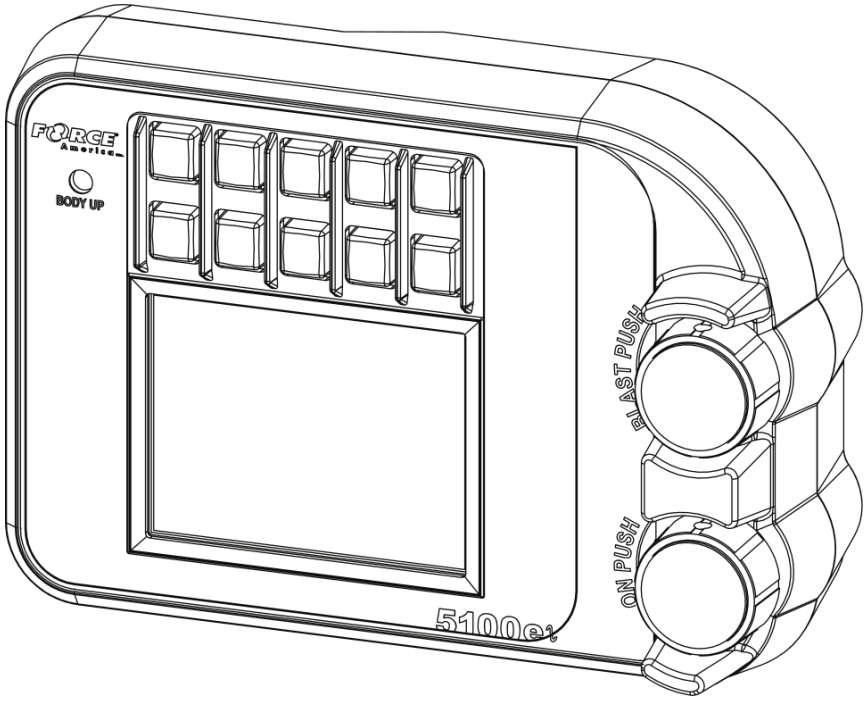
5100ex Calibration Manual



Firmware Version
4.3

FORCE® America INC.

Table of Contents

First Use Guide

The first time you configure your 5100ex, you will need to complete the following steps to ensure that your vehicle runs at optimum efficiency:

If you use granular systems, also complete the following steps:

If you use prewet systems, also complete the following steps:

If you use direct systems, also complete the following steps:

If you use event logging, also complete the following steps:

Entering the Calibration Menu

The Calibration menu is entered by pressing the Calib button in the Main Menu. Unlike the Material Select, Unload, Data, and Version Menus, the Calibration Menu requires the entry of an Access Code before it will appear. You can insert a USB supervisor key instead of entering the access code to access the Calibration Menu.

To enter Calibration using Access Code:

1. While the system is in Standby, press the Menu button on the Operation Screen.
2. Press the Calibration menu button. The Access Code window will appear, as shown in Figure 1.

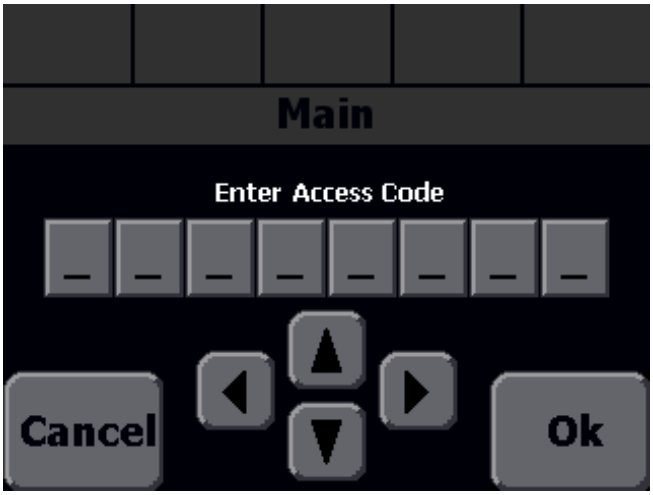


Figure 1: The Access Code Window

3. Enter the access code using the up and down arrow buttons on screen. Use the left and right arrows to move to a different digit. You may also tap a number cell to highlight it.

When entering the Access Code, the buttons have the following functions:

Input	Function
	Increase the highlighted digit by 1.
	Decrease the highlighted digit by 1.
	Highlight the previous digit.
	Highlight the next digit.
	Enter Access Code.
	Return to the Main menu.

Descriptions of Calibration Values

This section describes each setting in the Calibration Menu in detail.

Config

The Config menu allows you to set vehicle-wide settings, the supervisor access and clear codes, the vehicle's name, its valve frequencies, and enabled output modes.

Settings

The settings submenu allows you to export or import calibration settings to and from a USB flash drive. It also allows you to restore the 5100ex to its default settings.

Import Settings

The Import Settings menu item allows you to import all your configuration settings from a USB flash drive. See page 52 for a step-by-step guide on importing calibration settings.

Export Settings

The Export Settings menu item allows you to export all your configuration settings to a USB flash drive. See page 50 for a step-by-step guide on exporting calibration settings.

Restore Defaults

The Restore Defaults menu item will restore the 5100ex Calibration Settings to their factory defaults. When the button is pressed a confirmation box will appear, Press OK to Restore Defaults or CANCEL to close the confirmation box without upgrading the system.

Upgrade Firmware

The Upgrade Firmware menu item allows you to upgrade your 5100ex to a new version of firmware located on a USB flash drive. See page 32 for a step-by-step guide on upgrading firmware.

Access Code

The Access Code menu item allows you to change the supervisor code required to enter the Calibration Menu. This code should not be set to the same value as the data clear code. The default value is 00000000.

Clear Code

The Clear Code menu item allows you to change the code required to clear onboard data totals. This code should not be set to the same value as the supervisor access code. The default value is 31415926.

Screen Power Switch

The Screen Power Switch menu item allows you to enable or disable the Screen Power Switch that displays on boot. When enabled, the user will have to press a button on screen before they can run outputs. The default value is Enabled.

Truck Name

The Truck Name menu item changes the descriptive name given to the vehicle. This name is used in event logging. The default value is TRUCK1.

Application Mode

The Application Mode menu item selects the application modes that will be available to the driver. The available options are Granular, Gran/Dir 1 Lane, Gran/Dir 3 Lane, Direct 1 Lane, and Direct 3 Lane. The default value is Granular.

Application Mode	Operation
Granular	• The system will only run in granular mode. • The Mode menu item in the main menu will be disabled.
Gran/Dir 1 Lane	• The system can run in granular mode or direct mode. • The user can swap between granular and direct modes using the Mode menu item in the main menu. • The lane switches will be disabled.
Gran/Dir 3 Lane	• The system can run in granular mode or direct mode. • The user can swap between granular and direct modes using the Mode menu item in the main menu. • The user can turn on and off lanes by using the lane switches. • Aux Output 1 and Aux Output 2 are used by the lanes and cannot be used for other purposes.
Direct 1 Lane	• The system will only run in direct mode. • The Mode menu item in the main menu will be disabled. • The lane switches will be disabled.
Direct 3 Lane	• The system will only run in direct mode. • The Mode menu item in the main menu will be disabled. • The user can turn on and off lanes by using the lane switches. • Aux Output 1 and Aux Output 2 are used by the lanes and cannot be used for other purposes.

Units
The Units menu item changes the type of measurement system the vehicle uses for operation. The available options are English and Metric. The default value is English.

PWM Mode
The PWM Mode setting adjusts the PWM output to allow for operating coils with different resistance values. Normal PWM mode should be used with 6 ohm valve coils, while Profile 1 PWM mode should be used with 3 ohm valve coils. The default value is Normal.

Valve Freq
The Valve Freq menu item changes the frequency the 5100ex uses to run its valves. The frequency can be set to any value between 50Hz and 250Hz. The default value is 50 Hz.

Prewet
The Prewet menu item enables or disables Prewet application for the entire system. The default value is Disabled.

Event Logging
The Event Logging menu item selects the Event Logging format that will be used with the system. The available options are Disabled, PreCise, and AVL. The default value is Disabled. For more information on Event Logging, see page 28.

Model Code
The Model Code menu item is used by the factory to configure the unit.

Speed

The Speed menu allows you to configure settings for the vehicle's speedometer input.

Type

The Type menu item selects the type of speedometer the 5100ex is connected to, either Electronic or Mechanical. Electronic is a high-impedance setting suitable for most modern vehicles. Mechanical enables a pull-up on the speedometer signal for compatibility with legacy speedometer sensors. The default value is Electronic.

Low Trip

The Low Trip Point sets the voltage that the speedometer signal must drop below in order to cause a pulse. The default value is 0.5 V which should work with most vehicle speedometer signals. The low trip point is used to read Axle Pulses; if it is not set correctly, the 5100ex will never register a valid vehicle speed.

The Low Trip Point should be set when the vehicle is moving. Have a passenger slowly increase the low trip point until the menu item shows a mph/kph value greater than 0. In some cases, it may be necessary to adjust the High Trip point in conjunction with the Low Trip point to read a vehicle speed.

High Trip

The High Trip Point sets the voltage that the speedometer signal must climb above in order to cause a pulse. The default value is 2.0 V which should work with most vehicle speedometer signals. The high trip point is used to calculate Axle Pulses; if it is not set correctly, the 5100ex will never register a valid vehicle speed.

The High Trip Point should be set when the vehicle is moving. Have a passenger slowly decrease the high trip point until the menu item shows a mph/kph value greater than 0. In some cases, it may be necessary to adjust the High Trip point in conjunction with the Low Trip point to read a vehicle speed.

Axle Pulses

The Axle Pulses menu item allows you to manually set how many pulses from the speedometer input are expected in 1 mile or kilometer. The current vehicle speed will update as you adjust the value. The default value is 40000 pulses per mile or 24855 pulses per kilometer.

Axle Pulses are used in all closed and open loop operating modes, and should be configured as accurately as possible. If you already know your vehicle’s axle pulses per mile or kilometer you can enter the value directly using this menu. If you aren’t sure of the Axle Pulses per mile or kilometer, they can also be set automatically using the Cal By Distance menu item.

Cal By Distance

The Cal By Distance menu item will calibrate your axle pulses by counting pulses while you drive exactly 1 mile or kilometer. For more information on how to use Cal By Distance, please see Calibrating Axle Pulses by Distance on page 29.

Using the Cal By Distance menu item will change the value of the Axle Pulses menu item. Further refinement can be done by manually changing the Axle Pulses menu item.

Jump Start

The Jump Start Speed menu item sets a speed in miles per hour or kilometers per hour. If the actual vehicle speed is below the Jump Start Speed, the spreader will operate using the Jump Start Speed. The default value is 15 mph or 24 kph.

Note that Jump Start speed is not applied when operating in Dust Control and Herbicide mode, regardless of this setting.

Sim Speed
The Sim Speed menu item enables or disables the simulated speed operation feature. The simulated speed operation feature allows for the troubleshooting of the ground speed based components of the system without having to drive the vehicle. The default value is Disabled.

Ground Speed Interrupt
The Ground Speed Interrupt menu item enables ground speed interrupt when the auger is running in manual mode. When ground speed interrupt is enabled, the system will stop spreading granular material in manual mode when the vehicle is not moving. The default value is disabled.

Auger

The Auger menu allows you to configure settings for the vehicle's granular output. These settings apply across all granular materials. If Config → Application Mode is set to Direct 1 Lane or Direct 3 Lane, this menu will be disabled.

Options
The Options submenu contains settings that apply to the Auger system as a whole, such as Loop Mode and Pulses per Revolution.

Loop Mode
The Loop Mode menu item sets the granular output into either Closed or Open Loop Mode. Closed Loop mode monitors the auger feedback sensor to ensure accurate material displacement. Open Loop mode approximates material displacement from vehicle speed as well as auger and material calibration settings. The default value is Open Loop Mode.

If Prewet is enabled, setting the Auger Loop Mode menu item to Open will also change the Prewet Loop Mode menu item to Open.

Gain
The Gain menu item is a multiplier applied to closed loop granular operation, used to fine-tune the granular system's sensitivity to changes in vehicle speed or granular set rate. A high gain value will cause the granular system to adapt to changes quickly but might cause the system to overshoot the target RPM. A low gain value will cause the granular system to adapt to changes slowly but might cause the system to under apply material until it reaches the target RPM. The default value is 250.

