Red Board System Manual

As of version 00.01.29
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IMPORTANT INFORMATION

Please read this manual in its entirety before using the Red Board System (RBS) for the first time. This manual contains important information regarding the installation, setup and use of the RBS that should not be ignored. Failure to adhere to these important guidelines can result in property damage, serious bodily injury, and even death.

⚠ WARNING ⚠

Before operating the Red Board System, it is imperative that the following safety and operational guidelines are followed:

(1) Follow ALL instructions, guidelines, and warnings in the Red Board System operating manual and installation manual. The most up-to-date operating/installation manuals can be found online at www.redboardsystems.com.

(2) Follow ALL instructions, guidelines, and warnings (regarding safety and otherwise) in the Original Equipment Manufacturer's Dryer Manual and associated materials. This includes limits on grain drying temperatures and other parameters, as well as safety protocols when servicing the Dryer.

(3) Do NOT run the Red Board System and/or Dryer unattended.

(4) Do NOT bypass or otherwise disable any inputs or outputs on the Dryer or Dryer Panel. Specifically, among other things, do NOT bypass any safety circuits.

System Operation

Installation Checklist

Make sure the Red Board System is correctly installed per the included instructions. Of special importance are **making sure the Louver and Piston Sampler (if applicable) are correctly wired as per the installation instructions.**

The hardware installation instructions can be found at **https://www.redboardsystems.com/downloads/Red_Board_System_Install_v3.pdf .**

Pre-Operation Checklist

- Please go through ALL settings and Drying Config options to make sure everything is correct.

  Of special importance:
  - If applicable, make sure the Load On/Off Delay for SQ Dryers is correct. Failure to set this value to an appropriate setting could cause permanent damage to the Dryer and/or Loading equipment.
  - If applicable, make sure the Louver is set as "Installed" at *Dryer Config* ⇨ *Options Config* ⇨ *Motorized Louver*. Failure to set this value to an appropriate setting could cause permanent damage to the Dryer.
  - If applicable, make sure there is an appropriate Louver % Open value set at *Settings* ⇨ *Louver* ⇨ *Louver - Percent Open (Manual)*. Failure to set this value to an appropriate setting could cause permanent damage to the Dryer.
  - If applicable, make sure the Piston Sampler Extend and Retract times are correct under *Dryer Config* ⇨ *Piston Sampler*. Failure to set these values to appropriate settings could cause damage to the Piston Sampler and/or result in bad moisture readings.

- **Note:** Please do not alter or change any settings or configurations in the Dryer Config screen while the Dryer is running. This will result in unpredictable behavior.

- **Note:** To access the Dryer Config menu, press on the red (Outlet/Dry) moisture or temperature numbers on the Dashboard 5 times within 5 seconds.

Manual Operation

General steps to start the Dryer in **Manual Mode**:

Prerequisites

(1) Make sure the Red Box, Dryer Panel and User Interface are powered on.
(2) Make sure the Settings and Dryer Config are set up properly for your Dryer.
(3) Make sure the desired functions are enabled or disabled on the Enables screen of the User Interface.
(4) Make sure *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Manual or Automatic* is set to "Manual" on the User Interface.

Step 1: Press the START button on the User Interface.
Step 2: Acknowledge and respond to any modal screens that pop up (such as the "INFORMATION" dialog).
Step 3: Press the START button on the Dryer Panel.

If enabled, the Fan(s) will turn on, and the Burner will light (in the manner prescribed by the Honeywell Flame Pack, or the BASO with Flame Relay, depending on which is selected as the **Pilot Flame Control Option**). Then, if enabled, the Load and Unload will each turn on accordingly.

If all the proper functions are enabled, the Dryer will now dry grain at the temperature provided by *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and at the unload rate provided by *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*.

Automatic Operation

General steps to start the Dryer in **Automatic Mode**:

Prerequisites

(1) Make sure the Red Box, Dryer Panel and User Interface are powered on.
(2) Make sure the Settings and Dryer Config are set up properly for your Dryer.
(3) Make sure the proper functions are enabled or disabled on the Enables screen of the User Interface.
(4) Make sure *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Manual or Automatic* is set to "Automatic" on the User Interface, and that the **Automatic Mode** and **Drying Method** under the same menu are set for the desired operating mode/method.

Step 1: Press the START button on the User Interface.
Step 2: Acknowledge and respond to any modal screens that pop up (such as the "INFORMATION" dialog).
Step 3: Press the START button on the Dryer Panel.

If enabled, the Fan(s) will turn on, and the Burner will light (in the manner prescribed by the Honeywell Flame Pack, or the BASO with Flame Relay, depending on which is selected as the **Pilot Flame Control Option**). Then, if enabled, the Load and Unload will each turn on accordingly per the Automatic Mode and Method set.

If all the proper functions are enabled, the Dryer will now begin drying grain at the temperature and unload rate determined by the Automatic Mode/Method.

Automatic Modes

Moisture Based

Continuous Flow - Full Heat

This mode will apply a constant plenum temperature and unload rate during the first dryer pass, while the dryer collects data. The plenum temperature will be set to the value at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and the unload rate will be set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*. This drying mode assumes there is heat applied to the grain for the entire duration the grain is in the dryer.

After the first dryer pass, the Dryer will dynamically adjust the plenum temperature and unload rate after each dryer segment (1/32nd of a dryer pass), based on the collected data, depending on the Automatic (Moisture) Algorithm found at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Automatic (Moisture) Algorithm*. The collected data is continuously updated as moisture sensor and other data is measured.

Continuous Flow - Heat/Cool

This mode will apply a constant plenum temperature and unload rate during the first dryer pass, while the dryer collects data. The plenum temperature will be set to the value at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and the unload rate will be set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*. This drying mode assumes there is heat applied to the grain for a portion of the duration the grain is in the dryer, while the other portion is a cooldown period for the grain.

After the first dryer pass, the Dryer will dynamically adjust the plenum temperature and unload rate after each dryer segment (1/32nd of a dryer pass), based on the collected data, depending on the Automatic (Moisture) Algorithm found at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Automatic (Moisture) Algorithm*. The collected data is continuously updated as moisture sensor and other data is measured.

Temperature Based

Continuous Flow - AMC-T

This mode will adjust the unload rate based on the AMC-T temperature value, while keeping the plenum temperature at the value set at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*.

Baseline speed: When the absolute value of (AMC-T Target - AMC-T temperature) is less than the value at *Dryer Config* ⇨ *AMC-T Continuous Flow Settings* ⇨ *Low °F Delta Threshold (from AMC-T Target)*, then the unload rate will be at the value set at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*. This is the "Baseline"

speed, and is denoted by a "[B]" next to the unload rate on the Dashboard.

Low speed: When the value of (AMC-T Target - AMC-T temperature) is greater than or equal to the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ Low °F Delta Threshold (from AMC-T Target)* and less than the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ High °F Delta Threshold (from AMC-T Target)*, then the unload rate will be the value set at *Settings ⇨ Unload ⇨ Manual Unload Rate* minus the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ Low % Unload Rate Change (from Baseline)*. This is the "Low" speed, and is denoted by an "[L]" next to the unload rate on the Dashboard.

Low-Low speed: When the value of (AMC-T Target - AMC-T temperature) is greater than or equal to the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ High °F Delta Threshold (from AMC-T Target)*, then the unload rate will be the value set at *Settings ⇨ Unload ⇨ Manual Unload Rate* minus the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ High % Unload Rate Change (from Baseline)*. This is the "Low-Low" speed, and is denoted by an "[LL]" next to the unload rate on the Dashboard.

High speed: When the value of (AMC-T temperature - AMC-T Target) is greater than or equal to the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ Low °F Delta Threshold (from AMC-T Target)* and less than the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ High °F Delta Threshold (from AMC-T Target)*, then the unload rate will be the value set at *Settings ⇨ Unload ⇨ Manual Unload Rate* plus the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ Low % Unload Rate Change (from Baseline)*. This is the "High" speed, and is denoted by an "[H]" next to the unload rate on the Dashboard.

