Mathews Company

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PINNACLE

2

Volume

Controls Manual

DOC-P02-0713

Effective: July, 2013

CONTROLS MANUAL - PINNACLE

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Warranty Statement

MATHEWS COMPANY
LIMITED WARRANTY FOR WHOLE GOODS

Except as otherwise set forth herein, Mathews Company (Seller) warrants that the equipment supplied by Seller to Buyer shall be free from defects in materials and workmanship when properly installed and operated under normal conditions and in accordance with all applicable instruction manuals. This limited warranty shall expire two (2) years from the date of shipment from Seller's Crystal Lake, Illinois, U.S.A. facility. In addition, for a period of five (5) years from the date of shipment from Seller's Crystal Lake, Illinois, U.S.A. facility, Seller will re-balance M-C Shredder rotors for Buyer at Seller's Crystal Lake, Illinois, U.S.A. facility, provided that the rotors did not become unbalanced through abnormal use by Buyer or were not damaged by Buyer in any way.

To obtain consideration under this limited warranty, Buyer must first notify Seller in Crystal Lake, Illinois, U.S.A., stating in what respects the equipment is believed by Buyer to be defective and providing a list of the parts at issue. Additionally, Buyer must complete a warranty request form stating the machine serial number. Upon receipt by Seller of such notice from Buyer, Buyer may receive authorization from Seller to return the parts. If parts are to be scrapped locally, Buyer will be so advised. If Seller provides Buyer with authorization to return the parts, Buyer shall return such parts to Seller's facility in Crystal Lake, Illinois, U.S.A., transportation prepaid, for examination by Seller. No parts shall be returned to Seller unless Buyer first obtains a return authorization number from Seller. If, in Seller's sole judgment, the parts returned by Buyer are defective and covered under this limited warranty, Seller shall have the option of repairing, rebuilding or replacing such parts. This limited warranty shall not apply to parts which, in Seller's sole judgment, have been the subject of negligence, abuse, accident, misapplication, tampering, alteration, improper adjustment, or electrical problems caused by low voltage conditions; nor shall it apply to consumables, such as belts; nor shall it apply to parts damaged by acts of God, war or civil insurrection, acts of terrorism, improper installation, operation, maintenance or storage, or other than normal application, use or service, including, without limitation, operational failures caused by corrosion, erosion, wear and tear, rust or other foreign materials in the system in which they are utilized.

Failure to give notice within the warranty period shall be a waiver of this limited warranty and no assistance or other action thereafter taken by Seller shall be deemed to extend or revive the warranty period. This limited warranty covers only whole goods and shall not apply to replacement parts or upgrade kits. A separate warranty statement published by Seller covers the warranty on parts and upgrade kits. This limited warranty shall not apply to any products, parts, accessories or other equipment not manufactured by Seller, provided that Seller, upon request by Buyer, shall advise Buyer of any warranties known to Seller that may be offered by the manufacturer of such equipment. This limited warranty shall not cover, and Seller shall not under any circumstances be liable for, damages for injuries to persons or property; loss of crops or other products; losses caused by harvest delays; loss of profits; loss of use; cost of rental equipment; expenses of labor, travel or other items relating to the removal or replacement of defective parts; damages resulting from the removal of defective parts or the installation of repaired, rebuilt or replaced parts; expenses relating to the transportation of parts to and from Seller's facility; any consequential, incidental, contingent or special damages, whether arising in contract, in tort or under statute; or any other damages or expenses not agreed upon in writing by Seller, even if Seller has been advised of the potential for any such damages or expenses. THIS LIMITED WARRANTY IS IN LIEU OF ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ALL WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR USE. No person is authorized to give any other warranty or to assume any other liability on Seller's behalf.

Table of Contents

Section 1

Introduction

Overview

This volume of the manual is intended to provide you with a thorough overview and explanation of the touch screen software that interfaces with the Programmable Logic Controller (PLC). All possible features of the current Pinnacle software (HMI version 13.12.0152.XX and PLC version 13.11.0200.XX, where XX refers to a minor revision, 01, 02, etc.) will be explained. It is important to note that all dryers made from 2010-2012 will use HMI version 13.12.0151.XX.

Pinnacle and Pinnacle Lite are members of the Pinnacle family of control systems. The Pinnacle Lite system controls the dryer through a combination of a PLC interfaced with a Human Machine Interface (HMI) or "touch screen" and conventional relays and timers that are interfaced through buttons and switches. Conversely, Pinnacle, a completely PLC-controlled system, does not include any buttons or switches as all operator control is done through a larger touch screen.

Pinnacle Lite Remote Cabinet

Pinnacle Remote Cabinet

The Pinnacle control system's components are intermixed between the High Voltage Cabinet and the Remote Control Cabinet. The PLC is located in the High Voltage Cabinet, whereas the HMI is located on the Remote Control Cabinet.

User Interface

The touch screen interface of Pinnacle has been initially designed and continues to be refined, based on user feedback over past years, to provide the most intuitive and straightforward approach to interfacing with the machine. Navigation through the screens is accomplished by selecting one of the eight main chapters (Dryer Overview, Dryer Operation, Operational Setpoints, Alarm Setpoints, Alarms, PLC I/O, Trending, and System Configuration) that are shown across the bottom banner of the touch screen. Depending on what chapter you are on, the corresponding icon will illuminate in color which helps understand where you are within the program.

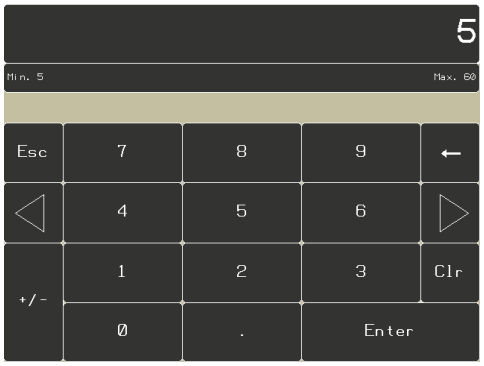
The side bar gives an operational overview, showing the Operation and Discharge modes and the green colored lights indicate what components are operating. Additionally, the Alarm Reset button will allow you to reset a current alarm.

The touch screen allows you to not only monitor parameters, but to also change operational and alarm set points. For the most part, values that can be changed will be displayed as black text with a white background. Values that display in white with the dark gray background are read-only values and cannot be changed.

Example of a displayed value that cannot be changed:

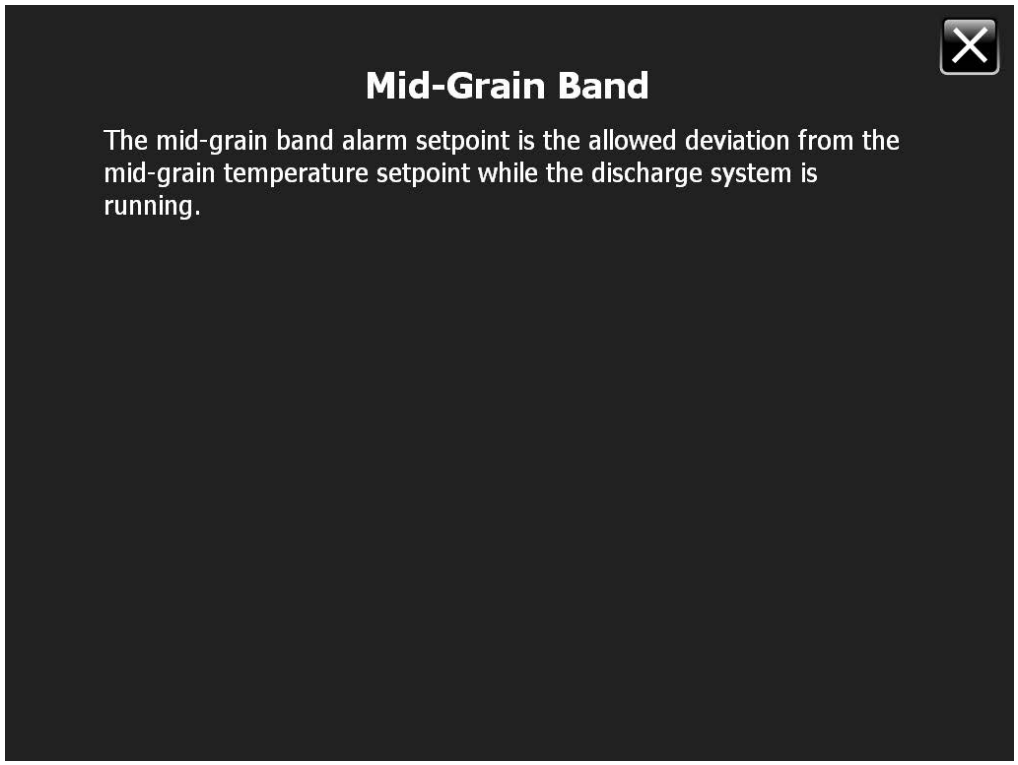
Example of a displayed value that can be changed:

Selecting a white field to change the numerical value will bring up a number keypad. Depending on the input that is being changed, there may be a minimum and maximum range to the value which will be displayed on the keypad. When attempting to enter a value outside of the min/max range, the value will be displayed red on the keypad and will not allow the value to be entered. Once a suitable value has been entered, press "Enter" to input the value and be returned to the screen that the value was being entered on. If you do not wish to change the value, press "Esc" to return without making a change. The "←" button will delete one digit and "Clr" will delete the entire entry.

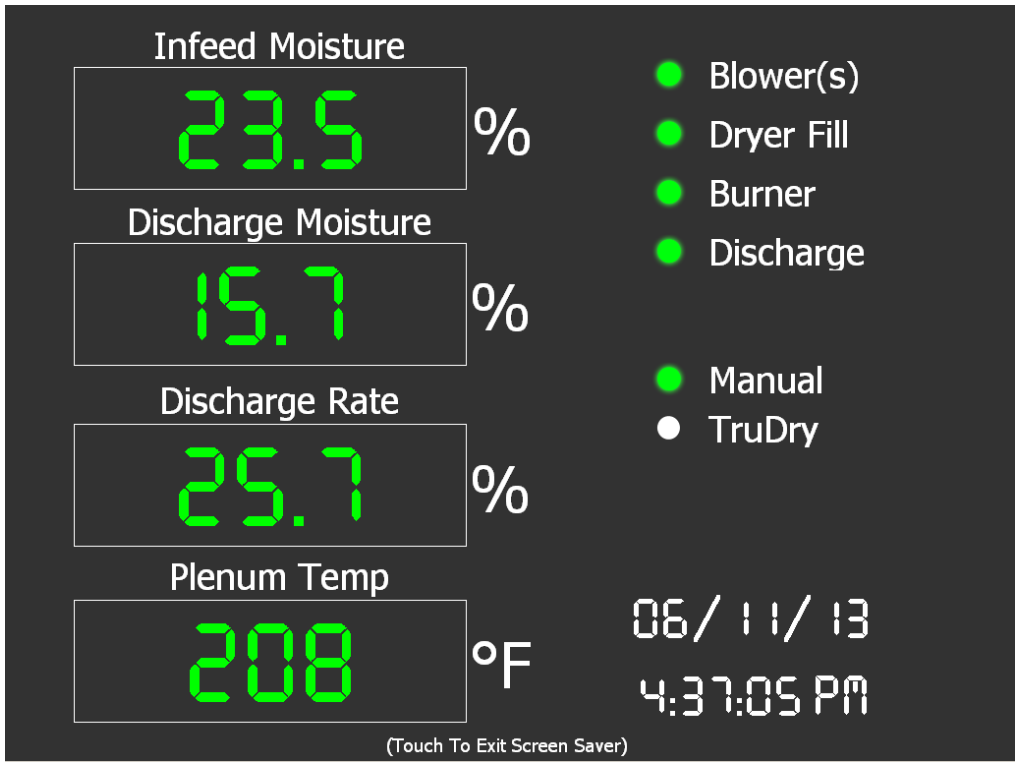


Certain data field inputs or buttons have a help button associated with it so that it's function or purpose is readily available. This will be indicated with a "?" button and simply pressing it will display a help message pop-up which can easily be closed by pressing the "x" button in the upper right hand corner.

Example of a "?" help button: 



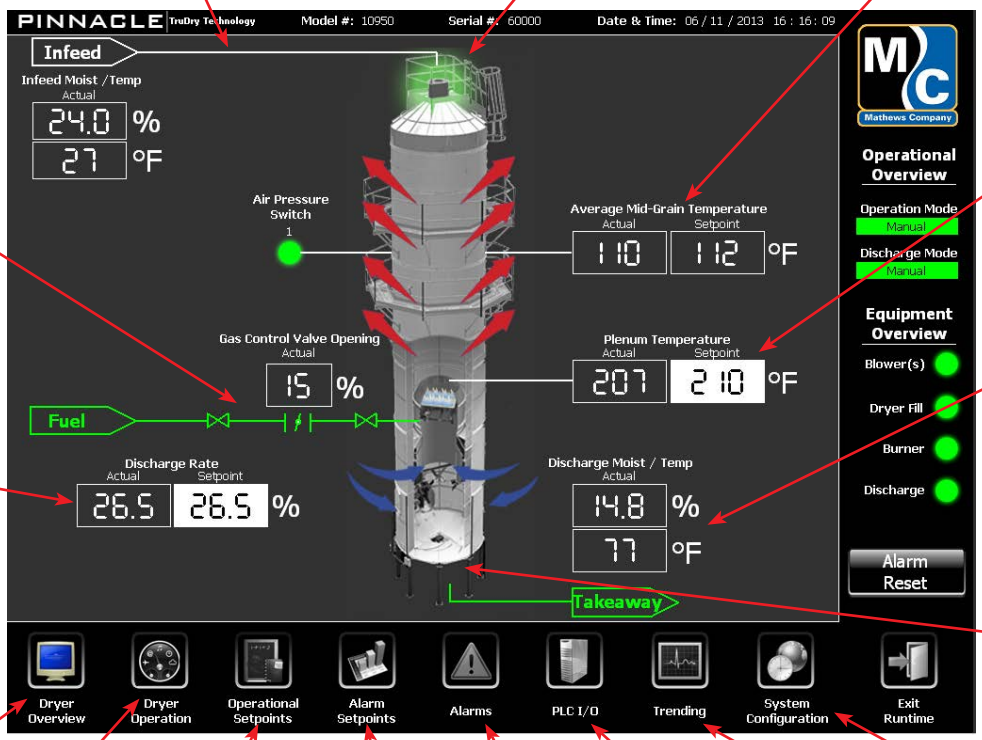
After a lapse of time, the screen saver will appear. Simply touch anywhere on the screen to make the screen saver disappear and revert to the screen most recently displayed. You can also hold the Dryer Overview button to manaully start the scren saver.



Operation

Overview

While operating the dryer, the majority of the time you will be monitoring the Dryer Overview screen to see the dryer's discharge rate, average mid-grain temperature, grain moisture and temperature, as well as the status of the fill and takeaway equipment, burner and fan(s):



Turns green when the customer fill equipment is energized.

Turns green when enabled and the grain fill is occurring.

Average of the readings from the four mid-grain temperature probes (RTDs).

Valves turn green as gas train is energized. Animation shows position of gas control valve.

Change the plenum temperature set point by touching the white setpoint field.

Change the discharge rate in manual mode by touching the white set point field.

Discharge temperature and moisture percentages are displayed.

Dryer overview screen (shown) is an animated visualization of the drying process.

Animation shows the center dump or discharge auger action and flashes green when activated.

Set operation and discharge modes and monitor the operational timers as the dryer runs. Also used for starting/ stopping the dryer in manual or automatic mode.

Change any of the operational set points for various parts of the system.

Change any of the alarm set points for various parts of the system.

View and address faults and fault history.

See values of analog inputs/ outputs or status of digital inputs/outputs.

View current and past data in a chartable graph format.

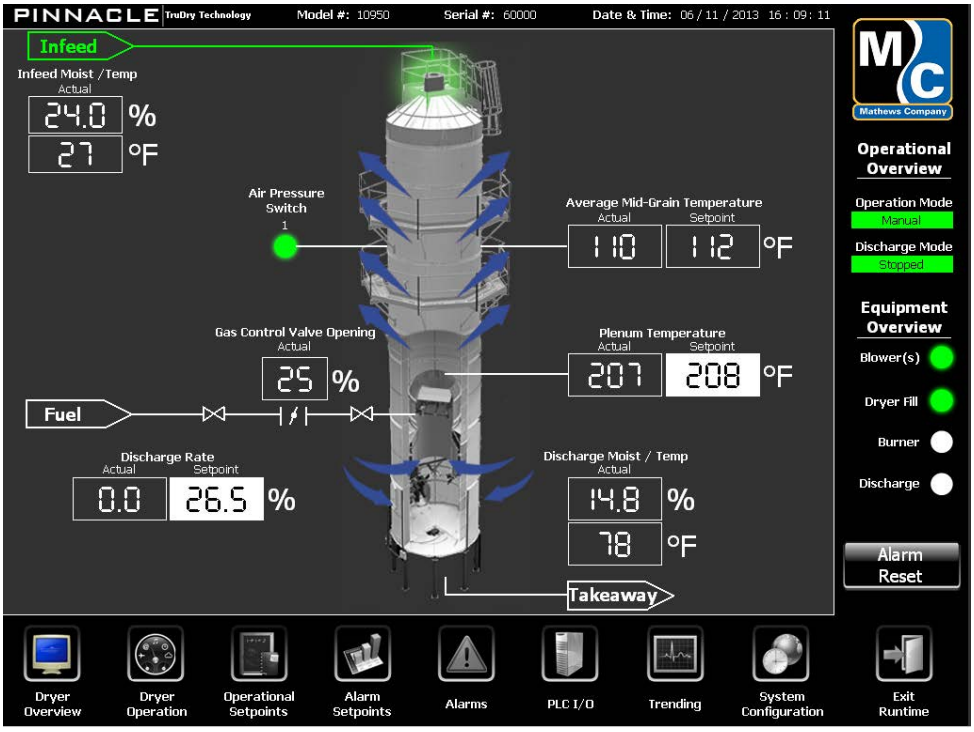
Configure system options and view factory settings.

Overview Animations

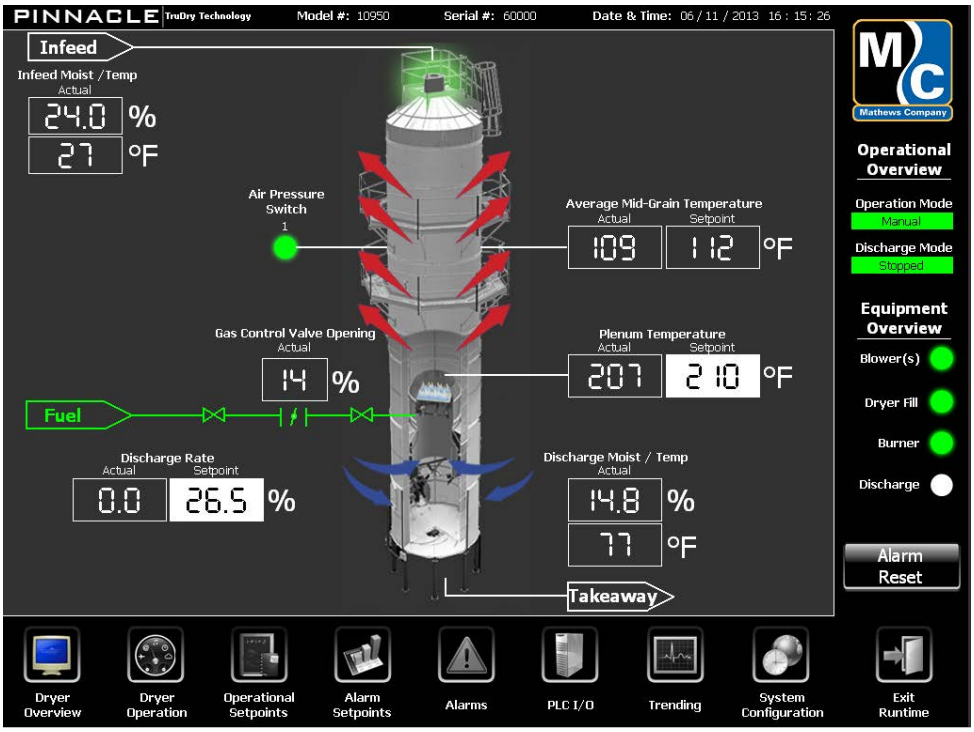
New in 2013, Pinnacle Software has included 3-dimensional renderings of the grain dryers. Along with the new renderings, additional notifications have been added to the Overview screen. Such animations include; the air pressure indicator LED, the blower and burner ON arrows, and the infeed and discharge active illuminations.