If the auger is hunting and not settling at a steady speed, try reducing the Gain value.

The Gain menu item will not be available if the Loop menu item is set to Open.

Pulses/Rev
The Pulses/Rev menu item sets how many pulses from the auger sensor are expected in 1 revolution of the auger. Pulses/Rev is used in closed loop operating mode and should be configured as accurately as possible. The default value is 128 pulses per revolution. The Pulses/Rev menu item will not be available if the Loop menu item is set to Open.

Blast Time
The Blast Time menu item sets the amount of time in seconds that blast will run once the blue Blast Knob has been pressed and released. The default value is 10 seconds.

Manual Mode
The Manual Mode menu item enables or disables the Manual mode switch on the Operation Screen. When operated in Manual mode, the 5100ex ignores any connected auger feedback sensor and vehicle ground speed and will instead drive the auger output at a fixed percent of maximum speed. The default value is disabled.

Unload
The Unload menu item enables unload mode for all granular materials in the Unload/Prime menu. The default value is disabled.

Low Material
The Low Material menu item determines what spreader action is triggered when the Low Material input becomes active. The available options are Warn or Warn + No Log. The default value is Warn.

Function	Operation
Warn	The Low Material error will appear in the header bar.
Warn + No Log	The low material error will appear in the header bar and the granular material totals will stop updating.

Aug Rev Valve
The Auger Reverse Valve Type menu item determines the operation of the Auger Forward and Auger Reverse outputs, depending on the type of valve installed in the system. This menu item is disabled in 5150 mode. The default value is None.

Option	Description
None	For systems with no Auger Reverse output
Proportional	For systems with two proportional valves, one for Auger Forward and one for Auger Reverse
Selector	For systems with one proportional valve used for Auger Forward and Auger Reverse, and an external selector valve to determine which output is run

Reverse
The Reverse menu item enables Auger Reverse mode and the Auger Reverse switch on the Operation Screen. The default value is disabled. The Reverse button is disabled in 5150 systems.

If the system is not equipped with a 9F harness, Auger Reverse mode will not run an output.

Clear Jam
The Clear Jam menu item enables Clear Jam and the Clear Jam switch on the Operation Screen. The default value is disabled. The Clear Jam button is disabled in 5150 systems.

If the system is not equipped with a 9F harness, Auger Reverse mode will not run an output.

Two Position Gate
The Two Position Gate menu item allows you to enable gate checking for your granular materials. The default value is Disabled. If enabled, you will be able to select the gate position for each granular material. Two Position Gate uses Input 1 for the low gate sensor and input 2 for the high gate sensor. They will not be usable for other features if this is enabled.

Aug Fwd
The Auger Forward submenu contains settings for normal operation of the auger.

Min DC
The Min DC menu item sets the duty cycle required to turn the auger at its slowest rate. Min DC is used in closed, open, manual, and unload modes, and should be configured as accurately as possible. The default value is 20%.

Use the green Standby knob to test the auger speed when adjusting the Min DC value. If a cross auger has its parent function set to Auger Forward it will run at max. If both cross augers have its parent function set to Auger Forward, then whichever was last selected on the operation screen will run at max (and the other will stay off). The current Auger RPM will be shown on the screen to assist with adjustments.

Max DC
The Max DC menu item sets the duty cycle required to turn the auger at its fastest rate. Max DC is used in closed, open, manual, and unload modes, and should be configured as accurately as possible. The default value is 75%.

Use the green Standby knob to test the auger speed when adjusting the Max DC value. If a cross auger has its parent function set to Auger Forward it will run at max. If both cross augers have its parent function set to Auger Forward, then whichever was last selected on the operation screen will run at max (and the other will stay off). The current Auger RPM will be shown on the screen to assist with adjustments.

Aug Rev
The Auger Reverse submenu contains settings for the auger during Auger Reverse mode. None of the settings in this submenu have any effect if Auger Reverse is disabled. The Aug Rev button and submenu is disabled in 5150 systems and if the Auger Reverse Valve Type is set to None or Selector. When the Auger Reverse Valve Type is set to Selector, the Auger Forward min and max DC will be used for both Auger Forward and Auger Reverse output.

Min DC
The Min DC menu item sets the duty cycle required to turn the auger at its slowest rate. Min DC is used in closed, open, manual, and unload modes when Auger Reverse is active and should be configured as accurately as possible. The default value is 20%.

Use the green Standby knob to test the auger speed when adjusting the Min DC value. If a cross auger has its parent function set to Auger Reverse it will run at max. If both cross augers have its parent function set to Auger Reverse, then whichever was last selected on the operation screen will run at max (and the other will stay off). The current Auger RPM will be shown on the screen to assist with adjustments.

Max DC
The Max DC menu item sets the duty cycle required to turn the auger at its fastest rate. Max DC is used in closed, open, manual, and unload modes when Auger Reverse is active and should be configured as accurately as possible. The default value is 75%.

Use the green Standby knob to test the auger speed when adjusting the Max DC value. If a cross auger has its parent function set to Auger Reverse it will run at max. If both cross augers have its parent function set to Auger Reverse, then whichever was last selected on the operation screen will run at max (and the other will stay off). The current Auger RPM will be shown on the screen to assist with adjustments.

Cross 1
The Cross 1 submenu contains the Minimum and Maximum Duty Cycle settings for running a single direction cross auger, or a dual-direction cross auger in the left direction. If Config → Application Mode is set to Gran/Dir 1 Lane, Gran/Dir 3 Lane, Direct 1 Lane, or Direct 3 Lane, this menu will be disabled. The Cross 1 button and submenu is also disabled in 5150 systems.

Parent
The Parent menu item sets when the Cross Auger 1 will run. When the parent function is running, the cross auger will run at a speed proportional to the speed of its parent function. If the parent function for Cross 1 and Cross 2 are the same, the active cross auger is determined using the CROSS LEFT/RIGHT soft switch. Cross 1 will operate when LEFT is selected and Cross 2 will operate when RIGHT is selected. The default value is Disabled.

Parent	Operation
Disabled	Cross 1 will not run.
Aug Fwd	Cross 1 will run when the auger forward output is active.
Aug Rev	Cross 1 will run when the auger reverse output is active.

Min DC
The Min DC menu item sets the duty cycle required to turn the cross auger at its slowest rate. The default value is 20%. Min DC is enabled when Cross Auger 1 Parent is set to Aug Fwd or Aug Rev. Min DC is disabled when Cross Auger 1 Parent is Disabled.

Max DC
The Max DC menu item sets the duty cycle required to turn the cross auger at its fastest rate. The default value is 75%. Max DC is enabled when Cross Auger 1 Parent is set to Aug Fwd or Aug Rev. Max DC is disabled when Cross Auger 1 Parent is Disabled.

Cross 2
The Cross Auger 2 submenu contains the Minimum and Maximum Duty Cycle settings for running a second cross auger or dual-direction cross auger in the right direction. If Config → Application Mode is set to Gran/Dir 1 Lane, Gran/Dir 3 Lane, Direct 1 Lane, or Direct 3 Lane, this menu will be disabled. The Cross 2 button and submenu is also disabled in 5150 systems or if Cross 1 is disabled.

Parent
The Parent menu item sets when the Cross Auger 2 will run. When the parent function is running, the cross auger will run at a speed proportional to the speed of its parent function. If the parent function for Cross 1 and Cross 2 are the same, the active cross auger is determined using the CROSS LEFT/RIGHT soft switch. Cross 1 will operate when LEFT is selected and Cross 2 will operate when RIGHT is selected. The default value is Disabled.

Parent	Operation
Disabled	Cross 2 will not run.
Aug Fwd	Cross 2 will run when the auger forward output is active.
Aug Rev	Cross 2 will run when the auger reverse output is active.

Min DC
The Min DC menu item sets the duty cycle required to turn cross auger 2 at its slowest rate. The default value is 20%. Min DC is enabled when Cross Auger 2 Parent is set to Aug Fwd or Aug Rev. Min DC is disabled when Cross Auger 2 Parent is Disabled.

Use the green Standby knob to test the cross auger speed when adjusting the Min DC value.

Max DC
The Max DC menu item sets the duty cycle required to turn cross auger 2 at its fastest rate. The default value is 75%. Max DC is enabled when Cross Auger 2 Parent is set to Aug Fwd or Aug Rev. Max DC is disabled when Cross Auger 2 Parent is Disabled.

Use the green Standby knob to test the cross auger speed when adjusting the Max DC value.

Granular Mats

The Granular Materials menu allows you to configure settings for up to 4 individual granular materials. These settings include custom displacement, set, and blast rates for each material. If Config → Application Mode is set to Direct 1 Lane or Direct 3 Lane, this menu will be disabled.

Materials Enabled
The Materials Enabled menu item changes how many granular materials will be available to the 5100ex during operation. If a granular material is configured with non-default settings and then is disabled with this menu item, its custom settings will not be cleared. The default value is 1.

Mat 1, Mat 2, Mat 3, etc.
Entering the Mat # submenu presents the custom settings available for a particular granular material.

Name
The Name menu item allows you to set a custom name for the granular material, such as “SAND” or “SALT”. A maximum of 5 characters can be used in the material name. This name will appear on the Operation Screen when selected. The default values are MAT1, MAT2, MAT3, and MAT4.

Gate Position
The Gate Position menu item sets the expected gate position for the material. The default value is Low. The Gate Position menu item will only be editable when Config → Auger → Options → Two Position Gate is set to Enabled.

AutoCal
The AutoCal menu item allows you to calibrate your displacement if your system is closed loop and full speed displacement rate for the granular material by measuring material dispensed. For more information on how to use AutoCal, please see AutoCalibration of Granular Materials on page 32.

Using the AutoCal menu item will change the value of the Displacement and Full Speed Displacement Rate menu items. Further refinement can be done by manually changing the Displacement or Full Speed Displacement Rate menu items.

Displacement
The Displacement menu item is only used for closed loop operation. It allows you to set the amount of pulses generated by the auger sensor when displacing one pound of material. The default displacement value is 6.000 pulses per pound or 13.228 pulses per kilogram. If this value is not known it can be determined using the built in AutoCal feature. For more information see AutoCalibration of Granular Materials on page 32. The Displacement menu item will not be available if the Loop menu item is set to Open.

Calculating Auger Displacement Using SSC5100 Calibration Values
If you know your auger sensor's pulses per revolution and your auger's output pounds or kilograms per revolution, use the equations below to calculate the appropriate pulses per pound or pulses per kilogram value.

$$Auger\ pulses\ per\ pound = \frac{Sensor\ pulses\ per\ revolution}{Auger\ pounds\ per\ revolution}$$

$$Auger\ pulses\ per\ kilogram = \frac{Sensor\ pulses\ per\ revolution}{Auger\ kilograms\ per\ revolution}$$

Full Speed Displacement Rate
The Full Speed Displacement Rate menu item allows you to set the maximum amount of granular material displaced by the auger in a single minute when running at Maximum RPM. The default value is 1000.0 pounds per minute or 0453.6 kilograms per minute. If this value is not known it can be determined using the built in AutoCal feature. For more information see AutoCalibration of Granular Materials on page 32.

Number Of Set Rates
The Number Of Set Rates menu item changes how many set rates will be available to the driver during operation. The default value is 10. If a set rate is configured with non-default settings and then is disabled by reducing the number of set rates using this menu item, its custom settings will not be cleared.

Set Rates
Entering the Set Rate submenu presents a list of all the custom set rates available for the granular material.

Set Rate 1, Set Rate 2, Set Rate 3, etc.
The Set Rate menu item sets which pounds per mile or kilograms per kilometer setting will be output when the user chooses the corresponding set rate. The default values are shown in the table below.

Set Rate	Default English Rate (Pounds per Mile)	Default Metric Rate (Kilograms per Kilometer)
Set Rate 1	100	28
Set Rate 2	200	56
Set Rate 3	300	85
Set Rate 4	400	113
Set Rate 5	500	141
Set Rate 6	600	169
Set Rate 7	700	197
Set Rate 8	800	225
Set Rate 9	900	254
Set Rate 10	1000	282

Set Rate 1 will always be used during operation when the green Standby Encoder is turned counter-clockwise more than 10 clicks. Turning the green Standby Encoder clockwise from Set Rate 1 will switch to the next Set Rate at 1 rate per click. Set Rate 2 will always be 1 click before Set Rate 3, and so on.

