

# **SCS 600 Serial Interface Installation and Service Manual**

*P/N 016-0159-488 Rev E*

*06/15*



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# SYMBOL DEFINITION

|         |                             |      |                            |
|---------|-----------------------------|------|----------------------------|
| GPM     | - Gallons per minute        | kg   | - Kilograms                |
| lit/min | - Liters per minute         | cm   | - Centimeters              |
| dl/min  | - Deciliter per minute      | dm   | - Decimeters               |
| PSI     | - Pounds per square inch    | m    | - Meter                    |
| kPa     | - Kilopascal                | MPH  | - Miles per hour           |
| GPA     | - Gallon per acre           | km   | - Kilometers               |
| lit/ha  | - Liter per hectare         | km/h | - Kilometers per hour      |
| ml/ha   | - Milliliter per hectare    | US   | - Volume per ACRE          |
| GPk     | - Gallons per 1,000 sq. ft. | SI   | - Volume per HECTARE       |
| mm      | - Millimeters               | TU   | - Volume per 1,000 sq. ft. |
| g       | - Grams                     | []   | - Metric numbers           |
| dkg     | - Decagrams                 | {}   | - 1,000 sq. ft. numbers    |
| hg      | - Hectograms                |      |                            |

## METER CAL CONVERSIONS

To convert the METER CAL number simply divide the original number by the desired conversion factor.

### FOR EXAMPLE:

$$\frac{\text{Original METER CAL No.}}{16} = \text{METER CAL No. for displays in Pounds.}$$

$$\frac{\text{Original METER CAL No.}}{.0283} = \text{METER CAL No. for displays in Kilograms.}$$

$$\frac{\text{Original METER CAL No.}}{2.83} = \text{METER CAL No. for displays in Decagrams}$$

$$\frac{\text{Original METER CAL No.}}{.283} = \text{METER CAL No. for displays in Hectagrams}$$

## WEIGHT CONVERSIONS

U.S. Ounce x 28.35 = Grams  
U.S. Ounce x .0283 = Kilograms  
U.S. Pounds x 453.6 = Grams  
U.S. Pounds x .453 = Kilograms

## PRESSURE

1 psi = 6.89 kPa

## 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

## 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

# INTRODUCTION

The Raven SCS 600 (CONTROL SYSTEM) is designed to improve the accuracy and uniformity of granular applications. Its performance relies on the installation and preventive maintenance of the complete sprayer. 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 600 consists of a computer based Control Console, a Speed Sensor, Drive Motor, Shaft Sensor and cables. The Console mounts directly in the cab of the vehicle for easy operator use. The Speed Sensor is mounted on a non-driven wheel of the vehicle or implement (Radar and Speedometer Drive Speed Sensors are also available). The Drive Motor and Shaft Sensor are mounted to the granular applicator. Appropriate cabling is furnished for field installation.

The operator sets the target application rate to be applied and the SCS 600 automatically maintains the application rate regardless of vehicle speed or gear selection. A manual override switch allows the operator to manually control the application rate for spot spraying. Actual rate per area being applied is displayed at all times. The SCS 600 additionally functions as an spray monitor, area monitor, speed monitor, volume totalizer. (SEE DEALER FOR SPRAY MONITOR OPTION).

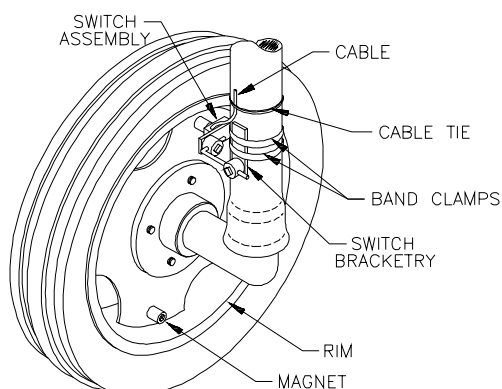
# INSTALLATION

## 1. MOUNTING WHEEL DRIVE SPEED SENSOR

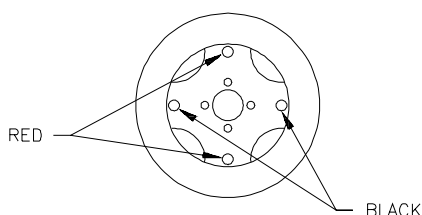
The Wheel Drive Speed Sensor consists of four magnets, a switch assembly with cable, and mounting hardware. (Installation instructions for the optional Radar Interface Speed Sensor are included in their shipping carton. See Appendix 4 for the installation instructions for Speedometer Drive Speed Sensor.

Sequence of mounting Speed Sensor:

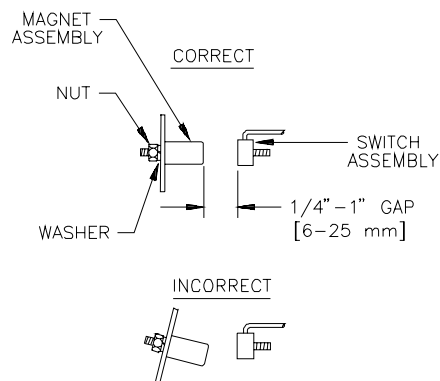
- 1) Select a non-driven wheel (left front tractor wheel or implement wheel).
- 2) Check for predrilled holes in rim. If not predrilled, see Appendix 1.
- 3) Mount the four magnets to inside of rim and tighten. (See Figures 1, 2, & 3). Magnets must be mounted in alternating red-black order.
- 4) Mount switch assembly to stationary column with the hardware provided. (See Figure 1). The switch assembly need not pivot with the wheel.



**FIGURE 1**



**FIGURE 2**



**FIGURE 3**

5) Position switch assembly so that as the wheel rotates the magnets pass across the center of the black, molded switch assembly. (See Figures 1 & 3).

