DRY COOKER SYSTEM MANUAL

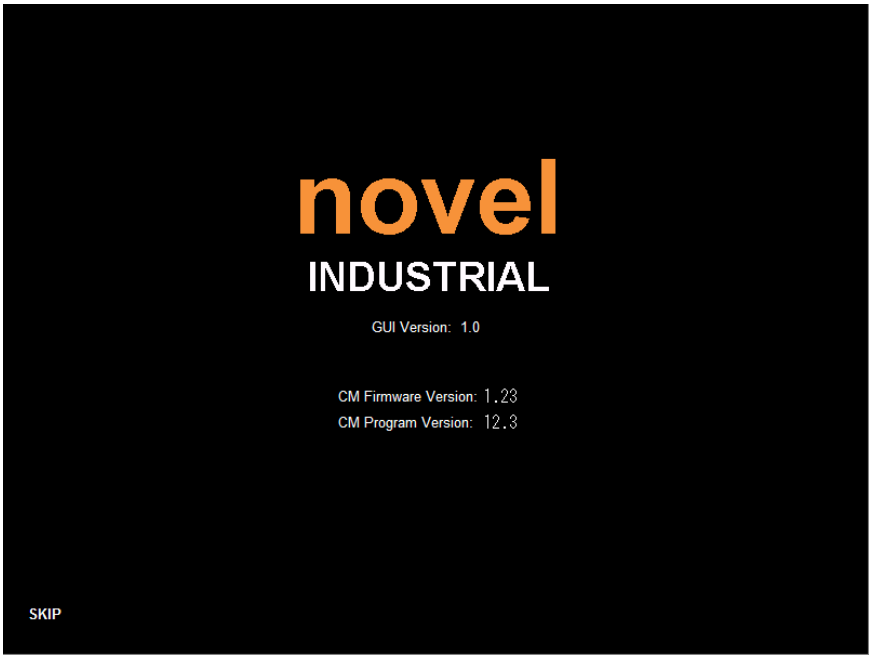
DOCUMENT NO. NI003

For

NOVEL INDUSTRIAL SOLUTIONS, LLC

1. Touch Screen Interface

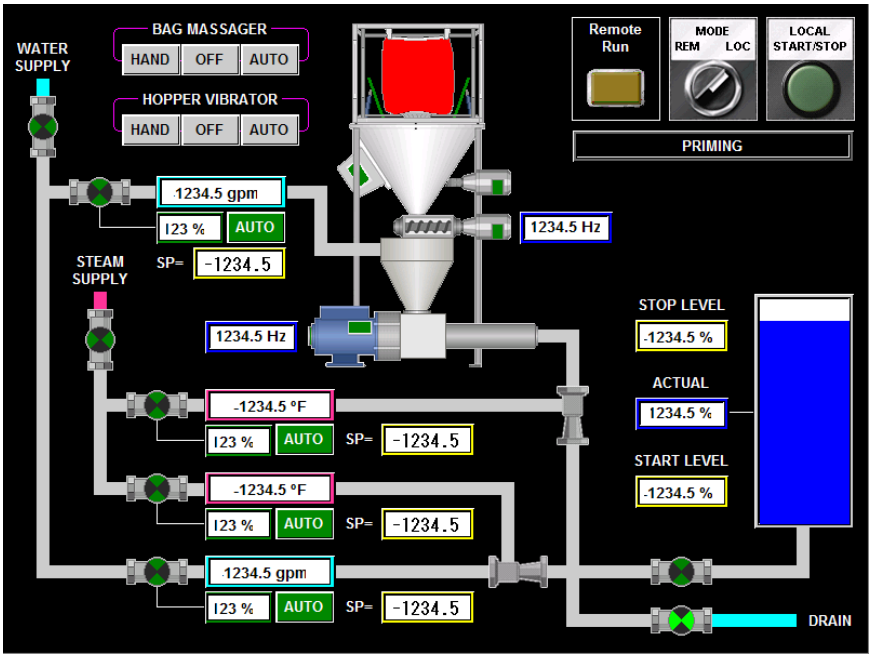
The dry cooker provides a touch screen interface for control and monitoring of the system. When the system is first powered on, the splash screen will be shown for ~5 seconds. After 5 seconds, the "Run" screen will be automatically displayed.



The splash screen provides the current program version information. The user can press the "Skip" button at the lower left of the screen to go immediately to the Run screen.

2. System Operation

The "Run" screen provides the user with the controls to start and stop the cooker, adjust flow rates and temperature set points as well as monitor current system operation.



2.1. Remote/Local Operation

The Mode selector switch at the upper right of the screen is used to set the mode of operation for the cooker. When set to remote (REM), the system start/stop is controlled via the remote run input. The remote run indicator will illuminate when the system is turned on remotely. When set to local (LOC), the start/stop of the system is controlled by the local start/stop push-button. In order to change the mode of operation, the operator will have to log in with at least a "User" security level in order to have authorization to change the system mode of operation.