Blast Rate
The Blast Rate menu item sets the amount of granular material the spreader will spread when it is activated in Blast mode. The default value is 1000 pounds per mile (282 kilograms per kilometer).

Spinner

The Spinner menu allows you to configure settings for the vehicle's spinner output. The following settings are not particular to any granular material. If Config → Application Mode is set to Direct 1 Lane or Direct 3 Lane, this menu will be disabled.

Spinner 1
The Spinner 1 submenu contains settings for Spinner 1, typically the primary spinner.

Parent
The Parent menu item sets when Spinner 1 will run. When the parent function is running, the spinner will run. If Spinner 1 and Spinner 2 are both set to the same Parent, both will run when that Parent is active. When in auger manual mode the spinner will run based on the spinner setting when the system is not in Standby. The default value is Aug Fwd.

Parent	Operation
Disabled	Spinner 1 will not run.
Aug Fwd	Spinner 1 will run when Auger Forward output is active.
Aug Rev	Spinner 1 will run when Auger Reverse output is active.
Cross 1	Spinner 1 will run when Cross 1 output is active.
Cross 2	Spinner 1 will run when Cross 2 output is active.
Auger	Spinner 1 will run when either Auger Fwd or Rev is active.

In most cases, a vehicle is only equipped with one spinner, which will be driven by the Spinner 1 output of the 5100ex. In these cases, set the Parent value to Auger Forward.

In the 5150 systems, the Parent can only be set to Disabled or Aug Fwd.

Min DC
The Min DC menu item sets the duty cycle required to turn the spinner at its slowest rate. The default value is 20%. Min DC button is disabled when Spinner 1 Parent is Disabled and enabled for all other Parent options.

Use the green Standby knob to test the spinner speed when adjusting the Min DC value.

Max DC
The Max DC menu item sets the duty cycle required to turn the spinner at its fastest rate. The default value is 75%. Min DC button is disabled when Spinner 1 Parent is Disabled and enabled for all other Parent options.

Use the green Standby knob to test the spinner speed when adjusting the Max DC value.

Spinner 2
The Spinner 2 submenu contains settings for Spinner 2, typically a secondary or alternate direction spinner. None of the settings in this submenu have any effect if Spinner 1 or Spinner 2 Parent is set to disabled. The Spinner 2 button and submenu are disabled in the 5150ex systems or if Spinner 1 is disabled.

Parent
The Parent menu item sets when Spinner 2 will run. When the parent function is running, the spinner will run. If Spinner 1 and Spinner 2 are both set to the same Parent, both will run when that Parent is active. When in auger manual mode the spinner will run based on the spinner setting when the system is not in Standby. The default value is Disabled.

Parent	Operation
Disabled	Spinner 2 will not run.
Aug Fwd	Spinner 2 will run when Auger Forward output is active.
Aug Rev	Spinner 2 will run when Auger Reverse output is active.
Cross 1	Spinner 2 will run when Cross 1 output is active.
Cross 2	Spinner 2 will run when Cross 2 output is active.
Auger	Spinner 2 will run when either Auger Fwd or Rev is active.

If a vehicle is equipped with a reversing tailgate auger, reversible main conveyor, or cross auger, the main direction spinner will be driven by the Spinner 1 output and the alternate direction spinner will be driven by the Spinner 2 output.

In these cases, set the Spinner 1 → Parent value to the primary direction of the associated auger or conveyor. Set the Spinner 2 → Parent value to the alternate direction of the associated auger or conveyor.

Min DC
The Min DC menu item sets the duty cycle required to turn Spinner 2 at its slowest rate. The default value is 20%. Min DC button is disabled when Spinner 2 Parent is Disabled and enabled for all other Parent options.

Use the green Standby knob to test the spinner speed when adjusting the Min DC value.

Max DC
The Max DC menu item sets the duty cycle required to turn Spinner 2 at its fastest rate. The default value is 75%. Max DC button is disabled when Spinner 2 Parent is Disabled and enabled for all other Parent options.

Use the green Standby knob to test the spinner speed when adjusting the Max DC value.

Number Of Set Rates
The Number Of Set Rates menu item changes how many set rates will be available to the driver during operation. The default value is 20. If a set rate is configured with non-default settings and then is disabled with this menu item, its custom settings will not be cleared.

Set Rates
Entering the Set Rate submenu presents a list of all the custom set rates available for the spinner.

Set Rate 1, Set Rate 2, Set Rate 3, etc.
The Set Rate menu item sets which duty cycle will be used to spin the spinner when the user chooses the corresponding set rate.

The default spinner set rates are meant to provide fine low-end speed control as well as rapid acceleration to maximum speed in the top rates for clearing multiple lanes or intersections. The default values are listed in the table below.

Set Rate	Default Duty Cycle
Set Rate 1	0
Set Rate 2	2
Set Rate 3	4
Set Rate 4	6
Set Rate 5	8
Set Rate 6	10
Set Rate 7	12
Set Rate 8	14
Set Rate 9	16
Set Rate 10	18
Set Rate 11	20
Set Rate 12	22
Set Rate 13	24
Set Rate 14	26
Set Rate 15	32
Set Rate 16	39
Set Rate 17	46
Set Rate 18	64
Set Rate 19	82
Set Rate 20	100

Set Rate 1 will always be used during operation when the blue Blast Encoder is turned counter-clockwise more than 20 clicks. Turning the blue Blast Encoder clockwise from Set Rate 1 will switch to the next Set Rate at 1 rate per click. Set Rate 2 will always be 1 click before Set Rate 3, and so on.

Prewet

The Prewet menu allows you to configure settings for the vehicle's prewet liquid output. These settings are not particular to any prewet material. None of the settings in this menu have any effect if Prewet is disabled in the System menu. If Config → Application Mode is set to Direct 1 Lane or Direct 3 Lane or if Config → Prewet is disabled, this menu will be disabled.

Options

The Options submenu allows you to set the Loop Mode, Gain, Manual Mode, Prewet Prime, and Drive Type for the vehicle's prewet output.

Loop Mode

The Loop Mode menu item sets the prewet output into Closed Loop, Open Loop, Manual Mode, or Gravity Feed. The default value is Open Loop Mode.

Gain

The Gain menu item is a multiplier applied to closed loop prewet operation, used to fine-tune the prewet system's sensitivity to changes in vehicle speed or prewet set rate. A high gain value will cause the prewet system to adapt to changes quickly but might cause the system to overshoot the target RPM. A low gain value will cause the prewet system to adapt to changes slowly but might cause the system to under apply material until it reaches the target RPM. The default value is 250. The Gain menu item will not be available if the Loop Mode menu item is set to Open, Manual, or Gravity Feed.

If the prewet pump is hunting and not settling at a steady speed, try reducing the Gain value.

Manual Mode

The Manual Mode menu item enables or disables the driver-accessible Prewet Manual mode item in the Materials Menu. When operated in Manual mode, the 5100ex ignores any connected prewet feedback sensor and vehicle ground speed and will instead drive the prewet output at a fixed percent of maximum speed. The default value is disabled. The Manual Mode menu item will not be available if the Loop Mode menu item is set to Manual or Gravity Feed.

Low Prewet

The Low Prewet menu item determines what spreader action is triggered when the Prewet Low input becomes active. The available options are Warn or Warn + Disable. The default value is Warn.

Function	Operation
Warn	Prewet low liquid error will appear in the header bar.
Warn + Disable	Prewet low liquid error will appear in the header bar and the prewet output will be turned off. The output will be prevented from turning on as long as the prewet low liquid input is active.

Prewet Prime

The Prewet Prime menu item enables prewet prime mode for the prewet material in the Unload/Prime menu. The default value is disabled.

Drive Type

The Drive Type menu item sets the drive type of the prewet system. The available options are Hydraulic, Electric, and Exhaust. The default value is Hydraulic.

Drive Type	Operation
Hydraulic	The prewet set rate is set independently from the auger rate by using a proportional valve on the valve block to control pump speed. The system will be able to control the prewet output in closed, open, and manual application modes.
Electric	The prewet set rate is set independently from the auger rate by using an electric motor to control the pump speed. The system will be able to control the prewet output in closed, open, and manual application modes.
Exhaust	The prewet application is controlled entirely or partially based on the auger rate by using the exhaust oil from the auger and an optional proportional valve to control the pump speed. When this drive type is selected it is recommended to use the open or manual application modes to control prewet.

Min DC
The Min DC menu item sets the duty cycle required to run the prewet pump at its slowest rate. Min DC is used in closed, open, manual, and prewet prime modes, and should be configured as accurately as possible. The default value is 20%. The Min DC menu item will not be available if the Loop Mode menu item is set to Gravity Feed.

Use the green Standby knob to test the prewet pump output when adjusting the Min DC value. If the loop mode is set to Closed and a prewet flowmeter is installed on the system, the current prewet flowmeter frequency will also be shown on the screen to assist with adjustments.

Max DC
The Max DC menu item sets the duty cycle required to run the prewet pump at its fastest rate. Max DC is used in closed, open, manual, and prewet prime modes, and should be configured as accurately as possible. The default value is 75%. The Max DC menu item will not be available if the Loop Mode menu item is set to Gravity Feed.

Use the green Standby knob to test the prewet pump output when adjusting the Max DC value. If the loop mode is set to Closed and a prewet flowmeter is installed on the system, the current prewet flowmeter frequency will also be shown on the screen to assist with adjustments.

Material Countdown
The Material Countdown submenu allows you to enable Material Countdown, set the Tank Size, and set the Low Liquid Level for the vehicle's prewet output.

Material Countdown
The Material Countdown menu item enables Material Countdown for prewet liquid. The default value is Disabled.

Tank Size
The Tank Size menu item sets the starting point for prewet Material Countdown. The default value is 200 Gallons.

Low Liquid Level
The Low Liquid menu item sets the percentage of remaining liquid that triggers the Low Liquid indication when prewet Material Countdown is Enabled. The default value is 10%.

Prewet Mat

The Prewet Mat menu allows you to configure settings for the prewet material. If Config → Application Mode is set to Direct 1 Lane or Direct 3 Lane or if Config → Prewet is disabled, this menu will be disabled.

Name

The Name menu item allows you to set a custom name for the prewet material, such as "PWT" or "CACL". A maximum of 5 characters can be used in the material name. This name will appear on the Operation Screen when prewet is enabled. The default value is PWT1.

AutoCal

The AutoCal menu item allows you to calibrate your displacement if your system is closed loop and full speed displacement rate for the prewet liquid by measuring liquid dispensed. For more information on how to use AutoCal, please see AutoCalibration of a Prewet Liquid on page 37.

Using the AutoCal menu item will change the value of the Displacement and Full Speed Displacement Rate menu items. Further refinement can be done by manually changing the Displacement or Full Speed Displacement Rate menu items.

The AutoCal menu item will not be available if the Loop Mode menu item is set to Manual or Gravity Feed.

Displacement

The Displacement menu item allows you to set the amount of pulses generated by the prewet sensor when displacing one gallon of material. This pulses per gallon or pulses per liter unit may be listed on your prewet sensor's specification sheet or listed on an attached tag as a "K-Factor". The default displacement value is 1500.0 pulses per gallon or 396.3 pulses per liter. If this value is not known it can be determined using the built in AutoCal feature. For more information see AutoCalibration of a Prewet Liquid on page 37. The Displacement menu item will not be available if the Loop Mode menu item is set to Open, Manual, or Gravity Feed.

Calculating Prewet Displacement Using SSC5100 Calibration Values

If you know your prewet sensor's pulses per revolution and your prewet pump's output ounces or milliliters per revolution, use the equations below to calculate the appropriate pulses per gallon or pulses per liter value.

$$Prewet\ pulses\ per\ gallon = \frac{Sensor\ pulses\ per\ revolution\ \times 128}{Prewet\ ounces\ per\ revolution}$$

$$Prewet\ pulses\ per\ liter = \frac{Sensor\ pulses\ per\ revolution\ \times 1000}{Prewet\ milliliters\ per\ revolution}$$

Full Speed Displacement Rate

The Full Speed Displacement Rate menu item allows you to set the maximum amount of prewet liquid displaced by the prewet pump in a single minute when running at the prewet pump maximum speed. The default value is 5.0 gallons per minute or 18.9 liters per minute. If this value is not known it can be determined using the built in AutoCal feature. For more information see AutoCalibration of a Prewet Liquid on page 37.