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. SYSTEM DIAGRAM

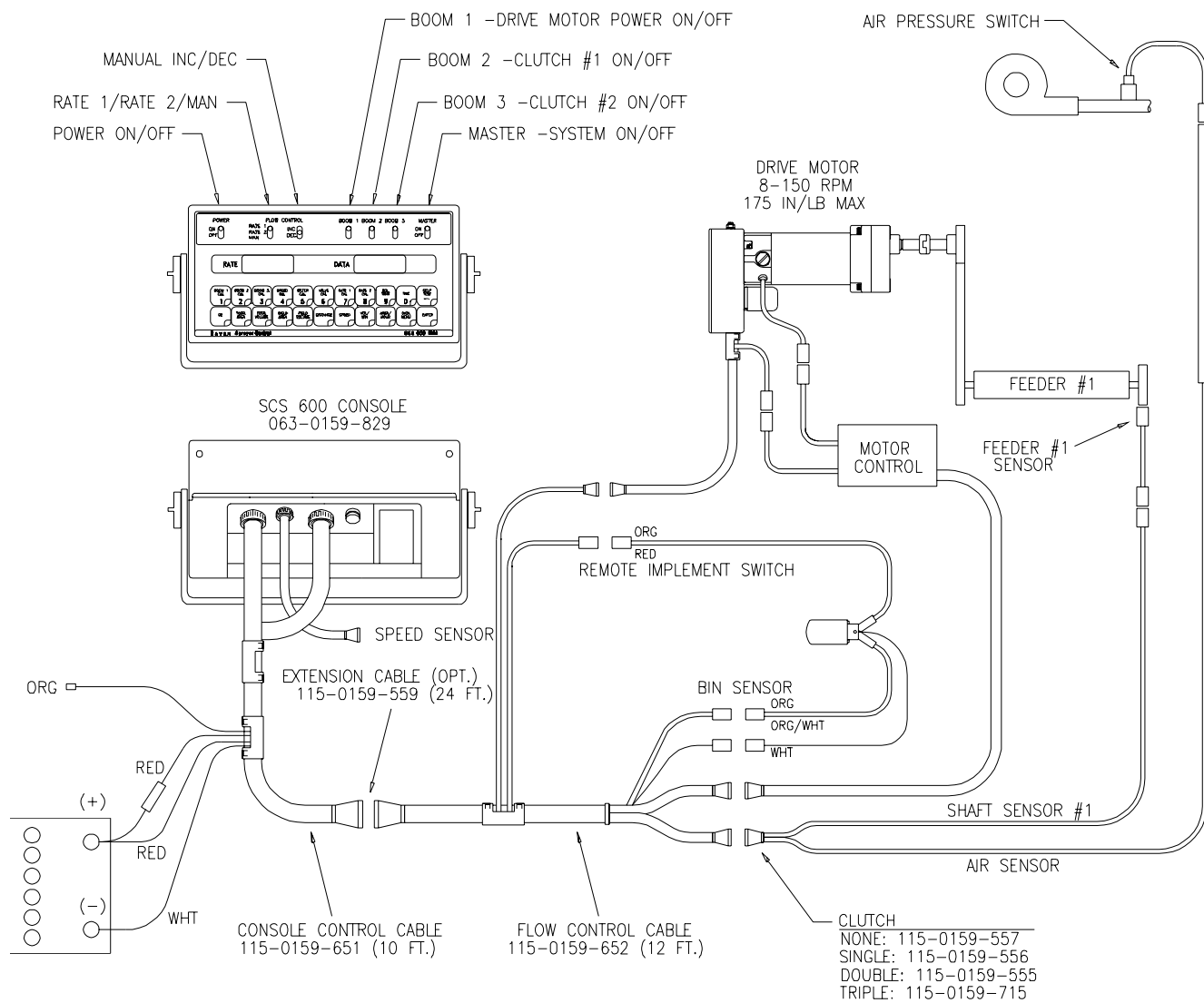


FIGURE 4

### 3. MOUNTING DRIVE MOTOR

Mount drive motor to feeder drive shaft on granular applicator using roller chain and sprockets (chain and sprockets not supplied with system). Secure drive motor with four 1/4-20 unc bolts.

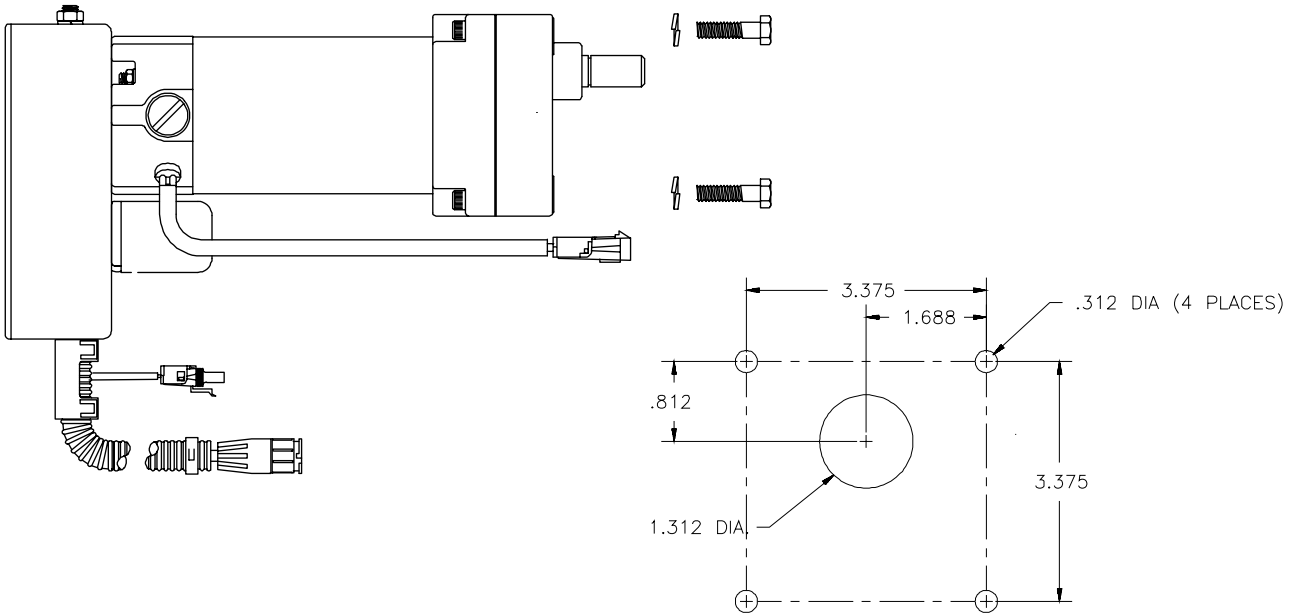


FIGURE 5

### 4. FEEDER SHAFT SENSOR HOUSING

- 1) Secure pulley assembly to feeder shaft using 1/4-20 set screw.
- 2) Use an appropriate bolt to fasten sensor assembly to frame of granular applicator. Additional brackets may need to be constructed to accommodate mounting sensor assembly.
- 3) Adjust sensor assembly so magnets pass by yellow painted area of sensor. Maintain a clearance between magnets and sensor of 1/8" to 1/4".

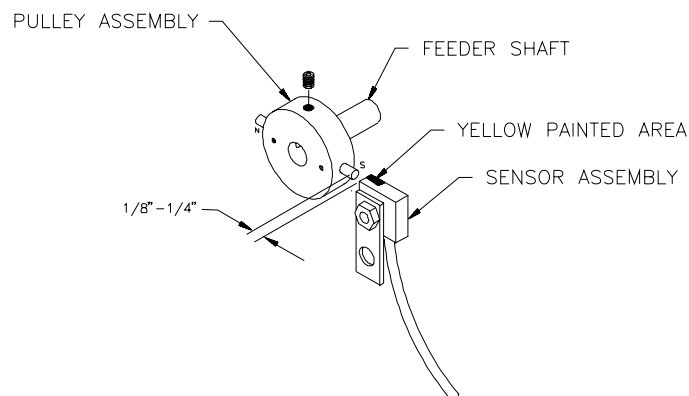


FIGURE 6



## 5. MOUNTING THE CONSOLE

- 1) Mount the Console to a secure support inside the cab of the vehicle.
- 2) Connect the 10 ft. Console Control Cable to the plug in the back of the Console. (Reference Figure 7). Run the Console Control Cable out of the vehicle cab and connect with 6 ft. Flow Control Cable on the sprayer. (Extension cables are available from your Dealer).

