



ACS CALIBRATION MANUAL

P/N SG07230014

**REVISION D
REV DATE 9-2-08 PWR**



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PURPOSE:

- This document is to service the needs of the individuals responsible to calibrate the vehicle before the snow season. Items include:
 - Basic material setups (Granular)
 - Measured Dump procedure
 - Speedometer calibration
- This document IS NOT intended for setup of the vehicle equipment. Items that will not be discussed are:
 - Operating modes
 - Liquid system setup/operation
 - Road watch
 - Pressure Sensors
 - Speedometer types
 - Cross conveyors
 - Feeder Reverse/Feeder Jam
 - Front/Rear Spinners
 - Joystick setup including trims and Shifts and dead-man functions
 - Configuration of all auxiliary input functions such as Rocker switch, Tank Float switches, Override switches, Temperature switches, and Pressure switches.
 - Date and Time
 - Network settings
 - Data Options
 - Log-Ins
 - Passwords
 - Display adjustments including contrast and Brightness.
- The flow of this document is intended to follow the typical flow of an actual vehicle calibration. It is assumed all equipment has been configured. If not, it may be necessary to contact your truck equipment dealer for further assistance on what equipment is installed or consult the ACS Administrators manual P#SG07230015 for assistance.

EQUIPMENT NEEDED:

- Fully functioning Truck with Spreader installed.
- Materials intended for use. i.e., Salt, Sand, Cinders.
- Pre-Wet with sufficient fluid in the tanks. Use caution if using straight water. Water will freeze, causing major damage to all system components. 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.
- Available Truck scale for measuring the weight of the vehicle before and after a measured dump.
- A calculator (if setting up multiple materials).
- A bathroom scale and 5 gallon bucket and shovel (if truck scale is unavailable).
- Stopwatch if running variable gate.

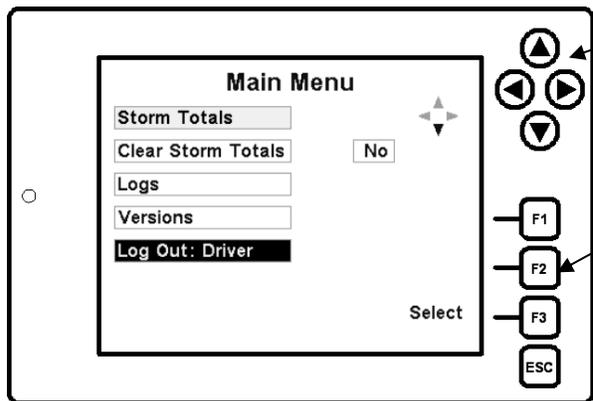
GETTING STARTED

1. Security Clearance

- Administrator: HIGHEST LEVEL OF ACCESS
 - NOT used for calibration. Use Technician level access for calibration.
 - Use Admin log-in if problem related to equipment setup is found. e.g. changing digital input assignment options, configuration of joystick dead-bands, configuring PWM output assignments.
 - The Admin user should possess a high level of understanding about the vehicle and its installed equipment.
 - The Admin user should possess a full understanding of the ACS setup process and understand what setup variables affect directly and indirectly hydraulic functions, including live activation of hydraulic functions such as a plow or conveyor when some menu variables are selected.
 - Access to all menus.
 - Ability to modify ANY system variable.
 - Ability to change passwords.
 - Clearing of the EEPROM (Resetting the control system to factory defaults calibration and setup data will be permanently lost).
- Technician: MEDIUM LEVEL ACCESS
 - Use Technician level access to calibrate the spreader control.
 - Change hydraulic motor trims.
 - Manually enter spreader calibration factors if they are known.
 - Set-up multiple materials to spread.
 - Calibrate MPH input, Feeder calibration, Spinner calibration, Liquid setup and trims.
 - Clear storm and Annual totals.
 - Access to diagnostics screen for troubleshooting.
 - Change network settings.
 - Adjust display and operating panel brightness.
- Operator: STANDARD LEVEL ACCESS
 - Use for typical daily operations of the ACS system and equipment it is controlling.
 - Ability to clear Storm totals if set-up by the administrator.

3. LOG-ON: TECHNICIAN for all calibration procedures:

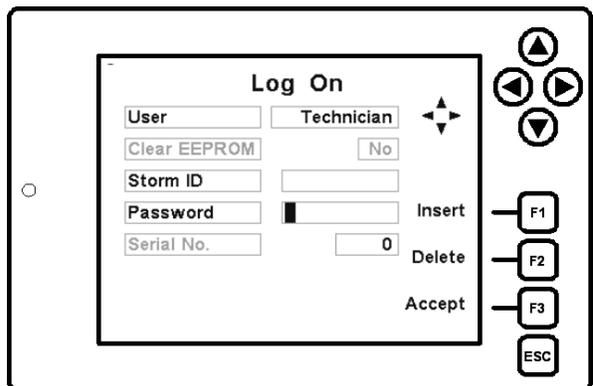
- Step 1: LOG-OUT: by default the system boots with the “driver” automatically ‘logged on’ unless it has been configured to force a log-on. In that case the log-on screen will appear instead of the operating screen. Skip to Step 2 below. In the case of the operating screen appearing at boot, simply follow the bullet point instructions below.
 - Must first log-out ‘driver’ (Operator). Follow the steps below to complete this operation.
 - Press **F3** key on *Operating Screen* to gain access to Main menu. Arrow down ▼ to Log-Out: as shown below.
 - Press **F3** key to log-out.
 - Use the illustrations below to guide you.



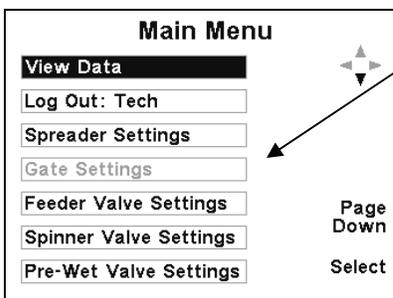
Arrow Up/Down, Left/Right keys. Used to navigate through menus, change variables and key in login passwords

F1, F2, F3, and ESC keys used for various menu functions.

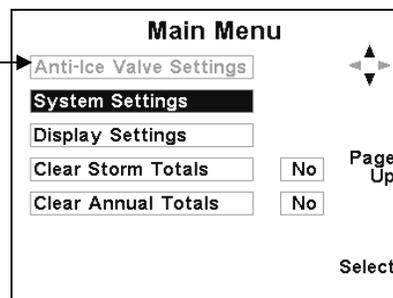
- Step 2: LOG-ON; With the Log-On screen displayed as shown below follow the bullet point instructions below.
 - Arrow right into 'user' field to select a user. Arrow up/down Press **F3** after a user log-in is set to "Technician,"
 - Arrow down to Password selection, then right into password field. Use arrow up/down, right/left to key in a password. Remember: Technician password is -BLANK- by default, so simply arrow into the password field and press **F3** -Accept- to log-in.



- After a successful log-in you will be shifted back to the Operating screen. Press **F3** again to gain access to the Main Menu.
 - All menus that you may access are in bold.
 - Note that "Log out: Technician" is still available for you to log-out without re-booting the system if you prefer after calibration is completed.



Note: Items that are grayed out have NOT been enabled by the Administrator



3. Passwords

- LOGINS – Operator (driver), Technician, Admin.
- Be sure to change at minimum your Administrator 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 damage.

USER	STORM ID.	PASSWORD
Technician		

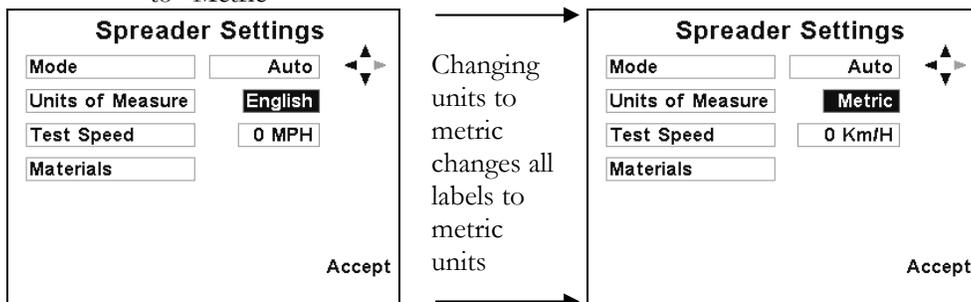
USER	CLEAR EEPROM	STORM ID.	PASSWORD
Administrator	YES/NO		ADMIN

USER	STORM ID.	USER ID.
Operator		

- Storm ID. Entry is optional but should be used if you wish to track operational data by storm. Use any Alpha numeric entry.
- User I.D only must be populated if it's configured under *System settings* by the Administrator to require log-on. User ID also should be used to track operational data by user. Use any Alpha numeric entry.
- The default factory Admin password is shown above. If it is changed & then lost it will be necessary to contact you local Certified Power Sales Representative for help.
- Technician and Admin passwords can be viewed/changed under Admin access only.

METRIC MODE

- The ACS can run in Metric units mode.
 - Log-in as Administrator
 - From the 'Main menu' navigate to 'Spreader Settings', change 'Units Measure' to "Metric"

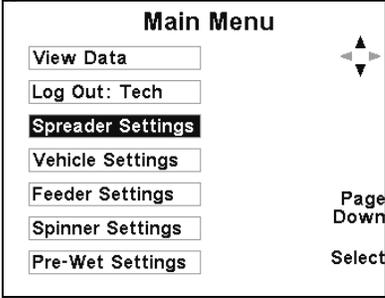


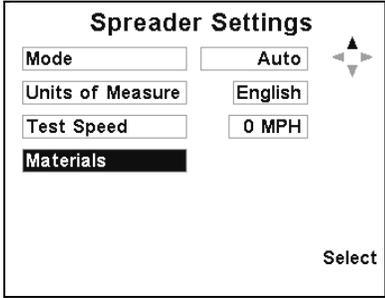
- All English labels are then converted to metric labels except Flow-Meter PPG (Pulses Per Gallon) it will be entered as US GALLONS..... Always!
 - The ACS system cannot be switched between English and Metric display; unit values DO NOT CONVERT between English and metric equivalents. The system will always need to be calibrated under the units it will be operated in.
- Metric label abbreviations are as follows: This applies to ALL setup and operating values
 - Kg. - Kilogram
 - Km. – Kilometer
 - MT – Metric Ton
 - cm. - centimeter
 - Kg/LnKm. – Kilogram per Lane Kilometer
 - L/Kg. - Liters per Kilogram
 - L/Min. – Liters per Minute
 - Km/H. - Kilometers per Hour
 - Kg/Min. – Kilograms per Minute

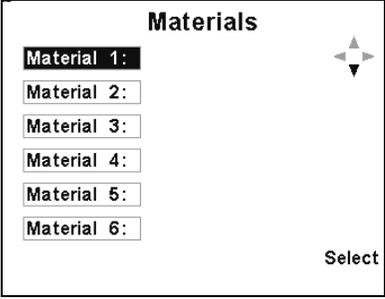
CONFIGURING MATERIALS

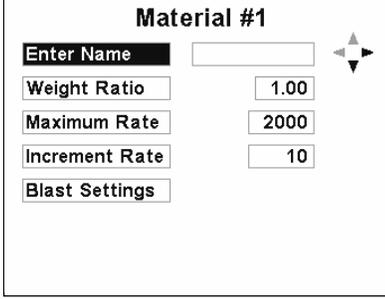
1. Material menus

- Use display arrow keys and **F3** “Select” key to navigate through to the “Spreader Settings” menu to “Materials menu,” eventually ending up in *Material #1* setup as shown below.

