RAVEN
INDUSTRIES
DCS 710

MASTER RATE **MANUAL** **SPINNER** **ALARM** **BLAST** **POWER**

ON / SEL / OFF — RATE M — INC / DEC — SPINNER O — GR/LI / GRAN / OFF

GRAN | LIQ | DATA

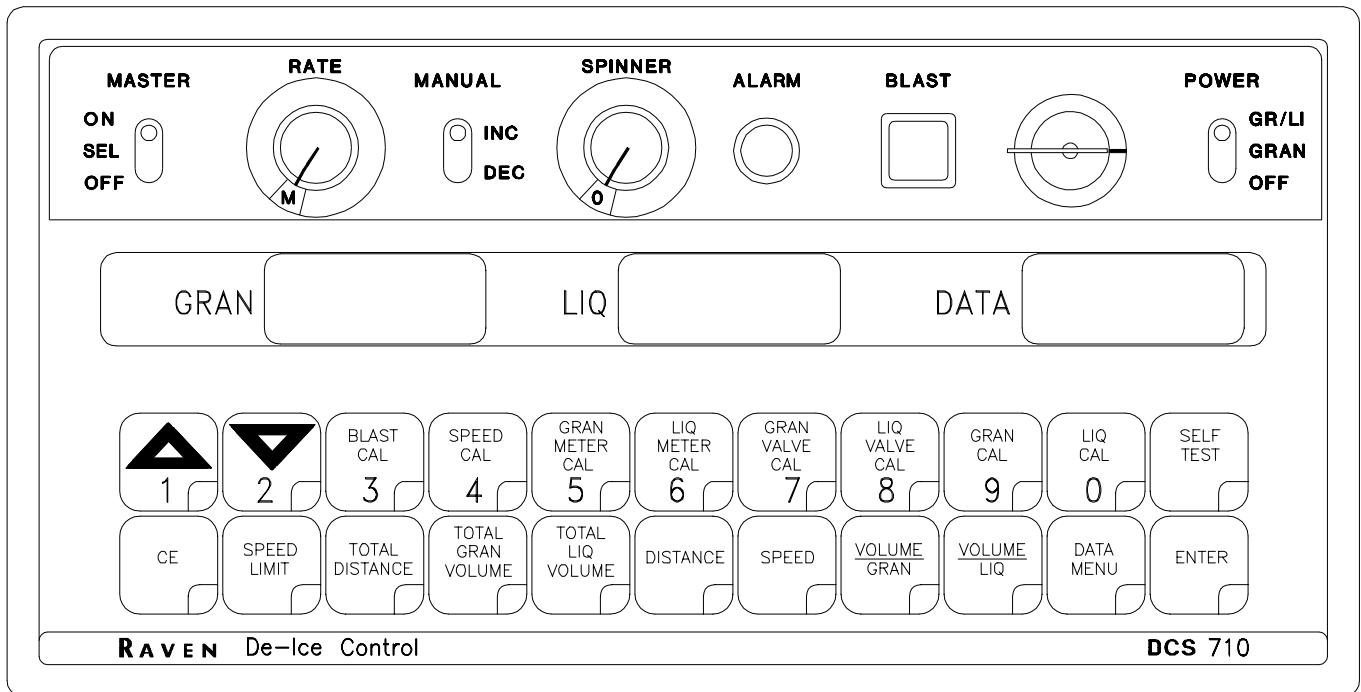| ▲ 1 | ▼ 2 | BLAST CAL 3 | SPEED CAL 4 | GRAN METER CAL 5 | LIQ METER CAL 6 | GRAN VALVE CAL 7 | LIQ VALVE CAL 8 | GRAN CAL 9 | LIQ CAL 0 | SELF TEST |
| CE | SPEED LIMIT | TOTAL DISTANCE | TOTAL GRAN VOLUME | TOTAL LIQ VOLUME | DISTANCE | SPEED | VOLUME GRAN | VOLUME LIQ | DATA MENU | ENTER |

RAVEN De-Ice Control   DCS 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.

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.
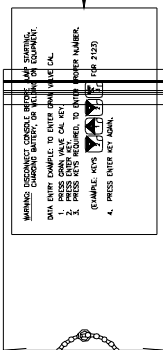
CUT ON DOTTED LINE

FOLD ON SOLID LINES

INSERT AND ZIP SHUT

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.

(EXAMPLE: KEYS [◄ 2] [► 1] [◄ 2] [BLAST CAL 3] FOR 2123)

4. PRESS ENTER KEY AGAIN.

(DCS 710)

Key	Label	Value
BLAST CAL 3	BLAST RATE	
	SAND	_____
	SALT	_____
	PRD 1	_____
	PRD 2	_____
	ANTI-ICE	_____
	BLAST TIME	_____
SPEED CAL 4	SPEED CAL	_____
GRAN METER CAL 5	GRAN METER CAL	
	SAND	_____
	SALT	_____
	PRD 1	_____
	PRD 2	_____
LIQ METER CAL 6	LIQ METER CAL	
	PRE-WET	_____
	ANTI-ICE	_____
GRAN VALVE CAL 7	GRAN VALVE CAL	_____
LIQ VALVE CAL 8	LIQ VALVE CAL	
	PRE-WET	_____
	ANTI-ICE	_____

GRAN CAL 9 — GRAN CAL

	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 CAL 0 — LIQ CAL

Label	Value
SAND	_____
SALT	_____
PRD 1	_____
PRD 2	_____

DATA MENU

OFFSET:

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: _____

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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 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 710.

The DCS 710 consists of a computer-based control console, lane switch box, 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 location 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 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 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 710 Console. The Red wire should be connected to switched 12VDC power. The White wire should be connected to the ground.

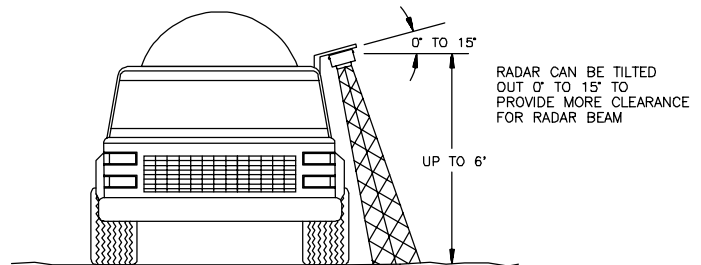|	
CAUTION:	The connection of the Radar power in reverse polarity could result in damage to the Radar.
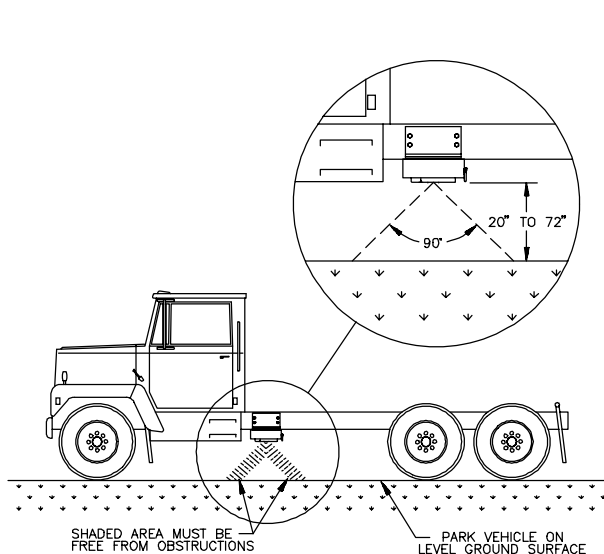
FIGURE 1

FIGURE 2

FIGURE 3
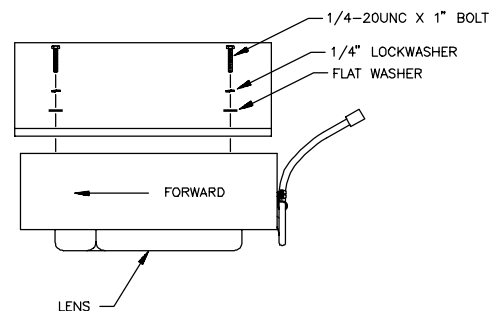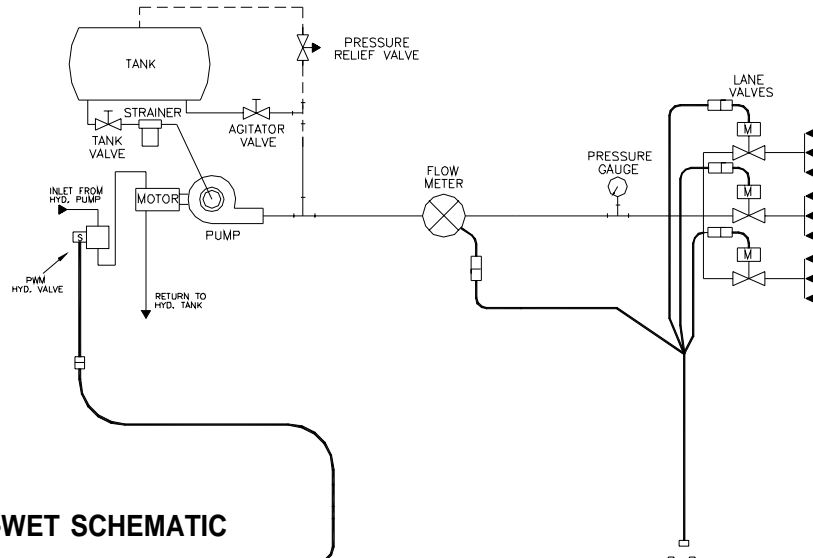
2. MOUNTING FLOW METER

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.