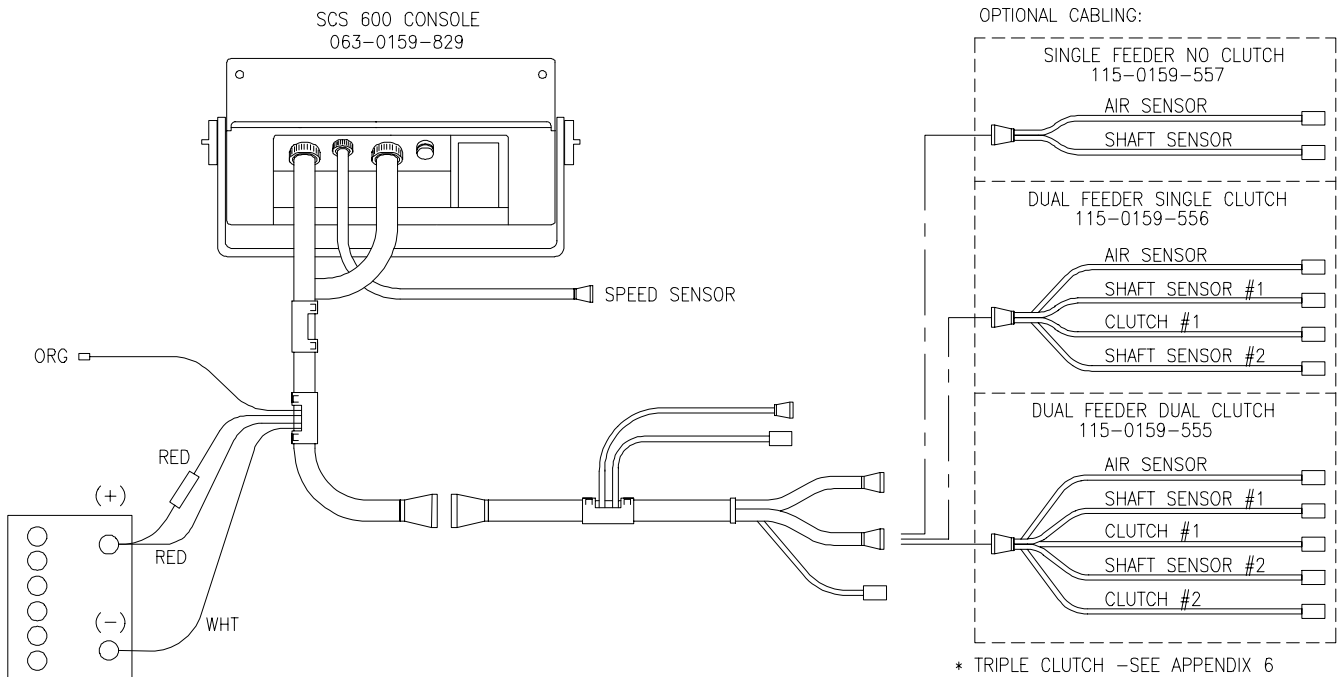


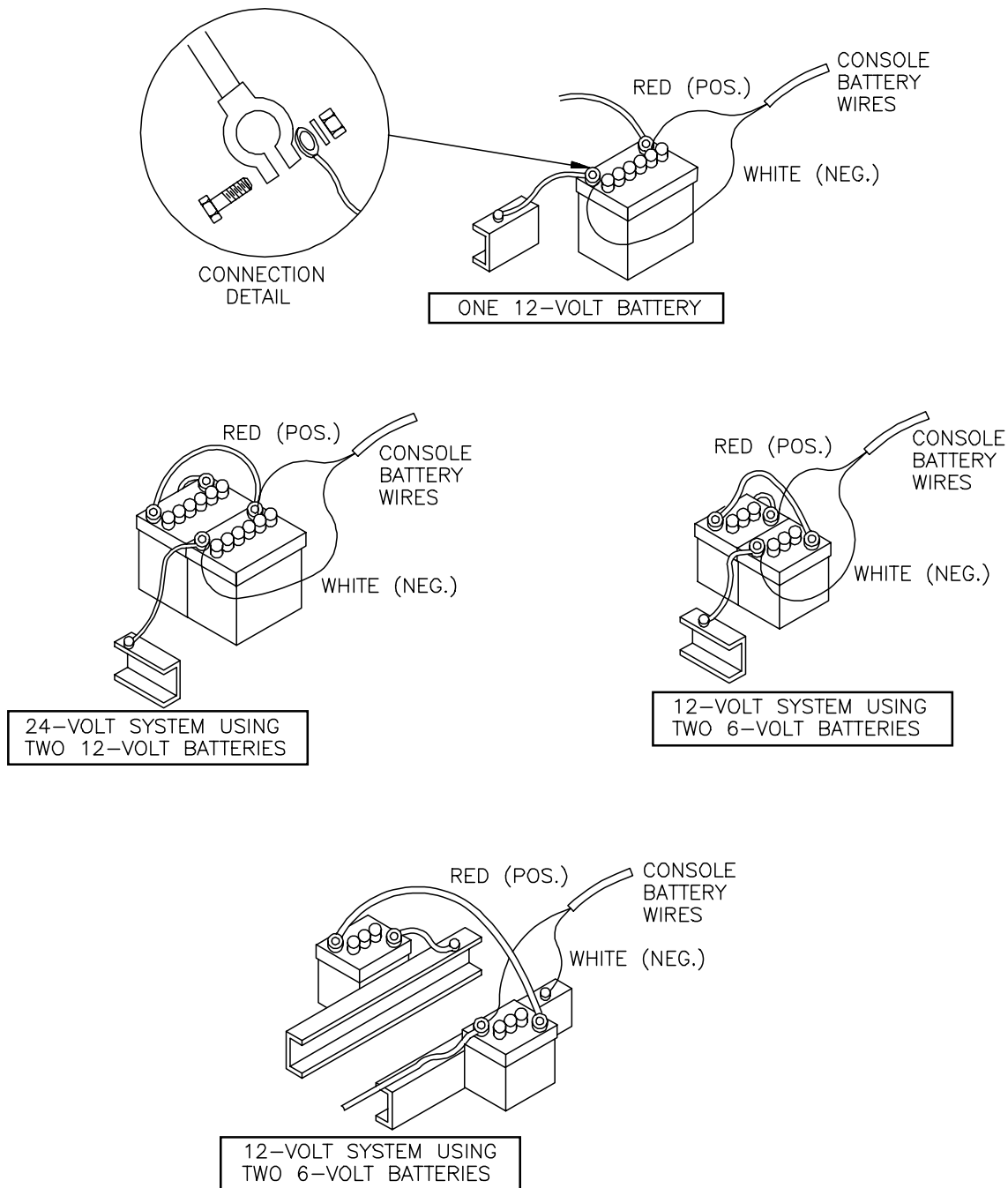
FIGURE 7

- 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 8 on page 8. (**DO NOT CONNECT RED OR 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.

