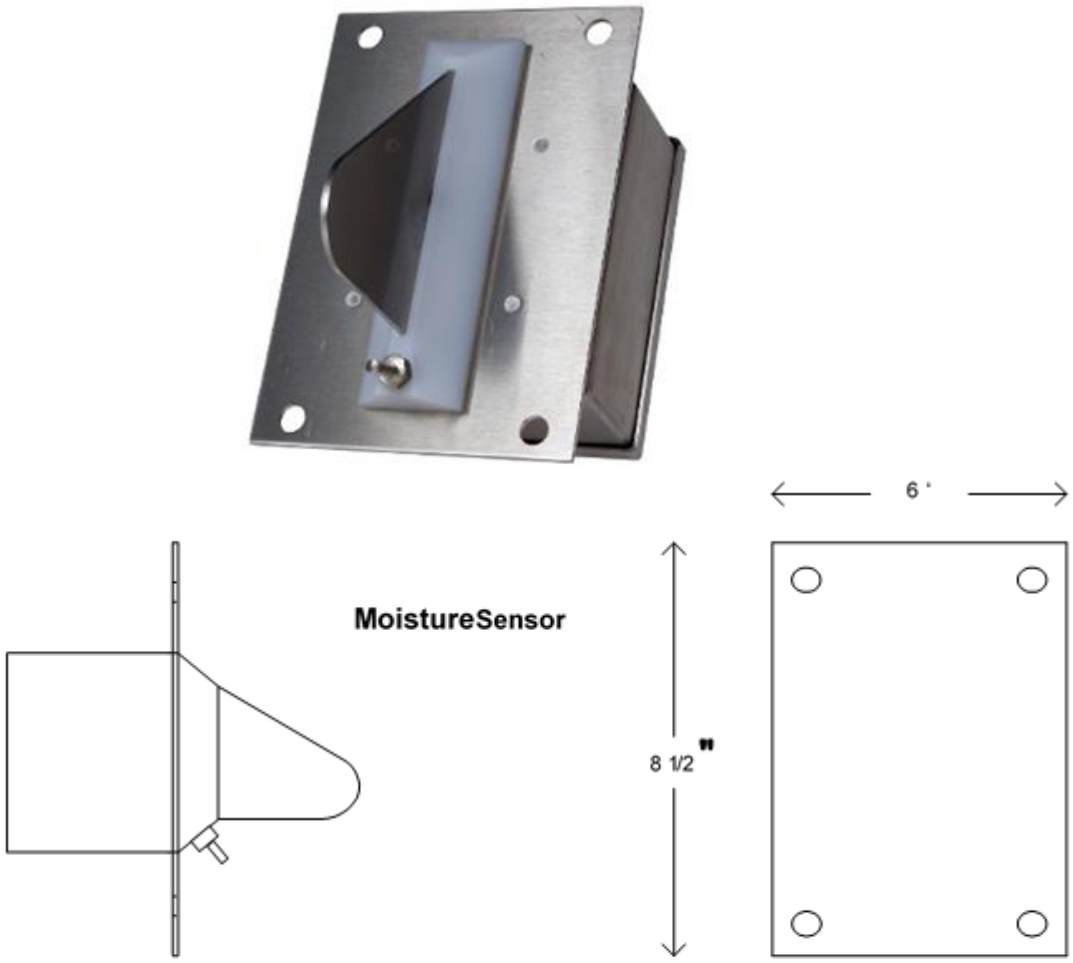


Figure 93. –Moisture Sensor

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

7.2.1 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.

7.2.2 Grounding

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

7.2.3 Signal Output

The sensor output is 0 – 10 Volts, 2 signals, dielectric (moisture) and product temperature. Minimum recommended load resistance is 10k ohm for each output. The outputs are protected from shorts to ground and supply. The output signal is a voltage to permit locating the sensor in class 2 and class 3 environments using Intrinsic Safety Barrier protection.

7.2.4 Sensor Not Reading Empty with no product present

In order for the sensor to operate properly it must show "Empty" when no product is present in the chute. If the sensor does not show empty either the Empty you will need to take the following corrective measures:

1) Check the Empty voltage settings. This value is typically 0.9 volts and is found at "Engineering Functions 3 – Slope, Offset entry"
2) If this setting is correct, check the voltage at "Engineering Functions 6 – Input voltage diagnostics display".
    a) If the value is greater than 0.9 volts either the distance between the sensor and the display unit is too large for the wire size used
    b) There is a ground potential difference which is interfering with the operation
    c) There is potentially high energy electrical noise radiating into the signal wiring.

To correct this do the following:

1) Join the "Black" signal & power lead in the moisture senor enclosure to the earth ground lead. Leave the existing connections in tack. This in effect grounds the Moisture sensor electronics to the case and also grounds the display to the moisture sensor. In 90% of the cases the problem will be eliminated.
2) If the issue is due to the distance between the sensor and the display
    a) Try doubling up on the black signal return lead. Use the shield as an additional conductor to bring the signal down.
    b) Increase the sensor Empty voltage setting.

7.3 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. There are no end user replaceable components in the sensor. If the sensor fails or cannot be setup as described on the diagnostics sheet it can be returned to Dryer Master for service. Contact Dryer Master for additional information.