Overview (Stopped)

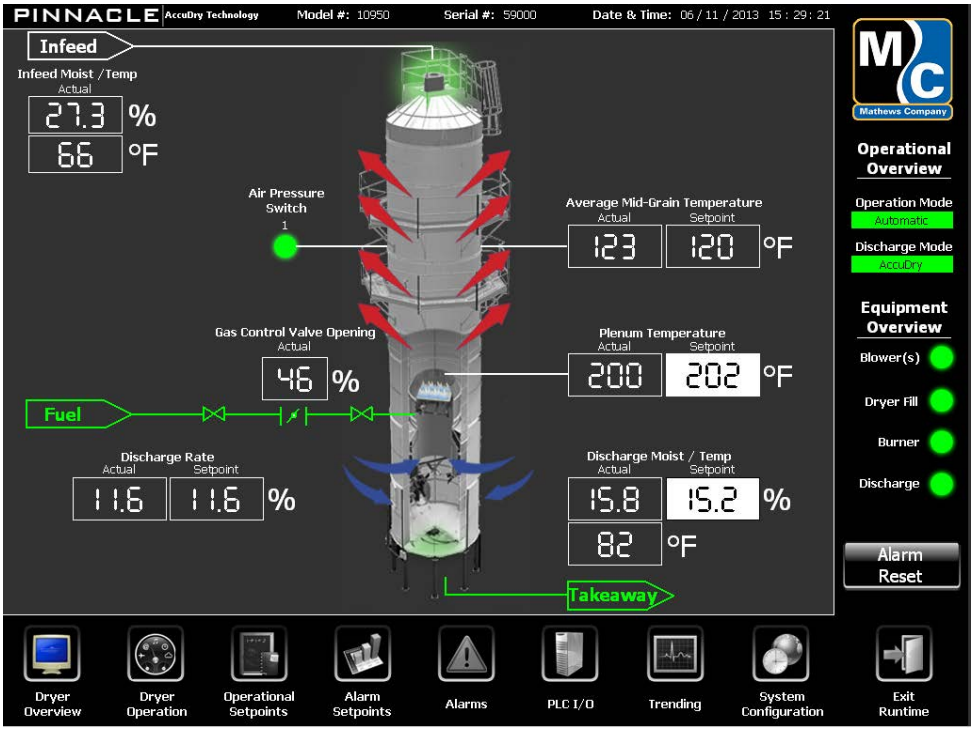
Overview (Blowers On, Filling)



Overview (Blowers On, Burners On, Infeed On)



Overview (Infeed On, Blowers On, Burners On, Discharging)



Note that there will be multiple other states of operation, but for the purposes of this manual only a select few were shown during critical states of operation.

Dryer Operation

From the Dryer Operation screen, you can select *Manual* or *Automatic* Start Up Mode for the dryer as well as set the discharge mode of control, either *Manual*, *TruDry*, or *AccuDry*. Attempting to change the start up mode while the dryer is running is not possible as the button is grayed out.

Start Up Mode

The start up mode section of the Dryer Operation screen allows you to set the mode of operation in either manual or automatic; manual allows you to manually start and stop components, whereas automatic allows you to perform an automatic sequence of events to start, stop or cool down the machine.

There is also a safety feature to prevent repeated starts of the blower(s) and this will be seen with a check box next to the field labeled "OK To Restart Blower(s)"; a blower cannot be started unless the box is checked. After a blower is started and subsequently shutdown, a timer will start and a repeated start of the blower will not be permitted until the timer has elapsed. If the machine is not equipped with a soft starter, this can be overridden by checking the box and accepting the warning message about repeated starts of the fan motor(s); this will require a service level login. If the system is equipped with a soft starter, overriding the timer is not permitted.

Manual Start Up Mode

Manual operation mode allows you to manually start and stop the dryer blowers, burner, fill equipment and discharge/takeaway equipment).

To start a component, press the button in the left hand column with the white lettering. To stop that particular component, press the opposite red-lettered button in the right hand column. If a button has white text, that button may be pressed, if a button has grey text that button is currently unavailable, and if a button has green text that operation is currently running.

Automatic Start Up Mode

Automatic operation allows you to initiate an automatic start-up, shut-down or cool-down sequence of operation with a single push button.

To start-up the machine automatically, a checklist needs to be fulfilled to confirm that the start-up conditions are met. The "OK To Restart Blower(s)" check box needs to be checked per the conditions previously explained. Similarly, the "No Faults", "Fill Off", "Blower(s) Off" and the "Discharge Off" conditions need to be met and the system will show the status of these conditions with the check boxes checked. Lastly, the "Gas Turned On", "Fill Equipment Enabled", "Burner Cover Removed" and the "Takeaway Equipment Enabled" check boxes are manually checked once those un-monitored conditions are met. Once all of the Start-Up conditions are met, the Start-Up button will illuminate indicating that it is active and start-up operations are permitted.

When the Start-Up button has been pressed, the dryer will sequentially start the blowers and enable the fill equipment. As the blower(s) are starting, a blower confirmation delay timer will elapse to allow air pressure to build up. If the dryer is empty, the fill equipment will operate and grain will be introduced to the dryer until the fill level is sufficient to actuate the fill switch, which indicates to the system that the dryer has completed a first-time fill. Provided that sufficient air pressure has been developed, the ignition process will be initiated and pop-up windows will appear, advising you the status of the burner ignition process.

Once the burner has successfully been lit, the dryer will now be fully operational and the only options that exist are to shut-down or cool-down the machine by selecting the corresponding button on the bottom of the screen. If cool-down mode is selected, the fan(s) will continue to run for the duration of the cool-down timer. If you desire to re-start the dryer while the machine is in cool-down, simply press the re-start button and after confirmation of the re-start, you will be guided through the burner ignition process again. Selecting the shut-down button will completely shut all equipment off once you have confirmed that you intend to shutoff the dryer.

Discharge Mode

The discharge mode refers to the manner in which the speed of the discharge system changes. The options are: (1) Manual discharge mode in which the user sets the intended discharge rate and (2) TruDry mode in which the system will change the speed with the goal of maintaining the average mid-grain temperature equal to the target mid-grain temperature and (3) AccuDry mode in which the system will change the speed with the goal of maintaining the discharge moisture equal to the target discharge grain moisture.

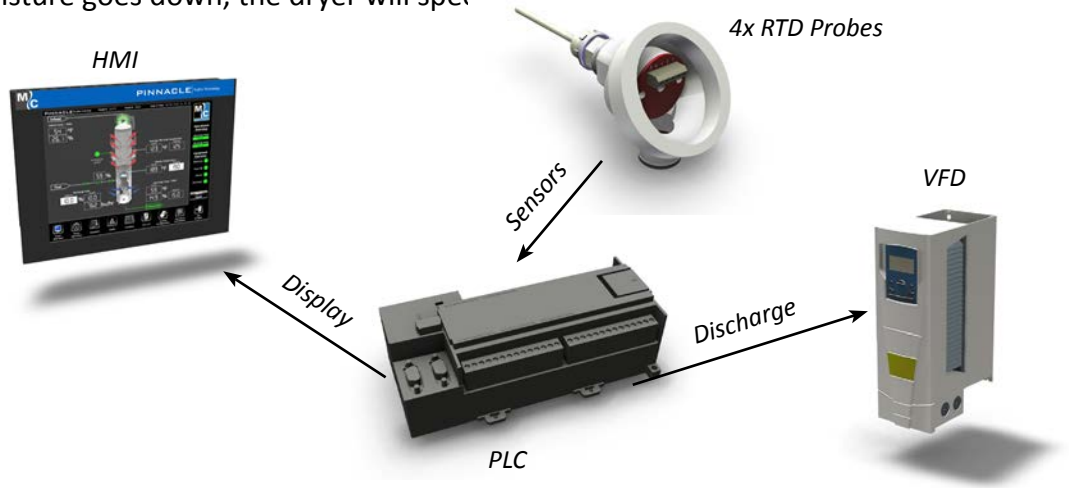
Manual

Manual mode of operation means you can directly tell the discharge metering system what speed the dryer will discharge grain at. Depending on what model dryer you are operating, the % discharge speed will correspond to an approximate bu/hr value. These values are calculated based on discharge capacity values which will be discussed further in the settings section. Additionally, a table is included below so that you may correlate the discharge speed % to bu/hr.

	Heat + Cool					
	20%-15% Moisture			25%-15% Moisture		
	bu/hr	tonnes/ hr	speed	bu/hr	tonnes/ hr	speed
10520	560	13.0	37%	320	7.5	18%
10630	690	16.1	48%	395	9.2	24%
10730	790	18.4	56%	455	10.6	29%
10840	945	22.0	57%	545	12.7	30%
101050	1,155	26.9	71%	670	15.6	38%
101275	1,385	32.3	87%	805	18.8	47%
10530	700	16.3	44%	400	9.3	19%
10740	930	21.7	41%	540	12.6	18%
10950	1,240	28.9	43%	720	16.8	19%
101160	1,500	34.9	42%	870	20.3	19%
101375	1,700	39.6	40%	1,000	23.3	18%
2000	2,000	46.6	44%	1,200	28.0	23%
2400	2,400	55.9	44%	1,440	33.5	23%
2700	2,700	62.9	42%	1,620	37.7	21%
3000	3,000	69.9	46%	1,800	41.9	24%
3500	3,500	81.5	48%	2,100	48.9	25%
4000	4,000	93.2	50%	2,400	55.9	26%
4800	4,800	111.8	55%	2,800	65.2	28%

TruDry Technology

TruDry is the name of a discharge mode of operation that automatically increases or decreases the discharge speed of the dryer. TruDry is not an automatic moisture control mode of operation and does not utilize the discharge moisture value, but instead controls the discharge rate by attempting to maintain an average mid-grain temperature setpoint. The principal of operation is that as the grain entering the dryer increases in moisture, the mid-grain temperature will go down and when the grain entering the dryer decreases in moisture, the mid-grain temperature will go up. Therefore, what the controller will do is utilize a negative responding Proportional-Integral-Derivative (PID) control loop which will increase the discharge rate when the mid-grain temperature goes up and decrease the discharge rate when the mid-grain temperature goes down. This essentially means that as the grain's moisture goes up, the dryer will slow down and as the grain's moisture goes down, the dryer will speed up.



In order to effectively use the TruDry mode of operation, it is important to allow the dryer to get to a steady state operating condition for 2-3 hours (depending on the size of the machine and the incoming grain moisture) with a desirable and consistent discharge moisture output. Once this steady state condition has been met, you will want to set the mid-grain temperature setpoint to a value equal to the current actual mid-grain temperature. Note that although you are running the dryer in manual, you will still be able to change the mid-grain temperature setpoint. At this point, the dryer has been running for 2-3 hours and steady state has been reached, so the current reading for the actual mid-grain temperature should correspond to the desired grain moisture that is currently being discharged from the dryer. It is important to understand that TruDry is not controlling the dryer on discharge moisture, but rather indirectly based on the average mid-grain temperature.

Another step to ensure a smooth and successful transition from manual mode to TruDry is to verify the minimum and maximum discharge speeds on the Operational Setpoints page of the Setpoints Chapter are set to a reasonable values. The minimum and maximum speed setpoint refers to the minimum and maximum speed that the dryer can run at. When running in TruDry mode this is especially important because the TruDry control algorithm will attempt to speed up and slow down to maintain the mid-grain temperature setpoint, and the amount of room that the controller has to work with is determined by the minimum and maximum speed setpoints. For example if the min/max speed setpoints are 0% - 100%, the range of speed output from the controller will be higher, which means the rate at which the speed changes will be higher. On the other hand, if the min/max setpoints are 30% - 75%, the controller can only operate within that band and only has a range of 45% to work with. More information on how to change the minimum and maximum speed setpoints on the Operational Setpoints screen is found in the Settings

section of this manual. A table of suggested minimum and maximum values is shown on page 2.8.

	Heat + Cool	
	Recommended	
	Min	Max
10520	0%	50%
10630	10%	60%
10730	10%	70%
10840	10%	70%
101050	20%	90%
101275	30%	100%
10530	5%	60%
10740	5%	60%
10950	5%	60%
101160	5%	60%
101375	5%	60%
2000	10%	60%
2400	10%	60%
2700	10%	60%
3000	10%	65%
3500	10%	65%
4000	10%	65%
4800	10%	65%

Once the average mid-grain temperature setpoint has been set and the minimum and maximum speed range has been established, TruDry mode of operation can be selected by touching the TruDry check box. Once TruDry mode of operation has been selected, the ability to manually change the speed will be inhibited and the only parameter that can be adjusted will be the mid-grain temperature setpoint.

While running in TruDry, you will see the speed continuously increase or decrease to maintain the target mid-grain temperature. Do not continuously tweak the mid-grain temperature, let it try to control to the setpoint value that you previously established. TruDry should be able to handle 3-5% swings in incoming moisture with reasonable discharge moisture variation if the dryer was properly brought up to steady state as previously explained. If after running for an extended period of time you have determined that the target mid-grain temperature is too high or too low, minor adjustments can be made, but should only be done periodically, not continuously. If you want to meticulously control the dryer, then you should be running in the manual mode of operation in which you can directly control the dryer's discharge rate.

AccuDry Technology

The AccuDry mode of operation utilizes input signals from both the discharge moisture sensor and the infeed moisture sensor to control the dryer's discharge rate. When the AccuDry mode of operation is available, it will display it's corresponding toggle button under the TruDry button. Also, when AccuDry is available, an additional input will be made available which allows you to enter the target discharge moisture setpoint.

When running in AccuDry, similar to the guidelines that were provided for TruDry, the minimum and maximum speed setpoints are important to the controller's operation. The AccuDry control algorithm will attempt to speed up and slow down to maintain the discharge moisture setpoint, and the amount of room that the controller has to work with is determined by the minimum and maximum speed setpoints. For example if the min/max speed setpoints are 1% - 100%, the range of speed output from the controller will be higher, which means the rate at which the speed changes will be higher. On the other hand, if the min/max setpoints are 30% - 75%, the controller can only operate within that band and only has a range of 45% to work with. More information on how to change the minimum and maximum speed setpoints on the Operational Setpoints screen is found in the Settings section of this manual.

Similar to how the mid-grain temperature setpoint (used in TruDry) can be changed while in manual mode, so too can the discharge moisture setpoint (used in AccuDry) be changed while in manual mode. The only limitation is that you cannot change the discharge speed setpoint when you are in TruDry or AccuDry.

In order to effectively use the AccuDry mode of operation, it is important to allow the dryer to get to a steady state operating condition for 2-3 hours upon initial installation (depending on the size of the machine and the incoming grain moisture) with a desirable and consistent discharge moisture output. Once this steady state condition has been met, you will confirm the discharge moisture setpoint that you want and make any required changes. Also, be sure to set the minimum and maximum discharge speed on the Operational Setpoints page of the Settings Chapter to an accurate band.

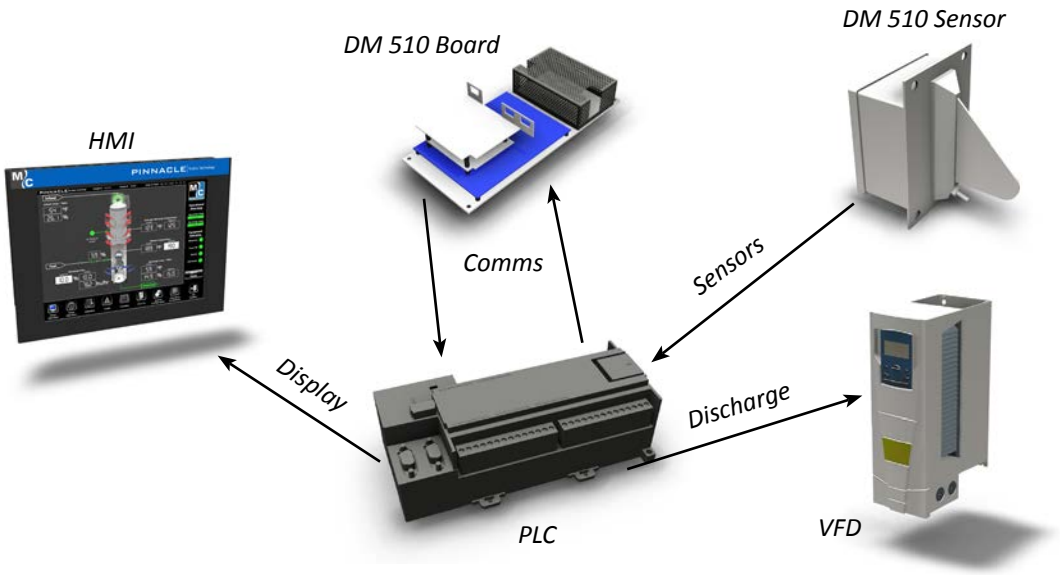
The AccuDry system will remember grain moistures upon startup from the previous shutdown. For example, if you were discharging 15.5% moisture the night prior, and start up with 15.4% the following morning, the system will allow you to quickly enter AccuDry mode.

If the discharge moisture is significantly different from the previous operations moisture, the system will not enable AccuDry until it has gathered sufficient information to run correctly and efficiently.

How AccuDry Works

AccuDry technology utilizes the Dryer Moisture Systems Dryer Master DM510 system. The DM510 system uses specially designed on-line moisture and temperature sensors located at both the infeed and discharge of the dryer. These sensors provide continuous moisture and temperature readings to the PLC, which is shared with the DM510 logic board.

The DM510 board uses this information to build an operating model of your dryer, as infeed moistures and drying conditions change throughout the day; AccuDry continuously calculates and automatically adjusts to the optimum discharge rate for current conditions.



AccuDry has two important advantages. First, in automatic mode, it can continually watch the dryer. It does not have to help unload trucks, load trains, or do any other jobs around the elevator that a normal dryer operator does throughout the day. The dryer receives the user's full attention.

Second, it has the benefit of continuous moisture information from both the infeed and discharge of the dryer, giving it a complete picture of all the grain in the dryer, and the grain exiting the dryer.

With this information, AccuDry does not have to wait to react to changes in the outlet moisture. It is able to adjust the discharge rate as the incoming moisture changes. For example, as wetter grain comes into the dryer, AccuDry begins to slow down the discharge rate just as the wetter grain reaches the hot zone.

