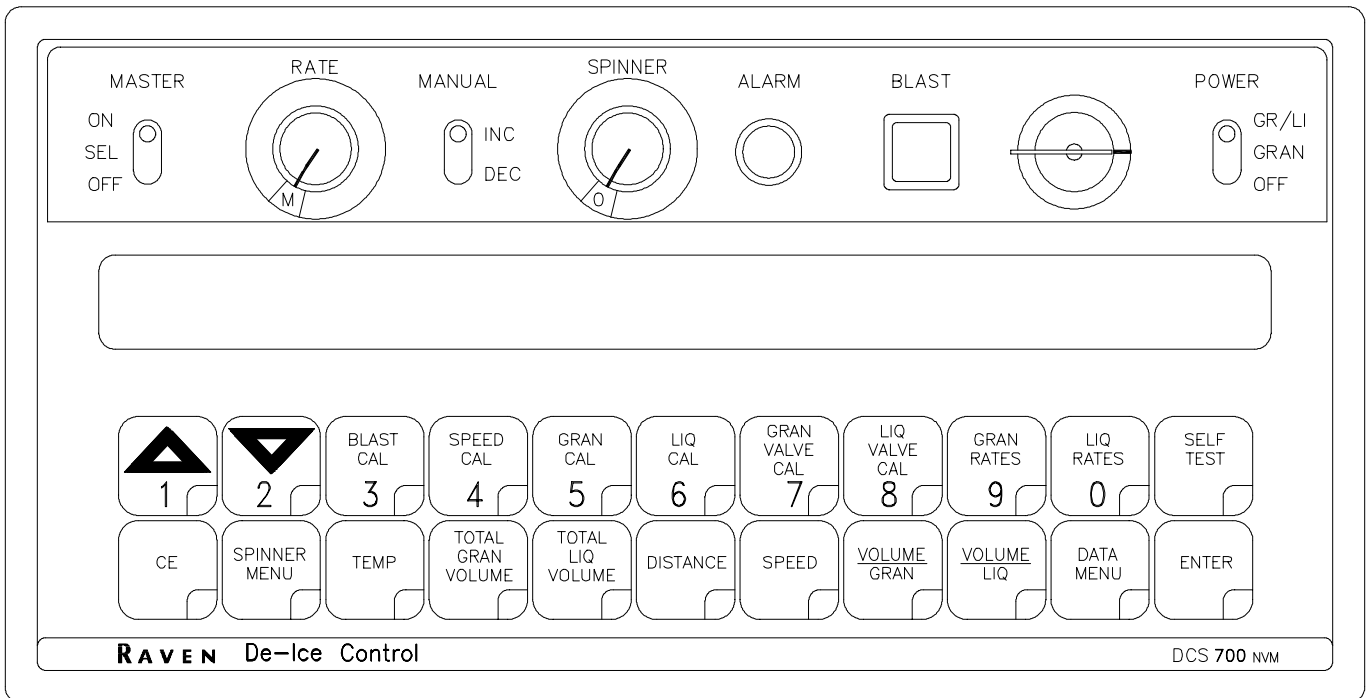


THE *Right* PRODUCTS
PEOPLE
CHOICE



DCS 700/710



INSTALLATION AND SERVICE MANUAL

N O T I C E

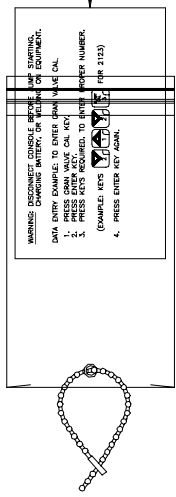
The use of the suspension type slurries will significantly reduce the life of the plastic parts in the Flow Meter and motorized Control Valve. Check the rotor and inlet hub assembly in the Flow Meter frequently for worn parts. Excessive wear can affect accuracy.

Do not attempt to modify or lengthen any of the three-wire Speed Sensor or Flow Meter cables. Extension cables are available from your Dealer.

W A R N I N G

Disconnect console before jump starting, charging battery, or welding on equipment.

THIS CARD IS PROVIDED FOR YOUR CONVENIENCE. PENCIL IN YOUR CALIBRATION NUMBERS FOR FUTURE REFERENCE.
 CUT ON DOTTED LINE, FOLD, AND INSERT INTO PLASTIC ENVELOPE.



INSERT AND ZIP SHUT

FOLD ON SOLID LINES

CUT ON DOTTED LINE

(DCS 700/710)

OFFSET:

DATA MENU	SPINNER HIGH	SPINNER LOW	GRANULAR HIGH	GRANULAR LOW	PRE-WET HIGH	PRE-WET LOW	ANTI-ICE HIGH	ANTI-ICE LOW
	_____	_____	_____	_____	_____	_____	_____	_____

ADDITIONAL NOTES:

TRUCK NUMBER: _____
 LOW GEAR RATIO: _____
 HIGH GEAR RATIO: _____

WARNING: DISCONNECT CONSOLE BEFORE JUMP STARTING,
 CHARGING BATTERY, OR WELDING ON EQUIPMENT.

DATA ENTRY EXAMPLE: TO ENTER GRAN VALVE CAL.

1. PRESS GRAN VALVE CAL KEY.
2. PRESS ENTER KEY.
3. PRESS KEYS REQUIRED, TO ENTER PROPER NUMBER.
4. PRESS ENTER KEY AGAIN.



BLAST CAL 3	BLAST RATE	SAND	PRD 1	PRD 2	ANTI-ICE	BLAST TIME
SPEED CAL 4	SPEED CAL					
GRAN CAL 5	GRAN CAL	SAND	PRD 1	PRD 2		
LIQ CAL 6	LIQ CAL	PRE-WET			ANTI-ICE	
GRAN VALVE CAL 7	GRAN VALVE CAL					
LIQ VALVE CAL 8	LIQ VALVE CAL	PRE-WET			ANTI-ICE	

GRAN RATES 9	GRAN RATES				
	SAND	SALT	PRD1	PRD2	ANTI-ICE
RATE 1	_____	_____	_____	_____	_____
RATE 2	_____	_____	_____	_____	_____
RATE 3	_____	_____	_____	_____	_____
RATE 4	_____	_____	_____	_____	_____
RATE 5	_____	_____	_____	_____	_____
RATE 6	_____	_____	_____	_____	_____
RATE 7	_____	_____	_____	_____	_____
RATE 8	_____	_____	_____	_____	_____
RATE 9	_____	_____	_____	_____	_____
RATE 10	_____	_____	_____	_____	_____

LIQ RATES 0	LIQ RATES	
	SAND	

	SALT	_____
	PRD 1	_____
	PRD 2	_____



RAVEN INDUSTRIES

LIMITED WARRANTY

WHAT IS COVERED?

This warranty covers all defects in workmanship or materials in your Raven Flow Control Product under normal use, maintenance, and service.

HOW LONG IS THE COVERAGE PERIOD?

This warranty coverage runs for 12 months from the purchase date of your Raven Flow Control Product. This warranty coverage applies only to the original owner and is not transferrable.

HOW CAN YOU GET SERVICE?

Bring the defective part, and proof of date of purchase, to your local dealer. If your dealer agrees with the warranty claim, he will send the part, and proof of purchase to his distributor or to Raven for final approval.

WHAT WILL RAVEN INDUSTRIES DO?

When our inspection proves the warranty claim, we will, at our option, repair or replace the defective part and pay for return freight.

WHAT DOES THIS WARRANTY NOT COVER?

Raven Industries will not assume any expense or liability for repairs made outside our plant without written consent. We are not responsible for damage to any associated equipment or product and will not be liable for loss of profit or other special damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person is authorized to assume for us any liability. Damages caused by normal wear and tear, mis-use, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.

TABLE OF CONTENTS

SYMBOL DEFINITION	3
INTRODUCTION	4
INSTALLATION.....	5
1. INSTALLATION OF RAVEN RADAR	5
2. MOUNTING THE FLOW METER	6
3. MOUNTING THE GRANULAR ENCODER	7
4. MOUNTING THE LIQUID AND GRANULAR CONTROL VALVES	8
5. MOUNTING THE CONSOLE AND CABLING.....	8
CONSOLE FEATURES.....	9
LANE BOX FEATURES.....	10
CONSOLE PROGRAMMING.....	11
1. INITIAL CONSOLE PROGRAMMING	12
CONSOLE CALIBRATION.....	16
1. CALCULATING OFFSETS	16
2. CALCULATING "SPEED CAL"	21
3. CALCULATING "GRAN CAL"	21
4. VERIFYING "GRAN CAL"	22
5. CALCULATING "LIQ CAL"	23
6. CALCULATING "GRAN AND LIQ VALVE CAL"	23
SELECTING PRODUCT	23
1. GRANULAR PRODUCT	23
2. GRANULAR PRODUCT WITH LIQUID PRE-WET.....	23
3. ANTI-ICE LIQUID, GRANULAR/ANTI-ICE OR GRAN/PREWET/ANTI-ICE	23
SIMULTANIOUSLY	23
OTHER CONSOLE FEATURES.....	24
1. SELF TEST FEATURE	24
2. SPINNER MENU	25
3. TEMPERATURE	26
4. VOLUME AND DISTANCE DISPLAYS	28
5. VOLUME/GRAN AND VOLUME/LIQ	30
6. BLAST BUTTON	30
7. MANUAL MODE LOCK OUT	30
8. CONTROL VALVE DELAY	31
9. BUMP RATE +/-	31
10. LOW TANK ALARM	31
11. LOW LIMIT FLOW ALARM	32
DATA MENU	33
SERIAL PORT MENU	33
GLOBAL POSITIONING SYSTEM MENU	35
TIME AND DATE MENU	35
FLOW MENU	36
ALARM MENU	37
OTHER ALARMS	38
MISCELLANEOUS MENU	39
PWM VALVE OFFSET MENU	40
CALIBRATION MENU	40
ANTI-ICE LANE MENU	44
SAND BLAST MENU	44

Continued on page 2

SALT BLAST MENU	44
PRODUCT 1 BLAST MENU	45
PRODUCT 2 BLAST MENU	45
PRE-WET BLAST MENU	45
ANTI-ICE BLAST MENU	45

APPENDIXES

1. SPEEDOMETER DRIVE SPEED SENSOR INSTALLATION AND CALIBRATION PROCEDURE	46
2. CALCULATING "GRAN & LIQ VALVE CAL"	48
3. ENTERING OFFSET VALUES	49
4. PROCEDURE TO TEST SPEED SENSOR EXTENSION CABLES	51
5. PROCEDURE TO TEST FLOW CABLES	52
6. FLOW METER MAINTENANCE AND ADJUSTMENT PROCEDURE	53
7. PROCEDURE TO RE-CALIBRATE FLOW METER	54
8. REMOTE SWITCH OPTIONS	55
9. DCS 700/710 DATA MENU REFERENCE GUIDE	56

REPLACEMENT PARTS SHEETS

SYMBOL DEFINITION

GPM	- Gallons per minute	MPH	- Miles per hour
lit/min	- Liters per minute	km	- Kilometers
PSI	- Pounds per square inch	km/h	- Kilometers per hour
kPa	- Kilopascal	US	- Volume per mile
mm	- Millimeters	SI	- Volume per kilometer
GPT	- Gallons per ton	[]	- Metric numbers
MT	- Metric ton	lb	- Pound
cm	- Centimeters	kg	- Kilogram
dm	- Decimeters		
m	- Meter		

LIQUID METER CAL CONVERSIONS

To convert the METER CAL number simply divide the original number (number printed on Flow Meter label) by the desired conversion factor.

FOR EXAMPLE:

$$\frac{\text{Original METER CAL No.}}{128} = \text{METER CAL No. for displays in Fluid Ounces}$$

$$\frac{\text{Original METER CAL No.}}{3.785} = \text{METER CAL No. for displays in Liters}$$

$$\frac{\text{Original METER CAL No.}}{\text{Weight of one gallon}} = \text{METER CAL No. for displays in Pounds}$$

LIQUID CONVERSIONS

U.S. Gallons x 128 = Fluid Ounces
U.S. Gallons x 3.785 = Liters
U.S. Gallons x 0.83267 = Imperial Gallons
U.S. Gallons x 8.34 = Pounds (Water)

LENGTH

1 millimeter (mm) = 0.039 inch
1 centimeter (cm) = 0.393 inch
1 meter (m) = 3.281 feet
1 kilometer (km) = 0.621 mile
1 inch = 25.4 millimeters; 2.54 centimeters
1 mile = 1.609 kilometers
1 mile = 5,280 feet

PRESSURE

1 psi = 6.89 kPa

AREA

1 square meter = 10.764 square feet

INTRODUCTION

The Raven DCS 700/710 (DE-ICE CONTROL SYSTEM) is designed to improve the accuracy and the uniformity of granular or liquid material applications. Its performance relies on the installation and preventive maintenance of the complete system. It is important that this Installation and Service Manual be reviewed thoroughly before operating the system. This manual provides a simple step-by-step procedure for installing and operating the DCS 700/710.

The DCS 700/710 system consists of a computer-based control console, lane switch box (710 only), speed sensor, hydraulic control valves, granular rate sensor, cables, and liquid flow meter. The console mounts directly in the cab of the vehicle for easy operator use. The speed sensor is installed in one of several locations based on the style of speed sensor that is used. The hydraulic valve mounts in the best location available for ease of service and installation. The granular sensor is either integral with the hydraulic motor or mounted to the auger/conveyor shaft. Appropriate cabling is furnished for dealer/field installation.

The operator selects the desired application rate for a particular granular or liquid material and the DCS 700/710 automatically maintains the desired rate regardless of vehicle speed. A manual mode can be selected to allow the operator to manually control the granular and liquid application rate. The desired application rate being applied is displayed at all times. The DCS 700/710 also displays additional features such as vehicle speed, recent and annual material volume totals, air and road surface temperature (must be equipped with sensor), and distance traveled.

INSTALLATION

1. INSTALLATION OF RAVEN RADAR

For mounting the radar, the following guidelines will assure proper installation: It is suggested that a large heavy mounting bracket, (P/N 107-0159-693) be attached to the vehicle frame for mounting the radar. (See Appendix 1 for Speedometer Speed Sensor installation instructions).

- 1) Park vehicle on level surface.
- 2) Select mounting site by considering the following:
 - a) The line of sight from the lens to the ground must not be obstructed by structures or tires. Road surface must not come closer than 20 inches to the bottom of the radar. See Figures 1 and 2.
 - b) The radar lens must be parallel to the ground from front to back. Radar can be tilted out 0-15 degrees to provide more clearance and miss obstructions. See Figure 2.
 - c) The radar should be mounted so that the **length** of the radar is **parallel** with direction of vehicle travel.
- 3) Use carpenters level to verify that mounting bracket is parallel to the ground.
- 4) Bolt mounting bracket to vehicle.
- 5) Bolt radar to mounting bracket using mounting hardware. See Figure 3.
- 6) Connect radar with Radar Interface Cable (P/N 115-0159-539), to the DCS 700/710 Console. The Red wire should be connected to switched 12VDC power. The White wire should be connected to the ground.

CAUTION: The connection of the radar power in reverse polarity could result in damage to the radar.