The local start/stop button will illuminate when the system is "turned on" and will be off when the system is "turned off". Note that upon turning the system off, it will continue to run for a period of time in order to perform an orderly shut down by flushing the lines before completely shutting down.

The "Operating Status" information window below the run indicators and mode selector switch displays the current operational mode of the system. This allows the operator to know exactly what point in the operational cycle the cooker is in. The message box indicates the following states:

System Off: Indicates that the system is not turned on either local or remote. The system will not run even if the storage tank low level set point is reached.

Priming:	The system has opened the fresh water valve, started the pump and is getting the make-up and post-dilution flows to set point. Once the flow rates are to set point, the system will begin priming steam.
Priming Steam:	The system is performing a controlled ramp of the steam valves to minimize hammer and vibration throughout the system in order to begin temperature control. Once primed, the system will enter preheat.
Preheat:	The system is getting the cook and post dilution water temperatures up to set point. Once the temperatures are within the configured alarm deviation temperature set points, the system will enter starch feed.
Feeding Starch:	The agitator and auger have been started. After the configured start process delay time, the system will open the process (tank) valve and close the drain valve and begin the batch run.
Cooking Batch:	The system is currently filling the process (holding) tank. Once the stop level is reached, the system will enter the flush process mode.
Flushing Process:	The starch feed is stopped (agitator and auger turned off) while the cooker continues to maintain temperature and water flow rates to flush the process lines. Once the configured flush time is met, the system will enter the flush to drain mode.
Flushing to Drain:	The system is preparing to shut down. The drain valve will be opened and the process valve will be closed. The steam valves will be closed allowing the system to cool down prior to shutting off. Once the configured drain period has expired, the pump will be shut off and the water valves will close.
System Idle:	Indicates that the system is turned on and is waiting for the storage tank to reach the low level start set point. When the low level is reached, the system will automatically start the cycle over and fill the storage tank up to the stop level set point. It will then automatically shut down again. It will repeat this cycle indefinitely until turned off.

2.2. Bag Massager

The run screen provides three push-buttons for the bag massager operation. When set to auto, the bag massager will activate during the "feeding starch" and "cooking batch" modes of operation when the hopper low level probe is reached. The bag massagers will cycle in and out according to the configuration time settings.

When set to off, the bag massagers will not operate.

When the "Hand" button is pressed, the bag massager plates will extend to compress the bag until the button is released. The operator can then press-release-press-release to cycle the bag massagers as necessary to work the bag. When the "Hand" button is released, the bag massager will automatically be set to "Off". It is then necessary for the operator to place the bag massager back into "Auto" if automatic operation is desired.

2.3. Hopper Vibrator

The run screen provides three push-buttons for hopper vibrator operation. When set to auto, the vibrator will be activate during the "feeding starch" and "cooking batch" modes of operation. The vibrator will cycle on and off according to the configuration time settings.

When set to off, the vibrator will not operate.

When the "Hand" button is pressed, the vibrator will run until the button is released. The operator can then press-release-press-release to cycle the vibrator as necessary. When the "Hand" button is released, the vibrator will automatically be set to "Off". It is then necessary for the operator to place the vibrator back into "Auto" if automatic operation is desired.

2.4. Auto/Manual

The temperature and water flows can be controlled automatically or manually by pressing the respective "AUTO" button next to the control output indicator for the respective control valve. When set to the default state of auto, the system will automatically control the temperature and water flow. To adjust the control set point for a valve, press the set point indicator field and a numeric keypad will be shown to allow set point entry. The set point will be stored in memory and used each time the system runs.