AccuDry Status

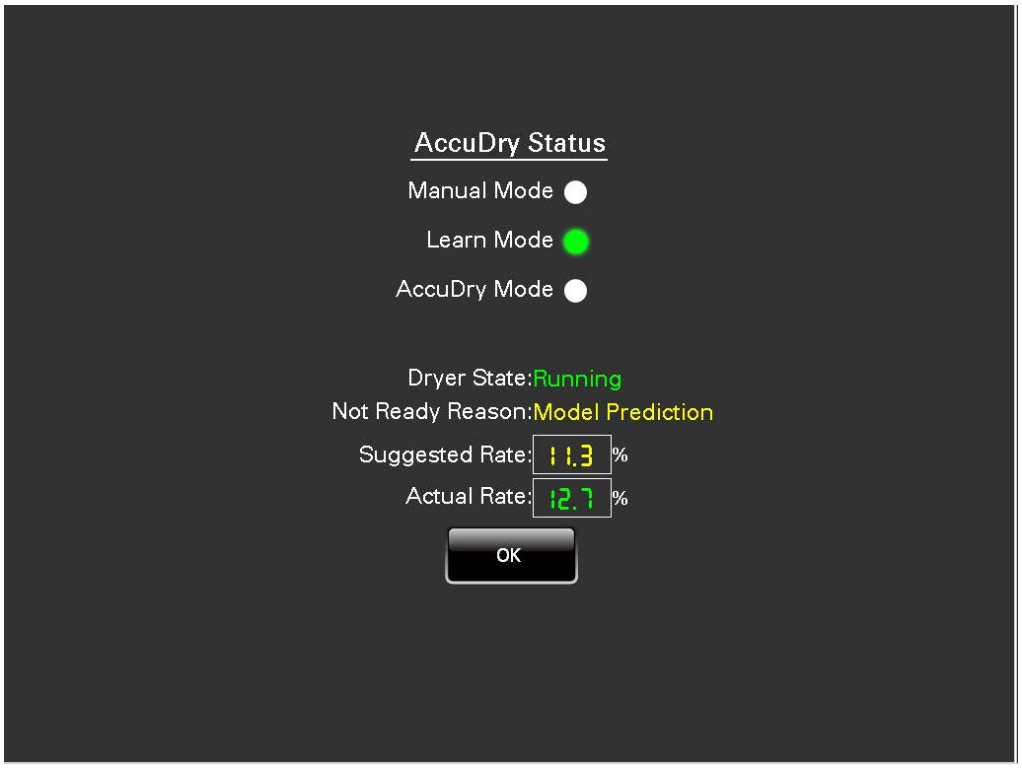
While running in manual mode, you will not be able to enter AccuDry mode until the system is "Ready." The ready state is shown by the color of the AccuDry button, which is explained below. There are three (3) different states of AccuDry which are as follows:

AccuDry Not Ready (Grayed Out AccuDry Button)

By default, the dryer will not have enough information for you to jump right into AccuDry mode. In order for AccuDry to be "Ready," the system must achieve the following before it will let you enter AccuDry mode:

1. There must not be any alarms present;
2. The dryer must be in the "Running" state of operation, further explanation may be found below;
3. The Actual Discharge Rate must be within 5% of the Suggested Rate;
4. The Discharge Moisture must be within 2% of the Setpoint Moisture and;
5. The AccuDry system must have enough knowledge and runtime, to have a Predicted Discharge Moisture within 2% of the Actual Discharge Moisture.

If you attempt to enter AccuDry Mode before the system is ready, you will encounter the AccuDry Status screen as shown below. This screen will display current mode, the dryer state, the not ready reason, the suggested rate, and your actual discharge rate. This screen will provide information to better achieve AccuDry readiness, and will get you into AccuDry much faster than guess work in Manual mode (see next page for full breakdown).



AccuDry Mode Of Operation

At the top of the AccuDry Status screen your current operating mode will be illuminated by a green indicator. These modes include; Manual Mode, Learn Mode, and AccuDry Mode. Manual mode is the default startup mode, where you will be constantly controlling the discharge rate. Learn mode will be illuminated when the dryer is operating (discharge is ON), and the moisture sensors have product being detected. This indicator states that the AccuDry system is "learning" from it's current operating inputs, and will stop "learning" and saving data when the discharge is turned OFF. Lastly is AccuDry mode, for when you are running in AccuDry mode.

AccuDry Dryer State

The dryer state field indicates the seven (7) stages of operating your dryer. The seven states are as follows;

Stand-By
The dryer fans, discharge, and burner(s) are off. The dryer may not be full (no moisture displayed by the infeed moisture sensor).

Primed
The dryer fans, discharge, and burner(s) are off. The dryer is full (moisture displayed by the infeed moisture sensor).

Idle Running
The dryer fans, discharge, and burner(s) are off. The dryer is full (moisture displayed by the infeed moisture sensor). This feature is only available on systems that make use of the fan switch input.

Shutdown
The dryer is OFF. The fans, the discharge, and burner(s) are off. The dryer is full (moisture displayed by the infeed moisture sensor). This feature is only available on systems that make use of the fan switch input.

Preheat
The dryer fans are on, the burner(s) are on, the discharge is off. The dryer is full (moisture displayed by the infeed moisture sensor).

Running
The dryer fans are on, the burner(s) are on, the discharge is on. The dryer is full (moisture displayed by the infeed moisture sensor). Moisture is displayed at the discharge sensor.

Holding
The dryer fans are on, the burner(s) are on, the discharge is off. The dryer is full (moisture displayed by the infeed moisture sensor). This is a temporary state and it will revert to Manual mode after 25 minutes as a safety precaution.

AccuDry Not Ready Reason

The not ready field indicates the reason the dryer will not allow you to enter AccuDry mode.

Discharge Off
The discharge is off and must be turned on.

Drying Temp Critical
Plenum temperature is in alarm and must be corrected.

Inlet Moisture Critical
Inlet grain moisture is in alarm and must be corrected.

Outlet Moisture Critical
Discharge grain moisture is in alarm and must be corrected.

Inlet Temperature Critical
Inlet grain temperature is in alarm and must be corrected.

Outlet Temperature Critical
Discharge grain temperature is in alarm and must be corrected.

Burner Off
Burner is OFF and must be lit.

Rate Off
Discharge rate is in alarm and must be corrected.

Fan Off
Fan is OFF and must be turned on.

Model Prediction
AccuDry is gathering data, and the predicted moisture (based on current data) is not acceptably close to the actual discharge moisture. Continue running in manual until enough data is taken to accurately predict correct discharge moistures.

Beta 2 Filling
A technical subset of model prediction. The system is gathering feedback on how your dryer is efficiently drying your particular grain. Continue running in manual until enough data is taken to accurately predict correct discharge moistures.

Beta 2 Stabilizing
A technical subset of model prediction as well. The system is fine-tuning feedback based on how your dryer is operating. Continue running in manual until enough data is taken to accurately predict correct discharge moistures.

Target Difference
Moisture setpoint is not acceptably close to the actual discharge moisture. Continue running in manual until discharge moisture is within 2% of setpoint moisture. This is done to alleviate moisture overshoot when switching to AccuDry.

Suggested Rate

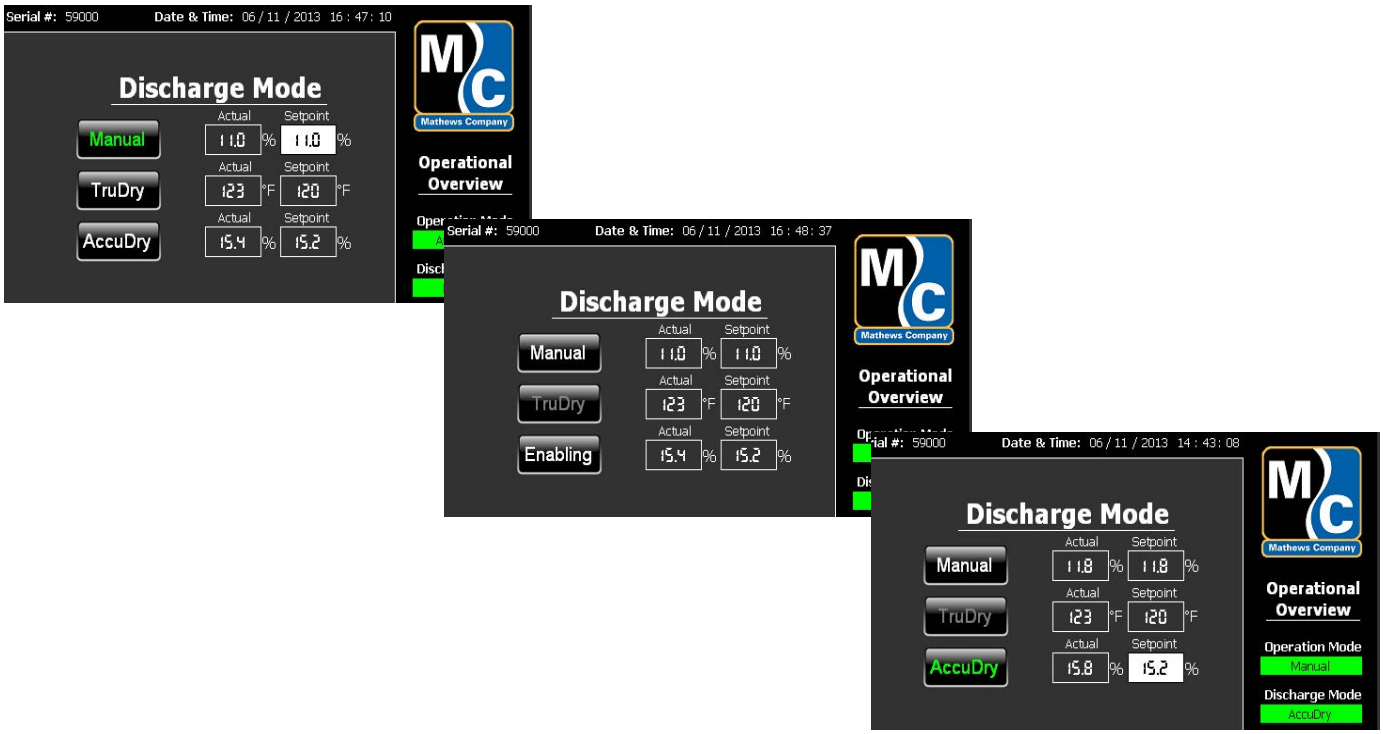
The suggested rate field indicates what the AccuDry system would run at that given moment if it were to take over controls of the VFD. It is important to note that this field updates regularly, and will become more and more accurate as the dryer learns for each individual grain type.

Actual Rate

The actual rate field indicates the real-time commanded speed from the PLC to the VFD.

AccuDry Ready

While running in manual and AccuDry reaches the "Ready" state, the AccuDry button text will change from gray to white. When you now select AccuDry, the button will flash "Enabling..." for a few seconds, and will illuminate the AccuDry text in green lettering; you are now in AccuDry mode.



Once AccuDry mode of operation has been selected, the ability to manually change the speed will be inhibited and the only parameter that can be adjusted will be the discharge moisture setpoint. While running in AccuDry, you will see the speed continuously increase or decrease to maintain the target discharge moisture setpoint. Do not continuously tweak the discharge moisture setpoint, let it try to control to the setpoint value that you previously established.

A Typical Daily Routine

The following steps should be included in your daily routine when using the AccuDry system:

1. Before dryer start-up, check the outlet moisture sensor to ensure it is clean and free of debris. The sensor chute has no obstructions ahead of the sensor, and the flow-metering device is operating.
2. Start your dryer as you have in the past from the dryer control panel. The Pinnacle software will indicate that you are in "Manual" mode.
3. On the Dryer Overview screen, verify your discharge rate and discharge moisture setpoints. Modify them accordingly.
4. After the normal fan and burner startup procedure, as outlined in the Operations Manual, begin discharging.
5. AccuDry can be selected when the AccuDry button is illuminated white. Begin running in AccuDry and double-check the discharge moisture setpoint (now the only setpoint you can change) is correct.
6. AccuDry will now automatically adjust the dryer discharge rate to achieve the displayed product target moisture.
7. Periodically check the moisture sensors to ensure they are clean and there is good product flow. You may turn off your metering for roughly 60 seconds to clear out any fines or bees wings that may have accumulated in the sampling chute.
8. While operating the dryer, calibrate the moisture sensors as required.
9. When you turn off the dryer discharge, AccuDry will automatically revert to "Manual" mode after 25 minutes.

Operational Timers

The Operational Timers section of the Dryer Operation screen display the values and the status of any timer as it is running. Some of the timer values can be changed in the Setpoints area of the software and those will be explained further in this manual.

Trending

The trending chapter is where you will go to view one of three historical data plots for: (1) Moistures - both infeed and discharge grain moistures (2) Percentages (%) - discharge speed and plenum temperature control valve opening, and (3) Temperatures - infeed, discharge, plenum and mid-grain temperatures. Although you will be able to access the Trending screens, you will not actually see data trends unless the dryer is currently discharging grain.

The (-) button will increase the time from the current time period to the prior time up to 36 hours to view on the trending screen. This will give you a day and a half of data to view on one screen.

The (+) button will shorten the time period from the prior to the current time. This will give you a shorter view of the data from prior time to the current time period.

PLC I/O

The PLC I/O chapter displays values corresponding to the digital and analog inputs and outputs that are interfaced with the PLC. Analog inputs and outputs refer to values that change in numerical value such as a temperature or a moisture reading, whereas digital inputs or outputs refer to parameters that are discrete and are either on or off, such as a high limit switch. The purpose of the PLC I/O chapter is for several reasons, some of which include the ability to diagnose issues that may arise or to get additional information pertaining to a particular input or output value.

Digital Inputs

Upon selecting the PLC I/O chapter button, you will be taken to the Digital Inputs screen. Because both digital inputs and digital outputs refer to discrete parameters, their values can be indicated with the equivalent of a colored bulb. If the indicator is white, the input is off, whereas if the indicator is green, the input is on.

The digital inputs that are monitored by the PLC are presented below with a brief description of their purpose:

I0.0 - Master Control Relay (MCR)
A green light indicates that the control power is ON and the safety circuit is functioning properly. White indicates it is OFF.

I0.1 - Blower(s) Overload
Green indicates that the blower circuit is OK, white indicates overload.

I0.2 - In-feed Bin Switch
Green indicates the grain level has fallen low enough for the paddle in the rotary bin switch to rotate. If white, the fill level is sufficient.

I0.3 - Discharge Level Switch
Green indicates that the level switch is made. White indicates that the grain has overloaded the level switch and it is open.

I0.4 - Discharge VFD OK
If green, the VFD is functioning properly. White indicates that the VFD is sending a fault signal to the PLC.

I0.6 - Discharge Prox Switch
Flashes from white to green at intervals in conjunction with the state of the RPM proximity sensor. When the discharge is running, the RPM proximity sensor will change state based on the rate of discharge. If the proximity sensor does not change state within a predetermined amount of time, an alarm indicating a discharge fault will be generated.

I0.7 - Linear Limit Circuit (LLC)
Green indicates that the linear limit circuit is complete and functioning properly. If white, the circuit is either incomplete or there is an error.

I1.0 - Blower #1 Auxiliary
Green indicates that the auxiliary contact for the #1 motor starter is ON. If white, it is OFF.

I1.1 - Blower #1 Press Switch
Green indicates that the #1 blower pressure switch has been activated and the blower is generating sufficient pressure. White indicates low or no pressure.

I1.2 - Discharge Prox Switch
Follows the same signal as I0.6 and is used for jam detection.

I1.3 - Low Gas Press Switch (CGA Only)
When white, the switch is off. When green, the switch is on. If CGA is enabled, the low gas pressure switch is monitored when the burner is ignited. If the gas pressure falls too low, the switch will be deactivated.

I1.4 - Burner High Limit
Green indicates that the high limit circuit is complete and is functioning properly. White indicates that the burner high limit setpoint has been reached, tripping the high limit switch.

I1.5 - Burner Ignition On
A green signal verifies that a flame is present. White signifies the absence of flame.

I1.6 - Blower #2 Auxiliary
Green indicates that the auxiliary contact for the #2 motor starter is ON. If white, it is OFF.

I1.7 - Blower #2 Press Switch
Green indicates that the blower pressure switch has been activated and the blower is generating sufficient pressure. White indicates low or no pressure.

I2.0 - High Gas Press Switch (CGA Only)
When white, the switch is OFF. When green, the switch is ON. If CGA is enabled, the high gas pressure switch is monitored when the burner is ignited. If the gas rises too high, the switch will be deactivated.

I2.1 - Tri-Start Auxiliary Contact
In an 18' tower/3-blower system only, green indicates that the auxiliary contacts of start contactor A and start contactor B are closed. White indicates one or both of the auxiliary contacts are open.

I2.3 - Blower #3 Auxiliary
Green indicates that the auxiliary contact for the #3 motor starter is ON. If white, it is OFF.

I2.4 - Blower #3 Press Switch
Green indicates that the blower pressure switch has been activated and the blower is generating sufficient pressure. White indicates low pressure.

I2.5 - LLC#1 OK
Green indicates that linear limit circuit #1 is complete and functioning properly.

I2.6 - LLC#2 OK (12' and 18' Tower Only)
Green indicates that linear limit circuit #2 is complete and functioning properly.

I2.7 - LLC#3 OK (12' and 18' Tower Only)
Green indicates that linear limit circuit #3 is complete and functioning properly.

NOT USED/SPARE
Inputs & outputs marked Not Used/Spare are never used.

NOT USED
Inputs & outputs marked Not Used are not used in a particular configuration but when that feature is active, the input/output is used.

Digital Outputs

Advancing to the next screen from the Digital Inputs by pressing the Next button will take you to the Digital Outputs screen. Similar to the digital inputs, digital outputs refer to discrete parameters and their values can be indicated with the equivalent of a colored bulb. If the indicator is white, the output is off, whereas if the indicator is green, the output is on.

The digital outputs that are monitored by the PLC are presented below with a brief description of their purpose:

Q0.0 - Customer Remote Fill Run
Green indicates that the customer's remote fill equipment is running and grain is filling the dryer. White indicates that the fill equipment is not running.

Q0.1 - Customer Remote Fill Clean Out
Green indicates that the customer's remote fill equipment will continue to run to permit clean out of the customer fill equipment. White indicates that it is not running.

Q0.2 - Blower #1 Motor Starter
Green indicates that the blower motor has been commanded to run. White indicates that it has not been commanded to run.

Q0.3 - Blower #2 Motor Starter
Green indicates that the blower motor has been commanded to run. White indicates that it has not been commanded to run.

Q0.4 - Blower #3 Motor Starter
Green indicates that the blower motor has been commanded to run. White indicates that it has not been commanded to run.

Q0.6 - Discharge VFD Run
Green indicates that the discharge VFD has been commanded to run. White indicates that it has not been commanded to run.

Q0.7 - Customer Takeaway Run
Green indicates that the customer's takeaway system has been commanded to run. White indicates that it has not been commanded to run.

Q1.0 - Burner Ignition
Green indicates that the burner has been commanded to ignite and will stay ON while operating. White indicates that it is OFF.

Q1.1 - Tri-Start Contactors
Green indicates that the start contactors A and B are turned ON. White means they are OFF.

Q1.2 - Green Lamp (if equipped)
The Green Lamp digital output commands the green light on the stack lamp to turn on when illuminated green. The green lamp on the stack light is on continuously when the control power is on and will continuously blink when the discharge is running. This digital output is only available if the machine is equipped with the auxiliary alarms feature.

Q1.4 - Discharge VFD Fault Reset
Flashes green momentarily when the PLC sends a reset request to the VFD. When white, no request is being sent.

Q1.5 - Maxon Solenoid (if configured)
Green indicates that the Maxon valve is energized. White indicates that it is not.

Q1.6 - Red Lamp (if equipped)
The Red Lamp digital output commands the red light on the stack lamp to turn on when illuminated. The red lamp on the stack light will blink when the dryer has shutdown with a Type "C" alarm or will alternate red/green blinking with a Type "A" alarm while discharging. More information is available on alarms in the Troubleshooting section of this manual. This digital output is only available if the machine is equipped with the auxiliary alarms feature.