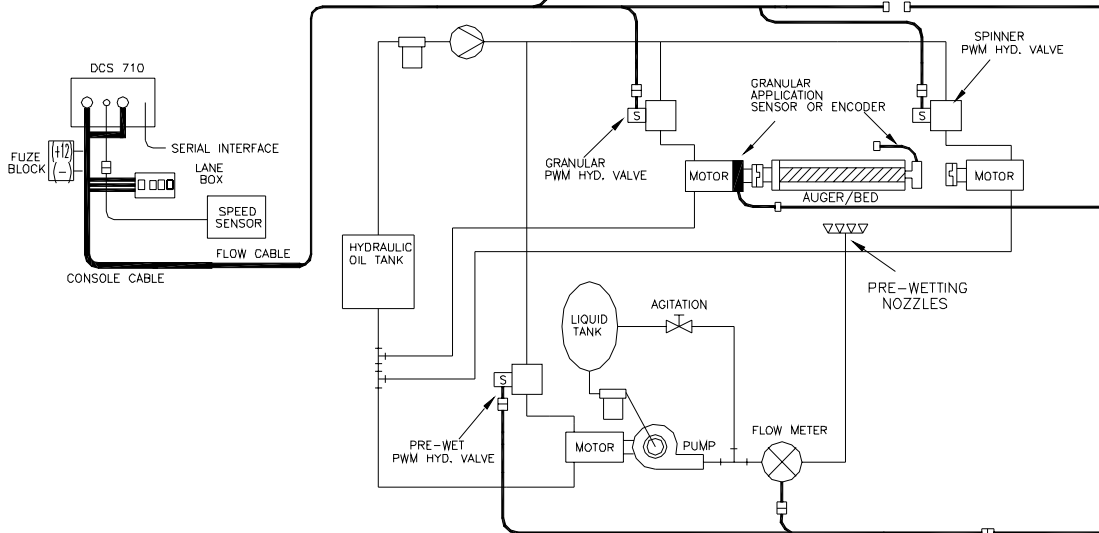**ANTI-ICE SCHEMATIC**

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.
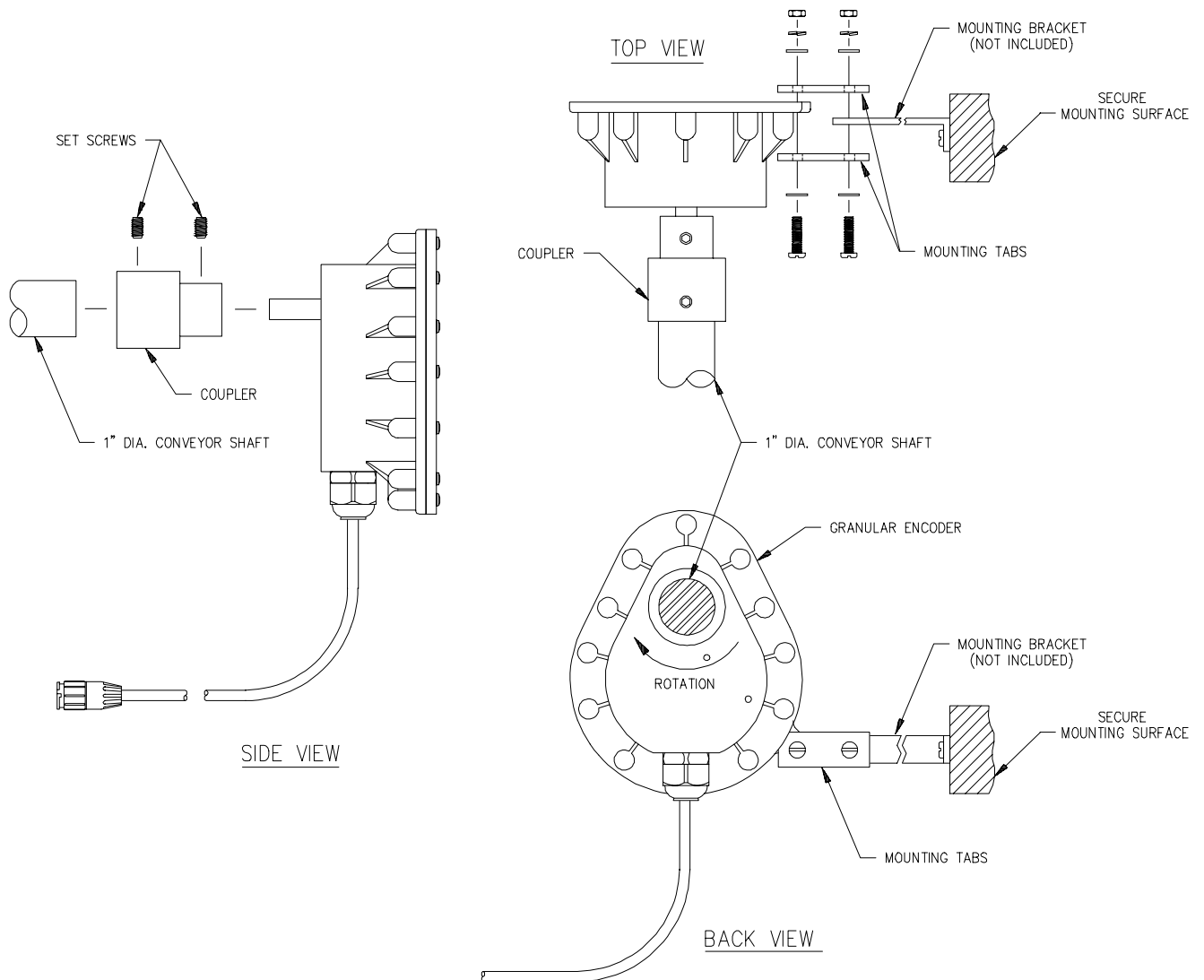
FIGURE 5

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).
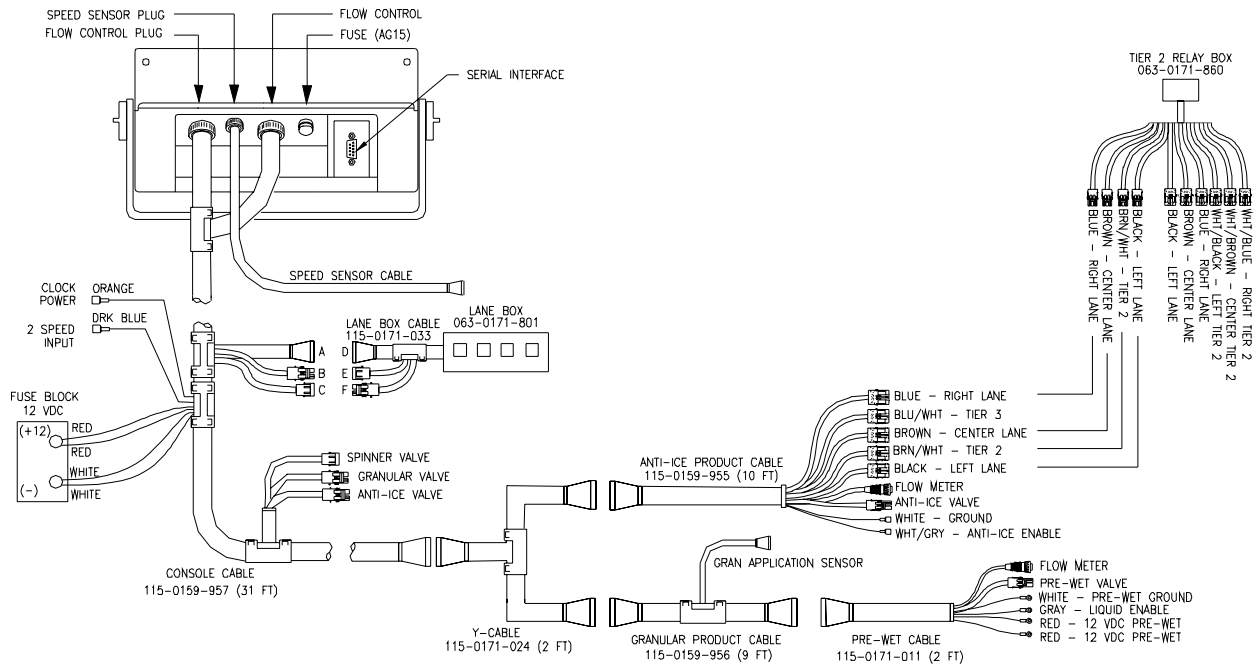
FIGURE 6

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) To connect the lane box if using a 3 valve block system, connect 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.

CONSOLE FEATURES

RAVEN
INDUSTRIES
Sioux Falls, S.D.
Made in U.S.A.

PART No.
SERIAL No.
REV
PGM
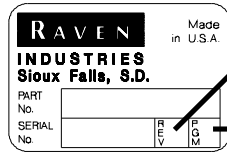
Console Revision can be determined by the letter stamped in REV box on label.

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

MASTER - Controls ON/OFF of granular or anti-ice and selection of Sand, Salt, Prd1, or Prd2.

RATE - Selects manual or fully automatic rates 1-10.

MANUAL - Increases or decreases application rate when "M" is selected on RATE.

SPINNER - Selects spinner OFF (0) or 1-10 RPM speeds.

ALARM - Visual indicator light for alarm conditions.

BLAST - Provides blast rate for a selected amount of time.

KEY SWITCH - Key must be in and turned horizontal to enter data into console.

POWER - Turns Console OFF or ON. Select either Granular only application or Granular with liquid pre-wetting.
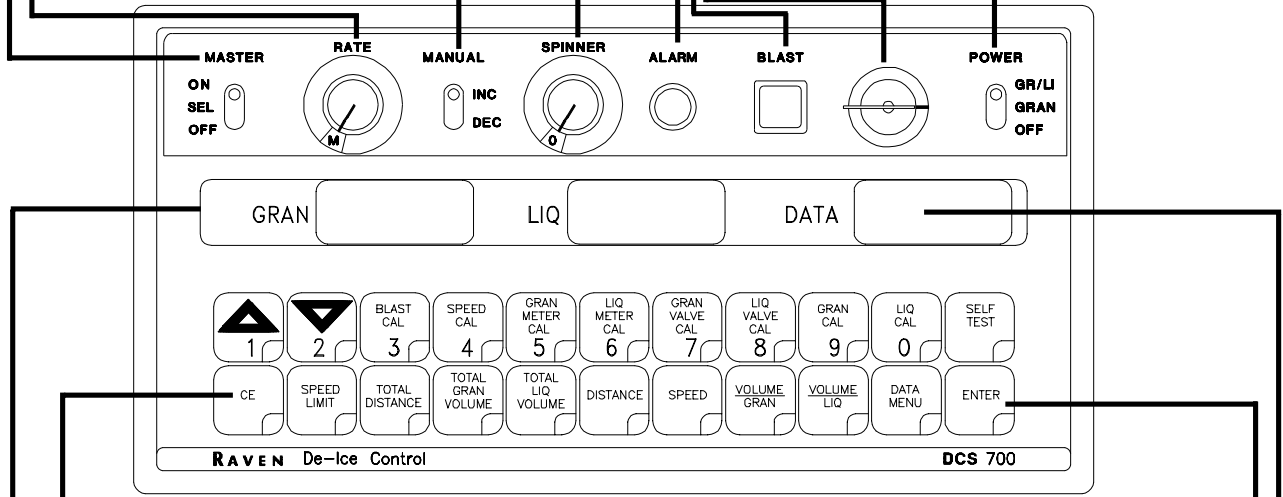
CE - Use like you do the CE key on a calculator.