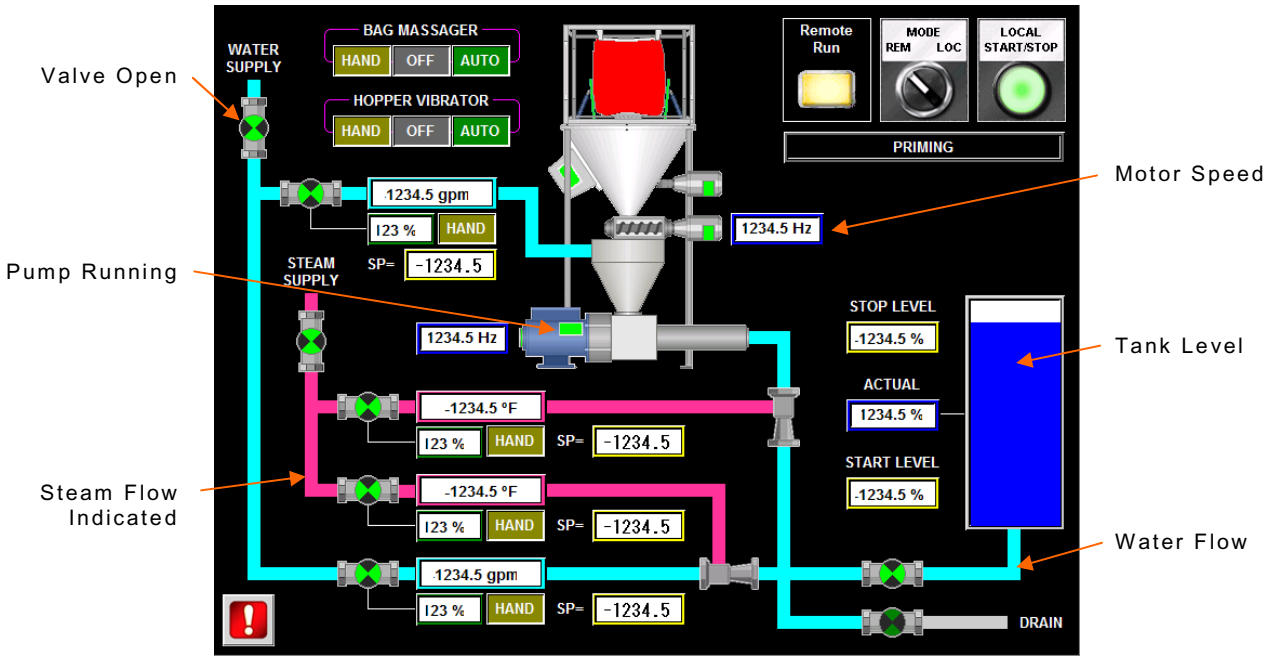
When a valve is set to "HAND", its position will be held at the %Out value shown in the output indicator field. Pressing the output field when in manual operation will display a numerical keypad that allows the user to enter a new output value from 0-100%. Pressing the button again will switch the system from manual back into auto and the system will then automatically control the output in order to maintain set point.

NOTE: *When the system is off the indicators will show 0%. The manual %Out entry will be maintained and used the next time the system is started.*

2.5. System Run Indicators

The temperature and flow indicators on the run screen will indicate current values at all times regardless of the system's mode of operation. The pump, valves and piping will also update during the different modes of operation to provide visual indication to the operator as to their respective operational states. For example, the pump indicator will turn bright green to indicate that it is currently operating.

NOTE: *Image does not depict actual values. Indicator values are for reference only.*



The bag level is monitored using level probe sin the hopper. When the low level probe (top most probe) no longer detects product in the hoper, the bag will turn yellow. When the low-low level probe (bottom most probe) in the hopper no longer detects product, the bag will turn red. When this occurs, the system will automatically shut down. When both level probes detect product, the bag will be a light blue in color.

2.6. Alarm Indicator

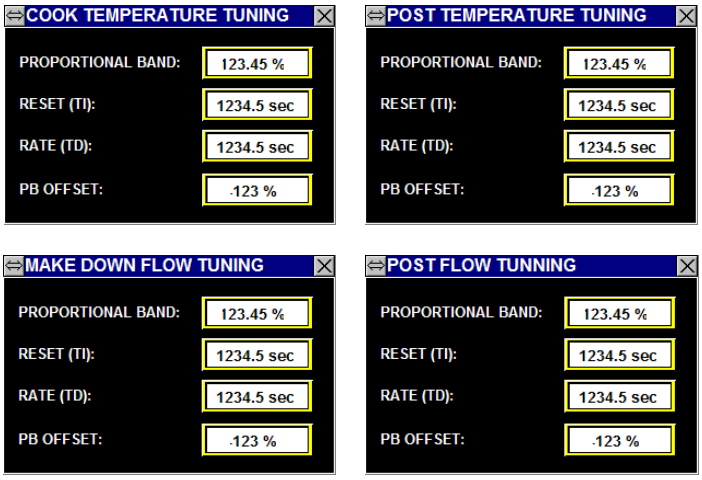
When an alarm occurs, the alarm window will automatically be displayed and pop-up over the run screen to alert the operator immediately on alarm occurrence. The operator can then move or close the window as desired.

As long as there is an active alarm, the alarm indicator button at the bottom left of the screen will be visible. Pressing the button will display the alarm window so the user can view any previous and/or active alarms. Alarms that shown down the system must be reset in order for the system to be started again. If the alarm condition that caused the alarm is still present, the alarm will not be able to be reset.