High-High speed: When the value of (AMC-T temperature - AMC-T Target) is greater than or equal to the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ High °F Delta Threshold (from AMC-T Target)*, then the unload rate will be the value set at *Settings ⇨ Unload ⇨ Manual Unload Rate* plus the value set at *Dryer Config ⇨ AMC-T Continuous Flow Settings ⇨ High % Unload Rate Change (from Baseline)*. This is the "High-High" speed, and is denoted by an "[HH]" next to the unload rate on the Dashboard.

Batch Mode Based

Batch Mode - Full Heat

This mode will apply full heat (at a constant temperature) for a given period of time to batches of grain. Each batch cycle comprises a drying phase and a loading/unloading phase.

For the drying phase, the full heat temperature is the value set at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, while the drying time is the value set at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Batch Drying Time*.

After the drying phase is completed, then the load/unload phase is activated. Note that the Burner stays activated during this time. The time for this phase is determined as a calculation of the Minutes To Unload value set at *Settings* ⇨ *Unload* ⇨ *Minutes To Unload Value*, the unload rate value set at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*, and the value set at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Batch Amount To Unload*. The unload rate is set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*.

After the unload timer is expired, then the process starts over with a drying phase.

Batch Mode - Heat/Cool

This mode will apply heat (at a constant temperature) for a given period of time, followed by a cooling phase, and then a loading/unloading phase.

For the drying phase, the temperature is the value set at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, while the drying time is the value set at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Batch Drying Time*.

For the cooling phase, the cooling time is the value set at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Batch Drying Time*. During this phase, the burner is turned off.

After the cooling phase timer expires, the load/unload phase is activated. Note that the Burner stays off during this time. The time for this phase is determined as a calculation of the Minutes To Unload value set at *Settings* ⇨ *Unload* ⇨ *Minutes To Unload Value*, the unload rate value set at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*, and the value set at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Batch Amount To Unload*. The unload rate is set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*.

After the unload timer is expired, then the process starts over with a drying phase.

Batch Mode - AMC-T

This mode will apply full heat (at a constant temperature) to batches of grain until the AMC-T temperature value meets or exceeds a given value set at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *AMC-T Target Setpoint*.

After the given AMC-T temperature value is met, the load/unload phase is activated. Note that during this time, the Burner stays activated. The time for this phase is determined as a calculation of the Minutes To Unload value set at *Settings* ⇨ *Unload* ⇨ *Minutes To Unload Value*, the unload rate value set at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*, and the value set at *Settings* ⇨ *Grain Type / Drying Mode* ⇨ *Batch Amount To Unload*. The unload rate is set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*.

Red Board System Settings

Settings

Grain Type / Drying Mode

Grain Type

Options:

Corn / Corn (waxy) / Soybeans / Wheat (red) / Wheat (white) / Milo / Rice / Oats / Barley / Canola / Sunflower / Flax / Rye / Other

It is important to choose the correct grain type for the commodity being dried. This option affects, among other things, the moisture sensor calculations.

Note: As of this version, Settings and Dryer Configuration parameters are not saved according to the Grain Type selected. In other words, if the Grain Type is changed, then any relevant Settings and/or Dryer Configuration must be changed if they differ from the previous settings/configuration.

Manual or Automatic

Options:

Manual / Automatic

When **Manual** is selected, then all Settings below it (except for AMC-T Target Setpoint) are greyed out, since the Dryer will be run in Manual.

When **Automatic** is selected, then the appropriate settings are enabled, depending on the "Automatic Mode" and "Drying Method" selected.

Note: If the user desires to switch between Manual Mode and a given Automatic Mode while the Dryer is running, then the Automatic Mode must be selected prior to switching to the Automatic Mode (i.e., while still in Manual Mode). Once the Dryer is started in Automatic, the Automatic Mode cannot be changed until the dryer is put into Manual Mode again.

Automatic Mode

Options:

Moisture Based / Temperature Based* / Batch Mode Based

When **Moisture Based** is selected, then the Drying Methods of **Continuous Flow - Full Heat** and **Continuous Flow - Heat/Cool** are available.

When **Temperature Based** is selected, then the Drying Method of **Continuous Flow - AMC-T** is available.

When Batch Mode Based is selected, then the Drying Methods of **Batch Mode - Full Heat**, **Batch Mode - Heat/Cool** and **Batch Mode - AMC-T*** are available.

***Note:** **Temperature Based** and **Batch Mode - AMC-T** options are available only if the AMC-T Probe is "Installed" under *Dryer Config* ⇨ *Options Config* ⇨ *AMC-T Probe*.

Drying Method

Options (Depending on Automatic Mode):
(Moisture Based) Continuous Flow - Full Heat /
(Moisture Based) Continuous Flow - Heat/Cool /
(Temperature Based) Continuous Flow - AMC-T /
(Batch Mode Based) Batch Mode - Full Heat /
(Batch Mode Based) Batch Mode - Heat/Cool /
(Batch Mode Based) Batch Mode - AMC-T

When **Continuous Flow - Full Heat** is selected, then the Dryer will operate in this mode when running and the "Manual or Automatic" Setting is set to Automatic.

When **Continuous Flow - Heat/Cool** is selected, then the Dryer will operate in this mode when running and the "Manual or Automatic" Setting is set to Automatic.

When **Continuous Flow - AMC-T** is selected, then the Dryer will operate in this mode when running and the "Manual or Automatic" Setting is set to Automatic.

When **Batch Mode - Full Heat** is selected, then the Dryer will operate in this mode when running and the "Manual or Automatic" Setting is set to Automatic.

When **Batch Mode - Heat/Cool** is selected, then the Dryer will operate in this mode when running and the "Manual or Automatic" Setting is set to Automatic.

When **Batch Mode - AMC-T** is selected, then the Dryer will operate in this mode when running and the "Manual or Automatic" Setting is set to Automatic.

Automatic (Moisture) Algorithm

Options:
Normal Mode / Capacity Mode

When **Normal Mode** is selected, the plenum temperature will be set to the value at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and the unload rate will be set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*.

After the first dryer pass, the Dryer will dynamically adjust the plenum temperature and unload rate after each dryer segment (1/32nd of a dryer pass), based on the collected data. The collected data is continuously updated as moisture sensor and other data is measured.

When **Capacity Mode** is selected, for the first dryer pass, the plenum temperature will be set to the value at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and the unload rate will be set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*. This allows the Dryer to gather data for the first entire dryer pass before making adjustments to the Plenum Temperature and Unload Rate.

After the first dryer pass, the Capacity Mode algorithm will set the Unload Rate to the maximum Unload Rate allowed by the value at *Settings* ⇨ *Moisture Based Continuous Flow Settings* [FH or HC] ⇨ *Unload Rate Upper Rail*. Then the Plenum Temperature is set with respect to the current Unload Rate, Drying Factor, Target Setpoint, and the temperature boundaries set by the values at *Settings* ⇨ *Moisture Based Continuous Flow Settings* [FH or HC] ⇨ *Plenum Temp Lower Rail* and *Settings* ⇨ *Moisture Based Continuous Flow Settings* [FH or HC] ⇨ *Plenum Temp Upper Rail.*

If the Plenum Temperature cannot be set within the boundaries set by the Plenum Temperature Upper and Lower Rails, then the Unload Rate will be adjusted (e.g., lowered) to account for this, and the Plenum Temperature will be set within the appropriate range. If it is not possible to adjust both the Unload Rate and Plenum Temperature to values within range of the corresponding Rails, then a warning dialog will pop up on the screen.

Minutes To Unload Value

This is the number of minutes it takes to unload the dryer completely at 100% Unload Rate. Note that this value must be correct in order for the Automatic Modes/Algorithms to work correctly.

Batch Amount To Unload

This is the percentage of the Dryer Capacity to unload between batches.

Batch Drying Time

This is the time, in minutes, that the Dryer will apply heat to the batch load before either unloading or cooling down (depending on whether it's in **Batch Mode - Full Heat** or **Batch Mode - Heat / Cool**, respectively).

Batch Cooling Time

This is the time, in minutes, that the Dryer will hold a batch load without applying heat (after the **Batch Drying Time** in **Batch Mode - Heat/Cool**, or after the AMC-T Probe reaches the **AMC-T Target Setpoint** in **Batch Mode - AMC-T**).