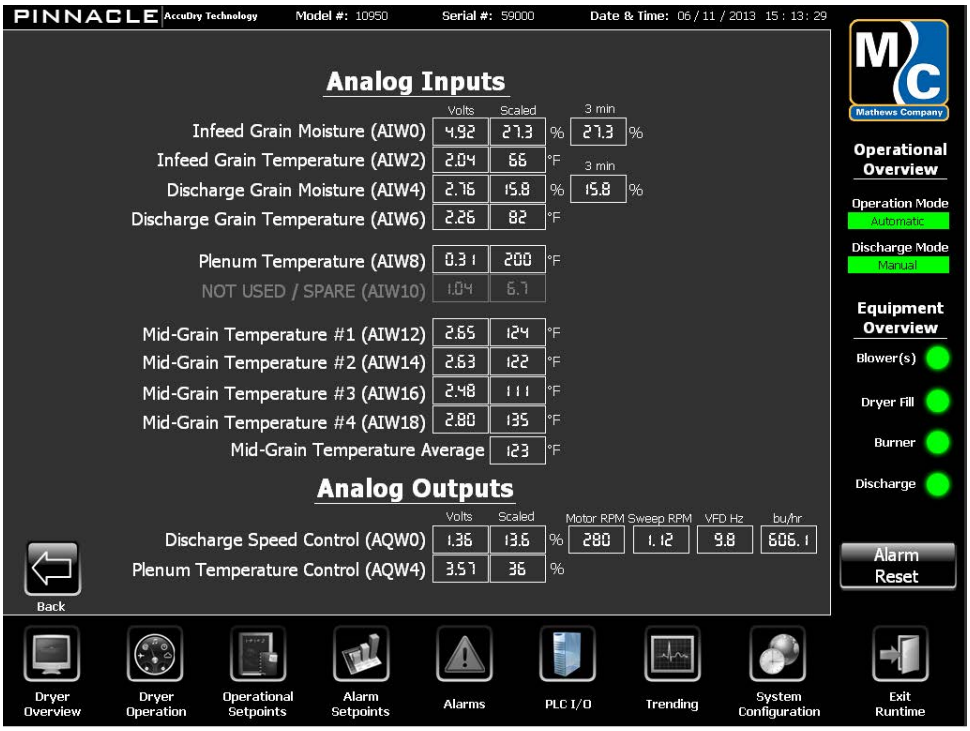
Q1.7 - Fire Alarm Signal
Green indicates that the fire alarm has been activated. White indicates that it has not.

NOT USED/SPARE
Inputs & outputs marked Not Used/Spare are never used.

NOT USED
Inputs & outputs marked Not Used are not used in a particular configuration but when that feature is active, the input/output is used.

Analog Inputs & Outputs

Advancing to the next screen from the Digital Outputs by pressing the Next button will take you to the Analog Inputs and Outputs screen. The Analog Inputs and Outputs screen displays the raw and scaled values.



The analog inputs and outputs that are monitored by the PLC are presented below with a brief description of their purpose:

AIW0 & AIW4 - Infeed and Discharge Grain Moisture
Indicate the moisture of the grain flowing across the infeed and discharge moisture sensors repectively.

AIW2 & AIW6 - Infeed and Discharge Grain Temperature
Indicate the temperature of the grain flowing across the infeed and discharge moisture sensors respectively.

AIW8 - Plenum Temperature
Indicates the plenum temperature from the plenum RTD.

AIW12 - Mid-Grain Temperature #1
Indicates mid-grain temperature #1 from the RTD transmitter.

AIW14 - Mid-Grain Temperature #2
Indicates mid-grain temperature #2 from the RTD transmitter.

AIW16 - Mid-Grain Temperature #3
Indicates mid-grain temperature #3 from the RTD transmitter.

AIW18 - Mid-Grain Temperature #4
Indicates mid-grain temperature #4 from the RTD transmitter.

AQW0 - Discharge Speed Control
Indicates the commanded discharge speed sent to the VFD.

The discharge speed analog output provides all pertinent discharge speed information. The scaled discharge speed output % that is defined either manually in Manual mode or automatically in Trudry or AccuDry mode is shown as well as the corresponding output voltage from the PLC. This is the analog output voltage that is sent to the VFD for discharge speed control. This value can be verified for troubleshooting purposes by measuring the voltage across the output of the PLC output or by measuring the analog input voltage on the VFD. A tabulation of data for all dryer models is shown on the next page with VFD frequency, metering speed, and discharge rate (bu/hr) for 0% - 100% in 10% increments.

The VFD frequency is shown to provide an indication of what frequency the discharge metering motor is running at; this value is not read directly from the VFD, but rather it is a calculated value based on the discharge speed %.

The discharge motor speed and the corresponding metering system speed are both shown with units of revolutions per minute (RPM). The metering speed is the speed at which either the metering rolls or sweep system are running at downstream of the discharge gearbox speed reduction.

The bu/hr portion of the screen is the real-time output of bushels per hour of dryer operation, if the dryer were to run for one hour at the exact same state. This value wil change in response to incoming moisture fluctuations.

A tabulation of data for all tower dryer models is shown on the next page with VFD frequency, metering speed, and discharge rate (bu/hr and metric tonnes/hr) for 0% - 100% in 10% increments.

	Discharge Speed (%)											
	0%				10%				20%			
	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)
L1250		0.6	83	1.9		1.2	175	4.1		1.8	266	6.2
L1350												
L2550		0.8	176	4.1		1.7	369	8.6		2.6	562	13.1
L2650												
L2700	5.0				10.5				16.0			
L3100												
L3105												
L4145		1.6	351	8.2		3.4	738	17.2		5.1	1125	26.2
L5175												
L6205												
CF 320 / 320C			42	1.0			87	2.0			133	3.1
CF 420 / 240C			62	1.5			131	3.1			200	4.7
CF 520 / 520C												
CF 620 / 620C	5.0	0.6	83	1.9	10.5	1.2	175	4.1	16.0	1.8	266	6.2
CF 720												
CF 730			104	2.4			219	5.1			333	7.8
CF 820 / 820C			126	2.9			264	6.1			402	9.4
T2030 / 2030V			104	2.4			219	5.1			333	7.8
T2440 / 2440V	5.0	0.6	126	2.9	10.5	1.2	264	6.1	16.0	1.8	402	9.4
T2850 / 2850V			146	3.4			307	7.2			469	10.9
10520												
10630			93	2.2			219	5.1			344	8.0
10730	5.0	0.6			11.7	1.3			18.4	2.1		
10840												
101050			110	2.6			257	6.0			405	9.4
101275												
10530			172	4.0			293	6.8			414	9.6
10740			241	5.6			411	9.6			580	13.5
10950	5.0	0.6	310	7.2	8.5	1.0	528	12.3	12.0	1.4	745	17.4
101160			379	8.8			645	15.0			911	21.2
101375			448	10.4			762	17.8			1076	25.1
2000			345	8.0			725	16.9			1104	25.7
2400	5.0	0.6	414	9.6	10.5	1.2	869	20.3	16.0	1.8	1325	30.9
2700			483	11.3			1014	23.6			1546	36
3000			496	11.6			1042	24.3			1588	37.0
3500	5.0	0.2	558	13.0	10.5	0.4	1173	27.3	16.0	0.7	1787	41.6
4000			621	14.5			1303	30.4			1986	46.3
4800			683	15.9			1433	33.4			2184	50.9

	Discharge Speed (%)											
	30%				40%				50%			
	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)
L1250		2.5	358	8.3		3.1	450	10.5		3.7	541	12.6
L1350												
L2550		3.4	756	17.6		4.3	949	22.1		5.2	1142	26.6
L2650												
L2700	21.5				27.0				32.5			
L3100												
L3105												
L4145		6.9	1511	35.2		8.6	1898	44.2		10.4	2284	53.2
L5175												
L6205												
CF 320 / 320C			179	4.2			225	5.2			271	6.3
CF 420 / 240C			269	6.3			337	7.9			406	9.5
CF 520 / 520C												
CF 620 / 620C	21.5	2.5	358	8.3	27.0	3.1	450	10.5	32.5	3.7	541	12.6
CF 720												
CF 730			448	10.4			562	13.1			677	15.8
CF 820 / 820C			540	12.6			678	15.8			816	19.0
T2030 / 2030V			448	10.4			562	13.1			677	15.8
T2440 / 2440V	21.5	2.5	540	12.6	27.0	3.1	678	15.8	32.5	3.7	816	19.0
T2850 / 2850V			630	14.7			791	18.4			952	22.2
10520												
10630			469	10.9			594	13.8			719	16.8
10730	25.1	2.9			31.8	3.7			38.5	4.4		
10840												
101050			552	12.9			699	16.3			847	19.7
101275												
10530			535	12.5			655	15.3			776	18.1
10740			749	17.4			918	21.4			1087	25.3
10950	15.5	1.8	963	22.4	19.0	2.2	1180	27.5	22.5	2.6	1397	32.5
101160			1176	27.4			1442	33.6			1708	39.8
101375			1390	32.4			1704	39.7			2018	47.0
2000			1484	34.6			1863	43.4			2243	52.2
2400	21.5	2.5	1780	41.5	27.0	3.1	2236	52.1	32.5	3.7	2691	62.7
2700			2077	48.4			2608	60.8			3140	73.1
3000			2135	49.7			2681	62.4			3227	75.2
3500	21.5	0.9	2401	55.9	27.0	1.1	3016	70.2	32.5	1.3	3630	84.6
4000			2668	62.1			3351	78.0			4033	93.9
4800			2935	68.4			3686	85.9			4437	103.3

	Discharge Speed (%)																			
	60%				70%				80%				90%				100%			
	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)	VFD Freq (Hz)	Metering Speed (RPM)	Disch Rate (bu/hr)	Disch Rate (tonnes/hr)
L1250	38.0	4.3	633	14.7	43.5	5.0	724	16.9	49.0	5.6	816	19.0	54.5	6.2	908	21.1	60.0	6.8	999	23.3
L1350		6.1	1335	31.1		6.9	1529	35.6		7.8	1722	40.1		8.7	1915	44.6		9.6	2109	49.1
L2550																				
L2650																				
L2700																				
L3100																				
L3105																				
L4145		12.1	2671	62.2		13.9	3057	71.2		15.7	3444	80.2		17.4	3830	89.2		19.2	4217	98.2
L5175																				
L6205																				
CF 320 / 320C	38.0	4.3	317	7.4	43.5	5.0	362	8.4	49.0	5.6	408	9.5	54.5	6.2	454	10.6	60.0	6.8	500	11.6
CF 420 / 240C			475	11.1			543	12.7			612	14.3			681	15.9			750	17.5
CF 520 / 520C																				
CF 620 / 620C			633	14.7			724	16.9			816	19.0			908	21.1			999	23.3
CF 720																				
CF 730			791	18.4			906	21.1			1020	23.8			1135	26.4			1249	29.1
CF 820 / 820C			954	22.2			1092	25.4			1230	28.6			1368	31.9			1506	35.1
T2030 / 2030V	38.0	4.3	791	18.4	43.5	5.0	906	21.1	49.0	5.6	1020	23.8	54.5	6.2	1135	26.4	60.0	6.8	1249	29.1
T2440 / 2440V			954	22.2			1092	25.4			1230	28.6			1368	31.9			1506	35.1
T2850 / 2850V			1113	25.9			1274	29.7			1435	33.4			1596	37.2			1757	40.9
10520	45.2	5.2	845	19.7	51.9	6.0	970	22.6	58.6	6.7	1,095	25.5	65.3	7.5	1,220	28.4	72.0	8.3	1,345	31.3
10630																				
10730																				
10840			994	23.2			1,141	26.6			1,289	30.0			1,436	33.4			1,583	36.9
101050																				
101275																				
10530	26.0	3.0	897	20.9	29.5	3.4	1018	23.7	33.0	3.8	1139	26.5	36.5	4.2	1259	29.3	40.0	4.6	1380	32.1
10740			1256	29.3			1425	33.2			1594	37.1			1763	41.1			1932	45.0
10950			1615	37.6			1832	42.7			2049	47.7			2267	52.8			2484	57.9
101160			1973	46.0			2239	52.2			2505	58.3			2770	64.5			3036	70.7
101375			2332	54.3			2646	61.6			2960	68.9			3274	76.3			3588	83.6
2000	38.0	4.4	2622	61.1	43.5	5.0	3002	69.9	49.0	5.6	3381	78.8	54.5	6.3	3761	87.6	60.0	6.9	4140	96.4
2400			3146	73.3			3602	83.9			4057	94.5			4513	105.1			4968	115.7
2700			3671	85.5			4202	97.9			4733	110.3			5265	122.6			5769	135.1
3000	38.0	1.6	3773	87.9	43.5	1.8	4319	100.6	49.0	2.0	4865	113.3	54.5	2.3	5411	126.0	60.0	2.5	5957	138.8
3500			4244	98.9			4859	113.2			5473	127.5			6087	141.8			6701	156.1
4000			4716	109.8			5398	125.7			6081	141.6			6763	157.5			7446	173.4
4800			5187	120.8			5938	138.3			6689	155.8			7440	173.3			8191	190.8

The calculated discharge rate is displayed in bu/hr and is calculated based on the quantity of grain that is discharged with each revolution of the metering system and is referred to as the discharge capacity with units of bu/rev. The default value for this parameter is model specific and has been approximated based on past experience, as shown in the following table. It is important to understand that this value can be adjusted for a more accurate discharge rate indication. A further explanation on how to adjust this parameter will be found in the Settings section of this manual.

	Discharge Capacity (bu/rev)	(m3/rev)
L1250	2.433	0.08571
L1350	3.667	0.12918
L2550		
L2650		
L2700		
L3100		
L3105		
L4145		
L5175		
L6205		
CF 320 / 320C	1.217	0.04287
CF 420 / 240C	1.825	0.06429
CF 520 / 520C	2.433	0.08571
CF 620 / 620C		
CF 720		
CF 730	3.042	0.10717
CF 820 / 820C	3.667	0.12918
T2030 / 2030V	3.042	0.10717
T2440 / 2440V	3.667	0.12918
T2850 / 2850V	4.278	0.15071
10520	2.708	0.09540
10630		
10730		
10840	3.187	0.11227
101050		
101275		
10530	5.000	0.17857
10740	7.000	0.25000
10950	9.000	0.32143
101160	11.000	0.39286
101375	13.000	0.46429
2000	10.000	0.35714
2400	12.000	0.42857
2700	14.000	0.49340
3000	40.000	1.42857
3500	45.000	1.60714
4000	50.000	1.78571
4800	55.000	1.96429

AQW4 - Plenum Temperature Control

Indicates the commanded opening for the fuel control valve to regulate plenum temperature.

Section 3

Settings

The Pinnacle control system has features that are customizable with several settings that can be changed as necessary. These settings are thoroughly discussed throughout this section of the manual. It is important to note that this portion of the manual is dependant on the two main technologies that may be installed (1) TruDry Technology and (2) AccuDry Technology.

Setpoints (TruDry)

Selecting the setpoints chapter button will take you to the first of three screens, alarms setpoints, followed by operational setpoints and lastly, sensor calibration.

Alarm Setpoints (TruDry)

The alarm setpoints screen provides you with the ability to change limits and other values that correspond to alarm values. The alarms that these setpoints correspond to will be explained further in the Troubleshooting section of this manual.

Mid-Grain Band

The Alarm Set Point is the allowed deviation from the mid-grain temperature set point while the discharge system is running.

Mid-Grain Band Delay

The Mid-Grain Band delay is a user-defined time duration that will delay the cool down of the dryer after the Mid-Grain Band warning alarm has occurred.

Grain Flow Timeout
The Grain Flow Timeout set point is the time delay allowed once the grain level has dropped below the bin level switch. Once the grain flow timeout set point has been reached, an alarm will be triggered that will place the dryer into COOL-DOWN mode.

Discharge Moisture Low Limit
The Discharge Moisture Low Limit alarm set point is a discharge moisture value that will trigger an alarm when the value drops below the discharge moisture low limit set point for duration of 5-minutes while the discharge is running.

Discharge Moisture High Limit
This Discharge Moisture High Limit alarm set point is a discharge moisture value that will trigger an alarm when the value exceeds the discharge moisture high limit set point for duration of 5-minutes while the discharge is running.

Plenum Temperature Band
The Plenum Temperature band is the maximum allowed deviation between the actual plenum temperature and the plenum temperature set point.

Bushel Count Warning Enable
This button enables an alarm (to be displayed) when the bushel count limit is achieved (see below).

Bushel Count Limit
The total bushels that the dryer is permitted to discharge (up to the dry storage capacity). Once the set point is reached, a warning alarm will be displayed.

Operational Setpoints (TruDry)

Selecting the Operational Setpoints screen from the bottom ribbon will provide you with the ability to change operational values that affect the performance of the machine.

Plenum Temperature
The Plenum Temperature set point is used to control the plenum temperature when the burner is lit. The PLC will control plenum temperature by adjusting the burner control valve to increase or decrease the amount of fuel flowing to the burner.

Control Valve Initial Opening
The Control Valve Initial Opening is the position of the fuel control valve commanded as the burner is undergoing the initial ignition sequence.

Control Valve Min Opening
The Fuel Control Valve Minimum Opening % set point is the lowest possible control valve output allowed by the dryer.

Control Valve Max Opening
The Fuel Control Valve Maximum Opening % set point is the highest possible control valve output allowed by the dryer.

Auto Temp Adjust Jump
The Auto Temp Adjust Jump set point refers to the automatic temperature decrease of the plenum temperature set point when the VFD back off speed set point has been reached.

Auto Temp Adjust Max
The Auto Temp Adjust Max set point refers to the total allowed adjustment to the plenum temperature as a result of multiple auto temp adjustments.

Auto Adjust Timer
The Auto Adjust Timer refers to the time before an automatic temperature adjustment is made to the plenum temperature set point.

VFD Back off Speed
The VFD Back-off Speed refers to the VFD speed at which the automatic plenum temperature set point adjustment feature will become enabled.

Cool-Down Timer
The Cool-Down Timer refers to the length of time that the dryer will be placed in COOL-DOWN mode following a type-B fault or when the dryer is placed in COOL-DOWN mode.

Mid-Grain Temp
The Mid-Grain Temperature set point refers to the target mid-grain temperature that the dryer will attempt to maintain during automatic discharge control.

Fill Start Delay
The Fill Start Delay set point refers to the time between when the grain level has dropped below the Bin Level switch and when the Dryer Fill System is activated.

Fill Stop Delay
The Fill Stop Delay set point refers to the time between when the grain level has risen above the Bin Level switch and when the Dryer Fill System is deactivated.

Takeaway Cleanout Delay
The Takeaway Cleanout Delay setpoint refers to the amount of time that the dryer takeaway system will be commanded to operate after the Dryer Discharge system has stopped.

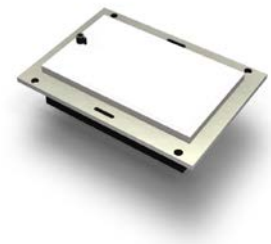
Sensor Calibration (TruDry)

Selecting the Next button from the Operational Setpoints screen will take you to the Sensor Calibration screen:

The moisture sensors that are used on the dryer are special devices that measure the capacitance of the grain passing over the sensor's surface which correlates to a voltage that is then calibrated to a moisture value. Furthermore, the moisture sensor also measures the grain temperature because grain temperature is an important parameter to monitor while drying, but also because the temperature is used to compensate the measured grain moisture; this temperature compensation step is done within the PLC so that the moisture value that is displayed on the touch screen is a temperature compensated moisture which reflects what is measured with third party moisture testers.

Accurate calibration equations are critical for reliable and consistent operation. The Pinnacle software is equipped with four different calibration methods: (1) Single Point, (2) Advanced Linear (3) Advanced Polynomial and (4) Slope & Offset. Regardless of what calibration method is utilized, the end result is that there will be an equation that correlates the moisture sensor's voltage to an uncompensated moisture value. It is referred to as an uncompensated moisture because the moisture measured by the sensor needs to be compensated from a reference temperature to the actual grain temperature. It is important to note that depending on the moisture sensor(s) installed, some methods of calibration may not apply to your model.