2.7. System Tuning

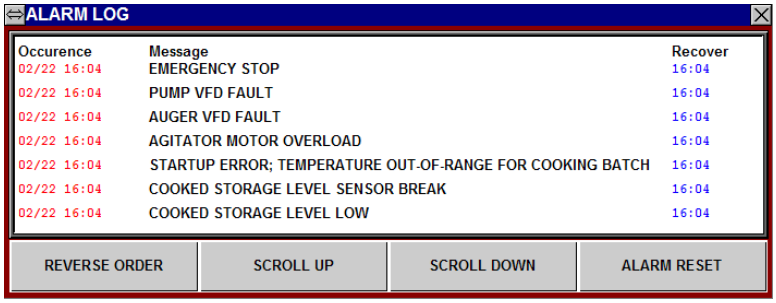
The temperature and flow control loop tuning can be adjusted by pressing the respective valve indicator for the loop that requires tuning. In order to access the tuning parameters, the operator will have to log in with at least a "User" security level. Upon entering the valid password, a pop-up window will be shown containing the tuning parameters for the loop.

The available tuning parameters include the proportional band (PB), reset (TI) and rate (TD) as well as a proportional band offset (PB Offset). It is important that only persons with the proper training and knowledge regarding PID control loop operation adjust these values.



3. Alarms

The alarm window provides the operator with the most recent alarm as well as a historical list of past alarms.



When the alarm output is on, the "ALARM RESET" button will be highlighted red indicating that an alarm is active and that it can be reset by the operator. Pressing the button will turn off the alarm output if the condition that has caused the alarm has been corrected. If the alarm caused the system to shut down (critical alarm) and the alarm condition is cleared, the operator can restart the system.

In order to restart the system, the operator must press the local start/stop button or the remote run input to the system (when in remote mode) must cycle from the off to on state. System alarms include the following:

Emergency Stop:	Emergency stop button pressed. Requires manual reset of E-Stop button to clear alarm condition.
Pump VFD Fault:	Pump motor VFD fault. Requires manual reset on VFD to clear alarm condition.
Auger VFD Fault:	Auger motor VFD fault. Requires manual reset on VFD to clear alarm condition.
Agitator Motor Overload:	Agitator motor overload tripped. Requires manual reset of motor overload to clear alarm condition.
Startup Fault:	Indicates that the system is unable to reach the desired temperature and/or flow set points during startup. The alarm occurs when the maximum startup time expires and the system has not entered the "cooking batch" cycle state. Check steam supply/valve operation and insure that the temperature and flow deviation alarms are set properly.
Cooked Storage Level Sensor Break:	When system is equipped with a level sensor for monitoring tank level, this alarm indicates that the storage level transmitter has failed. Check sensor/wiring.

Cooked Storage Level Low:	When system is equipped with a level sensor for monitoring tank level, this alarm can be used to indicate a critical low storage level to alert an operator that there may be a problem and the system is not automatically starting.
Cooked Storage Level High:	When system is equipped with a level sensor for monitoring tank level, this alarm can be used to indicate a critical high storage level to alert an operator that there may be a problem with the system and it is not automatically stopping which could cause loss of product.
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Cook Temperature Sensor Break:	Indicates that the cook temperature sensor has failed. Check sensor/wiring. If the sensor break shutdown override is enabled, the system will continue running in manual mode. The sensor must be repaired in order to switch the system back into automatic temperature control.
Cook Temperature Low:	Indicates that the cook temperature has exceeded the low alarm set point. Alarm is not enabled until the system is in “cooking batch”.
Cook Temperature High:	Indicates that the cook temperature has exceeded the high alarm set point.
Cook Temperature Deviation:	Indicates that the cook temperature has deviated too far from the desired set point. Alarm is not enabled until the system is in “cooking batch”. During preheat mode, once the cook temperature is within the deviation alarm band around set point, the system switches from preheat to “feeding starch”.
Post Dilute Temp Sensor Break:	Indicates that the post dilution temperature sensor has failed. Check sensor/wiring. If the sensor break shutdown override is enabled, the system will continue running in manual mode. The sensor must be repaired in order to switch the system back into automatic temperature control.
Post Dilute Temperature Low:	Indicates that the post dilution temperature has exceeded the low alarm set point. Alarm is not enabled until the system is in “cooking batch”.
Post Dilute Temperature High:	Indicates that the post dilution temperature has exceeded the high alarm set point.
Post Dilute Temp Deviation:	Indicates that the post dilution temperature has deviated too far from the desired set point. Alarm is not enabled until the system is in “cooking batch”.