AMC-T Target Setpoint

This is the temperature setpoint, in °F, that the AMC-T Probe must reach during the drying phase of **Batch Mode - AMC-T** before going into the cooling phase.

Moisture Based Continuous Flow Settings (Full Heat)

Auto-Flush Unload Rate

This is the metering speed, as a percentage, at which the unload will run during the **Auto-Flush Time** for **Continuous Flow - Full Heat** mode.

Auto-Flush Time

This is the time, in minutes, during which the Dryer will flush (i.e., unload) grain before starting the first dryer pass.

Target Moisture

This is the target moisture percentage for the automatic algorithm. The goal is to dry the grain to get as close to this **Target Moisture** as possible coming out of the Dryer.

Minutes To Unload Value

This is the number of minutes it takes to unload the dryer completely at 100% Unload Rate. Note that this value must be correct in order for the Automatic Modes/Algorithms to work correctly.

Auto Moisture Mode: Plenum Temp Lower Rail

This is the plenum temperature, in °F, below which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will increase the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Plenum Temp Upper Rail

This is the plenum temperature, in °F, above which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will decrease the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Lower Rail

This is the metering speed, as a percentage, below which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will increase the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Upper Rail

This is the metering speed, as a percentage, above which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will decrease the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Reset Drying Factor?

This function will reset the global Drying Factor and initialize it to the calculated Drying Factor for the next outgoing Segment.

Note: This may be useful in situations where environmental conditions or other factors have changed substantially over time (such as, for example, by starting the Dryer the morning after a rainstorm).

Purge ALL Segment Data (including Drying Factor)?

This function will reset the global Drying Factor and all collected Dryer Segment data. This will cause the Dryer to run another full Dryer Pass before recalculating the automatic setpoints. Thus, the plenum temperature will be set to the value at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and the unload rate will be set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate* for the duration of the Dryer Pass.

Note: This effectively causes the Automatic Algorithm to "start over" with new data. Thus, this may be useful when the user wants to reset the Drying Factor and related parameters without having to restart the Dryer.

Moisture Based Continuous Flow Settings (Heat/Cool)

Auto-Flush Unload Rate

This is the metering speed, as a percentage, at which the unload will run during the **Auto-Flush Time** for **Continuous Flow - Full Heat** mode.

Auto-Flush Time

This is the time, in minutes, during which the Dryer will flush (i.e., unload) grain before starting the first dryer pass.

Target Moisture

This is the target moisture percentage for the automatic algorithm. The goal is to dry the grain to get as close to this **Target Moisture** as possible coming out of the Dryer.

Minutes To Unload Value

This is the number of minutes it takes to unload the dryer completely at 100% Unload Rate. Note that this value must be correct in order for the Automatic Modes/Algorithms to work correctly.

Auto Moisture Mode: Plenum Temp Lower Rail

This is the plenum temperature, in °F, below which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will increase the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Plenum Temp Upper Rail

This is the plenum temperature, in °F, above which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will decrease the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Lower Rail

This is the metering speed, as a percentage, below which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will increase the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Upper Rail

This is the metering speed, as a percentage, above which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will decrease the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Reset Drying Factor?

This function will reset the global Drying Factor and initialize it to the calculated Drying Factor for the next outgoing Segment.

Note: This may be useful in situations where environmental conditions or other factors have changed substantially over time (such as, for example, by starting the Dryer the morning after a rainstorm).

Purge ALL Segment Data (including Drying Factor)?

This function will reset the global Drying Factor and all collected Dryer Segment data. This will cause the Dryer to run another full Dryer Pass before recalculating the automatic setpoints. Thus, the plenum temperature will be set to the value at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and the unload rate will be set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate* for the duration of the Dryer Pass.

Note: This effectively causes the Automatic Algorithm to "start over" with new data. Thus, this may be useful when the user wants to reset the Drying Factor and related parameters without having to restart the Dryer.

Load

Load Enable

This setting enables or disables the Load on the Dryer.

Load On Delay

This is the delay, in seconds, that the Load waits before activating when an event triggers the Load to be on.

Load Off Delay

This is the delay, in seconds, that the Load waits before deactivating when an event triggers the Load to be off.

Note: If the **Load Enable** setting is disabled while the Load is on, then the Load will turn off immediately, without regard to the **Load Off Delay** setting.

Fans

Fan Enable

This setting enables or disables the Fan(s) on the Dryer.

Burner

Burner Enable

This setting enables or disables the Burner on the Dryer.

Manual Plenum Temperature

This is the temperature, in °F, at which the Plenum Temperature Setpoint is set while drying in Manual Mode.

Note: This setting is also used in various other modes, such as **Continuous Flow - Full Heat** and **Continuous Flow - Heat/Cool,** during the first dryer pass.

Max Plenum Temperature (Setpoint)

This is the maximum temperature, in °F, that the **Manual Plenum Temperature** setting can be set to.

Note: This value is not used to trigger Alarms. Rather, it is only used to determine the maximum plenum temperature setpoint.

Burner Cycle Timer (On/Off)

This is the number of seconds (out of 15) that the Burner is on during each 15 second interval of the Burner Cycle Timer (BCT).

Note: The BCT time will be displayed as "x/n Seconds", wherein 'x' represents the on time of the cycle, and 'n' represents the off time of the cycle.

Auto Moisture Mode: Plenum Temp Lower Rail

This is the plenum temperature, in °F, below which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will increase the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Plenum Temp Upper Rail

This is the plenum temperature, in °F, above which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will decrease the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Unload

Unload Enable

This setting enables or disables the Metering System on the Dryer.

Manual Unload Rate

This is the metering speed, as a percentage, at which the Unload Rate is set while drying in Manual Mode.

Note: This setting is also used in various other modes, such as **Continuous Flow - Full Heat** and **Continuous Flow - Heat/Cool,** during the first dryer pass.

Max Unload Rate

This is the maximum metering speed, as a percentage, that the **Manual Unload Rate** setting can be set to.

Clean Out (Aux Unload) On Delay

This is the delay, in seconds, that the Aux Unload waits before activating when an event triggers the Aux Unload to be on.

Clean Out (Aux Unload) Off Delay

This is the delay, in seconds, that the Aux Unload waits before deactivating when an event triggers the Aux Unload to be off.

Minutes To Unload Value

This is the number of minutes it takes to unload the dryer completely at 100% Unload Rate. Note that this value must be correct in order for the Automatic Modes/Algorithms to work correctly.

Auto Moisture Mode: Unload Rate Lower Rail

This is the metering speed, as a percentage, below which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will increase the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Upper Rail

This is the metering speed, as a percentage, above which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will decrease the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Alarms

Auto Algorithm Outside Rails

This setting enables or disables the Auto Algorithm Outside Rails alarm. If this setting is enabled, then if any mode of the Automatic Algorithms determines that the Unload Rate and Plenum

Temperature should be set to values outside the range of the corresponding Rails, then this Alarm will happen.

Dirty Heat Zone Alarm (After Burner On)

This setting enables or disables the Dirty Heat Zone Alarm after the lighting of the Burner is completed.

Note: Dirty Heat Zone Alarms that occur during the process of lighting the Burner cannot be disabled. Only Dirty Heat Zone Alarms that occur after the Burner is lit can be disabled.

Note: When *Dryer Config* ⇨ *Pilot / Burner Controls* ⇨ *Pressure Gauge Type* is **Dwyer Photohelic**:

This alarm is triggered when (1) this setting is set to Enabled, (2) the Burner status is Enabled / ON, and (3) the Dirty Heat Zone input becomes active.

Note: When *Dryer Config* ⇨ *Pilot / Burner Controls* ⇨ *Pressure Gauge Type* is **QPM 2**:

This alarm is triggered when (1) this setting is set to Enabled, (2) the Burner status is Enabled/ ON, and (3) the Plenum Air Pressure is greater than the *Dryer Config* ⇨ *Limits* ⇨ *Pressure Upper Limit* setting.

Exit Grain Temp Too High Alarm

This setting enables or disables the Exit Grain Temp Too High Alarm.