Moisture Sensor(s)
The presence of a moisture sensor on the discharge and the infeed of the dryer can be selected. The option to select an infeed moisture sensor requires the presence of a discharge moisture sensor. Once a discharge moisture sensor is selected, you will have the option to specify what type of sensor is installed and whether or not the sensor is mounted in a sampler assembly. Correctly selecting the model of the moisture sensor will ensure that the proper temperature scaling is used and the presence of the moisture sampler assembly will enable the Advanced Linear and Advanced Polynomial calibration methods. The same applies to the infeed sensor as well. In order to determine the correct moisture sensor installed on your machine, see the images below to correctly identify the physical sensor with the model:

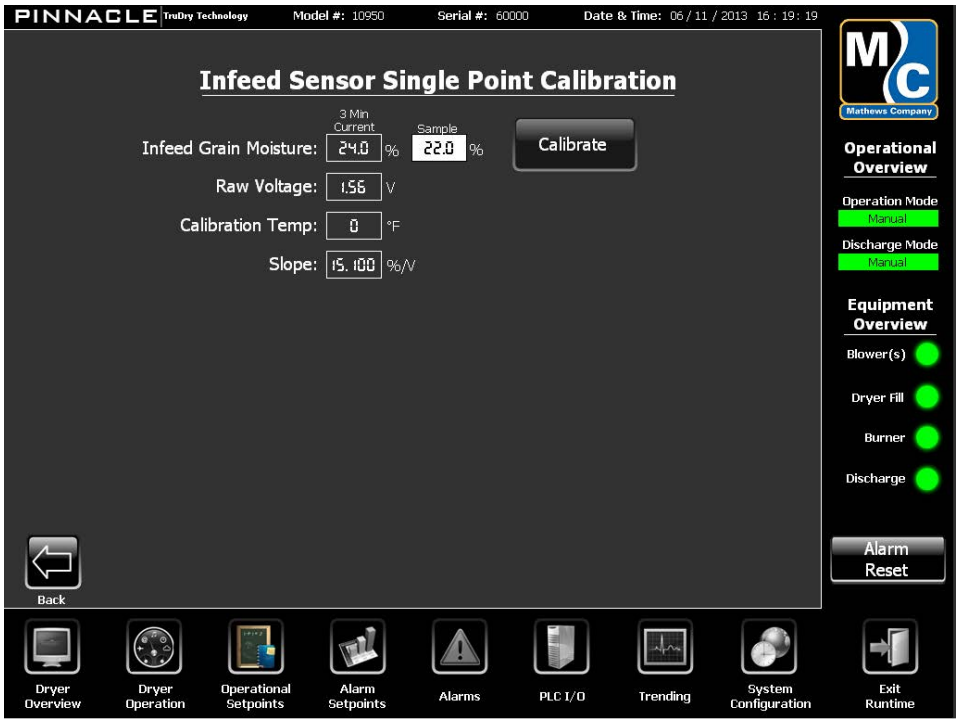


FP21C Moisture Sensor

FP32C Moisture Sensor

DM510 Moisture Sensor

Once you are on the sensor calibration screen, you will select what calibration method will be applied to the moisture sensor(s). The Features Enable section where the moisture sensors are enabled also has a toggle to indicate what model moisture sensor is being used (FP21C, FP32C, or DM510) and whether or not the moisture sensor is installed. The Pinnacle software needs to know what sensor is being used because the temperature-voltage relationship is different and each model of moisture sensor has it's own calibration methods.



Single Point Calibration (FP21C or FP32C Model)

The Single Point calibration method establishes a simple relationship between sensor voltage and grain moisture. Additionally, when using the single point calibration method, it is assumed that 0.00V corresponds to 0% moisture (uncompensated). For example, if it is known that the grain's moisture is 16.2% and the sensor's voltage is reading 1.15V, the calculated calibration will be 14.09 %/V which is referred to as the "slope". This is a simple linear relationship that calculates the moisture as 14.09 %/V, so if the sensor's voltage changes to 1.05V, the calculated moisture will then change to 14.8% which is calculated as the product of the "slope" and the current voltage or 14.09%/V x 1.05V = 14.8%.

The benefit of using the Single Point Calibration is that it is easy to quickly setup the moisture sensor, however the limitation is that it will not be accurate over a wide moisture range.

In order to apply a single point calibration to your moisture sensor, make sure the Single Point method is selected and navigate to the Single Point Settings screen. On this screen you will see the current voltage being measured by the moisture sensor as well as the current moisture being calculated from the current single point calibration slope being used. The calibration slope will be shown on the screen as well as the calibration temperature that is in effect. Lastly, the sample moisture value is shown.

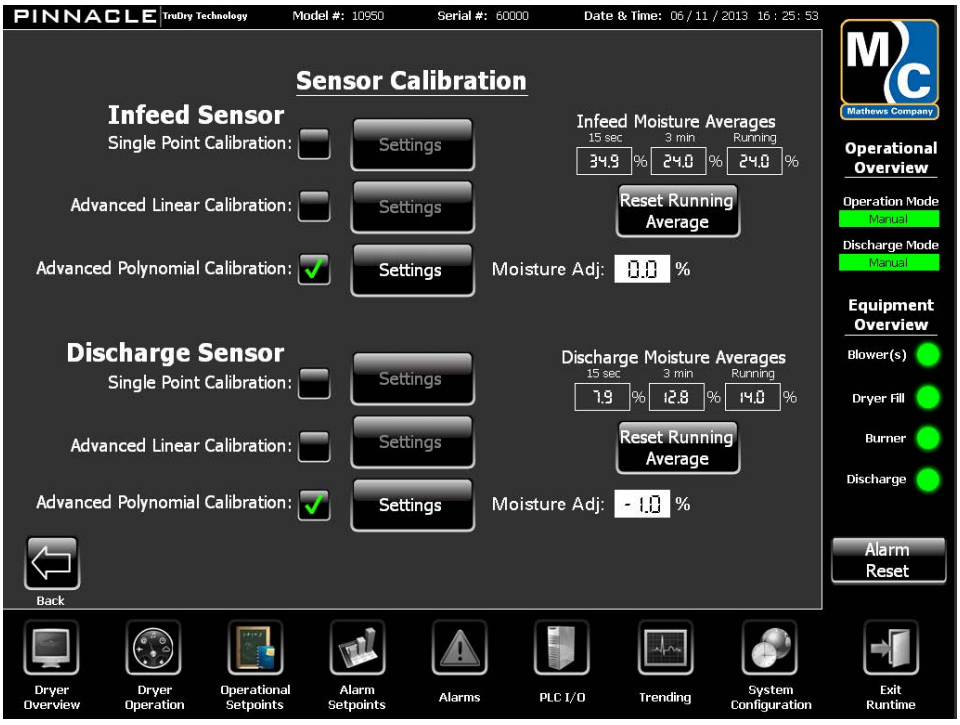
To establish and apply a new calibration slope, pull a sample of grain as close as possible to the moisture sensor. This will ensure that the voltage that is read off the touch screen corresponds with the grain that is passing over the sensor. Once that sample is taken, measure the sampled grain's moisture in your third party moisture tester, enter the value in the sample input box and select the Calibrate button. Once the Calibrate button is pressed, the new slope will be calculated as well as the new calibration temperature which is taken as the current grain temperature measured from the sensor.

After the calibrate button is pressed, you will then start to see the current moisture value change because the new calibration slope is now in effect.

Advanced Linear Calibration (FP32C Model Only)

Because of the limitations of the Single Point calibration method, the Pinnacle Lite software also includes an Advanced Linear calibration method which is based on more than one data point. Up to 8 data points can be used to establish an advanced linear calibration equation and the way in which you input the data points into the touch screen allow you to view the calibration data before applying it.

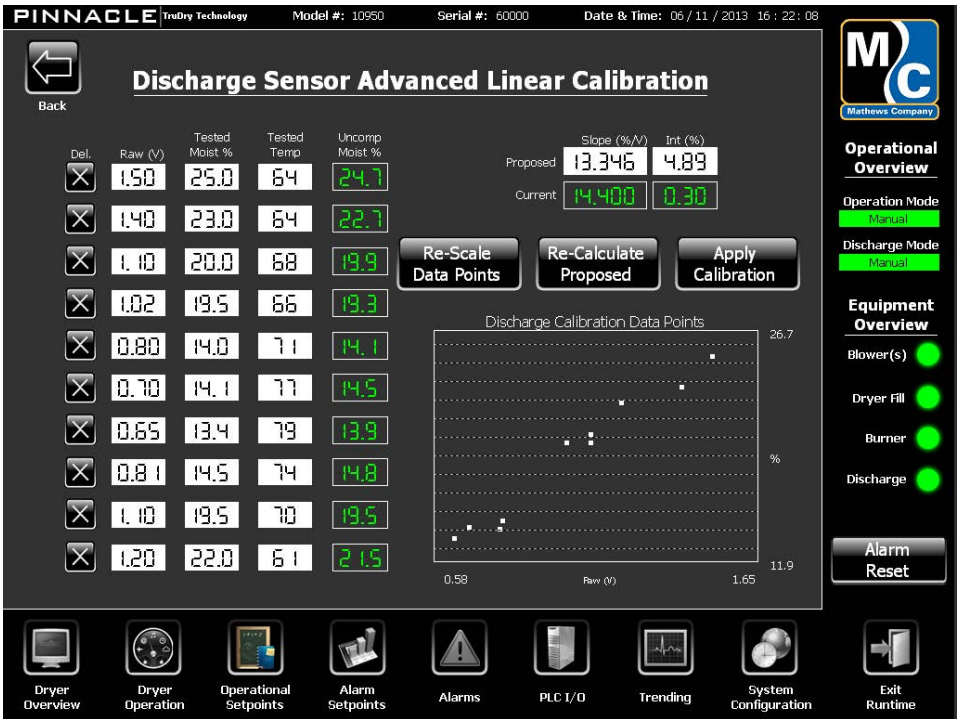
The principal behind the Advanced Linear Calibration method is that a collection of sensor voltages, tested moistures, and tested temperatures are plotted over the desired range of the sensor. The ideal time to collect this data is when the dryer is first being put into operation at the start of a drying session. The more tested samples the better, as long as they are spread out over the desired range - be aware that two data points at 13% and 17% will produce much better results than five data points between 14.5% and 15.5%.



When you are ready to collect a sample, it is important to pull a sample of grain as close as possible to the moisture sensor which will ensure that the voltage that is read off the touch screen corresponds with the grain that is currently passing over the sensor. When you do pull a sample of grain, be sure to record the moisture sensor's voltage from the touch screen (15-sec average on the Analog Input screen). After you have recorded the voltage, measure the grain's moisture and temperature at least 3-5 times taking an average of the values. You will likely see that each time you test the grain moisture, you will get a different value from your third party moisture tester which is normal and expected.

Date/Time	Sensor Voltage	Grain Temp	Grain Moist

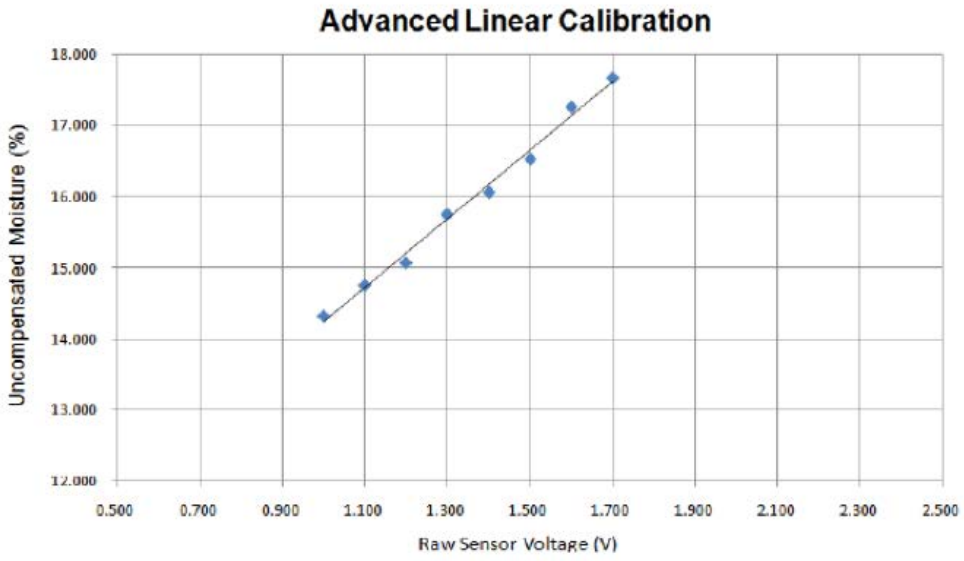
You can also skip logging on a sheet of paper and enter it directly on the touchscreen by enabling the Advanced Linear Calibration method and selecting the Settings button.



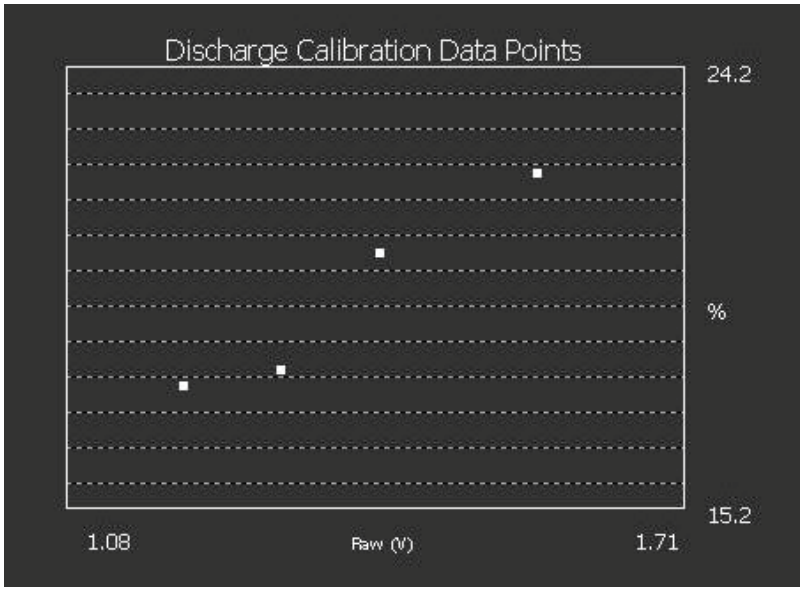
Here you will see a table that allows for entry of the previously mentioned voltage, moisture, and temperature values collected for multiple samples.

Based on the tested temperature, the uncompensated moisture will be calculated as shown in the read-only column. To clear the values of a sample row, simply press the x button to the left of the values. When clearing a row of sample data, it will then be excluded from the calculated calibration equation.

Because you now have the ability to enter multiple data points, the slope of the calibration will be calculated, as previously mentioned in the Single Point Calibration method, as well as an "intercept" value. At any point you can see what slope and intercept values currently being used by looking in the lower right hand corner where they are presented in green on a dark background. After all of your samples are entered in the table, press the re-scale data points button and followed by the re-calculate proposed button and a linear regression will be performed on the samples entered. A linear regression will calculate the slope and intercept of a trend line that passes thorough the data points previously input. Graphically, this can be represented as follows:



The sample data points are plotted as uncompensated moisture values on the vertical axis with the corresponding raw sensor voltage on the horizontal axis. The trend line shown above is drawn as close as possible through the data points and the corresponding slope and intercept of the line is then taken to be the calibration equation once the calibration is applied. After the slope and intercept are calculated, the values will be shown in the upper right hand corner as proposed values. In order to determine if entered samples produce a reasonable calibration curve, you can select the View Data Points button which will show a scatter plot of the entered samples:



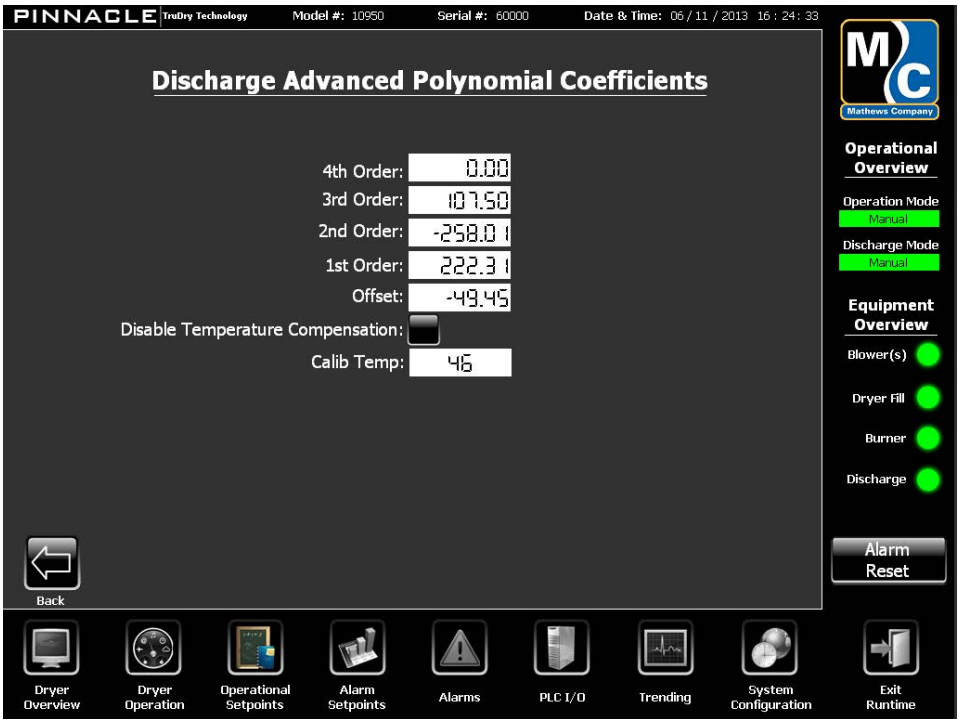
Note that when viewing the plotted data points, the values should always produce a line that slopes from the lower left corner to the upper right hand corner as shown above. Once the values are determined to be acceptable, the proposed calibration can be applied by pressing the Apply Calibration button. Once this is done, the Current Calibration will be copied from the Proposed Calibration values and the moisture will now be calculated from the new calibration.

You are also able to perform the same process in a spreadsheet program of your choice if more than 8 samples are collected. Instead of entering the samples individually and calculating the slope and intercept on the touch screen, you can enter the slope and intercept directly in the white input boxes in the lower left hand corner.

The advantage of the Advanced Linear Calibration method is that it covers a wider range of moisture and, as a result, is more accurate and reliable when compared to the Single Point calibration method. The limitation is that it requires some dedicated time to get the calibration accurate for a particular grain to be dried.

Advanced Polynomial Calibration (FP32C Model Only)

Because of the limitations of the Single Point and Advanced Calibration methods, the Pinnacle Lite system offers a third method that allows for the input of the sensor manufacturer's certified calibration constants. This is the easiest method to apply and is the most accurate. Enabling the Advanced Polynomial Calibration option and selecting the Settings screen will display the advanced polynomial constants which are provided by the sensor manufacturer for a particular type of grain and sensor type.



Similar to third party moisture testers, updated calibration data is occasionally made available for different grain types used with different sensor types. The default values that are loaded are for standard Corn being used with a moisture sampler that is equipped with the FP32C moisture sensor. Updated and/or new calibration constant for use with the Advanced Polynomial Calibration method will periodically be made available for other grains or hybrid varieties of Corn.

In the event that these constants need to be changed or updated, simply touch the value and enter the updated value. This should only be done as directed by your dealer or Mathews Company personnel.

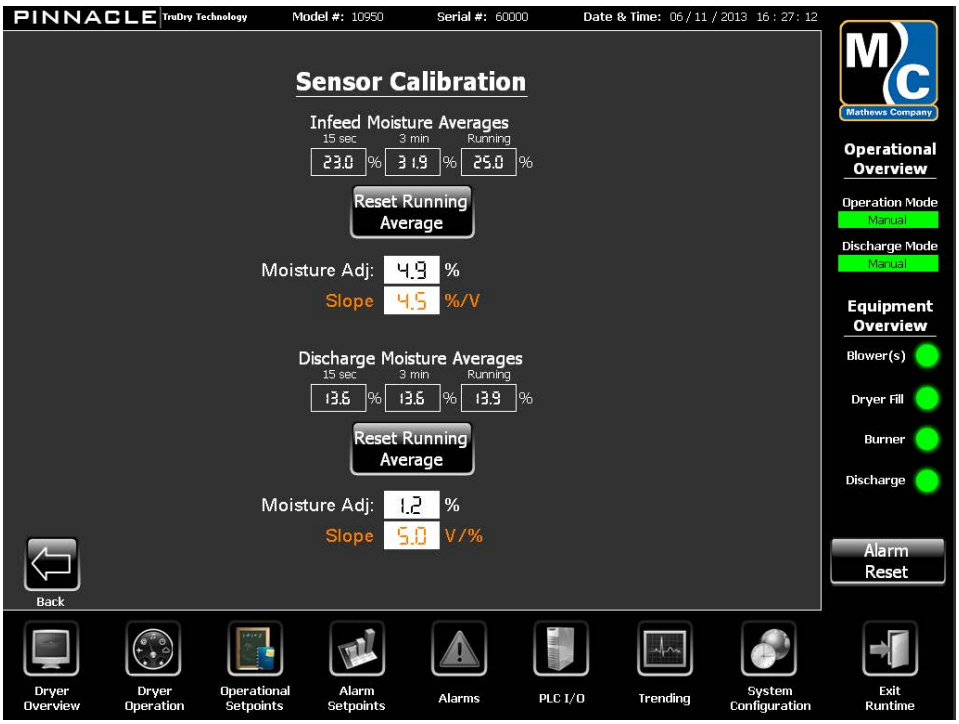
Although this calibration data is provided by the sensor manufacturer, it is possible that there may be a discrepancy between the correlation of sensor voltage and the moisture reading on the sensor. This discrepancy would be due to the type, variety or hybrid of grain that was used to perform the certified calibration by the sensor manufacturer. In the event that there is a consistent discrepancy, for example, consistently 1.3% low or high from what your 3rd party moisture sensor is reading, there is a feature that you can employ to close the gap of this discrepancy. On the calibration screen when the advanced polynomial calibration mode is selected, you will see the up and down arrows which allows you to make minor adjustments to the offset of the sensor. If your display is consistently showing the measured grain moisture to be 1.3% lower than your 3rd party moisture tester, you will want to add a positive offset adjustment, by increasing to +1.3%. After a few minutes, you will see the results of the adjustment and your moisture display should be more consistent with your 3rd part testing equipment.