1. 

2. 

3. 

4. 

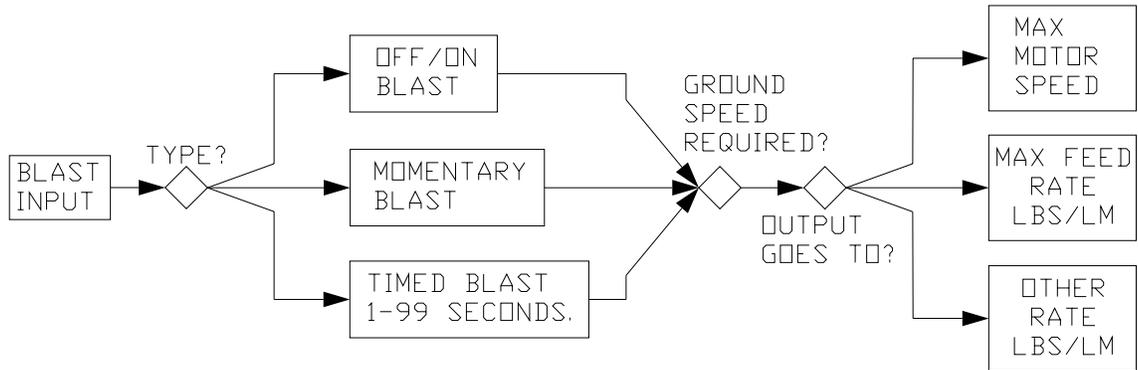
2. How to set up materials (configuring materials continued...)

- On the following page is an example table filled in for a basic material setup. The column and rows are formatted to follow the flow of menu items within the ACS system material menus. The table shows some example settings that are commonly chosen. Follow the instructions below.
- You must calibrate the vehicle with one (1) material. All other materials are based on a ratio of the calibrated material vs. the new material.
 - Set up *MATERIAL #1* as the material you will dispense during *Measured Dump*. Follow the example chart on the next page as a guide. I recommend that the first material in the list (Material 1) be the calibrated material or *Measured Dump* Material.
 - Below find the example table. I have included additional *Blank* tables to be filled out as each material is set up. The tables you fill out will be used in the future as a guide for additional setups or to check settings months later when a problem may arise.
- ASSIGN A MATERIAL NAME. This will be the name that appears on the operator’s screen. Choose 1-10 alpha-numeric characters.

Continued on next page.....

3. Configuring Blast Settings (configuring materials continued...)

Follow the flow Diagram below to help assist in understanding the Blast features available. Read the descriptions on the next pages. Record your settings along with the material data in the charts provided. If in metric LBS/LM becomes Kg/LnKm.



(Blast Settings continued.....)

- Blast type:
 - TIMED
 - Blast timer (sets blast duration in seconds 0-99)
 - Note: -Setting a -0- forces a toggle operation switching between ON and OFF each time the BLAST switch is pressed.
 - MOMENTARY (Blast is active while the 'Blast' switch is held down.)
- Ground Speed Rqd. > (Required)
 - YES (Blast functions ONLY while the vehicle is in motion.)
 - NO (Blast will function at ANY TIME.) If "Max Rate" or "Other" is selected below under *Blast Setting*, please note the following functionality *without* a Ground Speed signal:
 - Blast defaults to Max trim if "Ground Speed Rqd." Is set to "No" and the vehicle is NOT moving. The control will go to "Max Rate" or "Other" once the vehicle is moving again.
 - Blast functionality with NO ground speed (the vehicle is not moving) will record NO material output in the Storm totals or Annual Totals.
- Blast Setting
 - OTHER (See "Other Blast Setting below.")
 - MAX RATE=Blast will go to the "Maximum Rate" setting for this material. (You set this at the beginning of Materials section.)
 - MAX TRIM (Blast will go to the "Max Trim" setting for the Feeder Valve.)
- OTHER BLAST SETTING (Use alternative Rate 0-9999 Lb/Lane Mile or [Kilograms/Lane Mile])
 - Note: You are limited by the physical maximum output of material the feeder will deliver.

4. Material Setup Sheet: keep track of your material setups!

MATERIAL 1

NAME (UP TO 10 DIGITS)	
WEIGHT Ratio	
Maximum Rate	
Increment Rate	

BLAST SETTINGS

Blast type	
Blast timer	
Ground Speed Rqd.	
Blast Setting	
"Other" blast setting	

MATERIAL 2

NAME (UP TO 10 DIGITS)	
WEIGHT Ratio	
Maximum Rate	
Increment Rate	

BLAST SETTINGS

Blast type	
Blast timer	
Ground Speed Rqd.	
Blast Setting	
"Other" blast setting	

MATERIAL 3

NAME (UP TO 10 DIGITS)	
WEIGHT Ratio	
Maximum Rate	
Increment Rate	

BLAST SETTINGS

Blast type	
Blast timer	
Ground Speed Rqd.	
Blast Setting	
"Other" blast setting	

PREPARE FOR CALIBRATION

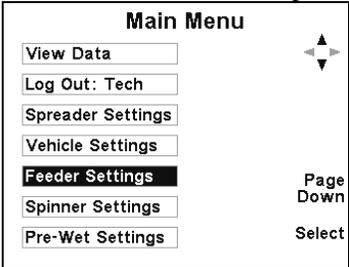
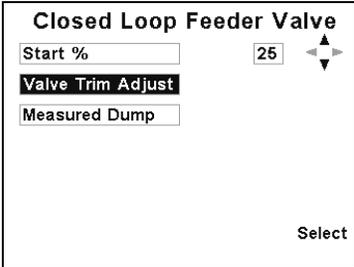
- **WARNING:** Keep all personnel clear of the vehicle and mechanism before continuing. The feeder is live while in measured dump!
- Make sure gate is fixed at proper opening for your spreader. Make sure typical baffles/plates/shields are installed.
- For tailgate spreader, adjust plates for typical auger opening.

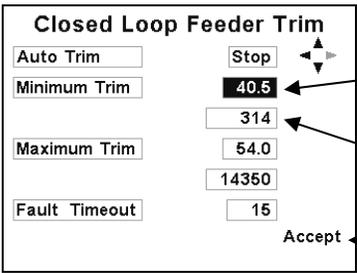
1. Bring the Hydraulic system up to temperature:

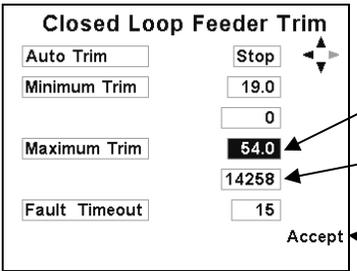
- It is better to calibrate the system at typical operating temperatures especially open-loop calibration (no feedback sensor installed).
- The Minimum trim level may be affected if set when the hydraulic oil and motor are not at normal operating temperature. This is especially important if running open-loop!

MAKE/CHECK TRIM ROUGH ADJUSTMENTS

- Before loading the vehicle: It's good to set rough trims - that way you're not emptying the vehicle of all material after you go through the hassle to load it.
- Follow the menu sequence below to make ROUGH trim adjustments. Use arrow and F3 Keys to navigate to the trim screens shown below.
 - Min trim, Adjust *min trim* for a min pulse count between 300-600 pulse/minute and SAVE.
 - Max Trim, Adjust *max trim* and SAVE the new *max* value. Highest pulse count possible should be achieved without overshooting it.

1.  2. 

3.  Adjust trim using display arrow ▼▲ keys.
 Sensor feedback 300-600 pulses showing
 Be sure to press "Accept" after new level is set.

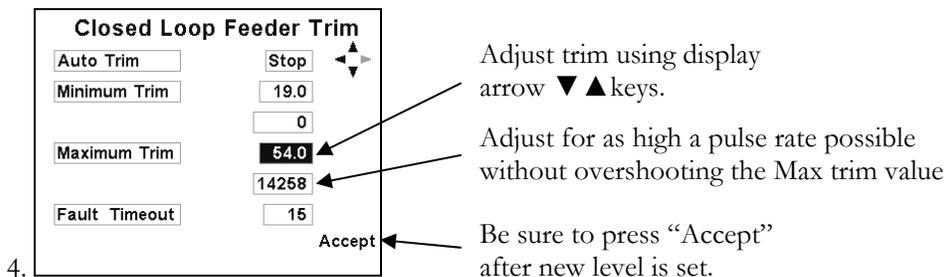
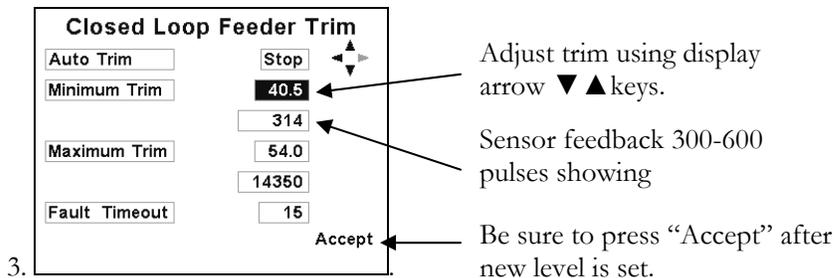
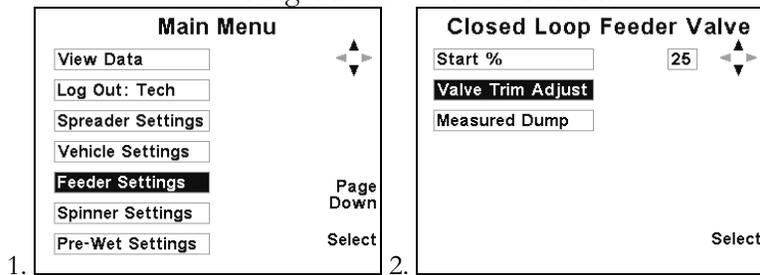
4.  Adjust trim using display arrow ▼▲ keys.
 Adjust for as high a pulse rate possible without overshooting the Max trim value
 Be sure to press "Accept" after new level is set.