Note: If enabled, this alarm is triggered when the Exit Grain Temperature exceeds the value set at *Settings* ⇨ *Limits* ⇨ *Exit Grain Temperature Limit High*.

Inlet Sensor (Lost Comm) Alarm

This setting enables or disables the Inlet Sensor (Lost Communication) Alarm.

Note: If enabled, this alarm is triggered when the Red Board loses communication with the Inlet Moisture Sensor for more than 2.0 - 2.5 seconds.

Metering System Timeout Alarm

This setting enables or disables the Metering System Timeout Alarm.

Note: If enabled, this alarm is triggered when the Metering System is not detected for a period of time greater than the value set at *Settings* ⇨ *Timers* ⇨ *Metering Sys Timeout*.

Outlet Moisture Above High Limit Alarm

This setting enables or disables the Outlet Moisture Above High Limit Alarm.

Note: If enabled, this alarm is triggered when the Outlet Moisture Sensor detects a moisture % greater than the value set at *Settings* ⇨ *Limits* ⇨ *Moisture Limit High*.

Outlet Moisture Below Low Limit Alarm

This setting enables or disables the Outlet Moisture Below Low Limit Alarm.

Note: If enabled, this alarm is triggered when the Outlet Moisture Sensor detects a moisture % less than the value set at *Settings* ⇨ *Limits* ⇨ *Moisture Limit Low*.

Outlet Sensor (Lost Comm) Alarm

This setting enables or disables the Outlet Sensor (Lost Communication) Alarm.

Note: If enabled, this alarm is triggered when the Red Board loses communication with the Outlet Moisture Sensor for more than 2.0 - 2.5 seconds.

Plenum Temp Too High Alarm

This setting enables or disables the Plenum Temp Too High Alarm.

Note: If enabled, this alarm is triggered when the Plenum Temperature is greater than the value set at *Settings* ⇨ *Limits* ⇨ *Plenum Temperature Limit High*.

Plenum Temp Too Low Alarm

This setting enables or disables the Plenum Temp Too Low Alarm.

Note: If enabled, this alarm is triggered when the Plenum Temperature is less than the value set at *Settings* ⇨ *Limits* ⇨ *Plenum Temperature Limit Low.*

Startup Plenum Temp Not Achieved Alarm

This setting enables or disables the Startup Plenum Temp Not Achieved Alarm.

Note: If enabled, this alarm is triggered when the Plenum Temperature does not reach or exceed the value set at *Settings* ⇨ *Limits* ⇨ *Startup Plenum Temperature* Low within the timeframe set at *Dryer Config* ⇨ *Limits* ⇨ *Plenum Startup Temp Time*.

Unload Pressure Switch On Alarm

This setting enables or disables the Unload Pressure Switch On Alarm.

Note: If enabled, this alarm is triggered when the Unload Pressure Switch is activated while the Unload is Enabled / On.

Wet Grain Timeout Alarm

This setting enables or disables the Wet Grain Timeout Alarm.

Note: If enabled, this alarm is triggered when the Low Grain Switch and/or the Rear Low Grain Switch are activated for a period of time greater than the value set at *Settings* ⇨ *Timers* ⇨ *Wet Grain Timer*.

Wet Moisture % < Dry Low Limit Alarm

This setting enables or disables the Wet Moisture % < Dry Low Limit Alarm.

Note: If enabled, this alarm is triggered when the Inlet Moisture Sensor reading is less than the Dry Low Limit set at *Settings* ⇨ *Limits* ⇨ *Moisture Limit Low*.

Timers

Load On Delay

This is the delay, in seconds, that the Load waits before activating when an event triggers the Load to be on.

Load Off Delay

This is the delay, in seconds, that the Load waits before deactivating when an event triggers the Load to be off.

Note: If the **Load Enable** setting is disabled while the Load is on, then the Load will turn off immediately, without regard to the **Load Off Delay** setting.

Wet Grain Timer

This setting is the length of time, in minutes, for the Wet Grain Timer.

Cooldown Time

This setting is the length of time, in minutes, for the Cooldown Timer.

Minor Alarm Time

This setting is the length of time, in minutes, for the Minor Alarm Timer.

Hold/Resume Time

This setting is the length of time, in minutes, for the Hold/Resume Timer.

Clean Out (Aux Unload) On Delay

This is the delay, in seconds, that the Aux Unload waits before activating when an event triggers the Aux Unload to be on.

Clean Out (Aux Unload) Off Delay

This is the delay, in seconds, that the Aux Unload waits before deactivating when an event triggers the Aux Unload to be off.

Metering Sys Timeout

This setting is the maximum amount of time, in seconds, that the Metering System can go undetected without causing a Minor Alarm.

Burner Cycle Timer (On/Off)

This is the number of seconds (out of 15) that the Burner is <u>on</u> during each 15 second interval of the Burner Cycle Timer (BCT).

Note: The BCT time will be displayed as "x/n Seconds", wherein 'x' represents the on time of the cycle, and 'n' represents the off time of the cycle.

Delay for Unload Alarms (After Unload On)

This is the delay, in seconds, that must pass after the Unload is turned on before certain Minor Alarms will activate. The three minor alarms are: (1) Outlet Moisture Above High Limit Alarm, (2) Outlet Moisture Below Low Limit Alarm, and (3) Wet Moisture % < Dry Low Limit Alarm.

(Alarm) Limits

Exit Grain Temperature Limit High

This setting is the maximum temperature, in °F, above which a temperature reading from the Outlet Moisture Sensor will cause a Minor Alarm.

Plenum Temperature Limit High

This setting is the maximum temperature, in °F, above which a Plenum Temperature reading will cause a Minor Alarm.

Plenum Temperature Limit Low

This setting is the minimum temperature, in °F, below which a Plenum Temperature reading will cause a Minor Alarm.

Startup Plenum Temperature Low

This setting is the minimum temperature, in °F, which the Plenum Temperature must reach within the time period given by *Dryer Config* ⇨ *Limits* ⇨ *Plenum Startup Temp Time*. If this minimum temperature is not reached in the given time, then a Minor Alarm will be activated.

Moisture Limit High

This setting is the maximum moisture, in %, above which a reading by the Outlet Moisture Sensor will cause a Minor Alarm.

Moisture Limit Low

This setting is the minimum moisture, in %, below which a reading by the Outlet Moisture Sensor will cause a Minor Alarm.

Pressure Lower Limit

This setting is the lower limit, in "W.C., below which a Low Air Flow Minor Alarm will trigger, which will also, in turn, cause a No Baso Pilot Flame Minor Alarm and a Cooldown if the Burner was lit.

Pressure Upper Limit

This setting is the upper limit, in "W.C., above which a Dirty Heat Zone Minor Alarm will trigger.

Louver

Louver - Percent Open (Manual)

This setting is the percentage that an installed Louver will be opened upon starting the Dryer.

Note: For a Louver to be recognized by the Red Board System, it must be wired correctly per the installation instructions, and it must be configured as "Installed" in the software at *Dryer Config* ⇨ *Options Config* ⇨ *Motorized Louver*. Failure to properly install and configure the Louver could result in damage to the Dryer.

Calibration Offsets

Inlet Moisture Sensor Offset

This setting is the actual offset, in %, that will be applied to the Inlet Moisture Sensor moisture reading.

Inlet Temperature Sensor Offset

This setting is the actual offset, in °F, that will be applied to the Inlet Moisture Sensor temperature reading.

Outlet Moisture Sensor Offset

This setting is the actual offset, in %, that will be applied to the Outlet Moisture Sensor moisture reading.

Outlet Temperature Sensor Offset

This setting is the actual offset, in °F, that will be applied to the Outlet Moisture Sensor temperature reading.

Plenum Temperature Sensor Offset

This setting is the actual offset, in °F, that will be applied to the Plenum Temperature reading.

AMC-T Temperature Sensor Offset

This setting is the actual offset, in °F, that will be applied to the AMC-T Probe temperature reading.

Plenum Pressure Offset

This setting is the actual offset, in "W.C., that will be applied to the Plenum Air Pressure reading.