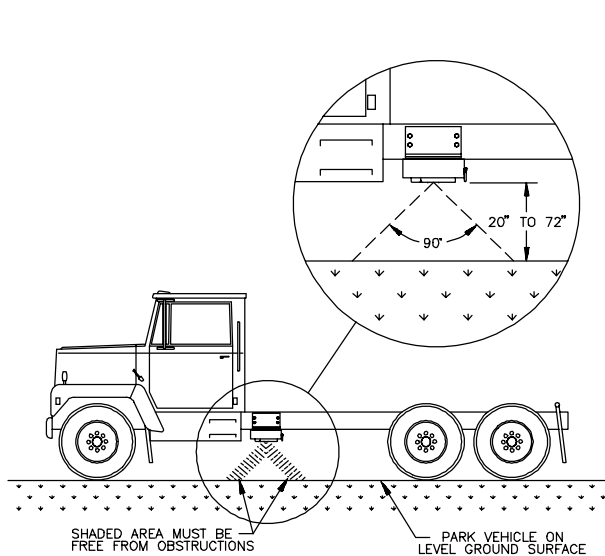


FIGURE 1

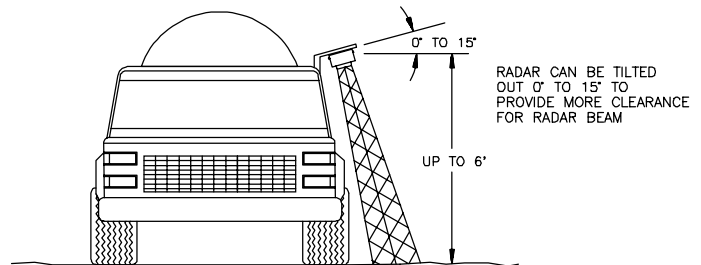


FIGURE 2

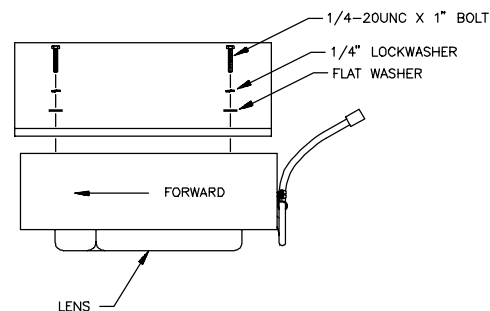
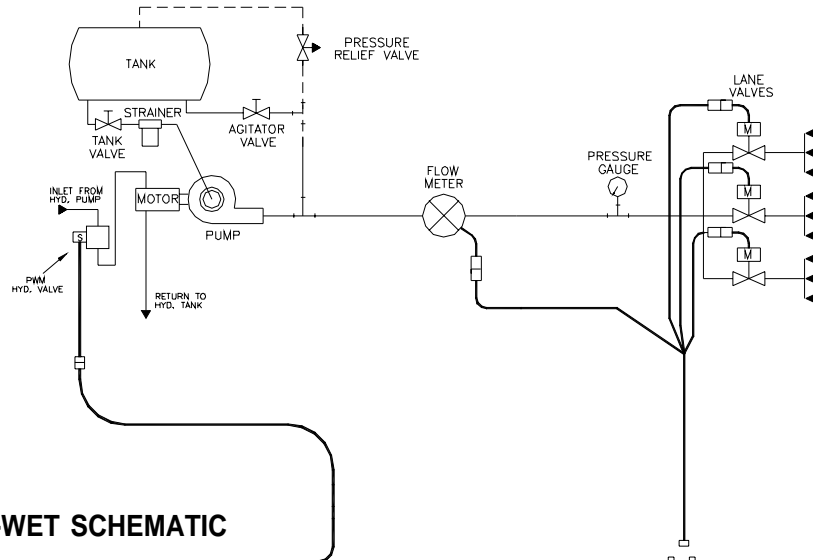


FIGURE 3

2. MOUNTING FLOW METER

- 1) Mount Flow Meter in the area of the liquid control per Figure 4. All flow through Flow Meter must go to pre-wetting or anti-icing nozzles only, i.e., no return line to tank or pump after Flow Meter.
- 2) Flow must be in direction of arrow on Flow Meter.

ANTI-ICE SCHEMATIC (DCS 710 only)



GRANULAR WITH PRE-WET SCHEMATIC

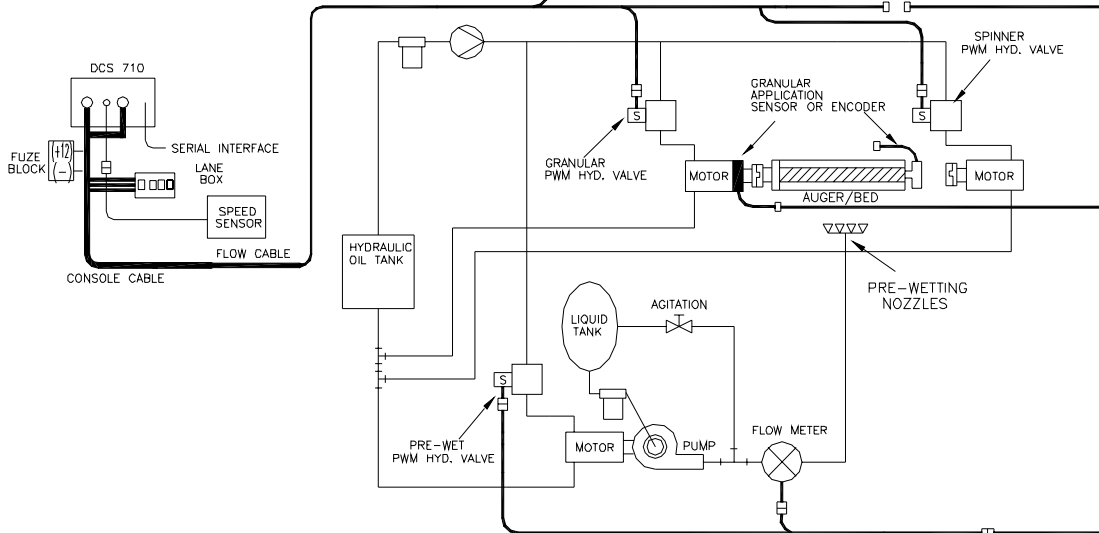


FIGURE 4

NOTE: This is one example of a application schematic.

It is essential, when using suspensions, that the system be thoroughly rinsed out each day after use.

3. MOUNTING GRANULAR ENCODER

- 1) Mount Encoder on output shaft of conveyor or other shaft which rotates at a known ratio to the conveyor.
- 2) Apply grease to Encoder shaft, conveyor shaft, and Encoder coupler (fits 1" diameter conveyor shaft). Secure coupler to Encoder and conveyor shafts with set screws provided.
- 3) Install mounting tabs to Encoder as shown in Figure 5. Connect mounting tab to mounting bracket (not provided) to prevent Encoder from rotating. **DO NOT** rigidly mount Encoder. Encoder is to be supported by coupler **ONLY**.

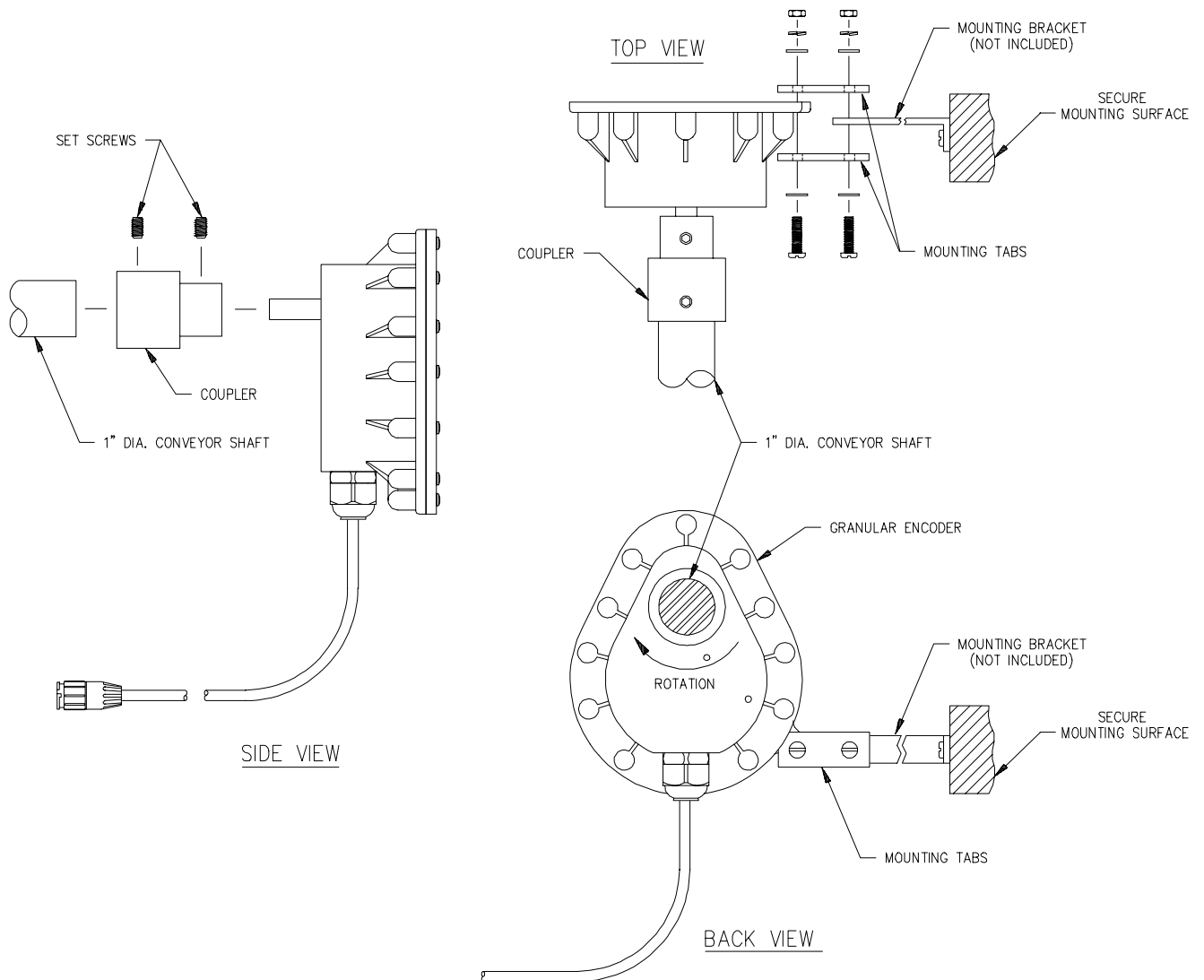


FIGURE 5

4. MOUNTING LIQUID AND GRANULAR CONTROL VALVES

The mounting of the liquid and granular Control Valves are based on the type of pre-wet and hydraulic system of the truck.

5. MOUNTING CONSOLE AND CABLING

NOTE: For instructions on mounting custom cabling, hydraulic valves, and liquid control systems, consult your dealer.

- 1) Mount the Console to a secure support inside the cab of the vehicle without hindering the visibility of the operator.
- 2) Connect the Console Control Cable to the plugs in the back of the Console. (See Figure 6).

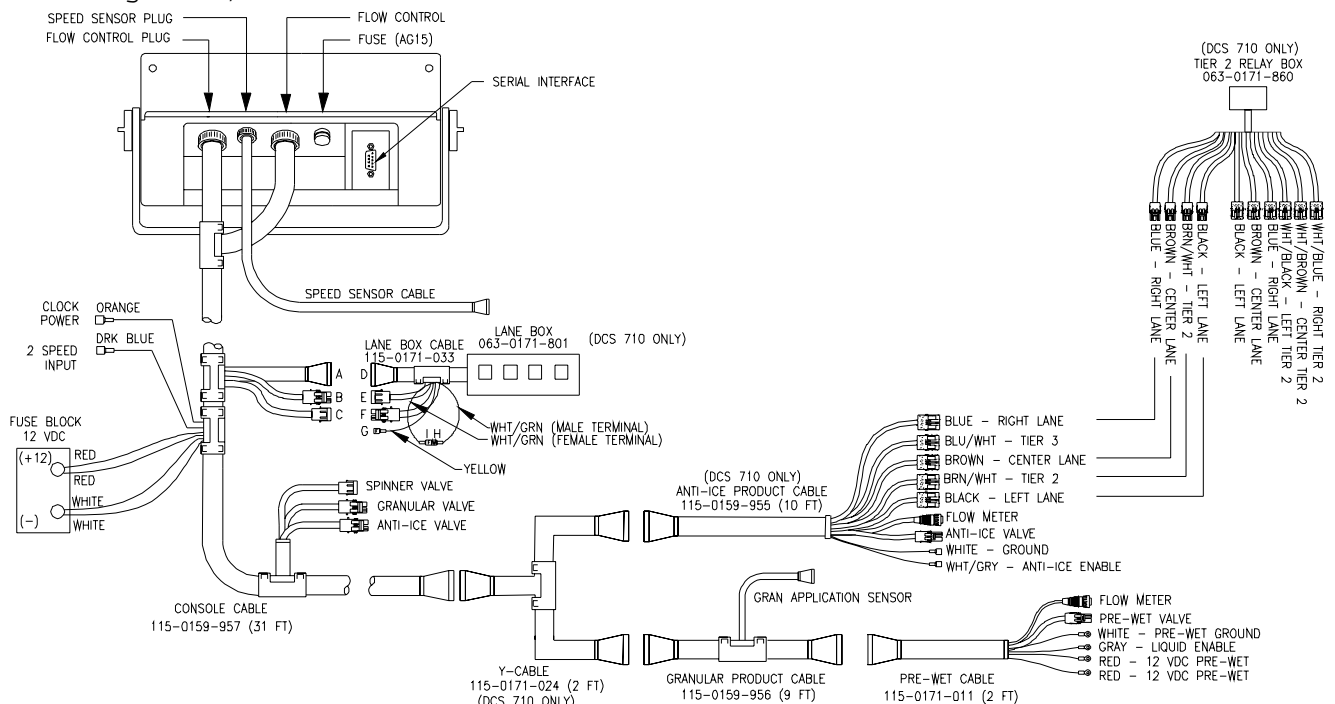
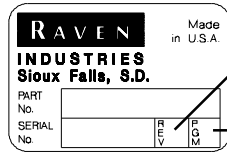


FIGURE 6

- 3) Turn POWER ON/OFF switch OFF and route the Red wire to the +12 volt fuse block and White wire to the negative connection. **(DO NOT CONNECT WIRES TO THE STARTER)**. Secure the wires with plastic cable ties.
- 4) Connect the Speed Sensor Cable to the plug in the back of the Console.
- 5) DCS 700 console cable must have plug installed in connector A, and B connected to C.
- 6) When using a DCS 710 and a 3 valve block system, connect the lane box by connecting A to D, B to C, and leave E and F disconnected. If using a 2 valve block system, connect A to D, B to E, and C to F.
- 7) When using a DCS 710 and GRAN/PREWET/ANTI ICE mode is selected, disconnect H and I then connect G and H.

