

FREEDOM 2

Freedom 2 Calibration/Operator/Owner's Manual

P/N SG07230037

REVISION C

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Document Revision History

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A	01/18/13	INITIAL RELEASE
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Purpose

This manual is a guide to assist in the setup, management and operation of the Freedom 2 spreader control unit. This manual leads the user through a step-by-step setup process for several given application examples presented below.

Contents

Document Revision History	2
Purpose.....	2
Getting Started	5
Operator’s Overview	6
Spreader Controls.....	6
Selecting a material	7
Setting Granular Rate	8
Setting Spinner Rate	8
Setting Liquid Rate (Prewet & Anti-ice).....	9
Spreader Modes	10
Blast	11
Viewing/Saving/Clearing Storm totals.....	11
User ID	12
Administration/Technician Basic Setup.....	13
Security.....	13
Logging In.....	14
F.I.R.S.T. (Freedom Interactive Rapid Setup Tutorial).....	14
Units (Imperial-US/Metric)	14
Date/Time.....	15
Truck ID.....	15
Day/Night Brightness.....	15
Calibration	16
Equipment Needed.....	16
Calibrating Ground Speed (MPH)	16
Configuring Materials	17
Spreader Calibration.....	18
Setting Trims.....	20
Measured Dump.....	Error! Bookmark not defined.
Closed Loop Measured Dump	21
Open Loop Measured Dump	24
Spinner Calibration	24

Percent Mode	26
Lane Mode	26
Prewet Calibration	27
Anti-Ice Calibration	29
Administrative Setup and Functionality	32
Open Loop Mode	32
Encoder Clicks Per Increment	32
Change Password	32
System Stats Menu	33
System Setup Menu	33
Save and Restore Menu	34
Administrative Operating Screen Troubleshooting Tools	37
Glossary	38
Appendix I: Freedom 2 Errors	40
Appendix II: Important Reference Documents and Part Numbers	41

Getting Started

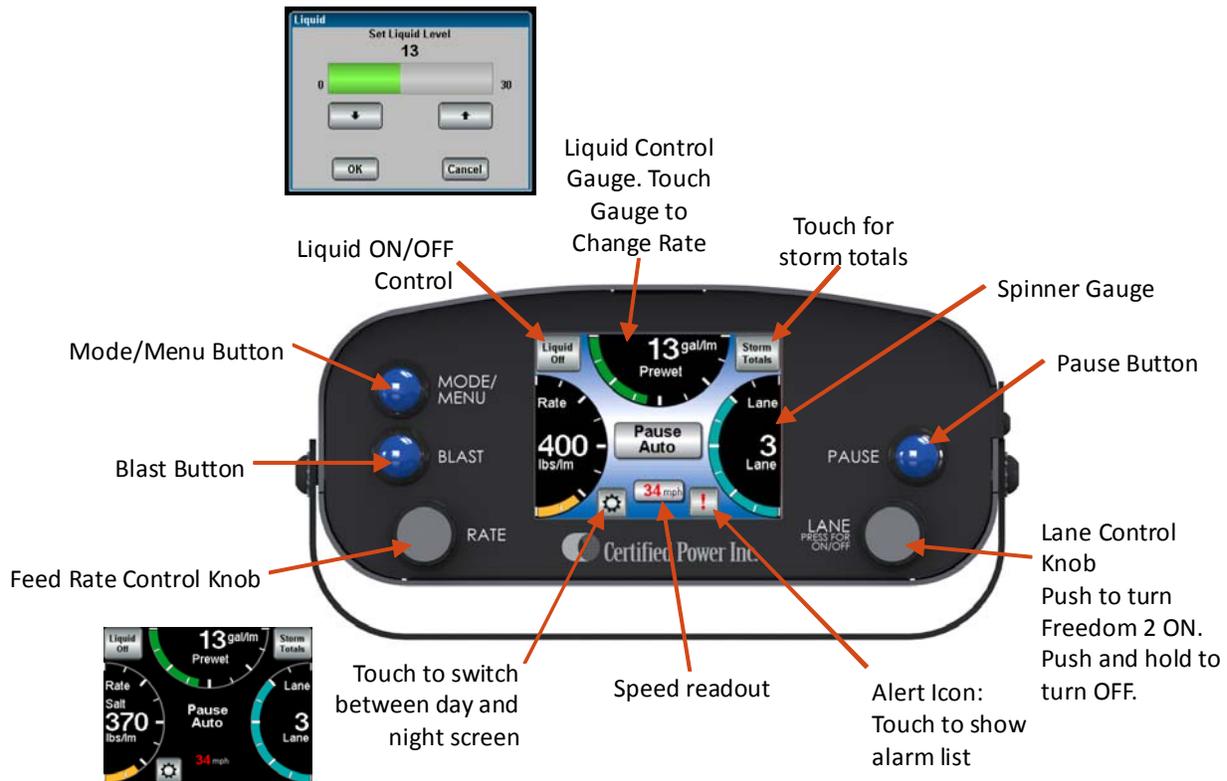
The Freedom 2 spreader control system is the latest in the line of Certified Power midrange spreader controls. The Freedom 2 is designed to replace many older spreader controls including but not limited to, GL400, AS3, DS2, AS2 and MS2. The Freedom 2 comes in 3 distinct versions, 2.0, 2.1 and 2.2. Each type adds upon the features of the model before it. Refer to the chart below for information on the Freedom 2 feature matrix.

FEATURE MATRIX			
FREEDOM 2.X	2.0	2.1	2.2
Ground Speed Oriented Spreading	X	X	X
Ground Speed Triggered	X	X	X
Manual Mode (voltage or current control active)	X	X	X
Auto mode Open-loop Control (V & Amp active)	X	X	X
Auto mode Closed-loop Control			X
Remote pause	X	X	X
Unload mode	X	X	X
Remote blast		X	X
4 Configurable Materials	X	X	X
Liquid (Closed Loop)			X
Liquid (Open Loop current control active)		X	X
Auxiliary Output	X	X	X
AVL Freedom Talk			X
Configurable 0 mph spinner shutoff	X	X	X
Storm Totals USB/ON-SCREEN	X	X	X
Liquid Tank Float Input		X	X
OL and Manual Current (Amps) Regulated Output	X	X	X
Test Speed	X	X	X
Conveyor Stall Input	X	X	X
On-Screen Error Messages & Audible Alarm	X	X	X
Touch screen	X	X	X
Configurable digital inputs	X	X	X
Output Short/Open Detection	X	X	X
Sensor Short detection (Msg/Alarm)	X	X	X

Before setting up or operating your Freedom 2 determine what type you have. It is marked on the back of the unit. It can also be found in the lower left hand corner of the screen during system start or in the “System Info” menu. Keep this chart in mind when reading the manual as some features might not apply to the unit you are using.

This manual only provides assistance in running and initial setup of the spreader control software. It does not include information required to wire the truck. For assistance with truck wiring please refer to the Freedom 2 quick start guide, CPI part number SG07230025.

Controls Overview



Operator's Overview

1. This section of the document covers the "User" level login only.
2. The user has access only to the tools required to operate the spreader control while driving the truck.
3. By default the Freedom 2 will start in "User" Mode
4. The system will not power on automatically with the vehicle. It must be turned on by pressing in the lane knob momentarily.

Spreader Controls

1. Reference the above diagram
2. The knob on the left hand side adjusts the rate of the feeder. Turn knob to increase or decrease the feeder rate.
 - a. The gauge on the screen labeled "Rate" will follow this knob.
 - b. The bar on the gauge will show the amount of available spread rate used.
 - c. The number inside the gauge will show the current spread rate and current material.
3. The knob on the right hand side marked "LANE".
 - a. Turning the knob changes the spinner rate.
 - b. Pressing the knob in turns the control on.
 - c. Pressing and holding the knob for 3 seconds when the control is on will shut the control off.

- d. The gauge above will show the current spinner rate in either lanes or percentage depending on the truck configuration.
- e. The bar on the gauge will show the amount of spinner rate used.
4. **The Pause button will start and stop the operation of the spreader. Before bringing the spreader out of the pause mode, ensure all personnel and equipment are clear of the spreader.**
5. The Blast switch engages Blast mode. When blast is active it will be indicated inside the “Rate” gauge.
6. The Mode switch changes between the available spreading modes. NOTE: All modes may not be available depending upon spreader control software version. The current mode is displayed in the status box in the middle of the screen.
 - a. Automatic Mode: Material output is based on ground speed.
 - b. Manual Mode: 0-100% control of material output. This mode does not change with ground speed.
 - c. Unload Mode: Used to unload the truck.
 - i. Unload mode is canceled if the truck goes higher than 5 mph. The unit returns to pause in auto mode or manual mode.
 - ii. **IMPORTANT!!** Storm totals are not recorded while in unload mode.
7. To toggle prewet on/off press the “Liquid On” or “Liquid Off” button in the upper left corner of the screen.
 - a. If the text and bar are grey in color the liquid is turned off.
 - b. If the text is white and the graph is green in color the liquid is turned on.
8. To change Liquid rate touch the liquid bar graph.
 - a. This brings up the screen to change the liquid percentage output.
 - b. Up and down arrows on the screen will increase and decrease the liquid rate.
 - c. You can also press and drag the bar graph on screen to increase and decrease the liquid rate faster.
 - d. While the adjustment screen is up the Rate knob will also adjust the liquid spread rate.
 - e. Press “OK” to save the rate.
9. The “Sun” symbol in the lower left of the screen toggles between day and night modes.
10. Ground speed, if available, is displayed in the lower center of the screen.
 - a. In ground speed oriented mode speed is displayed in MPH or KPH.
 - b. In ground speed triggered mode only “ON” or “OFF” is displayed.
11. Errors, if active, are shown in the box with an exclamation mark (!) in the lower right of the screen.
12. Storm totals can be viewed with the Storm Totals key in the upper right corner of the screen.

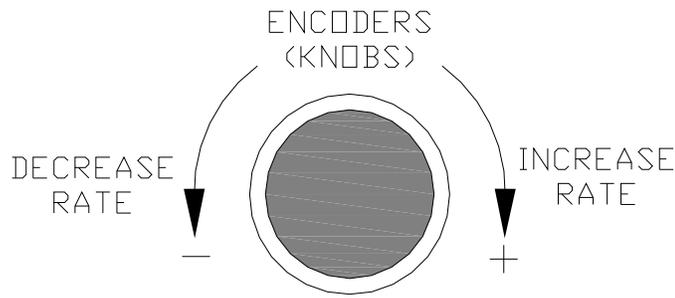
Selecting a material

1. In order to select a material press and hold the “MODE/MENU” to enter the *Main Menu*.
2. Press *Material Selection*.
3. Select one of the named materials listed in the drop down box.
4. Press “OK” to accept material.
5. Press the MODE/MENU button to return to the main operating screen.

(NOTE: It is important to select to the correct material so the Freedom 2 can accurately spread material.)