Date/Time

Hour

This setting is the hour of the day, as a number (0-23).

Note: The AM hours are represented by numbers 0 through 11, and the PM hours are represented by numbers 12 through 23.

Examples:

HH:MM:SS
12:07:53AM would have an Hour value of 0.
1:00:42AM would have an Hour value of 1.
12:15:12PM would have an Hour value of 12.
1:27:33PM would have an Hour value of 13.
7:57:08PM would have an Hour value of 19.

Minute

This setting is the minute of the hour, as a number (0-59).

Examples:

HH:MM:SS
12:07:53AM would have a Minute value of 7.
1:00:42AM would have a Minute value of 0.
12:15:12PM would have a Minute value of 15.
1:27:33PM would have a Minute value of 27.
7:57:08PM would have a Minute value of 57.

Second

This setting is the second of the minute, as a number (0-59).

Examples:

HH:MM:SS
12:07:53AM would have a Second value of 53.
1:00:42AM would have a Second value of 42.
12:15:12PM would have a Second value of 12.
1:27:33PM would have a Second value of 33.
7:57:08PM would have a Second value of 8.

Month

This setting is the month of the year, as a number (1-12).

Examples:

June 6, 2021	would have a Month value of 6.
January 2, 2032	would have a Month value of 1.
March 13, 2025	would have a Month value of 3.
August 31, 2027	would have a Month value of 8.
December 25, 2099	would have a Month value of 12.

Day

This setting is the day of the month, as a number (1-31).

Examples:

June 6, 2021	would have a Day value of 6.
January 2, 2032	would have a Day value of 2.
March 13, 2025	would have a Day value of 13.
August 31, 2027	would have a Day value of 31.
December 25, 2099	would have a Day value of 25.

Year

This setting is the year, as a number (2020-2100).

Examples:

June 6, 2021	would have a Year value of 2021.
January 2, 2032	would have a Year value of 2032.
March 13, 2025	would have a Year value of 2025.
August 31, 2027	would have a Year value of 2027.
December 25, 2099	would have a Year value of 2099.

Time Zone

This setting is the time zone in which the Red Box is located. This assists in automatically setting the correct time when the Red Box is connected to the Internet.

Text Messaging

Text Messaging

This setting enables or disables the text messaging functionality of the Red Box. Note that even if individual alarms are enabled, this setting must also be enabled in order for text messaging to work.

Text Messaging: Minor Alarm Enables

Pressing the "Show" button will display a list of all the Minor Alarms that can be Enabled or Disabled for text messaging. Note that upon installation, these settings are all initialized to Disabled to avoid nuisance text messages.

Phone/Messaging Number(s) 1-3

These are the mobile phone numbers to which text messages will be sent. Each phone number is a 10-digit number, including the area code. To clear a phone number, enter the number "0".

Send Test Text Message(s)

If Text Messaging is Enabled at *Settings* ⇨ *Text Messaging* ⇨ *Text Messaging*, the "Send Test" button will send a test message text to each mobile phone number identified by *Settings* ⇨ *Text Messaging* ⇨ *Phone/Messaging Number [1-3]*.

Other

Grain Type

Options:

Corn / Corn (waxy) / Soybeans / Wheat (red) / Wheat (white) / Milo / Rice / Oats / Barley / Canola / Sunflower / Flax / Rye / Other

It is important to choose the correct grain type for the commodity being dried. This option affects, among other things, the moisture sensor calculations.

Note: As of this version, Settings and Dryer Configuration parameters are <u>not</u> saved according to the Grain Type selected. In other words, if the Grain Type is changed, then any relevant Settings and/or Dryer Configuration must be changed if they differ from the previous settings/configuration.

License Number

This setting is the License Number for the Red Box of the Red Board System.

Note: The License Number can be found on a sticker on the back of the Red Box. As of this version, the License Number must be re-entered after every update of the Red Box software (i.e., it is not remembered between updates).

Red Board System Dryer Config Menu

Dryer Config

Note: Please do not alter or change any settings or configurations in the Dryer Config screen while the Dryer is running. This will result in unpredictable behavior.

Note: To access the Dryer Config menu, press on the red (Outlet/Dry) moisture or temperature numbers on the Dashboard 5 times within 5 seconds.

Options Config

Aux Unload

This setting indicates to the Red Board System whether an Aux Unload is Installed or Not Installed.

Motorized Louver

This setting indicates to the Red Board System whether a Motorized Louver is Installed or Not Installed.

Sweep Auger

This setting indicates to the Red Board System whether a Sweep Auger is Installed or Not Installed.

Piston Sampler

This setting indicates to the Red Board System whether a Piston Sampler is Installed or Not Installed.

AMC-T Probe

This setting indicates to the Red Board System whether an AMC-T Probe is Installed or Not Installed.

Limits

Pressure Lower Limit

This setting is the lower limit, in "W.C., below which a Low Air Flow Minor Alarm will trigger, which will also, in turn, cause a No Baso Pilot Flame Minor Alarm and a Cooldown if the Burner was lit.

Pressure Upper Limit

This setting is the upper limit, in "W.C., above which a Dirty Heat Zone Minor Alarm will trigger.

Plenum Startup Temp Time

This is the time, in seconds, in which the Plenum Temperature must reach or exceed the value set at *Settings* ⇨ *Limits* ⇨ *Startup Plenum Temperature* Low. If this temperature is not reached within this given timeframe, a Startup Plenum Temp Not Achieved Alarm will be triggered.

Absolute Minimum Unload Rate

This is the absolute lowest unload rate that the system will allow in Automatic Mode settings (such as at *Settings* ⇨ *Unload* ⇨ *Auto Moisture Mode: Unload Rate Lower Rail*) and in Manual Mode at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*.

Pilot / Burner Controls

Pressure Gauge Type

Options:
Dwyer Photohelic / QPM 2

This configuration setting is the pressure gauge type installed on the Dryer.

Pilot Flame Control Option

Options:
Baso with Flame Relay / Honeywell Flame Pack

RTD Probe Type

Options:
Legacy (2541-071/167) / Substitute (2541-423/425)

This configuration setting is for the RTD Temperature Probe Type. This should be changed to "Substitute (2541-423/425)" if a third-party aftermarket solution is installed.

Purge Time

This is the time, in seconds, that the system waits after the Air Check Delay is completed before attempting to light the Burner.

Note: This configuration setting does not apply when the Pilot Flame Control Option is set to Honeywell Flame Pack.

Ignition Time

This is the time, in seconds, that the system will wait after the **Purge Time** for the Burner to be confirmed. If the Burner is not confirmed during this time, then a No Baso Pilot Flame Minor Alarm is triggered.

Note: This configuration setting does not apply when the Pilot Flame Control Option is set to Honeywell Flame Pack.

Stroke Time - Mod Valve 1

This is the full stroke time, in seconds, for the mod valve installed as "Mod Valve 1".

Note: This time cannot be greater than 65 seconds.

Honeywell Burner 1 Confirmed Timeout

This configuration setting is the time, in seconds, within which the Burner #1 must be confirmed. If Burner #1 is not confirmed during this time, then the Dryer will go into Cooldown mode.

Timers

Purge Time

This is the time, in seconds, that the system waits after the Air Check Delay is completed before attempting to light the Burner.

Note: This configuration setting does not apply when the Pilot Flame Control Option is set to Honeywell Flame Pack.

Ignition Time

This is the time, in seconds, that the system will wait after the **Purge Time** for the Burner to be confirmed. If the Burner is not confirmed during this time, then a No Baso Pilot Flame Minor Alarm is triggered.

Note: This configuration setting does not apply when the Pilot Flame Control Option is set to Honeywell Flame Pack.

Stroke Time - Mod Valve 1

This is the full stroke time, in seconds, for the mod valve installed as "Mod Valve 1".

Note: This time cannot be greater than 65 seconds.

Stroke Time - Louver

This is the full stroke time, in seconds, for the (optional) Louver, if it is set to Installed at *Dryer Config* ⇨ *Options Config* ⇨ *Motorized Louver*.

Note: This time cannot be greater than 65 seconds.