Displays actual rate of GRAN (granular) and LIQ (liquid).

ENTER - Used only to enter data into the Console.

Displays function and calibration DATA.

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 METER CAL --	Granular Calibration Number
LIQ METER CAL --	Flow Meter Calibration Number
GRAN VALVE CAL --	Valve Response Time
LIQ VALVE CAL --	Valve Response Time
GRAN CAL --	Granular Desired Application Rate (Rates 1-10)
LIQ CAL --	Pre-Wet and Anti-Ice Application Rate
SELF TEST --	Simulates Vehicle Speed
SPEED LIMIT --	Speed at which alarm will sound

|	
FUNCTION KEYS --	Used to Display Data
TOTAL DISTANCE --	Total Distance Applied
TOTAL GRAN VOLUME--	Granular Volume Applied
TOTAL LIQ VOLUME --	Liquid Volume Applied
DISTANCE --	Distance Traveled
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

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

ANTI-ICE   LEFT   CENTER   RIGHT

GRAN   LANE   LANE   LANE
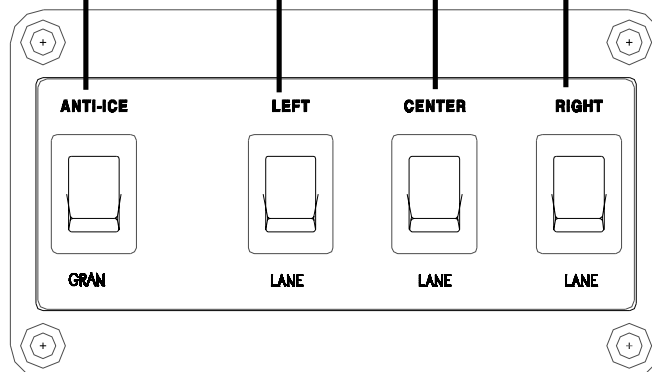
CONSOLE PROGRAMMING

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

NOTE: DATA MUST BE ENTERED INTO KEYS 3 THRU 0.
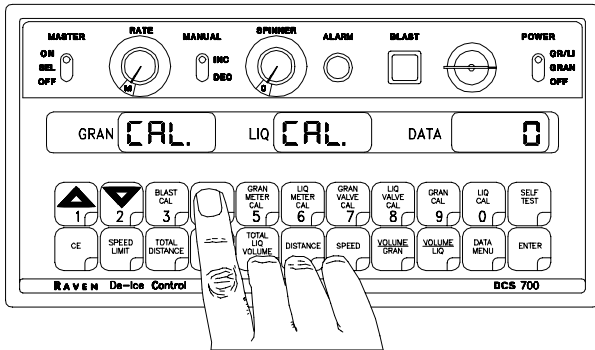
Depress the key in which you wish to enter data.
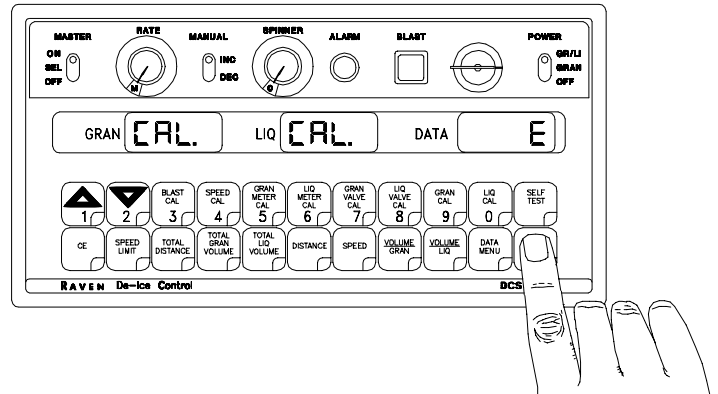
Depress the ENTER key. An "E" will illuminate in the DATA display.
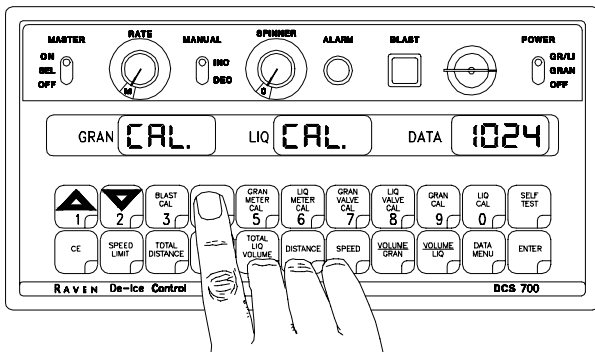
Depress the keys corresponding to the number you wish to enter(i.e. "1","0","2","4"). The numbers will be displayed as they are entered.
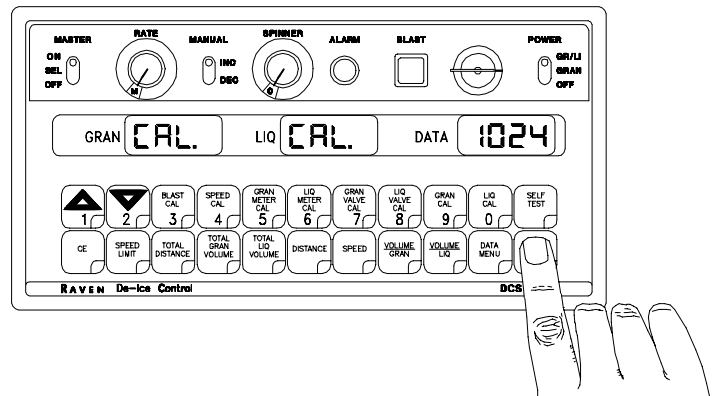
Complete the entry by again depressing the ENTER key.

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 "CAL" in the GRAN and LIQ displays. 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: [VOLUME GRAN] [VOLUME LIQ] [DISTANCE] [SELF TEST] . A "0" (zero) may be entered for "day distances", "day granular volumes", "day liquid volumes". Refer to 'Distance and Volume Displays' on page 25 for procedure.
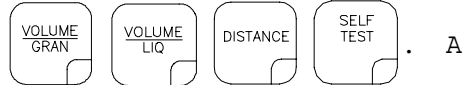
The following steps must be followed for proper calibration:

1) Selecting US (lbs/mile), or SI (Kg/km).

a) To select US or SI, depress [CE] until the desired selection is displayed in the DATA display.

b) Momentarily depress [ENTER], the DATA display will now display "SP1".

2) Selecting SP1 (drive shaft, wheel drive, etc.), SP2 (radar), or SP3 (transmission).

a) To select SP1, SP2, or SP3 depress [CE] until desired selection is displayed.

b) Momentarily depress [ENTER], the DATA display will now display "0".

c) Depress and hold [SELF TEST]. The previous 2 settings that were selected and 1-P, 2-P, and 3-P will be displayed in the DATA display. Verify the selections made are correct before proceeding to the next step. If an error is noted, place key switch to horizontal prosition and POWER switch OFF, depress and hold [CE], place POWER switch to GRAN, and repeat steps 1-2.

3) Enter the following values in [BLAST CAL 3]. Depress [▲1] to advance through the BLAST CAL menu.

DISPLAY SCREENS

GRAN	LIQ	DATA	PROCEDURE
SAnd	bL-r	0	Enter the desired Sand Blast Rate (lbs/mile) [kg/km].
SALt	bL-r	0	Enter the desired Salt Blast Rate (lbs/mile) [kg/km].
Prd1	bL-r	0	Enter the desired Product 1 Blast Rate (lbs/mile) [kg/km].
Prd2	bL-r	0	Enter the desired Product 2 Blast Rate (lbs/mile) [kg/km].
Anti	bL-r	0	Enter the desired Anti-ice Blast Rate (gal/mile) (gal/lane mile) [lit/km][lit/lane km].
	bL-S	0	Enter the desired Blast Time (seconds).

NOTE: Blast Time is the same value for Sand, Salt, Product 1, Product 2, and Anti-ice.

4) Enter an initial value of "200" in [SPEED CAL 4]. The actual SPEED CAL number will be obtained after initial programming is completed. Refer to section "CALCULATING SPEED CAL" for more instructions.

5) Enter the following values in [GRAN METER CAL 5]. Depress [▲1] to advance through the GRAN METER CAL menu.

DISPLAY SCREENS

GRAN	LIQ	DATA	PROCEDURE
SAnd		0	Enter an initial value of "0".
SALt		0	Enter an initial value of "0".
Prd1		0	Enter an initial value of "0".
Prd2		0	Enter an initial value of "0".

The actual GRAN METER CAL values will be obtained after initial programming is completed. Refer to section "CALCULATING GRAN METER CAL" for further instructions.

6)   Enter the calibration number from flow meter tag in [LIQ METER CAL 6]. Depress [▲ 1]

to advance through the LIQ METER CAL menu.

DISPLAY SCREENS

GRAN	LIQ	DATA	PROCEDURE
PrE-	UEt	0	Enter the number from Pre-wet Flow Meter.
Anti	iCE	0	Enter the number from Anti-ice Flow Meter.

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

7)   Depress [GRAN VALVE CAL 7]. This console contains a factory default value of "73".   Refer

to Appendix 2 page 44 to adjust this value if necessary.

8)   Depress [LIQ VALVE CAL 8]. Depress [▲ 1] to advance through the LIQ VALVE CAL menu.

DISPLAY SCREENS

GRAN	LIQ	DATA	PROCEDURE
PrE	UEt	73	This console contains a factory default value of 73.
Anti	iCE	73	This console contains a factory default value of 73.

> **NOTE:** This console contains a factory default value of "73", for Pre-wet and Anti-ice. Refer to Appendix 2 page 44 to adjust this value if necessary. If pre-wet system is not controlled by the console (open loop system) enter "0" in Pre-Wet valve cal.

9) Enter the following values in [GRAN CAL 9].

DISPLAY SCREENS

GRAN	LIQ	DATA	PROCEDURE
SAnd	r-01	0	Enter the desired granular application rate (lbs/mile) [kg/km].

Depress the [▲ 1] and [▼ 2] keys to advance through rates 1-10 ("r-01" through "r-10") for Sand.

NOTE: Salt, Prd1, and Prd2 application rates will default to the Sand application rates during initial calibration. These application rates can be changed after initial calibration is completed.

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10) Enter the following values in [LIQ CAL 0]. Depress [▲ 1] to advance through the LIQ CAL menu.