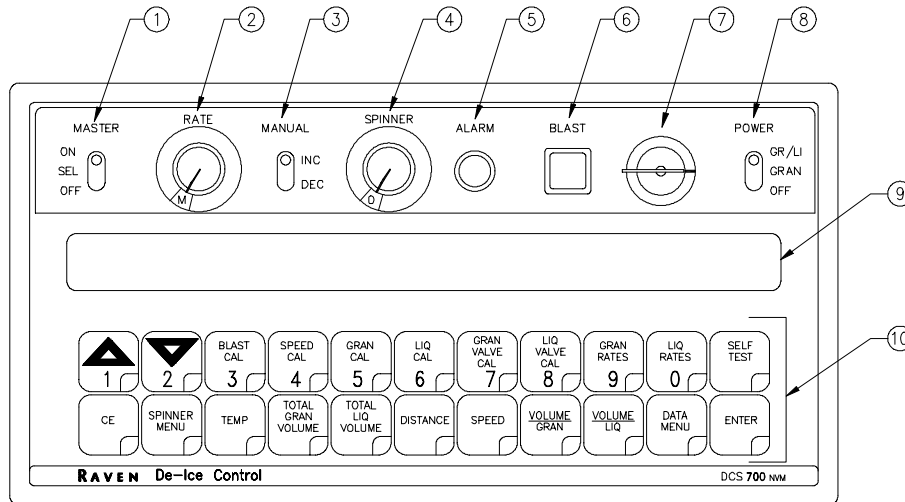
CONSOLE FEATURES

IMPORTANT: This Console requires selection of **US** (miles), **Metric** [km] distance; and **SP1** (wheel drive, etc.), **SP2** (radar), or **SP3** (transmission) speed sensor.



Console Revision can be determined by the letter stamped in REV box on label.

Console Program can be determined by the letter stamped in PGM box on label.



- 1) MASTER SWITCH - Activates the granular and/or anti-ice application. Also allows for the selection of Sand, Salt, Product 1, or Product 2.
- 2) RATE KNOB - Allows selection of manual operation or 10 pre-programmed automatic application rates.
- 3) MANUAL SWITCH - Increases or decreases application rate when Rate Knob is placed on "M". Also used during unloading operations.
- 4) SPINNER KNOB - Adjusts the speed of the spinner.
- 5) ALARM LIGHT - Visual indicator for alarm conditions.
- 6) BLAST BUTTON - Temporarily increases the application rate for problem areas. Blast rate and time can be preprogrammed.
- 7) KEY - Used to secure calibration values and other console data.
- 8) POWER SWITCH - Turns console ON or OFF and selects granular or granular with liquid applications.
- 9) DISPLAY SCREEN - Displays application rates and other console information.
- 10) KEYPAD - Used during calibration process and to access other data in the console.

CALIBRATION KEYS	--	Used to enter data into the Console to calibrate the system.
BLAST CAL	--	Selected Blast Rate And Time Period
SPEED CAL	--	Determined by Speed Sensor
GRAN CAL	--	Granular Calibration Number
LIQ CAL	--	Flow Meter Calibration Number
GRAN VALVE CAL	--	Valve Response Time
LIQ VALVE CAL	--	Valve Response Time
GRAN RATES	--	Granular Desired Application Rate (Rates 1-10)
LIQ RATES	--	Pre-Wet and Anti-Ice Application Rate
SELF TEST	--	Simulates Vehicle Speed
SPINNER MENU	--	Speed at which alarm will sound

FUNCTION KEYS	--	Used to Display Data
TEMP	--	Displays Ambient and Pavement Temperature
TOTAL GRAN VOLUME	--	Granular Volume Applied
TOTAL LIQ VOLUME	--	Liquid Volume Applied
DISTANCE	--	Distance Traveled and Distance Applied
SPEED	--	Speed of Vehicle
VOLUME/GRAN	--	Volume Remaining in Granular Box
VOLUME/LIQ	--	Volume Remaining in Liquid Tank
DATA MENU	--	Various data options

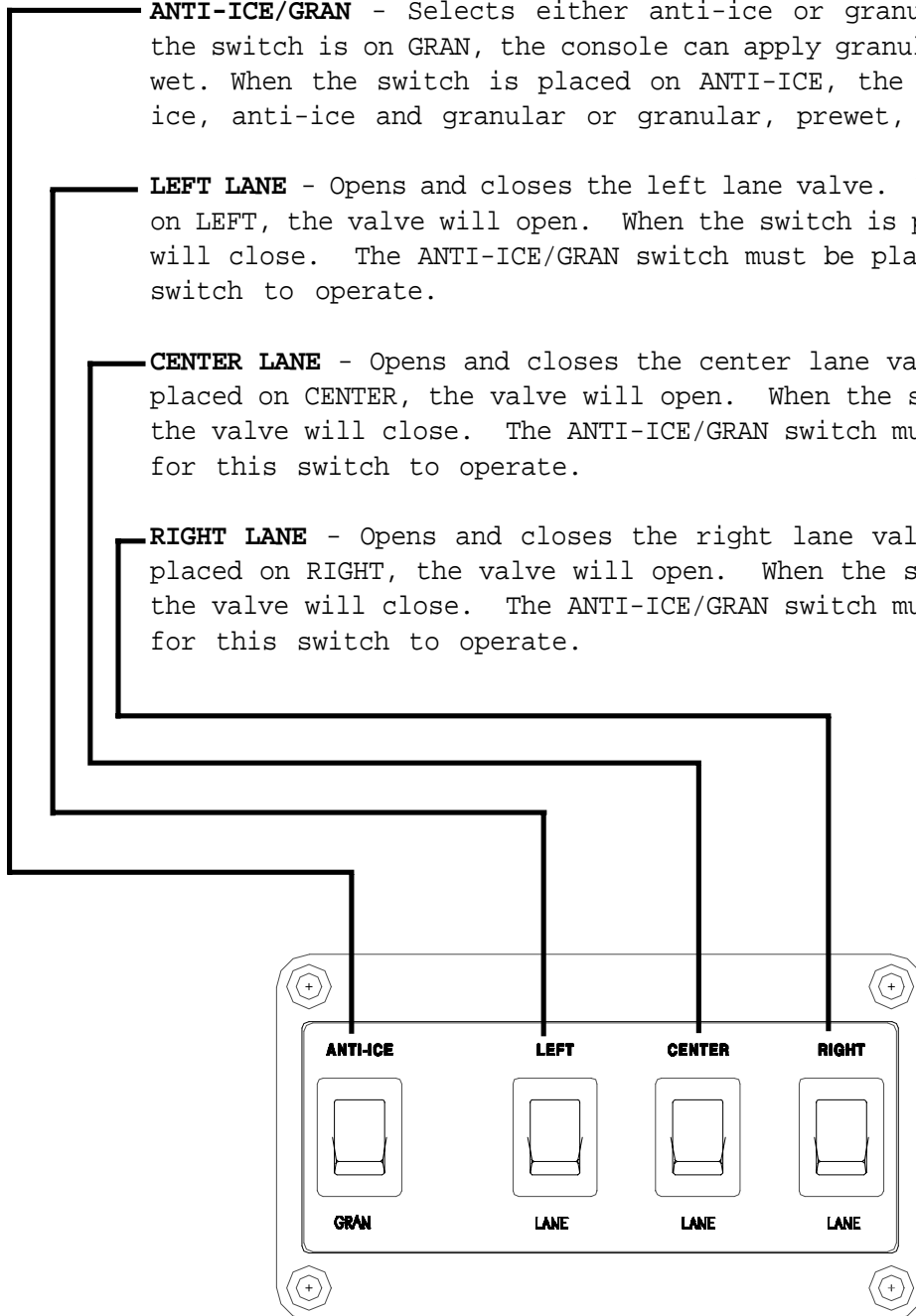
LANE BOX FEATURES - DCS 710 ONLY

ANTI-ICE/GRAN - Selects either anti-ice or granular application. When the switch is on GRAN, the console can apply granular or granular with prewet. When the switch is placed on ANTI-ICE, the console can apply anti-ice, anti-ice and granular or granular, prewet, anti-ice together.

LEFT LANE - Opens and closes the left lane valve. When the switch is placed on LEFT, the valve will open. When the switch is placed on LANE, the valve will close. The ANTI-ICE/GRAN switch must be placed on ANTI-ICE for this switch to operate.

CENTER LANE - Opens and closes the center lane valve. When the switch is placed on CENTER, the valve will open. When the switch is placed on LANE, the valve will close. The ANTI-ICE/GRAN switch must be placed on ANTI-ICE for this switch to operate.

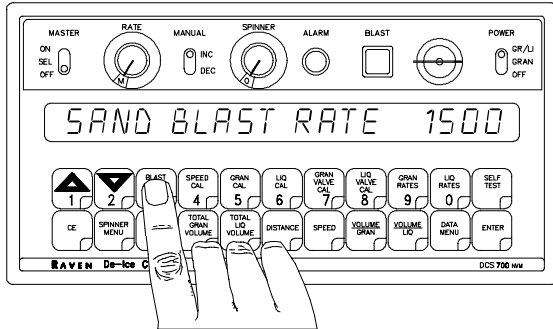
RIGHT LANE - Opens and closes the right lane valve. When the switch is placed on RIGHT, the valve will open. When the switch is placed on LANE, the valve will close. The ANTI-ICE/GRAN switch must be placed on ANTI-ICE for this switch to operate.



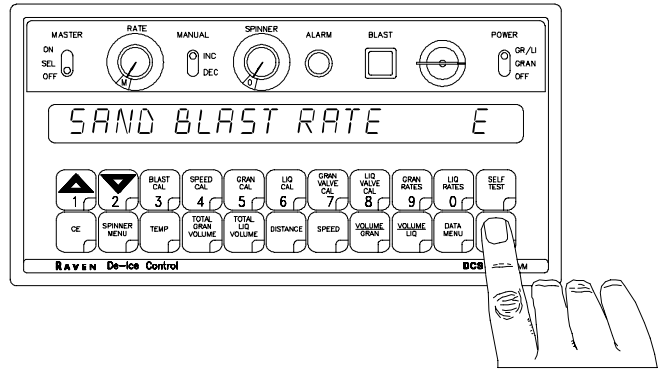
CONSOLE PROGRAMMING

When entering data into the Console, the entry sequence is always the same.

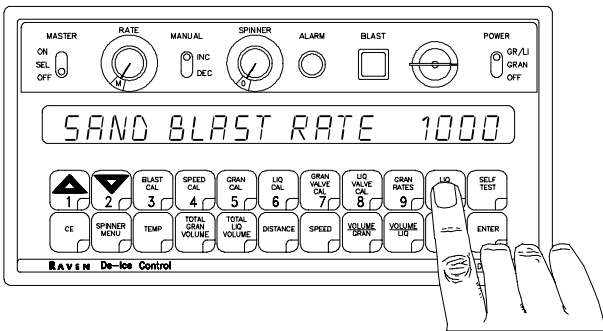
NOTE: DATA MUST BE ENTERED INTO KEYS 3 THRU 0.



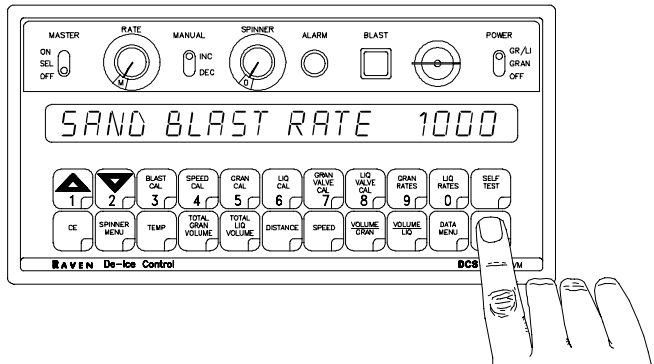
Depress the key in which you wish to enter data.



Depress the ENTER key. An "E" will illuminate in the display.



Depress the keys corresponding to the number you wish to enter (i.e. "1", "0", "0", "0"). The numbers will be displayed as they are entered.







Complete the entry by again depressing the ENTER key.

1. INITIAL CONSOLE PROGRAMMING



Verify MASTER switch is OFF. After all installation procedures have been completed, place POWER switch to GRAN, the Console will flash *CALIBRATION MODE* in the display. This means that the Console must be "programed" before it can be operated. This is a one-time operation which does not have to be repeated. Placing the POWER switch OFF or disconnecting power to the Console does not affect the Console memory. All data is retained in nonvolatile memory.





NOTE: The KEY switch must be in and turned to the horizontal position to enter data into the Console. This is referred to as the "programming mode".



Only the following keys are an exception:     . A



"0" (zero) may be entered for "day distances", "day granular volumes", "day liquid volumes". Refer to 'Distance and Volume Displays' on page 28 for procedure.

The following steps must be followed for proper calibration:


- 1) Selecting the unit of measurement US (lbs/mile), or Metric (Kg/km).
 - a) To select *US* or *METRIC*, depress  until the desired selection is displayed.
 - b) Momentarily depress , the display will now display *CALIBRATION MODE SP1*.

- 2) Selecting Speed Sensor type SP1 (drive shaft, wheel drive, etc.), SP2 (radar), or SP3 (transmission).
 - a) To select *SP1*, *SP2*, or *SP3* depress  until desired selection is displayed.
 - b) Momentarily depress , the display will now display *CALIBRATION MODE 0*.
 - c) Depress and hold . The previous 2 settings that were selected and 1-P, 2-P, and 3-P will be displayed. Verify the selections made are correct before proceeding to the next step. If an error is noted, place key switch to horizontal position and POWER switch OFF, depress and hold , place POWER switch to GRAN, and repeat steps 1-2.

NOTE: For the remainder of the Console programming the  and  keys will be used to advance through the various selections.



- 3) Depress . This console contains factory default values. If the desired value is different than the default value, then enter the desired value. If the default value is acceptable, then continue to the next value. Depress  to advance through the BLAST CAL menu.

<u>DISPLAY SCREEN</u>	<u>DESCRIPTION</u>
SAND BLAST RATE 1500	The amount of material applied when the BLAST button is depressed. (lbs/mile)[kg/km].
SALT BLAST RATE 1000	The amount of material applied when the BLAST button is depressed. (lbs/mile)[kg/km].
PRODUCT 1 BLAST RATE 1500	The amount of material applied when the BLAST button is depressed. (lbs/mile)[kg/km].
PRODUCT 2 BLAST RATE 1500	The amount of material applied when the BLAST button is depressed. (lbs/mile)[kg/km].
PREWET BLAST RATE 0	The amount of material applied when the BLAST button is depressed (gals/mile)[lit/km]. Only used when gallons/mile option has been selected. See Data Menu.
*ANTI ICE BLAST RATE 100	The amount of material applied when the BLAST button is depressed (gals/mile)(gals/lane mile)[lit/km][lit/lane km].
BLAST TIME 0	The number of seconds the BLAST rate will be applied after the blast button is let go. If the BLAST time is 0, then the rate will be applied as long as the button is depressed.

- 4) Depress . Enter an initial value of 200 or a previously known value if applicable. The actual SPEED CAL number will be obtained after the initial programming is completed. Refer to the "CALCULATING SPEED CAL" section for further instructions.

<u>DISPLAY SCREEN</u>	<u>DESCRIPTION</u>
CALIBRATION MODE 0	Calibration value for speed sensor. Can be calibrated by performing a distance verification test or by matching the console speed to the vehicle speed.



* = DCS 710 ONLY

- 5) Depress  . The GRAN CAL value for all 4 products initially is defaulted at 0. If the GRAN CAL number is known, it may be entered. If unknown, the actual GRAN CAL values will be obtained after the initial programming is completed. Refer to the "CALCULATING GRAN CAL" section for further instructions. Depress  to advance through the GRAN CAL menu.