Gas Pressure Confirmed Timeout

This is the time, in seconds, during which the Gas Pressure must be confirmed after the Gas Main Activated output is activated. If the Gas Pressure is not confirmed during this time, then a Gas Main Timeout Minor Alarm is triggered.

Honeywell Burner 1 Confirmed Timeout

This configuration setting is the time, in seconds, within which the Burner #1 must be confirmed. If Burner #1 is not confirmed during this time, then the Dryer will go into Cooldown mode.

Fan and Louver Settings

Fan Motor Qty

This is the number of fans installed on the Dryer.

Fan 1-2 Delay

This is the delay, in seconds, between the starting of the first fan and the second fan.

Fan 2-3 Delay

This is the delay, in seconds, between the starting of the second fan and the third fan.

Fan 3-4 Delay

This is the delay, in seconds, between the starting of third fan and the fourth fan.

Air Check Delay

When the **Pressure Gauge Type** is set to QPM 2 (regardless of the **Pilot Flame Control Option** setting):

> This is the time, in seconds, after which the system looks for the Plenum Air Pressure to be above the value set at *Dryer Config* ⇨ *Limits* ⇨ *Pressure Lower Limit*. If the Plenum Air Pressure is not above the set value, then a Low Air Flow Minor Alarm is triggered.

When the **Pressure Gauge Type** is Dwyer Photohelic, and the **Pilot Flame Control Option** is set to BASO with Flame Relay:

> This is the time, in seconds, during which the system looks for the Air Flow Confirmed input to be activated after the Gas Pressure is confirmed. If the Air Flow Confirmed output is not activated after this time expires, then a Low Air Flow Minor Alarm is triggered.

Note: The Air Check Delay does not apply when the **Pressure Gauge Type** is Dwyer Photohelic and the **Pilot Flame Control Option** is set to Honeywell Flame Pack. In this case, the Honeywell Flame pack will sense the air pressure itself.

Absolute Minimum Louver Position

This is the absolute lowest louver position that the system will allow, such as at *Settings* ⇨ *Louver* ⇨ *Louver - Percent Open (Manual)*.

Stroke Time - Louver

This is the full stroke time, in seconds, for the (optional) Louver, if it is set to Installed at *Dryer Config* ⇨ *Options Config* ⇨ *Motorized Louver*.

Note: This time cannot be greater than 65 seconds.

Piston Sampler

Piston Sampler Option

This setting indicates to the Red Board System whether a Piston Sampler is Installed or Not Installed.

Piston Sampler Piston Extend Time

This setting is the amount of time, in seconds, that the Piston takes to extend the arm to push out previously sampled grain.

Note: In order for the Piston Sampler to operate correctly (and not "reversed" with respect to the extend and retract functions), the Piston Extend functionality must be wired to the *Close #2 Mod Valve* output as per the installation instructions.

Piston Sampler Piston Retract Time

This setting is the amount of time, in seconds, that the Piston takes to retract the arm from its extended position to allow fresh grain to enter the sampling port.

Note: In order for the Piston Sampler to operate correctly (and not "reversed" with respect to the extend and retract functions), the Piston Retract functionality must be wired to the *Open #2 Mod Valve* output as per the installation instructions.

Piston Sampler Sample Hold 1

This setting is the amount of time, in seconds, that the Piston Sampler will take to collect the sample.

Piston Sampler Sample Hold 2

This setting is the amount of time, in seconds, that the Piston Sampler will take to stabilize the sample.

Piston Sampler Sample Period

This setting is the amount of time, in seconds, that the Piston Sampler will take to read the moisture data of the sample.

Burner PID Loop

Caution: These values should only be changed by a trained professional!!

x: Percent to open/close mv1 each time

This is the amount, as a percentage, to open or close the #1 Mod Valve after each period **d**.

Note: The #1 Mod Valve controls the amount of gas supplied to the burner.

d: Delay (seconds) between measurements

This is the amount of time, in seconds, between measurements of the plenum temperature and subsequent adjustments of the #1 Mod Valve (if any).

w: Window for +/- setpoint to be satisfied

This is the number of degrees, in °F, above and below the Plenum Temperature Setpoint (whether set manually or via an automatic algorithm), inside of which the predicted Plenum Temperature Setpoint (as a function of setting **p**) will be considered satisfied (and thus no adjustments will be made to the #1 Mod Valve).

p: Periods (of time d) to look ahead

This is a factor, as a multiplier, of time **d** in which the system will look ahead to calculate the future predicted value of the plenum temperature, based on previously measured temperatures.

a: Window breakpoint (in °F) for aggressive mode

This is the amount of degrees, in °F, below the Plenum Temperature Setpoint that is set as a threshold for engaging "aggressive mode" as a function of **x** and **f**. If the predicted future plenum temperature (as a function of settings **d** and **p**) is below the calculated threshold (as a function of setting **a** and the Plenum Temperature Setpoint), then "aggressive mode" is activated.

f: Factor to multiply "x" when in aggressive mode

When in "aggressive mode," this is the factor, as a multiplier, by which **x** is multiplied before adjusting #1 Mod Valve after period **d**.

Temperature / Moisture Averaging

Rolling number of samples to average (Dry/Wet)

This is the number of samples (*n*) to average for the Wet and Dry M%, and Wet and Dry Temperature. This is a rolling window that averages the last *n* samples collected.

Rolling number of samples to average (Plenum/AMC-T)

This is the number of samples (*n*) to average for the Plenum and AMC-T Temperature readings. This is a rolling window that averages the last *n* samples collected.

Approximate sample interval (for all sensors)

This is the amount of time, in seconds, between readings of all sensor data (such as, for example, Wet/Dry M%, Wet/Dry Temperature, AMC-T Temperature, Plenum Temperature). The lower this number is, the more frequent the readings will be.

Ignore suspected bad readings (for all sensors)

This setting enables or disables the "ignore suspected bad readings" functionality. When enabled, any sensor data readings outside the "outlier" setting thresholds are ignored and will not be averaged or factored into any other data.

Wet M% outlier low threshold

This is the threshold, as a percentage, below which a Wet M% reading will be ignored (if **Ignore suspected bad readings (for all sensors)** is enabled).

Wet M% outlier high threshold

This is the threshold, as a percentage, above which a Wet M% reading will be ignored (if **Ignore suspected bad readings (for all sensors)** is enabled).

Dry M% outlier low threshold

This is the threshold, as a percentage, below which a Dry M% reading will be ignored (if **Ignore suspected bad readings (for all sensors)** is enabled).

Dry M% outlier high threshold

This is the threshold, as a percentage, above which a Dry M% reading will be ignored (if **Ignore suspected bad readings (for all sensors)** is enabled).

Plenum temperature outlier low threshold

This is the threshold, in °F, below which a plenum temperature reading will be ignored (if **Ignore suspected bad readings (for all sensors)** is enabled).

Plenum temperature outlier high threshold

This is the threshold, in °F, above which a plenum temperature reading will be ignored (if **Ignore suspected bad readings (for all sensors)** is enabled).

AMC-T temperature outlier low threshold

This is the threshold, in °F, below which an AMC-T temperature reading will be ignored (if **Ignore suspected bad readings (for all sensors)** is enabled).

AMC-T temperature outlier high threshold

This is the threshold, in °F, above which an AMC-T temperature reading will be ignored (if **Ignore suspected bad readings (for all sensors)** is enabled).

Database Settings

Clear Event Log?

This allows the user to completely clear the Event Log by clicking the *Yes* button.

Note: This function will make the Event Log data unrecoverable, and will require a reboot of the Red Box to properly complete.

Clear Wet and Dry Graph?

This allows the user to completely clear the Wet and Dry Graph (i.e., the graph on the Dashboard screen) by clicking the *Yes* button.

Note: This function will make the Wet and Dry Graph data unrecoverable, and will require a reboot of the Red Box to properly complete.

AMC-T Continuous Flow Settings

Low % Unload Rate Change (from Baseline)

This is the amount, as a percentage, that the Unload Rate will change, based on the difference between the AMC-T temperature and the **AMC-T Target Setpoint**.

If the absolute value of the difference is less than or equal to the **Low °F Delta Threshold**, then the Unload Rate is set to the Baseline Unload Rate. This is the "Baseline" speed.