MAKE/SET TRIM FINE ADJUSTMENTS

1. **Load the Vehicle with material:** Load to typical capacity.
2. **How to minimize mess:** Back-up the vehicle close to the MATERIAL pile as possible.
 - If tailgate spreader, load the auger by raising the bed until auger is loaded.
3. **Fine adjustment to min and max trims:** Feeder
 - Follow the menu sequence below to SET FINE trim adjustments. Use arrow and F3 Keys to navigate to the trim screens shown below.
 - Min trim: With the weight of the material on the feeder, adjust *min trim* for a min pulse count (sensor feedback) between 300-600 pulses/minute and SAVE.
 - If running *open loop* (no sensor), adjust *min trim* to point where feeder is running as slow as possible but without stalling.

Max trim: With the weight of the material on the feeder, adjust *max trim* and SAVE the new *max* value. Adjust the Max Trim value until pulses stop increasing, then lower the trim percent until pulses begin to drop-off. Now adjust Max Trim up just until you reach the max pulse count value again. This setting is important for reliable accurate Closed-Loop and Open-loop.

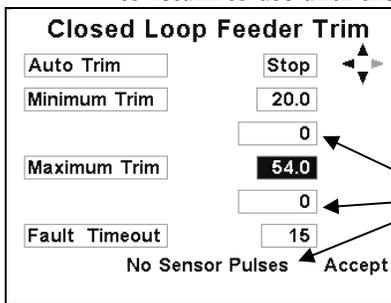
 - If running open loop, it is best to use a hand held mechanical tachometer somewhere on the feeder mechanism. Have someone use a tachometer and call out the RPM until an increase in the MAX TRIM value no longer increases Feeder RPM.



See notes about Trims setting on next page.....

4. Important information about setting/saving trim settings

- Note: If setting closed loop trims and the ACS system is not reading pulses from the feeder sensor, the ACS system will not allow TRIM settings to be saved. See below screen. The following points define this feature:
 - Helps prevent accidental over-write of original calibrate settings saved while the sensor was working, including OPEN LOOP settings. This can happen when a technician is using Trim screens for diagnosis of system problems.
 - Helps prevent Trim settings from being corrupted or set incorrectly by requiring a working sensor (active sensor feedback) for CLOSED LOOP trim setting.
 - Helps ensure the ACS system will operate reliably in OPEN LOOP (no sensor) mode without any changes, while also preventing changes to the system configuration. Mechanics do not have to change the controller to OPEN LOOP mode; the ACS system simply defaults to open loop each time after the sensor “fault time-out” occurs. This improves the reliability of accurate OPEN LOOP operation, allowing the vehicle to return to use until the sensor can be fixed.

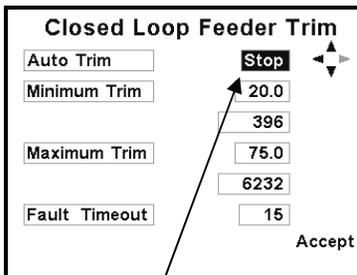


Lack of any sensor feedback prevents trims from being saved. Message; “No Sensor Pulses” is displayed. Trim setting will not change.

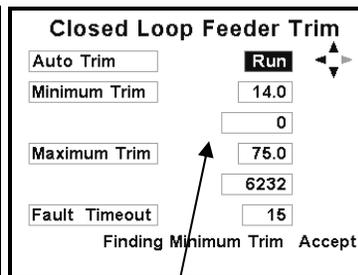
AUTO TRIM

An alternative to setting FINE TRIM ADJUSTMENTS above would be to use *Auto Trim*.

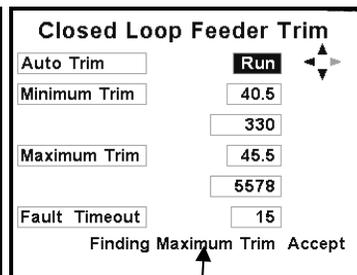
- Complete the “Prepare for Calibration” section of this manual.
- Auto-trim is only available for Closed Loop functions (feedback sensors installed).
- Feedback sensors must be functioning or Auto trim will not complete.
- !!KEEP ALL personnel clear of the vehicle!!



-Use Up/arrow to start Auto-trim.
-Use ESC. to exit any time without saving changes.
-Left arrow can be used to Stop Auto-trim at any time.



-Auto trim runs automatically from when it’s started.
-Min trim increments up until feedback appears in the window.



-Once min trim is reached, Auto trim switch to max trim.
-Max trim pulses are found as the output is feathered up and back again to the exact Max trim value and Max pulse value.

FAULT TIME-OUT

- While in the Trim screens, set a fault time-out for the ACS control to switch into Open-Loop mode.
- Should be adjusted for a value between 1 and 30 seconds.
- Time-out operation important for default Open-Loop operation to maintain a regulated output in event of sensor failure.

Closed Loop Feeder Trim	
Auto Trim	Run
Minimum Trim	40.5
	330
Maximum Trim	45.5
	5578
Fault Timeout	15
Finding Maximum Trim Accept	

-Adjust Sensor Fault time-out value for 1 -30 seconds

CLOSED LOOP MEASURED DUMP (FEEDER SENSOR INSTALLED)

Note: Proceed to OPEN LOOP MEASURED DUMP if you have NO feeder sensor installed.

1. Check-list for (closed-loop) Measured Dump

Complete before continuing.

- *Using Variable height gate?* If performing a measured dump with a variable height gate, THE FEEDER MUST BE RUN AT A FIXED SPEED. Set the gate at its typical opening (calibrate height); then perform the measured dump at a fixed output percent (i.e., 35% as shown on the illustration below); then continue on to section: "CALIBRATING VARIABLE GATE" after completing Measured Dump.
 - Note: The smallest gate increment is (.5). e.g. 4.5 inches or 11.5 centimeters
 - Record your fixed output (when prompted below) after completing the measured dump to use later in the Gate calibration.
- *Using a Fixed Gate?* Make sure gate is fixed at proper opening for your spreader. Make sure typical baffles/plates/shields are installed.

Closed Loop Meas'd Dump	
Feeder Drive	35
	2583
Pounds Dumped	0
Pounds / Pulse	0.000
Accept	

Output percent value = 35.

To be recorded and used during GATE calibration if using variable gate.

- If you are continuing to "Measured Dump" from "Trim Adjustments" section, please check that vehicle still has close to a typical load. It is important the feeder stays fully supplied with material during measured dump.
- If you have not set/checked trims, please do so before continuing with measured DUMP.
 - If you have not checked trims this season and are re-calibrating the vehicle for any reason, The *Make/Check Trim Adjustment* section of this manual should be followed. The vehicle should be filled with a typical load of material when setting trims.

- If this vehicle has never been calibrated or has recently had the “EEPROM” cleared by the Administrator; the feeder trims **MUST** be set first!
 - The controller **WILL NOT** calculate proper default Open Loop values needed in event there is a sensor failure, if there are **NO** “Pulse/Minute” values presently saved under the “Trims” screen.
 - By default from the factory or after an EEPROM clear, these values are set to zero (0) and must be set and saved with **REAL** values achieved after completing the *Make/Check Trim Adjustment* section of this manual.
- If the Vehicle does not have a working feeder sensor for **CLOSED LOOP**, the Measured Dump procedure cannot be completed.

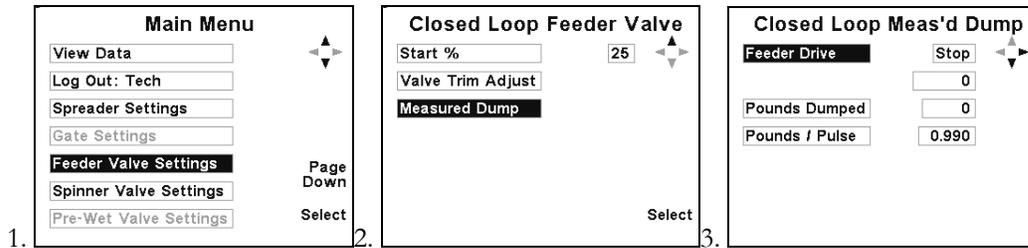
2. Familiarization of Measured Dump Procedure

- The vehicle must be weighed twice; once before, and once after the Measured Dump procedure. When it’s necessary to re-weigh the vehicle after “Measured dump,” be sure the measurement is recorded in the same manner as previously to measured dump, i.e., *Driver is in the vehicle both times the weight is recorded.*
- Weigh the vehicle loaded with material.
 - Record vehicle weight here: _____
 - Driver **IN** or **OUT** of vehicle (circle one)
 - Note: A simple bathroom scale and bucket can be used to weigh material if a truck scale is unavailable. See instructions following on next pages.
- Once again *back* the vehicle up as close to the salt pile as possible.

CONTINUED ON NEXT PAGE....

Navigate to the measured dump screen shown below using the arrow and F3 keys on the display.

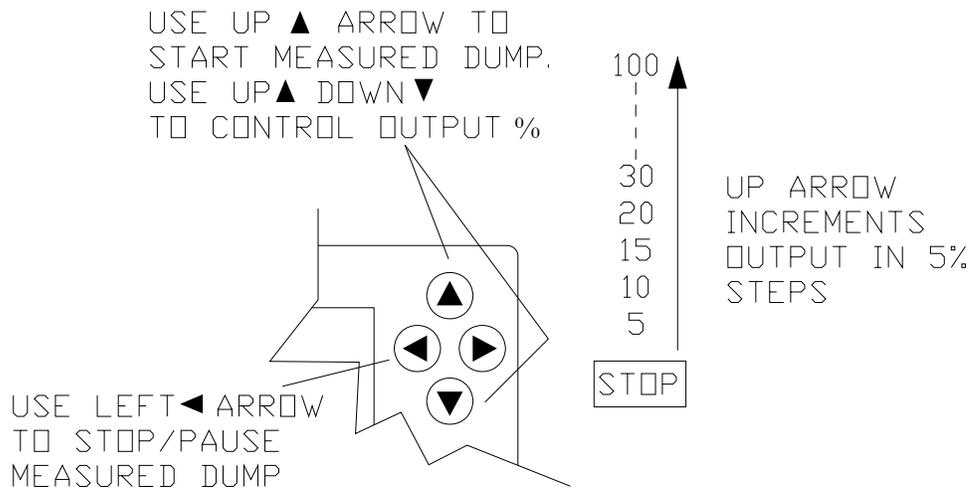
- Be sure Feeder is loaded with Salt.



Safety first!

Use caution! Please note the following bullets and study the diagram below:

- **WARNING:** Keep all personnel clear of the vehicle and mechanism before continuing. The feeder is LIVE while in measured dump!

