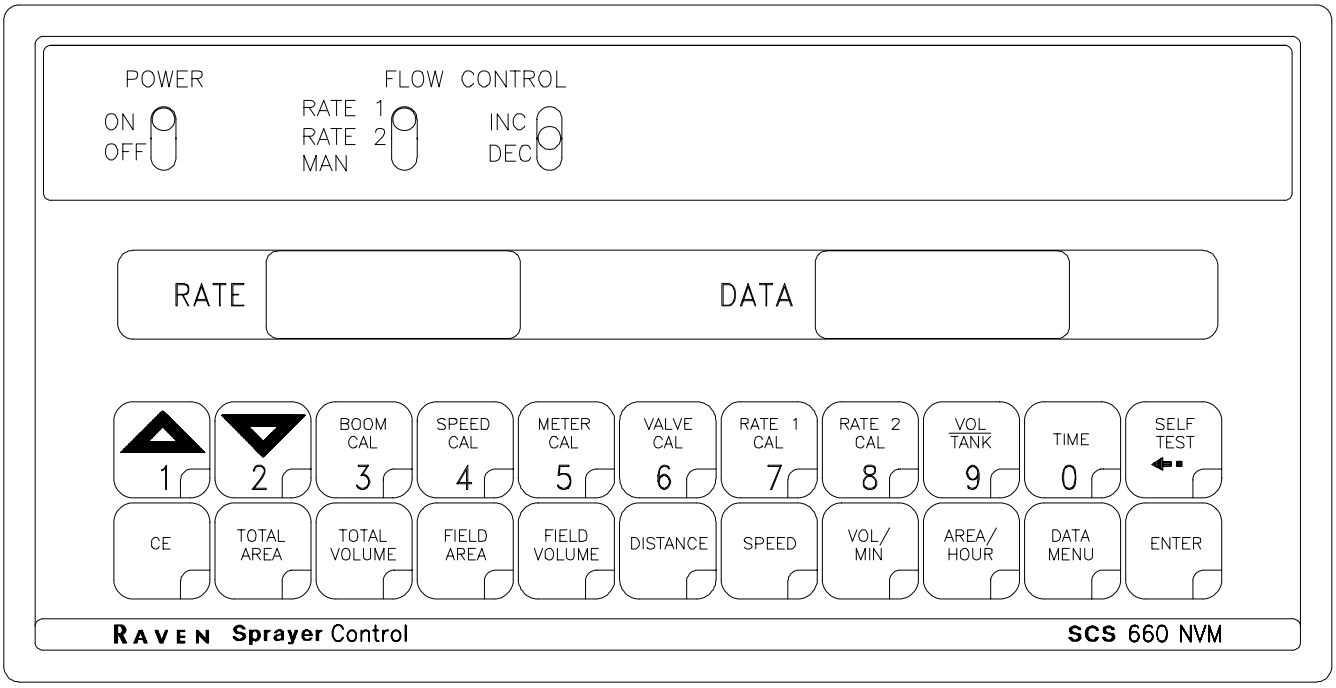
RAVEN

INDUSTRIES

SCS 660

FOR GRANULAR APPLICATIONS



INSTALLATION AND SERVICE MANUAL

016-0159-572
9/97

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APPENDIXES

SYMBOL DEFINITION

PPM	- Pounds per minute
kg/min	- Kilograms per minute
PPA	- Pounds per acre
kg/ha	- Kilograms per hectare
PPK	- Pounds per 1,000 sq. ft.
mm	- Millimeters
cm	- Centimeters
dm	- Decimeters
m	- Meter
MPH	- Miles per hour
km	- Kilometers
km/h	- Kilometers per hour
US	- Volume per acre
SI	- Volume per hectare
TU	- Volume per 1,000 sq. ft.
[]	- Metric numbers
{}	- 1,000 sq. ft. numbers

DRY CONVERSIONS

Pound x 2.2 = Kilograms
Kilograms x .455 = Pounds

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

AREA

1 square meter = 10.764 square feet
1 hectare (ha) = 2.471 acres; 10,000 square meters
1 acre = 0.405 hectare; 43,560 square feet
1 square mile = 640 acres; 258.9 hectares

VOLUME

1 cubic meter = 1000 liters
1 cubic centimeter = 1 milliliter

INTRODUCTION

The Raven SCS 660 (CONTROL SYSTEM) is designed to improve the uniformity of granular applications. Its performance relies on installation and preventive maintenance of the complete spreader. 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 SCS 660 consists of a Control Console, a Speed Sensor, an Encoder, and a Hydraulic Control Valve. The Console mounts directly in the cab of the vehicle for easy operator use. The Radar Speed Sensor is mounted to the frame of the spreader implement. (Other Speed Sensors are also available). The Hydraulic Control Valve mounts to the framework of the vehicle and the Encoder mounts to the conveyor drive shaft. Appropriate cabling is furnished for field installation.

The operator sets the target weight per area to be applied and the SCS 660 automatically maintains the application regardless of vehicle speed or gear selection. A manual override switch allows the operator to manually control application for system check-out and spot application. Actual weight per area being applied is displayed at all times. The SCS 660 additionally functions as an area monitor, speed monitor, and volume totalizer.

NOTE: The SCS 660 Control Console is designed to be used with external Boom switches. In order for the Console to know when and which Boom is ON or OFF, Boom signal wires are provided.

INSTALLATION

1. MOUNTING THE RAVEN RADAR SPEED SENSOR

See Appendix 8 for Wheel Drive Speed Sensor installation instructions.
See Appendix 9 for Speedometer Drive Speed Sensor installation instructions.

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.

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. Obstructions 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 implement.

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 Console. The Red wire should be connected to the Orange cable wire. The White wire should be connected to the negative terminal of the battery. See Figure 10.

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

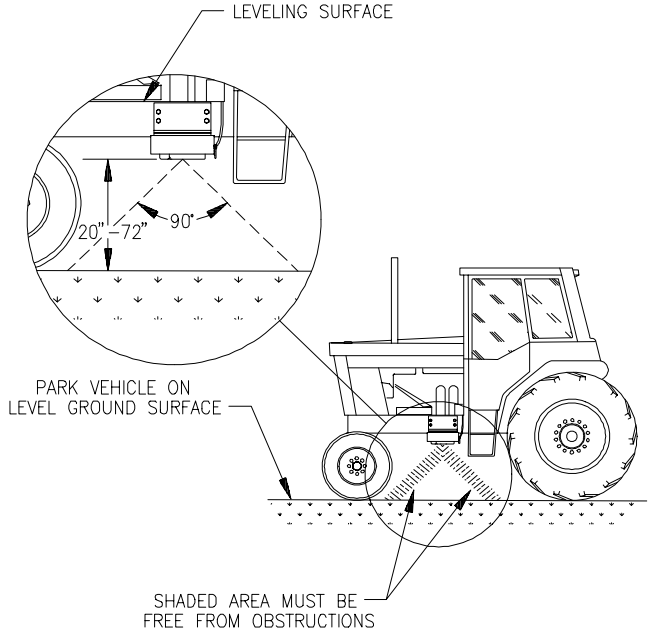


FIGURE 1

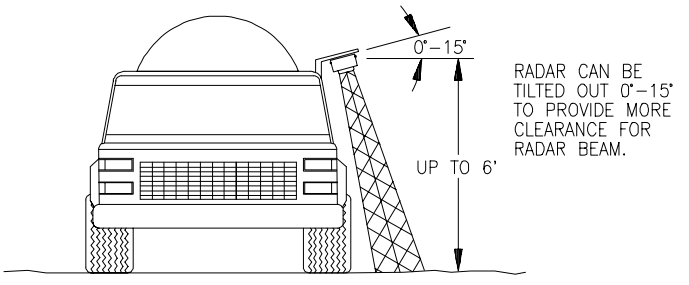


FIGURE 2

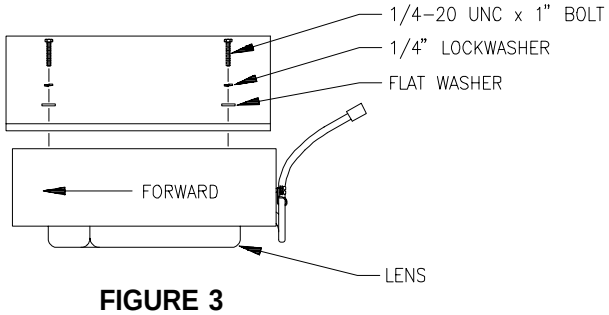


FIGURE 3

2. MOUNTING THE ENCODER

1) Mount Encoder on output shaft of conveyor, or other shaft which rotates at a known ratio to the conveyor. (See Figures 5,6,7,& 8).

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 4. 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.