Slope & Offset Calibration (DM510 Model Only)

The DM510 sensor will require only two main values (1) the moisture point offset and (2) the moisture sensor calibration slope.

The value entered as the offset is the incremental change the sensor will compensate. The default value is 0%. So if the sensor is reading 14.5% but the lab measurement says 16.0%, entering an offset value of 1.5% will have the sensor now read 16%.

If logged in, the user will be able to see the DM sensor slope value as shown below. The sensors moisture value is the product of the slope and voltage reading plus the offset. While this slope value can be changed, it is recommended to first consult with a qualified technician before doing so.



Setpoints (AccuDry)

Selecting the setpoints chapter button will take you to the first of three screens, alarms setpoints, followed by operational setpoints and lastly, sensor calibration.

Alarm Setpoints (AccuDry)

The alarm setpoints screen provides you with the ability to change limits and other values that correspond to alarm values. The alarms that these setpoints correspond to will be explained further in the Troubleshooting section of this manual.

Mid-Grain Band

The Alarm Set Point is the allowed deviation from the mid-grain temperature set point while the discharge system is running.

Mid-Grain Band Delay

The Mid-Grain Band delay is a user-defined time duration that will delay the cool down of the dryer after the Mid-Grain Band warning alarm has occurred.

Grain Flow Timeout

The Grain Flow Timeout set point is the time delay allowed once the grain level has dropped below the bin level switch. Once the grain flow timeout set point has been reached, an alarm will be triggered that will place the dryer into COOL-DOWN mode.

Plenum Temperature Band

The Plenum Temperature band is the maximum allowed deviation between the actual plenum temperature and the plenum temperature set point.

Bushel Count Warning Enable
This button enables an alarm (to be displayed) when the bushel count limit is achieved (see below).

Bushel Count Limit
The total bushels that the dryer is permitted to discharge (up to the dry storage capacity). Once the set point is reached, a warning alarm will be displayed.

DM Cooldown Delay
You have the ability to enable the dryer to cooldown on eight (8) alarms pertaining to grain moistures and temperatures. This delay is the amount of time the dryer will wait until the cooldown sequence is initiated.

Enable DM Cooldown
This is a toggle switch allowing the Dryer Master board to cooldown the dryer when selected alarms have reached this critical alarm setpoints. These alarms can only be displayed and toggled to cooldown the dryer when the Enable DM Cooldown box is checked. Those alarms can be viewed by clicking the next button. These specific alarms will be mentioned in the next chapter, and can be found when hitting the "AccuDry Alarms" button on the Alarm Setpoints screen.

AccuDry Specific Setpoints

These specific alarms can be found when hitting the "Next" button on the Alarm Setpoints screen. These alarms pertain directly to the Dryer Master board alarms. All setpoints are easily modified by the user to increase alarm precision and/or fine tune the grain moisture and temperature to each individual installation and runtime environment.

For each alarm limit there are two states of alarm. The first stage is a warning alarm and the second stage is a critical alarm. The warning alarm alerts the user of a situation they may want to keep an eye on. In many instances the dryer will have made changes attempting to correct the situation. If the dryer cannot correct the situation, a critical alarm will be reached. This will either cooldown the dryer, after the specified delay time, if the "Enabled DM Cooldown" is selected and the individual shutdown "Enable" is checked, or prompt a critical alarm without cooling down if the "Enabled DM Cooldown" is not selected.

Discharge Rate / Plenum Temp Alarm Setpoints

The discharge rate and plenum temperature alarm setpoints are similar to the grain moisture and temperature alarms, however these four (4) alarms will NOT cooldown the dryer. These alarms will simply prompt the user with alert pop-ups.

Operational Setpoints (AccuDry)

Selecting the Next button from the Alarm Setpoints screen will take you to the Operational Setpoints screen which provides you with the ability to change operational values that affect the performance of the machine.

Plenum Temperature

The Plenum Temperature set point is used to control the plenum temperature when the burner is lit. The PLC will control plenum temperature by adjusting the burner control valve to increase or decrease the amount of fuel flowing to the burner.

Control Valve Initial Opening

The Control Valve Initial Opening is the position of the fuel control valve commanded as the burner is undergoing the initial ignition sequence.

Control Valve Min Opening

The Fuel Control Valve Minimum Opening % set point is the lowest possible control valve output allowed by the dryer.

Control Valve Max Opening

The Fuel Control Valve Maximum Opening % set point is the highest possible control valve output allowed by the dryer.

Auto Temp Adjust Jump

The Auto Temp Adjust Jump set point refers to the automatic temperature decrease of the plenum temperature set point when the VFD back off speed set point has been reached.

Auto Temp Adjust Max
The Auto Temp Adjust Max set point refers to the total allowed adjustment to the plenum temperature as a result of multiple auto temp adjustments.

Auto Adjust Timer
The Auto Adjust Timer refers to the time before an automatic temperature adjustment is made to the plenum temperature set point.

VFD Back off Speed
The VFD Back-off Speed refers to the VFD speed at which the automatic plenum temperature set point adjustment feature will become enabled.

Cool-Down Timer
The Cool-Down Timer refers to the length of time that the dryer will be placed in COOL-DOWN mode following a type-B fault or when the dryer is placed in COOL-DOWN mode.

Mid-Grain Temp
The Mid-Grain Temperature set point refers to the target mid-grain temperature that the dryer will attempt to maintain during automatic discharge control.

Fill Start Delay
The Fill Start Delay set point refers to the time between when the grain level has dropped below the Bin Level switch and when the Dryer Fill System is activated.

Fill Stop Delay
The Fill Stop Delay set point refers to the time between when the grain level has risen above the Bin Level switch and when the Dryer Fill System is deactivated.

Takeaway Cleanout Delay
The Takeaway Cleanout Delay setpoint refers to the amount of time that the dryer takeaway system will be commanded to operate after the Dryer Discharge system has stopped.

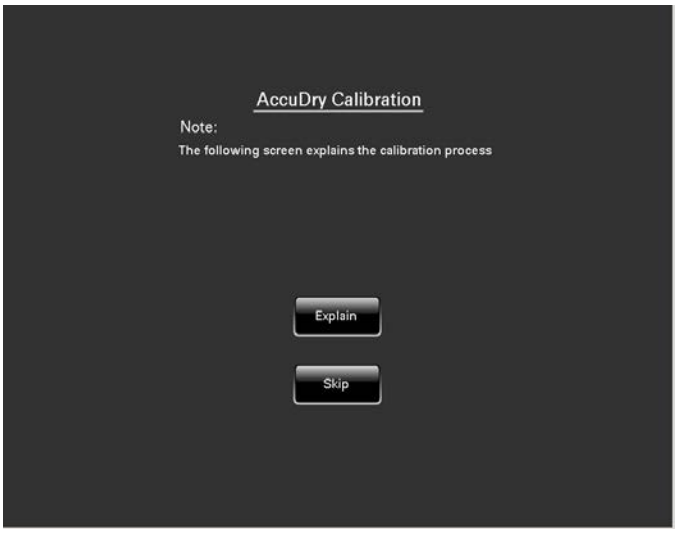
Sensor Calibration (AccuDry)

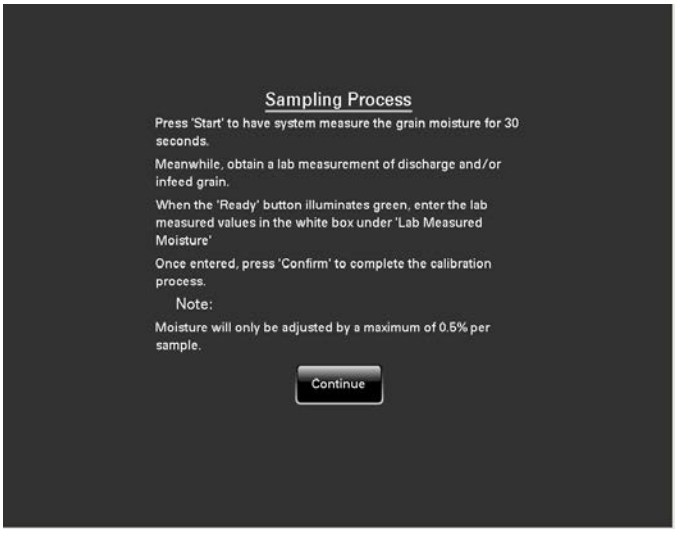
Selecting the Next button from the Operational Setpoints screen will take you to the Sensor Calibration screen:

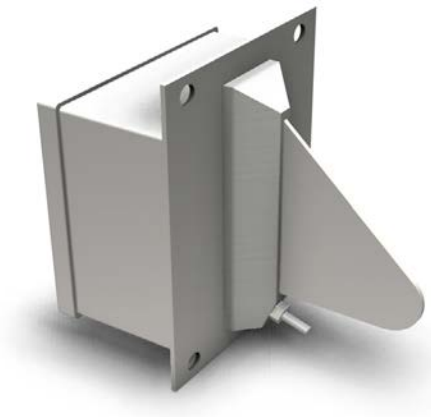
The moisture sensors that are used on the dryer are special devices that measure the capacitance of the grain passing over the sensor which correlates to a voltage that is then calibrated to a moisture value. Furthermore, the moisture sensor also measures the grain temperature because grain temperature is an important parameter to monitor while drying, but also because the temperature is used to compensate the measured grain moisture; this temperature compensation step is done either within the PLC or the sensor so that the moisture value that is displayed on the touch screen is a temperature compensated moisture which reflects what is measured with third party moisture testers.

If AccuDry is enabled, the calibration process for the sensor is automated:

Notice that there will be an option to skip the walk through and simply begin calibration. By clicking the walkthrough you will be prompted with a list of things you will be doing during the calibration process.

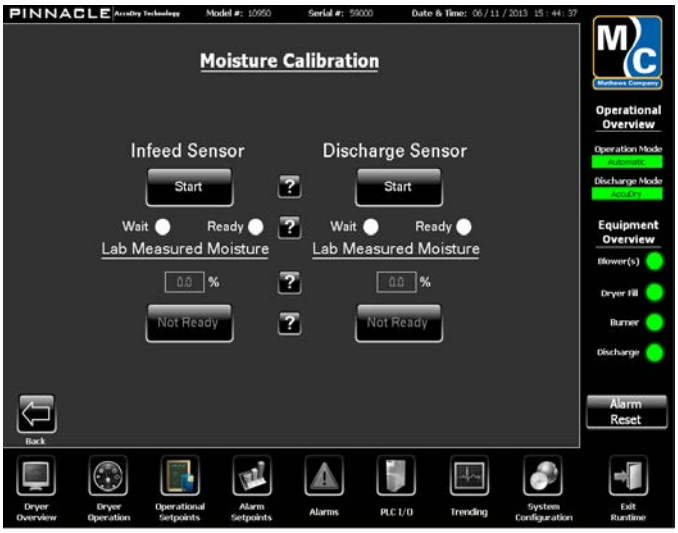






DM510 Moisture Sensor

After hitting the "Continue" button you will be taken to the Moisture Calibration main screen. This screen will have calibration routines for both your infeed and discharge sensors. Calibration will begin by selecting "Start" on your desired sensor. The button will now display "Sampling," at which point you will gather a sample of grain for calibration. It is important that you do this right after beginning the calibration process because for the next 30 seconds, the system will be taking an average of grain moistures at that sensor. For best results, comparing like grain to measured grain is desired.



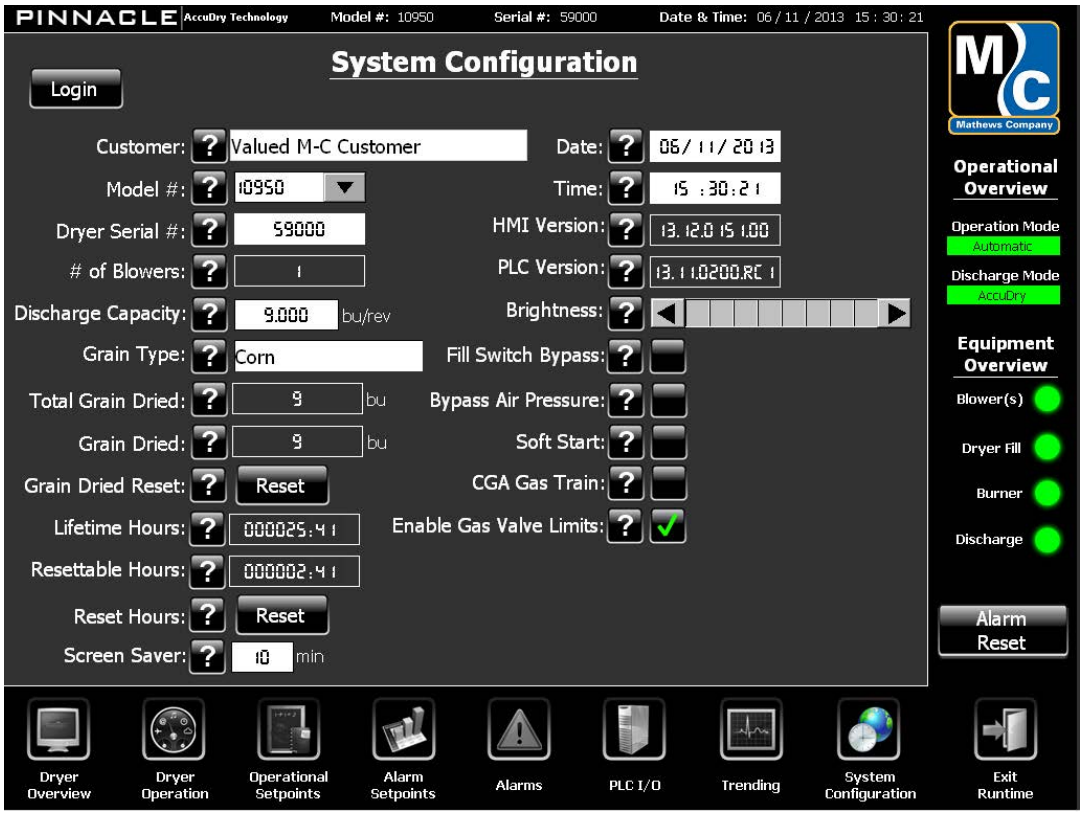
You will now notice a white box will appear for you to enter the "Lab Measured Moisture". This is the reading that you have measured on your moisture tester. Enter the moisture that your tester has given you. Now press confirm calibration, and your sensor will be calibrated accordingly.

It is important to note that the calibration will only make a 0.5% adjustment for each individual calibration performed. This is done to protect the system from a user entering an extremely large or small number and drastically changing the sensor.

System Configuration (TruDry)

Selecting the System Configuration chapter button will take you to the System Configuration screen which provides the ability to change various system parameters. Most of the system configuration will be performed at the factory and will not need to be changed by the operator.

General Configuration (TruDry)



The system configuration parameters are presented below with a brief description of their purpose:

Customer

The Customer name input is used for system identification and personalization throughout the program interface.

Model Number

The Model Number refers to the Mathews Company dryer model. This is a factory configured setting that will enable or disable features that are unique to a given dryer model.

Dryer Serial Number

The Dryer Serial Number is logged at the factory for system identification purposes.

Number of Blowers

The Number of Blowers is based on the dryer type and does not require an input. Based on the dryer model number that is selected, the corresponding number of blowers will be selected.

Discharge Capacity

The Discharge Capacity parameter is what the system uses to determine how many bu/hr the system is discharging. This also determines the total amount of grain dried. The only time this parameter should be changed is when adjustments need to be made based on measured operational data. If it is determined that the displayed bu/hr meter shown on the Dryer Overview screen, the Analog Inputs & Outputs screen or the Screen Saver screen is inaccurate, the following procedure should be followed to calibrate the discharge capacity:

1. Run the discharge constant for a set duration of time (minimum 30 min) and record the Metering Speed (RPM) from the Discharge Speed Analog Output.
2. Multiply the recorded Metering Speed (RPM) by the number of minutes the test was conducted. 2. This will be the number of revolutions that the metering system turned over the course of the test.
3. Determine how much grain was discharged from the dryer by either unloading the grain to a truck which can be weighed or (b) determining how much of a particular bin was filled during the time duration of the test. If bin volume is used, the total number of bushels or cubic meters will then be obtained. If grain weight is used, convert to volume based on the test weight of the grain.
4. Once the total volume of grain has been determined, divide that value by the number of revolutions calculated in step number 2 above. This value will now have units of bu/rev or m3/rev depending on what units are being used.
5. Update the Discharge Capacity parameter on the Factory Settings screen and select the Save Settings button.

Grain Type

The Grain Type that is being dried can be selected from a drop down list of options so that you may keep track of what grain is currently being processed. The DM Board uses this value to determine the appropriate preset parameters to be used when drying different grains.

Total Grain Dried

The total grain dried value is a bushel counter that refers to the total number of bushels that the dryer has processed.

Grain Dried
The grain dried value is a bushel counter that refers to the number of bushels that the dryer has processed since the Reset Grain Dried button has been pushed.

Grain Dried Reset
The Grain Dried Reset will reset the Grain Dried bushel counter back to zero.

Lifetime Hours
The Lifetime Hours is an hour counter that refers to the total number of hours that the dryer has been in operation.

Resettable Hours
The Resettable Hours is an hour counter that refers to the number of hours that the dryer has been in operation over a defined length of time.

Reset Hours
The Reset Hours button will reset the resettable hours counter back to zero.

Screen Saver
The screen saver setting determines how long the touchscreen will wait before going into screen saver mode.

Date
The displayed Date is a system parameter that can be changed by the user.

Time
The displayed Time is a system parameter that can be changed by the user.

HMI Version
The HMI Version refers to the software version of the HMI (Human Machine Interface) currently installed on the system.

PLC Version
The PLC Version refers to the software version of the PLC (Programmable Logic Controller) currently installed on the system.

Brightness
Use the Brightness adjustment to increase or decrease the HMI screen brightness.

Fill Switch Bypass
The Fill Switch Bypass toggle is used to bypass the In-feed Bin switch. Bypassing the bin switch will remove safeties associated with lighting the burner and should only be used for testing or diagnostic purposes. Use this toggle with caution.

Bypass Air Pressure
The Bypass Air Pressure toggle enables or disables the Air Pressure switch. Bypassing the Air Pressure switch will remove safeties associated with lighting the burner and should only be used for testing or diagnostic purposes. Use this toggle with caution.

Soft Start
If the dryer is equipped with a Soft Start, this toggle will be enabled by the factory.