Setting Granular Rate

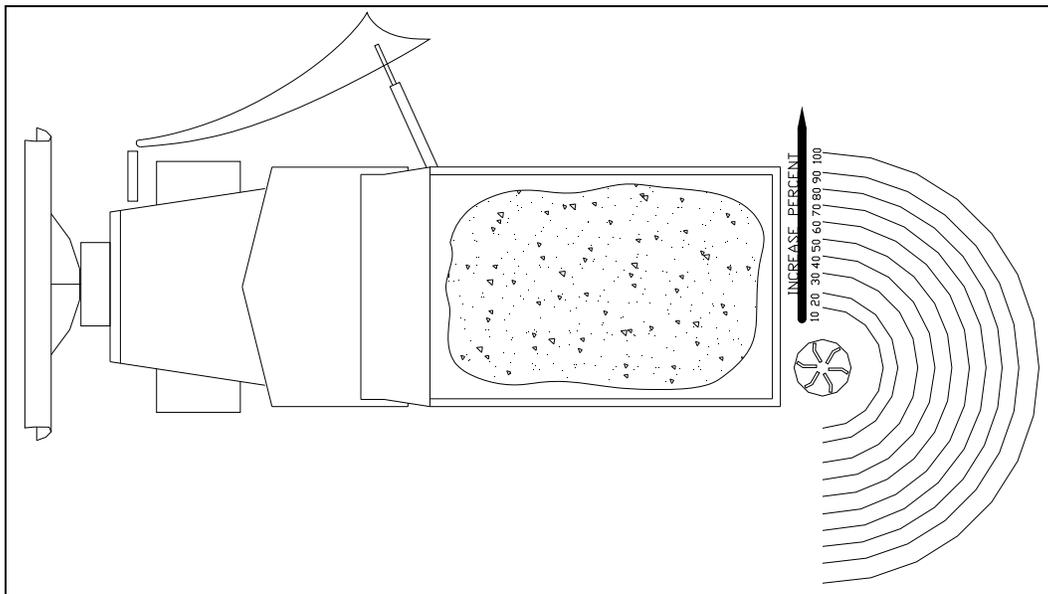
1. In auto mode turning the knob clockwise will increase the rate to the next higher increment step.
2. Turning the knob counter clockwise decreases the rate to the next lower increment step.
3. The increment steps are adjustable and are pre determined by a supervisor during setup.
4. In manual mode the same adjustment applies only it will increase or decrease the percent of available trim from 0-100% in 5% increments.



Setting Spinner Rate

1. Using Percent % mode spinner.
 - a. The spinner speed is adjustable and controlled from 0-100% in 5% increments.
 - b. The feeder operates independently of the Spinner: Granular FEED IS NOT ADJUSTED for changes in the spinner lane width.

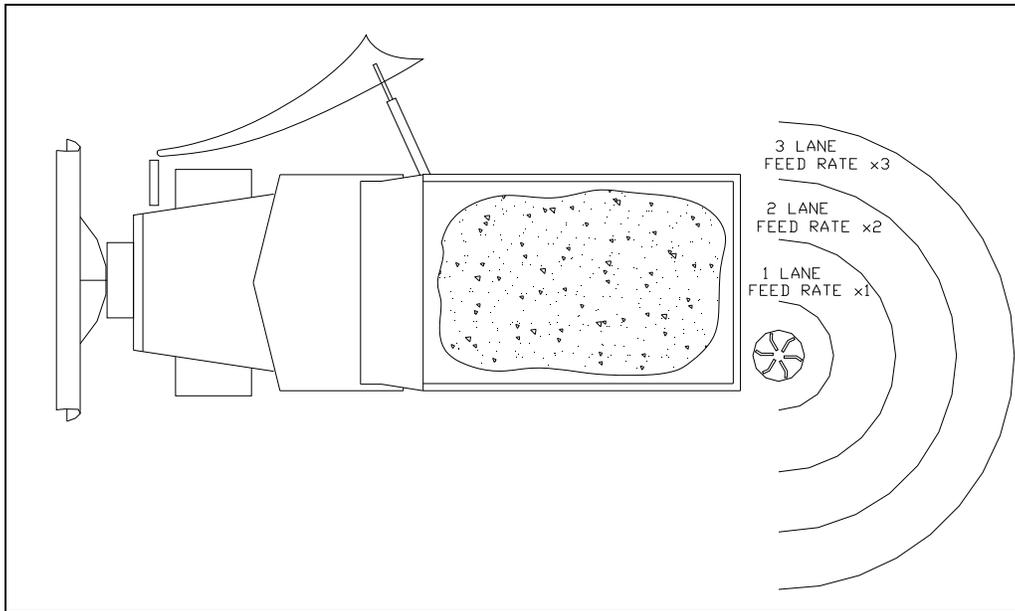
(Spinner percent mode depicted below)



- c. Turning the spinner knob clockwise increases the spinner rate percent, turning the spinner knob counterclockwise decreases the spinner rate percent.

2. Using Lane mode Spinner.
 - a. LANE CONTROL SPINNER: Lanes have been pre-calibrated for you. You simply choose 0-1-2-3 or 4 lanes. (Max number of lanes is set by your systems supervisor during setup). Note: If 0 lanes are selected the feeder will not run.
 - b. The Feeder is controlled by the spinner in 'LANE' mode: Granular feed Lbs./LnM (Pounds per Lane-Mile) is automatically adjusted for your selected lane width to maintain uniform coverage for your set granular rate.

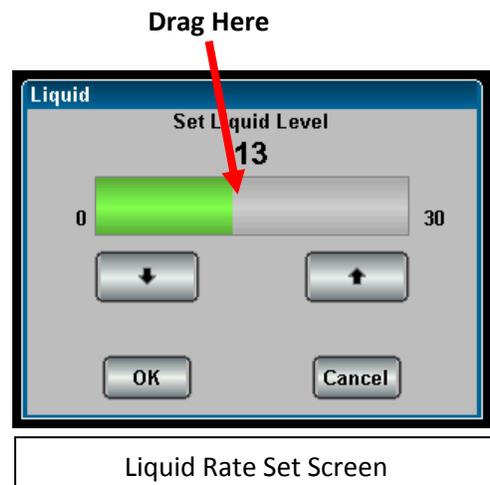
(Lane control spinner operation depicted below)



- c. Turning the spinner knob clockwise increases the lanes being spread, turning the spinner knob counterclockwise decreases the lanes.
 - d. The number of lanes being spread will be shown in the middle of the lane gauge.
3. When in Lane or Percentage mode and not in pause the spinner may be active! The spinner may not stop with ground speed if the administrator has selected this option in system setup.

Setting Liquid Rate (Prewet & Anti-ice)

1. Press the liquid gauge in the top middle of the screen. This brings up the screen that allows the setting of the liquid rate.
2. The liquid can be set by pressing and dragging the bar graph in the screen or using the up and down arrows or using the rate knob
 - a. Prewet is set in
 - i. 0-100% in manual mode
 - ii. 0-30 gallons/ton in automatic mode



- b. Anti-ice is set in
 - i. 0-100% in manual mode
 - ii. 0-120 gallons/lane-mile in automatic mode

*Note: When using the 3 lane switch box accessory SG07010479, The Freedom 2 controller does not automatically account for changes in lane selection. If connected to a 3 lane anti-ice unit, the operator will have to double or triple the rate setting to accurately set the liquid output rate. For example:

For a 60 gallon per lane mile setting, the operator will have to set either 60, 120 or 180 on the screen for 1,3 or 3 lanes respectively.

3. Prewet will follow spread rate in automatic mode delivering the desired gallons of liquid per ton of material spread.
4. After selecting your rate press "OK" to confirm and return to the main operating screen
5. Liquid can be turned on and off independent of the granular rate by pressing the button in the upper left corner of the screen
 - a. If the rate is displayed in grey the prewet is off
 - b. If the rate is displayed in white the prewet is on
6. If you have "ON/OFF Prewet" the only prewet control available is turning it on and off via the button in the upper left of the screen.

Spreader Modes

1. Manual Mode
 - a. Manual mode may not be available for use. This is configurable during system setup. Check with your supervisor if you are unable to operate in Manual mode.
 - b. Do not use Manual mode to unload vehicle. It will incorrectly record the material dumped to storm totals.
 - c. Rates in manual mode are percentage of trim only.
 - i. There is no automatic feed rate increase in ground speed
 - ii. Precise material delivery per mile is not available
2. Unload Mode
 - a. Unload mode has identical functionality as Manual Mode except it does not write material data into logs. Use "unload mode" instead of manual mode to unload the vehicle at the yard. This will keep the Storm and Annual Totals from being mistakenly recorded; generating false Granular and Liquid spread data.
 - b. The controller limits the vehicle speed while unloading to less than 5 mph or the controller will default back into Auto mode/pause.
3. Automatic Mode
 - a. Auto mode provides the most accurate material delivery.
 - b. Ground speed is tracked to increase and decrease the material feed rate as necessary to place the set amount of material per lane mile.
 - c. Prewet will also increase with the increase in granular spread rate
 - d. If lane mode is enabled as the spinner lanes are increased the material feed rate is increased to distribute the same amount of material on the second lane as was being spread on the first lane.

Blast

1. Blast is used for feeder and prewet only
 - a. Blast is used to increase the amount of material over current spread rate for use in intersections and bridge decks or other places where ice is detrimental.
 - b. Ask your supervisor where and when to use Blast.
 - c. Blast has no interaction with anti-ice operation.
 - d. All Blast settings are set up individually with each granular material by your equipment supervisor.
2. Blast types:
 - a. ON/OFF: Press Blast to activate function. Blast runs indefinitely until Blast button is pressed again.
 - b. MOMENTARY: Blast functions only while Blast switch is held
 - c. TIMED: Blast will function for pre-set time (1-99 seconds) after the button is released. Pressing the Blast button again will stop the blast mode before the timer runs out.
3. Ground Speed Required: Blast can be configured to require ground speed for activation
4. When in Blast output goes to:
 - a. MAX TRIM: Feeder will go to maximum speed allowed by trim settings
 - b. MAX RATE: Maximum feeder rate in pounds per lane/mile or lbs/mile set up by your equipment supervisor for each granular material. If running "Lane mode" spinner the number of lanes is factored into the Blast output to keep a true pounds/Lane mile output.
 - c. OTHER RATE: Any configured rate between 1-9,999 lbs/lane mile.

Viewing/Saving/Clearing Storm totals

1. Viewing Storm Totals
 - a. Do not view storm totals while driving the truck
 - b. To view Storm Totals for the selected material simply press the "Storm Totals" button in the upper right and of the screen
 - c. Clear functionality may not be available to the "User" level operator based on settings. This is configurable by the system administrator.
 - d. The selected material will be displayed on the top of the window along with all storm data since the last time the control was cleared
 - e. Alternatively to view all storm totals enter the *Main Menu*



Storm total screen accessed via the operating screen



- i. Press *Data View*
 - ii. You can select to view Storm or Annual totals for the truck.
2. Saving Storm Totals
 - a. If you have a USB thumb drive inserted into the front USB port of the Freedom 2 it is also possible to save the Storm Totals to a .CSV file for importation into a database.