Make up Flow Sensor Break:	Indicates that the make up flow meter has failed. Check sensor/wiring. If the sensor break shutdown override is enabled, the system will continue running in manual mode. The flow meter must be repaired in order to switch the system back into automatic flow control.
Make up Flow Low:	Indicates that the make up flow has exceeded the low alarm set point. Alarm is not enabled until the system is in “cooking batch”.
Make up Flow High:	Indicates that the make up flow has exceeded the high alarm set point.
Make up Flow Deviation:	Indicates that the make up flow has deviated too far from the desired set point. Alarm is not enabled until the system is in “cooking batch”.
Post Dilute Flow Sensor Break:	Indicates that the post dilute flow meter has failed. Check sensor/wiring. If the sensor break shutdown override is enabled, the system will continue running in manual mode. The flow meter must be repaired in order to switch the system back into automatic flow control.
Post Dilute Flow Low:	Indicates that the post dilute flow has exceeded the low alarm set point. Alarm is not enabled until the system is in “cooking batch”.
Post Dilute Flow High:	Indicates that the post dilute flow has exceeded the high alarm set point.
Post Dilute Flow Deviation:	Indicates that the post dilute flow has deviated too far from the desired set point. Alarm is not enabled until the system is in “cooking batch”.
Pump Speed Sensor Break:	Indicates that the pump speed input has failed. Check wiring. If the sensor break shutdown override is enabled, the system will continue running.
Pump Speed Low:	Indicates that the pump speed has exceeded the low alarm set point.
Pump Speed High:	Indicates that the pump speed has exceeded the high alarm set point.
Auger Speed Sensor Break:	Indicates that the auger speed input has failed. Check wiring. If the sensor break shutdown override is enabled, the system will continue running.
Auger Speed Low:	Indicates that the auger speed has exceeded the low alarm set point.

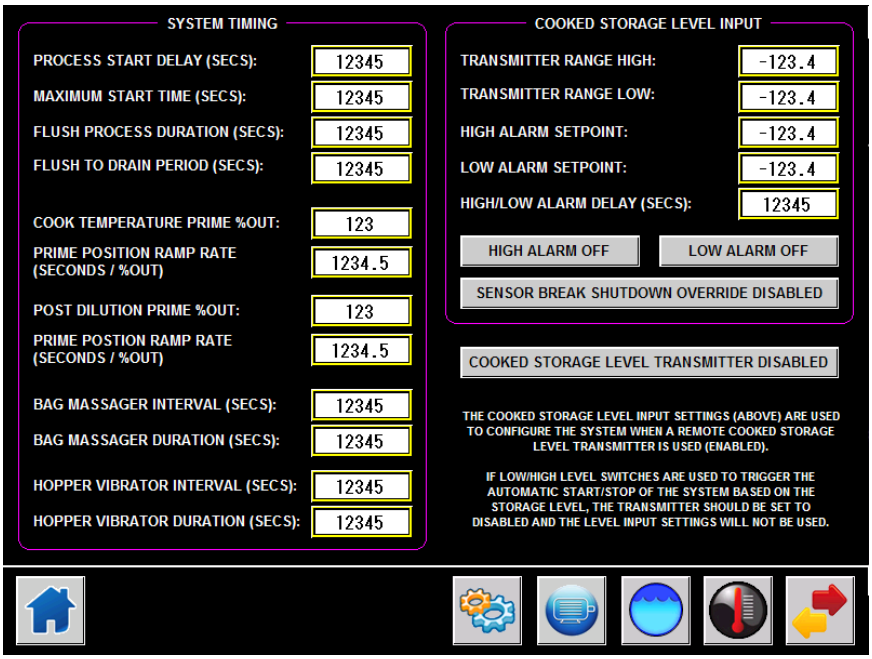
Auger Speed High:	Indicates that the auger speed has exceeded the high alarm set point.
Hopper Level Low:	Indicates that the hopper is empty. The system will not begin operation until the hopper is refilled. If alarm occurs during operation, the system will automatically shut down.
No Flow (washdown cone plugged):	Indicates low flow condition at pump outlet. Check washdown cone for obstruction and water valves for proper operation. Check set point of flow switch. If flow set point set too high, false alarms can be generated.

4. System Configuration

The system configuration provides access to all of the control settings for the system including sensor ranges, set point limits, alarms, etc. The system configuration is entered via a hidden button just above the storage level tank on the run screen.

To enter the system configuration, press and hold your finger on the area just above the storage tank on the run screen for ~3 seconds. You will then be prompted to enter the Novel password. Once the proper password is entered, the System Configuration Options screen will be shown.

NOTE: *See the Appendix of this manual for the system passwords.*



The system configuration settings are divided into 4 categories. The configuration options, motor input setup, flow input setup and temperature input setup. An additional test mode screen is provided which allows each output of the system to be forced on and off for diagnostic purposes as well as view current status of the system inputs.

System Timing

Process Start Delay: This entry is used to set the time in seconds that the system shall remain in “feeding starch” prior to entering process (cooking batch) operation. The time can be entered from 0 to 32767 seconds.

Maximum Start Time: This entry is used to set the maximum allowed time that the system should take to enter the “cooking batch” mode of operation from the point at which the system starts operation.