DISPLAY SCREENS

GRAN	LIQ	DATA	PROCEDURE
	SAnd	0	Enter the desired Sand pre-wet application rate (gal/ton) [lit/kg].
	SALt	0	Enter the desired Salt pre-wet application rate (gal/ton) [lit/kg].
	Prd1	0	Enter the desired Product 1 pre-wet application rate (gal/ton) [lit/kg].
	Prd2	0	Enter the desired Product 2 pre-wet application rate (gal/ton) [lit/kg].

NOTE: Any application rates that are not programmed will default to zero (0). If pre-wet system is not controlled by the console (closed loop system) enter "0" for each product.

Anti	r-01	0	Enter the desired Anti-ice application rate (gal/mile)(gal/lane mile)[lit/km] [lit/lane km]

Depress the [▲ 1] and [▼ 2] keys to advance through rates 1-10 ("r-01" through "r-10") for Anti-ice.

YOU HAVE NOW COMPLETED PROGRAMMING THE CONSOLE
The flashing "CAL" will now extinguish. If not, repeat procedure starting at Step 3.

11) Depress and hold [GRAN METER CAL 5] until DATA display flashes. Enter number of pulses per revolution from the encoder/granular application sensor. This console contains a factory default value of "36".

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CONSOLE CALIBRATION

1.   CALCULATING OFFSETS

1)   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.

a)   Depress [DATA MENU] until GRAN display shows "oFS". LIQ display will show "Sphi".

DATA display will show "254".

b)   Depress [ENTER].

c)   Depress [▼2] to start the spinner rotating. While spinner is rotating

depress and hold [▼2] 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 [ENTER]. HIGH OFFSET is now set.

e)   Depress [▲1] to advance to SPINNER LOW OFFSET.

2)   SPINNER LOW OFFSET

a)   GRAN display will show "oFS". LIQ display will show "SpLo". DATA display will show "2".

b)   Depress [ENTER].

c)   Depress [▲1] and spinner will stop rotating. Depress and hold [▲1]

until the spinner begins to rotate. Depress [▲1] and [▼2] until spinner

is rotating at the minimum speed desired.

d)   After desired speed is set, depress [ENTER]. LOW OFFSET is now set.

e)   Depress [▲1] to advance to GRANULAR HIGH OFFSET.

3)   **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.
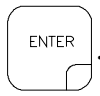
a)   GRAN display will show "oFS". LIQ display will show "Grhi". DATA display will show "254".

b)   Depress [ENTER] .

c)   Depress [▼2] to start the auger/bed turning. The RPM's of the granular motor/shaft and "oFS" will alternately be displayed in the GRAN display.

While auger/bed is turning, depress and hold [▼2] until the RPM's begin

to decrease. Depress [▲1] to slowly increase RPM's until the maximum

RPM is noticed, then increase offset value displayed in the DATA display by an additional 10.

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

e)   Depress [▲1] to advance to GRANULAR LOW OFFSET.

4)   **GRANULAR LOW OFFSET**
a)   GRAN display will show "oFS". LIQ display will show "GrLo". DATA display will show "2".

b)   Depress [ENTER] .

c)   Depress [▲1] and the auger/bed will stop turning. The RPM's of the granular motor/shaft and "oFS" will alternately be displayed in the GRAN display. Depress and hold [▲1] until the auger/bed starts turning. Depress [▼2]

to slowly decrease RPM's until "0000" is displayed, then decrease offset value displayed in the DATA display by an additional 10.

**d)**   After desired offset value is set, depress [ENTER] . LOW OFFSET is now set.

e)   Depress [▲1] to advance to PRE-WET HIGH OFFSET.

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

5) **PRE-WET HIGH OFFSET**
   When setting the Pre-wet 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 GRAN, and MASTER switch to ON.
   a) GRAN display will show "oFS". LIQ display will show "Prhi". DATA display will show "254".

   b) Depress [ENTER] .

   c) Depress [▼2] to start running the liquid pump. The vol/min of pre-wet liquid and "Prhi" will alternately be displayed in the LIQ display. While liquid pump is running, depress and hold [▼2] until the vol/min begins to decrease. Depress [▲1] to slowly increase the vol/min until the maximum vol/min is noticed, then increase offset value displayed in the DATA display by an additional 10.

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

   e) Depress [▲1] to advance to PRE-WET LOW OFFSET.

6) **PRE-WET LOW OFFSET**
   a) GRAN display will show "oFS". LIQ display will show "PrLo". DATA display will show "2".

   b) Depress [ENTER] .

   c) Depress [▲1] and the liquid pump will stop running. The vol/min of the liquid and "PrLo" will alternately be displayed in the LIQ display. Depress and hold [▲1] until the pump starts running. Depress [▼2] to slowly decrease the vol/min until "0000" is displayed, then decrease offset value displayed in the DATA display by an additional 10.

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

   e) Depress [▲1] to advance to ANTI-ICE HIGH OFFSET.

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7) 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) GRAN display will show "oFS". LIQ display will show "Anhi". DATA display will show "254".

b) Depress [ENTER] .

c) Depress [▼2] to start running the liquid pump. The vol/min of liquid and "Anhi" will aternately be displayed in the LIQ display. While liquid pump is running, depress and hold [▼2] until the vol/min begins to decrease. Depress [▲1] to slowly increase the vol/min until the maximum vol/min is noticed, then increase offset value displayed in the DATA display by an additional 10.

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

e) Depress [▲1] to advance to ANTI-ICE LOW OFFSET.

8) ANTI-ICE LOW OFFSET

a) GRAN display will show "oFS". LIQ display will show "AnLo". DATA display will show "2".

b) Depress [ENTER] .

c) Depress [▲1] and the liquid pump will stop running. The vol/min of the liquid and "AnLo" will alternately be displayed in the LIQ display. Depress and hold [▲1] until the pump starts running. Use [▼2] to slowly decrease the vol/min until "0000" is displayed, then decrease offset value displayed in the DATA display by an additional 10.

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

e) Depress [▲1] to advance back to SPINNER HIGH OFFSET.

2. CALCULATING "SPEED CAL"

1) Depress [DATA MENU] until the GRAN display shows "CAL". The LIQ display will show "SPEd". DATA display will show "on" or "oFF".

2) Momentarily depress [CE] to turn CAL speed "on".

3) Depress [SPEED].

4) While driving the vehicle at normal operating speed, depress the [▲ 1] and [▼ 2] keys to match the speed displayed in the DATA display to the speedometer of the truck.

5) When matched, depress [DATA MENU] and depress [CE] to turn CAL speed "oFF" when calibrated.

6) Depress [SPEED CAL 4] 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 METER CAL"

1) Weigh loaded truck and record as weight #1.

2) Depress [GRAN METER CAL 5] and enter a value of "0" for Sand, Salt, Prd1, or Prd2 depending on which product is being calibrated.

> **NOTE**: "SAnd" will be displayed in GRAN display. Depress [▲ 1] to advance GRAN display to "SALt", Prd1", or "Prd2".

3) Depress [DATA MENU] until the GRAN display shows "CAL". The LIQ display will show "SPEd". DATA display will show "on" or "oFF".

4) Depress [▲ 1] . The GRAN display will show "CAL". The LIQ display will show "GrAn". DATA display will show "oFF". Turn GRAN CAL "on" by depressing [CE] .

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5) Place the RATE knob to "M" and the MASTER switch to SEL. Depress [▲1] and

[▼2] to select the respective product (Sand, Salt, Prd1, or Prd2) being cali-

brated. 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 [▲1]. The GRAN display will show "CAL". The LIQ display will show

"Grto". The DATA display will show "0".

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 "Grto"

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

11) Depress [GRAN METER CAL 5] and the DATA display will show the new Meter Cal number for that

product.

4.   VERIFYING "GRAN METER CAL"

Factors which can affect the product GRAN METER 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 METER 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 METER CAL value is entered into [GRAN METER CAL 5].

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

4) Depress [TOTAL GRAN VOLUME]. The GRAN display will show "SAnd". The LIQ display will show "dAY".

The DATA display will show the volume. Depress [▲1] to advance the GRAN display

to Salt, Prd1, or Prd2. Enter a "0" in this key.

5) Place POWER switch to GRAN, MASTER switch to SEL and verify the correct product

is displayed or depress [▲1] and [▼2] 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 DATA 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 METER CAL   = 200
TOTAL GRAN VOLUME reading   = 0.2 [0.2]
Weight of collected material = 328 lbs = 0.164 tons [150 kg = 0.15 MT]
Corrected GRAN METER CAL = Calculated GRAN METER CAL x TOTAL GRAN VOLUME reading
                                          Weight of collected material

       ENGLISH UNITS: METRIC UNITS:
       = 200 x 0.2 = 244   = 200 x 0.2 = 267
          0.164   0.15

Corrected GRAN METER CAL = 244 [267]

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

8)   To verify Salt, Prd1, Prd2, and GRAN METER CAL repeat the above described procedure.

5.   CALCULATING "LIQ METER 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 3, page 44.

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, Prd1, or Prd2, depress the [▲ 1] and [▼ 2]
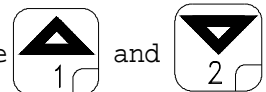
keys until desired product is displayed in the GRAN display. Only the products that have been calibrated will be displayed for selection.

    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 OR ANTI-ICE/GRANULAR 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 or anti-ice and granular material together, depress

[▲ 1] and [▼ 2] keys until desired selection is displayed. For anti-ice

only, the LIQ display will show "Anti" and DATA display will show "iCE".
For anti-ice and granular together, the GRAN display will show "GRAN",
the LIQ display will show "Anti", and DATA display will show "iCE".

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

[▲ 1] and [▼ 2] keys until desired granular product is displayed in GRAN

display 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.

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 [SELF TEST]. If 6 MPH [9.6 km/h] is

desired, enter 6.0 [9.6] (See CONSOLE PROGRAMMING). Verify speed by depress-

ing [SPEED] , 6.0 [9.6] will appear in the DATA 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.

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2)   To display the Console set-up selections, depress and hold [SELF TEST]. DATA dis-

play will cycle through the set-up selections (US or SI, 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 DATA display. With the

MASTER switch in the OFF position, depress ▲1 and ▼2 to advance through Sand, Salt, Product 1, Product 2, and Anti-ice calibration numbers as well as to advance through GRAN CAL r-01 and r-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 on how to use the DCS 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 [SELF TEST]. 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 GRAN display no longer increases.
4) The rate in the GRAN display is the maximum application rate at 25 mph.
5) Enter a self test speed of 30 mph and the GRAN 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. SPEED LIMIT FEATURE

Enter maximum application speed in [SPEED LIMIT]. A beeping alarm will sound if

actual speed is over maximum speed entered. Enter "0" to disable SPEED LIMIT alarm.