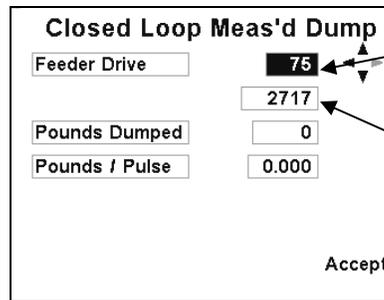


- Full control of feeder is achieved using the display keys.
- Operator panel is disabled except for Spinner knob. The Spinner knob is usable between 0-100% trim while in measured dump to help move material away from the truck and feeder. By default, the Spinner is 'OFF' when measured dump is started. Turn the Lane knob one click clock-wise to start the spinner turning. It can be turned off with the Lane knob while measured dump is active.
- Double check that there is plenty of material loaded onto the feed mechanism.

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3. Starting Measured Dump!

- NOTE: VARIABLE GATE: If using a variable gate, you MUST run the same percent of output (Rate) for the duration of measured dump and all gate dumps. You CANNOT vary the output while running the measured dump. Use up ▲ arrow to reach a suitable value like 35% as quickly as possible and keep it there until it's necessary to stop the output.
- If running FIXED GATE, you can run the output at any rate that you are comfortable with. It is OK to vary the output from 5-100% at any time.



Feeder Percent of output 0-100%. (Rate)

Pulses from sensor begin accumulating here. This is total pulses from sensor while feeder is running

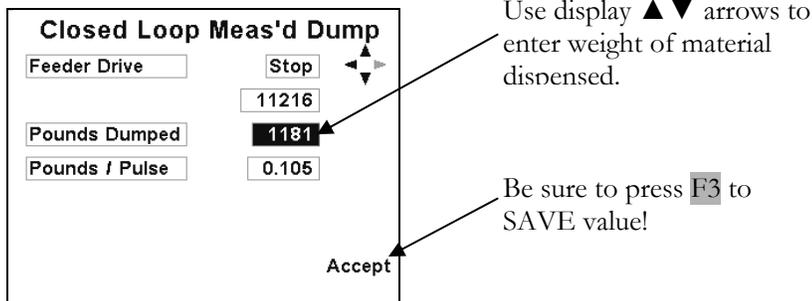
- Use Left arrow on the display panel to Pause measured dump at anytime, i.e., the feeder starts to dig a hole. DON'T USE ESCAPE KEY OR YOU WILL HAVE TO START OVER.
- Run measured dump as long as possible. It is normally sufficient to run the measured dump for 2-5 minutes or until 1500-2500 pounds [700 – 1200 kilograms] of salt have been dispensed. Usually a pile about 3-4 ft. high by 5-7ft. wide [1 meter high by 2 meters wide] is sufficient. If using a Truck scale to weigh vehicle, it makes sense to dispense as much as you can, but if you are using a bucket and shovel, you may wish to do less, perhaps 1000 lbs or [450 kilograms], which would require you to fill 16 - 18 buckets.
- Stop the measured dump and drive the truck to the scale and re-weigh. Be sure same driver is in vehicle if he was in the vehicle when it was weighed previous to measured dump. Record the vehicle weight _____.
- Record Feeder % used during measured dump. IF CALIBRATING A VARIABLE GATE LATER IN THIS INSTRUCTION you will need to know the percent value. Feeder (fixed) percent used. _____ % feeder.
- Record Gate opening (in inches) OR [centimeters] used during measured dump _____ inches. Or _____ centimeters.
- Original weight (recorded above) _____ (-) new weight (after dump) _____ = total weight of material dispensed. _____ (Pounds Dumped) or _____ [Kg. dumped].
- Key in the weight of the material for “Pounds Dumped” “Kilograms Dumped” variable. See screen shot below or on next page.

4. Getting Material weight dispensed using a simple Bathroom scale & bucket:

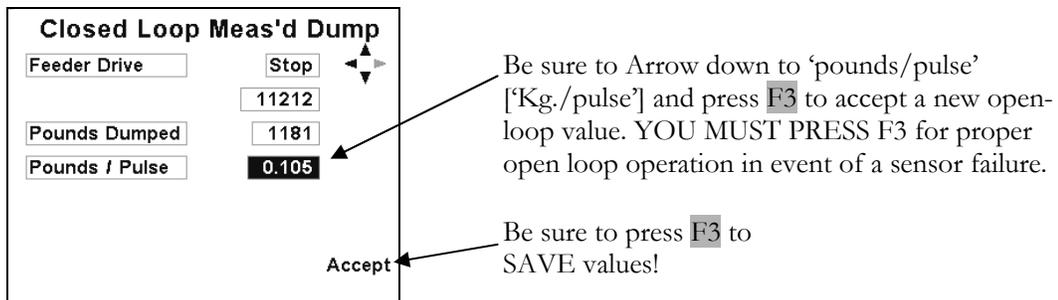
Alternative weighing method: Use Bathroom scale/bucket/shovel to weigh material.

- Note: If a truck scale is unavailable a simple bathroom scale can be used:
 - Create a pile roughly 3ft. high by 5-6 ft. [1 meter high by 2 meters wide].
 - Weigh the empty bucket. Record the weight in the blank space provided below for “empty bucket weight.”
 - Shovel the material into a 5 gallon bucket.
 - Weigh the first FULL bucket. Record it below.

- 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 FULL - minus the bucket weight. Record the weight. Write it down or you will forget it.
- Full bucket weight. _____ (-) empty bucket weight _____ = Material weight _____
- Now fill and count each bucket of salt using the */// ///* “slash then count” method. Write a slash down for each bucket because YOU WILL lose track of your bucket count otherwise. Be sure to fill each bucket to the brim and level it off. If you end up with a partial bucket at the end, you can weigh the bucket and subtract the bucket weight as you did above for the FULL bucket. Did I already say to write down your buckets or you’ll lose track? After all the material has been measured by bucket, add up your slash marks for total buckets. Use the equation below. Add the partial bucket weight as well.
- Total number of buckets _____ (x) material weight _____ = total material weight _____
- Navigate to Pounds [Kilograms] dumped window.
- DON’T PRESS ESCAPE KEY ELSE YOU WILL HAVE TO START OVER.
- Enter dispensed weight and press **F3** to save values!



- Navigate to the “Pounds/pulse” [Kilograms/pulse] value ENTER IT and press **F3** to save the value! –this calculates Open loop values, though they are not displayed to you at this time. It’s important to record the “pounds/pulse” or “kilograms/pulse” value. This value can be manually entered in the future if ever needed without having to repeat the measured dump.



- Record *Pounds / Pulse* value here. _____ or Kilograms/pulse _____

5. Manually enter Pounds/Pulse [Kilograms/Pulse]

- It’s not necessary to run measured dump if the Pounds/Pulse [Kilograms/Pulse] value is known. It can be manually entered at anytime. This could be necessary for any reason calibration variables may have been lost because the valve output module has been replaced or the EEPROM has been cleared by the administrator.

OPEN LOOP MEASURED DUMP (NO FEEDER SENSOR INSTALLED)

Note: Proceed to CLOSED LOOP MEASURED DUMP if you have a feeder sensor installed.

1. Checklist for (open-loop) Measured Dump

- *Using Variable height gate?* If performing a measured dump with a variable height gate: Set the gate at the most typical opening (calibrate height), perform the measured dump, then continue on to section: GATE CONTROL: CALIBRATING VARIABLE GATE.
 - Note: The smallest gate increment is (.5). e.g. 4.5 inches or 11.5 centimeters.
- *Using a Fixed Gate?* Make sure gate is fixed at proper opening for your spreader. Make sure typical baffles/plates/shields are installed.
- Note: A simple bathroom scale and bucket can be used to weigh material if a truck scale is unavailable. See instructions below and on the next pages.

2. Familiarization of measured Dump Procedure

- The vehicle must be weighed twice - once before and once after the Measured Dump procedure. When it's necessary to re-weigh the vehicle after "Measured dump," be sure the measurement is recorded in the same manner as previously to measured dump, i.e. *Driver is in the vehicle both times the weight is recorded.*
- Weigh the vehicle loaded with material.
 - Record vehicle weight here: _____
 - Driver IN or OUT of vehicle (circle one)
 - Note: A simple bathroom scale and bucket can be used to weigh material if a truck scale is unavailable. See instructions following and on next pages.
- Once again *back* the vehicle up as close to the salt pile as possible.
- Navigate to the measured dump screen shown below using the arrow and F3 keys on the display.
- Be sure Feeder is loaded with Salt.

1. **Main Menu**
 View Data
 Log Out: Tech
 Spreader Settings
 Gate Settings
Feeder Valve Settings Page Down
 Spinner Valve Settings Select
 Pre-Wet Valve Settings

2. **Open Loop Feeder Valve**
 Minimum Trim 19.0
 Maximum Trim 54.0
 Start % 25
Measured Dump Select

3. **Open Loop Measured Dump**
 Feeder Drive Stop
 1.00 S
 Pounds Dumped 0
 Max Lbs/ Minute 0
 Accept

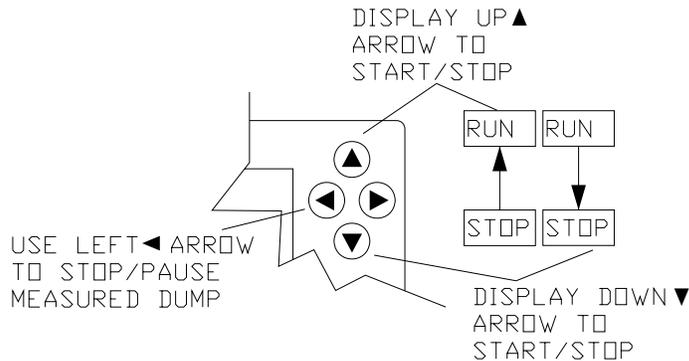
You should have this screen when the ACS system is configured for open-loop measured dump.

CONTINUED ON NEXT PAGE....

Safety first!

Use caution! Please note the following bullets and study the diagram below:

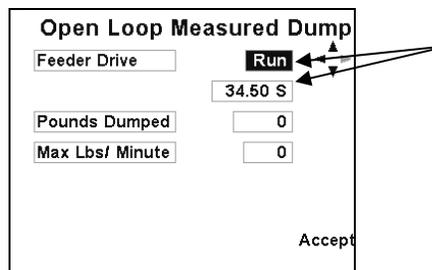
- **WARNING:** Keep all personnel clear of the vehicle and mechanism before continuing. The feeder is live while in measured dump!
- **CAUTION! FEEDER WILL RUN AT MAX TRIM FOR OPEN LOOP MEASURED DUMP.**



- Full control of feeder is achieved using the display keys.
- Operator panel is disabled except for Spinner knob. The Spinner knob is usable between 0-100% trim while in measured dump to help move material away from the truck and feeder. By default, the Spinner is 'OFF' when measured dump is started. Turn the Lane knob one click clock-wise to start the spinner turning. It can be turned off with the Lane knob while measured dump is active.
- Double check that there is plenty of material loaded onto the feed mechanism.