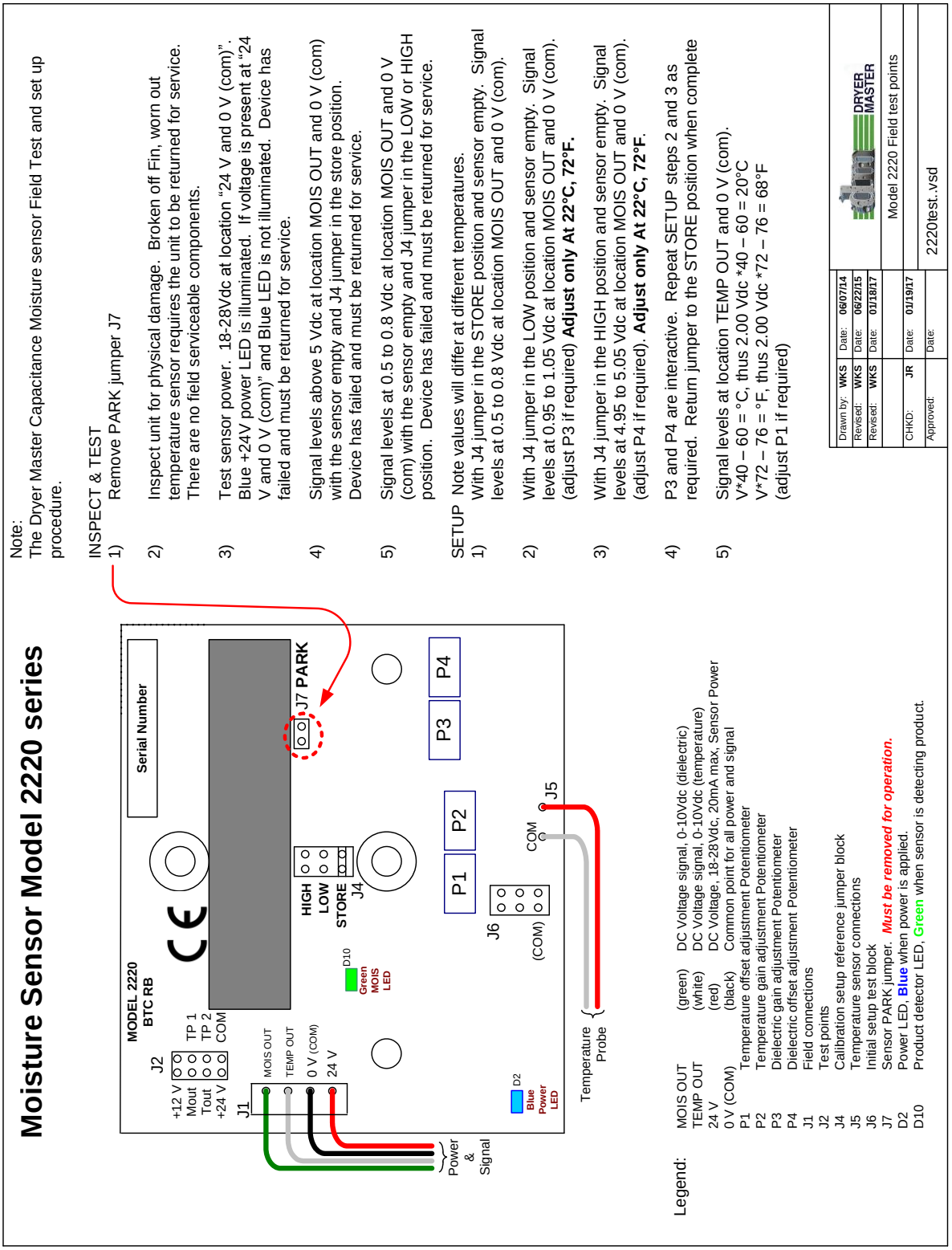


Figure 94. –Sensor Setup & diagnostics

8 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

8.1 Bypass Chute Installation Examples

8.1.1 Bypass Chute Installation square chute with screw metering

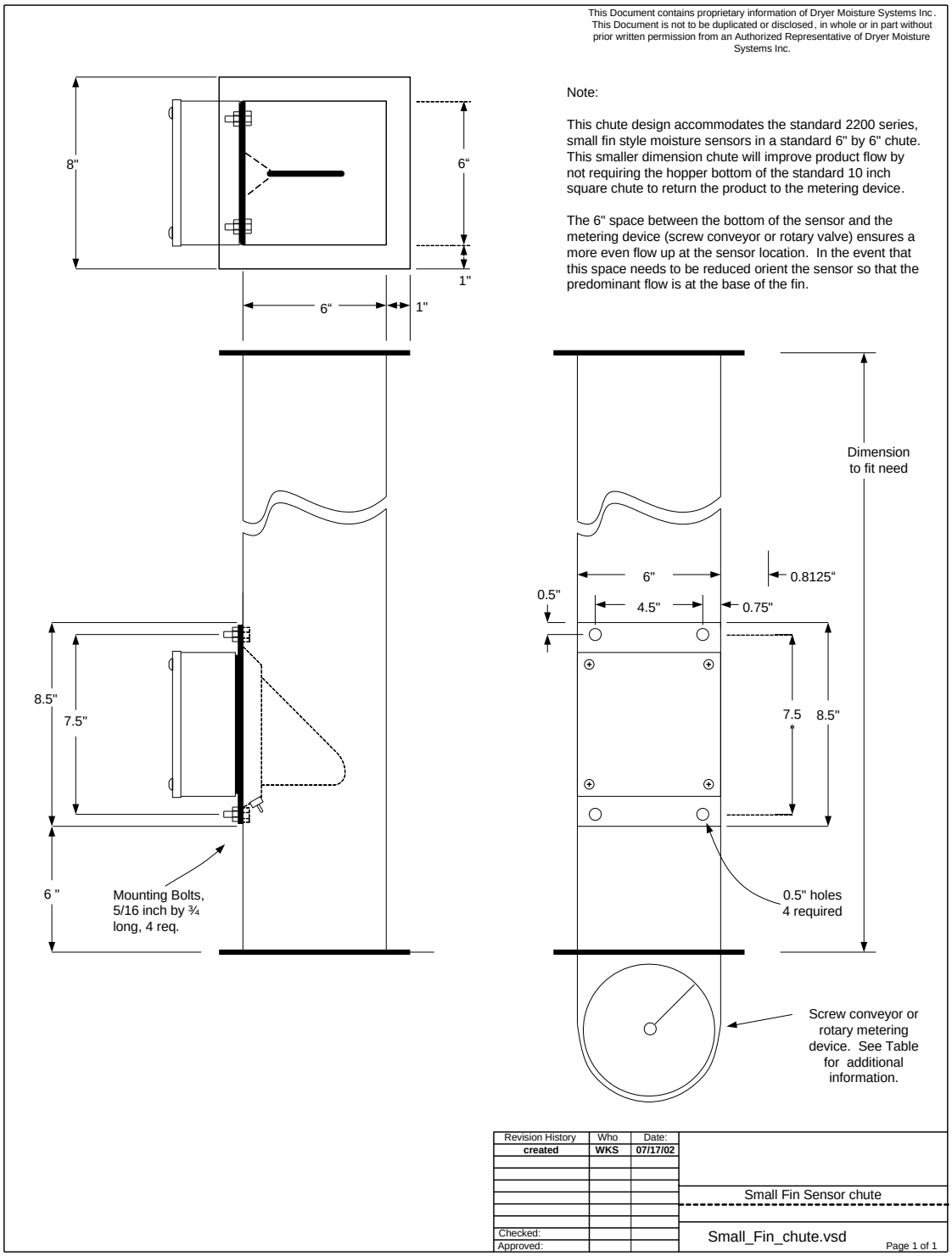


Figure 95. –Moisture Sensor Bypass Chute design #1 square pipe

8.1.2 Bypass Chute Installation round chute with screw metering