3. DISTANCE & VOLUME DISPLAYS

To zero out distance and volume totals that have "day" in the LIQ display screen depress ⌸ENTER⌸, zero (0), ⌸ENTER⌸. To zero out distance and volume totals that have "tOtL" in the LIQ display screen the key switch must be turned to the horizontal position and then perform the same procedure as mentioned above.

1) To display sand, salt, product 1, product 2, or anti-ice day distances and total distances, depress ⌸TOTAL DISTANCE⌸. To advance through the categories depress ⌸▲1⌸.

DISPLAY SCREENS

GRAN	LIQ	DATA	DESCRIPTION
SAnd	dAY	.0	Distance traveled while applying sand material during day, event, etc.
SALt	dAY	.0	Distance traveled while applying salt material during day, event, etc.
Prd1	dAY	.0	Distance traveled while applying product 1 material during day, event, etc.
Prd2	dAY	.0	Distance traveled while applying product 2 material during day, event, etc.
Anti	dAY	.0	Distance traveled while applying anti-ice material during day, event, etc.
SAnd	totL	0	Cumulative distance traveled while applying sand material.
SALt	totL	0	Cumulative distance traveled while applying salt material.
Prd1	totL	0	Cumulative distance traveled while applying product 1 material.
Prd2	totL	0	Cumulative distance traveled while applying product 2 material.
Anti	totL	0	Cumulative distance traveled while applying anti-ice material.

2) To display sand, salt, product 1, or product 2 day volumes and total volumes, depress ⌸TOTAL GRAN VOLUME⌸. To advance through the categories depress ⌸▲1⌸.

DISPLAY SCREENS

GRAN	LIQ	DATA	DESCRIPTION
SAnd	dAY	.0	Volume of sand applied during day, event, etc.
SALt	dAY	.0	Volume of salt applied during day, event, etc.
Prd1	dAY	.0	Volume of product 1 applied during day, event, etc.
Prd2	dAY	.0	Volume of product 2 applied during day, event, etc.
SAnd	tOtL	0	Cumulative volume total of sand material applied.
SALt	tOtL	0	Cumulative volume total of salt material applied.
Prd1	tOtL	0	Cumulative volume total of product 1 material applied.
Prd2	tOtL	0	Cumulative volume total of product 2 material applied.

3) To display pre-wet day volume, anti-ice day volume, pre-wet total volume, and anti-ice total volume depress [TOTAL LIQ VOLUME] . To advance through the categories depress [△ 1] .

DISPLAY SCREENS

GRAN	LIQ	DATA	DESCRIPTION
PrE-	dAY	0	Volume of pre-wet liquid applied during day, event, etc.
Anti	dAy	0	Volume of anti-ice liquid applied during day, event, etc.
PrE-	tOtL	0	Cumulative volume total of pre-wet liquid applied.
Anti	tOtL	0	Cumulative volume total of anti-ice liquid applied.

4. 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

[VOLUME GRAN] and volume of liquid (gal)[lit] in pre-wet tank and/or anti-ice tank in

[VOLUME LIQ]. These volumes must be re-entered each time box or tank is loaded.

5. 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 [BLAST CAL 3]

for 5 seconds until DATA display flashes. To zero this total, enter a "0".

6. 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.

7. CONTROL VALVE DELAY

Depress [SPEED CAL 4] until DATA display flashes. 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.

8. AUTOMATIC 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 RATE +/- depress

[GRAN CAL 9] for granular or [LIQ CAL 0] for pre-wet and anti-ice until DATA display flashes.

To enter a value depress [ENTER], increment value, and [ENTER]. When using this feature the preprogrammed application rates will be changed accordingly.

EXAMPLE: If granular rate is to change by "10":
Enter a value of 10 for 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.

9. 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 GRAN or LIQ display screen will flash "LEul". 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)   Depress [VOLUME GRAN] for granular or [VOLUME LIQ] for liquid until the DATA display

flashes.

b)   To enter a value, depress [ENTER], LOW TANK ALARM value, and [ENTER].

NOTE: Go to DATA MENU to silence audible alarm.

10. 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 GRAN or LIQ display screen. Depress [DATA MENU] until the GRAN display

shows "Fr". LIQ display will show "FLGr". DATA display will show ".0". To advance

through the categories depress [▲ 1].

DISPLAY SCREENS

GRAN	LIQ	DATA	DESCRIPTION
Fr	FLGr	.0	Displays actual vol/min of granular material.
Fr	FLPr	.0	Displays actual vol/min of pre-wet liquid.
Fr	FLAn	.0	Displays actual vol/min of anti-ice liquid.
Fr	LLGr	.0	Granular system minimum vol/min value.
Fr	LLPr	.0	Liquid pre-wet system minimum vol/min value.
Fr	LLAn	.0	Liquid anti-ice system minimum vol/min value.

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 the minimum flow ("LLGr", "LLPr", or "LLAn").

DATA MENU
DEFINITION OF DATA MENU KEYS:

DATA MENU — Depressing this key displays the selected Data Menu category in the GRAN display.

DATA MENU — Depressing this key again increments through the Data Menu categories ("SPr", "GPS", "dAtE", etc...) in the GRAN display.

1 — Depressing this key (after desired category is shown in GRAN display) advances up through desired features within a category. Selected feature is shown in the LIQ display.

2 — Depressing this key (after desired category is shown in GRAN display) advances down through desired features within a category. Selected feature is shown in the LIQ display.

TEMPERATURE SCREENS

Allows air and road surface temperature to be displayed with additional sensor and cable installed.

TEMPERATURE ON/OFF

a) GRAN display will show "tENP". LIQ display will show "tENP". DATA display will show "oFF".

b) Depressing [CE] steps the DATA display between "on" and "oFF". A setting of "on" enables the temperature feature, a setting of "oFF" disables the temperature feature.

c) Depress [▲ 1] to advance to TEMPERATURE MODE.

TEMPERATURE MODE

a) GRAN display will show "tENP". LIQ display will show "NodE". DATA display will show "FAr".

b) Depressing [CE] steps the DATA display between "FAr" and "CEL".

"FAr" setting displays temperature in fahrenheit and "CEL" displays temperature in celsius.

c) Depress [▲ 1] to advance to TEMPERATURE DISPLAY.

TEMPERATURE DISPLAY

a) GRAN display will show "tENP". LIQ display will show "Err". DATA display will show "Err".

b) When connected to the temperature sensor, the LIQ display will show "A000". DATA display will show "P000". LIQ display represents ambient/air temperature and DATA display represents pavement temperature.

c) BAUD RATE must be set to 9600. For more information, refer to the SERIAL PORT screen section of the DATA MENU.

d) Depress [▲ 1] to advance to TEMPERATURE ON/OFF.

e) Depress [DATA MENU] to advance to SERIAL PORT SCREENS.

SERIAL PORT SCREENS

CONSOLE DATA PRINTOUT

a) GRAN display will show "SPr". LIQ display will show "Prn". DATA display will show "CAL". To print calibration numbers, depress [ENTER].
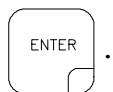
b) Depress [CE] to advance to print begin. GRAN display will show "SPr". LIQ display will show "Prn". DATA display will show "bEGn".

To print beginning totals, depress [ENTER].

c) Depress [CE] to advance to print end. GRAN display will show "SPr". LIQ display will show "Prn". DATA display will show "End". To print ending totals, depress [ENTER]. While "End" is in the DATA display; if a beginning total or calibration numbers printout is required, depress [CE] to advance the DATA display to "bEGn" or "CAL".

NOTE: If "End" is printed and a CAL number has been changed, a warning will be printed (print CAL to see which number has changed).

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d) Depress [▲ 1] to advance to TRUCK NUMBER.

TRUCK NUMBER
   a) GRAN display will show "SPrt". LIQ display and DATA display will show "0". The truck number can be entered in as 8 digits.
   b) Enter the truck number.
   c) Depress [▲ 1] to advance to BAUD RATE.

BAUD RATE
   a) GRAN display will show "SPr". LIQ display will show "bAUd". DATA display will show "1200".
   b) Depressing [CE] steps the DATA display between "1200" and "9600".
   c) Depress [▲ 1] to advance to RATE CHANGE ALARM ON/OFF.

RATE CHANGE ALARM ON/OFF
   a) GRAN display will show "SPr". LIQ display will show "rAtE". DATA display will show "on".
   b) Depressing [CE] steps the DATA display between "on" and "oFF". A

value of "on" means alarm is enabled; a value of "oFF" means alarm is disabled.

c)   Depress [▲1] to advance to DATA LOGGER TRIGGER VALUE.

DATA LOGGER TRIGGER VALUE

a)   GRAN display will show "SPr". LIQ display will show "triG". DATA display will show "0".

b)   Enter the TRIGGER VALUE.

c)   Depress [▲1] to advance to DATA LOGGER TRIGGER UNITS.

> **IMPORTANT:** The TRIGGER VALUE 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 LOGGER TRIGGER UNITS

a)   GRAN display will show "SPr". LIQ display will show "Unit". DATA display will show "Ft"["MEtr"].

b)   Depressing [CE] steps the DATA display between "Ft"["MEtr"] and "SEC".

A value of "Ft"["MEtr"] means feet [meters], or a value of "SEC" means seconds have been chosen as the unit of measurement for the TRIGGER VALUE programmed previously.

c)   Depress [▲1] to advance to DATA LOGGER.

DATA LOGGER ON/OFF

a)   The DATA LOGGER uses set communications 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 LOGGER TRIGGER VALUE and DATA LOGGER TRIGGER UNITS. Upon each trigger, 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)   GRAN display will show "SPr". LIQ display will show "dLoG". DATA display will show "oFF".

c)   Depressing [CE] steps the DATA display between "oFF" and "on". A value of "oFF" means DATA LOGGER is disabled; a value of "on" means DATA LOGGER is enabled

d)   Depress [▲1] to advance to CONSOLE DATA PRINTOUT.

e)   Depress [DATA MENU] to advance to the GLOBAL POSITIONING SYSTEM SCREENS.

GLOBAL POSITIONING SYSTEM SCREENS

GPS SYSTEM OPTIONS

a) GPS is inactive when the GRAN display shows "GPS", the LIQ display shows "SYSt", and the DATA display shows "inAC". The GPS features are explained further in the APPLICATION MANAGEMENT SYSTEM manual.

b) Depress [▲ 1] to advance to GPS FILE REFERENCE.

c) Depress [DATA MENU] to advance to the DATE SCREENS.