Storm total screen accessed via the main menu

 - i. Plug the USB drive in before entering the *Main Menu*.
 - ii. Browse to the *Data View* menu
 - iii. Press "Save To USB"
 1. Note: if you have a previous save on the drive the Freedom 2 will prompt you to Replace and start a new file or Add the new data to the existing file
 2. **It is recommended that you select "ADD" data. This will keep all existing data while appending the latest data to the drive**
 3. **By selecting "Replace" you risk losing data that may have not been already saved to the database.**
 - iv. Wait for the Freedom 2 to confirm the save is complete.
3. Clearing Storm Totals
 - a. If the administrator has given the permission for users to clear storm totals in the main storm total screen there will also be a button marked "Clear".
 - b. Press "Clear" to clear the totals for the material you are currently viewing.
 - c. The Freedom 2 will ask for confirmation if you are sure you want to clear the totals. If you are, press "Yes" to clear the totals
 - d. Each Material must be cleared separately
 - e. To clear annual totals you must be logged in as administrator or technician

User ID

1. Optionally the driver can login via their "User ID"
2. User ID grants no permissions more than a standard user login. It only allows the data collection features of the Freedom 2 to identify the User.
3. To change the User ID
 - a. Enter the *Main Menu*
 - b. Select *System Setup*
 - c. Select *User ID*
 - d. Enter your assigned user id into the text box
 - e. Press "OK"
 - f. Your User ID is now saved until the unit is restarted
 - g. Whenever the Freedom 2 is restarted the User ID will have to be reentered

Admin/Technician Basic Setup

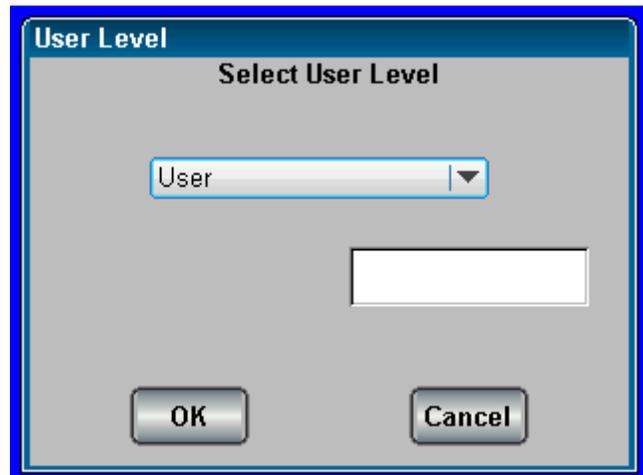
This section will lead you through the setup of a Freedom 2 Unit

Security

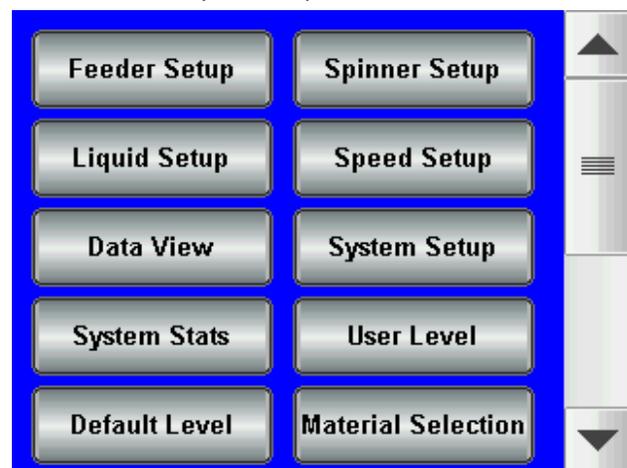
1. Admin: HIGHEST LEVEL OF ACCESS
 - a. NOT used for calibration. Use Technician level access for calibration.
 - b. Use Admin log-in if problem related to equipment setup is found. e.g. changing digital input assignment options.
 - c. The Admin user should possess a high level of understanding about the vehicle and its installed equipment.
 - d. The Admin user should possess a full understanding of the Freedom 2 setup process and understand what setup variables affect directly and indirectly hydraulic functions.
 - e. Access to all menus.
 - f. Ability to modify ANY system variable.
 - g. Ability to change passwords.
 - h. Clearing of the EEPROM (Resetting the control system to factory defaults calibration and setup data will be permanently lost). Loss of permissions will occur when resetting to factory defaults. Restoring permissions after factory defaults are set may require Certified Power assistance.**
1. Technician: MEDIUM LEVEL ACCESS
 - a. Use Technician level access to calibrate the spreader control.
 - b. Change motor trims.
 - c. Manually enter spreader calibration factors if they are known.
 - d. Set-up multiple materials to spread.
 - e. Calibrate MPH input, Feeder calibration, Spinner calibration, Liquid setup and trims.
 - f. Clear storm and Annual totals.
 - g. Adjust display and operating panel brightness.
2. Operator: STANDARD LEVEL ACCESS
 - a. Use for typical daily operations of the Freedom 2 system and equipment it is controlling.
 - b. Ability to clear Storm totals if set-up by the administrator.
 - c. Adjust display and operating panel brightness for day and night
3. Passwords
 - a. Logins
 - a. Operator (no password)
 - b. Technician (there is no password by default)
 - c. Admin (default is "admin")
 - b. Be sure to change your Administrator and Technician password to restrict access to critical setup values! This is a crucial step to keep un-qualified persons from mistakenly or maliciously changing setup values that could lead to equipment malfunction and/or damage.
 - c. If you lose or forget your password contact your regional Certified Power sales representative or sales office for instructions on how to reset them

Logging In

1. With the vehicle stopped (you cannot enter the menu when ground speed is present) press and hold the physical blue MODE/MENU key on the upper left of the Freedom 2 control for 4 seconds until the menu appears. After the menu appears release the key. The unit will not allow the menu to open unless the vehicle is stopped.
2. Using the touch screen press *User Level*
3. Select the appropriate user level for this operation, TECHNICIAN is preferred for calibration
4. Type in technician password. (Note: default password is blank)
5. Press ok
 - a. If the login information was correct it will display the Technician menu. This menu will have many more options than the default user. Only options available to you as this login level will be displayed.
 - b. If the login was incorrect the Freedom 2 will alert you
6. It is possible to do calibration as Admin but it is recommended that all calibration is done as Technician



Login Screen



Typical Freedom 2 Menu

F.I.R.S.T.

1. Calibration can be a difficult task so the Freedom 2 includes the F.I.R.S.T. guided setup
2. Once logged in as Technician locate the *F.I.R.S.T. GUIDE* button in the main menu
3. F.I.R.S.T. will step through every task associated with setting up a Freedom 2 for operation
4. F.I.R.S.T. will also allow the periodic recalibration of whatever functions require recalibration as part of yearly or other maintenance programs.
5. View calibration section of this manual for further details on calibration functions
6. You should be familiar with all topics covered in this manual before attempting to perform a FIRST setup.



F.I.R.S.T. Main Menu

Units (Imperial-US/Metric)

1. The Freedom 2 is capable of running in Imperial

and Metric units.

- a. The Eagle1 is capable of switching from one unit system to the other and back again as the user desires. However it is recommended that before setup begins the Eagle1 is put into the desired measurement system
- b. User must be logged in at the technician level using the process described previously.
 - i. From the Main Menu press: System Setup -> Display Units
 - ii. Choose the Measuring system desired and press OK
- c. Metric label abbreviations are as follows: This applies to ALL setup and operating values
 - i. kg - Kilogram
 - ii. km – Kilometer
 - iii. MT – Metric Ton or tonne
 - iv. kg/Ln.km – Kilogram per Lane Kilometer
 - v. l/kg - Liters per Kilogram
 - vi. l/min. – Liters per Minute
 - vii. km/h - Kilometers per Hour
 - viii. kg/min. – Kilograms per Minute

Date/Time

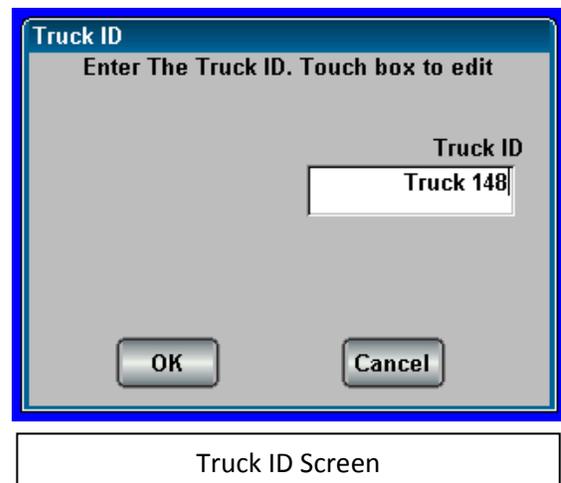
1. A new Freedom 2 may not arrive with the correct date and time entered. The unit will warn the operator that one or both of these values are not correctly set.
2. To check and set the date and time valves enter the *Main Menu -> System Setup*
 - a. There are two menus here for setting these valves
 - b. *Date*: Sets the current date
 - c. *Time*: Sets the current time
3. In either menu set the correct information with the drop down menus and press “Ok”.
4. The new Date and Time are now set and the system will no longer indicate the times are not set

Truck ID

1. Freedom 2 has a settable truck ID to identify each truck in your fleet for data collection purposes.
2. This is defaulted to the MAC address
3. 15 Characters max

Day/Night Brightness

1. All users can access the Day and Night brightness menus in the System Setup menu.
2. These are independently set. This allows for high visibility during the day and reduced glare at night
3. These can be changed at any time the menu is available.
4. The sun icon on the main operating screen will allow the operator to switch between day and night modes quickly.
5. Night mode also includes a night vision friendly high contrast black background



Calibration

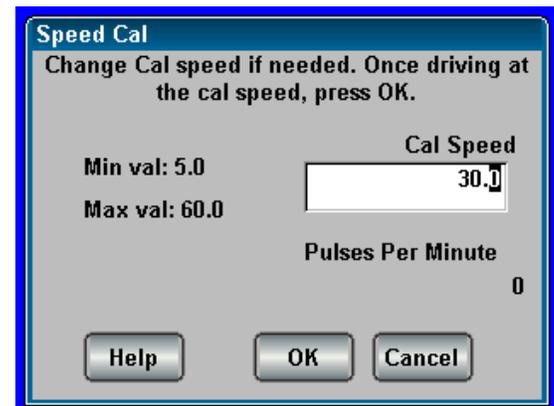
1. This section will guide you through the calibration necessary for operation of the Freedom 2
2. Log In as Technician for calibration

Equipment Needed

1. Fully functioning Truck with Spreader installed.
2. Materials intended for use. i.e., salt, sand, or cinders.
3. Pre-Wet with sufficient fluid in the tanks.
 - a. Use caution if using straight water. Water will freeze, causing major damage to all system components.
 - b. If water is to be used for calibration, be sure to flush the system thoroughly with windshield washer fluid when calibration is completed to remove all water.
4. Available Truck scale for measuring the weight of the vehicle before and after a measured dump.
5. A calculator (if setting up multiple materials).
6. A bathroom scale and 5 gallon bucket and shovel (if truck scale is unavailable).