If the absolute value of the difference is greater than the **Low °F Delta Threshold** and less than or equal to the **High °F Delta Threshold**, then the **Low % Unload Rate Change** amount is added to or subtracted from the Baseline Unload Rate (depending on the positive/negative sign of the difference). This is either "High" speed or "Low" speed, again depending on the positive/negative sign of the difference.

If the absolute value of the difference is greater than the **High °F Delta Threshold**, then the **High % Unload Rate Change** is added to or subtracted from the Baseline Unload Rate (depending on the positive/negative sign of the difference). This is either "High High" speed or "Low Low" speed, again depending on the positive/negative sign of the difference.

Note: The Baseline Unload Rate is the value set at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*.

High % Unload Rate Change (from Baseline)

This is the amount, as a percentage, that the Unload Rate will change, based on the difference between the AMC-T temperature and the **AMC-T Target Setpoint**.

If the absolute value of the difference is less than or equal to the **Low °F Delta Threshold**, then the Unload Rate is set to the Baseline Unload Rate. This is the "Baseline" speed.

If the absolute value of the difference is greater than the **Low °F Delta Threshold** and less than or equal to the **High °F Delta Threshold**, then the **Low % Unload Rate Change** amount is added to or subtracted from the Baseline Unload Rate (depending on the positive/negative sign of the difference). This is either "High" speed or "Low" speed, again depending on the positive/negative sign of the difference.

If the absolute value of the difference is greater than the **High °F Delta Threshold**, then the **High % Unload Rate Change** is added to or subtracted from the Baseline Unload Rate (depending on the positive/negative sign of the difference). This is either "High High" speed or "Low Low" speed, again depending on the positive/negative sign of the difference.

Note: The Baseline Unload Rate is the value set at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate*.

Low °F Delta Threshold (from AMC-T Target)

This is the temperature difference, in °F, between the AMC-T temperature and the **AMC-T Target Setpoint** which is used as a boundary value for determining whether to add to, or subtract from, the Baseline Unload Rate.

High °F Delta Threshold (from AMC-T Target)

This is the temperature difference, in °F, between the AMC-T temperature and the **AMC-T Target Setpoint** which is used as a boundary value for determining whether to add to, or subtract from, the Baseline Unload Rate.

Moisture Based Continuous Flow Settings (Full Heat)

Auto-Flush Unload Rate

This is the metering speed, as a percentage, at which the unload will run during the **Auto-Flush Time** for **Continuous Flow - Full Heat** mode.

Auto-Flush Time

This is the time, in minutes, during which the Dryer will flush (i.e., unload) grain before starting the first dryer pass.

Target Moisture

This is the target moisture percentage for the automatic algorithm. The goal is to dry the grain to get as close to this **Target Moisture** as possible coming out of the Dryer.

Minutes To Unload Value

This is the number of minutes it takes to unload the dryer completely at 100% Unload Rate. Note that this value must be correct in order for the Automatic Modes/Algorithms to work correctly.

Auto Moisture Mode: Plenum Temp Lower Rail

This is the plenum temperature, in °F, below which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will increase the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Plenum Temp Upper Rail

This is the plenum temperature, in °F, above which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will decrease the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Lower Rail

This is the metering speed, as a percentage, below which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will increase the plenum temperature setpoint (with the **Auto Moisture**

Mode: Plenum Temp Upper Rail as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Upper Rail

This is the metering speed, as a percentage, above which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will decrease the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Reset Drying Factor?

This function will reset the global Drying Factor and initialize it to the calculated Drying Factor for the next outgoing Segment.

Note: This may be useful in situations where environmental conditions or other factors have changed substantially over time (such as, for example, by starting the Dryer the morning after a rainstorm).

Purge ALL Segment Data (including Drying Factor)?

This function will reset the global Drying Factor and all collected Dryer Segment data. This will cause the Dryer to run another full Dryer Pass before recalculating the automatic setpoints. Thus, the plenum temperature will be set to the value at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and the unload rate will be set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate* for the duration of the Dryer Pass.

Note: This effectively causes the Automatic Algorithm to "start over" with new data. Thus, this may be useful when the user wants to reset the Drying Factor and related parameters without having to restart the Dryer.

Segment Drying Factor Delta Percentage

This is the amount, as a percentage of the difference between the global Drying Factor and the outgoing Segment Drying Factor, that is added to the global Drying Factor to create a new global Drying Factor.

Req'd Deg-Min Diff Satisfaction Window

This is the amount of degree minutes above and below a given required degree-minute calculation in which no adjustment to the unload rate or plenum temperature will be made. The smaller this value is, the more frequent the changes to the unload rate and plenum temperature.

Continuous Flow: Drying Factor Lower Rail

This is the Drying Factor below which the automatic drying algorithm will not set the calculated Drying Factor.

Continuous Flow: Drying Factor Upper Rail

This is the Drying Factor below which the automatic drying algorithm will not set the calculated Drying Factor.

Moisture Based Continuous Flow Settings (Heat/Cool)

Auto-Flush Unload Rate

This is the metering speed, as a percentage, at which the unload will run during the **Auto-Flush Time** for **Continuous Flow - Full Heat** mode.

Auto-Flush Time

This is the time, in minutes, during which the Dryer will flush (i.e., unload) grain before starting the first dryer pass.

Target Moisture

This is the target moisture percentage for the automatic algorithm. The goal is to dry the grain to get as close to this **Target Moisture** as possible coming out of the Dryer.

Minutes To Unload Value

This is the number of minutes it takes to unload the dryer completely at 100% Unload Rate. Note that this value must be correct in order for the Automatic Modes/Algorithms to work correctly.

Auto Moisture Mode: Plenum Temp Lower Rail

This is the plenum temperature, in °F, below which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will increase the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Plenum Temp Upper Rail

This is the plenum temperature, in °F, above which the automatic drying algorithm will not set the plenum temperature setpoint.

Note: If the plenum temperature setpoint is at this value, the automatic drying algorithm will decrease the unload rate setpoint (with the **Auto Moisture Mode: Unload Rate Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Lower Rail

This is the metering speed, as a percentage, below which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will increase the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Upper Rail** as a limit) to achieve the desired degree-minute value(s).

Auto Moisture Mode: Unload Rate Upper Rail

This is the metering speed, as a percentage, above which the automatic drying algorithm will not set the unload rate setpoint.

Note: If the unload rate setpoint is at this value, the automatic drying algorithm will decrease the plenum temperature setpoint (with the **Auto Moisture Mode: Plenum Temp Lower Rail** as a limit) to achieve the desired degree-minute value(s).

Reset Drying Factor?

This function will reset the global Drying Factor and initialize it to the calculated Drying Factor for the next outgoing Segment.

Note: This may be useful in situations where environmental conditions or other factors have changed substantially over time (such as, for example, by starting the Dryer the morning after a rainstorm).

Purge ALL Segment Data (including Drying Factor)?

This function will reset the global Drying Factor and all collected Dryer Segment data. This will cause the Dryer to run another full Dryer Pass before recalculating the automatic setpoints. Thus, the plenum temperature will be set to the value at *Settings* ⇨ *Burner* ⇨ *Manual Plenum Temperature*, and the unload rate will be set to the value at *Settings* ⇨ *Unload* ⇨ *Manual Unload Rate* for the duration of the Dryer Pass.

Note: This effectively causes the Automatic Algorithm to "start over" with new data. Thus, this may be useful when the user wants to reset the Drying Factor and related parameters without having to restart the Dryer.

Segment Drying Factor Delta Percentage

This is the amount, as a percentage of the difference between the global Drying Factor and the outgoing Segment Drying Factor, that is added to the global Drying Factor to create a new global Drying Factor.

Req'd Deg-Min Diff Satisfaction Window

This is the amount of degree minutes above and below a given required degree-minute calculation in which no adjustment to the unload rate or plenum

temperature will be made. The smaller this value is, the more frequent the changes to the unload rate and plenum temperature.

Continuous Flow: Drying Factor Lower Rail

This is the Drying Factor below which the automatic drying algorithm will not set the calculated Drying Factor.