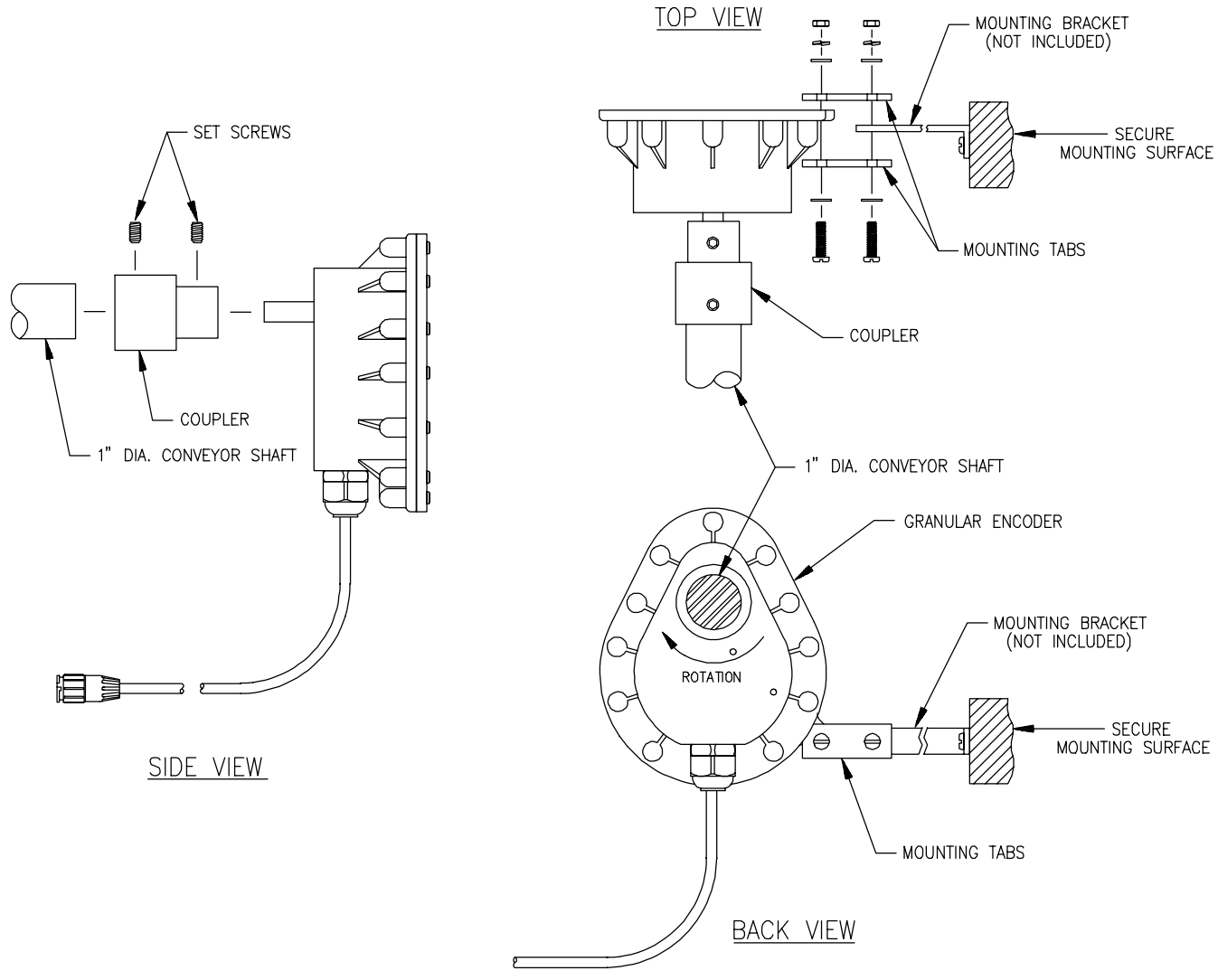


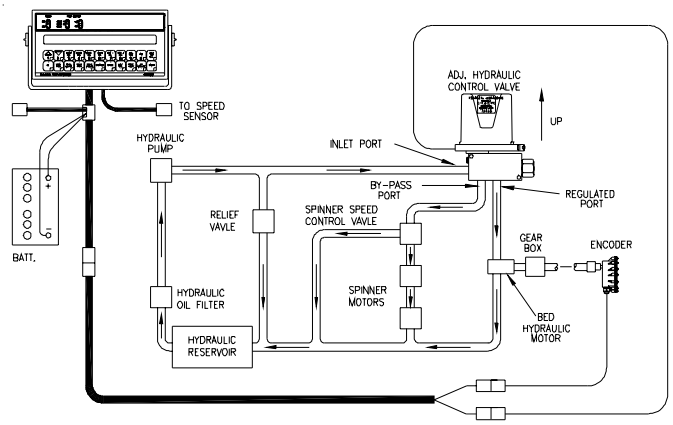
FIGURE 4

3. MOUNTING THE HYDRAULIC CONTROL VALVE

1) Refer to Figures 5,6,7,& 8 for typical placement of the Hydraulic Control Valve.

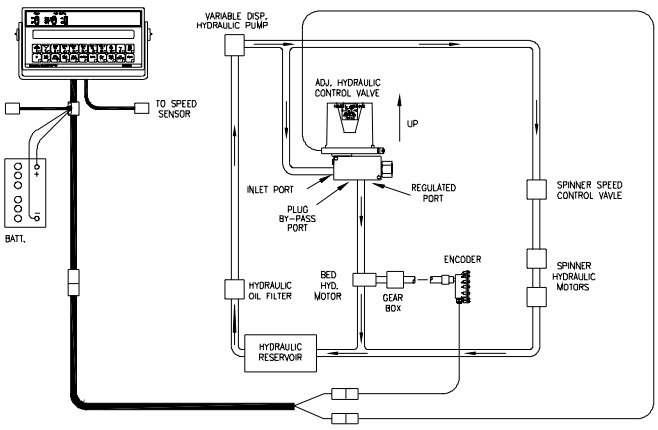
2) Valve is to be mounted with motor in the upright position.

SPINNER SYSTEM



OPEN HYDRAULIC SYSTEM (FIXED DISP. PUMP)

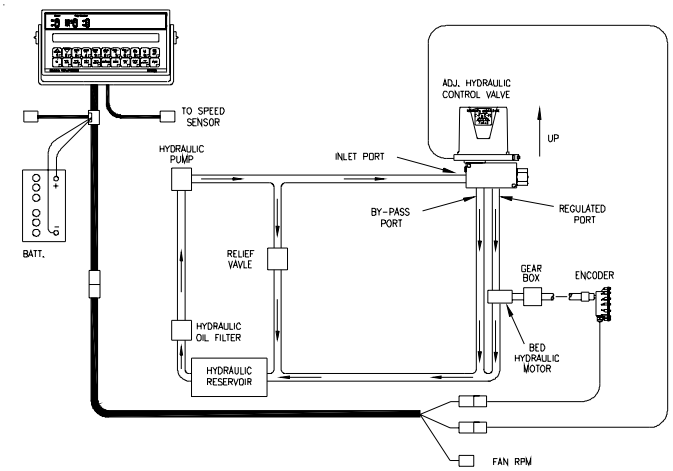
FIGURE 5



CLOSED HYDRAULIC SYSTEM (VARIABLE DISP. PUMP)

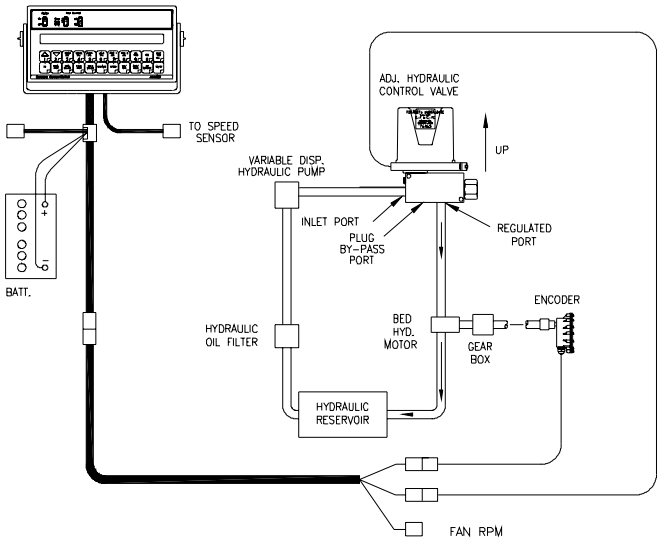
FIGURE 6

PNEUMATIC SYSTEM



OPEN HYDRAULIC SYSTEM (FIXED DISP. PUMP)

FIGURE 7



CLOSED HYDRAULIC SYSTEM (VARIABLE DISP. PUMP)

FIGURE 8

4. MOUNTING THE CONSOLE AND CABLING

1) Mount the Console and Switch Box to a secure support inside the cab of the vehicle.

2) Connect the Console Control Cable to the plug in the back of the Console. (See Figure 9). Route the Console Control Cable out of the vehicle cab and connect with Flow Control Cable. (Extension cables are available from your Dealer).

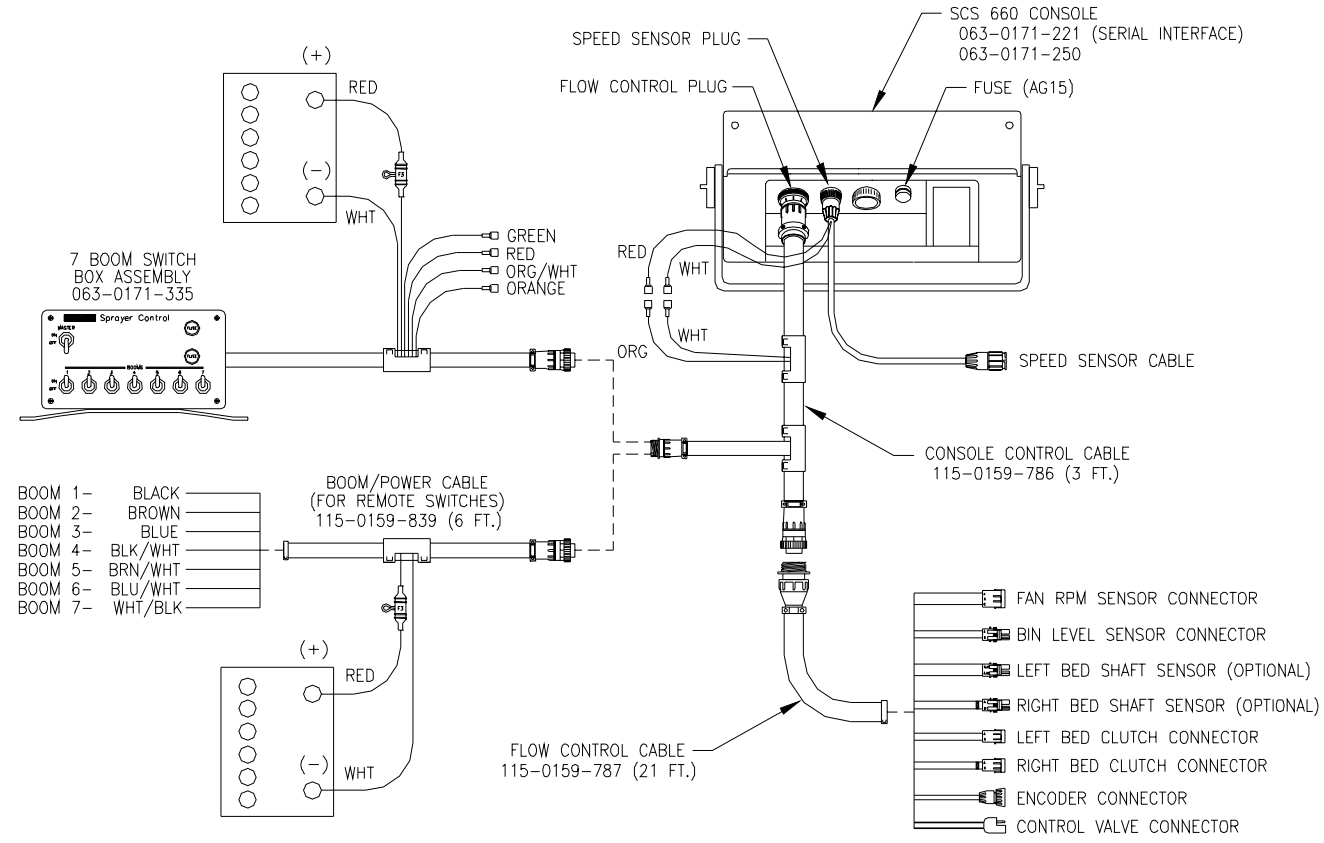


FIGURE 9

3) Turn POWER ON/OFF switch OFF and route the Red and White battery wires to a 12-volt battery. Attach the White battery wire to the **NEGATIVE** (-) terminal and the Red battery wire directly to the **POSITIVE** (+) battery terminal. (See Figure 10). **(DO NOT CONNECT RED AND WHITE WIRES TO THE STARTER)**. Secure the battery wires with plastic cable ties. **DO NOT** tie the battery wires close to the existing battery leads or any other electrical wiring.

4) Connect the Flow Control Cable to the Encoder, Hydraulic Control Valve, and sensors as required.

5) Connect the Speed Sensor to the plug in back of Console.

6) Secure Speed Sensor Cable and Console Control Cable with plastic cable ties.

7) Initial installation of the system is now complete.