The Full Speed Displacement Rate menu item will not be available if the Loop Mode menu item is set to Manual or Gravity Feed.

Number Of Set Rates
The Number Of Set Rates menu item changes how many set rates will be available to the driver during operation. If a set rate is configured with non-default settings and then is disabled with this menu item, its custom settings will not be cleared. The default value is 6. The # of Set Rates menu item will not be available if the Loop Mode menu item is set to Manual or Gravity Feed.

Set Rates
Entering the Set Rate submenu presents a list of all the custom set rates available for the prewet material. The Set Rates menu item will not be available if the Loop Mode menu item is set to Manual or Gravity Feed.

Set Rate 1, Set Rate 2, Set Rate 3, etc.
The Set Rate menu item sets which gallons per ton or liters per ton setting will be output when the user chooses the corresponding set rate. The default values are shown in the table below.

Set Rate	Default English Rate (Gallons per Ton)	Default Metric Rate (Liters per Tonne)
Set Rate 1	3.0	12.5
Set Rate 2	4.0	16.7
Set Rate 3	5.0	20.9
Set Rate 4	6.0	25.0
Set Rate 5	7.0	29.2
Set Rate 6	8.0	33.4

Direct

The Direct menu allows you to configure settings for the vehicle's direct liquid output. These settings are not particular to any direct material. None of the settings in this menu have any effect if Application Mode is set to Granular in the System menu. If Config → Application Mode is set to Granular, this menu will be disabled.

Options
The Options submenu allows you to set the Loop Mode, Gain, Blast Time, Manual Mode, Unload, Low Liquid, and Output Connector for the vehicle’s direct output.

Direct Type
The Direct Type menu item sets the specific type or combinations of multiple types of direct liquid application used by the controller. Each combination of the three types: Anti-Ice, Dust Control, and Herbicide are available. The default value is Anti-Ice.

The spreading units are chosen based on the selected Direct Type as follows:

Type	English Units	Metric Units
Anti-Ice	Gal/Mi	L/KM
Dust Control	Gal/Sq Yd	L/M^2
Herbicide	Gal/Ac	L/HA

Loop Mode
The Loop Mode menu item sets the direct output into either Closed or Open Loop Mode. Closed Loop mode monitors the direct feedback sensor to ensure accurate material displacement. Open Loop mode approximates material displacement from vehicle speed as well as direct pump and material calibration settings. To properly run the system in open loop mode the direct system must use a positive displacement pump. The default value is Open Loop Mode.

Gain
The Gain menu item is a multiplier applied to closed loop direct operation, used to fine-tune the direct system's sensitivity to changes in vehicle speed or direct set rate. A high gain value will cause the direct system to adapt to changes quickly but might cause the system to overshoot the target RPM. A low gain value will cause the direct system to adapt to changes slowly but might cause the system to under apply material until it reaches the target RPM. The default value is 100.

If the direct pump is hunting and not settling at a steady speed, try reducing the Gain value.

The Gain menu item will not be available if the Loop menu item is set to Open.

Blast Time
The Blast Time menu item sets the amount of time in seconds that blast will run once the blue Blast Knob has been pressed and released. The default value is 10 seconds.

Manual Mode
The Manual Mode menu item enables or disables the Manual mode switch on the Operation Screen. When operated in Manual mode, the 5100ex ignores any connected direct feedback sensor and vehicle ground speed and will instead drive the direct pump at a fixed percent of maximum speed. The default value is disabled.

Unload
The Unload menu item enables unload mode for direct liquid in the Unload/Prime menu. The default value is disabled.

Low Direct
The Low Direct menu item determines what spreader action is triggered when the Low Direct input becomes active. The available options are Warn or Warn + Disable. The default value is Warn.

Function	Operation
Warn	Low direct error will appear in the header bar.
Warn + Disable	Low direct error will appear in the header bar and the direct output will be turned off. The output will be prevented from turning on as long as the low direct input is active.

Output Connector
The Output Connector menu item determines what spreader output the direct system will use. The available options are Aug Fwd and Cross Rt/Direct. The default value is Cross Rt/Direct.

Min DC
The Min DC menu item sets the duty cycle required to run the direct pump at its slowest rate. Min DC is used in closed, open, manual, and unload modes, and should be configured as accurately as possible. The default value is 20%.

Use the green Standby knob to test the direct pump output when adjusting the Min DC value. If the loop mode is set to Closed and a direct flowmeter is installed on the system, the current direct flowmeter frequency will also be shown on the screen to assist with adjustments.

If Config → Application Mode is set to Gran/Dir 3 Lane or Direct 3 Lane, the left, center, and right lanes can be turned on an off using the first three switches.

Max DC
The Max DC menu item sets the duty cycle required to run the direct pump at its fastest rate. Max DC is used in closed, open, manual, and unload modes, and should be configured as accurately as possible. The default value is 75%.

Use the green Standby knob to test the direct pump output when adjusting the Max DC value. If the loop mode is set to Closed and a direct flowmeter is installed on the system, the current direct flowmeter frequency will also be shown on the screen to assist with adjustments.

If Config → Application Mode is set to Gran/Dir 3 Lane or Direct 3 Lane, the left, center, and right lanes can be turned on an off using the first three switches.

Max Hertz
The Max Hertz menu item sets the max hertz measured when the direct pump is run at its fastest rate. Max Hertz is used in closed mode, and should be configured as accurately as possible. This value is automatically updated from the last value measured in the Max DC screen. The default value is 175 Hertz.

Material Countdown
The Material Countdown submenu allows you to enable Material Countdown, set the Tank Size, and set the Low Liquid Level for the vehicle's direct output.

Material Countdown
The Material Countdown menu item enables Material Countdown for direct liquid. The default value is Disabled.

Tank Size
The Tank Size menu item sets the starting point for direct Material Countdown. The default value is 1,800 Gallons.

Low Liquid Level
The Low Liquid menu item sets the percentage of remaining liquid that triggers the Low Liquid indication when direct Material Countdown is Enabled. The default value is 20%.

Anti-Ice

The Anti-Ice menu allows you to configure settings for the Anti-Ice material. If Config → Application Mode is set to Granular or Anti-Ice is not selected as one of the available direct liquid types in the Direct Type options, this menu will be disabled.

Name
The Name menu item allows you to set a custom name for the direct material, such as "DIR" or "CACL". A maximum of 5 characters can be used in the material name. This name will appear on the Operation Screen when direct is enabled. The default value is DIR.

AutoCal
The AutoCal menu item allows you to calibrate your displacement if your system is closed loop and full speed displacement rate for the direct liquid by measuring liquid dispensed. For more information on how to use AutoCal, please see AutoCalibration of a Direct Liquid on page 42.

Using the AutoCal menu item will change the value of the Displacement and Full Speed Displacement Rate menu items. Further refinement can be done by manually changing the Displacement or Full Speed Displacement Rate menu items.

Displacement
The Displacement menu item allows you to set the amount of pulses generated by the direct sensor when displacing one gallon of material. This pulses per gallon or pulses per liter unit may be listed on your direct sensor's specification sheet or listed on an attached tag as a "K-Factor". The default displacement value is 100.0 pulses per gallon or 26.4 pulses per liter. If this value is not known it can be determined using the built in AutoCal feature. For more information see AutoCalibration of a Direct Liquid on page 42. The Displacement menu item will not be available if the Loop Mode menu item is set to Open.

Calculating Direct Displacement Using SSC5100 Calibration Values
If you know your direct sensor's pulses per revolution and your direct pump's output ounces or milliliters per revolution, use the equations below to calculate the appropriate pulses per gallon or pulses per liter value.

$$Direct\ pulses\ per\ gallon = \frac{Sensor\ pulses\ per\ revolution\ \times 128}{Direct\ ounces\ per\ revolution}$$

$$Direct\ pulses\ per\ liter = \frac{Sensor\ pulses\ per\ revolution\ \times 1000}{Direct\ milliliters\ per\ revolution}$$

Full Speed Displacement Rate
The Full Speed Displacement Rate menu item allows you to set the maximum amount of direct liquid displaced by the direct pump in a single minute when running at the direct pump maximum speed. The default value is 100.0 gallons per minute or 378.5 liters per minute. If this value is not known it can be determined using the built in AutoCal feature. For more information see AutoCalibration of a Direct Liquid on page 42.

Number Of Set Rates
The Number Of Set Rates menu item changes how many set rates will be available to the driver during operation. If a set rate is configured with non-default settings and then is disabled with this menu item, its custom settings will not be cleared. The default value is 10.

Set Rates
Entering the Set Rate submenu presents a list of all the custom set rates available for the direct material.

Set Rate 1, Set Rate 2, Set Rate 3, etc.
The Set Rate menu item sets which gallons per mi or liters per km setting will be output when the user chooses the corresponding set rate. The default values are shown in the table below.

Set Rate	Default English Rate (Gallons per Mile)	Default Metric Rate (Liters per Kilometer)
Set Rate 1	20.0	47.0
Set Rate 2	25.0	58.8
Set Rate 3	30.0	70.6
Set Rate 4	35.0	82.3
Set Rate 5	40.0	94.1
Set Rate 6	45.0	105.8
Set Rate 7	50.0	117.6
Set Rate 8	55.0	129.4
Set Rate 9	60.0	141.1
Set Rate 10	65.0	152.9

Blast Rate
The Blast Rate menu item sets the amount of direct material the spreader will spread when it is activated in Blast mode. The default value is 65 gallons per mile (152.9 liters per mile).

Dust Control

The Dust Control menu allows you to configure settings for the direct material. If Config → Application Mode is set to Granular or Dust Control is not selected as one of the available direct liquid types in the Direct Type options, this menu will be disabled.

The spreading units for dust control are:

Type	English Units	Metric Units
Dust Control	Gal/Sq Yd	L/M^2

Most of the functions inside the Dust Control menu operate the same as those in the Anti-Ice menu. Refer to the above section for information on setting each of these parameters. Dust control does have the following additional controls for Boom Width setup.

Boom Width
Entering the Boom Width submenu allows the boom widths to be set for each boom. Note that the Left and Right booms are only available when the Direct Liquid system is set to Multi-Lane.

Herbicide

The Herbicide menu allows you to configure settings for the direct material. If Config → Application Mode is set to Granular or Herbicide is not selected as one of the available direct liquid types in the Direct Type options, this menu will be disabled.

The spreading units for herbicide are:

Type	English Units	Metric Units
Herbicide	Gal/Ac	L/HA

Most of the functions inside the Herbicide menu operate the same as those in the Anti-Ice menu. Refer to the above section for information on setting each of these parameters. Herbicide does have the following additional controls for Boom Width setup.

Boom Width
Entering the Boom Width submenu allows the boom widths to be set for each boom. Note that the Left and Right booms are only available when the Direct Liquid system is set to Multi-Lane.

Inputs/Outputs

The Inputs/Outputs menu allows you to configure settings for the input and aux output wires on the primary spreader harness.

Inputs
The Inputs submenu allows you to configure the settings for the input wires.

Input 1, Input 2, Input 3, Input 5, Input 6
The Input menu item allows you to set what 5100ex function will run when the corresponding Input wire is grounded. The default value is Off. If Config → Auger → Options → Two Position Gate is Enabled, Input 1 and Input 2 will be used by that feature and cannot be adjusted here.

Function	Operation
Off	The input does nothing.
Blast	The input will be used to turn on and off the spreader blast function remotely.
Standby	The input will be used to activate and deactivate the spreader output remotely.
Low Material	The input will be used to activate an alarm when the granular material is running low or empty and the spreader is attempting to apply granular material
Low Prewet	The input will be used to activate an alarm when the liquid in the prewet liquid tank is low.
Conveyor Stall	The input will be used to indicate a Conveyor Stall condition.
Oil Level	The input will be used to indicate an Oil Level Warning.
Oil Temp	The input will be used to indicate an Oil Temperature Warning
Filter Bypass	The input will be used to indicate a Filter Bypass error condition.
Low Direct	The input will be used to activate an alarm when the liquid in the direct liquid tank is low.
Low Liquid	The input will be used to activate an alarm when the liquid in the direct liquid tank or prewet liquid tank is low.