DISPLAY SCREEN

DESCRIPTION

SAND CAL NUMBER	0	Calibration value for granular rate sensor. (pulses/10 lbs)
SALT CAL NUMBER	0	
PRODUCT 1 CAL NUMBER	0	
PRODUCT 2 CAL NUMBER	0	


- 6) Depress  . Locate the flow meter and enter the calibration number from the flow meter tag. Depress  to advance through the LIQ CAL menu. (DCS 710 ONLY)

DISPLAY SCREEN

DESCRIPTION

PREWET METER CAL	0	Calibration value for the prewet flow meter.
*ANTI ICE METER CAL	0	Calibration value for the anti-ice flow meter.



NOTE: If the pre-wet system is not controlled by the console (open loop system) enter "0" in prewet meter cal.

- 7) Depress  . This console contains a factory default value. If the desired value is different than the default value, then enter the desired value. Refer to Appendix 2 for a description of this valve cal value.

DISPLAY SCREEN

DESCRIPTION



CALIBRATION MODE	73	Calibration value for granular PWM valve.
------------------	----	---

- 8) Depress  . This console contains a factory default value. If the desired value is different than the default value, then enter the desired value. Refer to Appendix 2 for a description of the valve cal value. Depress  to advance through the LIQ VALVE CAL menu. (DCS 710 ONLY)

DISPLAY SCREEN

DESCRIPTION



PREWET VALVE CAL	73	Calibration value for prewet PWM valve.
*ANTI ICE VALVE CAL	73	Calibration value for anti-ice PWM valve.

9) Depress  . This console contains factory default application rates. If the desired rates are different than the default value, enter the desired value. During the calibration mode, only the Sand application rates will be displayed. When the initial calibration is completed the Salt, Product 1, and Product 2 application rates can be accessed. Depress  to advance through the GRAN RATES menu.

DISPLAY SCREEN

DESCRIPTION

SAND RATE 1	100	Granular application rate (lbs/mile)[kg/km]
SAND RATE 2	200	
SAND RATE 3	300	
SAND RATE 4	400	
SAND RATE 5	500	
SAND RATE 6	600	
SAND RATE 7	700	
SAND RATE 8	800	
SAND RATE 9	900	
SAND RATE 10	1000	

10) Depress  . This console contains factory default application rates. If the desired rates are different than the default value, enter the desired value. Depress  to advance through the LIQ RATES menu.

DISPLAY SCREEN


DESCRIPTION

SAND PREWET RATE	8	Prewet application rate (gals/ton)[lit/kg]
SALT PREWET RATE	8	
PRODUCT 1 PREWET RATE	8	
PRODUCT 2 PREWET RATE	8	
*ANTI ICE RATE 1	20	Anti-ice application rate (gals/lane mile) (gals/mile)[lit/lane km] [lit/km]
*ANTI ICE RATE 2	25	
*ANTI ICE RATE 3	30	
*ANTI ICE RATE 4	35	
*ANTI ICE RATE 5	40	
*ANTI ICE RATE 6	45	
*ANTI ICE RATE 7	50	
*ANTI ICE RATE 8	55	
*ANTI ICE RATE 9	60	
*ANTI ICE RATE 10	65	

* = DCS 710 ONLY

NOTE: If pre-wet system is not controlled by the console (closed loop system) enter "0" for each product.

YOU HAVE NOW COMPLETED PROGRAMMING THE CONSOLE - If console is still flashing *CALIBRATION MODE*, repeat steps 3-10.








- 11) Depress and hold  until *SENSOR PULSES/REV 36* is displayed. Enter number of pulses per revolution from the encoder/granular application sensor. This console contains a factory default value of "36".

CONSOLE CALIBRATION

1. CALCULATING OFFSETS






1) GRANULAR HIGH OFFSET

When setting the Granular offsets, the truck must be running and associated hydraulics turned on. Place POWER switch to GRAN, RATE knob on "M" *Lane Box switch on GRAN, and MASTER switch ON.

- a) Depress  until the display shows *PWM VALVE OFFSET MENU*.
- b) Depress  and the display will show *RPM 0 GRANULAR HIGH 253*.
- c) Depress  .
- d) Depress  to start the auger/bed turning. The RPM's of the granular motor/shaft will be displayed in the display. While auger/bed is turning, depress and hold  until the RPM's begin to decrease. Depress  to slowly increase RPM's until the maximum RPM is noticed, then increase the offset value in the display by an additional 10.
- e) After desired offset value is set, depress  . HIGH OFFSET is now set.

- f) Depress  to advance to GRANULAR LOW OFFSET.

2) GRANULAR LOW OFFSET

- a) The display will show *RPM 0 GRANULAR LOW 2*.
- b) Depress  .
- c) Depress  and the auger/bed will stop turning. The RPM's of the granular motor/shaft will be displayed in the display. Depress and hold  until the auger/bed starts turning. Depress  to slowly decrease RPM's until 0 is displayed, then decrease the offset value in the display by an additional 10.
- d) Depress  to advance to PRE-WET HIGH OFFSET.


* = DCS 710 ONLY




The following offsets only need to be set if the pre-wet system is controlled by the console (closed loop system).


3) PRE-WET HIGH OFFSET


When setting the Pre-wet offsets, the truck must be running and associated hydraulics turned on. (NOTE: If prewet hydraulics are plumbed off the granular exhaust, then granular system must also be running at maximum speed.) Place POWER switch to GR/LI, RATE knob on "M", *Lane Box switch on GRAN, and MASTER switch to ON.

a) The display will show *FLOW 0.0 PREWET HIGH 253*.

b) Depress  .


c) Depress  to start running the liquid pump. The FLOW (vol/min) of pre-wet liquid will be displayed in the display. While liquid pump is running, depress and hold  until the FLOW (vol/min) begins to decrease. Depress  to slowly increase the FLOW (vol/min) until the maximum FLOW (vol/min) is noticed, then increase offset value in the display by an additional 10.





d) After desired offset value is set, depress  . HIGH OFFSET is now set.


e) Depress  to advance to PRE-WET LOW OFFSET.

4) PRE-WET LOW OFFSET

a) The display will show *FLOW 0.0 PREWET LOW 2*.

b) Depress  .

c) Depress  and the liquid pump will stop running. The FLOW (vol/min) of the liquid will be displayed in the display. Depress  and hold  until the pump starts running. Depress  to slowly decrease the FLOW (vol/min) until 0.0 is displayed, then decrease the offset value in the display by an additional 10.







d) After desired offset value is set, depress  . LOW OFFSET is now set.

e) Depress  to advance to SPINNER HIGH OFFSET (DCS 700) or ANTI-ICE HIGH OFFSET (DCS 710).








* = DCS 710 ONLY

5) ***ANTI-ICE HIGH OFFSET**

When setting the Anti-ice offsets, the truck must be running and associated hydraulics turned on. Place POWER switch to GR/LI, RATE knob on "M", *Lane Box switch on ANTI-ICE, and MASTER switch to ON.


- a) The display will show *FLOW 0.0 ANTI ICE HIGH 253*.
- b) Depress  .
- c) Depress  to start running the liquid pump. The FLOW (vol/min) of liquid will be displayed in the display. While liquid pump is running, depress and hold  until the vol/min begins to decrease. Depress  to slowly increase the FLOW (vol/min) until the maximum FLOW (vol/min) is noticed, then increase the offset value in the display by an additional 10.
- d) After desired offset value is set, depress  . HIGH OFFSET is now set.
- e) Depress  to advance to ANTI-ICE LOW OFFSET.

6) ***ANTI-ICE LOW OFFSET**





- a) The display will show *FLOW 0.0 ANTI ICE LOW 2*.
- b) Depress  .
- c) Depress  and the liquid pump will stop running. The FLOW (vol/min) of the liquid will be displayed in the display. Depress  and hold  until the pump starts running. Use  to slowly decrease the FLOW (vol/min) until 0.0 is displayed, then decrease the offset value in the display by an additional 10.
- d) After desired offset value is set, depress  . LOW OFFSET is now set.
- e) Depress  to advance to SPINNER HIGH OFFSET.

7) **SPINNER HIGH OFFSET**








When setting the Spinner offsets, the truck must be running and associated hydraulics turned on. Place POWER switch to GRAN, SPINNER knob on "1", RATE knob on "M", *Lane Box switch on GRAN, and MASTER switch to ON. If SPINNER knob is on "0", the offsets can be set but the spinner will not be rotating. RPM will display 0 unless there is a sensor installed.

- a) The display will show *RPM 0 SPINNER HIGH 253*.
- b) Depress  .

* = DCS 710 ONLY




- c) Depress  to start the spinner rotating. While spinner is rotating, depress and hold  until the spinner speed begins to decrease. Continue this procedure until the spinner is rotating at the maximum speed desired.
- d) After desired speed is set, depress . HIGH OFFSET is now set.
- e) Depress  to advance to SPINNER LOW OFFSET.

8) **SPINNER LOW OFFSET**

- a) The display will show *RPM 0 SPINNER LOW 2*.
- b) Depress  .
- c) Depress  and spinner will stop rotating. Depress and hold  until the spinner begins to rotate. Depress  and  until spinner is rotating at the minimum speed desired.
- d) After desired speed is set, depress . LOW OFFSET is now set.
- e) Depress  to advance to GRANULAR AUTO OFFSETS.

9) **GRANULAR AUTO OFFSETS**




The granular auto offset feature will perform a series of diagnostics and establish both the high and low offsets. This feature was designed to make calibrating the PWM valve offsets of the DCS 700/710 console an automatic process.

- a) The display will show *GRANULAR AUTO OFFSETS OFF*.
- b) Follow the same instructions for placement of switches and knobs as stated in the Granular Offset procedure, verify a value is entered for GRAN CAL and then depress  and the console will begin the automatic process to determine the offsets. During this process, the display will show *TESTING IN PROGRESS*. When the console has set both the high and low offsets, the display will show *TESTING COMPLETE*.
- c) To continue to the next auto offset menu, you must first depress any other key and then depress  .
- d) Depress  to advance to PREWET AUTO OFFSETS.

10) **PREWET AUTO OFFSETS**




The pre-wet auto offset feature will perform a series of diagnostics and establish both the high and low offsets. This feature was designed to make calibrating the PWM valve offsets of the DCS 700/710 console an automatic process.

- a) The display will show *PREWET AUTO OFFSETS OFF*.










- b) Follow the same instructions for placement of switches and knobs as stated in the Pre-Wet Offset procedure and verify there is enough liquid in the tank to perform this calibration. Depress  and the console will begin the automatic process to determine the offsets. During this process, the display will show *TESTING IN PROGRESS*. When the console has set both the high and low offsets, the display will show *TESTING COMPLETE*.
- c) To continue to the next auto offset menu, you must first depress any other key and then depress .
- d) Depress  to advance to *ANTI-ICE AUTO OFFSETS.

11) ***ANTI ICE AUTO OFFSETS**

The anti-ice auto offset feature will perform a series of diagnostics and establish both the high and low offsets. This feature was designed to make calibrating the PWM valve offsets of the DCS 700/710 console an automatic process.


- a) The display will show *ANTI ICE AUTO OFFSETS OFF*.
- b) Follow the same instructions for placement of switches and knobs as stated in the Anti-ice Offset procedure and verify there is enough liquid in the tank to perform this calibration. Depress  and the console will begin the automatic process to determine the offsets. During this process, the display will show *TESTING IN PROGRESS*. When the console has set both the high and low offsets, the display will show *TESTING COMPLETE*.
- c) Depress  to advance to PWM OFFSET MENU.
- d) Depress  to advance to CALIBRATION MENU.


2. CALCULATING "SPEED CAL"







- 1) Depress  until the display shows *CALIBRATION MENU*.
- 2) Depress  and the display will show *SPEED CALIBRATION OFF*.
- 3) Momentarily depress  to turn speed calibration ON.
- 4) Depress .
- 5) While driving the vehicle at normal operating speed, depress the  and  keys to match the speed displayed in the display to the speedometer of the truck.
- 6) When matched, depress  and depress  to turn speed calibration OFF.
- 7) Depress  and record value for future reference.

NOTE: This is not an exact reading. For a more accurate calibration or for radar speed calibration refer to Appendix 1, Section 2 for "CALCULATING SPEED CAL".

3. CALCULATING "GRAN CAL"

- 1) Weigh loaded truck and record as weight #1.
- 2) Depress  and enter a value of "0" for Sand, Salt, Product 1, or Product 2, depending on which product is being calibrated.


NOTE: *SAND CAL NUMBER* will be displayed. Depress  to advance display to *SALT, PRODUCT 1, or PRODUCT 2 CAL NUMBER*.

- 3) Depress  until the display shows *CALIBRATION MENU*.
- 4) Depress  until the display shows *GRANULAR CALIBRATION OFF*.
Turn GRANULAR CALIBRATION ON by depressing .
- 5) Place the RATE knob to "M" and the MASTER switch to SEL. Depress  and  to select the respective product (Sand, Salt, Product 1, or Product 2) being calibrated. Place MASTER switch to ON and use the MANUAL INC/DEC switch to unload approximately 800-1500 pounds of material.
- 6) Place MASTER switch to OFF.
- 7) Weigh the truck and record the weight as weight #2.
- 8) Depress . The display will show *GRANULAR TOTAL WEIGHT*.

9) Calculate and enter in the total pounds (kg) of material unloaded.

EXAMPLE: Weight #1 = 32590
 Weight #2 = -31450
 Total unloaded 1140 Enter 1140 pounds (kg) as *GRANULAR TOTAL WEIGHT*


10) After total pounds are entered the display will show 0.

11) Depress  and the display will show the new Meter Cal number for that product.



4. VERIFYING "GRAN CAL"



Factors which can affect the product GRAN CAL numbers are the product particle size, density, temperature, and humidity. Always calibrate the material you have purchased. Complete INITIAL CONSOLE PROGRAMMING before proceeding with this procedure. The GRAN CAL value is verified using the following procedure:

1) Use a pre-weighed box to capture the material as it is metered out.

2) Verify calculated GRAN CAL value is entered into .

3) With the MASTER switch in the OFF position, place RATE knob to "M".

4) Depress . The display will show *SAND DAY 0.0*. Depress  to advance the display to Salt, Product 1, or Product 2. Enter a "0" for the product that is being verified.

5) Place POWER switch to GRAN, MASTER switch to SEL and verify the correct product is displayed or depress  and  to select the appropriate product. Place MASTER switch to ON to begin unloading material. Use the manual INC/DEC switch to adjust the auger/bed speed. During verification test, monitor material to ensure bridging or tunneling does not occur.

6) Place MASTER switch to OFF when display reads *0.2 [0.2 MT]*.

7) Weigh the collected material. If the actual weight is not 0.2 tons [0.2 MT] perform the following calculation:

EXAMPLE:

Calculated GRAN Cal	= 200
SAND DAY VOLUME reading	= 0.2 [0.2]
Weight of collected material	= 328 lbs = 0.164 tons [150 kg = 0.15 MT]
Corrected GRAN CAL	= $\frac{\text{Calculated GRAN CAL} \times \text{SAND DAY VOLUME reading}}{\text{Weight of collected material}}$

ENGLISH UNITS:
 = $\frac{200 \times 0.2}{0.164} = 244$

METRIC UNITS:
 = $\frac{200 \times 0.2}{0.15} = 267$

Corrected GRAN CAL = 244 [267]

This is the new GRAN CAL value. Repeat this procedure (starting with Step 4) until the weight of the metered material equals the value in the SAND DAY VOLUME display.

- 8) To verify other products GRAN CAL values, repeat steps 1-7.

5. CALCULATING "LIQ CAL"



The Flow Meter calibration number is stamped on the label attached to each Flow Meter.