Calibrating Ground Speed (MPH)

1. It is absolutely necessary as part of the calibration process to make sure the Freedom 2 speed display matches the vehicle speedometer if you are using a ground speed based control.
2. Drive the vehicle. The MPH display should match and track with the vehicle speedometer. If it does not, then follow the instructions below.
3. Go to: *Main Menu -> Speed Setup.*
4. Select from one of ground speed modes
 - a. None: No ground speed signal will be used. (Spreader will operate in manual mode 100% of the time. If this is the desired setting no further setup is required in this area)
 - b. Triggered: Spreader will turn on and off with ground speed in manual mode. (Spreader will operate in manual mode 100% of the time. If this is the desired setting no further setup is required in this area). Only "ON" or "OFF" will be shown in the speed box on the display.
 - c. Oriented: Spreader will be able to run in full automatic mode. Spreader will automatically adjust output rate to match ground speed.
5. Vehicle Speed input type
 - a. VRM: This setting used for Low voltage AC signals. This type of input can be susceptible to noise and the wiring should be shielded with a drain path to chassis ground.
 - b. Mechanical Source: This is the most typical setting. This setting will be used in most applications where the MPH signal source is the vehicles computer. Always check with the vehicle manufacturer before attaching to any vehicle wiring.
 - c. Mechanical Sink: Typically this setting is used for after-market hall-sensors that are NPN open-collector output.
 - d. Low Voltage: Same as mechanical source.
6. Confirm your selection and then enter the *Speed Cal* menu. You will now calibrate the Freedom 2's speed input.



Speed Calibration Screen

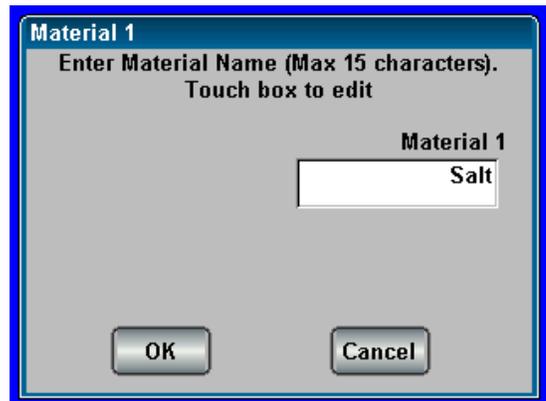
7. Change the “Cal Speed” value to the vehicle speed you intend to drive at. Typical values are around 30 mph.
Caution! Have someone else drive the vehicle while ANY calibration adjustments are made.
8. While the vehicle is in motion and the dash speedometer reads exactly the value you set in “Speed Cal” press OK to save the value
9. If no pulses appear on screen the ground speed is incorrectly wired or configured. Check your ground speed type and wiring and attempt to calibrate ground speed again.
10. When you return to the main operation screen the speed shown on the Freedom 2 should now match the vehicle speedometer.
11. OPTIONAL: Enter the *Speed Setup* -> *Speed Threshold* menu. This variable changes the size of a speed change required for the Freedom 2 to react. 0.5 is the recommended setting.

Configuring Materials

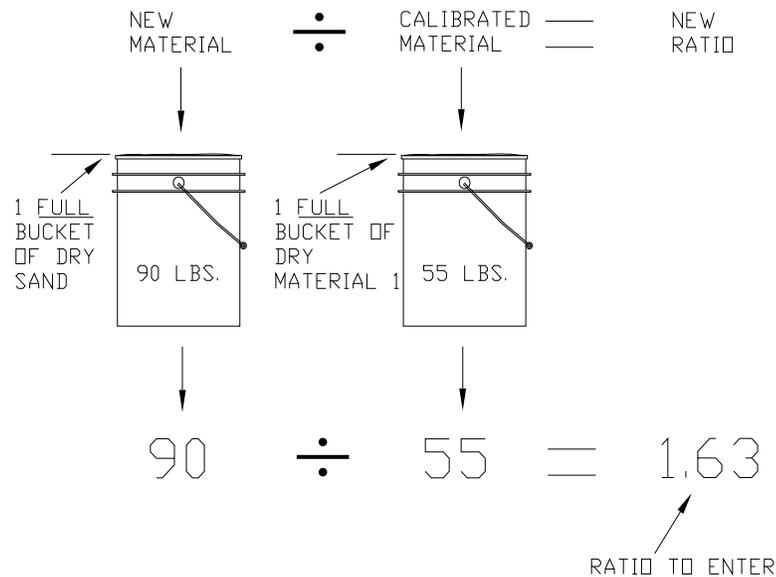
1. Before calibrating the feeder it is necessary to define the materials you intend to spread.
2. To setup materials navigate to the *Material Setup* screen. It is found *Main Menu* -> *Feeder Setup* -> *Material Setup*.
3. There are (4) materials allowed in the Freedom 2.

Each have the following attributes:

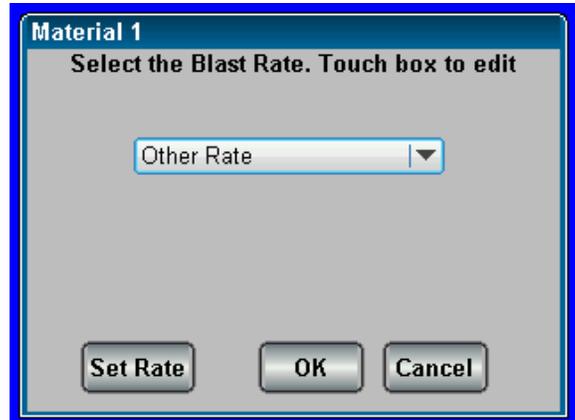
- a. Material Name: A unique name that identifies the material such as “SALT” or “50SALT50SAND” for a 50% salt sand mixture.
- b. Speed Required: Sets if there is a requirement for ground speed to “Blast” material. If set to “NO” the vehicle can Blast while not moving
- c. Increment Rate: The amount of change per click when turning the “RATE” knob when in auto mode
- d. Max Rate: The maximum allowed spreading rate in auto mode in weight/lane mile.
- e. Weight ratio: The weight of additional materials as compared to Material 1. Material 1’s weight ratio should always be (1.00)
 - i. Weight ratio can be calculated with the following equation (next page).
 - ii. The calibrated material refers to Material 1.



Material 1 Name Screen



- iii.
- f. Blast Type: There are 3 types of blast that occur when the blast button is pressed
 - i. Timed: Blast will be active for a user defined period of time. Use the “Set Time” button to setup this time
 - ii. Toggle: Pressing the Blast button once enables blast when it is pressed and it will remain on until blast is pressed again
 - iii. Momentary: Blast is active while the “Blast” switch is held down
- g. Blast Rate:
 - i. Max Trim: Blast will go to the “Max Trim” setting for the Feeder Valve
 - ii. Max Rate: Blast will go to the “Maximum Rate” setting for this material. (You set this at the beginning of Materials section.)
 - iii. Other Rate: Use alternative rate chosen. Note this rate is limited by the Max Trim setting



Blast Rate Setup Screen

Spreader Calibration

1. Prepare for calibration
 - a. **WARNING:** Keep all personnel clear of the vehicle and mechanism before continuing. The feeder is live while in measured dump!
 - b. Make sure gate is fixed at proper opening for your spreader. Make sure typical baffles/plates/shields are installed. Changing the gate height after calibration will invalidate the calibration
 - c. For tailgate spreader, adjust plates for typical auger opening.
 - d. Bring the Hydraulic system up to temperature:

- i. The Freedom 2 is current compensated to provide higher accuracy at all temperatures however it is very important to bring the system to operating temperature for the accuracy of the hydraulic system especially in open-loop and at lower Trim levels
2. Set Feeder Settings
 - a. Enter the menu *Main Menu ->Feeder Setup*
 - i. Feeder Enable: Enable or disable the Feeder. This should be enabled when granular spreading is required
 - ii. Feeder Sensor: Enable or disable the Feeder sensor. This allows closed loop feedback to be enabled.
 - iii. Open Loop Mode
 1. Current Controlled: F2 reads current sent to coil at all times to maintain optimum accuracy under all conditions. Current feedback should be used in all conditions except when using an electric motor or Solid State Relay (SSR).
 2. Uncompensated: No current feedback. Use with Solid State Relays and electric motors
 - iv. Material setup: Described in previous section
 - v. Feedback timeout: The number of seconds after sensor feedback is lost before the F2 defaults into open loop mode
 - vi. Calibration
 1. Measured Dump: Perform a measured dump (See “Measured Dump” section)
 2. Valve Setup
 - a. Min Trim Cal: Perform a minimum trim calibration
 - b. Max Trim Cal: Perform a maximum trim calibration(
 - c. Min Trim: Directly change the min trim value
 - d. Max Trim: Directly change the max trim value
 - e. Valve Frequency: Change the valve frequency.
 - f. Start Percent: Start percent delivers a small increase in PWM to help start the function from a stop. This setting lets you determine the percentage of available trim that is used for starting.
 - g. Start % Timeout: Sets the amount of time before the start percentage bump times out.
 - h. Open Reference: Allows the user to set the current reading at which the Freedom 2 detects an open circuit. This should usually be set to 0.1 Amps for traditional valve coils. If using a solid state relay set this to 0.
3. Set Spinner Settings
 - a. See “Spinner Setup” section of this manual for further instructions
 - b. Enter the menu *Main Menu ->Spinner Setup*
 - i. Spinner Mode
 1. Percent: Spinner runs at a percentage of available trim
 2. Lane: Spinner runs in lane mode as calibrated
 - ii. Spinner Sensor: Enable or disable the Spinner sensor. If closed loop feedback is available you can enable it here.

- iii. Open Loop Mode
 - 1. Current Controlled: F2 reads current sent to coil at all times to maintain optimum accuracy under all conditions.
 - 2. Uncompensated: No current feedback
- iv. Spinner shutdown: Determines if the spinner will turn off when ground speed reaches zero
- v. Feedback timeout: The number of seconds after sensor feedback is lost before the F2 defaults into open loop mode.
- vi. Calibration – Located at *Spinner Setup -> Calibration*
 - 1. *Valve Setup*
 - a. Min Trim Cal: Perform a minimum trim calibration
 - b. Max Trim Cal: Perform a maximum trim calibration
 - c. Min Trim: Directly change the min trim value
 - d. Max Trim: Directly change the max trim value
 - e. Valve Frequency: Change the valve frequency.
 - f. Start Percent: Start percent delivers a small increase in PWM to help start the function from a stop. This setting lets you determine the percentage of available trim that is used for starting.
 - g. Start % Timeout: Sets the amount of time before the start percentage bump times out.
 - h. Open Reference: Allows the user to set the current reading at which the Freedom 2 detects an open circuit. This should usually be set to 0.1 Amps for traditional valve coils. If using a solid state relay set this to 0.