DATE SCREENS

TIME

a) GRAN display will show "dAtE". LIQ display will show "tiME". The DATA display will show "0:00".

b) Enter the current time of day.

c) Depress [▲ 1] to advance to MONTH.

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.

MONTH

a) GRAN display will show "dAtE". LIQ display will show "onth". The DATA display will show "0".

b) Enter the current month by number (i.e. 1 = January, 2 = February, etc.).

c) Depress [▲ 1] to advance to DAY.

DAY

a) GRAN display will show "dAtE". LIQ display will show "dAY". The DATA display will show "0".

b) Enter the current day of the month.

c) Depress [▲ 1] to advance to YEAR.

YEAR

a) GRAN display will show "dAtE". LIQ display will show "YEAr". The DATA display will show "00".

b) Enter the current year.

c) Depress [▲ 1] 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) GRAN display will show "dAtE". LIQ display will show "P dn". The DATA display will show "30".

c) To change the delay time enter a new number from 0 to 200 days.

d) Depress [▲ 1] to advance to TIME.

e) Depress [DATA MENU] to advance to the FLOW RATE SCREENS.

FLOW RATE SCREENS

GRANULAR VOLUME/MINUTE

a) GRAN display will show "Fr". LIQ display will show "FLGr". The DATA display will show the volume per minute of granular material.

b) Depress [▲ 1] to advance to PRE-WET VOLUME/MINUTE.

PRE-WET VOLUME/MINUTE

a) GRAN display will show "Fr". LIQ display will show "FLPr". The DATA display will show the volume per minute of pre-wet liquid.

b) Depress [▲ 1] to advance to ANTI-ICE VOLUME/MINUTE.

ANTI-ICE VOLUME/MINUTE

a) GRAN display will show "Fr". LIQ display will show "FLAn". DATA display will show the volume per minute of anti-ice liquid.

b) Depress [▲ 1] to advance to GRANULAR LOW LIMIT FLOW ALARM.

GRANULAR LOW LIMIT FLOW ALARM

a) If the actual volume per minute falls below the set limit, the valve stops closing, an alarm sounds and the GRAN display flashes "-LL-".

b) GRAN display will show "Fr". LIQ display will show "LLGr". DATA display will show ".0".

c) Enter the low limit of the system (lb/min) [kg/min].

d) Depress [▲ 1] to advance to PRE-WET LOW LIMIT FLOW ALARM.

PRE-WET LOW LIMIT FLOW ALARM

    a)   If the actual volume per minute falls below the set limit, the valve stops closing, an alarm sounds and the LIQ display flashes "-LL-".

    b)   GRAN display will show "Fr". LIQ display will show "LLPr". DATA display will show ".0".

    c)   Enter the low limit of the system (gal/min) [lit/min].

    d)   Depress [▲1] to advance to ANTI-ICE LOW LIMIT FLOW ALARM.

ANTI-ICE LOW LIMIT FLOW ALARM

    a)   If the actual volume per minute falls below the set limit, the valve stops closing, an alarm sounds and the LIQ display flashes "-LL-". Enter the low limit in gallons [liters] per minute of the system.

    b)   GRAN display will show "Fr". LIQ display will show "LLAn". DATA display will show ".0".

    c)   Enter the low limit (gal/min) [lit/min].

    d)   Depress [▲1] to advance to TIER 2 ENABLE.

TIER 2 ENABLE

    a)   If the actual volume per minute is equal to or greater than the set flow rate, the tier valve opens.

    b)   GRAN display will show "Fr". LIQ display will show "tir2". DATA display will show ".0".

    c)   Enter the flow rate (gal/min) [lit/min].

    d)   Depress [▲1] to advance to TIER 3 ENABLE.

TIER 3 ENABLE

    a)   If the actual volume per minute is equal to or greater than the set flow rate, the tier valve opens.

    b)   GRAN display will show "Fr". LIQ display will show "tir3". DATA display will show ".0".

    c)   Enter the flow rate (gal/min) [lit/min].

    d)   Depress [▲1] to advance to PERCENT TIER DISABLE.

PERCENT TIER DISABLE

    a)   The percentage below the tier enable (flow rate) when the tier valve turns off.

    b)   GRAN display will show "Fr". LIQ display will show "bAnd". DATA display will show "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 ⏶1 to advance to GRANULAR VOLUME/MINUTE.

e)   Depress [DATA MENU] to advance to ALARM SCREENS.

ALARM SCREENS

AUDIBLE ALARM ON/OFF

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

    a)   GRAN display will show "ALr". LIQ display will show "ALrM". DATA display
will show "on".

    b)   Depressing [CE] steps the DATA display between "on" and "off". A value

         of "on" enables the audible alarm; a value of "oFF" disables the audible
alarm.

    c)   Depress ⏶1 to advance to GRANULAR OFF RATE ALARM.

GRANULAR OFF RATE ALARM

    Alarm sounds and GRAN 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 12%, but may be changed to a different number. A value of "0" will
disable this alarm.

    a)   GRAN display will show "ALr". LIQ display will show "Gror". DATA display
will show 12.

    b)   Depress ⏶1 to advance to LIQUID OFF RATE ALARM.

LIQUID OFF RATE ALARM

    Alarm sounds and LIQ 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)   GRAN display will show "ALr". LIQ display will show "Lior". DATA display
will show 30.

c)   Depress [DATA MENU] to advance to MISCELLANEOUS SCREENS.

NO SPEED ALARM

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

a)   The NO SPEED ALARM is 3 beeps followed by an 8 second pause which is repeated continuously.

b)   The alarm light will follow in sequence.

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 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 "LEuL" in the GRAN or LIQ display screen depending on which material has reached the alarm level.

b)   Depress VOLUME/GRAN or VOLUME/LIQ key for 5 seconds until DATA display flashes and enter a "0" to disable this feature.

MISCELLANEOUS SCREENS

DISPLAY SMOOTHING ON/OFF

a)   GRAN display will show "MiSC". LIQ display will show "diSP". DATA display will show "on".

b)   Depressing [CE] steps the DATA display 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 [▲1] to advance to MANUAL CONTROL ON/OFF.

MANUAL CONTROL ON/OFF

a) GRAN display will show "MiSC". LIQ display will show "MAn". DATA display will show "oFF".

b) Depressing [CE] steps the DATA display between "on" and "oFF". 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 [▲ 1] to advance to SPINNER CONTROL ON/OFF.

SPINNER CONTROL ON/OFF

a) GRAN display will show "MiSC". LIQ display will show "SPin". DATA display will show "oFF".

**b)** Depressing [CE] steps the DATA display between "on" and oFF". A value of "on" means spinner is on whenever MASTER is ON; a value of "oFF" means spinner goes on and off when granular bed/auger is on and off.

NOTE: Spinner must be "on" to calibrate spinner offsets.

---

c) Depress [▲ 1] to advance to DISPLAY SMOOTHING.

d) Depress [DATA MENU] to advance to OFFSET SCREENS.

OFFSET SCREENS

a) See pages 15, 16, 17, and 18 for OFFSET SCREENS.

b) Depress [DATA MENU] to advance to CAL SCREENS.

CAL SCREENS

CAL SPEED ON/OFF

a) GRAN display will show "CAL". LIQ display will show "SPEd". DATA display will show "on or oFF".

b) Depress [CE] to turn CAL speed to "on". This will allow the use of the

[▲ 1] and [▼ 2] keys to match the speed of the truck with the console.

Depress [CE] to turn CAL speed to "oFF" when calibrated.

> **NOTE:** This is not an exact reading. See Appendix 1, section 2 "CALCULATING
> SPEED CAL" for further instructions.

    c)   Depress [▲1] to advance to GRANULAR CAL**.**

GRANULAR CAL

    a)   GRAN display will show "CAL". LIQ display will show "GrAn". DATA display
will show "on or oFF".

    b)   Depress [CE] to turn GRAN CAL to "on".

    c)   For calibration see section "CALCULATING GRAN METER CAL".

    d)   Depress [▲1] to advance to GRANULAR CAL TOTAL.

GRANULAR CAL TOTAL

    a)   GRAN display will show "CAL". LIQ display will show "Grto". DATA display
will show "0".

    b)   Enter in total pounds (kg) of material unloaded when GRAN CAL is on.

    c)   Depress [▲1] to advance to CAL 2 SPEED.

CAL 2 SPEED

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

    a)   GRAN display will show "CAL". LIQ display will show "LSPd". DATA display
will show "0.00".

    b)   Enter in the low gear ratio as indicated on the line sheet or tag.

    c)   Depress [▲1]. GRAN display will show "CAL". LIQ display will show "hSPd".

DATA display will show "0.00".

    d)   Enter the high gear ratio as indicated on the line sheet or tag.

    e)   Depress [▲1] to advance to CAL FREQUENCY.

COIL FREQUENCY

    a)   GRAN display will show "CAL". LIQ display will show "FrEq". DATA display
will show "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 [▲1] to advance to CAL SPEED.

    d)   Depress [DATA MENU] to advance to LANE SCREENS.

LANE SCREENS

LANE WIDTH

    a)   GRAN display will show "LAnE". LIQ display will show "LanE". DATA display will show "0".

    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 ▲1 to advance to LEFT LANE WIDTH.

LEFT LANE WIDTH

    a)   GRAN display will show "LAnE". LIQ display will show "LEFt". DATA display will show "0".

    b)   Enter the left lane width (inches)[cm].

    c)   Depress ▲1 to advance to CENTER LANE WIDTH.

CENTER LANE WIDTH

    a)   GRAN display will show "LAnE". LIQ display will show "Cntr". DATA display will show "0".

    b)   Enter the center lane width (inches)[cm].

    c)   Depress ▲1 to advance to RIGHT LANE WIDTH.

RIGHT LANE WIDTH

    a)   GRAN display will show "LAnE". LIQ display will show "rGht". DATA display will show "0".

    b)   Enter the right lane width (inches)[cm].

    c)   Depress ▲1 to advance to LANE WIDTH.

    d)   Depress DATA MENU to advance to SAND BLAST SCREENS.

SAND BLAST SCREENS

    a)   Displays blast day distance, total distance, day volume, and total volume for sand product.

    b)   Depress ▲1 to advance through sand blast screens.

    c)   Depress DATA MENU to advance to SALT BLAST SCREENS.

SALT BLAST SCREENS

    a)   Displays blast day distance, total distance, day volume, and total volume for salt product.

b) Depress [▲1] to advance through salt blast screens.

c) Depress [DATA MENU] to advance to PRODUCT 1 BLAST SCREENS.