6. CALCULATING "GRAN AND LIQ VALVE CAL"

Refer to Appendix 2, page 48 to determine the value or if the console can automatically establish a value. To have the console determine this value, complete the procedure.

SELECTING PRODUCT



1. GRANULAR PRODUCT

- a) Place POWER switch to GRAN, verify *lane box switch is on GRAN, and place MASTER switch to SEL.
- b) To select between SAND, SALT, PRODUCT 1, or PRODUCT 2, depress the  and  keys until desired product is displayed. Only the products that have been calibrated will be displayed for selection.
- c) When the desired product is selected, place MASTER switch to ON and system will begin applying material.



2. GRANULAR PRODUCT WITH LIQUID PRE-WET

- a) Place POWER switch to GR/LI, verify *lane box switch is on GRAN, and place MASTER switch to SEL.
- b) Repeat steps b & c from the previous procedure.

3. *ANTI-ICE LIQUID, GRANULAR/ANTI-ICE OR GRAN/PREWET/ANTI-ICE SIMULTANEOUSLY



- a) Place POWER switch to GR/LI, place lane box switch to ANTI-ICE, and place MASTER switch to SEL.
- b) To select ANTI ICE ONLY, GRANULAR AND ANTI ICE, or GRAN/PREWET/ANTI ICE, depress  and  keys until desired selection is displayed.

* = DCS 710 ONLY




- c) To select or change granular product when applying anti-ice and granular together, place POWER switch to GRAN and MASTER switch to SEL. Depress  and  keys until desired granular product is displayed and place POWER switch to GR/LI.
- d) When the desired application is selected, place MASTER switch to ON and place appropriate lane switches (LEFT, CENTER, or RIGHT) on.
- e) When applying in the GRAN/PREWET/ANTI ICE mode, place the power switch to GR/LI, and the lane box switch to ANTI ICE. To shut off anti ice system, place all lane switches OFF. When operating in this mode, to change the granular rate, use the rate knob as normal, and to change the liquid rates, use the bump rate feature on page 31.

OTHER CONSOLE FEATURES

1. SELF TEST FEATURE


- 1) SELF TEST allows speed simulation for testing the system while the vehicle is not moving. Enter the simulated operating speed in  . If 6 MPH [9.6 km/h] is desired, enter 6.0 [9.6] (See CONSOLE PROGRAMMING). Verify speed by depressing  , 6.0 [9.6] will appear in the display. The SELF TEST speed will clear itself when motion of the vehicle is detected by the Speed Sensor. The speed displayed may be different than the self test speed entered depending on the SPEED CAL value.

NOTE: To prevent nuisance clearing of self-test speed, disconnect speed connector on back of the Console.

- 2) To display the Console set-up selections, depress and hold  . The display will cycle through the set-up selections (US or METRIC, SP1 or SP2 or SP3, 1-P, 2-P and 3-P). Depressing the calibration keys (keys 3-0) at any time will display that particular calibration number in the display. With the MASTER switch in the OFF position, depress  and  to advance through Sand, Salt, Product 1, Product 2, and Anti-ice calibration numbers as well as to advance through GRAN RATES 1-10. When the MASTER switch is positioned to ON, only that product calibration number will be displayed. Likewise, the position of the RATE switch will only allow that particular application rate to be displayed.
- 3) The following is an example of how to use the DCS 700/710 as a troubleshooting tool. When placed in the self-test mode, it allows the operator and technician to duplicate system operation.

EXAMPLE:

To determine the maximum application rate that the truck is capable of applying at a given speed:

- 1) Depress  . Enter a self-test speed of 25 mph.

- 2) Place the RATE knob to the "M" position.
- 3) Use the INC switch until application rate in the display no longer increases.
- 4) The rate in the display is the maximum application rate at 25 mph.
- 5) Enter a self test speed of 30 mph and the display will show the maximum application rate for that speed.
- 6) Repeat this procedure of increasing the speed to obtain all maximum application rates at specific speeds.

EXAMPLE:

The operator wants to travel at 30 mph and apply a rate of 1800 pounds per mile. After performing the procedure stated above it was determined that the maximum application rate at 30 mph was 1600 pounds per mile. At that speed and rate the hydraulic system of the truck is at the maximum capacity. The operator has 3 choices; 1) decrease the vehicle speed, 2) accept a lower application rate at that speed, or 3) raise the gate setting if possible and recalibrate the GRAN METER CAL values.

2. SPINNER MENU





DISPLAY SCREEN

DESCRIPTION

MANUAL OPERATION

The mode of operation for the spinner. There are 3 spinner modes of operation:

- 1) Manual-Spinner speed can be changed by turning knob setting from 1 through 10.
- 2) Accu Place-The spinner must be equipped with a sensor to operate in this mode. This mode controls the spinner at the same speed as the vehicle. To operate this mode, the console must have the pulses per revolution of the sensor, the spinner diameter, and the spinner knob placed on 1. Spinner settings 2-10 will be operated in the manual mode. Spinner menu display will show speed in MPH's.
- 3) Lane Width-The spinner must be equipped with a sensor to operate in this mode. This mode controls the spinner to cover 1, 2, or 3 lanes. As the number of lanes being covered increases or decreases, the application rate automatically increases or decreases to maintain the desired application rate on all lanes. To operate this mode, the console must have the pulses per revolution of the sensor, the spinner diameter, and RPM's for 1 lane. The spinner knob then would be placed on 1, 2, or 3 depending on the number of lanes being covered. Spinner settings 4-10 will be operated in the manual mode. Spinner menu display will show speed in RPM's.

<i>SPINNER ENABLE</i>	<i>0N</i>	When the enable value is ON, the spinner will rotate whenever the MASTER switch is ON. When the enable value is OFF, the spinner will rotate only when the bed/auger is moving.
<i>PERCENTAGE OF SPEED</i>	<i>100</i>	Percentage of the vehicle ground speed that the spinner will be controlled to when in the Accu Place mode.
<i>PULSES PER REVOLUTION</i>	<i>0</i>	The number of pulses per revolution of sensor on the spinner.
<i>SPINNER DIAMETER</i>	<i>0</i>	The outside diameter of the spinner wheel. (inches)[cm].
<i>SPINNER RPM FOR 1 LANE</i>	<i>0</i>	The number of RPM's the spinner must rotate to adequately spread material over 1 lane. To set the RPM's to cover 1 lane, place the spinner knob on 4, depress  , depress  and  to adjust the RPM's of the spinner. When the appropriate spinner speed is set, depress  . To clear this value, place the MASTER switch OFF and enter 0. This value must be 0 to operate the Accu Place and Manual mode.
<i>SPINNER VALVE CAL</i>	<i>73</i>	Calibration value for the spinner PWM valve.

3. TEMPERATURE

This feature allows the operator to view the ambient and pavement temperatures. A temperature sensor and interface cable (115-0171-062) must be installed.

<u>DISPLAY SCREEN</u>	<u>DESCRIPTION</u>
<i>AMBIENT PAVEMENT</i>	When the temperature feature is turned on, the console will display both the ambient and pavement temperatures. If there is a fault or bad connection with the sensor, the console will display ERROR.
<i>TEMPERATURE</i>	<i>OFF</i> Displays if the temperature display feature is on or off.
<i>TEMPERATURE MODE</i>	<i>FAHRENHEIT</i> Can select the temperature to be displayed in degrees Fahrenheit or degrees Celsius.

TEMP CONTROL MODE

OFF Can select to have temperature controlled application rates for granular, pre-wet, or anti-ice. To operate the temp control mode, the programmed rate must be 0.

EXAMPLE: If rate knob is placed on setting 10, the programmed rate must be 0 for rate 10, then the console will operate in the temp control mode.

Temperature Controlled Rates

Low Temperature 1 24

High Temperature 1 32

Control Rate 1 400

This particular example allows the console to apply 400 lbs/lane mile when the pavement temperature is between 24 and 32 degrees.

LOW TEMPERATURE 1

□ The minimum temperature to be controlled for control rate 1.

HIGH TEMPERATURE 1

□ The maximum temperature to be controlled for control rate 1.

CONTROL RATE 1

□ The application rate the console will apply when the pavement temperature is between low temperature 1 and high temperature 1.

LOW TEMPERATURE 2

□ The minimum temperature to be controlled for control rate 2.

HIGH TEMPERATURE 2

□ The maximum temperature to be controlled for control rate 2.

CONTROL RATE 2

□ The application rate the console will apply when the pavement temperature is between low temperature 2 and high temperature 2.

LOW TEMPERATURE 3

□ The minimum temperature to be controlled for control rate 3.



HIGH TEMPERATURE 3



□ The maximum temperature to be controlled for control rate 3.

CONTROL RATE 3



□ The application rate the console will apply when the pavement temperature is between low temperature 3 and high temperature 3.

4. VOLUME & DISTANCE DISPLAYS

To zero out distance and volume totals that have *DAY* after the product name, depress , zero (0), . To zero out distance and volume totals that have *TOTAL* after the product name, the key switch must be turned to the horizontal position and then perform the same procedure as mentioned above.



- 1) To display sand, salt, product1 or product 2 day volumes and total volumes, depress . To advance through the categories, depress .

<u>DISPLAY SCREEN</u>		<u>DESCRIPTION</u>
<i>SAND</i>	<i>DAY</i>	<i>0.0</i> Volume of sand applied during day, event, etc.
<i>SALT</i>	<i>DAY</i>	<i>0.0</i> Volume of salt applied during day, event, etc.
<i>PRODUCT 1</i>	<i>DAY</i>	<i>0.0</i> Volume of product 1 applied during day, event, etc.
<i>PRODUCT 2</i>	<i>DAY</i>	<i>0.0</i> Volume of product 2 applied during day, event, etc.
<i>SAND</i>	<i>TOTAL</i>	<i>0</i> Cumulative volume total of sand material applied.
<i>SALT</i>	<i>TOTAL</i>	<i>0</i> Cumulative volume total of salt material applied.
<i>PRODUCT 1</i>	<i>TOTAL</i>	<i>0</i> Cumulative volume total of product 1 material applied.
<i>PRODUCT 2</i>	<i>TOTAL</i>	<i>0</i> Cumulative volume total of product 2 material applied.

- 2) To display pre-wet day volume, *anti-ice day volume, pre-wet total volume, and *anti-ice total volume, depress . To advance through the categories, depress .

* = DCS 710 ONLY

<u>DISPLAY SCREEN</u>			<u>DESCRIPTION</u>
PREWET	DAY	0	Volume of pre-wet liquid applied during day, event, etc.
*ANTI ICE	DAY	0	Volume of anti-ice liquid applied during day, event, etc.
PREWET	TOTAL	0	Cumulative volume total of pre-wet liquid applied.
*ANTI ICE	TOTAL	0	Cumulative volume total of anti-ice liquid applied.

3) To display sand, salt, product 1, product 2, prewet or *anti-ice day distances and total distances, depress . To advance through the categories, depress .



<u>DISPLAY SCREEN</u>			<u>DESCRIPTION</u>
SAND	DAY	0.0	Distance traveled while applying sand material during day, event, etc.
SALT	DAY	0.0	Distance traveled while applying salt material during day, event, etc.
PRODUCT 1	DAY	0.0	Distance traveled while applying product 1 material during day, event, etc.
PRODUCT 2	DAY	0.0	Distance traveled while applying product 2 material during day, event, etc.
PREWET	DAY	0.0	Distance traveled while applying prewet liquid during day, event, etc.
*ANTI ICE	DAY	0.0	Distance traveled while applying anti-ice liquid during day, event, etc.
SAND	TOTAL	0	Cumulative distance traveled while applying sand material.
SALT	TOTAL	0	Cumulative distance traveled while applying salt material.
PRODUCT 1	TOTAL	0	Cumulative distance traveled while applying product 1 material.
PRODUCT 2	TOTAL	0	Cumulative distance traveled while applying product 2 material.

* = DCS 710 ONLY


<i>PREWET</i>	<i>TOTAL</i>	<i>0</i>	Cumulative distance traveled while applying prewet liquid.
<i>*ANTI ICE</i>	<i>TOTAL</i>	<i>0</i>	Cumulative distance traveled while applying anti-ice liquid.

5. VOLUME/GRAN AND VOLUME/LIQ

The following features may be used but are not necessary for the console to operate. These features allow the operator to monitor the amount of granular or liquid material remaining in the truck. The key is not required to enter these values in the console.

- 1) Enter the estimated volume (tons)[MT] of material in spreader/truck box in  and volume of liquid (gal)[lit] in pre-wet tank and/or anti-ice tank in . These volumes must be re-entered each time box or tank is loaded.

6. BLAST BUTTON

- 1) Depressing the BLAST button will cause the system to go to the programmed Blast Rate. The system will remain at the Blast Rate for as long as the button is depressed plus the programmed Blast Time after the button is released. If the BLAST button is used with zero speed the Console will assume a speed of 5 MPH [7 Km/hr].
- 2) To display the number of times the BLAST feature was used, depress and hold  until the display shows *BLAST COUNT* and the value. To zero this total, enter a "0".

7. MANUAL MODE LOCK OUT


If the key switch is in the vertical position (operate mode) and the Manual Control is off (see DATA MENU); the manual position (M) of the RATE knob will only function under two (2) conditions:

- 1) No speed (typical scenario to unload truck).
- 2) No flow signal.

With the RATE knob placed to the manual position (M) the Console will default to RATE 1 unless the above conditions exist. If the key is in the horizontal position (program mode); **OR** the key is vertical and the manual control is ON (see DATA MENU); the manual position (M) is active for all conditions. Using the MANUAL INC/DEC switch will increase or decrease your application rate.



* = DCS 710 ONLY



8. CONTROL VALVE DELAY

Depress and hold  until the display shows *CONTROL VALVE DELAY 1000*. The first digit, (X 0 0 0), is the Control Valve delay digit. This feature allows the user to set a delay between the time the MASTER is turned on and when the Console begins to control the application rate. A value of 1-9 means a delay of 1-9 seconds respectively. A value of 0 means no delay.

9. BUMP RATE +/-

This feature allows an increment to be set at which flow may be increased or decreased while in automatic operation (rates 1-10). To select BUMP RATE +/-

depress  for granular or  for pre-wet and *anti-ice until the display shows *GRANULAR BUMP RATE*, *PREWET BUMP RATE*, or **ANTI ICE BUMP RATE*.






To enter a value depress , increment value, and . When using this feature the preprogrammed application rates will be changed accordingly. The prewet bump rate is defaulted to 1.

EXAMPLE: If granular rate is to change by "10":

Enter a value of 10 for BUMP RATE. When in RATES 1-10, each time the MANUAL INC/DEC switch is positioned to INC, the RATE for that product will increase by "10". Likewise, when positioned to DEC, the RATE will decrease by "10". When POWER switch is on GRAN it increases or decreases granular rates, when on GR/LI, it increases or decreases liquid rates.

10. LOW TANK ALARM


This feature will sound the alarm when the granular or liquid volume drops below an entered value. If the granular or liquid volume falls below the low tank value entered, the alarm will sound 8 beeps every 15 seconds and depending on which tank is low the display screen will flash *LEVL*. The alarm will stop when a value equal to or greater than the Low Tank Alarm value is entered into VOLUME/GRAN, VOLUME/LIQ or the MASTER switch is turned OFF. Entering "0" into Low Tank Alarm disables the alarm.