	If the system can not attain the proper set point temperatures and flows (within deviation alarm bands), it will not enter the process mode and could continue dumping water to drain. Once this timer expires, the user will be altered by a system alarm so that the problem can be corrected. The time can be entered from 0 to 32767 seconds.
Flush Process Duration:	This field sets the flush time for the process lines once the storage stop level has been reached.
Flush to Drain Period:	This field sets the cool down time for the system after the system flush completes.
Cook Temp Prime %Out:	This field sets the maximum position that the cook temperature steam control valve is to open during the priming stage.
Prime Position Ramp Rate:	This field sets the rate at which the steam valve will open to its prime position during the priming stage. The entry is a time in seconds from 0.0 to 3276.7 seconds per %output. Note that if the desired temperature set point is achieved prior to reach 50% output, the output may stop increasing; however, the prime step will continue until the internal output limit is reached at the entered ramp rate.
Post Dilution Prime %Out:	This field sets the maximum position that the post dilution temperature steam control valve is to open during the priming stage.
Prime Position Ramp Rate:	This field sets the rate at which the steam valve will open to its prime position during the priming stage. The entry is a time in seconds from 0.0 to 3276.7 seconds per %output. Note that if the desired temperature set point is achieved prior to reach 50% output, the output may stop increasing; however, the prime step will continue until the internal output limit is reached at the entered ramp rate.
Bag Massager Interval:	This field sets the time between activations of the bag massager.
Bag Massager Duration:	This field sets the activation time of the bag massager at each timed interval.
Hopper Vibrator Interval:	This field sets the time between activations of the hopper vibrator.
Hopper Vibrator Duration:	This field sets the activation time of the vibrator at each timed interval.

Cooked Storage Level Input

Transmitter Range High: This field is used to enter the maximum range value of the level transmitter used to monitor the storage tank level.

Transmitter Range Low: This field is used to enter the minimum range value of the level transmitter used to monitor the storage tank level.

High Alarm Setpoint: This field is used to set storage level at which a high level alarm should activate.

The "high alarm off/on" button can be used to enable/disable the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen if the tank level exceeds the high alarm set point.

Low Alarm Setpoint: This field is used to set storage level at which a low level alarm should activate.

The "low alarm off/on" button can be used to enable/disable the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen if the tank level exceeds the low alarm set point.

High/Low Alarm Delay: This field is used to set how long a high or low alarm condition can be present before the alarm activates. The time can be set from 0 to 32767 seconds.

Sensor Break Shutdown Override: This button toggles the shut down override for the level sensor. When set to DISABLED, the system will shut down if there is a problem with the level sensor input.

If set to ENABLED, the system will ignore the level sensor failure and only post the alarm to the alarm screen and continue running.

Cooked Storage Level Transmitter Enable: This button enables the use of a level transmitter for the automatic start and stop of the system. If disabled, the system will use digital inputs for the remote start and stop based on low/high level switches instead of continuous level monitoring.

4.1. Motor Input Setup

The Motor Input Setup screen provides all settings relating to the monitoring of the pump and auger speeds.

Each motor speed input has the following settings:

Sensor Range High: This field is used to enter the maximum range value of the speed input from the VFD.

Sensor Range Low: This field is used to enter the minimum range value of the speed input from the VFD.

High Alarm Setpoint: This field is used to set the speed at which a high pump speed alarm should activate.

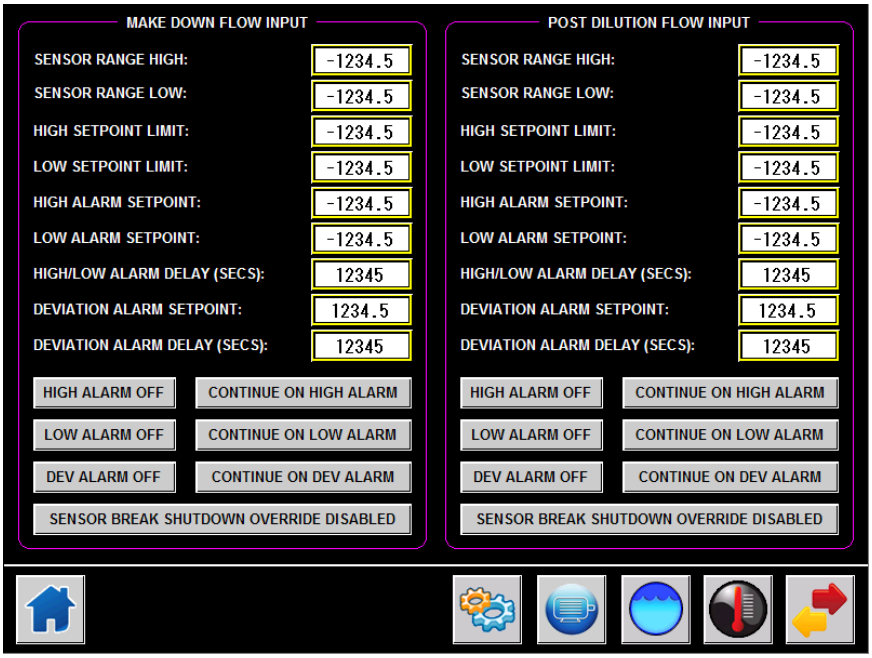
The ‘high alarm off/on” button is used to toggle the active state of the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen if the operator sets the pump speed above the high alarm set point.