**NOTE:** Whenever battery wires are disconnected, remove the optional 9-volt back-up battery from the Console.

- 4) Connect the Speed Sensor Cable to the plug in the back of the Console.
- 5) Secure and tie the Speed Sensor Cable and the Flow Control Cable with plastic cable ties.
- 6) Initial installation of the system is now complete.

# BATTERY CONNECTIONS



**FIGURE 8**

**NOTE:** Disconnect SCS 600 battery wires if the system is not used for an extended period, (i.e. two weeks). With the POWER switch to OFF, the system draws .25 milliamps of current to maintain information stored in Console computer. Whenever battery wires are disconnected, remove the optional 9-volt back-up battery from the Console.

# 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; the selection of **GRAN** (granular) or **440** (spray monitor) operating modes; and also **C-Sd** (Standard), **C-F** (Fast), or **C-FC** (Fast Close Valve).



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.

Selects manual or fully automatic control.

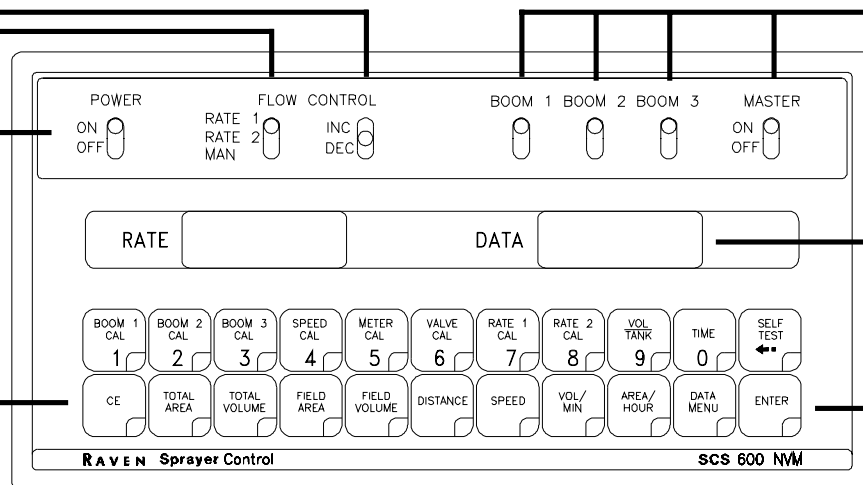
Manual override control provides capability for spot applications.

BOOM 1 -Drive motor On/Off

BOOM 2 -Clutch #1 On/Off

BOOM 3 -Clutch #2 On/Off

MASTER - System On/Off



CE -Use like you do the CE key on a calculator. This key is also used to select features listed in IMPORTANT box above.

ENTER -Used only to enter data into the Console.

Displays function and calibration data.

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

CALIBRATION KEYS -- Used to enter data into the Console to calibrate the system.

|            |    |  |
|------------|----|--|
| BOOM 1 CAL | -- | Length of Boom 1                             |
| BOOM 2 CAL | -- | Length of Boom 2                             |
| BOOM 3 CAL | -- | Length of Boom 3                             |
| SPEED CAL  | -- | Determined by Speed Sensor                   |
| METER CAL  | -- | Meter Calibration Number & Spreader Constant |
| VALVE CAL  | -- | Valve Response Time                          |
| RATE 1 CAL | -- | Target Application Rate                      |
| RATE 2 CAL | -- | Target Application Rate                      |

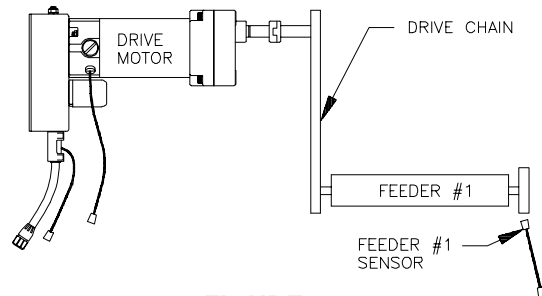
FUNCTION KEYS -- Used to Display Data

|              |    |                               |
|--------------|----|-------------------------------|
| TOTAL AREA   | -- | Total Area Applied            |
| TOTAL VOLUME | -- | Total Volume Applied          |
| FIELD AREA   | -- | Field Area Applied            |
| FIELD VOLUME | -- | Volume Applied to Field       |
| DISTANCE     | -- | Distance Traveled             |
| SPEED        | -- | Speed of Vehicle              |
| VOL/MIN      | -- | Volume Per Minute             |
| TIME         | -- | 24 Hour Clock (Military Time) |
| DATA MENU    | -- | Printer Option                |

# CONSOLE CALIBRATION

## 1. CALCULATING "BOOM CAL"

Select the figure below that correspond to the type of system to be used.

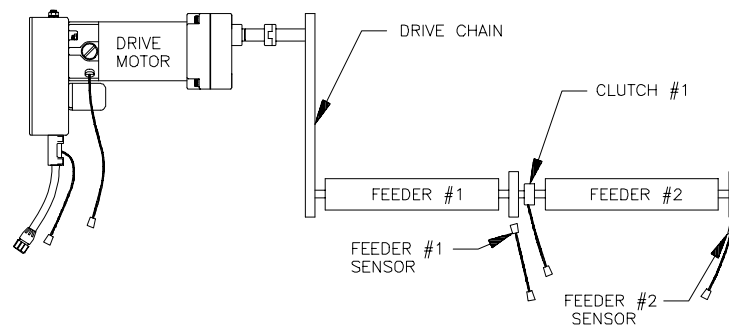


**FIGURE 9**

BOOM 1 CAL = total width of applicator in inches.