- a) For granular, depress  for 5 seconds and the display will show *GRANULAR LOW LEVEL 0.0*.
- b) For prewet, depress  for 5 seconds and the display will show *PREWET LOW LEVEL 0.0*. For anti-ice, depress  for 8 seconds and the display will show *ANTI ICE LOW LEVEL 0.0*.
- c) To enter a value, depress , low level value, and .

* = DCS 710 ONLY

11. LOW LIMIT FLOW ALARM

The low limit feature allows the operator to set a minimum vol/min in the console for the system to maintain regardless of vehicle speed. If the actual vol/min reaches the set minimum vol/min, the control valve will stop closing to ensure the low limit flow is maintained. When this occurs the console will be over applying material until the actual vol/min exceeds the low limit flow value. An audible and visual alarm will alert the operator. The visual alarm will display

LL in the display screen. Depress  until the display shows *FLOW MENU*.

To advance through the categories depress .

<u>DISPLAY SCREEN</u>		<u>DESCRIPTION</u>
<i>GRANULAR VOL/MIN</i>	<i>0.0</i>	Displays actual vol/min of granular material.
<i>PREWET VOL/MIN</i>	<i>0.0</i>	Displays actual vol/min of pre-wet liquid.
<i>*ANTI ICE VOL/MIN</i>	<i>0.0</i>	Displays actual vol/min of anti-ice liquid.
<i>GRANULAR LOW LIMIT</i>	<i>0.0</i>	Granular system minimum vol/min value.
<i>PREWET LOW LIMIT</i>	<i>0.0</i>	Liquid pre-wet system minimum vol/min value.
<i>*ANTI ICE LOW LIMIT</i>	<i>0.0</i>	Liquid anti-ice system minimum vol/min value.
<i>SPINNER LOW LIMIT</i>	<i>0.0</i>	Spinner minimum RPM or MPH when in Accu Place mode.

EXAMPLE:

- 1) Place RATE knob to the lowest application rate, typically this will be RATE 1.
- 2) Enter a SELF TEST speed.
- 3) Observe the granular, pre-wet, or anti-ice volume/minute.
- 4) Enter a lower SELF TEST speed.
- 5) Repeat steps 3 & 4 until auger/bed/pump begins to stall.
- 6) Record minimum volume/minute when auger/bed/pump turns smoothly. Enter this value for GRANULAR, PREWET, or ANTI-ICE LOW LIMIT.

* = DCS 710 ONLY

DATA MENU

DEFINITION OF DATA MENU KEYS:



Depressing this key displays the selected Data Menu category in the display.



Depressing this key again increments through the Data Menu categories (*SERIAL PORT, GPS, TIME AND DATE, etc.*) in the display.









Depressing this key (after desired menu is shown in the display) advances up through desired features within a menu. Selected menu is shown in the display.




Depressing this key (after desired menu is shown in the display) advances down through desired features within a menu. Selected feature is shown in the display.

SERIAL PORT MENU


CONSOLE DATA PRINTOUT

- a) Depress  and the display will show *PRINT CALIBRATION VALUES*.
To print calibration values, depress .
- b) Depress  to advance the display to *PRINT BEGINNING VALUES*. To print beginning values, depress .
- c) Depress  to advance the display to *PRINT ENDING VALUES*. To print ending values, depress .



NOTE: If ENDING VALUES are printed and a CAL number has been changed, a warning will be printed.

- d) Depress  to advance to TRUCK NUMBER.



TRUCK NUMBER

- a) The display will show *TRUCK NUMBER 0*. The truck number can have up to 6 digits.
- b) Enter the truck number.
- c) Depress  to advance to BAUD RATE.


BAUD RATE

- a) The display will show *BAUD RATE 9600*.
- b) Depressing  steps the value between *9600* and *1200*.
- c) Depress  to advance to RATE CHANGE ALARM ON/OFF.

RATE CHANGE ALARM ON/OFF



- a) The display will show *RATE CHANGE ALARM ON*.
- b) Depressing  steps the DATA value between *ON* and *OFF*. A value of *ON* means alarm is enabled; a value of *OFF* means alarm is disabled. This alarm is only used when the console is receiving a rate change from an AMS console, computer, or other external component.
- c) Depress  to advance to DATA LOGGING VALUE.

DATA LOGGING VALUE




- a) The display will show *DATA LOGGING VALUE 0*.
- b) Enter the value.
- c) Depress  to advance to DATA LOGGING UNIT.

IMPORTANT: The default value is "0". This value **must** be changed to a desired number ranging from 1-9999. The DATA LOGGER features will not work if this number is "0".

DATA LOGGING UNIT




- a) The display will show *DATA LOGGING UNIT FEET*.
- b) Depressing  steps the unit between *FEET* and *SECONDS*. The data logging feature uses the logging value and logging unit to determine how often information is stored to the AMS console or other external data collection device.
- c) Depress  to advance to DATA LOGGING FEATURE.

DATA LOGGING FEATURE

- a) The DATA LOGGING FEATURE uses set communication strings to pass data out through the serial port. The data is sent at a set time interval or a set distance traveled, as determined by the values entered in the DATA LOGGING VALUE and DATA LOGGING UNIT. Upon each value, the Actual Rate string, Data Strings 1, 2, 3, 4, and 5, and the time/date string are sent, in that order. When a Console calibration value or switch is changed, the Console will automatically send out the Cal 1, 2, 3, 4, 5, 6 and 7, Data 1, 2, 3, 4, and 5 strings and time/date.
- b) The display will show *DATA LOGGING FEATURE OFF*.
- c) Depressing  steps the value between *OFF* and *ON*. A value of *OFF* means the console will not data log information; a value of *ON* means the console will begin logging data.
- d) Depress  to advance to SERIAL PORT MENU.
- e) Depress  to advance to the GLOBAL POSITIONING SYSTEM MENU.


GLOBAL POSITIONING SYSTEM MENU

GPS MENU OPTIONS

- a) Depress  and the display will show *SYSTEM INACTIVE*. The GPS features are explained further in the APPLICATION MANAGEMENT SYSTEM manual.
- b) Depress  to advance to GPS FILE REFERENCE.
- c) Depress  to advance to the TIME AND DATE MENU.

TIME AND DATE MENU


TIME

- a) Depress  and the display will show *TIME 0:00*.
- b) Enter the current time of day.


NOTE: This is a 24 hour clock. Therefore, all time after 12:59 P.M., add 12 hours. Thus, 8:30 a.m. is entered as 8:30, but 1:30 p.m. is entered as 13:30 in the keyboard.

- c) Depress  to advance to MONTH.


MONTH

- a) The display will show *MONTH 0*.
- b) Enter the current month by number (i.e. 1 = January, 2 = February, etc.).
- c) Depress  to advance to DAY.



DAY

- a) The display will show *DAY 0*.
- b) Enter the current day of the month.
- c) Depress  to advance to YEAR.

YEAR



- a) The display will show *YEAR 00*.
- b) Enter the last two digits of the current year.
- c) Depress  to advance to POWER DOWN.

POWER DOWN


- a) If the Console is not used for 30 days, it will go into a power down (low power) mode of operation. In this mode, all data is retained, but the time of day clock will reset to 0:00. The delay time is initially set at 30 days; but can be changed by the user.
- b) The display will show *POWER DOWN 30*.
- c) To change the delay time, enter a new number from 0 to 200 days.
- d) Depress  to advance to TIME AND DATE MENU.
- e) Depress  to advance to the FLOW MENU.

FLOW MENU


GRANULAR VOLUME/MINUTE

- a) Depress  and the display will show *GRANULAR VOL/MIN 0.0.*
- b) Depress  to advance to PRE-WET VOLUME/MINUTE.


PRE-WET VOLUME/MINUTE

- a) The display will show *PREWET VOL/MIN 0.0.*
- b) Depress  to advance to ANTI-ICE VOLUME/MINUTE.


*ANTI-ICE VOLUME/MINUTE

- a) The display will show *ANTI ICE VOL/MIN 0.0.*
- b) Depress  to advance to GRANULAR LOW LIMIT.


GRANULAR LOW LIMIT

- a) If the actual volume per minute falls below the set limit, the valve stops closing, an alarm sounds and the display flashes *LL.*
- b) The display will show *GRANULAR LOW LIMIT 0.0.*
- c) Enter the low limit of the system (lb/min) [kg/min].
- d) Depress  to advance to PRE-WET LOW LIMIT.


PRE-WET LOW LIMIT

- a) If the actual volume per minute falls below the set limit, the valve stops closing, an alarm sounds and the display flashes *LL.*
- b) The display will show *PREWET LOW LIMIT 0.0.*
- c) Enter the low limit of the system (gal/min) [lit/min].
- d) Depress  to advance to ANTI-ICE LOW LIMIT.

*ANTI-ICE LOW LIMIT


- a) If the actual volume per minute falls below the set limit, the valve stops closing, an alarm sounds and the display flashes *LL.*
- b) The display will show *ANTI ICE LOW LIMIT 0.0.*
- c) Enter the low limit (gal/min) [lit/min].
- d) Depress  to advance to SPINNER LOW LIMIT.

SPINNER LOW LIMIT


- a) If the actual volume per minute falls below the set limit, the valve stops closing, an alarm sounds and the display flashes *LL.*
- b) The display will show *SPINNER LOW LIMIT 0.0.*
- c) Enter the low limit (revolutions/min).
- d) Depress  to advance to TIER 2 ENABLE VALUE.

* = DCS 710 ONLY

*TIER 2 ENABLE VALUE

- a) If the actual volume per minute is equal to or greater than the set flow rate, the tier 2 valve opens.
- b) The display will show *TIER 2 ENABLE VALUE 0.0*.
- c) Enter the flow rate (gal/min) [lit/min].
- d) Depress  to advance to TIER 3 ENABLE VALUE.

*TIER 3 ENABLE VALUE

- a) If the actual volume per minute is equal to or greater than the set flow rate, the tier 3 valve opens.
- b) The display will show *TIER 3 ENABLE VALUE 0.0*.
- c) Enter the flow rate (gal/min) [lit/min].
- d) Depress  to advance to TIER DISABLE PCT.



*TIER DISABLE PCT

- a) The percentage below the tier enable (flow rate) when the tier valve closes.
- b) The display will show *TIER DISABLE PCT 10*.
- c) Enter the percentage.

EXAMPLE:

Main boom capacity	-	15 (gal/min) [lit/min]
Tier 2 capacity	-	30 (gal/min) [lit/min]
Tier 3 capacity	-	60 (gal/min) [lit/min]
Total System capacity	-	105 (gal/min) [lit/min]




Set Tier 2 Enable at 15 (gal/min) [lit/min] (main boom)
Set Tier 3 Enable at 45 (gal/min) [lit/min] (main boom + tier 2)
Percentage tier disable default is 10%. In this case, tier 2 would be enabled at 15.0 (gal/min) [lit/min] and disabled at 13.5 (gal/min) [lit/min]. Tier 3 would be enabled at 45.0 (gal/min) [lit/min] and disabled at 40.5 (gal/min) [lit/min].

- d) Depress  to advance to FLOW MENU.
- e) Depress  to advance to ALARM MENU.

ALARM MENU

AUDIBLE ALARM

The DCS 700/710 has several alarm indicators. The alarms can be turned on or off to accommodate the operators preference.


- a) Depress  and the display will show *AUDIBLE ALARM OFF*.
- b) Depressing  steps the display between *OFF* and *ON*. A value of *OFF* disables the audible alarm; a value of *ON* enables the audible alarm.
- c) Depress  to advance to GRANULAR OFF RATE PCT.

* = DCS 710 ONLY

GRANULAR OFF RATE PCT

Alarm sounds and the display will show *OR* when the actual rate is off from the application rate by a specified percentage for 5 seconds. The off rate value is preset to 30%, but may be changed to a different number. A value of "0" will disable this alarm.


a) The display will show *GRANULAR OFF RATE PCT 30*.

b) Depress  to advance to PREWET OFF RATE PCT.

PREWET OFF RATE PCT

Alarm sounds and the display will show *OR* when the actual rate is off from the application rate by a specified percentage for 5 seconds. The off rate value is preset to 30%, but may be changed to a different number. A value of "0" will disable this alarm.


a) The display will show *PREWET OFF RATE PCT 30*.

b) Depress  to advance to ANTI-ICE OFF RATE PCT.

ANTI-ICE OFF RATE PCT

Alarm sounds and the display will show *OR* when the actual rate is off from the application rate by a specified percentage for 5 seconds. The off rate value is preset to 30%, but may be changed to a different number. A value of "0" will disable this alarm.

a) The display will show *ANTI ICE OFF RATE PCT 30*.


b) Depress  to advance to SPINNER OFF RATE PCT.

SPINNER OFF RATE PCT

Alarm sounds and the display will show *OR* when the actual rate is off from the application rate by a specified percentage for 5 seconds. The off rate value is preset to 30%, but may be changed to a different number. A value of "0" will disable this alarm.

a) The display will show *SPINNER OFF RATE PCT 30*.

b) Depress  to advance to AUDIBLE ALARM.

c) Depress  to advance to MISCELLANEOUS MENU.

OTHER ALARMS

NO SPEED ALARM

This sounds if the MASTER switch is ON, the RATE knob is on 1-10, and there is no ("0") speed detected.

a) The display will show *NO SPEED*.

b) When speed is detected, the display will return to normal operation.

NOTE: When operating in P valve mode, the console has an automatic zero speed shut off feature. The NO SPEED ALARM will sound in this case. The alarm will discontinue when vehicle begins moving.

CAUTION: Do not rely on zero speed shut off when performing maintenance on vehicle. A stray speed signal could suddenly turn the system on, especially when a radar speed sensor is being used.

SPEED LIMIT ALARM

This sounds when the programmed maximum application speed is exceeded (See OTHER CONSOLE FEATURES).

- a) This alarm sounds a constant beep and flashes the alarm light.
- b) Slowing vehicle speed will clear this alarm.
- c) This alarm can be disabled by turning the calibration key to the horizontal position and entering a "0" in the SPEED LIMIT KEY.




LOW TANK LEVEL ALARM

This sounds when the VOLUME/GRAN or VOLUME/LIQ reaches the programmed alarm level (See OTHER CONSOLE FEATURES).



- a) This alarm sounds eight (8) beeps every 15 seconds. The console automatically displays *LEV L* in the display screen depending on which material has reached the alarm level.
- b) Depress VOLUME/GRAN or VOLUME/LIQ key for 5 seconds until display shows *GRANULAR*, *PREWET*, or *ANTI ICE LOW LEVEL* and enter a "0" to disable this feature.

MISCELLANEOUS MENU



DISPLAY SMOOTHING ON/OFF

- a) Depress the  and the display will show *DISPLAY SMOOTHING ON*.
- b) Depressing  steps the value between *ON* and *OFF*. A value of *ON* means smoothing is enabled; a value of *OFF* means smoothing is disabled, therefore the actual granular and liquid rates will be displayed at all times. The percent smoothing is determined by the third digit of the GRAN VALVE CAL or LIQ VALVE CAL value.
- c) Depress  to advance to MANUAL MODE CONTROL ON/OFF.



MANUAL MODE CONTROL ON/OFF

- a) The display will show *MANUAL MODE CONTROL OFF*.
- b) Depressing  steps the value between *OFF* and *ON*. A value of *ON* enables manual control when the key switch is in the vertical position, a value of *OFF* disables manual control when key switch is in the vertical position.
- c) Depress  to advance to OPEN LOOP ENABLE.