The “continue/shutdown on high alarm” button determines whether the system should continue running or shut down when a high speed alarm occurs. If set to continue, the system will continue running. If set to shutdown, the system will shut down when the high speed alarm activates.

Low Alarm Setpoint:	This field is used to set the speed at which a low pump speed alarm should activate. The 'low alarm off/on" button is used to toggle the active state of the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen if the operator sets the pump speed below the low alarm set point. The "continue/shutdown on low alarm" button determines whether the system should continue running or shut down when a low speed alarm occurs. If set to continue, the system will continue running. If set to shutdown, the system will shut down when the low speed alarm activates.
High/Low Alarm Delay:	This field is used to set how long a high or low alarm condition can be present before the alarm activates. The time can be set from 0 to 32767 seconds.
Sensor Break Shutdown Override:	This button toggles the shut down override for the speed input. When set to DISABLED, the system will shut down if there is a problem with the speed input. If set to ENABLED, the system will ignore the speed input failure and only post the alarm to the alarm screen and continue running.

4.2. Flow Input Setup

The Flow Input Setup screen provides all settings relating to the system's water flow control.



Each flow control input has the following settings:

Sensor Range High:	This field is used to enter the maximum range value of the flow meter.
Sensor Range Low:	This field is used to enter the minimum range value of the flow meter.
High Setpoint Limit:	This field is used to set the maximum flow rate that the user can set for the flow control set point.
Low Setpoint Limit:	This field is used to set the minimum flow rate that the user can set for the flow control set point.
High Alarm Setpoint:	This field is used to set the flow rate at which a high flow alarm should activate. The "high alarm off/on" button is used to toggle the active state of the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen should the flow rate exceed the high alarm set point.

The "continue/shutdown on high alarm" button determines whether the system should continue running or shut down when a high flow alarm occurs. If set to continue, the system will continue running. If set to shutdown, the system will shut down when the high flow alarm activates.

Low Alarm Setpoint:

This field is used to set the flow rate at which a low flow alarm should activate.

The "low alarm off/on" button is used to toggle the active state of the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen should the flow rate exceed the low alarm set point.

The "continue/shutdown on low alarm" button determines whether the system should continue running or shut down when a low flow alarm occurs. If set to continue, the system will continue running. If set to shutdown, the system will shut down when the low flow alarm activates.

High/Low Alarm Delay:

This field is used to set how long a high or low alarm condition can be present before the alarm activates. The time can be set from 0 to 32767 seconds.

Deviation Alarm Setpoint:

This field is used to set maximum amount that the flow rate can deviate from the set point before the alarm should activate.

The "deviation alarm off/on" button is used to toggle the active state of the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen should the flow rate deviate from set point by more than the alarm set point.

The "continue/shutdown on deviation alarm" button determines whether the system should continue running or shut down when a deviation alarm occurs. If set to continue, the system will continue running. If set to shutdown, the system will shut down when the alarm activates.

NOTE: *This alarm is only active (when enabled) once the system is in the "cooking batch" mode of operation.*

Deviation Alarm Delay:

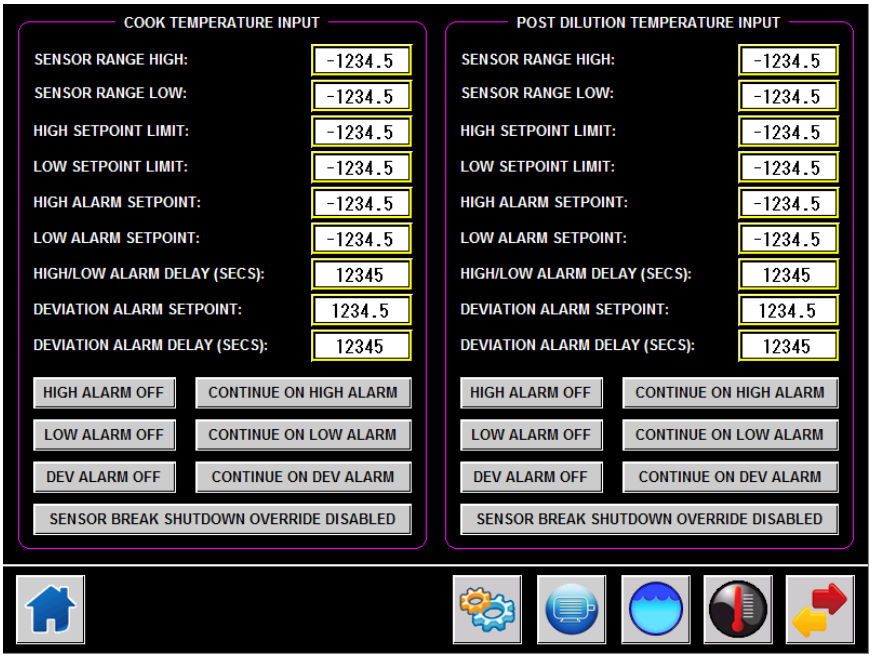
This field is used to set how long the deviation alarm can be present before the alarm activates. The time can be set from 0 to 32767 seconds.