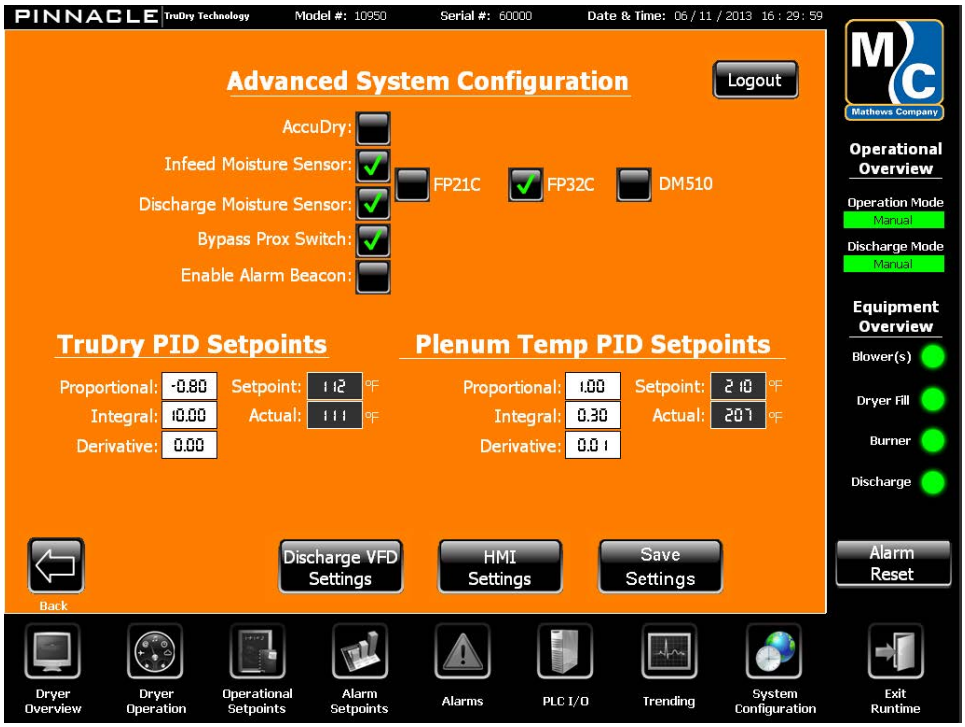
CGA Gas Train
If the dryer is equipped with a CGA-Approved Gas Train, this toggle will be enabled by the factory. A CGA approved gas train will include high and low gas pressure switches.

Enable Gas Valve Limits
The Fuel Control Valve Opening % set point is limited by the minimum and maximum valve opening % allowed by the dryer.

Advanced Configuration (TruDry)

In the upper left hand corner there is a login button to provide dealer and factory level access to advanced system configuration parameters. Upon logging in, the background color will change to an orange color indicating that you have logged into the system:

Additionally, a Next arrow will now appear in the lower right hand corner and upon selecting the Next button, you will be taken to the advanced system configuration screen:



The advanced system configuration parameters are presented below with a brief description of their purpose. The first section of the advanced system configuration screen is the features enable section which is used to select what options the dryer is equipped with. These settings will be done during system software configuration and testing at the Mathews Company facility, however your dealer or Mathews Company service personnel may make adjustments based on addition of upgrades or retrofits.

Sensor Selection

The upper portion of this screen is dedicated to enabling/selecting the sensors installed on the machine. The user may select the location of the sensor, as well as the technology version of that sensor. It is important to note that when "AccuDry" is selected, the system will automatically select the DM510 sensors. This is because only these sensors alone can be used with this technology.

Bypass Prox Switch

The Bypass Prox Switch enable will allow the discharge to run un-monitored without checking for the presence of a rotating discharge metering shaft. This feature is only used as directed by M-C service personnel or for demonstration purposes on tabletop Pinnacle Lite demonstration units.

Enable Alarm Beacon

The alarm beacon is used to annunciate alarms with either a flashing red or green lamp on the outside of the high voltage cabinet. This feature is only selected if the machine is equipped with this hardware.
Once this procedure has been followed, the discharge capacity has now been calibrated.

TruDry PID Setpoints

The purpose of the Mid-Grain Temp PID Values is to set the Proportional, Integral, and Derivative parameters of the TruDry PID control loop. Please note that changes to these parameters will drastically impact the operation of the dryer when running in TruDry mode and any settings change should only be done when instructed by Mathews Company service personnel.

On the left side, values for the Proportional, Integral, and Derivative parameters can be adjusted. On the right side you will see the mid-grain temperature setpoint and the actual mid-grain temperature. The default values for the Proportional, Integral, and Derivative parameters are recommended to be used. If fine-tune adjustments need to be made, the following explains the impact of each parameter:

Proportional - The Proportional parameter determines the gain of the control loop based on the difference between the setpoint and the actual value. Adjustment of this parameter will increase or decrease the gain when a difference between the setpoint and actual value is established.

Integral - The Integral parameter determines the responsiveness of the control loop from a time standpoint. Adjustment of this parameter will cause the control loop to become more or less responsive.
Derivative - The Integral parameter determines the amount of dampening that the control loop will exhibit. Adjustment of this parameter will increase or decrease the amount of overshoot that is observed by the control loop.

Plenum Temp PID Setpoints

The purpose of the Plenum Temp PID Values is to set the Proportional, Integral, and Derivative parameters of the Plenum Temperature PID control loop. Please note that changes to these parameters will drastically impact the operation of the dryer when controlling the plenum temperature and any settings change should only be done when instructed by Mathews Company service personnel.

On the left side, values for the Proportional, Integral, and Derivative parameters can be adjusted. On the right side you will see the mid-grain temperature setpoint and the actual mid-grain temperature. The default values for the Proportional, Integral, and Derivative parameters are recommended to be used. If fine-tune adjustments need to be made, the following explains the impact of each parameter:

Proportional - The Proportional parameter determines the gain of the control loop based on the difference between the setpoint and the actual value. Adjustment of this parameter will increase or decrease the gain when a difference between the setpoint and actual value is established.

Integral - The Integral parameter determines the responsiveness of the control loop from a time standpoint. Adjustment of this parameter will cause the control loop to become more or less responsive.

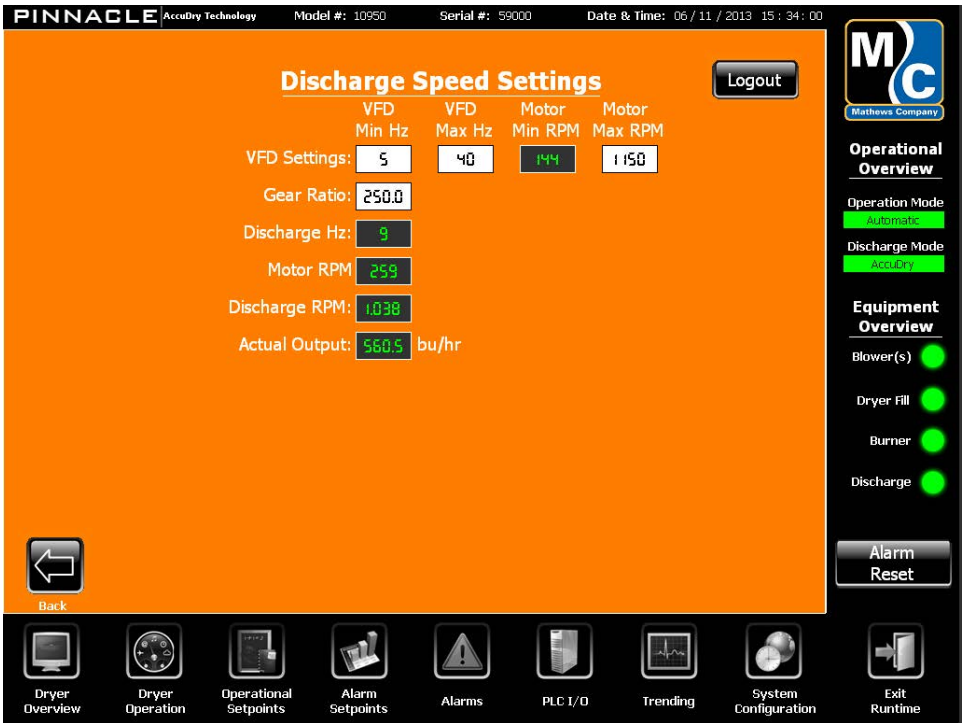
Derivative - The Integral parameter determines the amount of dampening that the control loop will exhibit. Adjustment of this parameter will increase or decrease the amount of overshoot that is observed by the control loop.

Discharge Speed Settings
On the Advanced System Configuration screen you may click the "Discharge VFD Settings" button. This button will bring you to a screen where the user may manually modify the maximum and minimum discharge rate limits. These values include;

Minimum VFD Speed
The Minimum VFD Speed setting will correlate with what has been programmed on the discharge metering VFD. This value allows for the calculation of the VFD Frequency displayed on the Discharge Speed Analog Output screen.

Maximum VFD Speed
The Maximum VFD Speed setting will correlate with what has been programmed on the discharge metering VFD. This value allows for the calculation of the VFD Frequency displayed on the Discharge Speed Analog Output screen.

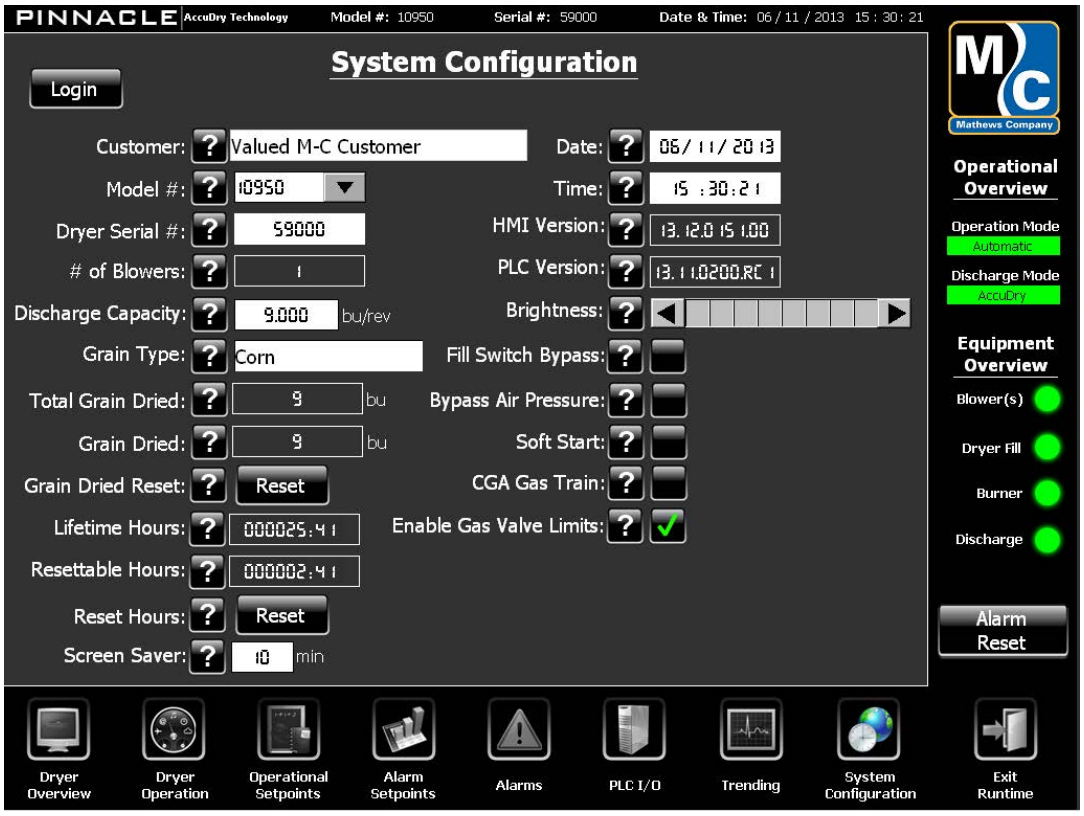
Maximum Discharge Motor Speed
The Maximum Discharge Motor Speed setting will correlate with what has been programmed on the discharge metering VFD. This value allows for the calculation of the Motor Speed displayed on the Discharge Speed Analog Output screen.



System Configuration (AccuDry)

Selecting the System Configuration chapter button will take you to the System Configuration screen which provides the ability to change various system parameters. Most of the system configuration will be performed at the factory and will not need to be changed by the operator.

General Configuration (AccuDry)



The system configuration parameters are presented below with a brief description of their purpose:

Customer

The Customer name input is used for system identification and personalization throughout the program interface.

Model Number

The Model Number refers to the Mathews Company dryer model. This is a factory configured setting that will enable or disable features that are unique to a given dryer model.

Dryer Serial Number

The Dryer Serial Number is logged at the factory for system identification purposes.

Number of Blowers

The Number of Blowers is based on the dryer type and does not require an input. Based on the dryer model number that is selected, the corresponding number of blowers will be selected.

Discharge Capacity

The Discharge Capacity parameter is what the system uses to determine how many bu/hr the system is discharging. This also determines the total amount of grain dried. The only time this parameter should be changed is when adjustments need to be made based on measured operational data. If it is determined that the displayed bu/hr meter shown on the Dryer Overview screen, the Analog Inputs & Outputs screen or the Screen Saver screen is inaccurate, the following procedure should be followed to calibrate the discharge capacity:

1. Run the discharge constant for a set duration of time (minimum 30 min) and record the Metering Speed (RPM) from the Discharge Speed Analog Output.
2. Multiply the recorded Metering Speed (RPM) by the number of minutes the test was conducted. 2. This will be the number of revolutions that the metering system turned over the course of the test.
3. Determine how much grain was discharged from the dryer by either unloading the grain to a truck which can be weighed or (b) determining how much of a particular bin was filled during the time duration of the test. If bin volume is used, the total number of bushels or cubic meters will then be obtained. If grain weight is used, convert to volume based on the test weight of the grain.
4. Once the total volume of grain has been determined, divide that value by the number of revolutions calculated in step number 2 above. This value will now have units of bu/rev or m3/rev depending on what units are being used.
5. Update the Discharge Capacity parameter on the Factory Settings screen and select the Save Settings button.

Grain Type

The Grain Type that is being dried can be selected from a drop down list of options so that you may keep track of what grain is currently being processed. The DM Board uses this value to determine the appropriate preset parameters to be used when drying different grains.

Total Grain Dried

The total grain dried value is a bushel counter that refers to the total number of bushels that the dryer has processed.

Grain Dried
The grain dried value is a bushel counter that refers to the number of bushels that the dryer has processed since the Reset Grain Dried button has been pushed.

Grain Dried Reset
The Grain Dried Reset will reset the Grain Dried bushel counter back to zero.

Lifetime Hours
The Lifetime Hours is an hour counter that refers to the total number of hours that the dryer has been in operation.

Resettable Hours
The Resettable Hours is an hour counter that refers to the number of hours that the dryer has been in operation over a defined length of time.

Reset Hours
The Reset Hours button will reset the resettable hours counter back to zero.

Screen Saver
The screen saver setting determines how long the touchscreen will wait before going into screen saver mode.

Date
The displayed Date is a system parameter that can be changed by the user.

Time
The displayed Time is a system parameter that can be changed by the user.

HMI Version
The HMI Version refers to the software version of the HMI (Human Machine Interface) currently installed on the system.

PLC Version
The PLC Version refers to the software version of the PLC (Programmable Logic Controller) currently installed on the system.

Brightness
Use the Brightness adjustment to increase or decrease the HMI screen brightness.

Fill Switch Bypass
The Fill Switch Bypass toggle is used to bypass the In-feed Bin switch. Bypassing the bin switch will remove safeties associated with lighting the burner and should only be used for testing or diagnostic purposes. Use this toggle with caution.

Bypass Air Pressure
The Bypass Air Pressure toggle enables or disables the Air Pressure switch. Bypassing the Air Pressure switch will remove safeties associated with lighting the burner and should only be used for testing or diagnostic purposes. Use this toggle with caution.

Soft Start
If the dryer is equipped with a Soft Start, this toggle will be enabled by the factory.

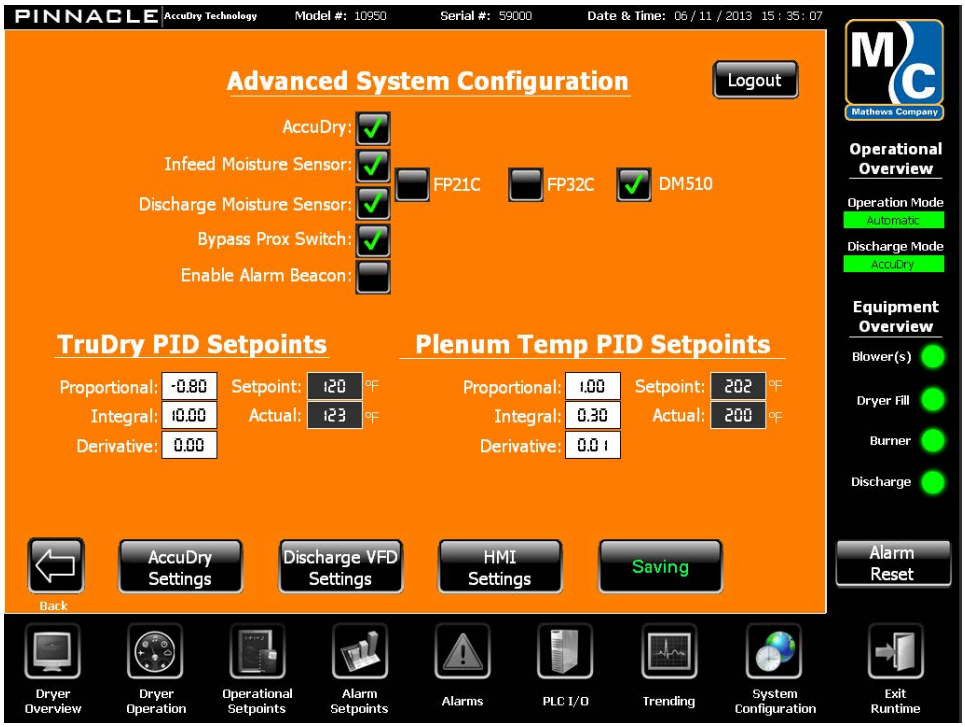
CGA Gas Train
If the dryer is equipped with a CGA-Approved Gas Train, this toggle will be enabled by the factory. A CGA approved gas train will include high and low gas pressure switches.

Enable Gas Valve Limits
The Fuel Control Valve Opening % set point is limited by the minimum and maximum valve opening % allowed by the dryer.

Advanced Configuration (AccuDry)

In the upper left hand corner there is a login button to provide dealer and factory level access to advanced system configuration parameters. Upon logging in, the background color will change to an orange color indicating that you have logged into the system:

Additionally, a Next arrow will now appear in the lower right hand corner and upon selecting the Next button, you will be taken to the advanced system configuration screen:



The advanced system configuration parameters are presented below with a brief description of their purpose. The first section of the advanced system configuration screen is the features enable section which is used to select what options the dryer is equipped with. These settings will be done during system software configuration and testing at the Mathews Company facility, however your dealer or Mathews Company service personnel may make adjustments based on addition of upgrades or retrofits.

Sensor Selection

The upper portion of this screen is dedicated to enabling/selecting the sensors installed on the machine. The user may select the location of the sensor, as well as the technology version of that sensor. It is important to note that when "AccuDry" is selected, the system will automatically select the DM510 sensors. This is because only these sensors alone can be used with this technology.

Bypass Prox Switch

The Bypass Prox Switch enable will allow the discharge to run un-monitored without checking for the presence of a rotating discharge metering shaft. This feature is only used as directed by M-C service personnel or for demonstration purposes on tabletop Pinnacle Lite demonstration units.

Enable Alarm Beacon

The alarm beacon is used to annunciate alarms with either a flashing red or green lamp on the outside of the high voltage cabinet. This feature is only selected if the machine is equipped with this hardware.
Once this procedure has been followed, the discharge capacity has now been calibrated.

TruDry PID Setpoints (Will Only Affect TruDry If Re-Enabled)
The purpose of the Mid-Grain Temp PID Values is to set the Proportional, Integral, and Derivative parameters of the TruDry PID control loop. Please note that changes to these parameters will drastically impact the operation of the dryer when running in TruDry mode and any settings change should only be done when instructed by Mathews Company service personnel.