OPEN LOOP ENABLE

- a) The display will show *OPEN LOOP ENABLE OFF*.
- b) Depressing  steps the value between *OFF* and *ON*. A value of *ON* enables the console to continue to control the rate based on ground speed when there is a loss of the granular application rate sensor. When this occurs, no application rate will be displayed or any volume accumulating.
- c) Depress  to advance to AUTO REVERSE FUNCTION.



AUTO REVERSE FUNCTION

- a) The display will show *AUTO REVERSE FUNCTION OFF*.
- b) Depressing  steps the value between *OFF* and *ON*. A value of *ON* allows the console to reverse the direction of the auger/bed for 5 seconds if it jams or stalls and then return to normal operation. It is important that the truck is equipped with the appropriate hydraulics and capable of 2 directional operation.
- c) Depress  to advance to *LOW TANK LEVEL SHUT OFF*.




LOW TANK LEVEL SHUT OFF

- a) The display will show *LOW TANK LEVEL SHUT OFF OFF*.
- b) Depressing  steps the value between *OFF* and *ON*. A value of *ON* enables the console to automatically close the lane valves when the tank reaches the low tank alarm. Values must be entered in  and low tank level alarm for this feature to function properly.
- c) Depress  to advance to *ZERO SPEED SHUT OFF*.


ZERO SPEED SHUT OFF

- a) The display will show *ZERO SPEED SHUT OFF OFF*.
- b) Depressing  steps the value between *OFF* and *ON*. A value of *ON* will allow the console to turn the power off on the anti-ice enable wire when zero speed is detected.
- c) Depress  to advance to *PREWET IN GALLONS/TON*.

PREWET IN GALLONS/TON


- a) The display will show *PREWET IN GALLONS/TON*.
- b) Depressing  steps the display between *PREWET IN GALLONS/TON* and *PREWET IN GALLONS/MILE*.
- c) Depress  to advance to *MISCELLANEOUS MENU*.
- d) Depress  to advance to *PWM VALVE OFFSET MENU*.



PWM VALVE OFFSET MENU

- a) See pages 16, 17, 18, 19, and 20 for *PWM VALVE OFFSET MENU*.
- b) Depress  to advance to *CALIBRATION MENU*.



CALIBRATION MENU

SPEED CALIBRATION ON/OFF (See Calibrating Speed Cal. page 21)


- a) Depress  and the display will show *SPEED CALIBRATION OFF*.

- b) Depress  to turn the speed calibration feature ON.
- c) Depress  to advance to GRANULAR CALIBRATION.

GRANULAR CALIBRATION



- a) The display will show *GRANULAR CALIBRATION OFF*.
- b) Depress  to turn the granular calibration feature ON.
- c) For calibration see section "CALCULATING GRAN CAL".
- d) Depress  to advance to GRANULAR TOTAL WEIGHT.

GRANULAR TOTAL WEIGHT


- a) The display will show *GRANULAR TOTAL WEIGHT 0*.
- b) Enter in total pounds (kg) of material unloaded when performing granular calibration procedure.
- c) Depress  to advance to 2 SPEED LOW RATIO.

2 SPEED LOW RATIO

NOTE: The 2 speed wire has to be hooked up to the 2 speed enable on truck.


- a) The display will show *2 SPEED LOW RATIO 0.00*.
- b) Enter in the low gear ratio as indicated on the line sheet or tag.
- c) Depress . The display will show *2 SPEED HIGH RATIO 0.00*.
- d) Enter the high gear ratio as indicated on the line sheet or tag.
- e) Depress  to advance to PWM COIL FREQUENCY.

PWM COIL FREQUENCY

- a) The display will show *PWM COIL FREQUENCY 180*.
- b) Enter in the frequency of the PWM valve (16 hz to 4000 hz). **As specified by the manufacture of the Hydraulic Valve.** Refer to Appendix 2 for recommended values for different coil types.
- c) Depress  to advance to SPEED LIMIT.





SPEED LIMIT

The speed limit feature allows a maximum application speed to be entered. If the speed limit value is exceeded by the actual speed, an intermittent beeping alarm will sound. To disable this feature, simply enter a 0 for the speed limit value.

- a) The display will show *SPEED LIMIT 0*.
- b) Enter the desired speed limit value.
- c) Depress  to advance to GRANULAR AUTO VALVE CAL.

GRANULAR AUTO VALVE CAL

The DCS 700/710 console will automatically determine a valve cal value for satisfactory operation over the entire range of the system capacity. This value can still be manually adjusted for optimum performance to meet your needs.

- a) Depress  until the display shows *CALIBRATION MENU* and then depress  until the display shows *GRANULAR AUTO VALVE CAL OFF*.
- b) Depress  and the console will begin the automatic process to determine the offsets. During the process, the display will show *TESTING IN PROGRESS*. When the console has established a valve cal, the display will show *TESTING COMPLETE*.
- c) To continue to the next auto valve cal menu, you must first depress any other key and then depress .






PREWET AUTO VALVE CAL

The DCS 700/710 console will automatically determine a valve cal value for satisfactory operation over the entire range of the system capacity. This value can still be manually adjusted for optimum performance to meet your needs. Before using this feature, verify there is enough liquid in the tank to perform this calibration.

- a) Depress  until the display shows *CALIBRATION MENU* and then depress  until the display shows *PREWET AUTO VALVE CAL OFF*.
- b) Depress  and the console will begin the automatic process to determine the offsets. During this process, the display will show *TESTING IN PROGRESS*. When the console has established a valve cal, the display will show *TESTING COMPLETE*.
- c) To continue to the next auto valve cal menu, you must first depress any other key and then depress .



ANTI-ICE AUTO VALVE CAL

The DCS 700/710 console will automatically determine a valve cal value for satisfactory operation over the entire range of the system capacity. This value can still be manually adjusted for optimum performance to meet your needs. Before using this feature, verify there is enough liquid in the tank to perform this calibration.


- a) Depress  until the display shows *CALIBRATION MENU* and then depress  until the display shows *ANTI ICE AUTO VALVE CAL OFF*.
- b) Depress  and the console will begin the automatic process to determine the offsets. During this process, the display will show *TESTING IN PROGRESS*. When the console has established a valve cal, the display will show *TESTING COMPLETE*.
- c) Depress  to advance to *CALIBRATION MENU*.
- d) Depress  to advance to *ANTI-ICE LANE MENU*.

*ANTI-ICE LANE MENU


LANE WIDTH

- a) Depress  and the display will show *LANE WIDTH IN FEET 12*.
- b) Enter the lane width (feet)[m] if desired application rate is gal/lane or lit/lane km. If desired application rate is gal/mile or lit/km enter "0".
- c) If a lane width was entered depress  to advance to LEFT LANE WIDTH.



LEFT LANE WIDTH

- a) The display will show *LEFT LANE IN INCHES 144*.
- b) Enter the left lane width (inches)[cm].
- c) Depress  to advance to CENTER LANE WIDTH.



CENTER LANE WIDTH

- a) The display will show *CENTER LANE IN INCHES 144*.
- b) Enter the center lane width (inches)[cm].
- c) Depress  to advance to RIGHT LANE WIDTH.



RIGHT LANE WIDTH

- a) The display will show *RIGHT LANE IN INCHES 144*.
- b) Enter the right lane width (inches)[cm].
- c) Depress  to advance to LANE WIDTH.
- d) Depress  to advance to SAND BLAST MENU.

SAND BLAST MENU



- a) Displays day distance applied, total distance applied, day volume applied, and total volume applied for sand product while using the blast button.
- b) Depress  to advance through sand blast menu.
- c) Depress  to advance to SALT BLAST MENU.

SALT BLAST MENU



- a) Displays day distance applied, total distance applied, day volume applied, and total volume applied for salt product while using the blast button.
- b) Depress  to advance through salt blast menu.
- c) Depress  to advance to PRODUCT 1 BLAST MENU.

* = DCS 710 ONLY



PRODUCT 1 BLAST MENU

- a) Displays day distance applied, total distance applied, day volume applied, and total volume applied for product 1 material while using the blast button.
- b) Depress  to advance through product 1 blast menu.
- c) Depress  to advance to PRODUCT 2 BLAST MENU.



PRODUCT 2 BLAST MENU

- a) Displays day distance applied, total distance applied, day volume applied, and total volume applied for product 2 material while using the blast button.
- b) Depress  to advance through product 2 blast menu.
- c) Depress  to advance to PRE-WET BLAST MENU.

PRE-WET BLAST MENU

- a) Displays day distance applied, total distance applied, day volume applied, and total volume applied for pre-wet product while using the blast button.
- b) Depress  to advance through pre-wet blast menu.
- c) Depress  to advance to ANTI-ICE BLAST MENU.

*ANTI-ICE BLAST MENU

- a) Displays day distance, total distance, day volume for anti-ice product.
- b) Depress  to step through anti-ice blast menu.
- c) Depress  to advance to SERIAL PORT MENU.

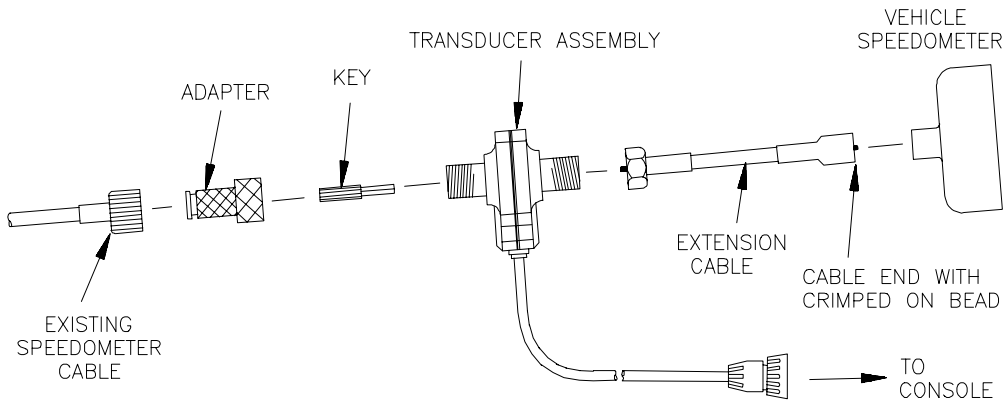
* = DCS 710 ONLY

APPENDIX 1

SPEEDOMETER DRIVE SPEED SENSOR INSTALLATION AND CALIBRATION PROCEDURE

1. MOUNTING THE SPEEDOMETER DRIVE SPEED SENSOR

- 1) Remove the existing speedometer cable from the back of the vehicle speedometer. Pull cable through fire wall into engine compartment.
- 2) Install adapter and key on speedometer cable and connect to Transducer Assembly. (Some units do not use adapter and key).
- 3) Connect Extension Cable to Transducer Assembly.



- 4) Push Extension Cable through fire wall and re-install on speedometer.
- 5) Connect the cable on the Transducer Assembly to the Console.
- 6) Secure all cables with plastic cable ties.

You are now ready to calibrate the Speedometer Drive Speed Sensor.

2. CALCULATING "SPEED CAL"

- 1) Complete "INITIAL CONSOLE PROGRAMMING" before doing this procedure.

2) Enter "0" in DISTANCE.

3) Enter a SPEED CAL of 200 [51] in SPEED CAL
4.

- 4) Drive 1 mile [1 km].

CAUTION: Do not use vehicle odometer to determine distance. Use section lines or highway markers, or measured distance.

5) Read DISTANCE by depressing



- a) DISTANCE should read a value of approximately 5280 [1000]. If it reads between 5200-5350 [990-1010], the SPEED CAL for your vehicle is 200 [51].
- b) If the DISTANCE display reads any other value, perform the following calculation:

Multiply the SPEED CAL by the actual distance traveled, then divide the sum by the actual value in the DISTANCE display on the console. This will give you the corrected value to enter for SPEED CAL. **You must round off to the nearest 3 digit whole number.**

EXAMPLE: SPEED CAL = 200 [51]
 Target distance reading = 5280 [1000]
 Assume the actual DISTANCE display reads 5000 [980]

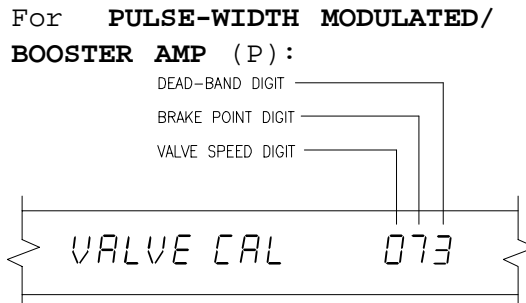
	ENGLISH UNITS:	METRIC UNITS:
=	$\frac{200 \times 5280}{5000} = 211.2$	$= \frac{[51] \times [1000]}{[980]} = [52.0]$

- 6) The corrected number to enter for SPEED CAL is 211 [52].
- 7) Verify the corrected SPEED CAL number calculated above:
 - a) Zero out the DISTANCE display as in Step 2.
 - b) Enter the corrected SPEED CAL number as in Step 3.
 - c) Repeat Steps 4 and 5a. If DISTANCE value does not read correctly repeat Steps 5b, 6, and 7.

APPENDIX 2

CALCULATING "GRAN AND LIQ VALVE CAL"

- 1) The default control valve calibration number is 73. These initial VALVE CAL numbers are used for both the GRAN and LIQ VALVE CAL. After operating the system, you may desire to refine this number. See definitions below:



- Valve Speed Digit -- Controls response time of Control Valve motor.
CAUTION: Running the Control Valve too fast will cause the system to oscillate.
- Range: 0 to 9 0-Slow, 9-Fast
- Brake Point Digit -- Sets the percent away from target rate at which the Control Valve motor begins braking, so as not to overshoot the desired rate.
- Range: 0 to 9 0 = 5%, 1 = 10%, 9 = 90%
- Dead-Band Digit -- Allowable difference between target and actual application rate, where rate correction is not performed.
- Range: 1 to 9 1 = 1%, 9 = 9%








<u>MANUFACTURER</u>	<u>VALVE CAL NUMBER</u>	<u>COIL FREQUENCY</u>
Brand	136	90-115
Compact	145	100
Dan Foss	133	1000
Energy	136	90-115
Gresen	125	50
Hydroforce	136	100-150
Rexroth	73	180-200
Vickors	136	

APPENDIX 3 ENTERING OFFSET VALUES






To enter known or previously obtained offsets without engaging the hydraulic system of the vehicle the operator must perform the following procedure.

NOTE: When setting offsets the MASTER switch must be ON, and the RATE knob must be on "M".

1) GRANULAR HIGH OFFSET






- a) Depress  until the display shows *PWM VALVE OFFSET MENU*.
- b) Depress  and the display will show *RPM 0 GRANULAR HIGH 253*.
- c) Depressing  allows the use of the  and  keys to set the offset value desired.
- d) After desired value is set, depress . HIGH OFFSET is now set.
- e) Depress  to advance to GRANULAR LOW OFFSET.

2) GRANULAR LOW OFFSET






- a) The display will show *RPM 0 GRANULAR LOW 2*.
- b) Depressing  allows the use of the  and  keys to set the offset value desired.
- c) After desired value is set, depress . LOW OFFSET is now set.
- d) Depress  to advance to PRE-WET HIGH OFFSET.

NOTE: The following offsets are only needed if pre-wet system is controlled by the console (closed loop system). To enter known offset, an application rate must be entered in Sand, Salt, Product 1, or Product 2 Liq Rates.