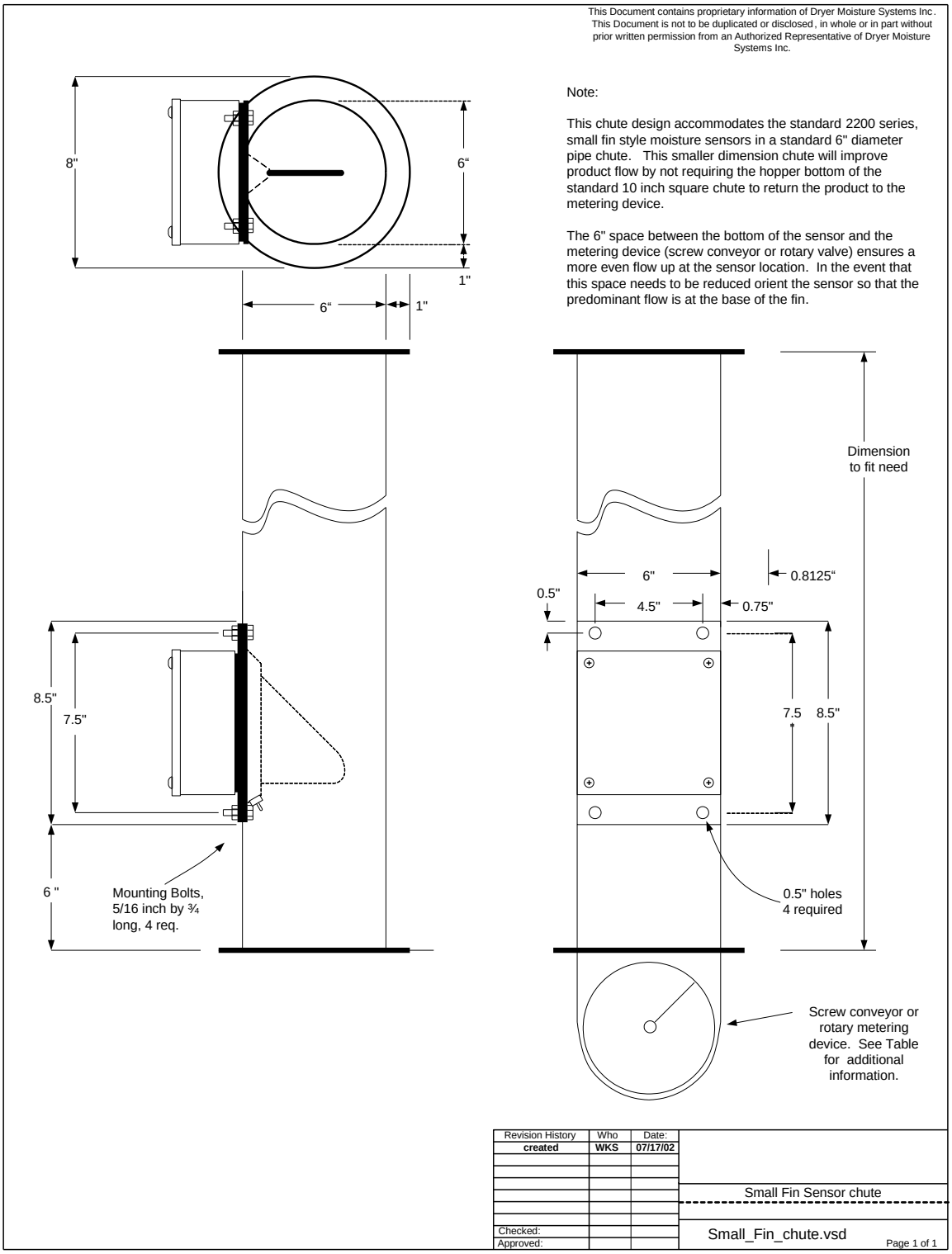


Figure 96. –Moisture Sensor Bypass Chute design #2 round pipe

8.1.3 Bypass Chute metering screw

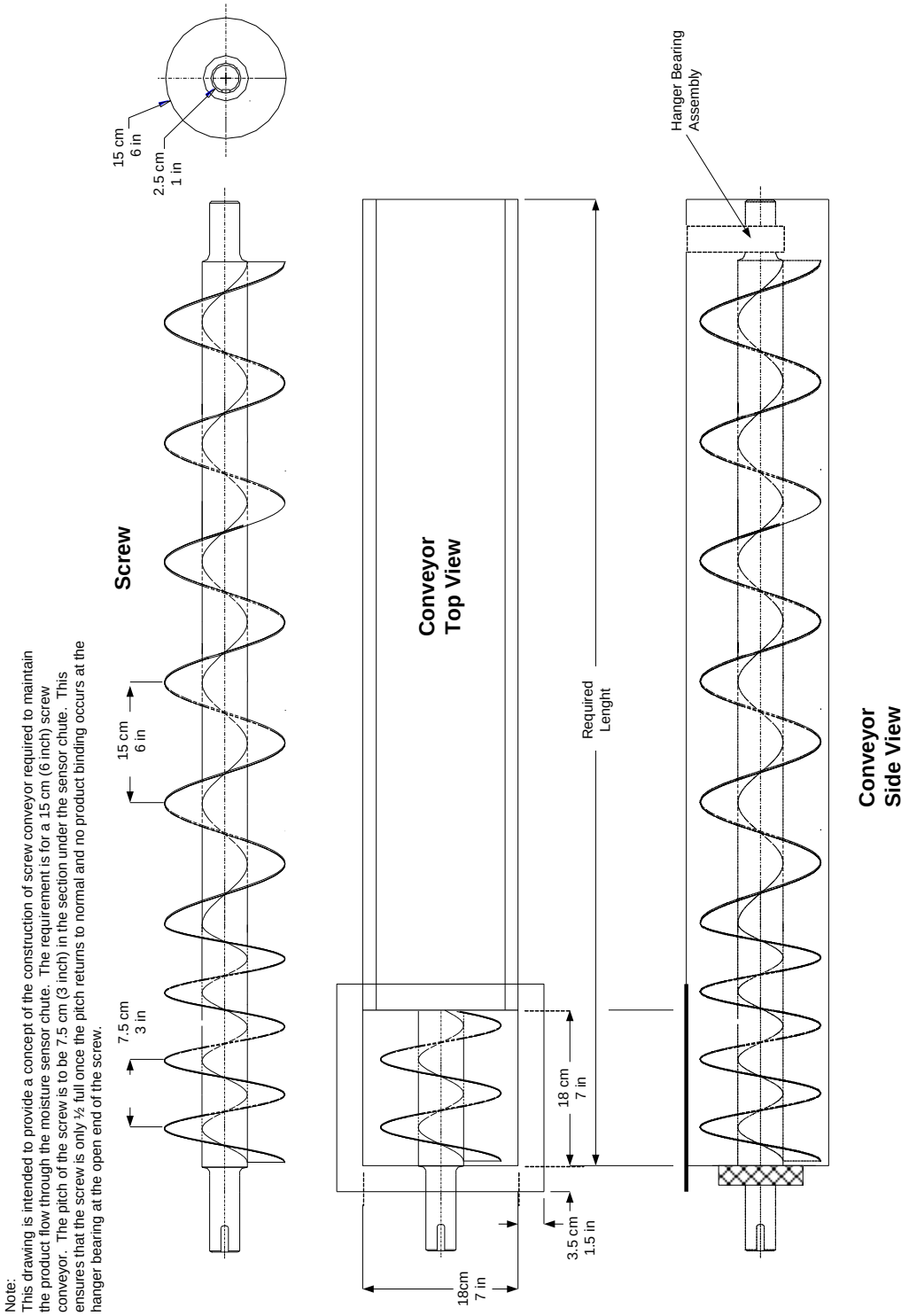


Figure 97. –Moisture Sensor Bypass Chute conceptual metering screw design

8.1.4 Bypass Chute screw metering RPM table

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 98. – 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.