3. Starting Measured Dump!

- If using a variable gate you must run the same percent of output (Rate) for the duration of all dumps. Open loop measured dump runs the output at MAX TRIM; therefore when the gate is calibrated it must be run at max trim as well (100%).



Timer begins running while feeder is in "RUN" mode

- Use Left arrow on the display panel to Pause measured dump at anytime, i.e., the feeder starts to dig a hole. DON'T USE ESCAPE KEY OR YOU WILL HAVE TO START OVER.
- 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 salt have been dispensed. Usually a pile about 3-4 ft. high by 5-7ft. wide [1 meter high by 2 meters wide] is sufficient. If using a Truck scale to weigh the vehicle, dispense as much as you can, but if you are using a bucket and shovel you may wish to do less, perhaps 1000 lbs [450Kg.] which would require you to fill 16 -18 buckets.
- Stop the measured dump and drive the truck to the scale and re-weigh. Be sure same driver is in vehicle.

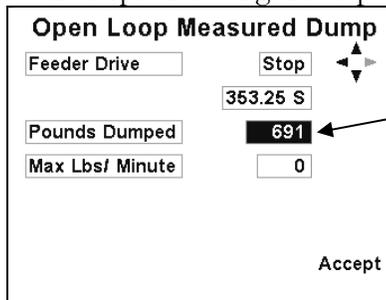
CONTINUE ON NEXT PAGE.....

- If USING VARIABLE GATE, record Gate opening (in inches) [centimeters] used during calibrated dump _____ inches/or _____ centimeters.
- Original weight (recorded above) _____ (-) new weight (after dump) _____ = total weight of material dispensed. _____
- Key in the weight of the material for “Pounds Dumped” or [Kilograms Dumped] variable. See screen shot below.

4. Getting Material weight dispensed using a simple Bathroom scale & bucket::

Alternative method Use Bathroom scale/bucket/shovel and shovel operator to weigh material.

- Note: If a truck scale is unavailable, a simple bathroom scale can be used:
 - Create a pile roughly 3ft. high by 5-6 ft. [1 meter high by 2 meters wide].
 - Weigh the empty bucket. Record the weight in the blank space provided below for “empty bucket weight.”
 - Shovel the material into a 5 gallon bucket.
 - Weigh the first FULL bucket. Record it below.
 - 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 FULL - minus the bucket weight. Record the weight. Write it down or you will forget it.
 - Full bucket weight. _____ (-) empty bucket weight _____ = Material weight _____
 - Now fill and count each bucket of salt using the ~~///~~ ~~///~~ “slash then count” method. Write a slash down for each bucket because YOU WILL lose track of your bucket count otherwise. Be sure to fill each bucket to the brim and level it off. If you end up with a partial bucket at the end, you can weigh the bucket and subtract the bucket weight as you did above for the FULL bucket. Did I already say write down your buckets or you’ll lose track? After all the material has been measured by bucket, add up your slash marks for total buckets. Use the equation below. Add the partial bucket weight as well.
 - Total number of buckets _____ (x) material weight _____ = total material weight _____
- Navigate to Pounds dumped [Kilograms dumped] window and key in weight. PRESS F3 “Accept” to save.
- DON’T PRESS ESCAPE KEY OR ELSE YOU WILL HAVE TO START OVER.
- Enter dispensed weight and press **F3** to save values!



Use display ▲ ▼ arrows to enter weight of material.

Be sure to press **F3** to SAVE values!

- The *MAX LBS/MIN* _____ or {Kilograms/minute} _____ value should now be displayed. Record the value just in case it’s needed in the future.

CONTINUED ON NEXT PAGE.....

5. Manually enter Pounds/minute [Kilograms/Minute].

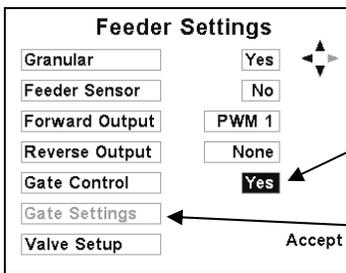
- It's not necessary to run measured dump if the LBS/MIN value is known. It can be manually entered at any time. This could be necessary if for any reason calibration variables may have been lost because the valve output module has been replaced or the EEPROM has been cleared by the administrator.

GATE CONTROL: CALIBRATING A VARIABLE GATE

1. About Variable Gate:

Feeder must be run at a fixed speed while performing ALL gate height calibrations.

- If running closed loop, you should have recorded the Feed percent used during measured dump in the "CLOSED LOOP MEASURED DUMP SECTION."
- Gate Control - Gate control can be used with a sensor (closed loop) or without a sensor (open loop).



Change "Gate Control" variable to "Yes" if using variable height gate.

Gate settings menu will become selectable.

Foreword: To obtain an accurate variable with a gate type spreader, the following guidelines should be used.

- The Feeder drive measured dump must be performed regardless of using variable Gate or not. If you have not done a measured dump for the feeder drive, that should be performed first. Calibrate height Pounds/pulse or [Kilograms/pulse](closed loop) or Lbs/Min or [Kg./Min.](open-loop) is entered under the measured dump screen in the *Feeder Settings/Valve Setup/Measured Dump* menu. Other gate settings are entered under the *Gate Settings* menu detailed herein.
- The vehicle should be warmed up, including the Hydraulic system, to typical operating temperature.
- Use a stop-watch to time equal dumps if possible (see below).
- The Vehicle should be loaded to its typical load capacity.
- Weigh the vehicle with the driver in the truck.
- The Feeder must be run for settings of:
 - "Low gate Dump,"
 - "Calibrated height" (done during MEASURED DUMP).
 - "High dump height."
- Dumping for ALL heights must be run at the same feeder speed percent used during *Measured Dump* to obtain an accurate calibration. If you just performed a measured dump, you recorded the *calibrate gate opening* in inches and also the *feed output percent* used during measured dump. If it's been more than a few days since the measured dump was performed, the feeder measured dump must almost always be re-performed even if it was previously calibrated because all three dumps should be performed under the same conditions.

2. How to enter Gate Settings

Gate Settings	
Maximum Height	18.0 "
Calibration Height	4.5 "
Low Gate Dump	1.0 "
Low Gate Lbs/Min	100
High Dump Height	9.0 "
High Gate Lbs/Min	1000

Enter all gate opening measurements

Enter Pounds/Minute [Kilograms/Minute] values

Page Down

- **MAXIMUM HEIGHT:** Enter the maximum height the Gate is capable of opening.
- **CALIBRATE HEIGHT:** Enter the height the vehicle's Feeder was calibrated at. You should have recorded it under measured dump above.
- **LOW GATE DUMP:** This is the lowest gate setting in which the vehicle's spreader will be operated.
- **LOW GATE LBS/MIN---HIGH GATE LBS/MIN [Kilograms/Minute]:** These values are obtained by running the feeder for a period of time at a fixed rate to determine the Lbs/Min [Kg./Min.] value at the Low Gate height (or high gate height) i.e., one minute at 50% output. If running Open loop (no sensor), the feeder must be run at 100% trim because that is where open-loop measured dump operates.

3. Running the Feeder for High & Low Gate Dumps

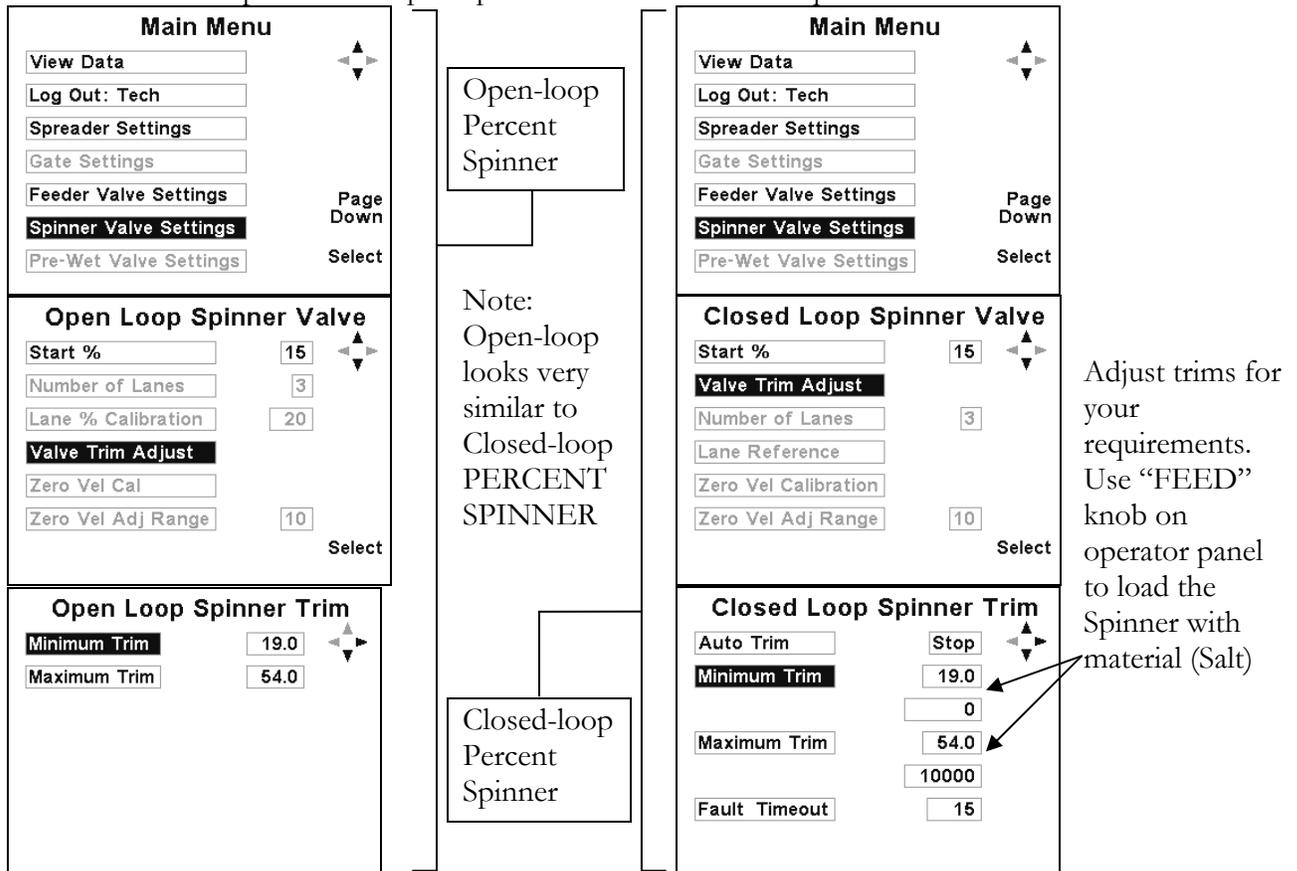
- Use **MANUAL OPERATING MODE**.
- If running closed loop (with sensor), adjust output rate (displayed on the operating screen) to **SAME** output feed percent recorded **PREVIOUSLY** during **CLOSED LOOP MEASURED DUMP**.
 - Adjust Gate to Low setting (or high setting if running High Gate Dump).
 - Back vehicle up close to salt pile.
 - Make sure feeder is loaded with material same as it was done during measured dump. (All the same shields and baffles should be in place.)
 - In **OPERATING (MANUAL MODE)** Be sure control is in **Pause**.