BATTERY CONNECTIONS

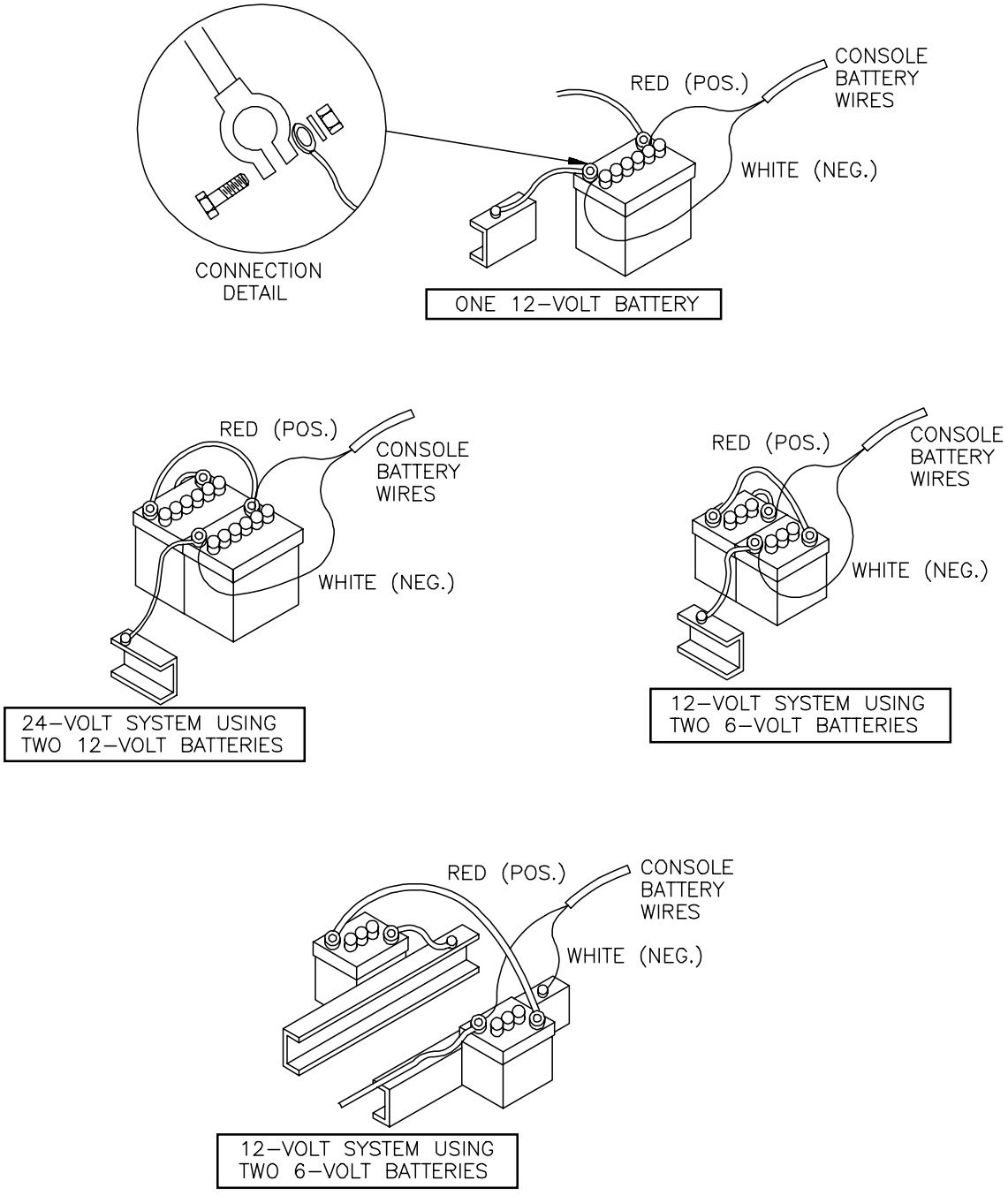
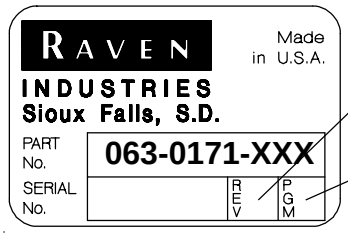


FIGURE 10

CONSOLE FEATURES

IMPORTANT: This Console requires selection of **US** (acres), **SI** [hectares], or **TU** {1,000 sq. ft.} area; **SP1** (wheel drive, etc.) or **SP2** (radar) speed sensor; **LI** (liquid sprayer), **GR1** (single bed belt), or **GR2** (split bed belt); and **C-Sd** (Standard Valve), **C-F** (Fast Valve), and **C-FC** (Fast Close Valve).



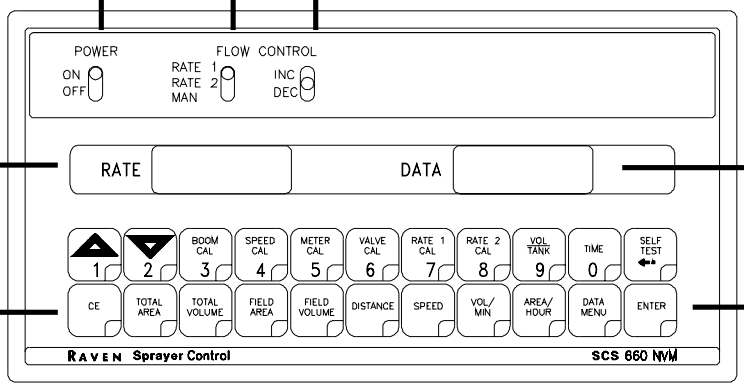
Console Revision can be determined by letter stamped in REV box on label.

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

POWER -Turns Console power ON or OFF. Turning Console OFF does not affect the data stored in the computer.

Manual override control provides capability for spot applications.

Selects manual or fully automatic control.



CE -Exits ENTER mode and is also used to select the features listed in IMPORTANT box above.

Displays actual rate of application and other messages.

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.

BOOM CAL -- Width of Boom 1-2. Select Boom number by using the UP/DOWN arrow keys.
SPEED CAL -- Determined by Speed Sensor
METER CAL -- Density/Spreader Constant
VALVE CAL -- Valve Response Time
RATE 1 CAL -- Target Application Rate
RATE 2 CAL -- Target Application Rate
VOL/TANK -- Volume in Tank *
TIME -- Time/Date features
SELF TEST -- Simulates Vehicle Speed

FUNCTION KEYS -- Used to Display Data

TOTAL AREA -- Total Area Applied
TOTAL VOLUME -- Total Volume Applied *
FIELD AREA -- Field Area Applied
FIELD VOLUME -- Field Volume *
DISTANCE -- Distance Traveled
SPEED -- Speed of Vehicle
VOL/MIN -- Volume Per Minute
AREA/HOUR -- Area per Hour
DATA MENU -- Various options

* Volumes are displayed with both the RATE and DATA displays when in GRANULAR mode.

CONSOLE CALIBRATION

1. CALCULATING "BOOM CAL"

Enter the total width of the spread pattern in inches [cm] as boom length (See "Definition of Boom Calibration keys").

2. CALCULATING "SPEED CAL"

Initial SPEED CAL is 598 [152]. Complete Steps 1 thru 6 to refine this number **after** section "INITIAL CONSOLE PROGRAMMING" has been completed.

1) Set POWER switches to ON, all other switches to OFF.

2) Enter "0" in key labelled 

3) Drive 1 mile [1 kilometer]. To achieve the most accurate calibration, accelerate and decelerate slowly.

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

4) Read DISTANCE by depressing key labelled 

DISTANCE should read a value of approximately 5280 [1000]. If it reads between 5260-5300 [990-1010], the SPEED CAL for the vehicle is 598 [152]. If the DISTANCE display reads any other value, perform the following calculation:

EXAMPLE: Assume DISTANCE reads 5000 [980].

$$\text{Corrected SPEED CAL} = \frac{\text{Old SPEED CAL} \times 5280}{\text{DISTANCE}}$$

ENGLISH UNITS:

$$= \frac{598 \times 5280}{5000} = 631.48$$

METRIC UNITS:

$$= \frac{[152] \times [1000]}{[980]} = [155]$$

5) The number to enter for SPEED CAL is 631 [155].

6) Recheck the new SPEED CAL derived in Step 5 by repeating Steps 2 thru 5.

3. CALCULATING "SPREADER CONSTANT"

1) For RATE displayed in 1 lb [1 kg] increments:

L = Length in inches [centimeters], of belt travel per 1 revolution of Encoder
GH = Gate Height in inches [centimeters]
GW = Gate Width in inches [centimeters]

English (US) :

$$\text{Spreader Constant (1 lb)} = \frac{311{,}040}{L \times GH \times GW}$$

Metric (SI):

$$\text{Spreader Constant (1 kg)} = \frac{[18{,}000{,}000]}{[L] \times [GH] \times [GW]}$$

EXAMPLE: 1) L = 13 inches [33 cm]
2) GH = 7 inches [18 cm]
3) GW = 15 inches [38 cm]

English (US):

$$\text{Spreader Constant (1 lb)} = \frac{311{,}040}{13 \times 7 \times 15}$$

$$= \frac{311{,}140}{1365} = 228$$

Metric (SI):

$$\text{Spreader Constant (1 kg)} = \frac{[18{,}000{,}000]}{[33] \times [18] \times [38]}$$

$$= \frac{[18{,}000{,}000]}{[22{,}572]} = [797]$$

NOTE: Verify Spreader Constant by performing Spreader Constant calibration procedure in Appendix 7 before field application.

4. CALCULATING "METER CAL"

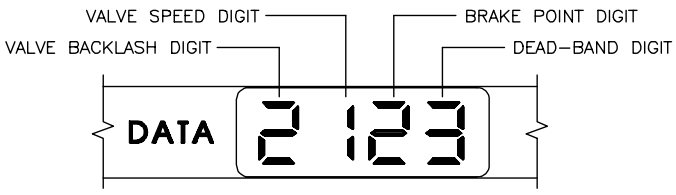
Product Density in lbs/cu.ft. [grams/liter] is entered as METER CAL.

NOTE: To increase the system accuracy when applying at low rates, use the decimal shift feature as explained in CONSOLE PROGRAMMING.

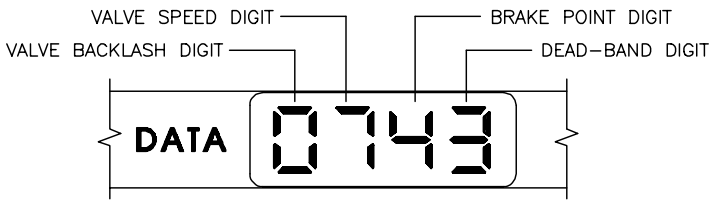
5. CALCULATING "VALVE CAL"

1) The initial Control Valve calibration number is 2123 for C-Sd, or 743 for C-FC. After operating the system, you may desire to refine this number. See definitions below:

For **STANDARD VALVE** (C-Sd):



For **FAST VALVE** (C-F or C-FC):



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.

C-Sd Valve Control	Product 1 Range:	1 to 9	1-Slow 9-Fast
C-F or C-FC Valve Control	Product 2-5 Ranges:	0 to 9	0-Fast 9-Slow

Brake Point Digit Sets the percent away from target rate at which the Control Valve motor begins turning at a slower rate, 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%

6. CALCULATING "RATE CAL"

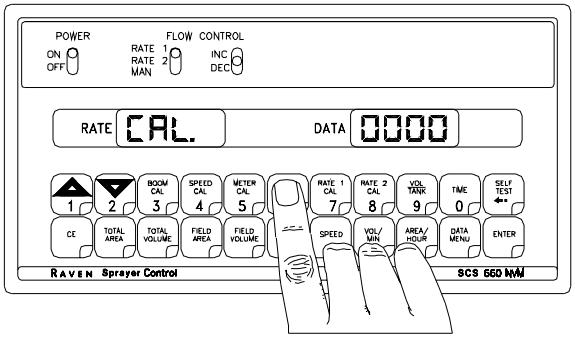
The application rate in lbs/acre [kg/ha] is entered as RATE CAL. Consult the equipment manual to insure that the selected gate opening is capable of applying at this application rate.

> **NOTE:** The Spreader Constant must be recalculated anytime the gate opening is changed.