8.1.5 Bypass Chute Installation rotary valve or airlock metering

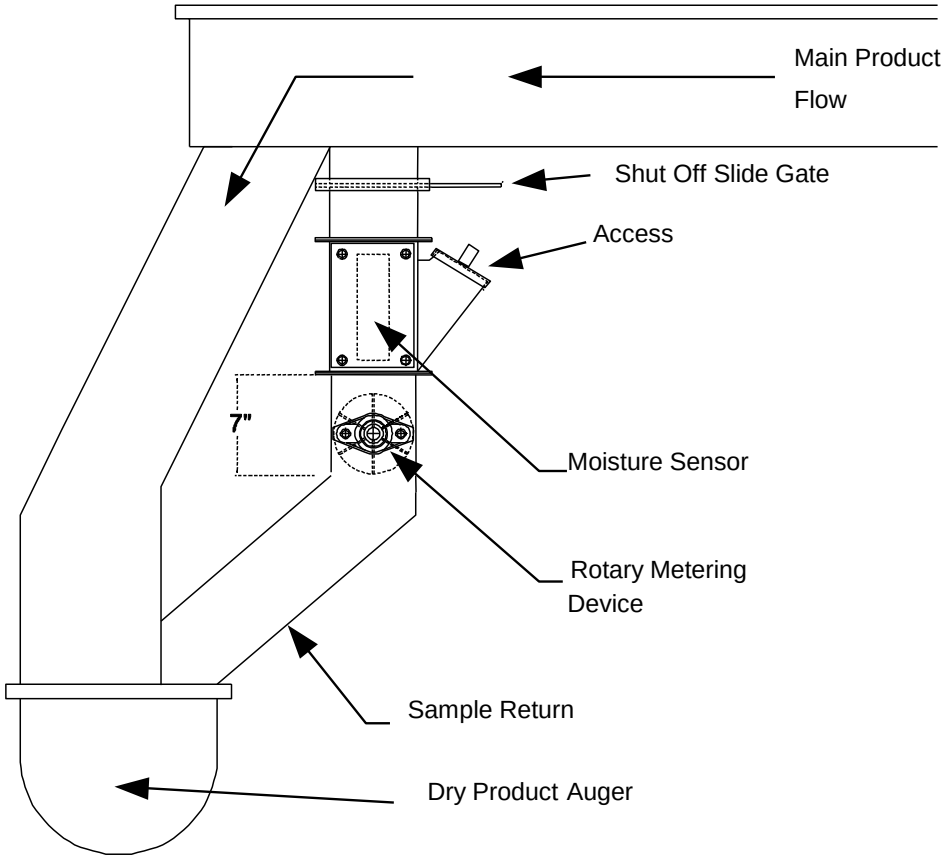


Figure 99. –Moisture Sensor, Example of a Sample Bypass Installation

8.1.6 Bypass Chute rotary valve or airlock metering RPM table

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 100. – Table of metering device RPM – rotary airlock or rotary valve

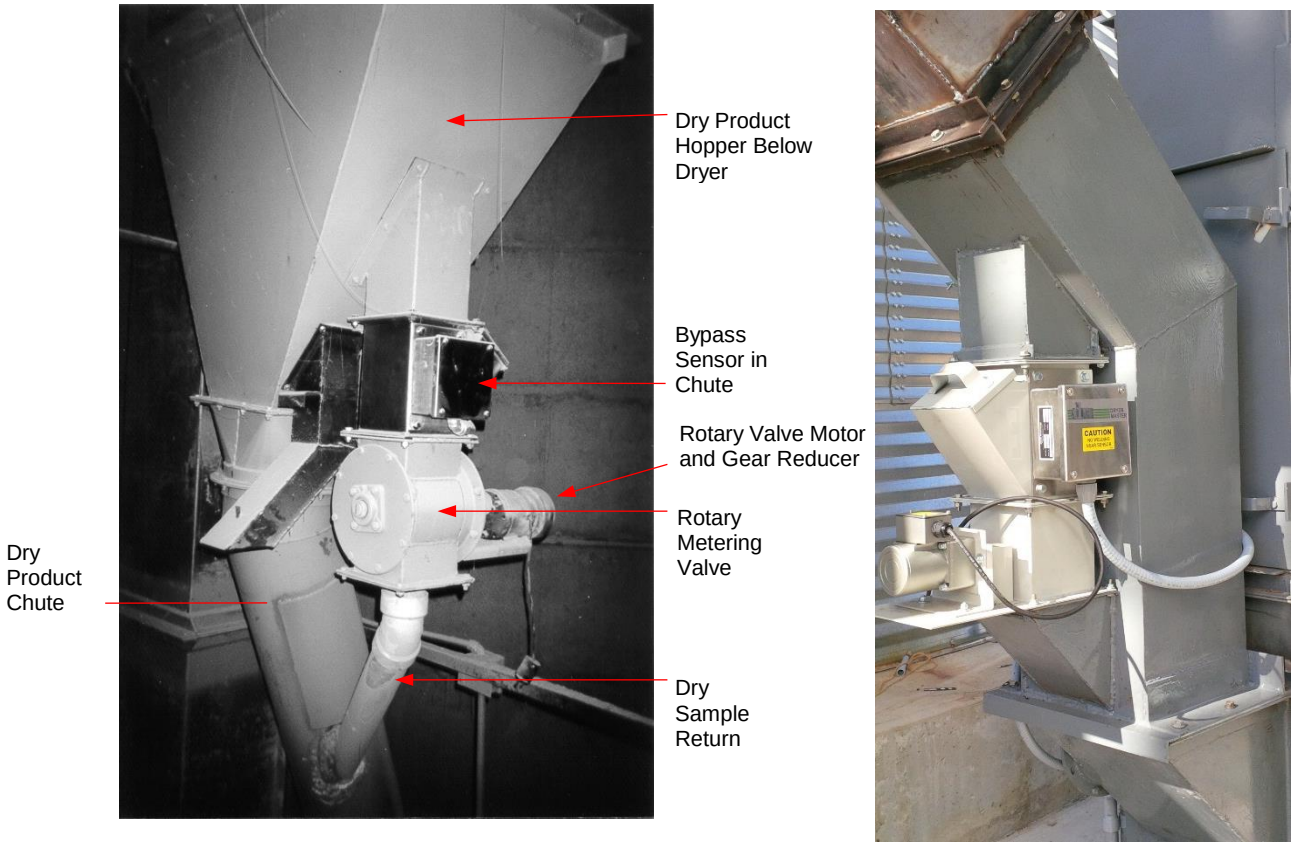


Figure 101. –Moisture Sensor, Example of a bypass Chute Installations

Dryer Master also offers a moisture sensor chute with a rotary feed (picture above right). There is more information on this chute in Appendix D.

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.