Note: Reference the operator's manual if you are not familiar with the operation of manual control.
 - Set feed rate to feeder output percent used during measured dump. If running Closed-Loop you should have recorded the percentage above after you completed the *measured dump* procedure. If you calibrated Open-Loop, adjust the output to 100%.
 - Caution! Be sure all personnel are well clear of the vehicle.
 - Start the stopwatch and remove **pause** at the same time.
 - Run the dump for exactly 1 minute or longer if you desire a more accurate calculation. Divide the dispensed final weight by number of minutes the test was run to achieve the Lbs/Min. [Kg./Min *metric mode*] value needed for calibration. Be sure the feeder does not dig holes, or else you will need to repeat the entire process again. (Just be sure to put the material back in the truck to get the truck back to its original weight.) **PRESS PAUSE AGAIN AT 1 MINUTE** or when a sufficient amount of material has accumulated!
 - If the test is run longer than one minute be sure to convert *minutes and seconds to whole minutes*. e.g. If test is run for 1 minute 15 seconds the equation would be: 15 seconds/60 seconds=.25 minutes or 1.25 minutes.

- Weigh the vehicle again (with the operator) subtracting the new weight from the original weight before the dump process, or else if you are measuring with a bathroom scale and bucket, follow the procedure described under “Bathroom Scale Method” within the measured dump procedure. Record here the **Low Gate Lbs./Min. _____ or Kg./Min. _____**; then enter the value under Feeder Drive “Gate Settings”.
Repeat the process above for High gate dump. Record **High Gate Lbs./Min. _____ or Kg./Min. _____**; then enter the value under Feeder Drive “Gate Settings”.
- That should be it. The Gate is calibrated!
- Gate Sensor Yes/No (Not Yet available)
 - Gate Sensor Low
 - Gate Sensor High

OPEN LOOP/CLOSED LOOP PERCENT SPINNER

- 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).
- There's no calibration necessary for PERCENT mode spinner. It is only necessary to make sure trim levels are set properly under load.
 - Load the truck with material if it's not already loaded from performing a measured dump.
 - Navigate to Spinner Setting menu using the display arrow and F3 keys. Follow the illustrations below for a guide.
 - If Spinner is setup for percent mode the menu sequence is as follows.



- CAUTION! Spinner is live when you going into MIN or MAX trim! Be sure all personnel are well clear of the vehicle.
- Adjust trims for your requirements.
- 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.
 - Be sure feedback is present when saving MIN and MAX TRIMS with closed loop Spinner.

OPEN LOOP LANE CONTROL SPINNER

- Lane control is used when it's important to keep uniform Lbs/Lane mile (Lb/LM) [Kg/LnKm *metric mode*] across all lanes while the truck is dispensing material. The spinner controls the feeder output. As the spinner is changed from 1 to 2 lanes, the feeder output is automatically doubled or tripled or quadrupled if running 4 lanes.
- Perform Trim adjustments as detailed in the previous section for *Open/Closed Loop percent mode spinner*.
- You must log-in as Administrator to change the Spinner Mode Type to "Lane" if the Spinner menu does not look like it does below (for technician log-in).
- NUMBER OF LANES should be chosen with the following conditions applied:
 - 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. If the feeder cannot keep up with the requirement, the operator will get "FEED RATE LOW – SLOW DOWN!" error in operating mode, and will see similar errors for the Pre-Wet as well.

Open Loop Spinner Valve

Start % ▲▼

Number of Lanes ←

Lane % Calibration ←

Valve Trim Adjust

Zero Vel Cal

Zero Vel Adj Range

Accept

Change # of Lanes to appropriate lanes for your needs. 1-2-3 or 4.

Note: For open-loop operation the "Lane % Calibration" variable should be boldly high-lighted.

- 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.
- Adjust Lane % Calibration up/down with the display arrow keys for (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.
 - If running (2) lanes you must keep "Lane % Calibration" below 50.
 - If running (3) lanes you must keep "Lane % Calibration" below 33.
 - If running (4) lanes you must keep "Lane % Calibration" below 25.

Open Loop Spinner Valve

Start % ▲▼

Number of Lanes ←

Lane % Calibration ←

Valve Trim Adjust

Zero Vel Cal

Zero Vel Adj Range

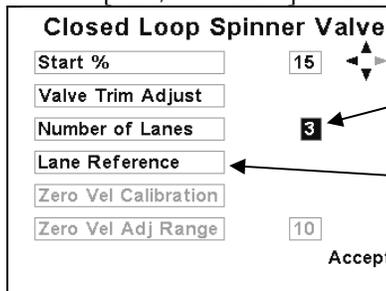
Accept

Adjust for exactly (1) lane of coverage.

CLOSED LOOP LANE CONTROL SPINNER

Lane control is used when it's important to keep uniform Lbs/Lane mile (Lb/LnM) [Kg/LnKm *metric mode*] across all lanes while the truck is dispensing material. The Spinner controls the feeder output. As the Spinner is changed from 1 lane to 2 lanes, the feeder output is automatically doubled or tripled or quadrupled if running 4 lanes.

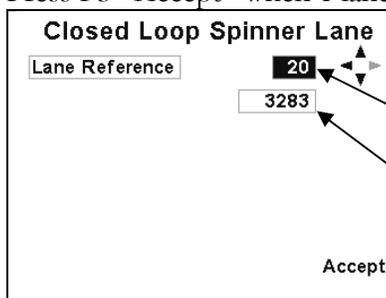
- Perform Trim adjustments as detailed in the previous section for *Open/Closed Loop percent mode spinner*.
- You must log-in as Administrator to change the Spinner Mode Type to “Lane” if the Spinner menu does not look like it does below (for technician log-in).
- NUMBER OF LANES should be chosen with the following conditions applied:
 - 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. If the feeder cannot keep up with the requirement, the operator will get “FEED RATE LOW FOR MPH” [Km/H-Metric] errors and similar errors for the Pre-Wet as well.



Change # of Lanes to appropriate lanes for your needs. 1-2-3 or 4.

Note: For closed-loop operation the “Lane Reference” menu should be boldly high-lighted

- Select into Lane Reference menu.
- 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 Reference value.
- Adjust Lane Reference value up/down with the display arrow key for 1 lane of material coverage. It may be necessary to drive the vehicle to account for material scatter. USE CAUTION! Be sure feeder is loading the Spinner with material (salt) while calibrating lanes.
 - If running (2) lanes you must keep “Lane Reference” below 50.
 - If running (3) lanes you must keep “Lane Reference” below 33.
 - If running (4) lanes you must keep “Lane Reference” below 25.
- Press F3 “Accept” when 1 lane of coverage is being applied.



Adjust exactly for (1) lane of coverage

Sensor feedback pulse/min are displayed here, and should display if the sensor is working properly.

If sensor feedback is not displaying, then the equipment is not set up properly or is malfunctioning. Check to be sure a feedback sensor is installed for closed-loop operation.

ZERO VELOCITY SPINNER

If you don't have a Zero Velocity Spreader installed on your vehicle please disregard this section.

1. Basic Operating principle of Zero Velocity:

- Material being distributed to the road surface is accelerated at a speed equal to the current vehicle speed in Miles Per hour or [Kilometer per hour *metric mode*] but in opposite direction to which the vehicle is traveling therefore canceling material velocity in relation to the road surface.
- As material contacts the road surface it will not tumble and scatter; therefore, it's possible to place material in an exact location, such as on the crown of the road reducing the amount of wasted material that tumbles to areas of little usefulness.

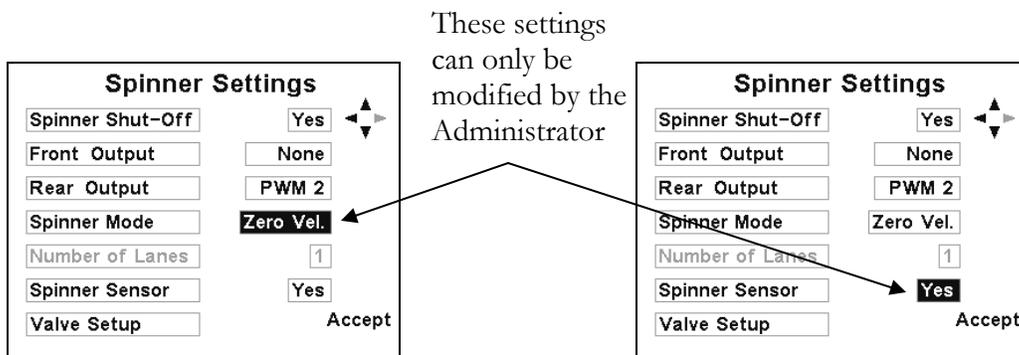
2. Prep and Setup of Zero Velocity Spinner

- The MPH input must be calibrated first. Anytime the MPH input is calibrated the ZV (zero velocity) spreader must be re-calibrated.
 - To test calibration of the MPH [Km/H *metric mode*] input drive the vehicle observing the ACS MPH [Km/H *metric mode*] display it should track with the vehicle speedometer.
- Setup for ZV by changing the "Spinner Settings" menu "Spinner Mode" to "Zero Vel."

Note: This can only be done by the Administrator log-in if ZV is not already set-up

- Change Spinner sensor to Yes (closed-loop) or No (open-loop)

Note: This can only be done by the Administrator log-in if ZV is not already set-up



 This point forward, all illustrations will be detailed as seen through the Technician log-in

- The hydraulic system should be brought up to normal operating temperature. This is especially important if performing an Open-loop calibration!
- The Vehicle should be loaded with material most typically spread by the ZV spreader.
 - If running variable gate, have the gate adjusted to the most typical opening. Be sure the current height is displaying on the operating screen.
- All motor sensors should be wired and functional for closed-loop operation
- Adjust the ZV shoot for typical angle and elevation.

CONTINUED ON NEXT PAGE....