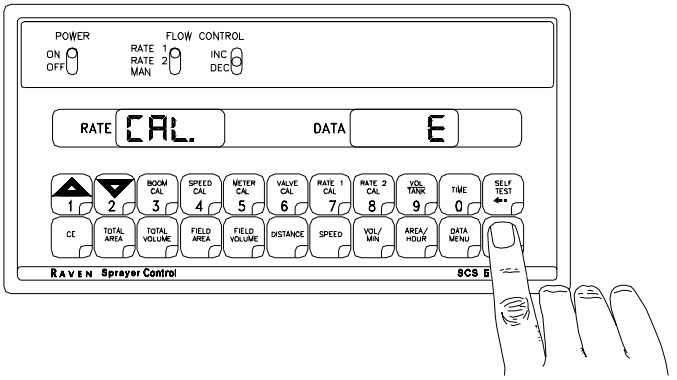
CONSOLE PROGRAMMING

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

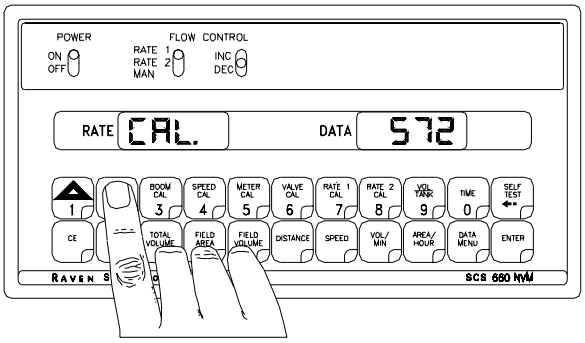
NOTE: DATA MUST BE ENTERED IN KEYS 3 THRU 8.



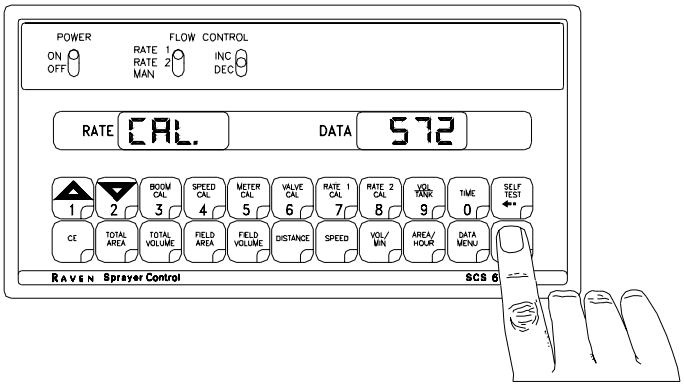
Depress the key in which you wish to enter data.



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. "5","7","2"). The numbers will be displayed as they are entered.



Complete the entry by again depressing the ENTER key.

1. INITIAL CONSOLE PROGRAMMING

When you first turn on Console power, after all installation procedures have been completed, the Console will flash "CAL" in the RATE display. This means you must "calibrate", or program, the Console before it can be operated. This is a one-time operation which does not have to be repeated. Turning OFF the POWER ON/OFF switch does not affect the Console memory. All data is retained.

IMPORTANT: If an entry selection error is made during Steps 1-8, place the POWER ON/OFF switch to OFF. Depress 

and hold while placing the POWER ON/OFF switch to ON. This will "reset" the Console.

The DATA display will show "US", and the RATE display will show "CAL". The following steps must be followed:

1) Display US (acres), SI [hectares], or TU {1000 sq. ft.}.

a) Depressing momentarily 

steps the DATA display from US to SI.

b) Depressing momentarily 

steps the DATA display from SI to TU.

c) Depressing momentarily 

steps the DATA display from TU to US.

2) Selecting US, SI, or TU.

a) To select US, SI, or TU, step 

until the desired code is displayed in DATA display.

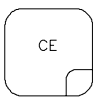
b) Momentarily depress 

. The DATA display will now display SP1.

3) Display SP1 (wheel drives, etc.) or SP2 (radar sensor).

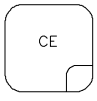
a) Depressing momentarily 

steps the DATA display from SP1 to SP2.

b) Depressing momentarily 

steps the DATA display from SP2 to SP1.

4) Selecting SP1 or SP2.

a) To select SP1 or SP2, step with 

until desired code is displayed in DATA display.

b) Momentarily depress 

. The DATA display will now display LI.

5) Displaying LI (liquid sprayer), GR1 (single bed belt), or GR2 (split bed belt).

a) Depressing momentarily 

steps the DATA display from LI to GR1.

b) Depressing momentarily 

steps the DATA display from GR1 to GR2.

c) Depressing momentarily 

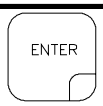
steps the DATA display from GR2 to LI.

6) Selecting LI, GR1, or GR2.

a) To select GR1, or GR2, step 

until desired code is displayed in the DATA display.

NOTE: If a liquid application (LI) is desired, see the SCS 660 Liquid Application Manual.

b) Momentarily depress 

. The data display will now display C-Sd.

7) Displaying C-Sd (Standard Valve), C-F (Fast Valve), or C-FC (Fast Close Valve).

a) Momentarily depressing 

steps the DATA display from C-Sd to C-F.

b) Momentarily depressing 

steps the DATA display from C-F to C-FC.

c) Momentarily depressing 

steps the DATA display from C-FC to C-Sd.

8) Selecting C-Sd, C-F, or C-FC.

a) To select C-Sd, C-F, or C-FC, step 

until desired code is displayed in DATA display.

b) Momentarily depress 

. The DATA display will now display 0.

9) Definition of Boom Calibration keys.

Depressing this key displays selected boom number in DATA display. **EXAMPLE:** Left Boom will be displayed as b-01, and Right Boom will be displayed as b-02.

Depressing this key after selecting BOOM CAL changes the boom number. **EXAMPLE:** b-01 will change to b-02.

Depressing this key after selecting BOOM CAL changes the boom number. **EXAMPLE:** b-02 will change to b-01.

10) Enter Left Boom Width b-01.

a) Select boom b-01.
b) Use boom width as calculated under "CALCULATING BOOM CAL".
c) For single boom enter total boom width in inches.
For dual boom or split bed belt enter one half the total boom width in inches.

11) Enter Right Boom Width b-02.

a) Select boom b-02.
b) Use boom width as calculated under "CALCULATING BOOM CAL".
c) For single boom enter 0.
For dual boom or split bed belt enter one half the total boom width in inches.

12) Enter SPEED CAL as calculated under "CALCULATING SPEED CAL" in key labelled 

.

13) Enter METER CAL.

a) Depress and hold 

key for 5 seconds. When the DATA display flashes 0, enter the Spreader Constant as calculated under "CALCULATING SPREADER CONSTANT".

b) Momentarily depress 

and enter Product Density.

NOTE: Verify Spreader Constant by performing Spreader Constant calibration procedure in Appendix 7 before field application.

14) Enter VALVE CAL calibration number in key labelled 

.

Valve Calibration numbers: C-Sd (2123)
C-F (0743)
C-FC (0743)

15) Enter RATE 1 CAL (lbs/acre) [Kg/ha] target application rate in key labelled 

.

16) Enter RATE 2 CAL (lbs/acre) [Kg/ha] target application rate in key labelled 

(If you do not use a second rate, enter the same rate as RATE 1 CAL).

YOU HAVE NOW COMPLETED PROGRAMMING THE CONSOLE

The flashing "CAL" will now extinguish. If not, repeat procedure starting at Step 9.

ENTERING ADDITIONAL DATA:

You may wish to enter data in the keys labelled 

and 

although it is not required for the operation of the system.

1) ENTERING VOLUME:

Enter the estimated VOLUME in the TANK (lbs)[kg] in key labelled 

. Each time the tank is refilled, this number must be re-entered.

> ***IMPORTANT:*** Both RATE and DATA displays windows are used to enter and view volume totals. This enables a volume from 1 to 99,999,999 to be entered into the Console. As information is entered, numbers move from the DATA display window across to the RATE display window.

2) ENTERING TIME, DATE, AND POWER DOWN:

Definition of Time, Date, and Power Down Key:

Depressing this key displays selected Time features in DATA display.
EXAMPLE: RATE display will display "TInE" and DATA will display 0:00.

Depressing this key after selecting TIME toggles up through desired features.
EXAMPLE: TIME, MONTH, DAY, YEAR, and POWER DOWN.

Depressing this key after selecting TIME toggles down through desired features.
EXAMPLE: POWER DOWN, YEAR, DAY, MONTH and TIME.

1) Enter TIME

A) Select TIME

B) Enter TIME when RATE display shows "TInE".

> **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.

2) Enter MONTH

A) Select MONTH

B) Enter MONTH when RATE display shows "OnTH".

3) Enter DAY

A) Select DAY

B) Enter DAY when RATE display shows "dAY"

4) Enter YEAR

A) Select YEAR

B) Enter YEAR when RATE display shows "YEAr"

5) POWER DOWN FEATURE

If the Console is not used for 10 days, it will go into a power down (low power) mode of operation. In this mode, all data will be retained, but the time of day clock will reset to 0:00. The delay time is initially set at 10 days, but can be changed by the user.

A) Enter POWER DOWN

1) Select POWER DOWN

2) Enter POWER DOWN when RATE display shows "Pdn".

2. OTHER DISPLAY FEATURES

1) To display TOTAL AREA covered, depress key labelled 

.

To "zero out" this total at any time, enter a "0" in this key.

2) To display TOTAL VOLUME (pounds)[kg] covered, depress key labelled 

.

To "zero out" this total at any time, enter a "0" in this key.

> ***IMPORTANT:*** Both RATE and DATA displays windows are used to enter and view volume totals. This enables a volume from 1 to 99,999,999 to be entered into the Console. As information is entered, numbers move from the DATA display window across to the RATE display window. If the volume is over 9,999, the RATE and DATA display windows are used to display TOTAL VOLUME.

3) To display FIELD AREA covered, depress key labelled 

.

To "zero out" this total at any time, enter a "0" in this key.

4) To display FIELD VOLUME (pounds)[Kg] of product applied, depress key labelled 

.

To "zero out" this total at any time, enter a "0" in this key.

> ***IMPORTANT:*** Both RATE and DATA displays windows are used to enter and view volume totals. This enables a volume from 1 to 99,999,999 to be entered into the Console. As information is entered, numbers move from the DATA display window across to the RATE display window. If the volume is over 9,999, the RATE and DATA display windows are used to display FIELD VOLUME.

5) To display DISTANCE (feet)[meters] traveled, depress key labelled 

.

To "zero out" this total at any time, enter a "0" in this key.

6) To display SPEED, depress key labelled 

.

7) To display VOL/MIN, depress the key labelled 

.

8) To display AREA/HOUR, depress key labelled 

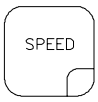
.

9) To display US, SI, or TU; SP1 or SP2; LI, GR1, or GR2; and C-Sd, C-F, or C-FC after being selected, depress key labelled 

.

3. SELF TEST FEATURE

SELF TEST allows speed simulation for testing the system while the vehicle is not moving. Enter the simulated operating speed in the key labelled 

. If 6 MPH [9.6 km/h] is desired, enter 6.0 [9.6] (See CONSOLE PROGRAMMING). Verify SPEED by depressing key labelled 

. 6.0 [9.6] will appear in the DATA display. The SELF TEST speed will clear itself when motion of vehicle is detected by the Speed Sensor. A SPEED CAL Value of 900 [230] or greater is recommended when operating in this mode.

NOTE: To prevent nuisance clearing of self-test speed, disconnect speed connector on back of the Console when Radar Speed Sensors are used.

4. VOLUME/MINUTE RATE FAULT

Depress 

until DATA display flashes. A low limit flow rate may now be entered. If the actual volume per minute falls below this limit, the Control Valve stops closing, an alarm sounds, and the display flashes "-LL-". The low limit value should be determined with all booms ON. This value is automatically proportional to the percentage of booms that are ON. (i.e. If the entered low limit is 4 and half the total boom length is shut off, the Console automatically reduces the low limit to 2).

NOTE: Go to DATA MENU to silence alarm.

5. VOLUME/AREA RATE ALARM

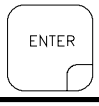
Console alarm sounds if the application rate is 30% or more away from the target application rate for more than 5 seconds.