BOOM 2 CAL = 0

BOOM 3 CAL = 0

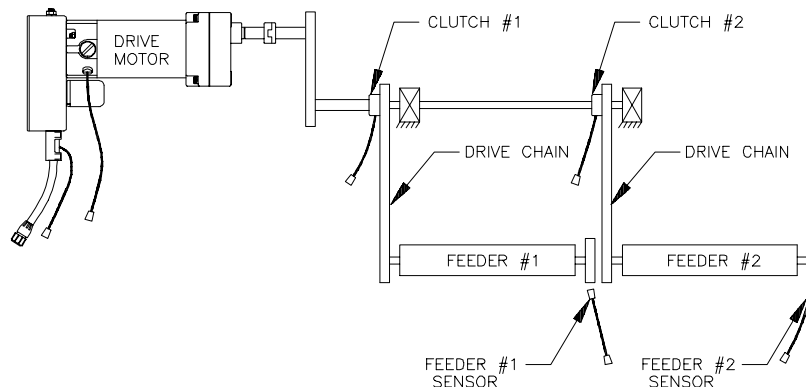


**FIGURE 10**

BOOM 1 CAL = one half of total boom width in inches.

BOOM 2 CAL = one half of total boom width in inches.

BOOM 3 CAL = 0

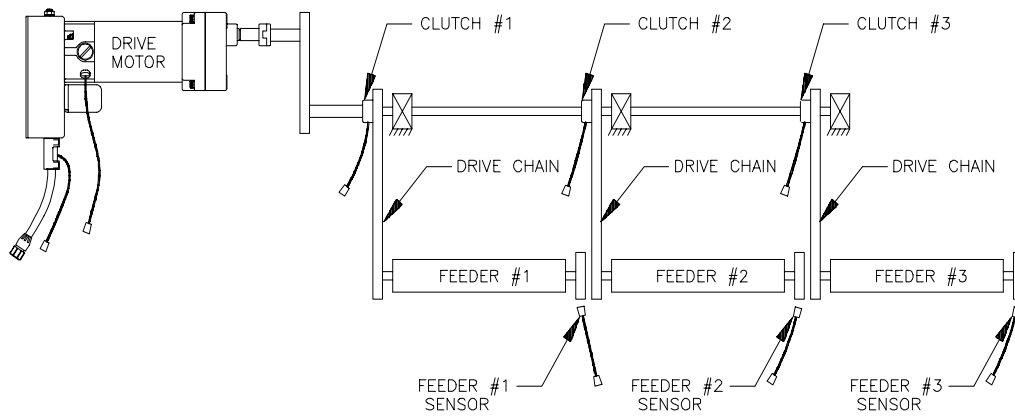


**FIGURE 11**

BOOM 1 CAL = 0

BOOM 2 CAL = one half of total boom width in inches.

BOOM 3 CAL = one half of total boom width in inches.



**FIGURE 12**

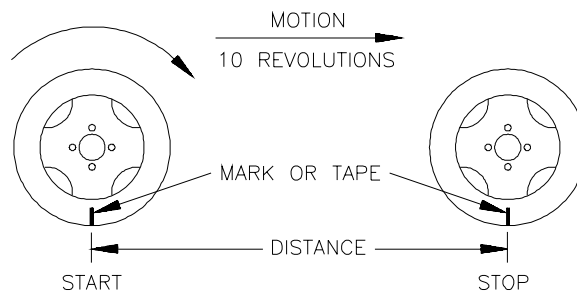
BOOM 1 CAL = one third of total boom width in inches.  
 BOOM 2 CAL = one third of total boom width in inches.  
 BOOM 3 CAL = one third of total boom width in inches.

## 2. CALCULATING "SPEED CAL"

This section applies only to the Wheel Drive Speed Sensor. (Instructions for Speedometer or Radar Speed Sensors are included in their packing carton).

- 1) Place chalk mark or tape on vehicle tire on which Speed Sensor is mounted, as shown in Figure 13.
- 2) Mark initial spot on the ground.
- 3) Drive vehicle straight ahead counting 10 revolutions of the wheel, with the mark stopping at the same position as starting.
- 4) Measure distance from start mark to stop mark in inches [cm]. (Round off fractions).
- 5) Write down this SPEED CAL calibration number for future reference when programming the Console.

**NOTE:** This measurement is critical to the performance of the SCS 600. **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.



**FIGURE 13**

### 3. CALCULATING "METER CAL"

Factors which can affect the product 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 METER CAL value is derived using the following procedure:

1) Use a pre-weighed box to capture granules as they are metered out. Use only one feeder for this procedure.

2) Enter a value of 80 into key labelled:



3) With the MASTER switch in the OFF position, place rate switch to MAN. Turn ON boom 1 switch and appropriate feeder clutch switch (boom 2 or boom 3).

4) Enter a "0" into the key labelled:



5) Turn MASTER switch to ON to begin collecting granules.

6) Turn MASTER switch OFF when total volume display reads 80.

7) Weigh the collected granules. If the actual weight is not 80 oz, perform the following calculation:

**EXAMPLE:** Old METER CAL = 80  
TOTAL VOLUME amount = 80  
Weight of collected material = 128

Corrected METER CAL =  $\frac{\text{Old METER CAL} \times \text{TOTAL VOLUME amount}}{\text{Weight of collected material}}$

$$= \frac{80 \times 80}{128} = 50$$

Corrected METER CAL = 50

This is the new METER CAL value. Repeat this procedure (starting with step 4), until the weight of the metered material equals the value in the total volume window.

8) To verify that both feeder settings are the same, calibrate the second feeder in the same manner as the first.

## 4. CALCULATING "SPREADER CONSTANT" (optional)

1) Multiply corrected METER CAL by density of material used. Divide this value by 10. This is the SPREADER CONSTANT for selected gate opening.

**EXAMPLE:** Corrected METER CAL = 312  
Density of material = 50 lbs.

$$\text{SPREADER CONSTANT} = \frac{\text{Corrected METER CAL} \times \text{Material Density}}{10}$$

$$= \frac{312 \times 50}{10} = 1560$$

$$\text{SPREADER CONSTANT} = 1560$$

2) Hold METER CAL key down for 5 seconds.

3) Enter SPREADER CONSTANT.

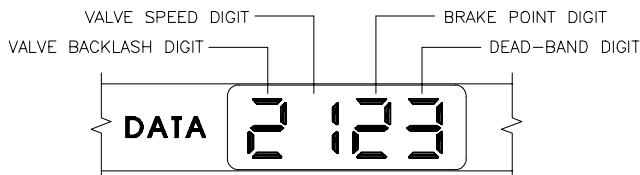
4) Enter density of material being used for METER CAL.