3) PRE-WET HIGH OFFSET

- a) The display will show *FLOW 0.0 PREWET HIGH 253*.
- b) Depressing  allows the use of the  and  keys to set the offset desired.
- c) After desired value is set, depress . HIGH OFFSET is now set.
- d) Depress  to advance to PRE-WET LOW OFFSET.






4) **PRE-WET LOW OFFSET**

- a) The display will show *FLOW 0.0 PREWET LOW 2.*
- b) Depressing  allows the use of the  and  keys to set the offset desired.
- c) After desired value is set, depress . LOW OFFSET is now set.
- d) Depress  to advance to ANTI-ICE HIGH OFFSET.






5) ***ANTI-ICE HIGH OFFSET**

- a) The display will show *FLOW 0.0 ANTI ICE HIGH 253.*
- b) Depressing  allows the user to use the  and  keys to set the offset value desired.
- c) After desired value is set, depress . HIGH OFFSET is now set.
- d) Depress  to advance to ANTI-ICE LOW OFFSET.







6) ***ANTI-ICE LOW OFFSET**

- a) The display will show *FLOW 0.0 ANTI ICE LOW 2.*
- b) Depressing  allows the user to use the  and  keys to set the offset value desired.
- c) After desired value is set, depress . HIGH OFFSET is now set.
- d) Depress  to advance to SPINNER HIGH OFFSET.

7) **SPINNER HIGH OFFSET**

- a) The display will show *RPM 0 SPINNER HIGH 253.*
- b) Depressing  allows the use of the  and  keys to set the offset value.
- c) After desired value is set, depress . HIGH OFFSET is now set.
- d) Depress  to advance to SPINNER LOW OFFSET.

8) **SPINNER LOW OFFSET**

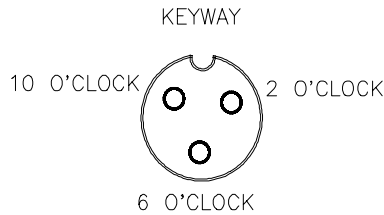
- a) The display will show *RPM 0 SPINNER LOW 2.*
- b) Depressing  allows the use of the  and  keys to set the offset value.
- c) After desired value is set, depress . LOW OFFSET is now set.
- d) Depress  to advance to GRANULAR AUTO OFFSETS or depress  to advance to CALIBRATION MENU.

* = DCS 710 ONLY

APPENDIX 4

PROCEDURE TO TEST SPEED SENSOR EXTENSION CABLES

Disconnect extension cable from Speed Sensor Assembly cable. Hold extension cable connector so that keyway is pointing in the 12 o'clock position.



PIN DESIGNATIONS



2 o'clock socket location is power.
10 o'clock socket location is ground.
6 o'clock socket location is signal.

VOLTAGE READINGS

- 1) 10 o'clock socket to 6 o'clock socket = +5 VDC.
- 2) 10 o'clock socket to 2 o'clock socket = +5 VDC or +12 VDC (RADAR).

If a +5 VDC voltage reading is not present, disconnect the Flow Sensor cable. If the Speed reading is restored, Test the Flow Sensor cable per Appendix "PROCEDURE TO TEST FLOW METER CABLES".

PROCEDURE TO CHECK CABLE:

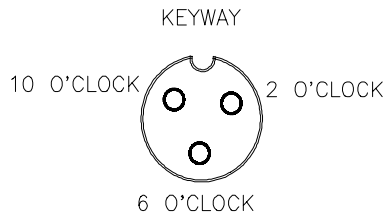
- 1) Enter SPEED CAL number of 9999 in .
- 2) Depress .
- 3) With small jumper wire (or paper clip), short between the 10 o'clock and 6 o'clock sockets with a "short-no short" motion. Each time a contact is made, the DISTANCE total should increase by increments of 1 or more counts.
- 4) If DISTANCE does not increase, remove the section of cable and repeat test at connector next closest to Console. Replace defective cable as required.
- 5) Perform above voltage checks.
- 6) If all cables test good, replace Speed Sensor.

NOTE: After testing is complete, re-enter correct SPEED CAL number before application.

APPENDIX 5

PROCEDURE TO TEST FLOW METER CABLES

Disconnect cable from Flow Sensor. Hold Flow Sensor cable so that the keyway is pointing in the 12 o'clock position:



PIN DESIGNATIONS





2 o'clock socket location is ground.
10 o'clock socket location is power.
6 o'clock socket location is signal.

VOLTAGE READINGS

- 1) 2 o'clock socket to 6 o'clock socket = +5 VDC.
- 2) 2 o'clock socket to 10 o'clock socket = +5 VDC.

If a +5 VDC voltage reading is not present, disconnect the Speed Sensor cable. If the Flow reading is restored, Test the Speed Sensor cable per Appendix "PROCEDURE TO TEST SPEED SENSOR EXTENSION CABLES".

PROCEDURE TO CHECK CABLE:

- 1) Enter a METER CAL number of one (1) in  for granular cable;  for liquid cable.
- 2) Depress  for granular cable;  for liquid cable.
- 3) Place MASTER switch to ON, POWER switch to GR/LI, and enter self test speed of 5 mph.
- 4) With small jumper wire (or paper clip), short between the 2 o'clock and 6 o'clock sockets with a "short-no short" motion. Each time a contact is made, the TOTAL VOLUME should increase by increments of 1 or more counts.
- 5) If TOTAL VOLUME does not increase, remove the section of cable and repeat test at connector next closest to Console. Replace defective cable as required.
- 6) Perform above voltage checks.
- 7) If all cables test good, replace Flow Sensor.

NOTE: After testing is complete, re-enter correct METER CAL numbers before application.



APPENDIX 6

FLOW METER MAINTENANCE AND ADJUSTMENT PROCEDURE

- 1) Remove Flow Meter from pre-wet or anti-ice system and flush with clean water to remove any chemicals.
- 2) Remove flange bolts or clamp from the Flow Meter.
- 3) Remove the turbine hub and turbine from inside Flow Meter.
- 4) Clean turbine and turbine hub of metal filings or any other foreign material, such as wettable powders. Confirm that the turbine blades are not worn. Hold turbine and turbine hub in your hand and spin turbine. The turbine should spin freely with very little drag inside the turbine hub.
- 5) If transducer assembly is replaced or if turbine stud is adjusted or replaced, verify the turbine fit before reassembling. Hold turbine hub with turbine on transducer. Spin turbine by blowing on it. Tighten turbine stub until turbine stalls. Loosen turbine stud 1/3 turn. The turbine should spin freely.
- 6) Re-assemble Flow Meter.
- 7) Using a low pressure (5 psi) [34.5 kPa] jet of air, verify the turbine spins freely. If there is drag, loosen hex stud on the bottom of turbine hub 1/16 turn until the turbine spins freely.
- 8) If the turbine spins freely and cables have been checked per Appendix "PROCEDURE TO TEST FLOW CABLES", but Flow Meter still is not totalizing properly, replace Flow Meter transducer.

APPENDIX 7

PROCEDURE TO RE-CALIBRATE FLOW METER

- 1) Enter a LIQ CAL number of 10 [38] in  .
- 2) Enter a TOTAL LIQ VOLUME of 0 in  .
- 3) Place MASTER switch to OFF.
- 4) Remove a boom hose and place in calibrated 5 gallon [19 liter] container.
- 5) Place POWER switch to GR/LI and MASTER switch to ON. Enter a self test speed of 5 mph. Pump exactly 10 gallons [38 liters].
- 6) Readout in display is the new METER CAL number. This number should be within +/-3% of the number stamped on the tag on Flow Meter.
- 7) Repeat this procedure several times to confirm accuracy. (Always "zero out" the TOTAL LIQ VOLUME display before retesting).

NOTE: For greatest precision, set METER CAL to 100 and pump 100 gallons (378 liters) of water.

- 8) To verify Flow Meter calibration, fill applicator tank with a predetermined amount of measured liquid (i.e. 250 gallons). **DO NOT RELY ON GRADUATION NUMBERS MOLDED INTO APPLICATOR TANK.** Empty the applicator tank under normal operating conditions. If the number displayed under TOTAL LIQ VOLUME is different from the predetermined amount of measured liquid by more than +/-3%, complete the following calculation.

EXAMPLE:

LIQ CAL		= 720 [190]
TOTAL LIQ VOLUME		= 260 [984]
Predetermined amount of measured liquid		= 250 [946]

Corrected METER CAL = $\frac{\text{LIQ CAL} \times \text{TOTAL LIQ VOLUME}}{\text{Predetermined amount of measured liquid}}$

ENGLISH UNITS:	METRIC UNITS:
= $\frac{720 \times 260}{250} = 749$	= $\frac{[190] \times [984]}{[946]} = [198]$

Corrected LIQ CAL = 749 [198]

- 9) Enter corrected LIQ CAL before resuming application.

NOTE: For RFM 200 series Flow Meter, use old METER CAL number of 164 [43] and calibrate as described in Step 8.

APPENDIX 8

REMOTE SWITCH OPTIONS

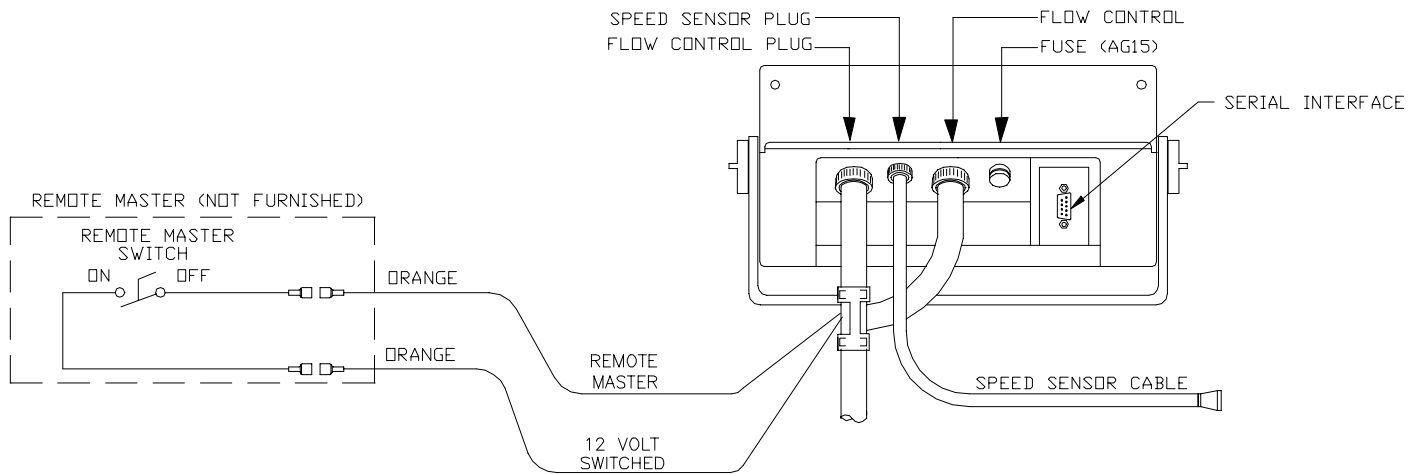


FIGURE 8

REMOTE MASTER

The REMOTE MASTER supplies power to the MASTER switch. Therefore switching the REMOTE MASTER ON when the MASTER switch is in the ON position will energize the granular applicator. The REMOTE MASTER only switches on the applicator. It does not select the material type. Only the Console MASTER switch will select Sand, Salt, Product 1, or Product 2.

The MASTER switch on the console must be placed in the ON position for the REMOTE MASTER to work properly.

INSTALLATION

To install a REMOTE MASTER, locate the solid orange wire within the console cable. Cut the orange wire and use both ends to install the REMOTE MASTER as shown in Figure 8.

APPENDIX 9

DCS 700/710 DATA MENU REFERENCE GUIDE

DISPLAY SCREEN

SERIAL PORT MENU

PRINT CALIBRATION VALUES
 TRUCK NUMBER
 BAUD RATE
 RATE CHANGE ALARM
 DATA LOGGING VALUE
 DATA LOGGING UNIT
 DATA LOGGING FEATURE

GPS MENU

SYSTEM INACTIVE

TIME AND DATE MENU

TIME
 MONTH
 DAY
 YEAR
 POWER DOWN

FLOW MENU

GRANULAR VOL/MIN
 PREWET VOL/MIN
 *ANTI ICE VOL/MIN
 GRANULAR LOW LIMIT
 PREWET LOW LIMIT
 *ANTI ICE LOW LIMIT
 SPINNER LOW LIMIT
 *TIER 2 ENABLE VALUE
 *TIER 3 ENABLE VALUE
 *TIER DISABLE PCT

ALARM MENU

AUDIBLE ALARM
 GRANULAR OFF RATE PCT
 PREWET OFF RATE PCT
 *ANTI ICE OFF RATE PCT
 SPINNER OFF RATE PCT

DISPLAY SCREEN

MISCELLANEOUS MENU

DISPLAY SMOOTHING
 MANUAL MODE CONTROL
 OPEN LOOP ENABLE
 AUTO REVERSE FUNCTION
 LOW TANK LEVEL SHUT OFF
 ZERO SPEED SHUT OFF
 PREWET IN GALLONS/TON

PWM VALVE OFFSET MENU

RPM 0 GRANULAR HIGH
 RPM 0 GRANULAR LOW
 FLOW 0.0 PREWET HIGH
 FLOW 0.0 PREWET LOW
 *FLOW 0.0 ANTI ICE HIGH
 *FLOW 0.0 ANTI ICE LOW
 RPM 0 SPINNER HIGH
 RPM 0 SPINNER LOW
 GRANULAR AUTO OFFSETS
 PREWET AUTO OFFSETS
 *ANTI ICE AUTO OFFSETS

CALIBRATION MENU

SPEED CALIBRATION
 GRANULAR CALIBRATION
 GRANULAR TOTAL WEIGHT
 2 SPEED LOW RATIO
 2 SPEED HIGH RATIO
 PWM COIL FREQUENCY
 SPEED LIMIT
 GRANULAR AUTO VALVE CAL
 PREWET AUTO VALVE CAL
 *ANTI ICE AUTO VALVE CAL

***ANTI ICE LANE MENU**

*LANE WIDTH IN FEET
 *LEFT LANE IN INCHES
 *CENTER LANE IN INCHES
 *RIGHT LANE IN INCHES

DISPLAY SCREEN

SAND BLAST MENU

DAY DISTANCE APPLIED
 TOTAL DISTANCE APPLIED
 DAY VOLUME APPLIED
 TOTAL VOLUME APPLIED

SALT BLAST MENU

DAY DISTANCE APPLIED
 TOTAL DISTANCE APPLIED
 DAY VOLUME APPLIED
 TOTAL VOLUME APPLIED

PRODUCT 1 BLAST MENU

DAY DISTANCE APPLIED
 TOTAL DISTANCE APPLIED
 DAY VOLUME APPLIED
 TOTAL VOLUME APPLIED

PRODUCT 2 BLAST MENU

DAY DISTANCE APPLIED
 TOTAL DISTANCE APPLIED
 DAY VOLUME APPLIED
 TOTAL VOLUME APPLIED

PREWET BLAST MENU

DAY DISTANCE APPLIED
 TOTAL DISTANCE APPLIED
 DAY VOLUME APPLIED
 TOTAL VOLUME APPLIED

***ANTI ICE BLAST MENU**

*DAY DISTANCE APPLIED
 *TOTAL DISTANCE APPLIED
 *DAY VOLUME APPLIED
 *TOTAL VOLUME APPLIED

* = DCS 710 ONLY