Setting Trims

- 1. Set/Check Trims (Rough Adjustments)
 - a. Before loading the vehicle: It's good to set rough trims. This eliminates excess material being spread during the measured dump process
 - b. Max Trim: Navigate to the *Max Trim Cal* menu. Adjust maximum trim and SAVE the new max value.
 - i. Highest pulse count possible should be achieved without overshooting it.
 - ii. If there is no closed loop feedback determine when the function no longer runs any faster even with increased trim.
 - c. Min trim: Navigate to the *Min Trim Cal* menu. Adjust min trim so the function is running very slowly. If you do not have a sensor have someone watch the function and let you know when the function is running smoothly without cogging.
 - d. Do the above steps for both feeder and spinner



Typical Trim Cal Screen

2. Set/Check Trims (Fine Adjustments)

- a. Load the Vehicle with material: Load to typical capacity.
- b. It is recommended to back the vehicle close to the material pile as possible.
- c. If using a tailgate spreader, load the auger by raising the bed until auger is loaded. Be sure the auger stays fully loaded during the following steps
- d. Making the adjustment
 - i. Note: The function must be running in order for the values to save.
 - ii. Enter the *Max Trim Cal* menu
 - 1. Increase truck engine RPM to 1200-1400 rpm to ensure adequate hydraulic flow to run the functions
 - 2. Max trim: With the weight of the material on the feeder, adjust max trim and SAVE the new max value. Increase the Max Trim value until pulses stop increasing and then lower the trim percent until pulses begin to drop-off. This setting is important for reliable accurate Closed-Loop and Open-loop.
 - 3. If running open loop, it is best to use a hand held mechanical tachometer somewhere on the feeder mechanism. Have an assistant use a tachometer and call out the RPM until an increase in the MAX TRIM value no longer increases Feeder RPM.
 - iii. Enter the *Min Trim Cal* menu
 - 1. Min trim: With the weight of the material on the feeder, press START. Adjust min trim so the spreader moves consistently without cogging.
 - 2. If running open loop (no sensor), adjust min trim to point where feeder is running as slow as possible but without stalling.

Setting Trims

1. Set/Check Trims (Rough Adjustments)

- a. Before loading the vehicle: It's good to set rough trims. This eliminates excess material being spread during the measured dump process
- b. Max Trim: Navigate to the *Max Trim Cal* menu. Adjust maximum trim and SAVE the new max value.
 - i. Highest pulse count possible should be achieved without overshooting it.
 - ii. If there is no closed loop feedback determine when the function no longer runs any faster even with increased trim.
- c. Min trim: Navigate to the *Min Trim Cal* menu. Adjust min trim so the function is running very slowly. If you do not have a sensor have someone watch the function and let you know when the function is running smoothly without cogging.
- d. Do the above steps for both feeder and spinner



Typical Trim Cal Screen

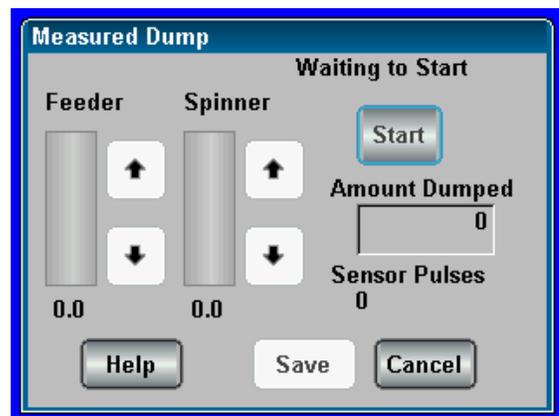
2. Set/Check Trims (Fine Adjustments)

- a. Load the Vehicle with material: Load to typical capacity.
- b. It is recommended to back the vehicle close to the material pile as possible.
- c. If using a tailgate spreader, load the auger by raising the bed until auger is loaded. Be sure the auger stays fully loaded during the following steps
- d. Making the adjustment
 - i. Note: The function must be running in order for the values to save.
 - ii. Enter the *Max Trim Cal* menu
 - 1. Increase truck engine RPM to 1200-1400 rpm to ensure adequate hydraulic flow to run the functions
 - 2. Max trim: With the weight of the material on the feeder, adjust max trim and SAVE the new max value. Increase the Max Trim value until pulses stop increasing and then lower the trim percent until pulses begin to drop-off. This setting is important for reliable accurate Closed-Loop and Open-loop.
 - 3. If running open loop, it is best to use a hand held mechanical tachometer somewhere on the feeder mechanism. Have an assistant use a tachometer and call out the RPM until an increase in the MAX TRIM value no longer increases Feeder RPM.
 - iii. Enter the *Min Trim Cal* menu
 - 1. Min trim: With the weight of the material on the feeder, press START. Adjust min trim so the spreader moves consistently without cogging.
 - 2. If running open loop (no sensor), adjust min trim to point where feeder is running as slow as possible but without stalling.

Closed Loop Measured Dump

1. Starting Closed Loop Measured Dump

- a. It is OK to vary the output from 1-100% at any time.
- b. Increase truck engine RPM to 1200-1400 rpm to ensure adequate hydraulic flow to run the functions.
- c. Run measured dump as long as possible. It is normally sufficient to run the measured dump for 2-5 minutes or until 1500-2500 pounds [700 – 1200 kilograms] of Material 1 have been dispensed. Usually a pile about 3-4 ft. high by 5-7ft. wide [1 meter high by 2 meters wide] is sufficient.
 - i. If using a truck scale to weigh the vehicle dispense as much material as you can while keeping the spreader fully loaded and proceed to Step 2 (next page).
 - ii. If you are using a bucket and shovel,



Closed Loop Measured Dump Screen.
Note: Sensor Pulses shown on screen

you may wish to do less, 1000 lbs or [450 kilograms], which would require you to fill 16 - 18 buckets. Skip to Step 3 of this section.

2. Calculating and entering the measured dump using a Vehicle Scale.
 - a. Weigh the vehicle loaded with material. Record vehicle weight here: _____
 - b. Was the Driver IN or OUT of vehicle (circle one)
 - c. Stop the measured dump and drive the truck to the scale and reweigh. Be sure the same driver is in vehicle if the vehicle was weighed with one previous to measured dump. Record the vehicle weight _____.
 - d. Record Gate opening in inches or centimeters used during Measured Dump:
_____ inches or _____ centimeters
 - e. Press the "Start" key to begin the dump. Pressing "Stop" will pause the measured dump at any time. Simply press start again to continue dumping material.
 - f. Original weight of truck (recorded above) _____ (-) new weight of truck (after dump) _____ = total weight of material dispensed _____ (lbs. or Kg. dumped).
 - g. Key in the weight of the material for "Pounds Dumped" or "Kilograms Dumped" in the space provided on the screen. Before saving this number double check that the information input is accurate. If this number is not accurate the spreader will not be accurate and may not operate correctly.
 - h. Press save
3. Alternative weighing method using the bathroom scale, bucket, and shovel Method:
 - a. Create a pile roughly 3ft. high by 5-6 ft wide. [1 meter high by 2 meters wide].
 - b. Weigh the empty bucket. Record the weight in the blank space provided below for "empty bucket weight."
 - c. Shovel the material into a 5 gallon bucket.
 - d. Weigh the first FULL bucket. Record it below.
 - e. Subtract the weight of the empty bucket from the full bucket weight completing the equation below. The result is the material weight of one bucket. Record the weight below.
 - f. Full bucket weight _____ (-) empty bucket weight _____ = Material weight per bucket _____ (lbs. or Kg)
 - g. Fill the bucket with Material 1 as before and count the total number of buckets filled. Record this information so you do not lose track of how many buckets you've filled. Also, do not forget to count the first bucket.
 - h. If you have a partial bucket at the end, weigh this bucket on the scale and subtract the empty bucket weight.
 - i. Use this equation to calculate the total Material 1 dumped:
Total number of buckets _____ (x) material weight _____ = total material weight _____
 - j. Enter this number in the space provided on the screen. Before saving this number double check that the information entered is accurate. If this number is not accurate the spreader will not be accurate and may not operate correctly.

- k. Press Save
- 4. Manually enter Pounds/Pulse [Kilograms/Pulse]
 - a. It's not necessary to run measured dump if the Pounds/Pulse [Kilograms/Pulse] value is known. It can be manually entered at any time. This could be necessary for any reason if calibration variables may have been lost because the controller has been replaced or the unit has had factory defaults restored by the administrator.
 - b. These values can also be saved via the *Save and Restore* menu under calibration. It is highly recommended that calibrations for each truck be saved incase a problem occurs with the spreader unit. Please read the section on Saving and Restoring for more information on this topic.

Open Loop Measured Dump

- 1. Starting Open Loop Measured Dump
 - a. Open Loop Measured Dump is run at 100% trim.
 - b. Press the Start key to begin the dump. "Stop" will pause the measured dump at any time. Simply press start again to continue dumping material.
 - c. Run measured dump as long as possible. It is normally sufficient to run the measured dump for 2-5 minutes or until 1500-2500 pounds [700 – 1200 kilograms] of Material 1 have been dispensed. Usually a pile about 3-4 ft. high by 5-7ft. wide [1 meter high by 2 meters wide] is sufficient.
 - i. If using a truck scale to weigh the vehicle dispense as much material as you can while keeping the spreader fully loaded and proceed to Step 2 (next page).
 - ii. If you are using a bucket and shovel, you may wish to do less, 1000 lbs. or [450 kilograms], which would require you to fill 16 -18 buckets. Skip to Step 3 of this section.



Open Loop Measured Dump Screen.
Note: Time shown on screen and no auger speed control.

- 2. Calculating and entering the measured dump using a Vehicle Scale.
 - a. Weigh the vehicle loaded with material. Record vehicle weight here: _____
 - b. Was the Driver IN or OUT of vehicle (circle one)
 - c. Stop the measured dump and drive the truck to the scale and reweigh. Be sure the same driver is in vehicle if the vehicle was weighed with one previous to measured dump. Record the vehicle weight _____.
 - d. Record Gate opening in inches or centimeters used during Measured Dump: _____ inches or _____ centimeters
 - e. Press the "Start" key to begin the dump. Pressing "Stop" will pause the measured dump at any time. Simply press start again to continue dumping material.