**NOTE:** Re-calculate SPREADER CONSTANT for change in gate opening.

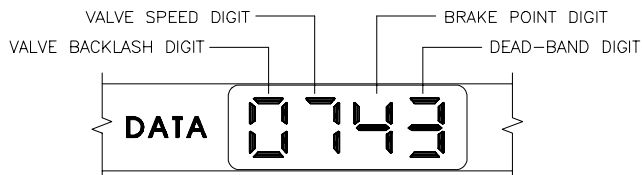
## 4. CALCULATING "VALVE CAL"

1) The Control Valve calibration number is pre-programmed (2123 for C-Sd, 743 for C-F or C-FC). No entry needs to be made for this value. However, if the response time of the Control Valve needs to be changed, a new calibration number can be entered by depressing the METER CAL key for 5 seconds. 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        | Range: 1 to 9 | 1-Slow, 9-Fast |
| C-F or C-FC Valve Control | Range: 0 to 9 | 9-Slow, 0-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%

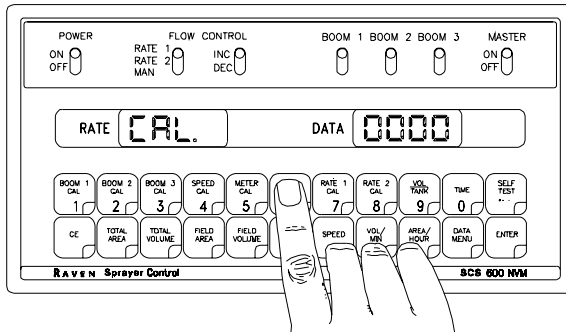
Dead-Band Digit -- Allowable difference between target and actual application rate, where rate correction is not performed.

Range: 1 to 9      1 = 1%, 9 = 9%

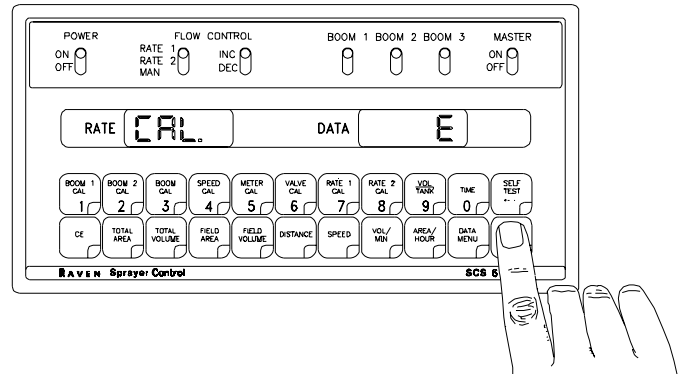


# CONSOLE PROGRAMMING

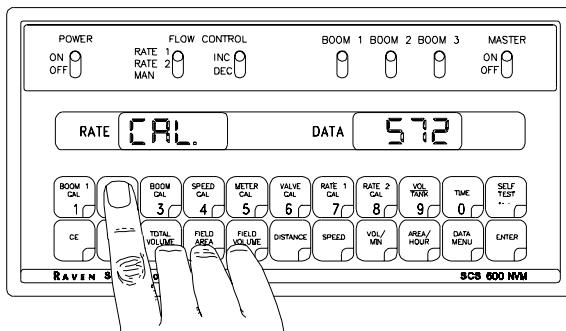
When entering data into the Console, the entry sequence is always the same. (NOTE: DATA MUST BE ENTERED INTO KEYS 1 THRU 8).



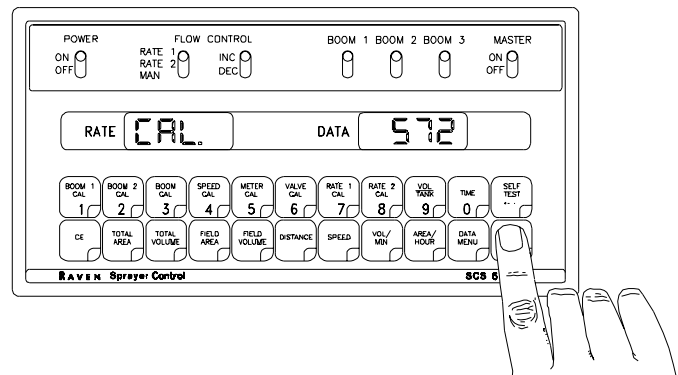
Depress the key in which you wish to enter data.



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 GRAN.


5) Displaying GRAN (granular monitor) or 440 (spray monitor).

a) Depressing momentarily  steps the DATA display from GRAN to 440.

b) Depressing momentarily  steps the DATA display from 440 to GRAN.

6) Selecting GRAN or 440.

a) To select GRAN or 440 step  until desired code is displayed in the DATA display.

b) Momentarily depress . The data display will now display C-Sd.


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


a) Depressing momentarily  steps the DATA display from C-Sd to C-F.

b) Depressing momentarily  steps the DATA display from C-F to C-FC.

c) Depressing momentarily  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) Enter BOOM 1 CAL in key labelled:



If using no clutch system enter total boom width in inches.

If using single clutch system enter one half the total boom width in inches.

If using dual clutch system enter 0.

If using triple clutch system enter one third the total boom width in inches.

10) Enter BOOM 2 CAL in key labelled:



If using no clutch system enter 0.

If using single clutch system enter one half the total boom width in inches.

If using dual clutch system enter one half the total boom width in inches.

If using triple clutch system enter one third the total boom width in inches.

11) Enter BOOM 3 CAL in key labelled:



If using no clutch system enter 0.

If using single clutch system enter 0.

If using dual clutch system enter one half the total boom width in inches.

If using triple clutch system enter one third the total boom width in inches.

12) Enter SPEED CAL in key labelled:



13) Enter METER CAL calibration number 200 in key labelled:




This METER CAL number will have to be refined by performing the procedure on page 13, CALCULATING METER CAL, after initial programming is complete.

14) Enter VALVE CAL calibration number (2123) in key labelled:




15) Enter RATE 1 CAL oz/acre [dl/ha] target application rate in key

labelled: 

**NOTE:** A decimal point is displayed automatically. Therefore, twenty ounces per acre is entered as 20.0, not 2.0.


16) Enter RATE 2 CAL oz/acre [dl/ha] target application rate, in key

labelled: 

**YOU HAVE NOW COMPLETED PROGRAMMING THE CONSOLE**

The flashing "CAL" will now extinguish. If not, repeat procedure starting at Step 5.

17) Enter the estimated TOTAL VOLUME in TANK (ounces) [dl] in key

labelled: 

Each time the tank is refilled, this number must be re-entered. However, entry of this data is not required for the operation of the system.

## 2. OTHER DISPLAYS

1) To display TOTAL AREA covered, momentarily depress key labelled: To "zero out" this total at any time, enter a "0" in this key.




2) To display FIELD AREA covered, momentarily depress key labelled: To "zero out" this total at any time, enter a "0" in this key.



3) To display FIELD VOLUME (ounces) [dl] of product applied, momentarily depress key labelled: To "zero out" this total at any time, enter a "0" in this key.




4) To display DISTANCE (feet) [m] traveled, momentarily depress key

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

5) To display MPH [km/h], momentarily 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 key labelled:  If 6 MPH

[9.6 km/h] is desired, enter 6.0 [9.6]. See CONSOLE PROGRAMMING on page 15.