Continuous Flow: Drying Factor Upper Rail

This is the Drying Factor below which the automatic drying algorithm will not set the calculated Drying Factor.

Known Limitations/Quirks and Pro-tips

- In situations where the Graphical User Interface (GUI) does not update properly, a "refresh" of the screen will usually fix it. On most tablets, a refresh can be accomplished by pulling down from the top of the screen.

- The Wet/Dry graph on the Dashboard screen and the Event Log will hold as many data points as received since the last refresh of the GUI. However, upon refresh of the GUI, only 100 data points of each type (Wet and Dry Moisture %) are loaded onto the GUI. This is to prevent "bogging down" the GUI with too many data points in memory. In a future release, the ability to go further back in time (i.e., to dynamically load older data points) will be implemented.

- In the event that a Minor Alarm is triggered, and then a second (or third, etc) Minor Alarm is triggered before the previous Minor Alarm(s) are cleared, then there is a "nested alarm" situation. In this situation, if <u>any</u> of the Minor Alarms conditions are cleared, then <u>all</u> Minor Alarms are cancelled. If any other Minor Alarm conditions is still present, then it will re-alarm as a <u>new</u> Minor Alarm.

  Example: If a Dirty Heat Zone Minor Alarm is triggered, and then an Unload Pressure Switch Minor Alarm is triggered, and then if the Unload Pressure Switch Minor Alarm condition goes away, then both the Dirty Heat Zone and Unload Pressure Switch Minor Alarms will be cancelled. If the Dirty Heat Zone condition is still present, then a new Minor Alarm will be triggered.

- **PRO-TIP:** Make sure the RBS SSID is set to <u>auto-reconnect</u> from the tablet/device, and <u>no other SSID is set to auto-reconnect to the tablet/device</u>. If this is not performed, then communication may not be automatically established between the Red Box and the tablet/device whenever either one is rebooted.

TROUBLESHOOTING
List of potential "gotcha" situations, causes, and solutions

During Installation of the RED BOX System, MAKE SURE THE LOUVER AND/OR PISTON SAMPLER ARE WIRED AS PER THE INCLUDED INSTRUCTIONS!

Problem	Possible Cause(s)	Possible Solution(s)
To avoid delays out in the field, please charge the included tablet and install the relevant app(s) (e.g., Chrome) before heading out to the field to install the RBS Retrofit Kit.		
TABLET ISSUES		
The tablet is not connecting to the Red Box.	(1) The tablet is connecting to a different network, and/or (2) The tablet may not be connected to the correct Red Box SSID/Network.	(1) Make sure the tablet is NOT set up to automatically connect to networks other than the Red Box, and that the tablet is set up to automatically connect to the Red Box network only. (2) Connect the tablet to the Red Box SSID/Network using the information on the label on the bottom of the Red Box.
The tablet falls asleep and the Dryer shuts off	(1) The tablet is not plugged into a power supply, or (2) the tablet has not been set up to not go to sleep after a period of inactivity.	(1) Plug the tablet into a power source, and make sure there is a clean connection (e.g., no dirt or other debris on the connection). (2) On the tablet, enable the "Developer Options" menu and enable the "Stay Awake" feature on the tablet (as shown in Step 6 of the *Galaxy Tab Setup Instructions* document).
The graphical user interface (GUI) is acting sluggish or displaying data that doesn't look correct.	(1) The GUI is out of sync with the Red Box.	(1) Refresh the GUI by using the "pull down" gesture from near the top of the screen of the tablet.
The Red Box and the Tablet/Device are not communicating.	(1) The antennas are not installed on the Red Box, causing there to be little or no wireless signal. (2) The Tablet/Device is not connected to the correct SSID (i.e., not connected to the correct wireless network). (3) The Tablet/Device is out of range of the Red Box wireless signal.	(1) Install the provided antennas onto the Red Box. (2) Connect the Tablet/Device to the correct SSID. (3) Bring the Tablet/Device back into wireless range (i.e., within 30-50 feet from the Red Box).
The “Dryer Config” menu is greyed out and inaccessible.	(1) The tablet was recently refreshed	(1) To access the Dryer Config menu, press the **red** (Outlet/Dry) moisture or temperature numbers on the Dashboard 5 times within 5 seconds.
RED BOARD ISSUES		
The red LED on the Red Board (on Dryer Panel) blinks on and off.	(1) The Dryer Panel power supply is oscillating due to insufficient load.	(1) Install the power supply “Load PCB” assembly on the Dryer Panel power supply.
RED BOX ISSUES		
The Red Box is not communicating with the Dryer Panel, even though the "Ready" light on the Red Box is blinking. For Example: Repeatedly pressing "Start" on the tablet does not light up the "Quantum Ready" light on the Dryer Panel.	(1) If the Dryer Panel is powered on after the Red Box is powered on, in some rare instances, there can be an RS-485 bus collision that prevents communication. (This is a protection feature built into the Communication System of the RED BOX to prevent damage.)	(1) Reboot the Red Box.
The Red Box will not operate after either importing settings or updating software.	(1) The USB flash drive was left plugged into the Red Box after importing or updating.	(1) Remove the flash drive and then reboot.

Performing an "Import Settings" operation causes the Red Box to crash.	(1) The RS-485 cable is not disconnected, or the Dryer Panel is not powered off, during the Import.	(1) Disconnect the RS-485 cable or power off the Dryer Panel *before* importing settings.
The Red Box and Red Board are not communicating.	(1) The RS-485 wires are installed in a reversed manner between the Red Box and Red Board. (2) The RS-485 comm chip inside the Red Box is locked up due to a tripped protection circuit (possibly caused by a current surge).	(1) Reverse the RS-485 communication wires. (2) Reboot the Red Box by unplugging the power supply for 20 seconds and plugging it back in.
The Red Box is not operable when powered on (e.g., the green LED is not blinking).	(1) The Red Box did not boot up correctly, or there was a software lockup issue with the Red Box.	(1) Reboot the Red Box by unplugging the power supply for 10-20 seconds and plugging it back in.
During the startup process for the Dryer, the Fans are running, however the Pilot lighting sequence will not begin (e.g., the Dryer will not begin the Purge phase).	(1) This is a known quirk that happens every once in a while.	(1) Try disabling and then re-enabling the Burner. If that does not work, then Stop the Dryer and Restart.
The Red Box crashes after setting the Date and/or Time.	(1) The Date/Time cannot be set on the Red Box while the Dryer is running.	(1) Set the Date/Time while the Dryer is OFF (i.e., not running).
The Controller Ready (sometimes labeled as “Quantum Ready” on some legacy systems) LED did not turn on after pressing the START button on the Tablet/Device.	(1) There was a communication issue between the Red Box and the Red Board.	(1) Press START again on the Tablet/Device. If that does not work, then hold STOP on the Tablet/Device to reset the Red Board and then press START again on the Tablet/Device.
INTERNET ISSUES		
The Red Box does not boot up at all when the Ethernet-to-USB adapter is plugged into the Red Box.	(1) The network configuration is not set up correctly to allow the Red Box to fully connect to the Internet. (2) There is a software bootup error.	(1) First, try power cycling the Red Box and see if the problem fixes itself. (2) To get the Red Box to boot up so that the user can at least run locally, power OFF the Red Box, unplug the Ethernet-to-USB adapter from the USB slot, and power ON the Red Box. (3) Set up the network so that the Red Box receives a DHCP (i.e., dynamic) address. (4) Make sure no firewalls are preventing access to/from the Red Box.
The website at **https://myredbox.live/[License Number]** (no brackets) is not populating data.	(1) The Red Box is not connected to the Internet. (2) The “s” in the “https” at the beginning of the URL address is missing.	(1) Make sure the network (ethernet) cable is plugged in, and that the network is functional. (2) Include the “s” in the URL address. This provides a secure connection and allows the Red Box to transmit and receive data securely.
The Red Box does not seem to be connected to the internet.	(1) The USB-to-Ethernet adapter was plugged in after the Red Box was turned on.	(1) Before booting up the Red Box, make sure the USB-to-Ethernet adapter is plugged into the USB port of the Red Box.