PRODUCT 1 BLAST SCREENS

a) Displays blast day distance, total distance, day volume, and total volume for product 1 material.

b) Depress [▲1] to advance through product 1 blast screens.

c) Depress [DATA MENU] to advance to PRODUCT 2 BLAST SCREENS.

PRODUCT 2 BLAST SCREENS

a) Displays blast day distance, total distance, day volume, and total volume for product 2 material.

b) Depress [▲1] to advance through product 2 blast screens.

c) Depress [DATA MENU] to advance to PRE-WET BLAST SCREENS.

PRE-WET BLAST SCREENS

a) Displays blast day distance, total distance, day volume, and total volume for pre-wet product.

b) Depress [▲1] to advance through pre-wet blast screens.

c) Depress [DATA MENU] to advance to ANTI-ICE BLAST SCREENS.

ANTI-ICE BLAST SCREENS

a) Displays blast day distance, total distance, day volume for anti-ice product.

b) Depress [▲1] to step through anti-ice blast screens.

c) Depress [DATA MENU] to advance to TEMPERATURE SCREENS.

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.
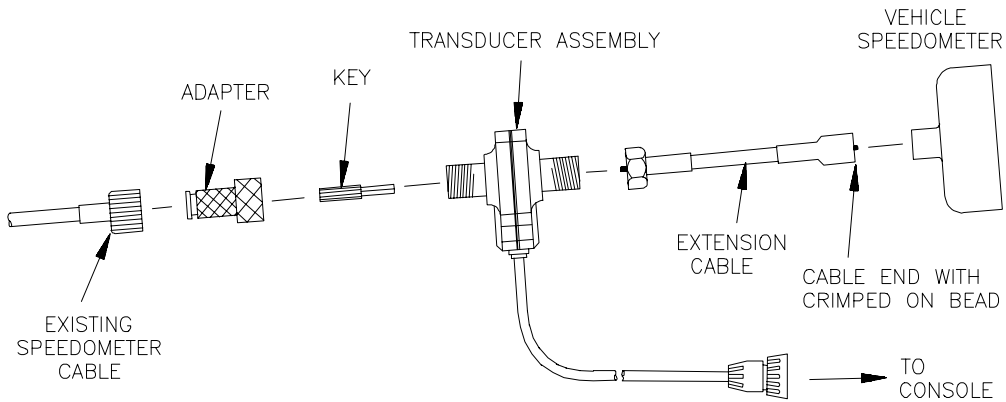
4)   Push Extension Cable through fire wall and re-install on speedometer.

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 [DISTANCE] .

    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 = 612 [155]
                      Target distance reading = 5280 [1000]
                      Assume the actual DISTANCE display reads 5000 [980]

ENGLISH UNITS: **METRIC UNITS:**

$$= \frac{612 \times 5280}{5000} = 646.3 \qquad = \frac{[155] \times [1000]}{[980]} = [158.1]$$

6)   The corrected number to enter for SPEED CAL is 646 [158].

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:

For **PULSE-WIDTH MODULATED/
BOOSTER AMP** (P):
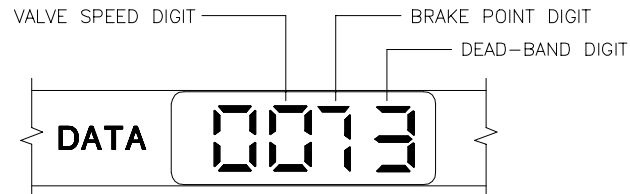
Valve Backlash Digit --   Controls the time of the first correction pulse after a change in correction direction is detected. (INC to DEC -or- DEC to INC).

                                Range: 1 to 9   1-Short Pulse, 9-Long Pulse

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%

MANUFACTURER	VALVE CAL NUMBER	COIL FREQUENCY
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

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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) SPINNER HIGH OFFSET

    a)   Depress [DATA MENU] until GRAN display shows "oFS". LIQ display will show "SPhi". DATA display will show "254".

    b)   Depressing [ENTER] allows the user to use the [▲ 1] and [▼ 2] keys to set to offset desired.

    c)   After desired value is set, depress [ENTER]. HIGH OFFSET is now set.

    d)   Depress [▲ 1] to advance to SPINNER LOW OFFSET.

2) SPINNER LOW OFFSET

    a)   GRAN display will show "oFS". LIQ display will show "SPLo". DATA display will show "2".

    b)   Depressing [ENTER] allows the use of the [▲ 1] and [▼ 2] keys to set the offset desired.

    c)   After desired value is set, depress [ENTER]. LOW OFFSET is now set.

    d)   Depress [▲ 1] to advance to GRANULAR HIGH OFFSET.

3) GRANULAR HIGH OFFSET

    a)   GRAN display will show "oFS". LIQ display will show "Grhi". DATA display will show "254".

    b)   Depressing [ENTER] allows the use of the [▲ 1] and [▼ 2] keys to set the offset desired.

    c)   After desired value is set, depress [ENTER]. HIGH OFFSET is now set.

D)   Depress [▲1] to advance to GRANULAR LOW OFFSET.

4)   **GRANULAR LOW OFFSET**
  A)   GRAN display will show "oFS". LIQ display will show "GrLo". DATA display will show "2".

  B)   Depressing [ENTER] allows the use of the [▲1] and [▼2] keys to set the offset desired.

  C)   After desired value is set, depress [ENTER]. LOW OFFSET is now set.

  D)   Depress [▲1] 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, Prd1 or Prd2 LIQ CAL

---

5)   **PRE-WET HIGH OFFSET**
  A)   GRAN display will show "oFS". LIQ display will show "Prhi". DATA display will show "254".

  B)   Depressing [ENTER] allows the use of the [▲1] and [▼2] keys to set the offset desired.

  C)   After desired value is set, depress [ENTER]. HIGH OFFSET is now set.

  D)   Depress [▲1] to advance to PRE-WET LOW OFFSET.

6)   **PRE-WET LOW OFFSET**
  A)   GRAN display will show "oFS". LIQ display will show "PrLo". DATA display will show "2".

  B)   Depressing [ENTER] allows the use of the [▲1] and [▼2] keys to set the offset desired.

  C)   After desired value is set, depress [ENTER]. LOW OFFSET is now set.

  D)   Depress [▲1] to advance to ANTI-ICE HIGH OFFSET.

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7)   ANTI-ICE HIGH OFFSET

a)   GRAN display will show "oFS". LIQ display will show "Anhi". DATA display will show "254".

b)   Depressing [ENTER] allows the user to use the [▲1] and [▼2] keys to set to offset value desired.

c)   After desired value is set, depress [ENTER]. HIGH OFFSET is now set.

d)   Depress [▲1] to advance to ANTI-ICE LOW OFFSET.

8)   ANTI-ICE LOW OFFSET

a)   GRAN display will show "oFS". LIQ display will show "AnLo". DATA display will show "2".

b)   Depressing [ENTER] allows the use of the [▲1] and [▼2] keys to set the offset value desired.

c)   After desired value is set, depress [ENTER]. LOW OFFSET is now set.

d)   Depress [▲1] to advance to SPINNER HIGH OFFSET.

e)   Depress [DATA MENU] to advance to CAL SCREENS.

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.

KEYWAY

10 O'CLOCK   2 O'CLOCK
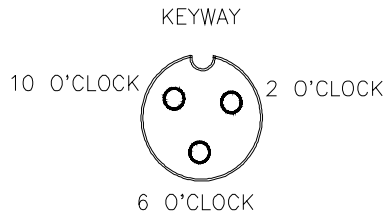
6 O'CLOCK

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 [SPEED CAL 4] .

2)   Depress [DISTANCE] .

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.

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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:

KEYWAY

10 O'CLOCK   2 O'CLOCK
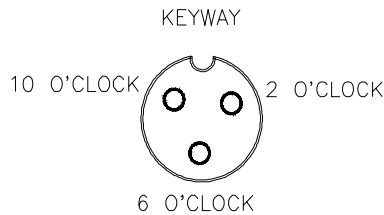
6 O'CLOCK

```
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 [GRAN METER CAL 5] for granular cable; [LIQ METER CAL 6] for liquid cable.

2)   Depress [TOTAL GRAN VOLUME] for granular cable; [TOTAL LIQ VOLUME] 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.
```

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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 METER CAL number of 10 [38] in [LIQ METER CAL 6].

2) Enter a TOTAL LIQ VOLUME of 0 in [TOTAL LIQ VOLUME].

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

Corrected METER CAL   =   LIQ METER CAL x TOTAL LIQ VOLUME
                               Predetermined amount of measured liquid

                      ENGLISH UNITS: METRIC UNITS:

$$= \frac{720 \times 260}{250} = 749 \qquad = \frac{[190] \times [984]}{[946]} = [198]$$

Corrected LIQ METER CAL = 749 [198]

9) Enter corrected LIQ METER 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
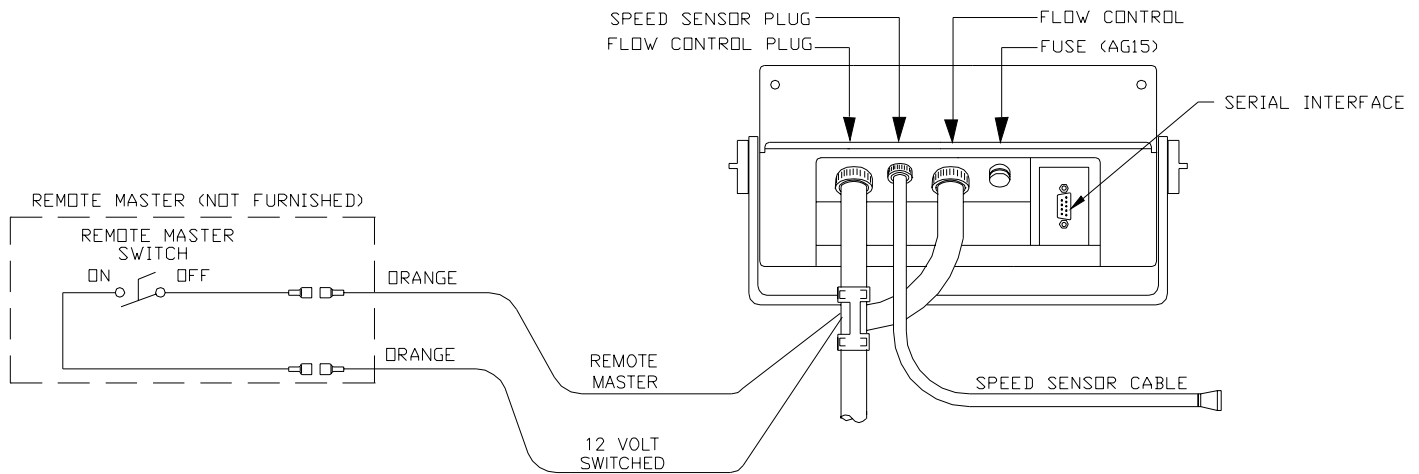
FIGURE 8

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, Prd1, or Prd2.