On the left side, values for the Proportional, Integral, and Derivative parameters can be adjusted. On the right side you will see the mid-grain temperature setpoint and the actual mid-grain temperature. The default values for the Proportional, Integral, and Derivative parameters are recommended to be used. If fine-tune adjustments need to be made, the following explains the impact of each parameter:

Proportional - The Proportional parameter determines the gain of the control loop based on the difference between the setpoint and the actual value. Adjustment of this parameter will increase or decrease the gain when a difference between the setpoint and actual value is established.

Integral - The Integral parameter determines the responsiveness of the control loop from a time standpoint. Adjustment of this parameter will cause the control loop to become more or less responsive.
Derivative - The Integral parameter determines the amount of dampening that the control loop will exhibit. Adjustment of this parameter will increase or decrease the amount of overshoot that is observed by the control loop.

Plenum Temp PID Setpoints (Will Only Affect TruDry If Re-Enabled)
The purpose of the Plenum Temp PID Values is to set the Proportional, Integral, and Derivative parameters of the Plenum Temperature PID control loop. Please note that changes to these parameters will drastically impact the operation of the dryer when controlling the plenum temperature and any settings change should only be done when instructed by Mathews Company service personnel.

On the left side, values for the Proportional, Integral, and Derivative parameters can be adjusted. On the right side you will see the mid-grain temperature setpoint and the actual mid-grain temperature. The default values for the Proportional, Integral, and Derivative parameters are recommended to be used. If fine-tune adjustments need to be made, the following explains the impact of each parameter:

Proportional - The Proportional parameter determines the gain of the control loop based on the difference between the setpoint and the actual value. Adjustment of this parameter will increase or decrease the gain when a difference between the setpoint and actual value is established.

Integral - The Integral parameter determines the responsiveness of the control loop from a time standpoint. Adjustment of this parameter will cause the control loop to become more or less responsive.

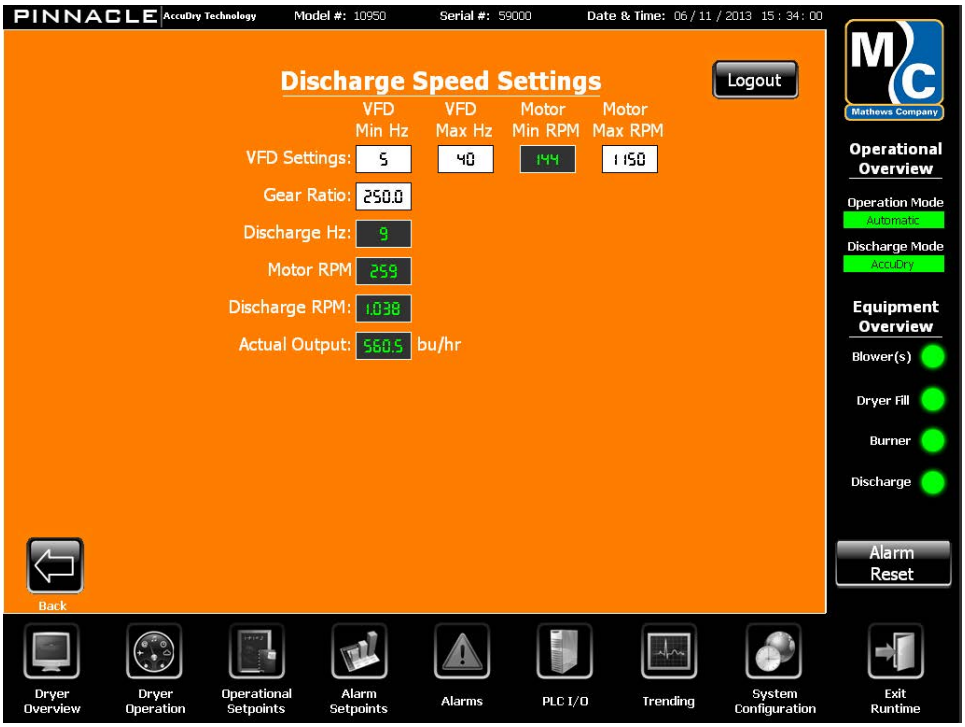
Derivative - The Integral parameter determines the amount of dampening that the control loop will exhibit. Adjustment of this parameter will increase or decrease the amount of overshoot that is observed by the control loop.

Discharge Speed Settings
On the Advanced System Configuration screen you may click the "Discharge VFD Settings" button. This button will bring you to a screen where the user may manually modify the maximum and minimum discharge rate limits. These values include;

Minimum VFD Speed
The Minimum VFD Speed setting will correlate with what has been programmed on the discharge metering VFD. This value allows for the calculation of the VFD Frequency displayed on the Discharge Speed Analog Output screen.

Maximum VFD Speed
The Maximum VFD Speed setting will correlate with what has been programmed on the discharge metering VFD. This value allows for the calculation of the VFD Frequency displayed on the Discharge Speed Analog Output screen.

Maximum Discharge Motor Speed
The Maximum Discharge Motor Speed setting will correlate with what has been programmed on the discharge metering VFD. This value allows for the calculation of the Motor Speed displayed on the Discharge Speed Analog Output screen.



AccuDry Settings

Upon clicking the AccuDry Settings button, you will initially be taken to the AccuDry Factory Settings page. This page displays the critical values for the AccuDry system to operate effectively. These values are; Garner Volume, Hot Zone Volume, Cold Zone Volume, Throughput rate, Dryer Off Rate, and Plenum Temp Off. Although these can be input manually, these values will be automatically generated by selecting a dryer model on the general "System Configuration" screen.

These values are dryer specific, and the AccuDry system uses these values to best determine the rate at which the dryer should be operating. These values also play a crucial role in how the AccuDry predicted moisture value is calculated. Although these valves can be input manually they can be automatically generated by selecting a dryer model on the general "System Configuration" screen.

This screen also provides all data being sent from the Dryer Master board to the PLC, in regards to the readiness of the AccuDry system. All values here can also be seen on the Not Ready Pop-Up screen when attempting to enter AccuDry mode if the system is Not Ready. Additionally, the DM Heart Beat indicator shows a green flashing dot, which indicates whether or not the DM board is both powered ON and communicating with the PLC.

This screen is where Mathews Company employees, and trained service technicians may manually adjust the DM sensors. This is done to alleviate the need to calibrate multiple times upon initial setup, due to the 0.5% restriction placed on normal calibration routines. The installer may simply enter the desired offset with a single touch of the button, and see the saved values in the white display fields.

This screen also displays the Analog Scale, which refers to the scaling of sensor inputs on the PLC. This can be used for installing older sensors to a Dryer Master system in certain extreme cases. Also, the installer may define the Dryer Off Rate on this screen.

This is the minimum rate at which the dryer will operate, and it is recommended to remain at 1.0%. This parameter is used to signal the DM510 that the dryer is not discharging and should not be taking any more data. If this is different than the Operational Setpoint Minimum Discharge Rate, then there is a risk that the system will be calculating dryer operations while shutdown; hurting the overall re-startup time for the next drying run.

If you wish to modify this parameter of the system it is strongly urged that you contact a Mathews Company Engineer or Mathews Company Service Technician before doing so.

Lastly, there is a field for entering the Plenum Temp Off temperature. This value is used by the DM 510 board in determining whether or not the burners are lit.

This screen also displays Beta2 values used on the algorithm inside the DM Board.

The Beta2 Value is a feedback from the sensors comparing the predicted moistures versus the actual measured values. This feedback determines how the dryer will control the discharge speed, and should not be modified.

If desired, an installer may use this field to gain access to AccuDry Mode within a series of minutes, regardless of the Dryer State. By consulting with a Mathews Company Engineer it is possible to modify the feedback such that the dryer will "Learn" at a much faster rate, and enter AccuDry much quicker than the initial start-up time of 2-3 hours.

The suggested and actual discharge rates are displayed here for real-time feedback on how the Beta2 change is affecting the system.

Section 4

Troubleshooting

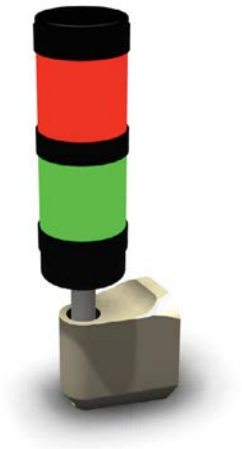
Alarms are presented to the user in three ways: (1) As pop ups when the alarm condition occurs, (2) A recorded event in the Alarms chapter, or (3) By means of the red and green stack light mounted to the High Voltage cabinet (if equipped).

Alarm Pop-Ups and History

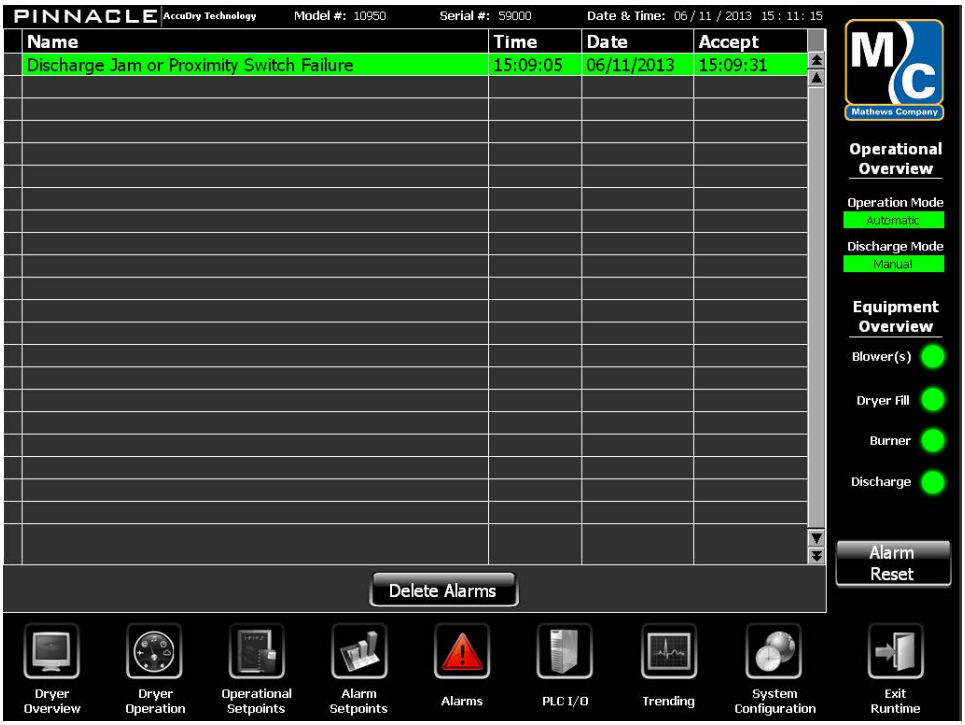
When an alarm condition occurs, a popup will appear on the screen detailing the reason for the alarm and what type of alarm it is. Press the "Accept" button to acknowledge the alarm and return to the previous screen.

To navigate to the alarm history, press the Faults icon on the bottom navigation bar. The alarm history shows a brief description of the alarm as well as the date it was recorded:

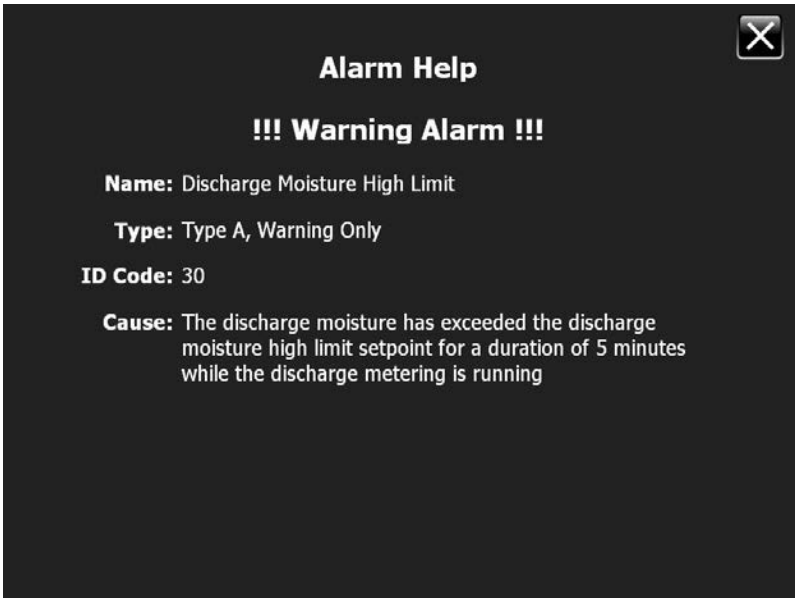
Stack Light Status (If Equipped)



Alarm Color Indication	Description
Solid Green Light	Control Power On Not Discharging
Pulsing Green Light	Dryer Is Discharging
Pulsing Green & Red Light	Dryer Is Discharging With Active Warning Alarms
Flashing Red Light	Dryer Has Shutdown



The alarms are in reverse chronological order so that the most recent alarms will always appear at the top. Alarms that have been acknowledged are shown in yellow. Alarms that have been resolved appear in green. Scroll to the right using the scroll bar or arrows to show the date/time of the alarm and the date/time that it was accepted from the initial pop up. Selecting a row from the alarm history list will pull up screen that explains the type of alarm, the ID code of the alarm and the cause of the alarm:



Alarm List

The following table summaries all of the possible alarms that can be generated by the Pinnacle Lite Control System:

Alarm Number	Alarm Name	Alarm Cause
1	Master Control Relay (MCR) De-Energized	The Master Control Relay has become de-energized due to lost power or a tripped safety circuit.
2	Linear Limit Fire Alarm	Linear Limits Circuit is Open - One of the LLC switches has opened due to high temperature.
3	High Gas Pressure	High gas pressure detected in the gas train.
6	Blower(s) Overload	Overload detected for blowers - Check motor circuit protector or soft starter if equipped.
7	Blower #1 Motor Starter	Blower #1 motor starter has experienced a fault condition.
8	Blower #1 Air Pressure	Blower #1 is not providing adequate air pressure for burner operation.
9	Blower #1 Air Pressure Switch	Blower #1 air pressure switch is indicating air pressure when the blower is not operating.
11	Blower(s) Tr-Start	One of the two contactors A or B has experienced a fault condition.
12	Blower #2 Motor Starter	Blower #2 motor starter has experienced a fault condition.
13	Blower #3 Motor Starter	Blower #3 motor starter has experienced a fault condition.

Alarm Number	Alarm Name	Alarm Cause
14	Blower #2 Air Pressure	Blower #2 is not providing adequate air pressure for burner operation.
16	Grain Fill Timeout	Infed grain fill is insufficient to maintain grain level.
18	Burner Ignition Failure	Burner failed to ignite after 3 trials.
19	Burner High Limit	Plenum temperature has reached high limit setpoint.
20	High Plenum Temperature	The plenum temperature has risen outside of the plenum temperature band.
21	False Flame	The flame sensing system has detected the presence of a flame with the burner off.
22	Low Plenum Temperature	Plenum temperature has dropped below the low limit setpoint.
23	Plenum Temperature RTD Failure	The plenum RTD input module on the PLC has detected a fault.
24	Low Gas Pressure	Low gas pressure detected in the gas train.
25	Discharge VFD	The discharge VFD has detected a fault due to a possible overload of the metering system.
26	Discharge Level	The discharge level switch is open due to a possible overload of grain or a blocked discharge takeaway system.

Alarm Number	Alarm Name	Alarm Cause
28	Discharge Jam or Proximity Switch Failure	The discharge metering system has stopped running. The proximity sensor is not detecting rotation of the metering system.
29	Dischareg Moisture Low Limit	The discharge moisture has dropped below the discharge moisture low limit setpoint for a duration of 5-mintes while the discharge metering is running.
30	Dischareg Moisture High Limit	The discharge moisture has exceeded the discharge moisture high limit setpoint for a duration of 5-mintes while the discharge metering is running.
31	Blower #3 Air Pressure	Blower #3 is not providing adequate pressure for burner operation.
33	Blower #2 Air Pressure Switch	Blower #2 air pressure switch is indicating air pressure when the blower is not operating.
34	Blower #3 Air Pressure Switch	Blower #3 air pressure switch is indicating air pressure when the blower is not operating.
35	Mid-Grain Band	The mid-grain temperature has exceeded or dropped below the mid-grain band alarm setpoint for a 30-second duration.
36	Mid-Grain Band Delay	The mid-grain temperature has exceeded or dropped below the mid-grain band alarm setpoint for the duration of the mid-grain band delay.
37	Mid-Grain Temperature Probe #1	The #1 mid-grain temperature probe has failed or become disconnected from the transmitter.
38	Mid-Grain Temperature Probe #2	The #2 mid-grain temperature probe has failed or become disconnected from the transmitter.
39	Mid-Grain Temperature Probe #3	The #3 mid-grain temperature probe has failed or become disconnected from the transmitter.

Alarm Number	Alarm Name	Alarm Cause
40	Mid-Grain Temperature Probe #4	The #4 mid-grain temperature probe has failed or become disconnected from the transmitter.
41	Mid-Grain Temperature Probe Transmitter #1	The #1 mid-grain temperature probe transmitter in the junction box has failed of become disconnected.
42	Mid-Grain Temperature Probe Transmitter #2	The #2 mid-grain temperature probe transmitter in the junction box has failed of become disconnected.
43	Mid-Grain Temperature Probe Transmitter #3	The #3 mid-grain temperature probe transmitter in the junction box has failed of become disconnected.
44	Mid-Grain Temperature Probe Transmitter #4	The #4 mid-grain temperature probe transmitter in the junction box has failed of become disconnected.
111	High Discharge Moisture	The AccuDry moisture control system has experienced high discharge moisture.
112	Critical High Discharge Moisture	The AccuDry moisture control system has experienced critical high discharge moisture.
113	High Discharge Temperature	The AccuDry moisture control system has experienced high discharge temperature.
114	Critical High Discharge Temperature	The AccuDry moisture control system has experienced critical high discharge temperature.
115	Low Discharge Moisture	The AccuDry moisture control system has experienced low discharge moisture.
116	Critical Low Discharge Moisture	The AccuDry moisture control system has experienced critical low discharge moisture.

Alarm Number	Alarm Name	Alarm Cause
117	Low Discharge Temperature	The AccuDry moisture control system has experienced low discharge temperature.
118	Critical Low Discharge Temperature	The AccuDry moisture control system has experienced critical low discharge temperature.
121	High Infeed Moisture	The AccuDry moisture control system has experienced high infeed moisture.
122	Critical High Infeed Moisture	The AccuDry moisture control system has experienced critical high infeed moisture.
123	High Infeed Temperature	The AccuDry moisture control system has experienced high infeed temperature.
124	Critical High Infeed Temperature	The AccuDry moisture control system has experienced critical high infeed temperature.
125	Low Infeed Moisture	The AccuDry moisture control system has experienced low infeed moisture.
126	Critical Low Infeed Moisture	The AccuDry moisture control system has experienced critical low infeed moisture.
127	Low Infeed Temperature	The AccuDry moisture control system has experienced low infeed temperature.
128	Critical Low Infeed Temperature	The AccuDry moisture control system has experienced critical low infeed temperature.
131	High Plenum Temperature	The AccuDry moisture control system has experienced high plenum temperature.

Alarm Number	Alarm Name	Alarm Cause
132	Critical High Plenum Temperature	The AccuDry moisture control system has experienced critical high plenum temperature.
133	Low Plenum Temperature	The AccuDry moisture control system has experienced low plenum temperature.
134	Critical Low Plenum Temperature	The AccuDry moisture control system has experienced critical low plenum temperature.
135	Dryer OFF	The AccuDry moisture control system has determined that the dryer is off.
141	High Discharge Speed	The AccuDry moisture control system has experienced high discharge speed.
142	Critical High Discharge Speed	The AccuDry moisture control system has experienced critical high discharge speed.
143	Low Discharge Speed	The AccuDry moisture control system has experienced low discharge speed.
144	Critical Low Discharge Speed	The AccuDry moisture control system has experienced critical low discharge speed.

Section 5

Notes