- f. Original weight of truck (recorded above) _____ (-) new weight of truck (after dump) _____ = total weight of material dispensed _____ (lbs. or Kg. dumped).
 - g. Key in the weight of the material for “Pounds Dumped” or “Kilograms Dumped” in the space provided on the screen. Before saving this number double check that the information input is accurate. If this number is not accurate the spreader will not be accurate and may not operate correctly.
 - h. Press save
3. Alternative weighing method using the bathroom scale, bucket, and shovel Method:
- a. Create a pile roughly 3ft. high by 5-6 ft wide. [1 meter high by 2 meters wide].
 - b. Weigh the empty bucket. Record the weight in the blank space provided below for “empty bucket weight.”
 - c. Shovel the material into a 5 gallon bucket.
 - d. Weigh the first FULL bucket. Record it below.
 - e. Subtract the weight of the empty bucket from the full bucket weight completing the equation below. The result is the material weight of one bucket. Record the weight below.
 - f. Full bucket weight _____ (-) empty bucket weight _____ = Material weight per bucket _____ (lbs. or Kg)
 - g. Fill the bucket with Material 1 as before and count the total number of buckets filled. Record this information so you do not lose track of how many buckets you’ve filled. Also, do not forget to count the first bucket.
 - h. If you have a partial bucket at the end, weigh this bucket on the scale and subtract the empty bucket weight.
 - i. Use this equation to calculate the total Material 1 dumped:
Total number of buckets _____ (x) material weight _____ = total material weight _____
 - j. Enter this number in the space provided on the screen. Before saving this number double check that the information entered is accurate. If this number is not accurate the spreader will not be accurate and may not operate correctly.
 - k. Press Save
4. Manually enter Pounds/Pulse [Kilograms/Pulse]
- a. It’s not necessary to run measured dump if the Pounds/Pulse [Kilograms/Pulse] value is known. It can be manually entered at any time. This could be necessary for any reason if calibration variables may have been lost because the controller has been replaced or the unit has had factory defaults restored by the administrator.
 - b. These values can also be saved via the *Save and Restore* menu under calibration. It is highly recommended that calibrations for each truck be saved incase a problem occurs with the spreader unit. Please read the section on Saving and Restoring for more information on this topic.

Spinner Calibration

Percent Mode

1. Percent mode spinner is utilized when the operator needs complete control over the Spinner speed. Percent mode spinner has no interaction with the Feeder. *See Lane Control Spinner* below if you wish to have the feeder controlled by number of Spinner lanes active (Lane control).
2. There's no calibration necessary for percent mode spinner. It is only necessary to make sure trim levels are set properly under load.
3. Load the truck with material if it's not already loaded from performing a Measured Dump.
4. Navigate to *Calibration* menu via *Spinner Setup* -> *Calibration* -> *Valve Setup*.
5. If Spinner is setup for percent mode the menu sequence is as follows.
6. **CAUTION! Spinner is live when you going into MIN or MAX trim! Be sure all personnel are well clear of the vehicle.**
7. Adjust trims for your requirements.
 - a. Min Trim is usually set to just barely turn the spinner without cogging.
 - b. Max Trim is set to the maximum spread distance required
8. Feeder is also available so material spread distance can be judged.
9. Closed Loop spinner works identical to above; the only difference will be Pulses/Min will be shown on the calibration screen with the presence of a working spinner sensor circuit.
10. Be sure feedback is present when saving MIN and MAX TRIMS with closed loop Spinner.



Spinner Trim Calibration Screen

Lane Mode

1. Lane control is used when it's important to keep uniform lbs/lane mile (lbs/Ln.mi.) [kg/Ln.km *metric mode*] across all lanes while the truck is dispensing material.
 - a. The feeder speed is tied to the spinner speed
 - b. As the spinner is changed from 1 to 2 lanes, the feeder output is automatically doubled. If 3 lanes are selected the feed rate is tripled.
2. This calibration is identical regardless of spinner feedback (open/closed loop)
3. Perform Trim adjustments as detailed in the previous section for Percent Mode Spinner
4. Ensure you are in "Lane" mode by checking the *Spinner Mode* menu under the *Spinner Setup* menu.
5. Set the number of lanes by entering *the Spinner Setup* -> *Calibration* -> *Control Values* -> *Max Lanes*.
 - a. NUMBER OF LANES should be chosen with the following conditions applied:
 - i. In LANE MODE; The Spinner controls the Feeder. Setting "Number of Lanes" to (4) allows the driver of the vehicle to select 1 to 4 lanes. The Feeder and Pre-Wet must be capable of putting out 4X the displayed feed rate set on the operating screen.

- ii. If the feeder cannot keep up with the requirement, the operator will get “FEED RATE LIMITED” error in operating mode, and will see similar errors for the Pre-Wet as well.

CAUTION! Keep all personnel clear of the mechanism. The Feeder and Spinner are active when adjusting “Lane % (percent) Calibration”. The Feeder will activate by turning the feeder knob clockwise 0-100% of valve trim while adjusting the Lane % calibration value or using the buttons available on screen.

6. Adjust Lane % Calibration up/down with the display arrow keys for one (1) lane of coverage. It may be necessary to drive the vehicle so you may account for material scatter. **USE CAUTION! Be sure feeder is loading the Spinner with material (salt) while calibrating lanes.**
 - a. If running (2) lanes you must keep “Lane % Calibration” below 50.
 - b. If running (3) lanes you must keep “Lane % Calibration” below 33.
 - c. If running (4) lanes you must keep “Lane % Calibration” below 25.

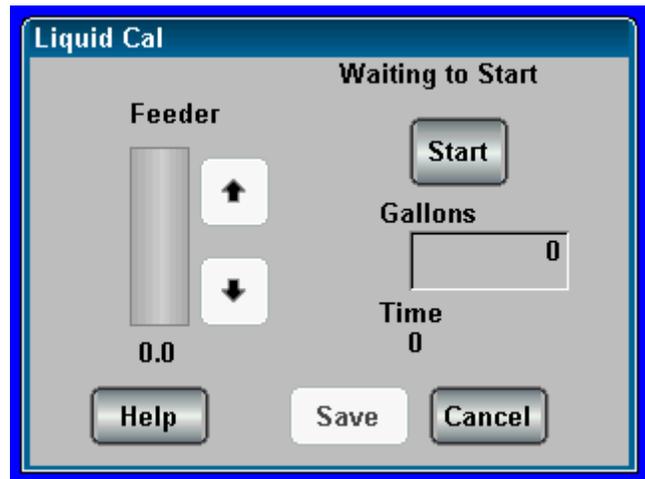
Prewet Calibration

1. Checklist: Before starting calibration.
 - a. Fill tanks with liquid.

Caution: If using straight water. Water will freeze causing major damage to all system components.
 - b. If water is to be used for calibration, be sure to flush system thoroughly with windshield washer fluid when calibration is completed to remove all water.
 - c. All typical plumbing and nozzles must be attached. Be sure nozzles are clean.
 - d. Liquid Pump Bypass valve (inside pump enclosure) must be set prior to calibration. Contact your local Certified Power sales representative if you have questions about proper valve settings.
 - e. Move the vehicle to a location where it’s ok to dispense liquid materials.
 - f. Electric pump motors can be driven directly by the Freedom 2. Valve Frequency is automatically set to 300Hz and current will be internally limited to 6 amps. Amp loads higher than 6A require a Solid State Relay (SSR).
 - g. Ensure the liquid type is set to one of the following in the *Liquid Type* menu
 - i. Prewet – use with a hydraulic driven Prewet Pump.
 - ii. Elec. Prewet – use when directly controlling an electrically driven Prewet Pump.
 - iii. Prewet On/Off – used for Hydraulic ratio Pre-wet systems, single speed electric motors, or relays
 - h. If you’re using an electric motor or a SSR you must run the “Open Loop Mode” for liquid as UNCOMPENSATED
2. Closed-loop Pre-wet calibration
 - a. Navigate to the *Pulses Per Gal* menu located in *Liquid Setup -> Calibration -> Control Values -> Pulses Per Gallon*
 - b. This menu allows you to set the pulses per gallon which is also known as the “K-factor”
 - c. Set the pulses per gallon as noted on the prewet flow meter
 - d. Next navigate to *Liquid Setup -> Calibration -> Valve Setup*
 - i. *Min Trim Cal*: Adjust min trim for the lowest pulses possible pulses. Press “Save” to save the calibration

- ii. *Max trim Cal*: Adjust Max Trim for the highest pulse count (sensor feedback) without raising the Max trim value above where pulses stop increasing. Raising this too high will cause poor resolution on the liquid control
 - e. Press Start/Pause to make sure min trim setting starts the Pre-Wet motor each time
 - f. If using a Hypro hydraulic motor on pre-wet pump do not exceed 40% trim for the max trim setting.
 - g. Optional: You can run the *Liquid Cal* measured dump.
 - i. This method is very useful if you cannot find the “K-Factor” on your flow meter
 - ii. This operates very similarly to closed loop feeder dump
 - iii. Route the prewet nozzles into a bucket so the output can be measured
 - iv. Prewet will run at the trim set on the screen. You can adjust this with the buttons on screen or the Rate knob
 - v. Press Start to begin the test
 - vi. Press Stop to end the test
 - vii. Enter the number of gallons dispensed in the provided box
 - viii. Press save
- 3. Feedback Timeout (closed-loop only)
 - a. This controls the amount of time between the loss of feedback pulses and when the control defaults to open loop control. This setting is important to maintain controlled output in the event of sensor failure.
 - b. From the main liquid menu enter the *Feedback Timeout* screen.
 - c. This time is adjustable between 1 and 60 seconds.
- 4. Open-loop Pre-wet calibration
 - a. Adjust Max Trim by watching for Max flow exiting the Pre-Wet nozzles without raising the Max trim value above where flow stops increasing.
 - b. Adjust min trim for the lowest Pre-wet pump speed that can be observed without stalling.
 - c. Press Start/Pause to make sure min trim setting starts the Pre-Wet motor each time

Note: If using a Hypro motor on pre-wet pump do not exceed 40% trim for max trim setting.
 - d. Optional: You can run the *Liquid Cal* measured dump.
 - i. This operates very similarly to open loop feeder dump
 - ii. Route the prewet nozzles into a bucket so the output can be measured
 - iii. Prewet will run at max trim during this test
 - iv. Press start to being the test



Open Loop Liquid Calibration Screen

- v. Stop to end the test
 - vi. Enter the number of gallons dispensed in the provided box
 - vii. Press save
5. ON/OFF open-loop Pre-wet calibration
 - a. On/Off Pre-wet used for Hydraulic ratio Pre-wet systems, single speed electric motors, or relays.
 - b. Output runs at Max trim value. Max trim typically set to 100%.
 - c. Output turns ON/OFF with Feeder, ground-speed and Tank empty inputs.
6. Tank Delay
 - a. Tank delay is the amount of time the prewet float indicates the tank is empty before the prewet is automatically shut down by the controller. The delay is designed to eliminate pulsation caused by tank slosh
 - b. This can be set between 1-60 seconds
 - c. 5 seconds is the recommended setting.
7. Liquid Shutdown speed
 - a. This is used to determine the speed at which the prewet is automatically disabled
 - b. Can be set from 0-120 mph.