8.1.7 Bypass Chute Example

Figure 102. –Bypass Chute Example

8.1.8 Bypass Chute Example: Dimensions

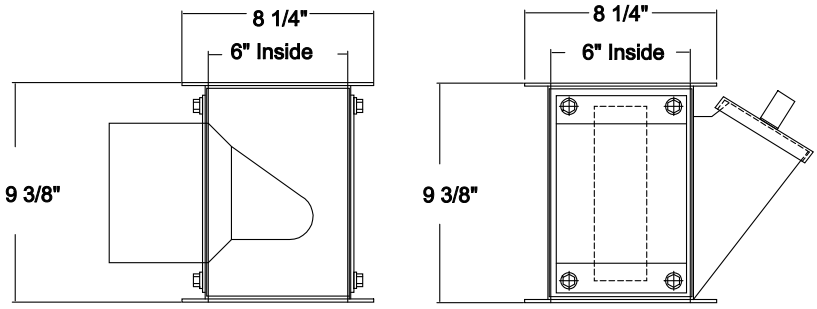
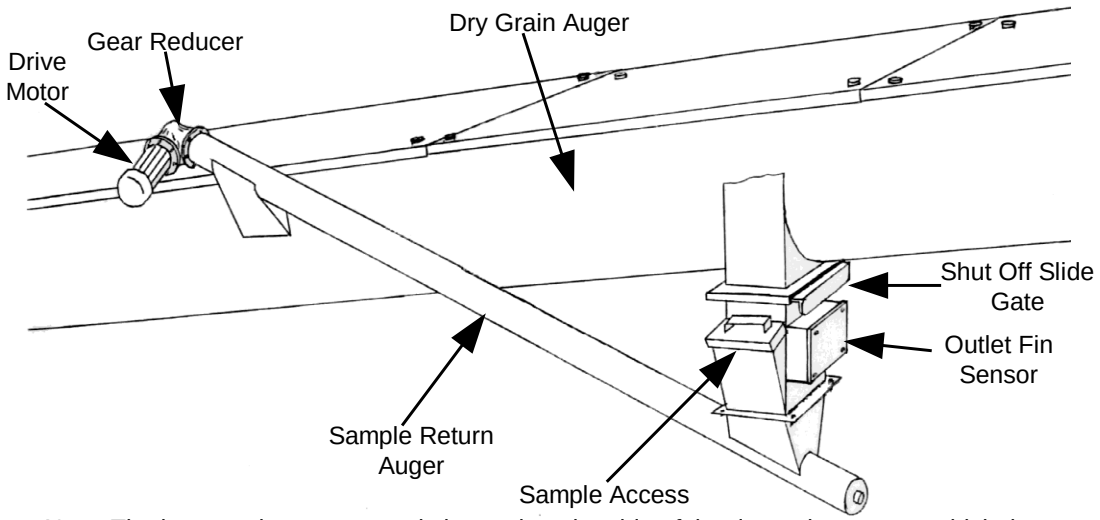


Figure 103. –Bypass Chute Example: Dimensions

8.1.9 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 104. –Moisture Sensor, Example of a bypass Chute Installation, product feeding back on itself

8.1.10 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.

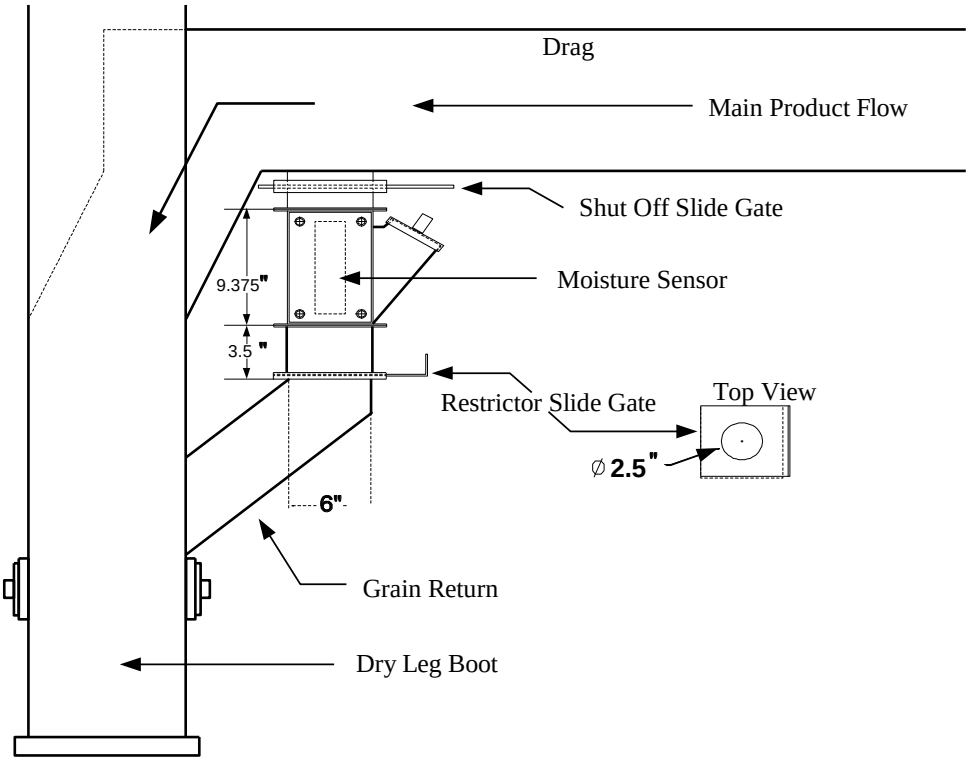


Figure 105. –Bypass Chute under Drag with mechanical flow restrictor metering.

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 mentioned products be prepared to replace it. It will not work.