3. Trim Adjustment

- Perform Trim adjustments as detailed in the previous section for *Open/Closed Loop percent mode spinner* after reading the bulleted items outlined below.
 - Trim adjustments are best done at the salt pile to help minimize mess.
 - Spinner MIN TRIM should be set as low as possible. However the ZV spreader should be running fast enough to keep clearing material out of it. Run the feeder close to minimum speed by clicking the Feed knob clock-wise one click.
 - Sensor pulses should display from the motor sensor if running closed-loop.
 - If running open-loop you'll need to adjust the trim and check what it's actually doing on the back of the truck. If someone can help you it makes the process work more efficiently.
 - MAX TRIM should be adjusted with NO granular material running through the ZV mechanism. This is because we wish to find the absolute maximum velocity the ZV can run under NO load or minimum load; however be sure NOT to exceed the mechanical limits established by the ZV manufacturer.

4. Manual entry of calibration settings

- Proceed to "Valve Setup", then "Zero Vel. Calibration"
- If calibration values "Pulses/Minute"(closed-loop) or "Open Loop Factor" (Open-loop) and "Vehicle Speed" are previously known they may be manually entered

The screenshot shows two menu screens. The top screen is titled "Closed Loop Spinner Valve" and contains the following fields: "Start %" with a value of 15 and a four-way arrow icon; "Valve Trim Adjust" (empty); "Number of Lanes" with a value of 3; "Lane Reference" (empty); "Zero Vel Calibration" which is highlighted with a black bar and has an arrow pointing to it from the text "Select the Zero Vel Calibration menu to access calibration screen for 'Low' and 'High Speed' calibration points"; and "Zero Vel Adj Range" with a value of 10. A "Select" button is at the bottom right. The bottom screen is titled "Closed Loop ZV Calibration" and contains: "Low Speed" (empty) with a four-way arrow icon; "Valve Drive Adjust" with a "Stop" button; "Pulses/Minute" with a value of 1416 and an arrow pointing to it from the text "Pulses/Minute or Vehicle Speed can be manually entered or modified at any time as shown, using the display up/down arrow keys. Be sure to press F3 key 'Accept', to save modified values."; and "Vehicle Speed" with a value of 8.0MPH and an arrow pointing to it from the same text. A "Page Down" button and an "Accept" button are at the bottom right.

- Manual Cal value adjustment:
 - Cal values can be adjusted up or down to fine tune performance.
 - Low Vehicle speed/Low material velocity adjustments should be made to "Low Speed" values.
 - High Vehicle speed/High material velocity adjustments should be made to High speed values.
 - Increasing "Pulses/Minute" value or decreasing MPH [Km/H *metric mode*] value increases material velocity.
 - Conversely decreasing "Pulses/minute" value or increasing MPH [Km/H *metric mode*] value decreases material velocity.

5. Getting ready for calibration

- It is necessary to calibrate a 2-point “Low Setting” and a “High Setting”. See illustrations and instructions below.

Note: “Low Speed” values shown.

• Use display ▲▼ arrows to control ON/OFF control and speed in 5% increments of ZV spreader.
 • Left arrow or ESC. Key aborts the ZV operation.

Pulses/minute value from sensor for this calibration point.

Current vehicle speed in Miles Per Hour for this calibration point. (Km/H if running Metric mode)

- The rest of the calibration involves driving the truck.
 - Find a low to no traffic area for testing if possible.
 - The ZV spinner will activate with the next step.
 - Open-loop ZV calibration is performed the same as closed-loop so both are covered here under the same text. The only difference is the “Open-loop Cal factor” is generated internally based on valve trim percent. Changing the “Open-Loop Factor” or “Vehicle Speed” value have the same effect on Open-loop control as “Pulses/Minute” and “Vehicle Speed” do to Closed-loop control as described previously for “Manual Cal value Adjustment”.

Note: Open-loop ZV Calibration displayed at the top of the screen.

“Pulses/Minute” is replaced by “Open-Loop Factor” when ZV is configured for “No” sensor

- If calibrating a closed-loop system, open-loop values are automatically saved simultaneously while saving closed loop values. Open-loop values are necessary in event sensor failure occurs in operating closed-loop mode. The number value open-loop “Open loop Factor” is identical to the “Pulses/Minute” value for closed-loop systems.

6. Low Speed Calibration

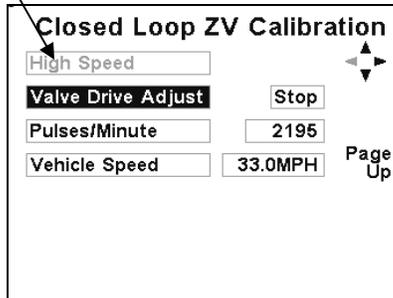
- Typical low speed calibration would be in the 5-8MPH range. Adjust the “Valve Drive Adjust” to 5% using the display arrow keys.
- Turn the Feeder knob clockwise one click to start feeding material into the ZV spreader.
- Drive the vehicle and locate a speed where material ZV is reached. A spotter car following the truck works well. A radio can be used for communication ideally, but something as simple as flashing headlights or honking the horn by the spotter car when the correct speed is observed can be used.
- Press the display F3 key to save values.

HIGH SPEED CALIBRATION CONTINUED ON NEXT PAGE....

7. High Speed Calibration

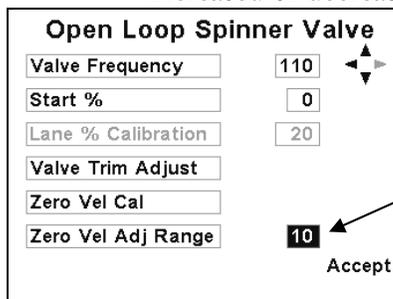
- Repeat the same procedure for High Speed calibration. Use display **Page Dn / F2** key or arrow keys to navigate to the ‘High Speed page’. It will be detailed as shown below.
 - The High speed value should be calibrated to the most common vehicle speed traveled. e.g. 30-35 MPH.
 - Increase feeder output by turning the feeder knob another 10-15 clicks to approximately 75% of full granular output capability. This gives a more realistic load to the ZV mechanism.
 - ZV Cal values can be adjusted manually if needed after the ZV has been tested in operating mode. This is especially true for Open-loop control. It is recommended that if calibrating closed-loop that open-loop control be tested by disconnecting the spinner sensor and testing the failure into open-loop. Adjust cal values accordingly if necessary. Adjusting cal values while running open-loop will only improve the responsiveness of closed-loop as well. Note: If PPM (pulses/minute) stop increasing with increases to the “Valve Drive Adjust” value, then you have already reached maximum hydraulic flow and ZV velocity and you need to decrease valve drive until the PPM drops off slightly. This also sets the maximum speed at which you will be able to operate the ZV spreader. In event max speed is exceeded while in normal ‘Operating Mode’ the Operator will receive a “Spin Rate low –Slow Down!” message on the display.

Note: “High Speed” values shown



8. Operator (override) LANE knob adjustment range

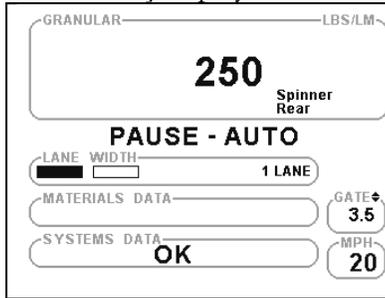
- Set Operator Knob override adjustment range.
 - 10% = 10% of valve trim between min and max trim. This is +/- from center cal position. So total range is actually 20%.
 - A typical value would be 10%. 0% = Gives no adjustment to the driver.
 - When the ‘Lane’ knob is adjusted in *Operating Mode* the ZV MPH [Km/H *metric mode*] display will show changes in material speed as the knob is increased or decreased.



Operator ‘Lane knob’ adjust range. 0-99%

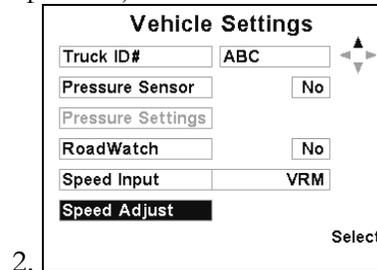
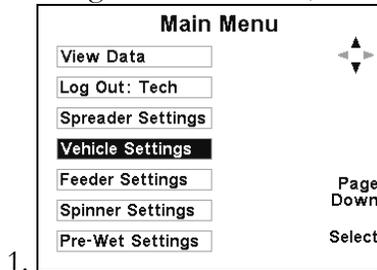
CALIBRATING MPH INPUT (Ground Speed Input)

It is absolutely necessary as part of the calibration process to make sure the ACS MPH [Km/H *metric mode*] display matches the Truck MPH display.

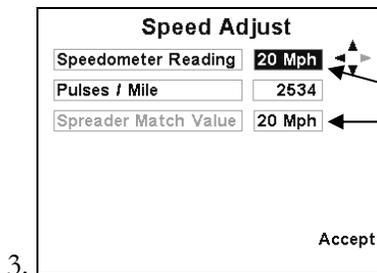


MPH [Km/H *metric mode*] display

- Drive the vehicle. The MPH [Km/H *metric mode*] display should match and track with the vehicle speedometer. If it does not, then follow the instructions below.
- Login to Main menu, Vehicle settings, Speed adjust.



- Adjust the speedometer reading value to a vehicle speed appropriate for where you are going to calibrate the vehicle. Use great caution while driving the vehicle avoid taking your eyes of the road.
- Drive the vehicle to the speed you have pre-set. When the vehicle speedometer reaches that speed press the **F3** “Accept” display key. The speedometer is now calibrated!



Use display ▲ ▼ arrows to adjust value up or down.

“Match Value” should match and track with truck speedometer.

Press Accept when your value is set to same value displayed on truck Speedometer.

- Note: If there is no signal, you will receive a “Ground Speed too low” message at the bottom of the screen when trying to press **F3** “Accept”.

CLOSED/OPEN LOOP PRE-WET CALIBRATION

1. Checklist: Before starting calibration.

- Tanks with liquid in them. Use caution if using straight water. Water will freeze causing major damage to all system components. 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.
- All typical plumbing and nozzles must be attached. Be sure nozzles are clean.
- Liquid Pump Bypass valve (inside pump enclosure) must be set prior to calibration. Contact your local Freedom Systems Salesperson if you have questions about how to set the valve.
- Move the vehicle to a location where it's ok to dispense liquid materials.
- Electric pump motors can be driven directly by the ACS output module; however Valve Frequency (illustrated below-right) **MUST** be set for 300Hz. and output current will automatically be internally limited to 6 amps.

CLOSED LOOP PRE-WET CALIBRATION ON NEXT PAGE....