Anti-Ice Calibration

1. Checklist: Before starting calibration.
 - a. Fill tanks with liquid.
Caution: If using straight water. Water will freeze causing major damage to all system components.
 - b. If water is to be used for calibration, be sure to flush system thoroughly with windshield washer fluid when calibration is completed to remove all water.
 - c. All typical plumbing and nozzles must be attached. Be sure nozzles are clean.
 - d. Move the vehicle to a location where it's ok to dispense liquid materials.
 - e. Electric pump motors can be driven directly by the Freedom 2. Valve Frequency is automatically set to 300Hz and current will be internally limited to 6 amps. Amp loads higher than 6A require a Solid State Relay (SSR).
 - f. Ensure the liquid type is set to "Anti-Ice" in the *Liquid Type* menu
 - g. If you're using an electric motor or a SSR you must run the "Open Loop Mode" for liquid as UNCOMPENSATED
2. Closed-loop Anti-ice calibration
 - a. Navigate to the *Pulses Per Gallon* menu located in *Liquid Setup -> Calibration -> Control Values -> Pulses Per Gallon*
 - b. This menu allows you to set the pulses per gallon which is also known as the "K-factor"
 - c. Set the pulses per gallon noted on the anti-ice flow meter
 - d. Navigate to *Liquid Setup -> Calibration -> Valve Setup*
 - i. *Min Trim Cal*: set minimum trim
 - ii. *Max trim Cal*: set maximum trim

- e. Adjust Max Trim for the highest pulse count (sensor feedback) without raising the Max trim value above where pulses stop increasing. Raising this too high will cause poor resolution on the liquid control
 - f. Adjust min trim for the lowest pulses possible to achieve a consistent operating feedback.
 - g. Press Start/Pause to make sure min trim setting starts the Anti-ice motor each time
 - h. Optional: You can run the *Liquid Cal* measured dump.
 - i. This method is very useful if you cannot find the “K-Factor” on your flow meter
 - ii. This operates very similarly to closed loop feeder dump
 - iii. Route the anti-ice nozzles into a bucket so the output can be measured
 - iv. Anti-ice will run at the trim set on the screen. You can adjust this with the buttons on screen or the Rate knob
 - v. Press start to begin the test
 - vi. Stop to end the test
 - vii. Enter the number of gallons dispensed in the provided box
 - viii. Press save
3. Feedback Timeout (closed-loop only)
- a. From *Liquid Setup* enter the *Feedback Timeout* screen
 - b. This controls the amount of time between the loss of feedback pulses and when the System defaults to open loop control.
 - c. This setting is important to maintain controlled output in the event of sensor failure.
 - d. This is adjustable between 1 and 60 seconds.
4. Open-loop Anti-Ice calibration
- a. Adjust Max Trim by watching for Max flow exiting the Anti-Ice nozzles without raising the Max trim value above where flow stops increasing. If this happens, the controller will not operate in open-loop control accurately.
 - b. Adjust Min Trim for the lowest setting where the Anti-Ice pump speed can be observed without stalling.
 - c. Press Start/Pause to make sure min trim setting starts the Anti-Ice motor each time
 - d. Optional: You can run the *Liquid Cal* measured dump.
 - i. This operates very similarly to open loop feeder dump
 - ii. Route the anti-ice nozzles into a bucket so the output can be measured
 - iii. Anti-ice will run at max trim during this test
 - iv. Press Start to begin the test
 - v. Press Stop to end the test
 - vi. Enter the number of gallons dispensed in the provided box
 - vii. Press save
5. Tank Delay
- a. Tank delay is the amount of time the Anti-ice float indicates the tank is empty before the Anti-ice is automatically shut down by the controller
 - b. The delay is designed to eliminate pulsation caused by tank slosh
 - c. This can be set between 1-60 seconds
 - d. 5 seconds is our recommended setting.

6. Liquid Shutdown speed
 - a. This is used to determine the speed at which the Anti-Ice is automatically disabled
 - b. Can be set from 0-120 mph.

Administrative Setup and Functionality

This section of the guide is to explain the setup of all of the Admin/High level functions not covered previously

Open Loop Mode

1. In each of the spreader functions the Freedom 2 is designed to control there are 2 different open loop modes
 - a. Current Controlled
 - i. Used on hydraulic valves
 - ii. The current sent to the hydraulic coil is constantly monitored to provide high accuracy
 - iii. Provides a “partial” closed loop. If the coil current is constant then hydraulic flow should be fairly constant as coil current determines valve flow
 - b. Uncompensated
 - i. Use this with electric motors and Solid State Relays (SSRs)
 - ii. This mode provides no feedback on the current the Freedom 2 is sending to the function
 - iii. Electric motor operation and SSR operation can be unstable without setting uncompensated
 - iv. PWM signal is not corrected for constant current so this mode is less accurate than Current Controlled
2. These options can be selected in Feeder, Spinner, and Liquid
3. **Always use current controlled unless you are operating a SSR or electric motor.**

Encoder Clicks Per Increment

1. This is available on
 - a. Feeder
 - b. Spinner
2. This is intended to make encoders less sensitive especially in “Lane” control conditions where one increment can make a very large feeder speed difference.
3. The two options are
 - a. One Click: A single click will increase or decrease the rate
 - b. Two Clicks: It takes two consecutive clicks to change the rate
4. It is recommended that the default, One Click, is used unless operators complain of sensitivity of one or both of the knobs.
5. Setting two clicks can make the system feel unresponsive to some operators.

Change Password

1. This function is located in the Main Menu
2. This is available when logged in as
 - a. Technician
 - b. Administrator
3. Remember to note your passwords!
4. Only allow personnel that require Technician and Admin access levels those passwords. This avoids accidental, malicious, and possibly dangerous setting changes

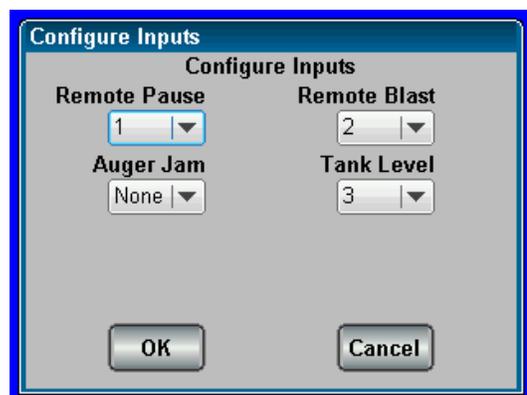
5. If your password is lost contact your local Certified Power sales representative for the password defaulting procedure.

System Stats Menu

1. This function is located in the Main Menu only when logged in as Administrator
2. This gives debugging and raw system data helpful in troubleshooting some problems
 - a. Processor Stats: Statistics of the processing core
 - b. Serial Ports: Data from the serial ports
 - c. Comm Driver Stats: Information about spreader communication with external devices
 - d. Thread Info: Shows the process thread status of the operating software
 - e. Timer Info: Shows the status of the software timers
 - f. Analog info: Very useful debugging data about the current voltage and current levels of the system
 - g. Event Counter: Shows counts of all critical system events since the device was last reset
 - h. Flash Files: Shows the files currently on the flash drive. It also allows you to delete them

System Setup Menu

1. This menu is located inside the Main Menu and allows you to access all of the non-calibration settings in the Freedom 2
2. The sub menus are:
 - a. System Info: Contains information like firmware version and firmware build date along with the unit's unique identifier (MAC address)
 - b. Truck ID: Settable truck ID to identify each truck in your fleet for data collection purposes. This is defaulted to the MAC address
 - c. User ID: A place to enter a unique ID for each truck driver for data collection
 - d. Time: Set the time
 - e. Date: Set the date
 - f. Manual Mode Lockout: This menu allows the administrator to forbid the use of manual mode if management desires. This can prevent overspreading.
 - g. Display Units: Allows to change between Imperial US and Metric modes
 - h. Day Brightness: Allows the operator to change the day time screen brightness
 - i. Night Brightness: Allows the operator to change the night time brightness
 - j. Audible Alarm: Allows the administrator to enable or disable the audible alarm
 - k. Configure Inputs: Allows the administrator to setup the 4 configurable inputs.
 - i. Note: There are 4 possible inputs but only 3 can be configured at a time
 - ii. Remote Pause: Allows a remote pause switch (Default 1)



Input Configuration Screen

- iii. Remote Blast: Allows a remote blast switch (Default 3)
- iv. Tank Level: Input for liquid float switch (Default 2)
- v. Auger Jam: Input for auger jam pressure switch. This error only displays a message on screen (not assigned by default)
- l. AVL Port: Sets the communication type for AVL. Only Freedom Talk is available.
- m. Aux Output: Configures the functionality of the Aux Output signal
 - i. Aux Off
 - ii. Aux on with feeder: Aux will be active whenever the feeder is turning
 - iii. Aux on with AI: Aux will be active whenever anti-ice is spraying
 - iv. The aux output can drive 400 mA maximum. It is recommended that you drive an external relay for most loads. Contact your local Certified Power sales representative if you have any questions
- n. Alarm List: Shows all of the active system alarms
- o. Save and restore: See section on Save and Restore
- p. Network Info: Has information about the on board network controller
- q. Full System Logging: Allows verbose detailed system logging for engineering troubleshooting purposes. Requires USB flash drive
- r. User Clearable Data: Allows or denies "USER" level access to clear storm totals.
- s. Show Splash Screen: Shows the Freedom 2 startup splash screen. Press any button or the screen to exit this mode.

Save and Restore Menu

1. This menu is located inside the System Setup menu and contains many powerful software management tools
2. Features included inside this menu can wipe out all configuration, permissions, and setup data. Please read and understand the functionality completely before using these tools.
3. This menu contains
 - a. Permission Overview: Shows which permissions you are allowed by your Freedom 2 version. See the feature matrix for more details
 - b. Configuration
 - i. Allows you to save and restore configurations
 - ii. It is recommended that you save your configuration after the unit is setup and keep it in a safe place in case of unit failure.
 - iii. *Save* will save the file to a thumb drive
 1. The file name is F2APPCFG.BIN
 2. There is only 1 file of this type permitted on a thumb drive. If you have multiple trucks with different configurations you will need a fresh thumb drive or remove the previous files before backing up another truck
 - iv. *Restore* will restore a saved configuration already on the thumb drive
 1. This is useful if you have a fleet of trucks with identical setups
 2. You can setup 1 truck and then flash the configuration onto all of the other trucks