8.2 In Line Chute Installation Examples

8.2.1 In Line Chute Example mechanical metering

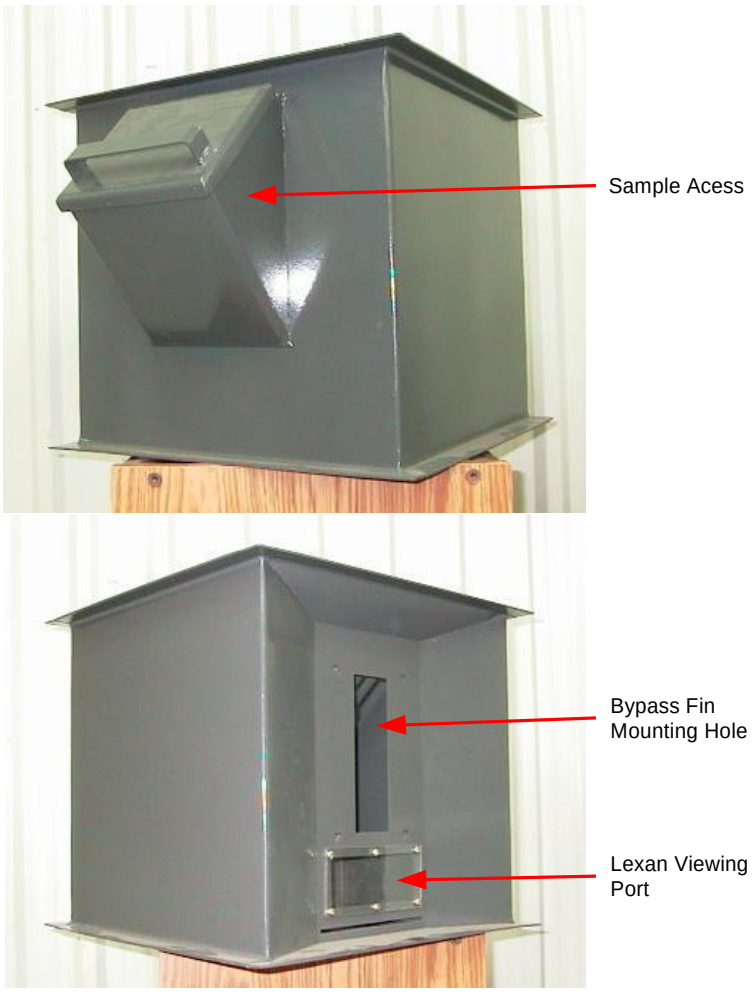


Figure 106. –In Line Chute Example

8.2.2 In Line Chute Example: Dimensions

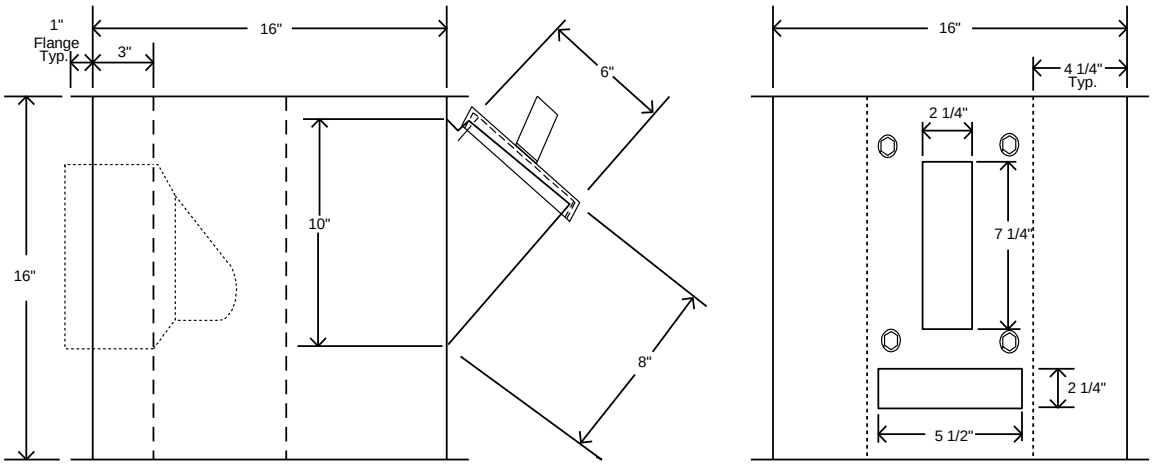


Figure 107. –In Line Chute Example: Dimensions

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 which do 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 mentioned products be prepared to replace it. It will not work.

9 Appendix A

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.

9.1.1History data example

Date	Time	Moisture	Moisture_Alarm	Temperature	Temperature_Alar	Moisture_Signal	Temperature_Sign	Rq_Rate	Mode	ProdName
24-03-2008	0:00	14.8299		108.604		2.46594	2.56469	45	2	3
24-03-2008	0:01	14.83		108.604		2.46594	2.56469	45	2	3
24-03-2008	0:02	14.8305		108.604		2.46594	2.56469	45	2	3
24-03-2008	0:03	14.8308		108.604		2.46594	2.56469	45	2	3
24-03-2008	0:04	14.8306		108.604		2.46719	2.56469	45	2	3
24-03-2008	0:05	14.8309		108.604		2.46594	2.56344	45	2	3
24-03-2008	0:06	14.831		108.604		2.46594	2.56344	45	2	3
24-03-2008	0:07	14.8307		108.627		2.46594	2.56469	45	2	3
24-03-2008	0:08	14.8311		108.627		2.46594	2.56469	45	2	3
24-03-2008	0:09	14.8313		108.627		2.46594	2.56469	45	2	3
24-03-2008	0:10	14.831		108.627		2.46719	2.56469	45	2	3
24-03-2008	0:11	14.8312		108.627		2.46594	2.56469	45	2	3
24-03-2008	0:12	14.8311		108.627		2.46594	2.56469	45	2	3
24-03-2008	0:13	14.8317		108.627		2.46719	2.56469	45	2	3
24-03-2008	0:14	14.8317		108.627		2.46594	2.56469	45	2	3
24-03-2008	0:15	14.8315		108.627		2.46594	2.56469	45	2	3
24-03-2008	0:16	14.8308		108.627		2.46594	2.56469	45	2	3
24-03-2008	0:17	14.8307		108.649		2.46719	2.56469	45	2	3
24-03-2008	0:18	14.8309		108.649		2.46594	2.56469	45	2	3
24-03-2008	0:19	14.8306		108.649		2.46594	2.56469	45	2	3

Figure 108. –History file data format

Column format:

Date	dd-mm-yyy,	dd = day, mm = month, yyyy = year
Time	hh:mm,	hh = hour, mm = minutes, 24 hour format,
Moisture	xx.xxxx	Moisture %, 1 minute averages
Moisture_Alarm	C or W	C = Critical alarm, W = Warning alarm
Temperature	xxx.xxx	Temperature, 1 minute averages,
Temperature_Alarm	C or W	C = Critical alarm, W = Warning alarm

Moisture_Signal	x.xxxxx	Sensor product dielectric signal voltage, 1 minute averages
Temperature_Signal	x.xxxxx	Sensor product temperature signal voltage, 1 minute averages
Rq_Rate	xx	Requested Rate, Rate set point output signal. Note this signal is always active. This is not the real speed when the Mode indicates 1. There is no provision to receive the speed while in local mode.
Mode	1, 2, or 3	Operation Mode, 1 = Local (speed set at Dryer), 2 = Manual (Speed set from Dryer Master), 3 = Automatic (Speed set at Dryer master)
Product	1, 2, 3, 4	Product selection, 1 = Corn, 2 = Beans, 3 = Wheat, 4 = Canola

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 109. –Calibration file data format

10 Appendix B – Warranty

WARRANTY

The property sold hereunder is warranted for 2 full years, unless otherwise stated, against defective workmanship or materials. Such warranty is expressly limited to replacing or repairing and property sold hereunder, which is demonstrated to seller's reasonable satisfaction to have been defective at the time of delivery thereof. The liability of the seller for defective goods sold under this warranty is hereby expressly limited to the cost of the repairs to, alterations of, corrections on, or replacement of said defective property and no other claims or demands whatsoever shall be made upon or required to be allowed by the seller. Seller shall not, however, be liable for any charges for repairs, alterations, corrections or replacement of the property as set out above, unless it has first received written notice from the buyer of any alleged defect and had a reasonable opportunity to inspect same. In no event shall seller's liability exceed such specific direct costs for labor, materials and transportation to repair, alter, correct, or replace said defective property as it shall have previously been approved in writing. Seller shall not be liable for any special, indirect, or consequential damages.

Seller will use all reasonable means to deliver within the time specified, but shall not be held responsible or liable for any loss, damage, detention or delay caused by accidents, strikes, lockouts, fire, explosions, theft, lightning, windstorm, earthquake, floods, storms, riots, civil commotion, malicious mischief, act of God or by any other cause beyond its reasonable control whether or not the same is herein specified and in any event, seller shall not be liable for any special, indirect or consequential damages arising therefrom.