Outputs
The Outputs submenu allows you to configure the settings for the aux output wires. If 5150 mode is enabled or Config → Application Mode is set to Gran/Dir 3 Lane or Direct 3 Lane, this menu will be disabled.

Output 1, Output 2
The Output menu item allows you to set what 5100ex function will activate the aux output. The default value is Off.

Function	Operation
Off	The aux output does nothing.

Auger On	The aux output will be on when the auger is running.
Auger Forward	The aux output will be on when auger forward is active.
Auger Reverse	The aux output will be on when auger reverse is active.
Prewet	The aux output will be on when prewet is active.
Prewet On	The aux output will be on when the prewet pump is running.
Prewet Divert	The aux output will be on when auger reverse and prewet are active.
Standby	The aux output will be on when the system is not in standby.
Direct	The aux output will be on when direct is active.
Direct On	The aux output will be on when the direct pump is running.

Hoist/Plow

The Hoist/Plow menu allows you to configure settings related to the operation of the hoist and plow on 5150ex systems. This menu is only available on 5150ex systems.

Options

The Options item allows you to configure which of the hydraulic functions can be activated using the unit. This feature is only available on 5150ex systems. The default value is Hoist & Plow.

Option	Description
Hoist & Plow	The system will contain switch functions and outputs for the hoist up, hoist down, plow up, plow down, plow left and plow right hydraulic functions.
Hoist	The system will contain switch functions and outputs for the hoist up, and hoist down hydraulic functions.
Plow	The system will contain switch functions and outputs for the plow up, plow down, plow left and plow right hydraulic functions.

Plow Float

The Plow Float menu item sets the operation of the Plow Down Float function. When active the plow down float function will keep 12 V on the plow down output. The plow down float function is deactivated by pressing the plow up switch. This feature is only available on 5150ex systems. The default value is Disabled.

Option	Description
Disabled	Plow float is not active.
Delayed	Plow float will activate when the plow down function is held for 3 seconds.
Enabled	Plow float will activate when the plow down function is pressed.

Max DC

The Max DC submenu allows you to set the duty cycle that the switch related hydraulic functions will operate at during standard operation. This feature is only available on the FORCE America ONE systems.

Plow Up

The Plow Up menu item adjusts the duty cycle that the plow up output will operate at during standard operation.

Plow Left

The Plow Left menu item adjusts the duty cycle that the plow left output will operate at during standard operation.

Plow Right
The Plow Right menu item adjusts the duty cycle that the plow right output will operate at during standard operation.

Hoist Up
The Hoist Up menu item adjusts the duty cycle that the hoist up output will operate at during standard operation.

Limit Percentages
The Limit Percentages submenu allows you to set the percentage of maximum range that the switch related hydraulic function will operate at when in limit mode. Limit mode is active whenever more than one of the following functions is active: Plow up, plow left, plow right, hoist up, hoist down or auger. The values in this menu are only editable when the Limit Scheme is set to Custom. This feature is only available on the FORCE America ONE systems.

Plow Up
The Plow Up menu item adjusts the limit percentage for the plow up output.

Plow Left
The Plow Left menu item adjusts the limit percentage for the plow left output.

Plow Right
The Plow Right menu item adjusts the limit percentage for the plow right output.

Hoist Up
The Hoist Up menu item adjusts the limit percentage for the hoist up output.

Hoist Down
The Hoist Down menu item adjusts the limit percentage for the hoist down output.

Auger
The Auger menu item adjusts the limit percentage for the auger output. When the auger output is being limited the prewet output will be adjusted as well.

Alarms

The Alarms menu allows you to configure buzzer settings for the various errors and warnings.

Auger
The Auger sub menu allows you to configure buzzer settings for the auger errors and warnings. If Config → Application Mode is set to Direct 1 Lane or Direct 3 Lane, this menu will be disabled.

Feedback
The Feedback menu item adjusts the buzzer setting for the auger feedback error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Solid Tone.

Auger Open
The Auger Open menu item adjusts the buzzer setting for the auger open loop default error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Beep.

Range
The Range menu item adjusts the buzzer setting for the auger range error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Solid Tone.

Low Material
The Low Material menu item adjusts the buzzer setting for the low material warning. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Chirp.

Conveyor Stall
The Conveyor Stall menu item adjusts the buzzer setting for the conveyor stall error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Beep.

Two Position Gate
The Two Position Gate menu item adjusts the buzzer setting for the gate sensor error and the gate position error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Silent.

Prewet
The Prewet sub menu allows you to configure buzzer settings for the prewet errors and warnings. If Config → Application Mode is set to Direct 1 Lane or Direct 3 Lane or if Prewet is set to disabled, this menu will be disabled.

Feedback
The Feedback menu item adjusts the buzzer setting for the prewet feedback error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Tone.

Prewet Shutoff
The Prewet Shutoff menu item adjusts the buzzer setting for the prewet shutoff error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Beep.

Range
The Range menu item adjusts the buzzer setting for the prewet range error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Solid Tone.

Low Prewet
The Low Prewet menu item adjusts the buzzer setting for the low prewet warning. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Chirp.

Direct
The Direct sub menu allows you to configure buzzer settings for the direct errors and warnings. If Config → Application Mode is set to Granular, this menu will be disabled.

Feedback
The Feedback menu item adjusts the buzzer setting for the direct feedback error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Solid Tone.

Direct Shutdown
The Direct Shutdown menu item adjusts the buzzer setting for the direct shutdown error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Beep.

Range
The Range menu item adjusts the buzzer setting for the direct range error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Solid Tone.

Low Direct
The Low Direct menu item adjusts the buzzer setting for the low direct warning. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Chirp.

Body Up
The Body Up menu item adjusts the buzzer setting for the body up warning. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Chirp.

Filter Bypass
The Filter Bypass menu item adjusts the buzzer setting for the filter bypass warning. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Chirp.

Oil Level
The Oil Level menu item adjusts the buzzer setting for the oil level warning. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Solid Tone.

Oil Temp
The Oil Temp menu item adjusts the buzzer setting for the oil temp warning. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Solid Tone.

PreCise
The PreCise menu item adjusts the buzzer setting for the PreCise connection error. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Beep.

Blast
The Blast menu item adjusts the buzzer setting for when blast is active. The options are Silent, Single Chirp, Single Beep, and Solid Tone. The default value is Single Chirp.

Event Logging

Event Logging is a method of vehicle usage monitoring that sends spreader data from the 5100ex spreader control to an external device for processing.

To use Event Logging with a PreCise™ MRM device:

1. Contact your local FORCE America Representative to purchase PreCise MRM devices that fit your needs.
2. Connect one PreCise MRM device to the 5100ex spreader in each vehicle you wish to equip with Event Logging. The PreCise MRM devices connect to a DB-9 connector on the back of the 5100ex using the RS-232 Serial Harness included with the PreCise MRM device.
3. Enter the Calibration Menu.
4. Set the Calibration → Config → Event Logging menu item to PreCise MRM.
5. Exit the Calibration Menu.

   Upon leaving Calibration, the 5100ex will authenticate with the PreCise MRM device. Once a successful connection has been established, the 5100ex shall begin sending event data to the PreCise MRM device.

   The gold icon shown in Figure __ will be displayed on screen when a successful connection has been made. If the connection is not successful, the same icon will be displayed with a red X through it.

To use Event Logging with an AVL device other than PreCise™ MRM:

1. Work with your preferred AVL provider to purchase AVL devices that fit your needs.
2. Connect one AVL device to each vehicle you wish to equip with Event Logging. The AVL device connects to a DB-9 connector on the back of the 5100ex.
3. Enter the Calibration Menu.
4. Set the Calibration → Config → Event Logging menu item to AVL.
5. Exit the Calibration Menu.

   Upon leaving Calibration, the 5100ex shall begin sending event data to the AVL device.

Calibrating Axle Pulses by Distance

The 5100ex can automatically set the Calibration → Speed → Axle Pulses value by recording the number of pulses traveled in a mile.

Before calibrating the Axle Pulses by distance:

1. Set the Calibration → Speed → Speedo Type setting.
2. Set the Calibration → Speed → Low Trip Point setting.
3. Set the Calibration → Speed → High Trip Point setting.

If the settings above are not configured properly, the axle pulses may be recorded incorrectly.

To calibrate the Axle Pulses by distance:

Calibrating axle pulses can be completed using either English or Metric units. The steps below will walk you through calibrating the axle pulses using English units.

STEP 1: Enter the Calibration Menu. See Entering the Calibration Menu on page 2.
STEP 2: Navigate to the Calibration → Speed → Cal By Distance setting. Figure 2 will appear, as shown below.

Figure 2: Cal By Distance Screen

STEP 3: Press the Continue button.
STEP 4: Drive the vehicle to a landmark from which you can measure exactly one mile such as an Interstate Highway mile marker.
STEP 5: Press the green, Standby knob to begin counting axle pulses. The status should change to “Counting”.
STEP 6: Drive exactly one mile.

STEP 7: Press the green Standby knob to stop counting axle pulses. The status should change to “Off”, as shown in Figure 3.

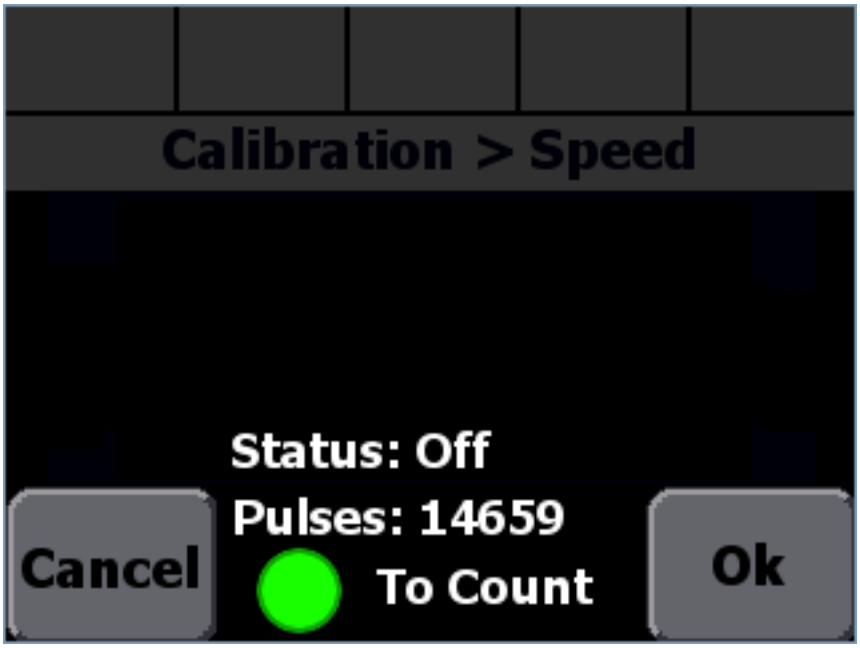


Figure 3: Cal By Distance Screen after Counting Pulses

STEP 8: Press Ok to save and close the Cal By Distance screen. You will be returned to the Axle Pulses screen.

Troubleshooting Calibration by Distance

Error Message	Condition	Possible Solutions
Value below min. Setting to min. 	The 5100ex recorded less than 5000 pulses. This may be caused by a disconnected or intermittent speedometer signal or not driving far enough.	Verify the wiring and connections of the speedometer cable. Verify the Speedometer Type is set properly. Increase the Low Trip Point. Decrease the High Trip Point.
Value above max. Setting to max. 	The 5100ex recorded more than 200,000 pulses. This may be caused by excess noise, a connection to a digital communication circuit on the vehicle or driving too far.	Verify the wiring and connections of the speedometer cable. Verify the Speedometer Type is set properly. Decrease the Low Trip Point. Increase the High Trip Point.

AutoCalibration of Granular Materials

The 5100ex can automatically calculate the displacement and full speed displacement rate values by dispensing granular material. Before you begin make sure Auger Min DC and Max DC have been calibrated. If your system uses a cross auger, also make sure Cross Min DC and Max DC have been calibrated.

To auto calibrate a granular material:

Calibrating displacement and full speed displacement rate can be completed using either English or Metric units. The steps below will walk you through calibrating the displacement and full speed displacement rate using English units.