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. ALARM DEFINITIONS

- 1) Out of range error - Alarm sounds when actual rate differs from target rate by 30% or more.
- 2) Flow alarm - Alarm sounds and Rate Display flashes "Flo Err" if flow is registered while booms are turned off.  
\*GRAN Mode Only
- 3) Boom error - Alarm sounds and Rate Display flashes "Boom Error" if booms are programmed in wrong sequence.
- 4) Shaft 1 alarm - Alarm sounds and Rate Display flashes "SHa1" if shaft 1 should be turning, but is not.
- 5) Shaft 2 alarm - Alarm sounds and Rate Display flashes "SHa2" if shaft 2 should be turning, but is not.
- 6) Shaft 3 alarm - Alarm sounds and Rate Display flashes "SHa3" if shaft 3 should be turning, but is not.
- 7) Air alarm - Alarm sounds and Rate Display flashes "Air" if air pressure in tank falls to zero.
- 8) Bin Level alarm - Alarm sounds and Rate Display flashes "bin" if bin level falls below set level.

## 5. PROGRAMING ALARM FEATURES

To program Alarm Features depress



for 5 seconds. "A on" will be displayed

in DATA display. (First Alarm Feature as listed below).

### ALARM MENU

- 1) Selecting "A on" or "A off" (enabling or disabling alarm buzzer).


a) To select "A on" or "A off" step with




until desired code is displayed in DATA display.

b) Depress "ENTER" key to store selection and advance to next Alarm Feature, Shaft 1 Alarm.


## DISPLAYING SHAFT 1 ALARM ("1 ON" OR "1 OFF")

- 1) Selecting "1 on" or "1 off".
  - a) To select "1 on" or "1 off" step with  until desired code is displayed in DATA display.
  - b) Depress "ENTER" key to store selection and advance to next Alarm Feature, Shaft 2 Alarm.


## DISPLAYING SHAFT 2 ALARM ("2 ON" OR "2 OFF")

- 1) Selecting "2 on" or "2 off".
  - a) To select "2 on" or "2 off" step with  until desired code is displayed in DATA display.
  - b) Depress "ENTER" key to store selection and advance to next Alarm Feature, Shaft 3 Alarm.


## DISPLAYING SHAFT 3 ALARM ("3 ON" OR "3 OFF")

- 1) Selecting "3 on" or "3 off".
  - a) To select "3 on" or "3 off" step with  until desired code is displayed in DATA display.
  - b) Depress "ENTER" key to store selection and advance to next Alarm Feature, Air Alarm.


## DISPLAYING AIR ALARM ("4 ON" OR "4 OFF")






- 1) Selecting "4 on" or "4 off".
  - a) To select "4 on" or "4 off" step with  until desired code is displayed in DATA display.
  - b) Depress "ENTER" key to store selection and advance to next Alarm Feature, Bin Level Alarm.

## DISPLAYING BIN LEVEL ALARM ("5 ON" OR "5 OFF")







- 1) Selecting "5 on" or "5 off".
  - a) To select "5 on" or "5 off" step with  until desired code is displayed in DATA display.
  - b) Depress "ENTER" key to store selection and advance to first Alarm Feature, Alarm Menu.






## 6. SEQUENCE TO ACTIVATE DATA-LOCK

- 1) Depress  for 5 seconds, NEW CODE message will appear.
- 2) Enter 4 digit code within 15 seconds.


**EXAMPLE:** For 1058, depress:     and 

## 7. SEQUENCE TO CHANGE DATA-LOCK

- 1) Depress  for 5 seconds, OLD CODE message will appear.
  - 2) Enter 4 digit code within 15 seconds.     and 
- NEW CODE message will appear. Enter 4 digit code within 15 seconds.

**EXAMPLE:** For 1258, depress:     and 



## 8. ENTER MODE SEQUENCE WITH ACTIVATED DATA-LOCK

- 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.

\* The DATA-LOCK feature prohibits the entry of data without first entering the DATA-LOCK CODE. If DATA-LOCK is not desired, omit Steps 6, 7, and 8. The DATA-LOCK CODE may be cleared by entering a code of "0" or by removing Console power.



## 9. POWER DOWN DELAY TIME 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 1:00. The delay time is initially set at 10 days, but can be changed by the user.

- 1) Displaying delay time.
  - a) Depress  for 5 seconds, the current delay time (in days) will appear.
- 2) Changing delay time.
  - a) Depress  for 5 seconds, the current delay time will appear.
  - b) Enter new delay time (0 to 200 days) using the same procedure as that for entering other data.

**NOTE:** In the event of a power loss to the Console, the power down delay time will go back to 10 days.

## 10. DISPLAY MENU

Depress  for 7 seconds until DATA display shows "d on". Depressing momentarily the  key steps the DATA display between "d on" and "d off". "d on" means RATE displays target rate when actual rate is within a percentage of target rate. This percentage is determined by the third digit of VALVE CAL value as shown:


Break Point Digit  
(3rd digit) of VALVE CAL 2 1  3

0 = 1% + Deadband  
1 = 3% + Deadband  
2 = 7% + Deadband  
3 = 10% + Deadband  
4 = 20% + Deadband



5 = 25% + Deadband  
6 = 30% + Deadband  
7 = 35% + Deadband  
8 = 40% + Deadband  
9 = 45% + Deadband

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

## 11. LOW LIMIT FLOW SET POINT AND LOW LIMIT ALARM

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 gal/min and half the total boom length is shut off, the Console automatically reduces the low limit to 2 gal/min).

## 12. CONTROL VALVE DELAY

Depress  until DATA display flashes. The first digit, (  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.



# INITIAL SYSTEM SET-UP

- 1) Fill bin(s) with required product.
- 2) Place MASTER ON/OFF to OFF and 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 in SELF TEST the normal operating Speed.
- 7) Place MASTER ON/OFF switches to ON.
- 8) Verify that each boom operates by operating BOOM ON/OFF switches.  
See CONSOLE FEATURES for operation of 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. Verify target rate falls between maximum and minimum rates shown in the RATE display.

# INITIAL SYSTEM FIELD TEST

- 1) Drive down field or road at target speed with MASTER ON/OFF switch OFF, to verify SPEED readout on Console.
- 2) Turn appropriate boom switches ON 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 MASTER ON/OFF to OFF to shut off flow. This also shuts off the area totalizer.
- 6) Verify area covered and volume used.