This warranty is expressly accepted by the buyer in lieu of any or all other warranties or representations, express or implied, in fact or in law arising out of the sale of the property and of all duties or liabilities of seller to the buyer arising out of the use of the property sold; and no agreement or understanding varying or extending the same will be binding upon seller unless in writing and signed by a duly authorized officer or seller. All electrical equipment carries standard manufacturer's warranties.

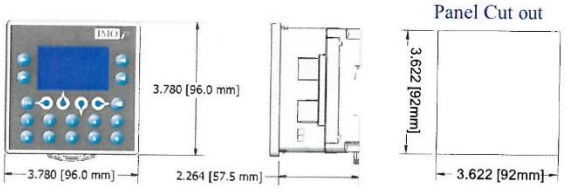
11 Appendix C - IMO Set-up Guide

i^3 User Start-up Guide

IMO The World's Finest

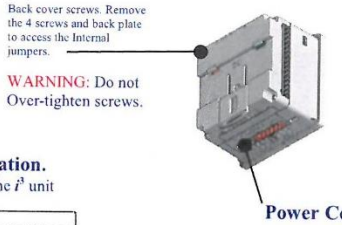
Getting Started:

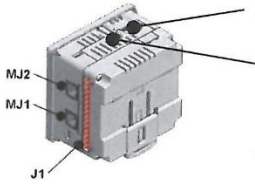
1. Connect the 24VDC power as shown on the connector below.
2. Install i^3 Configurator onto your PC.
3. Connect serial programming cable into port MJ1 port.
4. If using a USB to serial convertor (PC501), please check in Window Device Manager which com port has been assigned. Then enter menu Tools->Editor 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



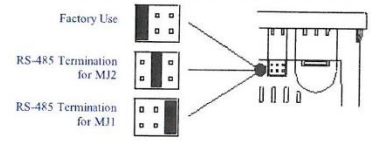
i 3 A 1 2 X /	128x64 Display, 14 programmable keys
1 0	12 Digital Inputs (4 HSC)
A	1 Analogue Input (10-bit)
0	0 Analogue Outputs (12 bit)
1	6 Relay Outputs
- S O O	2 Serial Ports, 0 CAN port
F	MicroSD Card

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





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



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

1 - Positive
2 - Negative
3 - Ground

Serial Ports
MJ1 / MJ2

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

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.

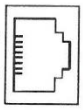
WARNING: EXPLOSION HAZARD – Substitution of components may impair suitability for Class I, Division 2
AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIAL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE 1, DIVISION 2

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.

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

- 1 -

i3A_IBD1F REV4_0909

I/O Register Map

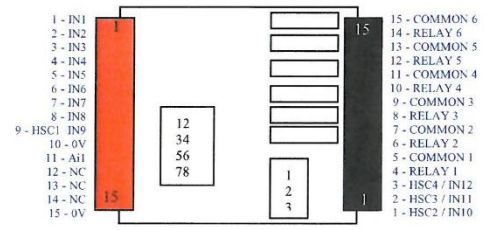
Registers	Description
%I1 to %I24	Digital Inputs
%I32	Output Fault
%I25 to %I31	Reserved
%Q1 to %Q16	Digital outputs
%Q17	Clear HSC1 accumulator to 0
%Q18	Totalizer: Clear HSC2 Quadrature 1-2: Accumulator 1 Reset to max – 1
%Q19	Clear HSC3 Accumulator to 0
%Q20	Totalizer: Clear HSC4 Quadrature 3-4: Accumulator 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



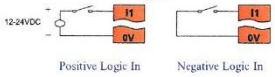
Internal Jumper Configuration

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

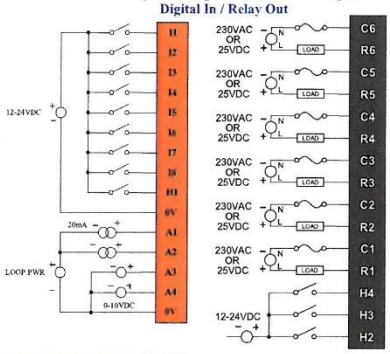
Positive Logic vs. Negative Logic Wiring

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



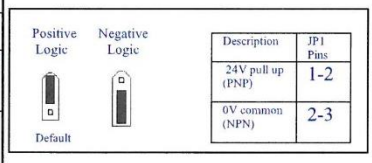
Wiring Example: Positive Logic

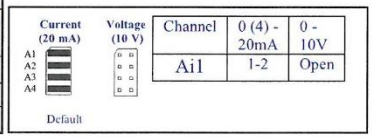
Digital In / Relay Out



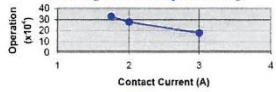
WARNING: Do not short loop power source directly to analogue inputs, more than 35mA load can damage input circuit.

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

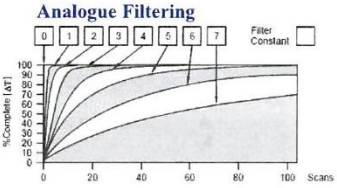




Relay Life Expectancy



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 DC Outputs

Outputs per Module	12 including 2 configurable PWM outputs
Commons per Module	1
Output Type	Sourcing / 10 K Pull-Down
Absolute Max. Voltage	28 VDC Max.
Output Protection	Short Circuit
Max. Output Current per point	0.5 A
Max. Total Current	4 A Continuous
Max. Output Supply Voltage	30 VDC
Minimum Output Supply Voltage	10 VDC
Max. Voltage Drop at Rated Current	0.25 VDC
Max. Inrush Current	650 mA per channel
Min. Load	None
OFF to ON Response	1 ms
ON to OFF Response	1 ms
Output Characteristics	Current Sourcing (Positive Logic)

Analogue Inputs High Resolution

Number of Channels	2
Input Ranges (Selectable)	0 - 10 VDC 0 – 20 mA 4 – 20 mA 100mV PT100 RTD, and J, K, N, T, E, R, S, B Thermocouples
Safe input voltage range	10 VDC: -0.5 V to +15 V 20 mA: -0.5 V to +6 V RTD / T/C: ±24 VDC
Nominal Resolution	10V, 20mA, 100mV: 14 Bits RTD, Thermocouple: 16 Bits
Input Impedance (Clamped @ -0.5 VDC to 12 VDC)	Current Mode: 100 W, 35mA Max. Continuous Voltage Mode: 500 kW, 35mA Max. Continuous
%AI full scale	10 V, 20 mA, 100 mV: 32,000 counts full scale. RTD / T/C: 20 counts / °C
Max. Over-Current	35 mA
Open Thermocouple Detect Current	50 nA

Thermocouple	**Temperature Range**
B / R / S	2912°F to 32.0°F (1600°C to 0°C)
E	1652°F to -328°F (900°C to -200°C)
T	752.0°F to -400.0°F (400°C to -240°C)
J	1382.0°F to -346.0°F (750°C to -210°C)
K / N	2498.0°F to -400°F (1370°C to -240°C)