STEP 1: Enter the Calibration Menu. See Entering the Calibration Menu on page 2.
STEP 2: Select Granular Mats
STEP 3: Select the Material you wish to calibrate.
STEP 4: Select AutoCal.
STEP 5: The Granular AutoCal screen will appear, as shown in Figure 4.

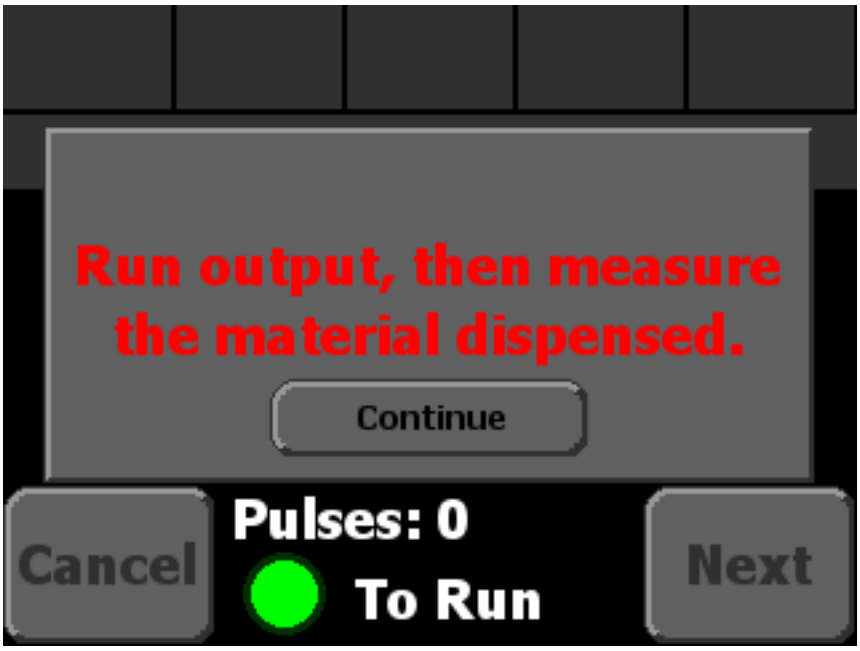


Figure 4: Granular AutoCal Screen

STEP 6: Press the Continue button to dismiss the dialog.
STEP 7: Setup a catch container under the auger to catch any material that is dispensed.
STEP 8: Set the auger percent by twisting the green knob. The value must be greater than 40% and cannot be adjusted once the process is started.
STEP 9: Set the spinner percent to the desired value, if you are using spinner, by twisting the blue knob.
STEP 10: Press the green, Standby knob to begin dispensing material. The status should change to “Running”.
STEP 11: Wait until at least 25 pounds of material have been dispensed. The more material dispensed, the higher the accuracy of the calibration.

STEP 12: Press the green, Standby knob to stop dispensing material. The status should change to “Off”, as shown in Figure 5. If your system is an Open Loop system the pulses will be 0.

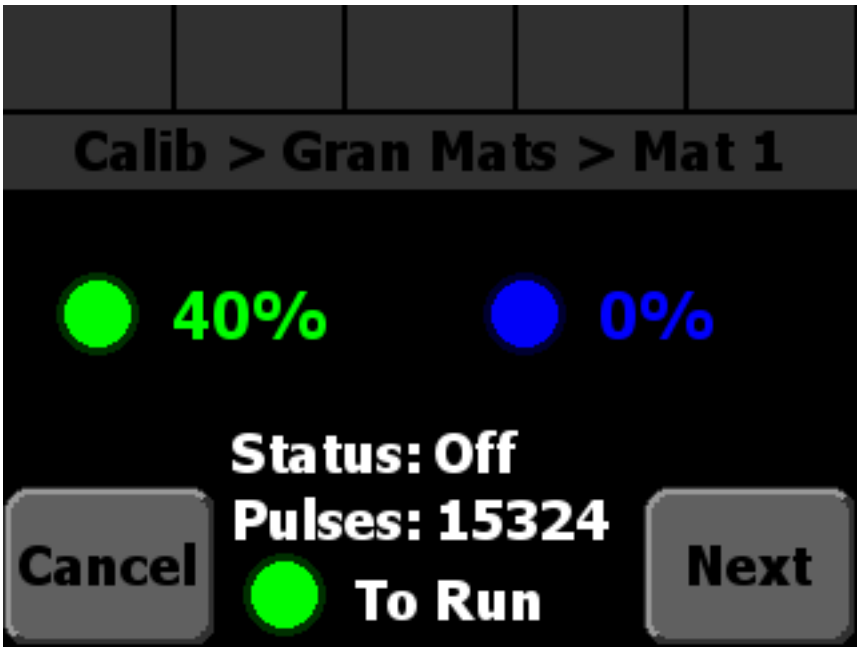


Figure 5: Granular AutoCal Screen after running

STEP 13: Press Next to continue to the next AutoCal screen. It should look like Figure 6 below:

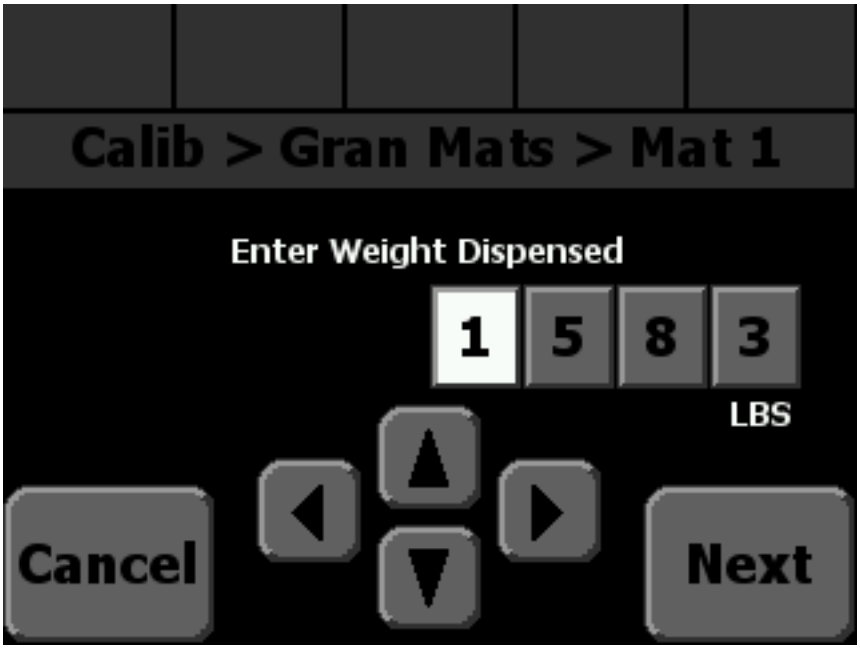


Figure 6: Granular AutoCal Enter Weight

STEP 14: Weigh the amount of material that was dispensed and enter the value. The process will have to be started over if less than 25 LBS were dispensed.

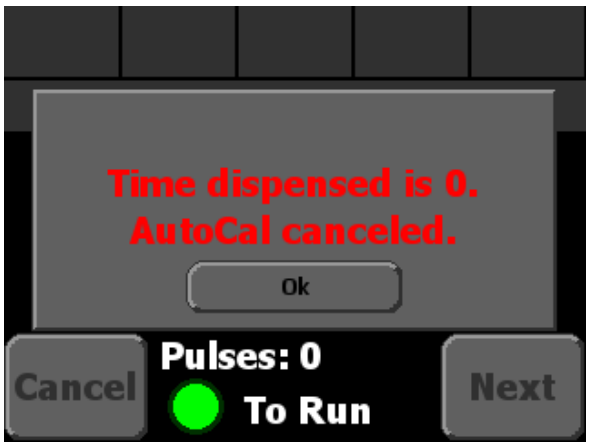
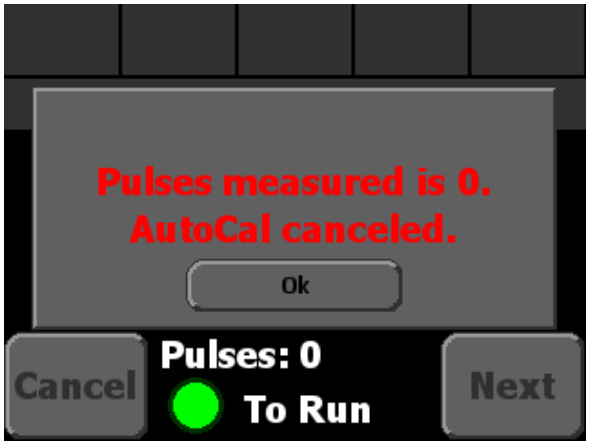
STEP 15: Press Next to continue. The Full Speed Displacement Rate screen will appear. It will be populated with the value calculated by the 5100ex. You can adjust this value if necessary using the arrow keys.

STEP 16: If your system is an open loop system skip to step STEP 18:.

STEP 17: Press Next to continue. The Displacement screen will appear populated with the value calculated by the 5100ex. You can adjust this value if necessary using the arrow keys.

STEP 18: Press Done. AutoCal is complete and you will be returned to the menu you entered from.

Troubleshooting Granular AutoCal

Error Message	Condition	Possible Solutions
Time dispensed is 0. AutoCal Canceled. 	The system was not run.	Press the green, standby pushbutton to dispense material.
Pulses measured is 0. AutoCal Canceled. 	No pulses were detected.	Verify the connection to the auger feedback sensor.
Value below min. Setting to min. 	An inaccurate number of pulses were detected. An inaccurate weight was entered.	Verify the integrity of the auger feedback sensor. Return to the AutoCal weight entry screen and re-enter the value.

Error Message	Condition	Possible Solutions
Value above max. Setting to max. 	An inaccurate number of pulses were detected. An inaccurate weight was entered.	Verify the integrity of the auger feedback sensor. Return to the AutoCal weight entry screen and re-enter the value.

AutoCalibration of a Prewet Liquid

The 5100ex can automatically calculate the displacement and full speed displacement rate values by dispensing prewet liquid. Before you begin, make sure Prewet Min DC and Max DC have been calibrated.

To auto calibrate a prewet liquid:

Calibrating displacement and full speed displacement rate can be completed using either English or Metric units. The steps below will walk you through calibrating the displacement and full speed displacement rate using English units.

STEP 1: Enter the Calibration Menu. See Entering the Calibration Menu on page 2.
STEP 2: Select Prewet Mat
STEP 3: Select AutoCal.
STEP 4: The Prewet AutoCal screen will appear, as shown in Figure 7.

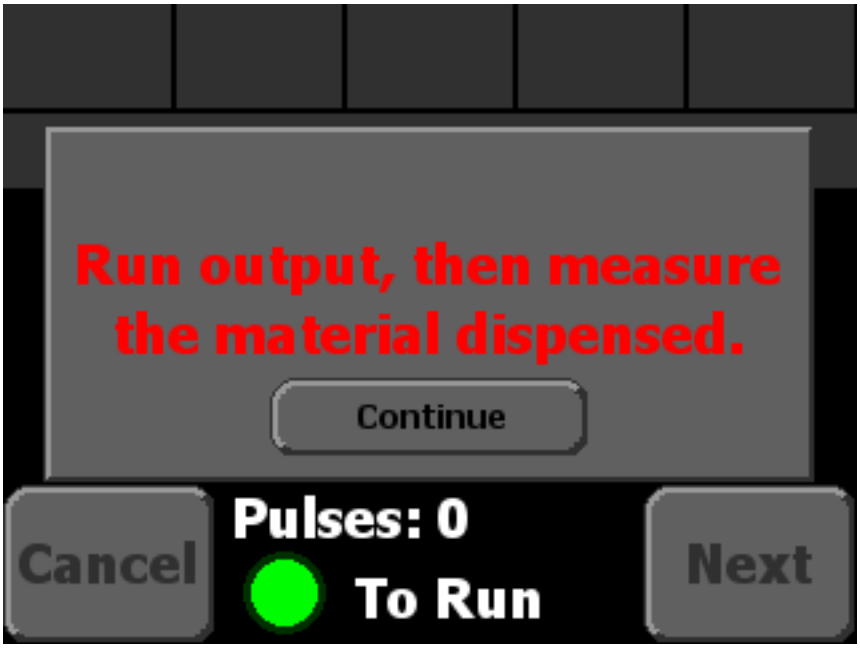


Figure 7: Prewet AutoCal Screen

STEP 5: Press the Continue button to dismiss the dialog.
STEP 6: Setup a catch container under the prewet system to catch any liquid that is dispensed.
STEP 7: If your prewet drive type is set to exhaust: Set the auger percent by twisting the green knob. The value must be greater than 40% and cannot be adjusted once the process is started
STEP 8: Set the prewet percent by twisting the blue knob. The value must be greater than 40% and cannot be adjusted once the process is started.
STEP 9: Press the green, Standby knob to begin dispensing material. The status should change to “running”.
STEP 10: Wait until at least 2 gallons of liquid have been dispensed. The more material dispensed, the higher the accuracy of the calibration.