Sensor Break Shutdown Override: This button toggles the shut down override for the flow control. When set to DISABLED, the system will shut down if there is a problem with the flow meter.

If set to ENABLED, the system will ignore the flow meter failure and only post the alarm to the alarm screen and continue running. The control loop will automatically switch to manual operation and maintain its last output value until changed by the user. Once the sensor break has cleared, the user can then switch the loop back into automatic operation.

4.3. Temperature Input Setup

The Temperature Input Setup screen provides all settings relating to the system's temperature control.



Each temperature control input has the following settings:

Sensor Range High: This field is used to enter the maximum range value of the temperature sensor.

Sensor Range Low: This field is used to enter the minimum range value of the temperature sensor.

High Setpoint Limit:	This field is used to set the maximum temperature that the user can set for the temperature control set point.
Low Setpoint Limit:	This field is used to set the minimum temperature that the user can set for the temperature control set point.
High Alarm Setpoint:	This field is used to set the temperature at which a high temperature alarm should activate. The "high alarm off/on" button is used to toggle the active state of the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen should the temperature exceed the high alarm set point. The "continue/shutdown on high alarm" button determines whether the system should continue running or shut down when a high temperature alarm occurs. If set to continue, the system will continue running. If set to shutdown, the system will shut down when the high temperature alarm activates.
Low Alarm Setpoint:	This field is used to set the flow rate at which a low temperature alarm should activate. The "low alarm off/on" button is used to toggle the active state of the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen should the temperature exceed the low alarm set point. The "continue/shutdown on low alarm" button determines whether the system should continue running or shut down when a low temperature alarm occurs. If set to continue, the system will continue running. If set to shutdown, the system will shut down when the low temperature alarm activates.
High/Low Alarm Delay:	This field is used to set how long a high or low alarm condition can be present before the alarm activates. The time can be set from 0 to 32767 seconds.
Deviation Alarm Setpoint:	This field is used to set maximum amount that the temperature can deviate from the set point before the alarm should activate.

The "deviation alarm off/on" button is used to toggle the active state of the alarm. If set to off, the alarm is disabled and there will be no alert to the user. If set to on, the alarm will be shown on the alarm screen should the temperature deviate from set point by more than the alarm set point.

The "continue/shutdown on deviation alarm" button determines whether the system should continue running or shut down when a deviation alarm occurs. If set to continue, the system will continue running. If set to shutdown, the system will shut down when the alarm activates.

NOTE: *This alarm is only active (when enabled) once the system is in the "cooking batch" mode of operation.*

Deviation Alarm Delay: This field is used to set how long the deviation alarm can be present before the alarm activates. The time can be set from 0 to 32767 seconds.

Sensor Break Shutdown Override: This button toggles the shut down override for the temperature control. When set to DISABLED, the system will shut down if there is a problem with the temperature sensor.

If set to ENABLED, the system will ignore the sensor failure and only post the alarm to the alarm screen and continue running. The control loop will automatically switch to manual operation and maintain its last output value until changed by the user. Once the sensor break has cleared, the user can then switch the loop back into automatic operation.

4.4. I/O Monitor/Test

The I/O Monitor/Test screen is provided as a means for diagnostics and trouble shooting.

The system input status is provided at the top left of the screen. These include:

- Remote Run Input
- Remote Alarm Reset
- Remote Storage Low Level Input
- Remote Storage Level High Input
- Hopper Empty Level Input
- Hopper Low Level Input
- Emergency Stop Input
- Pump VFD Fault Input
- Auger VFD Fault Input
- Agitator Motor Overload Input
- Flow Switch Input

All system outputs are also shown (yellow indicators). However, unlike the inputs, all outputs can be forced on and off by touching their respective indicator. Note that the output force time must first be set to a non-zero value to do this.

This is the amount of time that the output will remain forced on during test mode. This time period is reset each time an output is turned on or off. If no output force state is changed within the time out period, any outputs that are still forced on will be automatically turned off.

This provides a minimal level of safety in case the operator has to step away from the machine during testing and left an output forced on. The steam and flow output force fields allow the operator to enter a percentage of output to verify that the proportional control valves are working properly.

Appendix

User Level	Password	Access
USER	SETUP	remote/local, tuning
NOVEL	CONFIG	remote/local, tuning, system settings, system configuration