Thermocouple Common Mode Range	±10V
Converter Type	Delta Sigma
Max. Error at 25°C (*excluding zero)	*4-20 mA ±0.10%* *0-20 mA ±0.10%* *0-10 VDC ±0.10%* RTD (PT100) ±1.0 °C 0-100 mV ±0.05%
Max Thermocouple Error (After 1Hr Warm Up)	±0.2% (±0.3% below -100°C)
Conversion Speed, Both Channels Converted	10V, 20mA, 100mV: 30 Times/Second RTD, Thermocouple: 7.5 Times/Second
Conversion Time per Channel	10V, 20mA, 100mV: 16.7mS RTD, Thermocouple: 66.7mS
RTD Excitation Current	250 mA

Analogue Outputs

Number of Channels	2
Output Ranges	0-10 VDC, 0-20 mA
Nominal Resolution	12 Bits
Update rate	Once per PLC scan
Minimum 10 V load	1 kW
Maximum 20 mA load	500 W
Analogue Outputs; Output Points Required	2
Maximum Error at 25°C (excluding zero)	0.10%
Additional error for temperatures other than 25°C	0.01% / °C

General Specifications

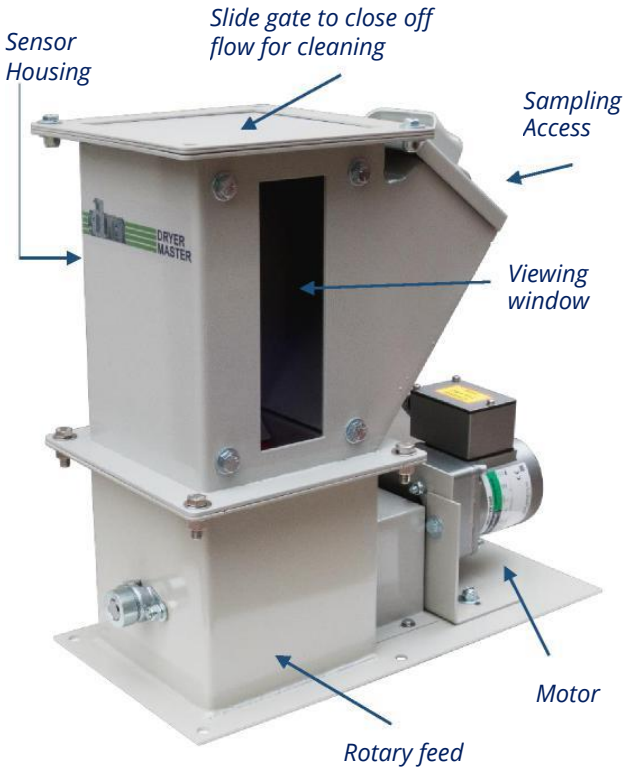
Required Power (Steady State)	130 mA @ 24 VDC
Required Power (Inrush)	30 A for 1 ms @ 24 VDC – DC Switched
Primary Power Range	10 - 30 VDC
Operating Temperature	-10° to 60° Celsius
Storage Temperature	14 to 140°F (-10 to 60°C)
Relative Humidity	5 to 95% Non-condensing
Filtering	15Hz hash (noise) filter 1-128 scan digital running average filter
Terminal Type	Screw Type,5 mm Removable
Weight	12.5 oz. (354.36g)
Shock / Vibration	IEC68-2-6 and IEC68-2-27
CE	Approved
UL	
Clock Accuracy	+/- 35 ppm maximum at 25° C (+/- 1.53 Minutes per Month)

IMO Precision Controls Ltd
1000 North Circular Rd, Staples Corner, London. NW2 7JP
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

12 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.

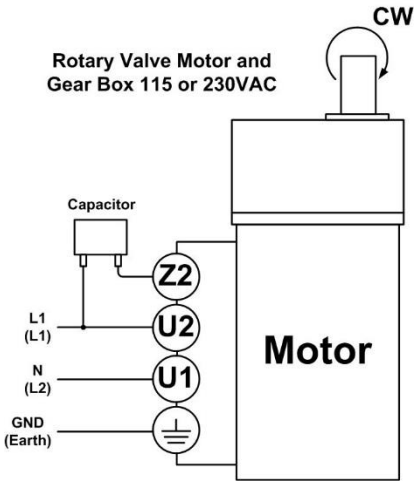


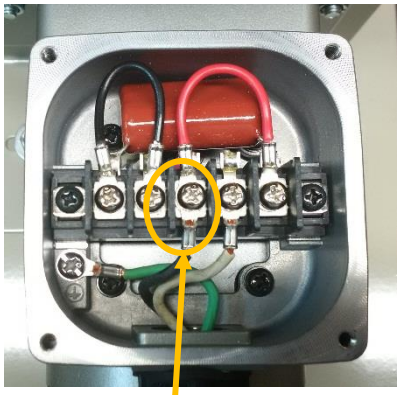
- Dimensions: 16 1/2" L x 8 1/2" W x 16 1/2" H
  Upper mounting flange 8 1/2" x 8 1/2"
- Built in sampling access
- Motor is IP65, 25W, 115VAC single phase, 0.43FLA reversible motor with 180:1 gear reduction (230VAC also available if required)
- Sensor housing can be mounted in any direction without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

Installation Considerations:

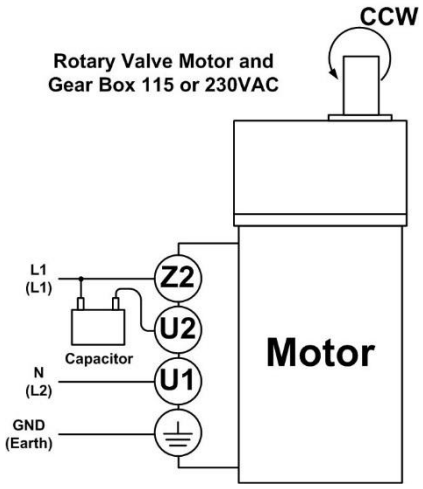
1. The sensor housing (top portion of the assembly) can be mounted in any direction. You can unbolt the four bolts attaching the sensor housing to the rotary feed, then rotate the housing to the desired direction, and then bolt back together. The sensor can also be mounted where the viewing window is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

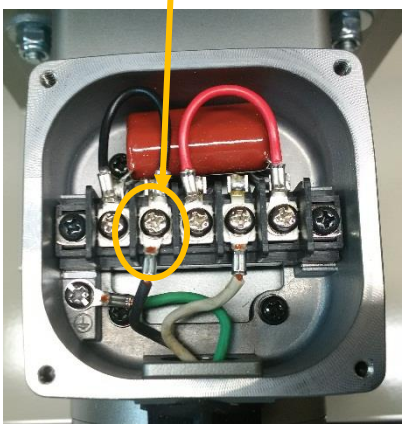
The motor can run either clockwise (CW) or counter clockwise (CCW).





Move the black wire to change the direction of rotation





13 Appendix E Motor Speed Control Wiring Diagram

Included in this section is a generic wiring diagram for a common motor speed control. If your motor speed control is different and you need guidance with the connections contact the Dryer Master Support Center for assistance. We usually are able to provide you with a more specific diagram for your particular motor speed control.

Generic DM510 to VFD voltage input (0-10 vdc)

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