STEP 11: Press the green, Standby knob to stop dispensing liquid. The status should change to “Off”, as shown in Figure 8. If your system is an Open Loop system the pulses will be 0.

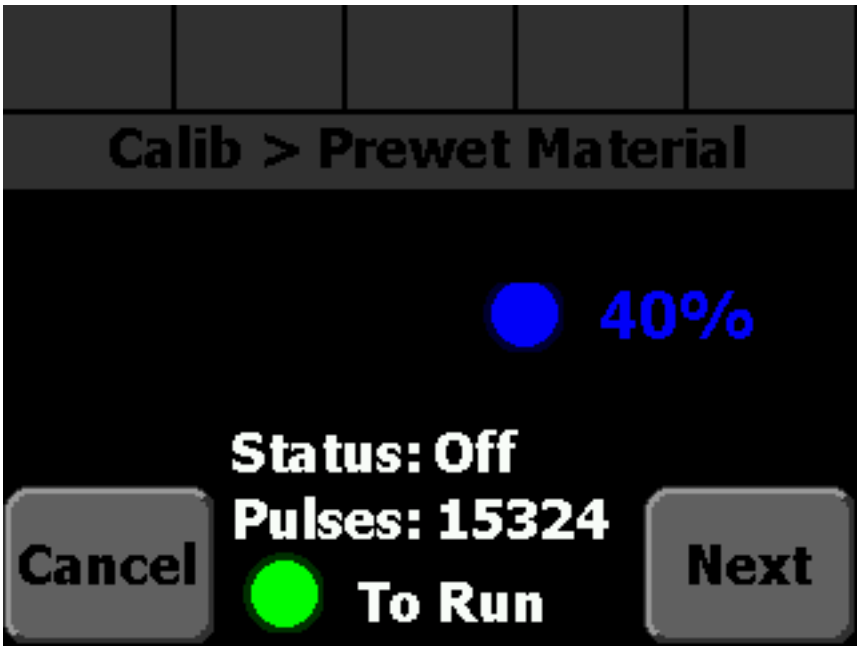


Figure 8: Prewet AutoCal Screen after running

STEP 12: Press Next to continue to the next AutoCal screen. It should look like Figure 9 below:

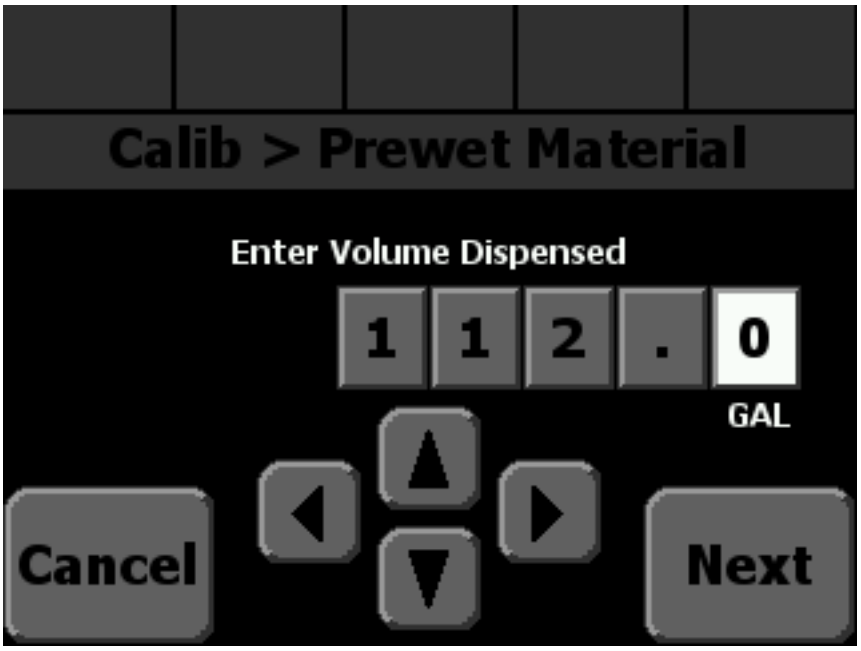


Figure 9: Prewet AutoCal Enter Volume

STEP 13: Measure the amount of liquid that was dispensed and enter the value. The process will have to be started over if less than 2 gallons were dispensed.

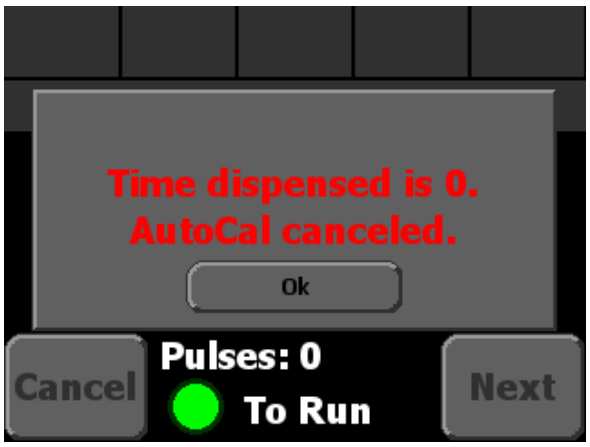
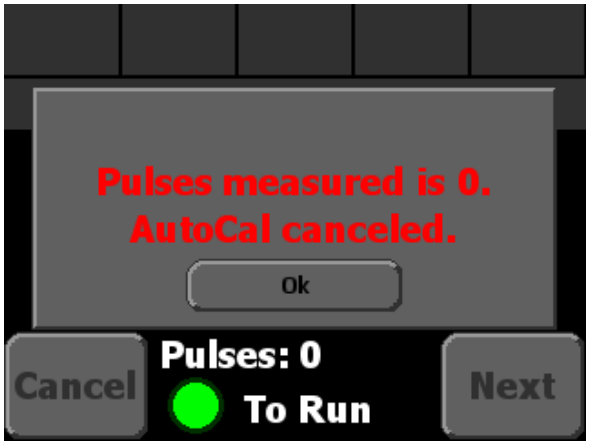
STEP 14: Press Next to continue. The Full Speed Displacement Rate screen will appear. It will be populated with the value calculated by the 5100ex. You can adjust this value if necessary using the arrow keys.

STEP 15: If your system is an open loop system skip to step STEP 17:.

STEP 16: Press Next to continue. The Displacement screen will appear populated with the value calculated by the 5100ex. You can adjust this value if necessary using the arrow keys.

STEP 17: Press Done. AutoCal is complete and you will be returned to the menu you entered from.

Troubleshooting Prewet AutoCal

Error Message	Condition	Possible Solutions
Time dispensed is 0. AutoCal Canceled. 	The system was not run.	Press the green, standby pushbutton to dispense liquid.
Pulses measured is 0. AutoCal Canceled. 	No pulses were detected.	Verify the connection to the prewet feedback sensor.
Value below min. Setting to min. 	An inaccurate number of pulses were detected. An inaccurate weight was entered.	Verify the integrity of the prewet feedback sensor. Return to the AutoCal weight entry screen and re-enter the value.

Error Message	Condition	Possible Solutions
Value above max. Setting to max. 	An inaccurate number of pulses were detected. An inaccurate weight was entered.	Verify the integrity of the prewet feedback sensor. Return to the AutoCal weight entry screen and re-enter the value.

AutoCalibration of a Direct Liquid

The 5100ex can automatically calculate the displacement and full speed displacement rate values by dispensing direct liquid. Before you begin, make sure Direct Min DC and Max DC have been calibrated.

To auto calibrate a direct liquid:

Calibrating displacement and full speed displacement rate can be completed using either English or Metric units. The steps below will walk you through calibrating the displacement and full speed displacement rate using English units.

STEP 1: Enter the Calibration Menu. See Entering the Calibration Menu on page 2.
STEP 2: Select a Direct Liquid type to calibrate: Anti-Ice, Dust Control, or Herbicide
STEP 3: Select AutoCal.
STEP 4: The Direct AutoCal screen will appear, as shown in Figure 10.

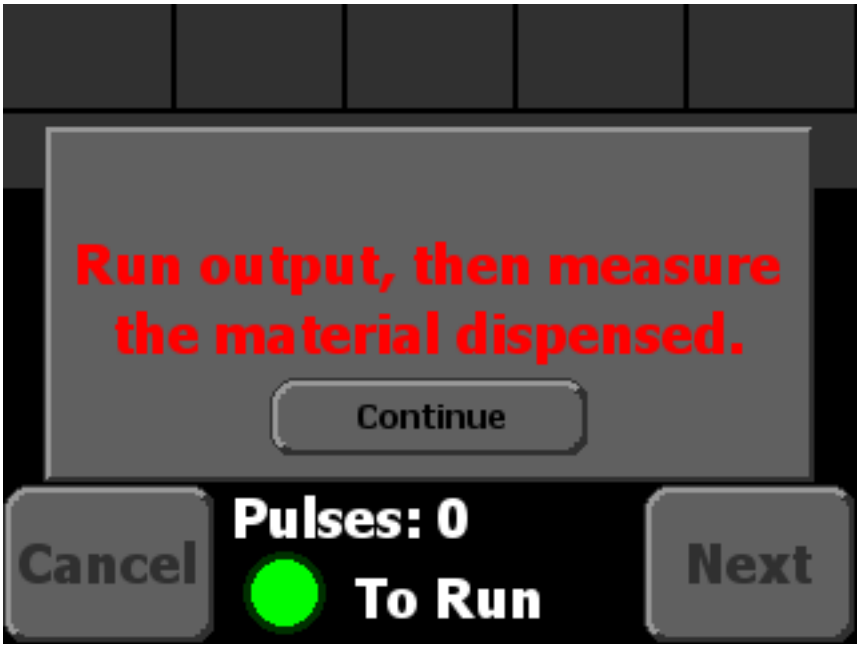


Figure 10: Direct AutoCal Screen

STEP 5: Press the Continue button to dismiss the dialog.
STEP 6: Setup a catch container under the direct system to catch any liquid that is dispensed.
STEP 7: Set the direct percent by twisting the green knob. The value must be greater than 40% and cannot be adjusted once the process is started.
STEP 8: If Config → Application Mode is set to Gran/Dir 3 Lane or Direct 3 Lane, the left, center, and right lanes can be turned on an off using the first three switches.
STEP 9: Press the green, Standby knob to begin dispensing material. The status should change to “running”.
STEP 10: Wait until at least 2 gallons of liquid have been dispensed. The more material dispensed, the higher the accuracy of the calibration.

STEP 11: Press the green, Standby knob to stop dispensing liquid. The status should change to “Off”, as shown in Figure 11. If your system is an Open Loop system the pulses will be 0.

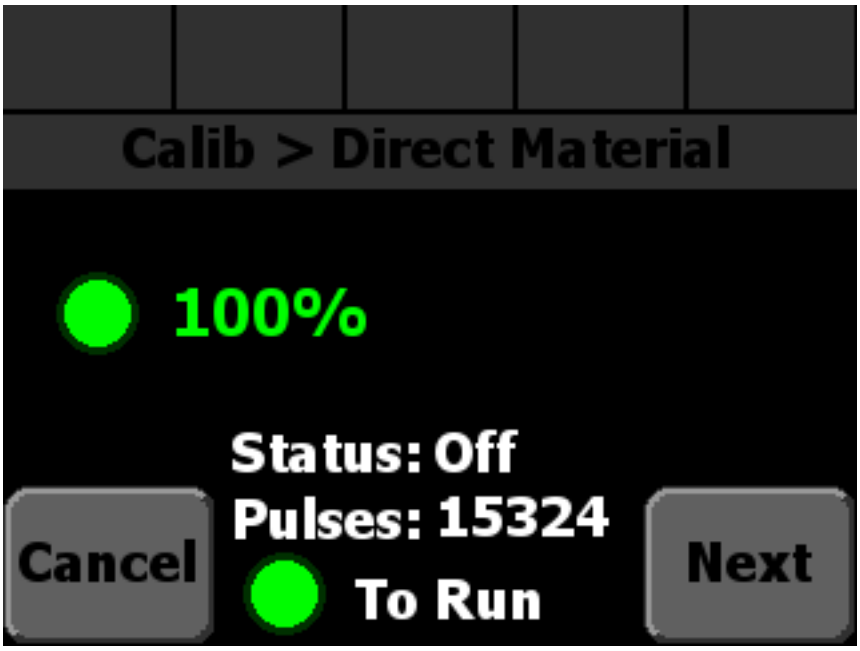


Figure 11: Direct AutoCal Screen after running

STEP 12: Press Next to continue to the next AutoCal screen. It should look like Figure 12 below:

Figure 12: Direct AutoCal Enter Volume

STEP 13: Measure the amount of liquid that was dispensed and enter the value. The process will have to be started over if less than 2 gallons were dispensed.