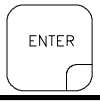
6. LOW TANK FAULT

This feature will sound the alarm when the volume in the tank drops below an entered value. The alarm will intermittently beep every 15 seconds and the RATE display will flash "LEVL". The alarm will stop when a value equal to or greater than the LOW TANK ALARM is entered into VOL/TANK or the booms are turned OFF. Entering "0" into LOW TANK ALARM disables it.

To select LOW TANK ALARM depress 

until DATA display flashes.

To enter value depress 

then LOW TANK ALARM value, and 

.

NOTE: Go to DATA MENU to silence alarm.

7. AUTOMATIC RATE +/-

This feature sets the increment at which flow is increased or decreased in RATE 1 or RATE 2 operation. Enter rate change value by depressing key labelled RATE 1 CAL 7 until DATA display flashes. To enter a value depress ENTER, then the increment value, and ENTER .

EXAMPLE: If rate is to change by "1":
Enter a value of 1 for RATE +/-. When in RATE 1 or RATE 2, each time the INC/DEC switch is positioned to INC the RATE CAL for that rate will increase by "1". Likewise, when positioned to DEC the RATE CAL will decrease by "1".

8. 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 booms are turned ON and when the Console begins to control the flow rate. A value of 1-9 means a delay of 1-9 seconds respectively. A value of 0 means no delay. This delay is active if the time between turning OFF and turning ON the booms is less than 30 seconds.

9. SEQUENCE TO ACTIVATE DATA-LOCK

1) Depress CE for 5 seconds, NEW CODE message will appear.

2) Enter 4 digit code within 15 seconds.

EXAMPLE: For 1058, depress ▲ 1, TIME 0, METER CAL 5, RATE 2 CAL 8 and ENTER .

10. SEQUENCE TO CHANGE DATA-LOCK

1) Depress CE for 5 seconds, OLD CODE message will appear.

2) Enter 4 digit code within 15 seconds ▲ 1, TIME 0, METER CAL 5, RATE 2 CAL 8 and ENTER .

NEW CODE message will appear. Enter 4 digit code within 15 seconds.

EXAMPLE: For 1582, depress ▲ 1, METER CAL 5, RATE 2 CAL 8, ▼ 2 and ENTER .

11. ENTER MODE SEQUENCE WITH ACTIVATED DATA-LOCK

The DATA-LOCK feature prohibits the entry of data without first entering the DATA-LOCK CODE. If DATA-LOCK is not desired, omit Steps 9, 10, and 11.

1) Depress the key into which you wish to enter data.

2) Depress 

. CODE message will appear. Enter your DATA-LOCK CODE. If CODE is correct, "E" will appear. Now enter data normally.

3) The DATA-LOCK CODE may be cleared by entering a code of "0" or by resetting the Console. To RESET Console place POWER ON/OFF switch to OFF, depress 

and hold while placing the POWER ON/OFF switch to ON.

12. DATA MENU

The following are brief descriptions of features available under the DATA MENU key (some features are only available on consoles with serial interface port):

DISPLAY RATE	DISPLAY DATA	FEATURE and DESCRIPTION
Prn	bEGn	**CONSOLE DATA PRINTOUT** Sends data through serial port to attached optional printer to print field begin and field end pages (Serial interface console only).
ALrn	on	**AUDIBLE ALARMS ON/OFF** Turns audible alarms ON or OFF for the following: 1) Volume/Area Rate Alarm 2) Volume/Minute Rate Fault 3) Left Shaft Fault 4) Right Shaft Fault 5) Low Tank Fault 6) Bin Level Fault
diSP	on	**DISPLAY SMOOTHING ON/OFF** Turns display smoothing ON or OFF. Selecting display smoothing ON means the RATE window displays target rate when actual rate is within a percentage of target rate. The third digit of VALVE CAL determines this percentage.
FAn	0000	**FAN RPM** Displays fan RPM in DATA window.
SHFT	1oFF	**LEFT SHAFT FAULT ON/OFF** Turns left shaft fault detector ON or OFF. When fault detector is selected ON; alarm sounds and RATE display flashes "SHA1" if left shaft should be rotating, but is not.

DISPLAY RATE	DISPLAY DATA	FEATURE and DESCRIPTION
SHFT	2oFF	**RIGHT SHAFT FAULT ON/OFF** Turns right shaft fault detector ON or OFF. When fault detector is selected ON; alarm sounds and RATE display flashes "SHA2" if right shaft should be rotating, but is not.
bin	oFF	**BIN LEVEL FAULT ON/OFF** Turns bin level fault detector On or OFF. When fault detector is selected ON; alarm sounds and RATE display flashes "bin" if granular level drops below the bin level sensor.
FCAL	0	**FAN CALIBRATION** Displays and allows entering on fan calibration number.
rATE	on	**RATE CHANGE ALARM ON/OFF** Turns rate change alarm ON or OFF. When rate change alarm is selected ON; alarm sounds 4 long beeps when the rate 1 calibration number is changed via the serial port using a valid change request data string (Serial interface console only).
FILE	1	**GPS FILE REFERENCE** Used only with Raven Grid Application System. See Grid Application System manual for more details (Serial interface console only).
GPS	InAC	**GPS OPTIONS** Used only with Raven Grid Application System. See Grid Application System manual for more details (Serial interface console only).
FrEF	0	**FIELD REFERENCE** Allows user to enter up to a four-digit number to represent a field. Field reference is included in field begin and field end pages and the data logger time/date string (Serial interface console only).
bAUd	1200	**BAUD RATE** Used in GPS mode and data logging mode. Selectable between 1200 or 9600 baud (Serial interface console only).
TriG	0	**DATA LOGGER TRIGGER VALUE** Used in data logging mode. The trigger determines how often actual rate data string (See Appendix 6 for data communication string formats) is sent to the serial port. The trigger may be either feet [meters] or seconds (Serial interface console only).

DISPLAY RATE	DISPLAY DATA	FEATURE and DESCRIPTION
UniT	FT	**DATA LOGGER TRIGGER UNITS** Used in data logging mode. The trigger unit is selectable between feet [meters] or seconds (Serial interface console only).
dLoG	oFF	**DATA LOGGER ON/OFF** Turns data logger ON or OFF (Serial interface console only).

1) Definition of Data Menu Key:

Depressing this key displays selected Data Menu features in RATE display. **EXAMPLE:** RATE display will display options by name and DATA will display default setting.

Depressing this key after selecting DATA MENU toggles up through desired features.
EXAMPLE: "Prn" "bEGn, "ALrn""on", "diSP""on", etc....

Depressing this key after selecting DATA MENU toggles down through desired features.
EXAMPLE: "Prn" "bEGn, "DLoG""oFF", "UniT""FT", etc....

2) CONSOLE DATA PRINTOUT

A) RATE display will show "Prn". DATA display will show "bEGn" (Print Field Begin).

1) To Print Field Begin, depress key labelled 

B) RATE display will now show "Prn" and DATA display will show "End" (Print Field End).

1) To Print Field End, depress key labelled 

2) While "End" is displayed, if Field Begin is required, depress key labelled 

to toggle DATA display to "BEGn".

C) Momentarily depress 

to advance to AUDIBLE ALARM ON/OFF.

3) AUDIBLE ALARM ON/OFF

A) RATE display will show "ALrn". DATA display will show "on".

B) Depressing 

momentarily changes the DATA display between "on" and "off". A value of "on" means the audible alarms are enabled; a value of "off" means the audible alarms are disabled.

C) Momentarily depress 

to advance to DISPLAY SMOOTHING ON/OFF.

4) DISPLAY SMOOTHING ON/OFF

A) RATE display will show "diSP". DATA display will show "on".

B) Depressing 

momentarily changes the DATA display between "on" and "oFF". A value of "on" means smoothing is enabled; a value of "oFF" means smoothing is disabled. The percent smoothing is determined by the third digit of VALVE CAL value as shown:

Brake Point Digit
(3rd digit) of VALVE CAL 2 1 [2] 3

0 = 1% + Deadband	5 = 25% + Deadband
1 = 3% + Deadband	6 = 30% + Deadband
2 = 7% + Deadband	7 = 35% + Deadband
3 = 10% + Deadband	8 = 40% + Deadband
4 = 20% + Deadband	9 = 45% + Deadband

Actual rate is displayed if unit does not reach deadband within 10 seconds. "oFF" means RATE displays the actual rate at all times.

C) Momentarily depress 

to advance to FAN RPM.

5) FAN RPM

A) RATE display will show "FAn". DATA display will show actual FAN RPM.

B) Momentarily depress 

to advance to LEFT SHAFT FAULT ON/OFF.

6) LEFT SHAFT FAULT ON/OFF

A) RATE display will show "SHFT". DATA display will show "loFF".

B) Depressing 

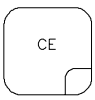
momentarily changes the DATA display between "loFF" and "l on". A value of "l on" means fault detector is enabled; a value of "loFF" means fault detector is disabled.

C) Momentarily depress 

to advance to RIGHT SHAFT FAULT ON/OFF.

7) RIGHT SHAFT FAULT ON/OFF

A) RATE display will show "SHFT". DATA display will show "2oFF".

B) Depressing 

momentarily changes the DATA display between "2oFF" and "2 on". A value of "2 on" means fault detector is enabled; a value of "2oFF" means fault detector is disabled.

C) Momentarily depress 

to advance to BIN LEVEL FAULT ON/OFF.

8) BIN LEVEL FAULT ON/OFF

A) RATE display will show "bin". DATA display will show "oFF".

B) Depressing 

momentarily changes the DATA display between "oFF" and "on". A value of "on" means fault detector is enabled; a value of "off" means fault detector is disabled.

C) Momentarily depress 

to advance to FAN CALIBRATION.

9) FAN CALIBRATION

A) RATE display will show "FCAL". DATA display will show "0".

B) Enter the FAN CALIBRATION number.

C) Momentarily depress 

to advance to RATE CHANGE ALARM ON/OFF.

10) RATE CHANGE ALARM ON/OFF

A) RATE display will show "rATE". DATA display will show "on".

B) Depressing 

momentarily changes the DATA display between "on" and "oFF". A value of "on" means alarm is enabled; a value of "oFF" means alarm is disabled.

C) Momentarily depress 

to advance to GPS FILE REFERENCE.

11) GPS FILE REFERENCE

A) RATE display will show "FILE". DATA display will show a "1".

B) Enter the GPS file number.

C) Momentarily depress 

to advance to GPS OPTIONS.

12) GPS OPTIONS

A) GPS is inactive when the RATE display shows "GPS" and the DATA display shows "InAC". The GPS features are explained further in the GRID APPLICATION SYSTEM MANUAL.

B) Momentarily depress 

to advance to FIELD REFERENCE.

13) FIELD REFERENCE

A) RATE display will show "FrEF". DATA display will show "0".

B) Enter the field number.

C) Momentarily depress 

to advance to BAUD RATE.

14) BAUD RATE

A) RATE display will show "bAUd". DATA display will show "1200".

B) Depressing 

momentarily changes the DATA display between "1200" and "9600".

C) Momentarily depress 

to advance to DATA LOGGER TRIGGER VALUE.

15) DATA LOGGER TRIGGER VALUE

A) RATE display will show "TriG". DATA display will show "0".

B) Enter the TRIGGER VALUE.

C) Momentarily depress 

to advance to DATA LOGGER TRIGGER UNITS.

NOTE: The TRIGGER VALUE default value is "zero". This value must be change to a desired number ranging from 1-9999. The DATA LOGGER features will not work if this number is not changed.

16) DATA LOGGER TRIGGER UNITS

A) RATE display will show "UniT". DATA display will show "FT"["nETr"].

B) Depressing 

momentarily changes the DATA display between "FT" [nETr"] and "SEC". A value of "FT"["nETr"] 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) Momentarily depress 

to advance to DATA LOGGER.