2. Closed-loop Pre-wet calibration

- Navigate to the Pre-wet Valve setup screen shown below using the display's arrow and F3 keys on the display panel. Use the illustrations below as a guide.
- Set the flow-meter K-Factor

<p>Main Menu</p> <p>View Data</p> <p>Log Out: Tech</p> <p>Spreader Settings</p> <p>Vehicle Settings</p> <p>Feeder Settings</p> <p>Spinner Settings</p> <p>Pre-Wet Settings</p>	<p>Page Down</p> <p>Select</p>	<p>Pre-Wet Settings</p> <p>Pre-Wet Type: Hydraulic</p> <p>Max: 30</p> <p>Increment: 1</p> <p>Shutoff @ Speed: 99</p> <p>Output: PWM 8</p> <p>Flow Meter: Yes</p> <p>Valve Setup</p>	<p>Select</p>	<p>Closed Loop Pre-Wet Valve</p> <p>Valve Frequency: 200</p> <p>Start %: 25</p> <p>Feedback Channel: FB 3</p> <p>Flow Meter PPG: 1240</p> <p>Valve Trim Adjust</p>	<p>Accept</p>
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Note: Flow-meter is set to "YES". This is Closed-Loop operation.

Enter directly: The flow-meter K-Factor. Normally found on a Tag located on the flow-meter. This is entered as (P)ulses (P)er (G)allons US even when in Metric mode.

- Navigate to the "Valve Trim Adjust" screen shown below using the display's arrow and F3 keys on the display panel. Use the illustrations below as a guide.

<p>Closed Loop Pre-Wet Valve</p> <p>Valve Frequency: 200</p> <p>Start %: 25</p> <p>Feedback Channel: FB 3</p> <p>Flow Meter PPG: 1240</p> <p>Valve Trim Adjust</p>	<p>Select</p>	<p>Closed Loop Pre-Wet Trim</p> <p>Auto Trim: Stop</p> <p>Minimum Trim: 19.0</p> <p>Maximum Trim: 31.0</p> <p>Fault Timeout: 15</p>
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Typical Min Trim setting and pulses feedback For Hydraulic Stack-driven pre-wet.

Typical Max Trim setting and pulse feedback for Hydraulic Stack-driven Pre-wet. Do not to exceed 40% max trim value for typical Hypro type Hydraulic motors.

- Adjust min trim for the lowest pulses possible pulses: 300-600. Press display F3 key to "Accept"; SAVE the value.
 - Exit in and out of min trim value to make sure min trim setting starts the Pre-Wet motor each time
- Adjust Max Trim for the highest pulse count (sensor feedback) without raising the Max trim value above where pulses stop increasing. If this happens the controller response while operating in closed-loop is slowed down and the Open loop control does not work accurately in event the Flow-meter fails.
 - If using Hypro motor on pre-wet pump do not exceed 40% trim for Max.
- It is not recommended to use Auto-trim for Pre-Wet trim calibrations due to excess flows exceeding the manufacturer's rating of the hydraulic pump motor (4 GPM). Max trim for a typical Stack-driven Pre-wet should be no more than 40%.

3. Fault time-out (closed-loop only)

- While in the Trim screens (see above illustrations), set a fault time-out for the ACS control to switch into Open-Loop mode.
- Should be adjusted for a value between 1 and 30 seconds.
- Time-out operation important for default Open-Loop operation to maintain a regulated output in event of sensor failure.

OPEN-LOOP PRE-WET CALIBRATION ON NEXT PAGE.....

4. Open-loop Pre-wet calibration

Pre-Wet Settings	
Pre-Wet Type	Hydraulic
Max	30
Increment	1
Shutoff @ Speed	99
Output	PWM 8
Flow Meter	No
Valve Setup	Select

Open Loop Pre-Wet Valve	
Valve Frequency	200
Minimum Trim	19.0
Maximum Trim	31.0
Start %	25
Maximum GPM	2
	Accept

Typical Min Trim setting for a Hydraulic Stack-driven pre-wet.

Typical Max Trim setting for a Hydraulic Stack-driven Pre-wet.

Do not to exceed 40% max trim value for typical Hypro type Hydraulic motors.

Note: Flow-meter is set to “NO”. This is Open-Loop operation.

Enter directly the Max GPM [LPM *metric mode*] capability of your pump-motor. This value is derived by pumping a measured volume in a given time to derive your max GPM (G)allon (P)er (M)inute value.

- Adjust min trim for the lowest Pre-wet pump speed that can be observed without stalling. Press display F3 key to “Accept”; SAVE the value.
 - Exit in and out of min trim value to make sure min trim setting starts the Pre-Wet motor each time.
- Adjust Max Trim by watching for Max flow exiting the Pre-Wet nozzles without raising the Max trim value above where flow stops increasing. If this happens, the controller will not operate open-loop control very accurately.
 - One method to measure the max GPM value on open-loop pre-wets would be to re-direct the nozzle output into a 5 gallon bucket. Time how long it takes to fill the bucket. Divide 5 gallons e.g. 5 divided by 1.5 minutes = 3.33GPM.
 - If using Hypro motor on pre-wet pump do not exceed 40% trim for Max.

5. ON/OFF open-loop Pre-wet calibration

- On/Off Pre-wet used for Hydraulic ratio Pre-wet systems. Or single speed electric motors or relays.
- Output runs at Max trim value. Max trim typically set to 100%.
- Output turns ON/OFF with Feeder, ground-speed (MPH) [Km/H *metric mode*], and Tank empty inputs.

Pre-Wet Settings	
Pre-Wet Type	On/Off
Max	30
Increment	1
Shutoff @ Speed	99
Output	PWM 8
Flow Meter	No
Valve Setup	Select

Set frequency to 300% for electric motors, relays and ON/OFF coils.

Set max trim to 100% typically for ON/OFF Pre-wet. Used for ON/OFF coils, motors and relays. Current limited to 6 Amps

Open Loop Pre-Wet Valve	
Valve Frequency	200
Minimum Trim	19.0
Maximum Trim	31.0
Start %	25
Maximum GPM	3

CLOSED/OPEN LOOP ANTI-ICE CALIBRATION

1. Checklist: Before starting calibration.

- Tanks with liquid in them. Use caution if using straight water. Water will freeze causing major damage to all system components. 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.
- All typical plumbing and nozzles/booms must be attached. Be sure nozzles are clean.
- Move the vehicle to a location where it's ok to dispense liquid materials.
- Flow-meter Cal factor needed for Closed-loop operation. Typically found on flow-meter as "K-Factor".
- Max GPM or [LPM *metric mode*] output with all nozzles/booms active. (Open-Loop operation only).

2. Closed-loop Anti-Ice calibration

Anti-Ice Settings	
Anti-Ice	Yes
Max	200
Increment	5
Shutoff @ Speed	99
Output	None
Flow Meter	Yes
Valve Setup	Select

Note: Flow-meter is set to "YES". This is Closed-Loop operation.

Closed Loop Anti-Ice Valve	
Valve Frequency	110
Start %	25
Feedback Channel	FB 2
Flow Meter PPG	99
Valve Trim Adjust	

Enter directly: The flow-meter K-Factor or PPG (P)ulses (P)er (G)allon. Normally found on a Tag located on the flow-meter. PPG is always entered as US gallons in English or Metric modes of operation.

Closed Loop Anti-Ice Trim	
Auto Trim	Stop
Minimum Trim	40.4
	192
Maximum Trim	47.4
	6205
Fault Timeout	15

Adjust Min Trim until feedback is received.

Adjust Max Trim setting for maximum Pulse Feedback.

Adjust trim up until pulses stop changing (note max pulses).

Reduce trims until pulses just start to drop, then increase again just until max pulses are achieved again. Press F3 to save.

- Adjust min trim for the lowest possible pulses: 300-600. Press display F3 key to "Accept"; SAVE the value.
 - If running *open loop* (no sensor) adjust *min trim* to point where pump-motor is running as slow as possible without stalling.
 - Exit in and out of min trim value to make sure min trim setting starts the Anti-Ice pump-motor each time
- Adjust Max Trim for the highest pulse count (sensor feedback) without raising the Max trim value above where pulses stop increasing. If this happens the controller response while operating in closed-loop is slowed down and the Open loop control does not work accurately in event the Flow-meter fails.
 - Read caption above next to illustration showing Anti-Ice trims setting.
 - It is not recommended to use Auto-trim for trim calibrations due to excess flows exceeding the manufacturer's rating of the hydraulic pump motor.

3. Fault time-out (closed-loop only)

- While in the Trim screens (see above illustrations), set a fault time-out for the ACS control to switch into Open-Loop mode.
- Should be adjusted for a value between 1 and 30 seconds.

4. Open-loop Anti-ice calibration

Anti-Ice Settings	
Anti-Ice	Yes
Max	200
Increment	5
Shutoff @ Speed	99
Output	PWM 3
Flow Meter	No
Valve Setup	Select

Open Loop Anti-Ice Valve	
Valve Frequency	110
Minimum Trim	40.4
Maximum Trim	47.4
Start %	25
Maximum GPM	62
Accept	

Adjust Min Trim until Pump is running slowly. Exit in and out of value to be sure pump starts reliably.

Adjust Max Trim until Pump Flow no longer increases with increases in the Max trim value.

Note: Flow-meter is set to “NO”. This is Open-Loop operation.

Enter directly the Max GPM capability of your pump-motor. This value is derived by pumping a measured volume in a given time to derive your max GPM (G)allon (P)er (M)inute value.

- Adjust min trim for the lowest Anti-Ice pump-motor speed that can be observed without stalling. Press display F3 key to “Accept”; SAVE the value.
 - Exit in and out of min trim value to make sure min trim setting starts the Anti-Ice pump-motor each time.
- Adjust Max Trim by watching for Max flow exiting the booms/nozzles without raising the Max trim value above where flow stops increasing. If this happens the controller will not operate open-loop control very accurately.
- Enter Max GPM output of booms.
 - Perform a measured dump in manual mode at 100% pump speed with all Booms active to calculate max GPM value - if it’s not previously known.

5. Running Anti-Ice with pre-Wet equipment (Pre-wet direct application).

- This is accomplished using the Pre-Wet pump output with a manual diverter valve that diverts the flow of fluid to a boom for direct application to the road surface.
- Remember:
 - Flow-Meter PPG (Pulses Per Gallon) will be entered as US GALLONS..... Always!
- First Step: Follow the Pre-Wet calibration section of this manual to calibrate the Pre-Wet.
- Last Step: Under the Administrators log-in change the following:
 - Anti-Ice ‘type’ (detailed below) to Pre-Wet.
 - Change the ‘Output’ assignment under Anti-Ice settings to be that of the same as assigned under the Pre-Wet settings.
 - Complete the Anti-Ice Calibration section of this manual.
 - Works for Open or Closed loop operation.

Anti-Ice Settings	
Anti-Ice	Pre-Wet
Max	200
Increment	5
Shutoff @ Speed	99
Output	PWM 3
Flow Meter	No
Valve Setup	Accept

Change ‘type’ to: Pre-Wet to operate Pre-Wet as direct application.

Change output assignment to match output assignment under ‘Pre-Wet Settings’ menu.