STEP 14: Press Next to continue. The Full Speed Displacement Rate screen will appear. It will be populated with the value calculated by the 5100ex. You can adjust this value if necessary using the arrow keys. This value will only be correct if you have a positive displacement pump or set the output to 100% during STEP 7:

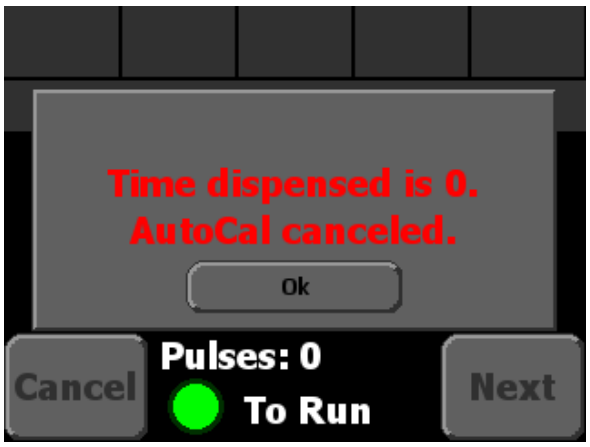
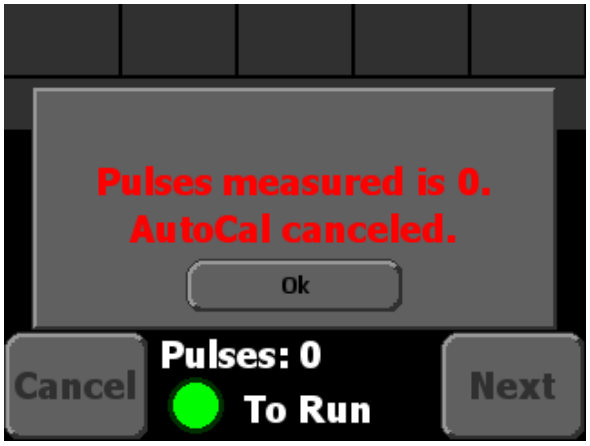
STEP 15: If your system is an open loop system skip to step STEP 17:.

STEP 16: Press Next to continue. The Displacement screen will appear populated with the value calculated by the 5100ex. You can adjust this value if necessary using the arrow keys.

STEP 17: Press Done. AutoCal is complete and you will be returned to the menu you entered from.

STEP 18: Repeat the above steps for each Direct Liquid material type that is enabled.

Troubleshooting Direct AutoCal

Error Message	Condition	Possible Solutions
Time dispensed is 0. AutoCal Canceled. 	The system was not run.	Press the green, standby pushbutton to dispense liquid.
Pulses measured is 0. AutoCal Canceled. 	No pulses were detected.	Verify the connection to the direct feedback sensor.
Value below min. Setting to min. 	An inaccurate number of pulses were detected. An inaccurate weight was entered.	Verify the integrity of the direct feedback sensor. Return to the AutoCal weight entry screen and re-enter the value.

Error Message	Condition	Possible Solutions
Value above max. Setting to max. 	An inaccurate number of pulses were detected. An inaccurate weight was entered.	Verify the integrity of the direct feedback sensor. Return to the AutoCal weight entry screen and re-enter the value.

Upgrading Firmware

FORCE America may release firmware upgrades which add features or resolve issues with the 5100ex Spreader Control. Your 5100ex may be upgraded using a USB flash drive.

Before upgrading the 5100ex firmware:

1. Save a copy of the 5100ex firmware upgrade in the main folder of your flash drive. Firmware upgrades placed inside subfolders will not be detected by the 5100ex.

To Upgrade the 5100ex Firmware:

STEP 1: Enter the Calibration Menu. See Entering the Calibration Menu on page 2.
STEP 2: Navigate to the Calibration → Config → Upgrade Firmware screen. Figure 13 will appear, as shown below.

Figure 13: Upgrade Firmware screen with "Connect USB" message

STEP 3: Connect the USB drive containing the firmware upgrade to the USB port on the left-hand side of the 5100ex.
STEP 4: Once the 5100ex has found the upgrade files, an upgrade file selection menu will appear, as shown in Figure 14.

Figure 14: Upgrade Firmware screen with File Selector

STEP 5: Use the up and down arrow buttons to select an upgrade file to use. If more than 6 upgrade files are available, use the page left and page right buttons on each side of the box to see the other files.

STEP 6: Press the Ok button to select a file. A confirmation box similar to Figure 15 will appear.

Figure 15: Upgrade Firmware File Confirmation

STEP 7: If the file listed is the correct file, press the Ok button to begin the upgrade process and Figure 16 will appear. Otherwise press Cancel and return to STEP 5:

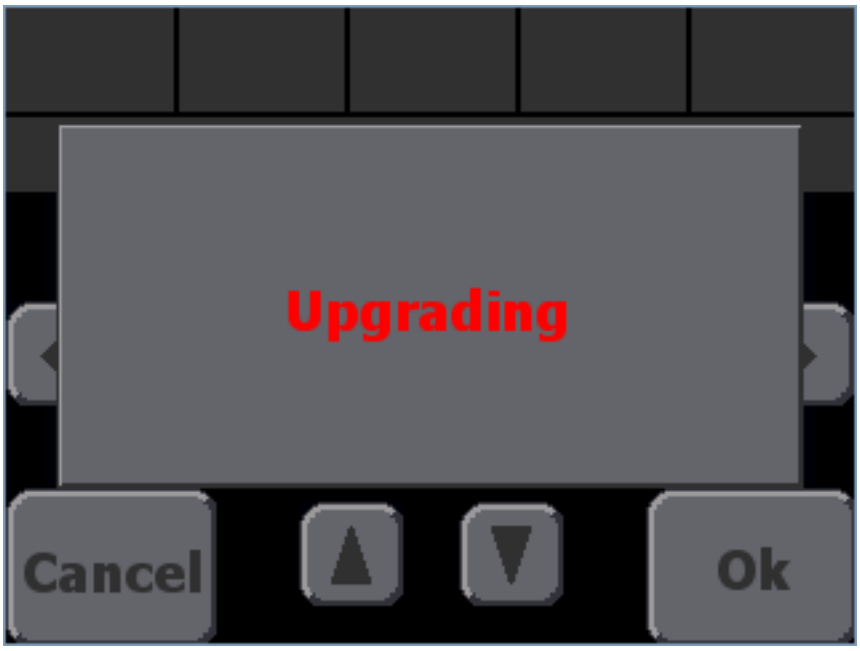


Figure 16: Firmware Upgrade in Process

STEP 8: Wait for the upgrade process to complete. The 5100ex will beep repeatedly until it is finished. Once the upgrade is complete, the 5100ex will restart and return you to the Operation screen.

Exporting Calibration Settings

If you wish to view the calibration settings from a 5100ex or copy settings from one vehicle to another because their hydraulic systems are similar, you may copy them to a USB flash drive using the Export Calibration Settings option. Both a human-readable text file (.TXT) and a secure 5100ex configuration file (.CALEX) will be saved to the USB flash drive during this process.

To Export 5100ex Calibration Settings:

STEP 1: Enter the Calibration Menu. See Entering the Calibration Menu on page 2.
STEP 2: Navigate to the Calibration → Config → Settings → Export Settings screen. Figure 17 will appear, as shown below.

Figure 17: Export Settings File Name Screen

STEP 3: Use the arrow buttons to name the file. The letter can be changed using the up and down arrow keys. The letter to change can be selected using the left and right arrows or pressing the letter to highlight it. The default file name is the value of the Calibration → Config → Truck Name menu item.
STEP 4: Press OK to begin exporting the file. Figure 18 should appear.

Figure 18: Export Settings screen with "Connect USB" message

STEP 5: Connect the USB drive to the USB port on the left-hand side of the 5100ex.
STEP 6: Wait for the Export to complete. Figure 19 will appear.

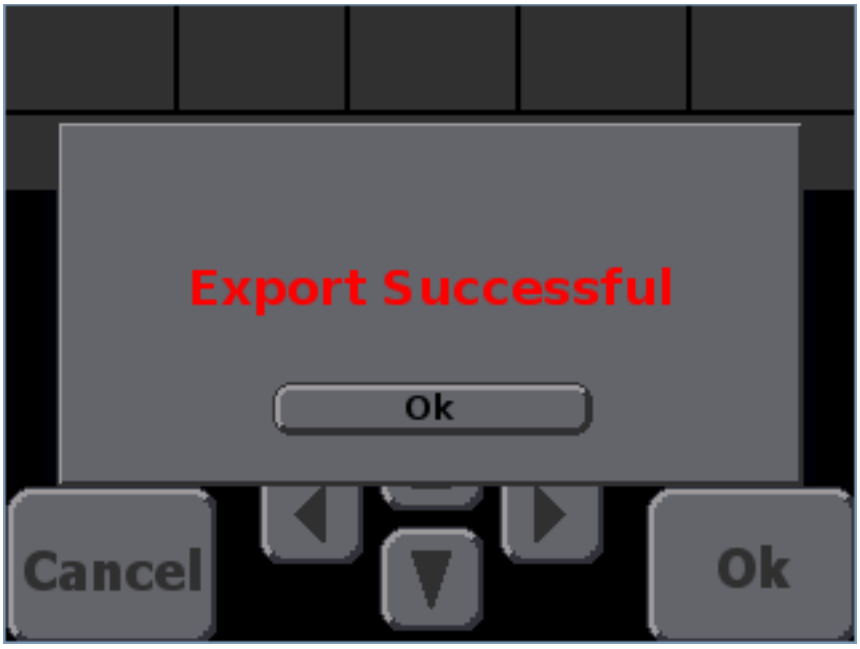


Figure 19: Export Successful Screen

STEP 7: Once the export is complete, press OK and you will be returned to the Calibration menu.

Importing Calibration Settings

If you wish to copy settings from one vehicle to another because their hydraulic systems are identical, you may copy them using the Import Calibration Settings option and a USB flash drive. NOTE: The 5100ex will only import secure 5100ex configuration files (.CALEX). The human-readable exported files (.TXT) cannot not be imported.

To Import 5100ex Calibration Settings:

STEP 9: Enter the Calibration Menu. See Entering the Calibration Menu on page 2.
STEP 10: Navigate to the Calibration → Config → Settings → Import Settings screen. Figure 20 will appear, as shown below.

Figure 20: Import Settings screen with "Connect USB" message

STEP 11: Connect the USB drive containing the configuration settings file to the USB port on the left-hand side of the 5100ex.
STEP 12: Once the 5100ex has found the upgrade files, a configuration settings file selection menu will appear, as shown in Figure 21.

Figure 21: Import Settings screen with File Selector

STEP 13: Use the up and down arrow buttons to select an upgrade file to use. If more than 6 configuration files are available, use the page left and page right buttons on each side of the box to see the other files.

STEP 14: Press the Ok button to select a file. A confirmation box similar to Figure 22 will appear.

Figure 22: Import Settings File Confirmation

STEP 15: If the file listed is the correct file, press the Ok button to begin the import process and Figure 23 will appear. Otherwise press Cancel and return to STEP 12:

Figure 23: Import Successful Screen

STEP 16: Once the import is complete, press OK and you will be returned to the Calibration screen.

Document No: M0119-P
Released: 03/01/2021