17) DATA LOGGER ON/OFF

A) The DATA LOGGER uses the communications strings listed in Appendix 6 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, and 3, and the Time/date string are sent, in that order. When a Console calibration value is changed, the Console will automatically send out the Cal 1, 2, and 3 strings. When a Console switch is changed, the Data 1, 2, 3, Time/Date, and Cal 1, 2, 3 strings will be sent by the Console. The Data, (with Time/Date string included) and Cal strings can also be requested by the data logger using the request strings shown in Appendix 6.

B) RATE display will show "dLOG". DATA display will show "oFF".

C) Depressing 

momentarily changes 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) Momentarily depress 

to advance to CONSOLE DATA PRINTOUT.

NOTE: Some options within the DATA MENU LISTINGS may be unavailable if certain features are on or active. The options affected are:

CONSOLE DATA PRINTOUT:	Console Data Printout will not be available when DATA LOGGER is ON or when GPS functions are ACTIVE.
GPS OPTIONS:	GPS Options will not be available when DATA LOGGER is ON.
DATA LOGGER:	DATA LOGGER will not be available when GPS functions are active.

13. DECIMAL SHIFT

The DECIMAL SHIFT feature is used to increase system accuracy at low application rates. Shifting of the decimal point is done during the entry of METER CAL. After entering METER CAL mode, depress the decimal shift key labelled 

, enter the meter calibration constant number, and depress 

. The sequence to unshift the decimals while in METER CAL is to enter the meter calibration constant number and depress 

.

The following table illustrates how shifting the decimal point can increase system accuracy.

DECIMAL PLACE LOCATIONS

		US		*METRIC*		*TURF*	
		UNSHIFT	*SHIFT*	*UNSHIFT*	*SHIFT*	*UNSHIFT*	*SHIFT*
METER CAL	Spreader Constant	0000	0000	0000	0000	0000	0000
	Density	000.0	000.0	0000	0000	000.0	000.0
RATE DISPLAY		0000	000.0	0000	000.0	000.0	000.0
RATE 1 CAL		0000	000.0	0000	000.0	000.0	000.0
RATE 2 CAL		0000	000.0	0000	000.0	000.0	000.0
TANK VOLUME *		0000|0000	0000|000.0	0000|0000	0000|000.0	0000|000.0	0000|000.0
TOTAL AREA		000.0	000.0	000.0	000.0	0000	0000
TOTALVOL *		0000|0000	0000|000.0	0000|0000	0000|000.0	0000|000.0	0000|000.0
FIELD AREA		000.0	000.0	000.0	000.0	0000	0000
FIELD VOLUME *		0000|0000	0000|000.0	0000|0000	0000|000.0	0000|000.0	0000|000.0
VOL/MINUTE		0000	000.0	0000	000.0	000.0	000.0
AREA/HOUR		000.0	000.0	000.0	000.0	0000	0000
RATE +/-		0000	000.0	0000	000.0	000.0	000.0
LOW TANK LEV		0000	000.0	0000	000.0	000.0	000.0
LOW VOL/MIN		0000	000.0	0000	000.0	000.0	000.0

* These specified options use both the DATA and RATE displays to enter and view data.

INITIAL SYSTEM SET-UP

1) With **NO** product in bin.

2) Place boom ON/OFF switches to OFF.

3) Place RATE 1/RATE 2/MAN switch to MAN.

4) Place POWER ON/OFF switch to ON.

5) Verify correct Boom Widths, SPEED CAL, METER CAL, VALVE CAL, and RATE CALS have been entered in the Console.

6) Enter into SELF TEST the normal operating speed.

7) Place boom ON/OFF switches to ON.

8) Verify that each boom operates by operating boom ON/OFF switches.

9) Hold the INC/DEC switch in INC position for approximately 12 seconds. Note maximum rate displayed in RATE display.

10) Hold the INC/DEC switch in DEC position for approximately 12 seconds. Note minimum rate displayed in RATE display.

11) The target application rate must be between the maximum and minimum rate displayed.

INITIAL SYSTEM FIELD TEST

1) Drive down field or road at target speed with boom ON/OFF switches OFF, to verify SPEED readout on Console.

2) Turn on appropriate boom switches, and place the RATE 1/RATE 2/MAN switch to RATE 1. Increase or decrease speed by one MPH [2 km/h]. The system should automatically correct to the target application rate.

3) If for any reason, the system is unable to correct to the desired RATE, check for improper vehicle speed or a defect in the system.

4) If the system does not appear to be correcting properly, first review INITIAL SYSTEM SET-UP, then refer to SERVICE MANUAL and TROUBLESHOOTING GUIDE.

5) At the end of each row, switch the boom ON/OFF switches to OFF to shut off application. This also shuts off the area totalizer.

6) Verify area covered and volume used.

TROUBLESHOOTING GUIDE

PROBLEM	CORRECTIVE ACTION
1) NO DISPLAY LIGHTS WITH POWER ON.	1) Check fuse on back of Console. 2) Check battery connections. 3) Check operation of POWER ON/OFF switch. 4) Return Console to your Dealer to replace Processor Board Assembly.
2) ALL KEYBOARD LIGHTS ON AT SAME TIME.	1) Return Console to your dealer to replace Face Plate Sub-Assembly.
3) A DIGIT CANNOT BE ENTERED VIA KEYBOARD.	1) Return Console to your Dealer to replace Face Plate Sub-Assembly.
4) AN INDICATOR LIGHT ON A KEY WILL NOT ILLUMINATE.	1) Return Console to your Dealer to replace Face Plate Sub-Assembly and/or Processor Board Assembly.
5) CONSOLE DISPLAYS FLASHING "CAL" WHENEVER VEHICLE ENGINE IS STARTED.	1) Return to your dealer for repair.
6) CONSOLE DISPLAYS FLASHING "CAL" WHENEVER MASTER SWITCH IS TURNED ON OR OFF.	1) Return to your dealer for repair.
7) CONSOLE DISPLAYS FLASHING "CAL" WHENEVER SPEED IS CHANGED.	1) Check battery voltage and battery connections.
8) "TIME" FUNCTION IS INACCURATE OR DRIFTING.	1) Return Console to Dealer to replace Processor Board Assembly.
9) ONE DISPLAY DIGIT HAS ONE OR MORE MISSING SEGMENTS.	1) Return Console to Dealer to replace LCD Display Board Assembly.
10) SPEED DISPLAY "0"	1) Check Speed Sensor cable connector and plug on back of Console for loose pins. 2) Clean pins and sockets on Speed Sensor cable connectors. 3) If no extension cable is used, replace Speed Sensor. 4) If Speed Sensor Extension Cable is used, see Appendix 1.
11) SPEED INACCURATE OR UNSTABLE	1) Wiggle cable at the Speed Sensor connector. If speed is displayed, tighten connector or replace Speed Sensor.

12) RATE READS "0000".	1) Verify SPEED is registering accurately. If SPEED is zero, refer to Troubleshooting Problem 10. 2) Verify TOTAL VOLUME is registering flow. If not, refer to Troubleshooting Problem 15. 3) Enter a typical speed in SELF TEST. With BOOM 1 and MASTER ON, verify AREA/HOUR is registering. If not, check wiring from Console to BOOM switch.
13) RATE INACCURATE OR UNSTABLE.	1) Verify that all numbers "keyed in" Console are correct. Verify SPEED is registering accurately. If SPEED is inaccurate, refer to Troubleshooting Problem 11. 2) In MAN (manual) operation, verify that RATE display holds constant. 3) If problem persists, return Console to Dealer to replace Processor Board Assembly.
14) CAN NOT VARY RATE IN MANUAL OR AUTO.	1) Check cabling to Hydraulic Control Valve for breaks. 2) Check connections in cabling for cleanliness. 3) Verify that there is voltage at the valve connector by manually operating INC/DEC switch. 4) Verify that Hydraulic Control Valve is turning, if not, replace.
15) TOTAL VOLUME DOES NOT REGISTER.	1) Check Metering Shaft Encoder cable for breaks and shorts. See Appendix 2 for test procedure. 2) Replace Metering Shaft Encoder.

APPENDIX 1
WHEEL DRIVE SPEED SENSOR INSTALLATION AND CALIBRATION PROCEDURE

1. MOUNTING WHEEL DRIVE SPEED SENSOR

The Wheel Drive Speed Sensor consists of four magnets, a switch assembly with cable, and mounting hardware.

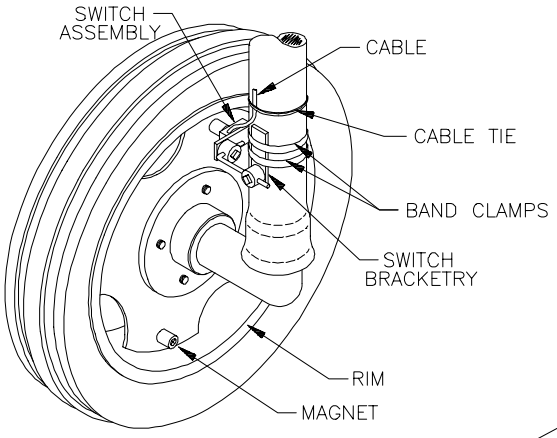
Sequence of mounting Speed Sensor:

1) Select a non-driven wheel (left front tractor wheel or implement wheel).

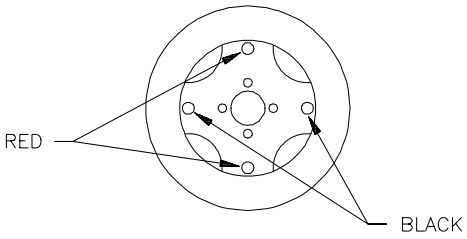
2) Check for predrilled holes in rim. If not predrilled, see "RIM DRILLING INSTRUCTIONS FOR WHEEL DRIVE SPEED SENSOR".

3) Mount the four magnets to the inside of rim and tighten (See Figures below). Magnets must be mounted in alternating red-black order.

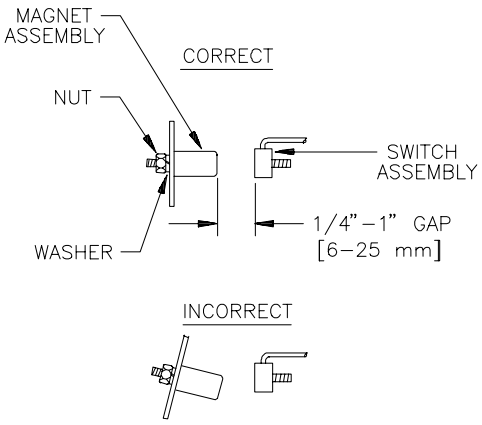
4) Mount switch assembly to stationary column with the hardware provided (See below). The switch assembly need not pivot with the wheel.



SWITCH ASSEMBLY



MAGNET LOCATION



MAGNET ASSEMBLY

5) Position switch assembly so that as the wheel rotates the magnets pass across the center of the black, molded switch assembly.

6) Clearance gap between magnets and switch assembly must be between 1/4 inch [6 mm] and 1 inch [25 mm]. With wheels pointed straight ahead, rotate wheel to ensure gap is correct. Make sure vehicle wheels can be turned to their extremes in each direction without the magnets hitting the switch assembly.

7) Tighten switch assembly bracketry.

8) Secure cable to column with plastic cable ties.