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
SERIAL INTERFACE

1) Cable pinout (P/N 115-0159-624), supplied with Thermal Printer Kit
(P/N 117-0159-529).

```
                                    DSR  6 ←――――――――  5
                                    CTS  8 ←――――┘
            RAVEN                   DTR  4 ――――――――→  6        Printer
            CONSOLE                 TXD  3 ――――――――→  2        25 Pin
            9 PIN                   RXD  2 ←――――――――  3
                                    GND  5 ――――――――   7
```
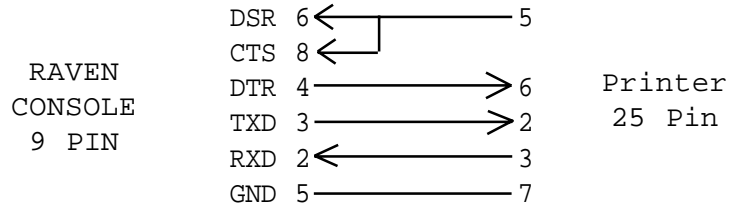
2) Changing GRAN CAL and LIQ CAL by remote computer.
   a) Configuration of RS-232C serial port:

        1200 or 9600 Baud Rate
        NO Parity
        8 Data Bits
        2 Stop Bits

   b) Data stream to Raven Console.

   EXAMPLE: Change GRAN to 1234 and LIQ to 6.5

```
              $R,RC,1234,65<CR><LF>
                                              Line Feed
    Communication
    string      Rate  Cal   GRAN    LIQ      Carriage
                            = 1234  = 6.5    Return
```
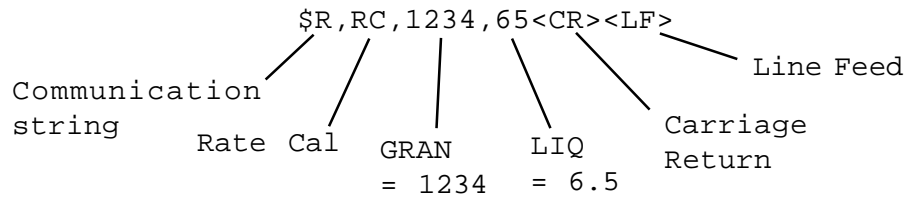
   Decimal point is not sent from Remote Computer to Raven Console.

3) Optional 9 pin to 9 pin cable pinout [(P/N 115-0159-822) - 10 ft.
                                              (P/N 115-0171-040) - 3 ft.]

```
                                DSR  6 ←――――――  4
                                CTS  8 ←――――┘
            RAVEN               DTR  4 ――――――→  6        COMPUTER/
            CONSOLE                   └―――――→  8           GPS
            9 PIN               TXD  3 ――――――→  2         9 Pin
                                RXD  2 ←――――――  3
                                GND  5 ――――――   5
```
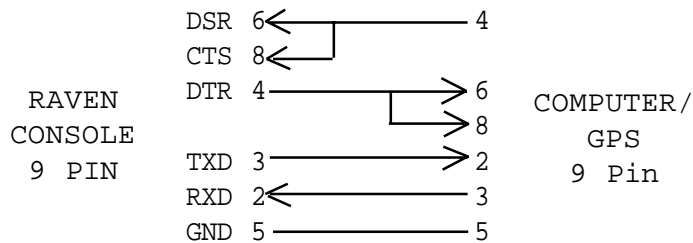
APPENDIX 10
DCS 710 DATA MENU REFERENCE GUIDE

DATA MENU

The DCS 710 has multiple features that are located in the DATA MENU key. The following are brief descriptions of features available under the DATA MENU and the default settings for these features:

DISPLAY SCREENS

GRAN	LIQ	DATA	FEATURE
TEMPERATURE SCREENS			
tENP	tENP	oFF	**TEMP ON OR OFF**
tENP	NodE	FAr	**SELECTS TEMP MODE** **FAR = FARENHEIT** **CEL = CELSIUS**
tENP	Err	Err	**DISPLAYS ERROR IF SENSOR MALFUNCTIONS OR INSTALLED INCORRECTLY.**
tENP	A	P	**A = AMBIENT TEMP P = PAVEMENT TEMP**
SERIAL PORT SCREENS			
SPr	Prn	CAL/bEGn/End	**CONSOLE DATA PRINTOUT**
SPrt		0	**TRUCK NUMBER**
SPr	bAUd	1200	**BAUD RATE**
SPr	rAtE	on	**RATE CHANGE ALARM ON/OFF**
SPr	triG	0	**DATA LOGGER TRIGGER VALUE**
SPr	Unit	Ft	**DATA LOGGER TRIGGER UNITS**
SPr	dLoG	oFF	**DATA LOGGER ON/OFF**
GLOBAL POSITIONING SYSTEM SCREENS			
GPS	SYSt	inAC	**GPS SYSTEM OPTIONS**
DATE SCREENS			
dAtE	tiME	0:00	**TIME**
dAtE	onth	0	**MONTH**
dAtE	dAY	0	**DATE**
dAtE	YEAr	0	**YEAR**
dAtE	P dn	30	**POWER DOWN**

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DISPLAY SCREENS

GRAN	LIQ	DATA	FEATURE
FLOW RATE SCREENS			
Fr	FLGr	.0	**VOLUME/MINUTE GRANULAR**
Fr	FLPr	.0	**VOLUME/MINUTE PRE-WET**
Fr	FLAn	.0	**VOLUME/MINUTE ANTI-ICE**
Fr	LLGr	.0	**GRANULAR LOW LIMIT ALARM**
Fr	LLPR	.0	**PRE-WET LOW LIMIT ALARM**
Fr	LLAn	.0	**ANTI-ICE LOW LIMIT ALARM**
Fr	tir2	.0	**TIER 2 ENABLE VALUE**
Fr	tir3	.0	**TIER 3 ENABLE VALUE**
Fr	bAnd	.0	**TIER DISABLE PERCENTAGE**
ALARM SCREENS			
ALr	ALrM	on	**AUDIBLE ALARMS ON/OFF**
ALr	Gror	12	**GRANULAR OFF RATE ALARM**
ALr	Lior	30	**LIQUID OFF RATE ALARM**
MISCELLANEOUS SCREENS			
MiSC	diSP	on	**DISPLAY SMOOTHING ON/OFF**
MiSC	MAn	oFF	**MANUAL CONTROL ON/OFF**
MiSC	SPin	on	**SPINNER CONTROL ON/OFF**
OFFSET SCREENS			
oFS	SPhi	254	**SPINNER HIGH OFFSET**
oFS	SPLo	2	**SPINNER LOW OFFSET**
oFS	Grhi	254	**GRANULAR HIGH OFFSET**
oFS	GrLo	2	**GRANULAR LOW OFFSET**
oFS	Prhi	254	**PRE-WET HIGH OFFSET**
oFS	PrLo	2	**PRE-WET LOW OFFSET**
oFS	Anhi	254	**ANTI-ICE HIGH OFFSET**
oFS	AnLo	2	**ANTI-ICE LOW OFFSET**

DISPLAY SCREENS

GRAN	LIQ	DATA	FEATURE
CAL SCREENS			
CAL	SPEd	oFF	**SPEED CALIBRATION**
CAL	GrAn	oFF	**GRANULAR CALIBRATION**
CAL	Grto	0	**GRANULAR TOTAL**
CAL	LSPd	0.00	**TWO SPEED CAL (Low gear ratio)**
CAL	hSPd	0.00	**TWO SPEED CAL (High gear ratio)**
CAL	FrEq	180	**COIL FREQUENCY (PWM Valve)**
LANE SCREENS			
LAnE	LAnE	12	**LANE WIDTH**
LAnE	LEFt	144	**LEFT LANE WIDTH**
LAnE	Cntr	144	**CENTER LANE WIDTH**
LAnE	rGht	144	**RIGHT LANE WIDTH**
SAND BLAST SCREENS			
bLSd	ddAY	0.00	**SAND DAY DISTANCE**
bLSd	dtoL	0	**SAND TOTAL DISTANCE**
bLSd	udAY	0.00	**SAND DAY VOLUME**
bLSd	utoL	.0	**SAND TOTAL VOLUME**
SALT BLAST SCREENS			
bLSt	ddAY	0.00	**SALT DAY DISTANCE**
bLSt	dtoL	0	**SALT TOTAL DISTANCE**
bLSt	udAY	0.00	**SALT DAY VOLUME**
bLSt	utoL	.0	**SALT TOTAL VOLUME**
PRODUCT 1 BLAST SCREENS			
bLP1	ddAY	0.00	**PRODUCT 1 DAY DISTANCE**
bLP1	dtoL	0	**PRODUCT 1 TOTAL DISTANCE**
bLP1	udAY	0.00	**PRODUCT 1 DAY VOLUME**
bLP1	utoL	.0	**PRODUCT 1 TOTAL VOLUME**

DISPLAY SCREENS

GRAN	LIQ	DATA	FEATURE
PRODUCT 2 BLAST SCREENS			
bLP2	ddAY	0.00	**PRODUCT 2 DAY DISTANCE**
bLP2	dtoL	0	**PRODUCT 2 TOTAL DISTANCE**
bLP2	udAY	0.00	**PRODUCT 2 DAY VOLUME**
bLP2	utoL	.0	**PRODUCT 2 TOTAL VOLUME**
PRE-WET BLAST SCREENS			
bLPr	ddAY	0.00	**PRE-WET DAY DISTANCE**
bLPr	dtoL	0	**PRE-WET TOTAL DISTANCE**
bLPr	udAY	0	**PRE-WET DAY VOLUME**
bLPr	utoL	0	**PRE-WET TOTAL VOLUME**
ANTI-ICE BLAST SCREENS			
bLAn	ddAY	0.00	**ANTI-ICE DAY DISTANCE**
bLAn	dtoL	0	**ANTI-ICE TOTAL DISTANCE**
bLAn	UdAY	0	**ANTI-ICE DAY VOLUME**
bLAn	utoL	0	**ANTI-ICE TOTAL VOLUME**

NOTES

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.