- c. Calibration
 - i. Allows you to save and restore calibrations
 - ii. It is recommended that you save your calibration after the unit is setup and keep it in a safe place in case of unit failure.
 - iii. *Save* will save the file to a thumb drive
 - 1. The file name is F2APPCAL.BIN
 - 2. There is only 1 file of this type permitted on a thumb drive. If you have multiple trucks with different calibrations you will need a fresh thumb drive or remove the previous files before backing up another truck
 - iv. *Restore* will restore a saved configuration already on the thumb drive
- d. Permissions
 - i. Allows you to save and restore permissions
 - ii. It is recommended that you save your permissions in case the unit is accidentally cleared
 - iii. *Save* will save the file to a thumb drive
 - 1. The file name is F2Permit.BIN
 - 2. There is only 1 file of this type permitted on a thumb drive.
 - 3. When saving permissions it will append that unit's unique permissions to the permissions file. This allows 1 permission file per site.
 - iv. *Restore* will restore a saved permissions file already on the thumb drive
 - 1. Permissions can only be restored to a matching unit
 - 2. If the permission file does not contain the information about that unique Freedom 2 it will not restore the unit with the Permissions file loaded to the USB
 - 3. If the Freedom 2 is defaulted and no permission backup is available contact your local Certified Power sales representative.
- e. Firmware:
 - i. Upgrade from 4.0+ to newer software
 - 1. This screen allows you to update the firmware on your unit
 - 2. There are 3 files required to update firmware
 - a. BSP (rom.bin)
 - b. Main Image (image.bin)
 - c. Backup Image (backup.bin)
 - 3. Place all 3 files onto an **empty** USB flash drive
 - 4. Insert into front USB port on Freedom 2
 - 5. Press "Start" in Firmware Screen
 - 6. This process will take approximately 15-20 minutes to complete
 - 7. Do not turn off your Freedom 2 during this process.
 - 8. The unit will automatically restart when complete
 - ii. Firmware: Upgrade from older than 4.0 software
 - 1. Alternately use procedure SG07100142
 - 2. There are 3 files required to update firmware

- a. BSP (rom.bin)
 - b. Main Image (image.bin)
 - c. Backup Image (backup.bin)
 3. Place backup.bin on one empty USB drive
 4. Place rom.bin and image.bin on a separate USB thumb drive
 5. Insert thumb drive containing backup.bin
 6. Save your Permissions
 7. Save your Configuration
 8. Save you Calibration
 9. Remove backup.bin USB drive
 10. Insert rom.bin and image.bin USB Drive
 11. Navigate to firmware screen and press start.
 12. This process will take approximately 10 minutes to complete
 13. When the unit has restarted and is on the main operating screen remove the USB drive and insert the one containing the backup.bin
 14. Login as administrator
 15. Return to the Firmware screen and press start again
 16. This process will take approximately 10 minutes to complete
 17. When the unit has restarted and is on the main operating screen login as administrator
 18. Follow the procedure below to perform a reset to factory default. When prompted if you are sure to proceed press "Yes"
 19. If you are upgrading from software older than 2.0 you will have to reconfigure and calibrate your truck and you are finished with this procedure. If you are upgrading from 2.0 or newer continue with this procedure.
 20. When the unit has restarted and is on the main operating screen login as administrator
 21. Restore Permissions
 22. Restore Configuration
 23. Restore Calibration
 24. Press Mode/Menu to return to the main operation screen and the unit will automatically restart
- f. Restore Factory Default
- i. **This function will COMPLETELY erase the 3 save-able files listed above**
 1. **Configuration**
 2. **Calibration**
 3. **Permissions**
 - ii. **If your unit was calibrated and setup with 2.2 or 2.1 permissions and this function is used the unit will default to 2.0 permissions with all factory settings.**
 - iii. **If you are performing this function it is recommended that at minimum you backup the permissions file**

Administrative Operating Screen Troubleshooting Tools

1. When logged in as administrator there are several special tools that can be utilized while on the main screen.
2. These tools are available elsewhere in the menus when logged in as administrator but while using them from the main screen you can see them change real time while the control is operating.
3. **While viewing these tools the buttons and knobs on the front of the control are active!**
4. The tools are as follows
 - a. Touching the Status Box in the middle of the screen brings up a menu with access to the following tools.
 - i. Analog Info: See “Systems Stats” section of this manual
 - ii. Processor Stats: See “Systems Stats” section of this manual
 - iii. Material Selection: See “Selecting a Material” section of this manual
 - iv. Input Info: Shows the current input status. 0 = Off; 1 = On.
 - v. Output Info: Shows the Target Rate in percent of trim, Actual Rate in percent of trim, and Output PWM Frequency of each of the 3 main outputs
 - vi. Return: (Returns to the main screen)
 - b. Touching the “Rate” gauge will bring up detailed statistics about the Feeder
 - c. Touching the “Lane” gauge will bring up detailed statistics about the Spinner

Glossary

Auto Mode: The Driver sets a feed rate in lbs/lane mile. The system automatically increases/decreases the material feed rate with the increase/decrease in ground speed. Feed rate will also change with the selected lanes if the Lane Mode for the Spinner is active.

Blast: A temporary increase in the Feed rate to cover areas where additional material is critical

Closed Loop: The control configuration where feedback is provided by a sensor which directly relates to the shaft speed of the machinery. This feedback is used to ensure the operation is running at the correct speed to provide accurate and repeatable material feed at all times. Feedback is generally provided by the auger speed sensor or liquid flow meter.

Firmware: Software that runs the Freedom 2. It is upgradeable via the USB port on the side of the unit.

Ground Speed Oriented: Spreader will automatically adjust output rate based on ground speed. This is only available in "Auto" mode

Ground Speed Triggered: Spreader control will automatically turn on when ground speed is detected (vehicle moving) and off when ground speed is lost (vehicle stopped)

Liquid Shutdown Speed: The speed at which the liquid system is automatically turned off by the controller

Low Voltage Speed Sensor: See Mechanical Source

Manual Mode: Driver directly sets feed rates based on available trim. There no change of material feed rate with the change in ground speed

Measured Dump: The procedure used to configure the spreader for automatic mode operation.

Mechanical Source: Ground speed type used in applications where the vehicle speed signal source is the vehicle's computer. Always check with the vehicle manufacturer before attaching to any vehicle wiring.

Mechanical Sink: This setting is used for after-market hall-sensors or 12v pulse signals. Also can limit interference on the ground speed input that causes erratic or erroneous ground speed indication.

Open Loop: The control configuration where no sensor is installed on the auger or conveyor shaft. Without shaft speed feedback there can be small variances in speed of the motor which the system cannot sense. These small variances will lead to small spreading inaccuracies.

Open Reference: A value in Amps at which the Freedom 2 will determine if a circuit is open (no connection) at. This is individually set for each of the 3 PWM outputs. This should usually be set to 0.1 Amps for traditional valve coils. If using a solid state relay set this to 0.

Speed Threshold: This variable changes the size of a speed change required for the Freedom 2 to react. 0.5 is the recommended setting.

Start Percent: A boost to the output at initial turn on to give the function a “kick start”. Start Percent is only enabled in closed loop until pulse feedback is sensed. In open loop mode start percent stays on for the set timeout duration.

Tank Delay: Tank delay is the amount of time the prewet float indicates the tank is empty before the prewet is automatically shut down by the controller

Trim: The calibrated range of PWM frequency that is permitted via calibration. Generally minimum trim is the minimum rate at which the function just starts to move. Maximum trim is the rate at which further increase of the output PWM has no effect on the driven function. Maximum trim can also be set lower if desired.

Unload Mode: Unload mode has identical functionality as Manual Mode except it does not write material data into logs. Use “unload mode” instead of manual mode to *UNLOAD* the vehicle at the yard. This will keep the Storm and Annual Totals from being mistakenly written into, generating false Granular and Liquid spread data. The controller limits the vehicle speed while unloading to less than 5 mph or the controller will be kicked back into Auto mode/pause.

Valve Frequency: This is the PWM frequency that the spreader control uses to drive the valve. All systems are different and no two have the same characteristics so there are no set in stone values to use for this. As rule of thumb however 180Hz is a good starting point when setting PWM frequency.

VRM: A ground speed setting used for Low voltage AC signals. This type of input can be susceptible to noise and the wiring should be shielded with a drain path to chassis ground.

Appendix I: Freedom 2 Errors

Setting not Saved, Min exceeds Max: This is a common message seen while saving trims. Usually occurs if saving a minimum trim percent that is over the maximum trim percent. Try setting max trim first then set minimum trim last. The error also appears if no feedback is being received from the closed-loop sensor when a Save is applied.

Setting not Saved, Valve open: This error message appears when saving trims and the F2 cannot detect current flowing through the Hydraulic valve electrical circuit. Suspect a connector or broken wire between the F2 control and Valve coil connection on the hydraulic valve.

Ground Speed Error: This error appears if trying to save a “Speed Cal” and not having any groundspeed signal present at the MPH Ground Speed input. Try a different “Speed Type” and watch for the “Pulses Per minute” value to reflect a frequency indicating a good groundspeed signal at the input.

Sensor Power Error: If the sensor power supply line is shorted to ground or has more than 750mA. of current draw the sensor power supply from the F2 is being overloaded. Suspect a faulty Feeder sensor or Liquid Flow-meter sensor. Also suspect a pinched or crushed wire, corroded connector or any fault that may cause a short to chassis ground.

Feeder Rate limited: If the Feeder is running at max speed and the current target application rate is NOT being met, this error will display. Sometimes this error would be indicative of a system that has not been calibrated or has been calibrated improperly. This error also applies to Liquid, and the Spinner. This error clears itself when the target rate is being met.

Feeder Rate Overrun: If the Feeder is running at its lowest speed and the current target application rate is NOT being met, this error will display. Sometimes this error would be indicative of a system that has not been calibrated or has been calibrated improperly. This error also applies to Liquid, and the Spinner. Usually this error will only display at very low sustained vehicle speeds of usually 5mph or less and low target rates. This error clears itself when the target rate is being met.

Sensor fault and Feeder Override: This error occurs when the F2 was operating in closed-loop mode and was not receiving sensor feedback. The F2 automatically defaults into open-loop after this error occurs. Suspect a stalled motor or conveyor, or dry or stalled liquid pump. Could also be caused by a failed sensor or faulty harness. This error occurs for any closed-loop function. The error condition is cleared with a power cycle.

Liquid Tank Empty: The liquid tank is empty

Appendix II: Important Reference Documents and Part Numbers

SG07230026: Freedom 2 Quick Start Guide

SG07100142: Freedom 2 Firmware Upgrade Procedure

F22SPREADER: Freedom 2.2 Product Document

F21SPREADER: Freedom 2.1 Product Document

F20SPREADER: Freedom 2.0 Product Document

SGS00600200001: BSP image, rename to rom.bin before flashing firmware

SGS00600200002: Main image, rename to image.bin before flashing firmware

SGS00600200003: Backup image, rename to backup.bin before flashing firmware

SGS00600300005: Master Permissions file, rename to f2permit.bin before restoring

SG07051072: Freedom 2.0 main harness

SG07051073: Freedom 2.1 & 2.2 main harness

SG07051073-AVL: Freedom 2.2 with AVL main harness

SG07051034: GL400 to Freedom 2 adapter harness

SG07051106: GL400 to Freedom 2 adapter harness with AVL

SG07051111: Freedom 2 stand-alone anti-ice harness

SG07051111-AVL: Freedom 2 stand-alone anti-ice with AVL

SG07051035: AS2, AS3, MS2 to Freedom 2 adapter harness

SG07051035-001: DS2 to Freedom 2 adapter harness