2. RIM DRILLING INSTRUCTIONS FOR WHEEL DRIVE SPEED SENSOR MAGNETS

On wheels which do not have pre-punched mounting holes, proceed as follows:

RIMS WITH FOUR OR EIGHT HOLE STUD PATTERN:

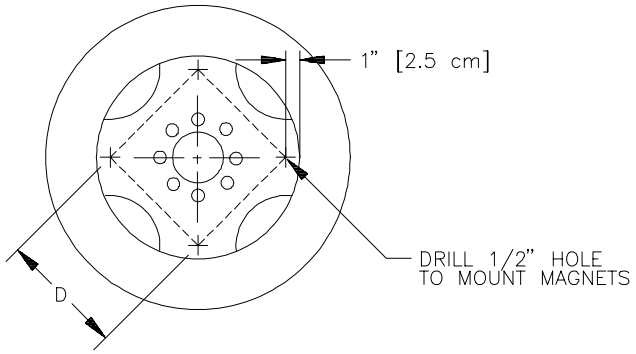
Choose stud holes that are opposite each other as shown below. Using the center of opposite holes, scribe two lines on the rim web to divide the circumference into four equal parts. Measure in one inch from the outer edge of the web on each of the lines drawn. Mark this point as the center. Drill four 1/2" holes for mounting the magnets.

> **NOTE:** The distance (D) between each set of drilled holes must be equal within 1/8" [3 mm] to ensure accuracy of system.

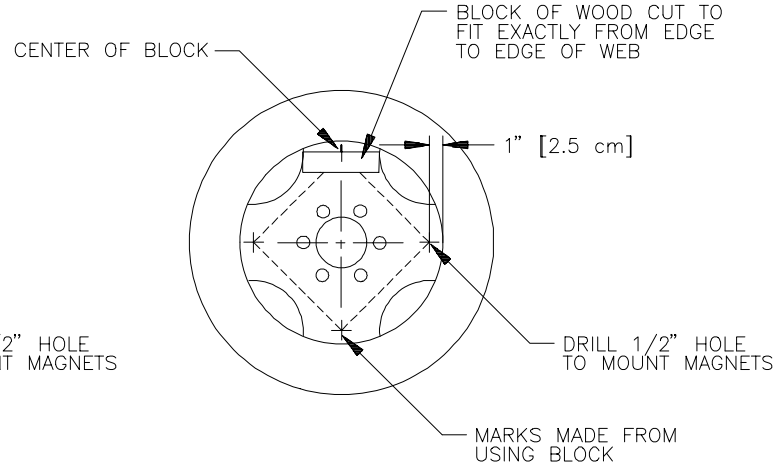
RIMS WITH SIX HOLE STUD PATTERN:

Locate the center of the holes to be drilled by using the rim webbing as a guide. Obtain a small piece of wood and cut to fit exactly over the web as shown. Measure the length of the piece of wood and mark the center on one edge. Using the center mark on the piece of wood, mark each of the four webs. Measure in one inch from the outer edge of the web on each of the lines drawn. Mark this point as center and drill four 1/2" holes for mounting the magnets.

> **NOTE:** The distance (D) between each set of drilled holes must be equal within 1/8" [3 mm] to ensure accuracy of system.



EIGHT HOLE STUD PATTERN



SIX HOLE STUD PATTERN

3. CALCULATING "SPEED CAL"

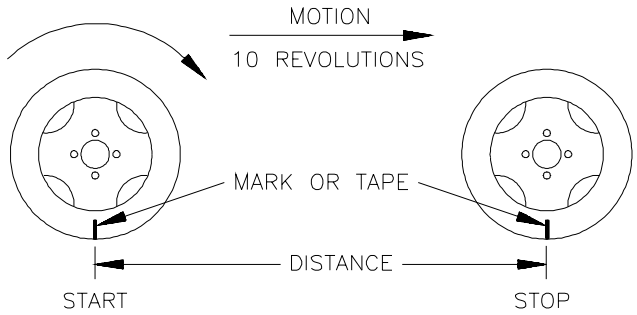
1) Place a chalk mark or tape onto the vehicle tire that the Speed Sensor mounted to it as shown below.

2) Mark the initial spot on the ground.

3) Drive vehicle straight ahead counting 10 full revolutions of the wheel. The mark must stop at the same position it was in when the vehicle started.

4) Measure the distance from the ground starting mark to stopping mark in inches [dm] (Round off fractions).

5) Write down this distance as the SPEED CAL number; keep it for future reference when programming the Console.



NOTE: This measurement is critical to the performance of the Console. **MEASURE CAREFULLY**. Be sure tire is properly inflated before measuring. Measure tire in type of soil in which you will be spraying. Circumference of tire will vary when measured in soft soil versus hard packed soil. For best results, measure several times and average the results.

Large tires and very low speed applications may require additional magnets to insure accurate speed readings. Any even number of magnets may be used as long as they are of alternating color and equally spaced. After calculating "SPEED CAL", this number must be adjusted according to the number of magnets used.

$$\frac{\text{Normal Number of Magnets}}{\text{Actual Number of Magnets}} \times \text{Speed Cal} = \text{Adjusted Speed Cal}$$

Example: $\frac{4}{6} \times 1200 = 800$

SCS 330, SCS 500 and SCS 550 normally use two magnets. All other consoles normally use four magnets.

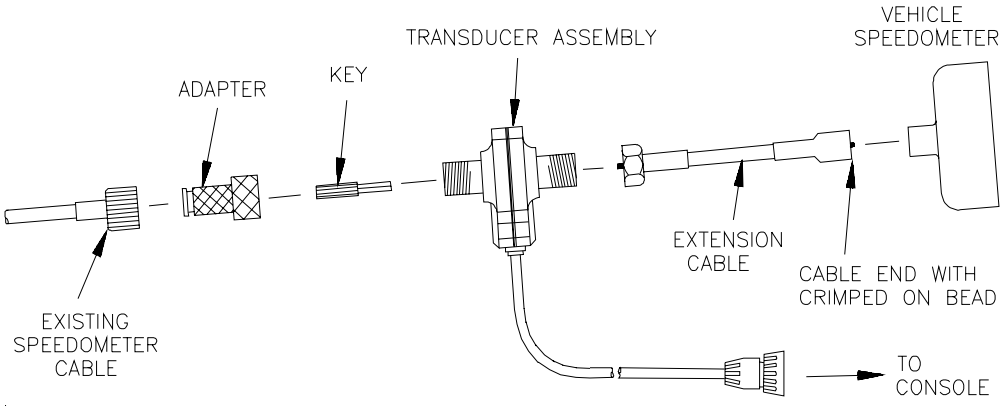
APPENDIX 2
SPEEDOMETER DRIVE SPEED SENSOR INSTALLATION AND CALIBRATION PROCEDURE

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 key labelled 

3) Enter a SPEED CAL of 612 [155] in key labelled 

4) Drive 1 mile [1 km].

> **CAUTION:** Do not use vehicle odometer to determine distance. Use section lines or Highway markers.

5) Read DISTANCE by depressing key labelled 

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 612 [155].

b) If the DISTANCE display reads any other value, perform the following calculation:

Multiply the SPEED CAL by the target distance reading, then divide the sum by the actual value in DISTANCE display. 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:**
=	$\frac{612 \times 5280}{5000} = 646.3$	$= \frac{[155] \times [1000]}{[980]} = [158.1]$

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

7) Verify the corrected SPEED CAL number calculated above:

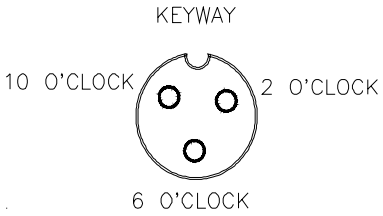
a) Zero out the DISTANCE display as in Step 2.

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 3
PROCEDURE TO TEST SPEED SENSOR EXTENSION CABLES

Verify that the Console is in the SP1 Speed Sensor mode while testing the cable. 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.

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 1000 in key labelled 

2) Depress key labelled 

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.

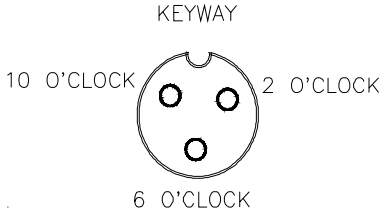
5) Perform above voltage checks.

6) If all cables test good, replace Speed Sensor.

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

APPENDIX 4
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 key labelled 

2) Depress key labelled 

3) Place BOOM switches to ON.

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 5
VERIFICATION OF SPREADER CONSTANT

To verify and refine the Spreader Constant, perform the following procedure (after completing INITIAL CONSOLE PROGRAMMING):

1) Weigh loaded truck and note weight.

2) Enter the Product Density in lbs/cu.ft. [grams/liter] into key labelled 

3) Enter a "0" into the key labelled 

4) With the rate switch in the MAN position, unload a portion of the load by positioning the boom switch to ON.

5) Determine the actual weight unloaded by re-weighing the truck.

6) Compare to the TOTAL VOLUME displayed by the Console.

7) Perform the following calculation to correct the Spreader Constant if desired:

$$\text{Corrected Spreader Constant} = \frac{\text{old Spreader Constant} \times \text{TOTAL VOLUME}}{\text{actual weight unloaded}}$$

EXAMPLE:

old Spreader Constant	=	228 [797]
TOTAL VOLUME amount	=	2000 lbs [4400 kg]
actual weight unloaded	=	1950 lbs [4290 kg]

English (US):

$$\text{Corrected Spreader Constant (1 lb)} = \frac{228 \times 2000}{1950} = 234$$

Metric (SI):

$$\text{Corrected Spreader Constant (1 kg)} = \frac{[797] \times [4400]}{[4290]} = [817]$$

This is the new Spreader Constant. Repeat this procedure until the weight of the metered material equals the TOTAL VOLUME value.

APPENDIX 6
PROCEDURE TO PROGRAM SERIAL 660 FOR NEW LEADER MARK IV INTERFACE

The initialization for the console should be:

1) US for acres, pounds, etc.
2) SP1 or SP2, depending on the truck's speed sensor.
3) GR1 for single belt.
4) C-NL1 for "Hall Effect" control valve. C-NL2 for "Reed Switch" control valve.
5) The rest of the console calibration is the same as described in the SCS 660 GRANULAR APPLICATION manual. (BOOM CAL, SPEED CAL, METER CAL, SPREADER CONSTANT [starting values below], VALVE CAL, RATE 1 CAL, and RATE 2 CAL).

Spreader Constants (for New Leader/HiWay Equipment Co L-3020 box with 0.256 Chain & Belt Over Chain, Mark IV stepper system only). Starting Spreader Constant is 1172 for the first inch of gate opening. The Spreader Constant for a desired gate height is determined by dividing 1172 by the exact gate opening. One inch increments are listed below for your convenience.

2" gate = 586	3" gate = 391
4" gate = 293	5" gate = 234
6" gate = 195	7" gate = 167
8" gate = 147	9" gate = 130
10" gate = 117	

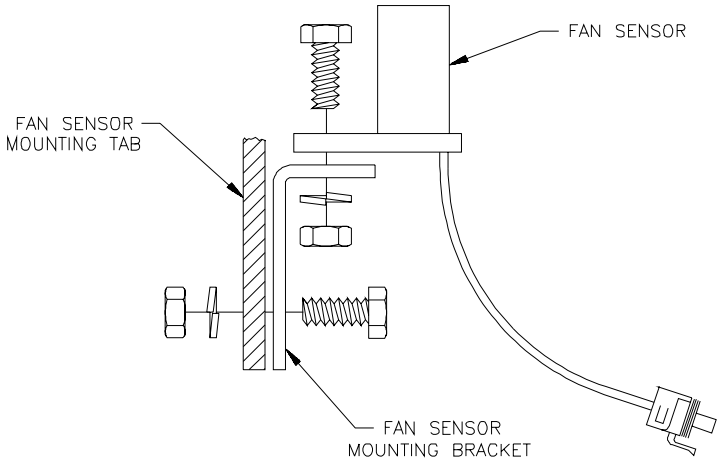
Spreader Constants (for New Leader/HiWay Equipment Co L-2020 box with 0.192 Chain & Belt Over Chain, Mark IV stepper systems only). Starting Spreader Constant is 1563 for the first inch of gate opening. The Spreader Constant for a desired gate height is determined by dividing 1563 by the exact gate opening. One inch increments are listed below for your convenience.

2" gate = 782	3" gate = 521
4" gate = 391	5" gate = 313
6" gate = 261	7" gate = 223
8" gate = 195	9" gate = 174
10" gate = 156	

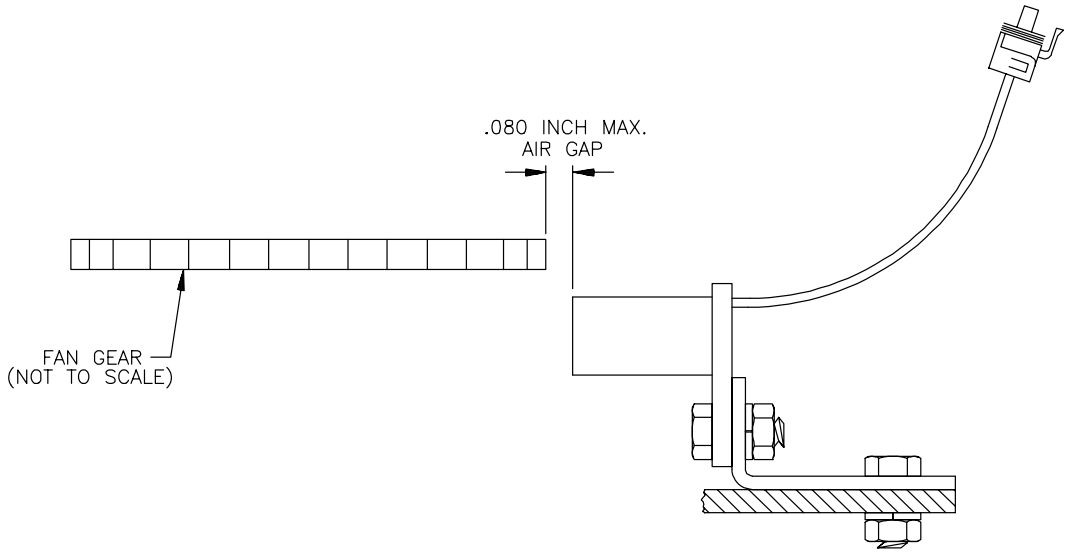
NOTE: Verify Spreader Constant by performing Spreader Constant calibration procedure in Appendix 5 before field application.

APPENDIX 7
FAN RPM SENSOR INSTALLATION

117-0159-575



Assemble Fan Sensor to fan sensor bracket with stainless steel bolt, lock washer, and nut. Assemble fan sensor bracket to fan sensor mounting tab on box with stainless steel bolt, lock washer, and nut. (See Figure above).

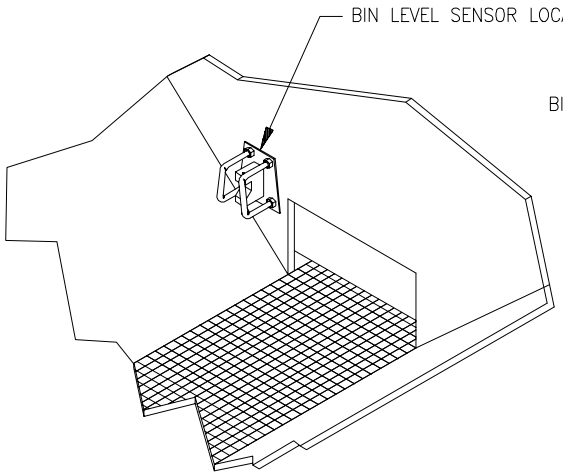


Adjust fan sensor air gap between .040 and .080 inch (.080 inch max.)

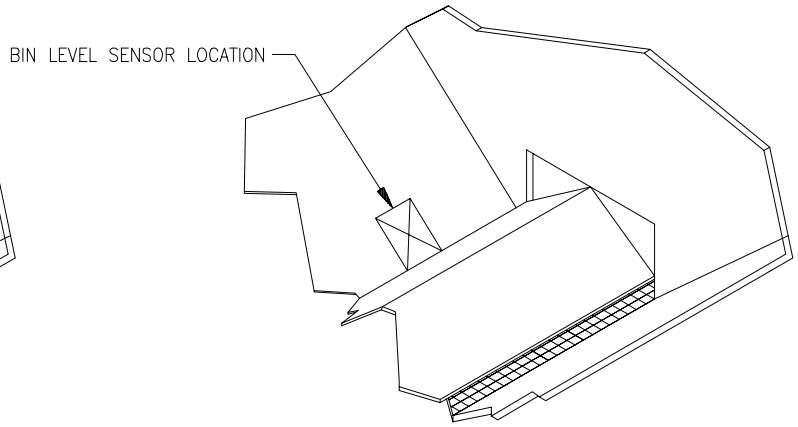
APPENDIX 8
BIN LEVEL SENSOR INSTALLATION

063-0171-252

Install Bin Level Sensor in spreader bin at location illustrated. Select location in accordance to bin construction.

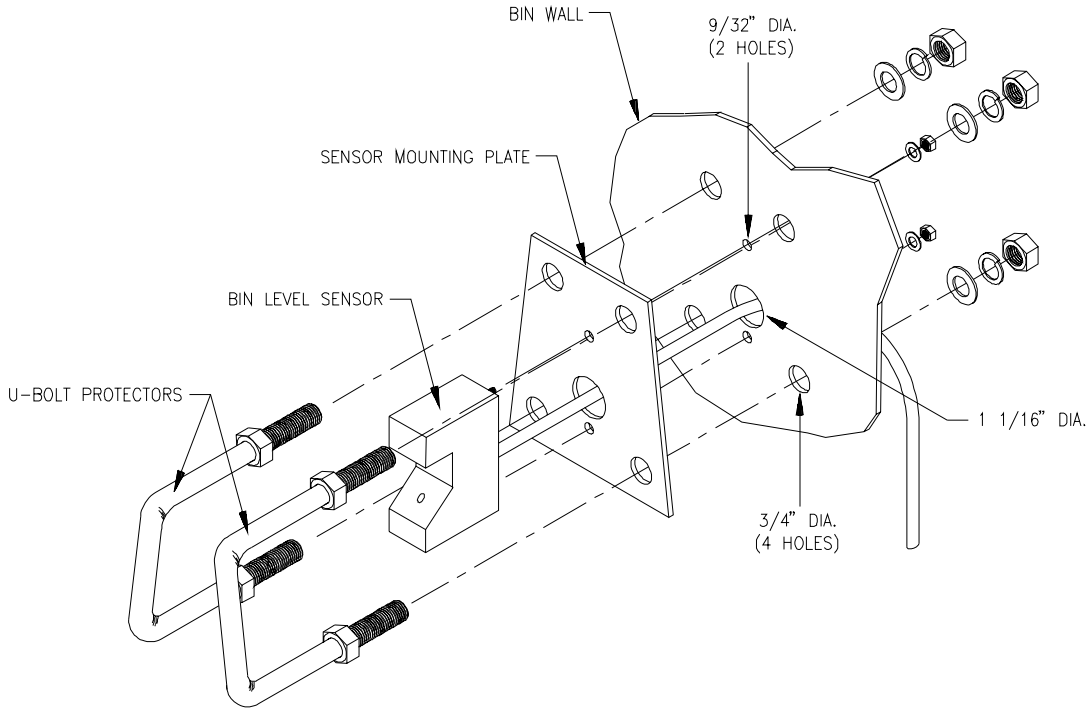


V-BOX WITHOUT DEFLECTOR SHIELD



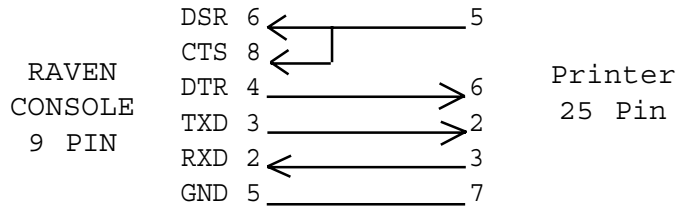
V-BOX WITH DEFLECTOR SHIELD

Use the mounting plate as a template to mark the location for the holes. Drill and deburr all holes. Route the sensor cable and secure the mounting plate to the bin wall using U-bolt protectors. Route and connect the sensor cable connector to the flow cable connector. Secure all cables with plastic cable ties.



APPENDIX 9
SERIAL INTERFACE

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



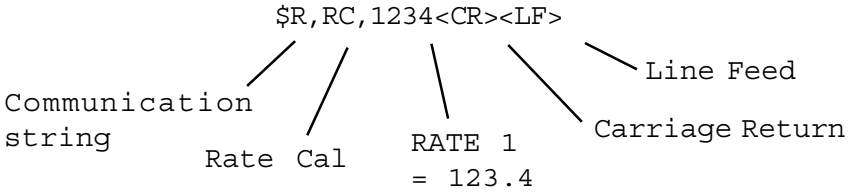
2) Changing RATE 1 CAL by remote computer.

a) Configuration of RS-232C serial port:

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

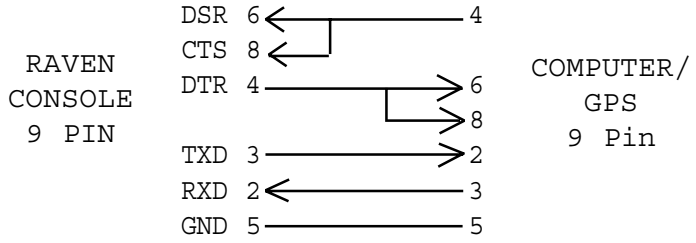
b) Data stream to Raven Console.

EXAMPLE: Change RATE 1 to 123.4



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).



APPENDIX 10
SCS 660 COMMUNICATION STRINGS

REMOTE COMPUTER TO SCS 660 CONSOLE

All request strings begin with $R, to indicate a Raven communication string.

Rate 1 Change Request:

$R,RC,<rate_1_cal><CR><LF>

Calibration String Values Request:

$R,CR<CR><LF>

Data String Request:

$R,DR<CR><LF>

SCS 660 CONSOLE TO REMOTE COMPUTER

All console output strings begin with $R040C, the $R indicates a Raven communication string, the 040 is the last three digits of the current SCS 660 programmed chip part number and C is the software revision number.

Calibration Strings:

$R040C,C1,<switch_byte_1>,<switch_byte_2>,<boom_1_cal>,
<boom_2_cal>,<boom_3_cal>,<boom_4_cal>,<boom_5_cal>,
<boom_6_cal>,<boom_7_cal>,<speed_cal> <CR><LF>

$R040C,C2,<meter_cal>,<spreader_constant><CR><LF>

$R040C,C3,<valve_cal>,<rate_1_cal>,<rate_2_cal><CR><LF>

Bit	Switch Byte 1	Switch Byte 2
0	boom 1	0
1	boom 2	0
2	boom 3	0
3	boom 4	rate 1
4	boom 5	rate 2
5	boom 6	0
6	boom 7	0
7	1	1

NOTE: If rate 1 and rate 2 are both zero, the console is in Manual. For switch Byte Bits; 0 = off and 1 = on.

Data Strings:

$R040C,D1,<total_area>,<field_area><CR><LF>

$R040C,D2,<total_volume>,<field_volume><CR><LF

$R040C,D3,<tank_volume>,<distance><CR><LF>

Actual Rate:

$R040C,AR,<actual_rate><CR><LF>

Time/Date:

$R040C,TD,<hr:min>,<month/day/year>,<field_reference><CR><LF>

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.

Manual Rev. E, SCS 660, 9-97
Order: 50,9-11-97, #016-0159-572