# TROUBLESHOOTING GUIDE

| <u>PROBLEM</u>   | <u>CORRECTIVE ACTION</u>   |
|--|--|
| 1) NO DISPLAY LIGHTS WITH POWER ON.  | 1) Check fuse on back of Console.<br>2) Check battery connections.<br>3) Check operation of POWER ON/OFF switch.<br>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) Check battery voltage and battery connections.<br>2) Install stand-by 9-volt "alkaline" battery in battery box at rear of Console. (Duracell MN 1604 or EverReady 522).<br>3) Install CB Radio suppressor kit on vehicles ignition system.                                    |
| 6) CONSOLE DISPLAYS FLASHING "CAL" WHENEVER MASTER SWITCH IS TURNED ON OR OFF. | 1) Check battery voltage and battery connections.<br>2) Obtain electrical noise suppressors from CB radio shop and install on boom On/Off Valves.  |
| 7) CONSOLE DISPLAYS FLASHING "CAL" WHENEVER SPEED IS CHANGED.                  | 1) Check battery voltage and battery connections.<br>2) Check for bad spark plug wires with engine analysis computer.<br>3) Obtain electrical noise suppressors from CB radio shop and install on spark plug and generator. Install grounding strap from engine hood to chassis. |
| 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 Switch Assembly.
- 4) If 24 foot Speed Sensor Extension Cable is used, see Appendix 4.

11) SPEED INACCURATE OR UNSTABLE  
(WHEEL DRIVE SPEED SENSOR).

- 1) Run speed check on hard surface road. If SPEED is accurate, investigate Speed Sensor on different wheel.
- 2) Remove one red magnet and one black magnet from the wheel. (Reposition remaining red and black magnets directly across from each other). Enter a SPEED CAL number in the Console twice as large as the correct SPEED CAL number. Run speed check on hard surface road. Remove these two magnets and replace with other two. Run speed check. If SPEED is inaccurate with only one set of magnets, replace the bad set. If SPEED is inaccurate with both sets, replace Speed Sensor Assembly.

NOTE: Re-enter original SPEED CAL number after testing is complete.

12) SPEED INACCURATE OR UNSTABLE  
(SPEEDOMETER DRIVE SPEED  
SENSOR).

- 1) Wiggle cable at the Speed Sensor connector. If speed is displayed, tighten connector or replace Transducer Assembly.
- 2) Check Speedometer Cable Adapter, Key, and Transducer Assembly for proper connections and engagement.
- 3) Check for kinked speedometer cable or too sharp of bend.
- 4) Check for bad spark plug wires with engine analysis computer.
- 5) Obtain electrical noise suppressors from CB radio shop and install on spark plugs and generator. Install grounding strap from engine hood to chassis.
- 6) Replace Speedometer Transducer Assembly.

13) 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 17.

14) 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 or 12.
- 2) In MAN (manual) operation, verify that RATE display (oz/acre) holds constant. If not, refer to Troubleshooting Problem 18.
- 3) In MAN (manual) operation, check low end and high end pressure range. Pressure range must be per installation procedure on page 15. If pressure can not be adjusted manually, refer to Troubleshooting Problem 17.
- 4) If problem persists, return Console to Dealer to replace Processor Board Assembly.

15) CAN NOT VARY RATE IN MANUAL OPERATION OR IN AUTO.

- 1) Check cabling to Motorized Control Valve for breaks.
- 2) Check connections in cabling for cleanliness.
- 3) Verify that there is voltage at the valve connector by placing MASTER switch ON; RATE 1/RATE 2/MAN switch to MAN; and POWER switch to ON. Manually operate INC/DEC switch to verify voltage.
- 4) Verify that valve is turning, if not, replace motorized Control Valve.

16) TOTAL VOLUME DOES NOT REGISTER.

- 1) Check Metering Shaft Sensor cable for breaks and shorts. See Appendix 3 for test procedure.
- 2) Replace Metering Shaft Sensor.

# APPENDIX 1

## 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:

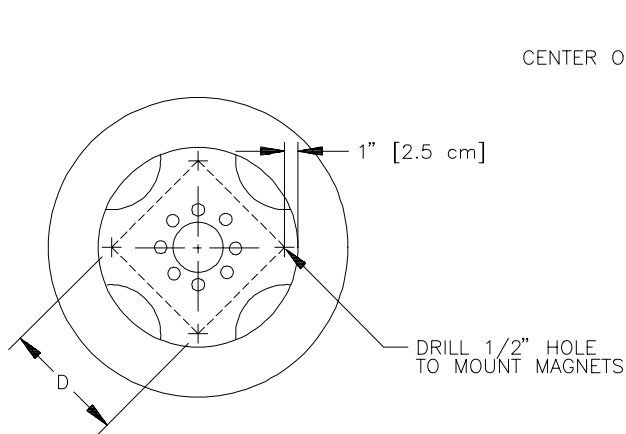
Choose stud holes that are opposite each other as shown in Figure 14. Using the center of opposite holes, scribe two lines on the rim web to divide the circumference into four equal parts. Measure in one inch from the outer edge of the web on each of the lines drawn. Mark this point as the center. Drill four 1/2" holes for mounting the magnets.

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

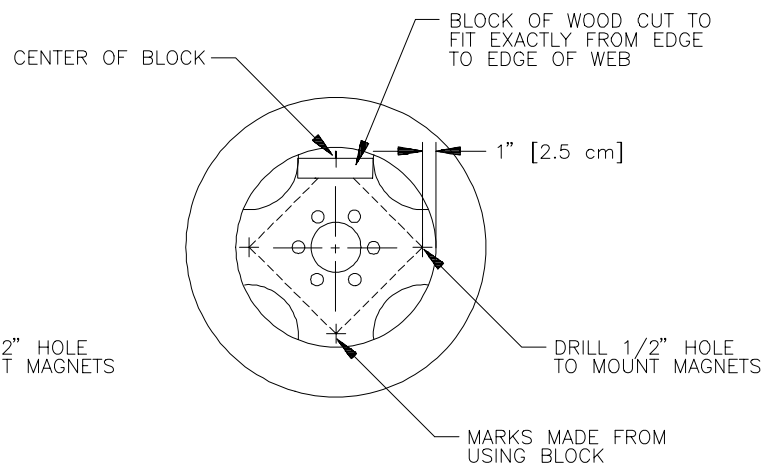
### RIMS WITH SIX HOLE STUD PATTERN:

Locate the center of the holes to be drilled by using the rim webbing as a guide. (See Figure 15). Obtain a small piece of wood and cut to fit exactly over the web as shown in Figure 15. 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:** Distance (D) between each set of drilled holes must be equal within 1/8" [3 mm] to ensure accuracy of system.



**FIGURE 14**  
**EIGHT HOLE STUD PATTERN**

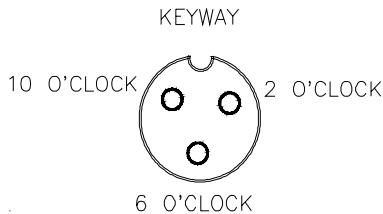


**FIGURE 15**  
**SIX HOLE STUD PATTERN**

## APPENDIX 2

# 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.



- 1) 2 o'clock socket is power.
- 2) 10 o'clock socket is ground.
- 3) 6 o'clock socket is signal.

### VOLTAGE READINGS

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

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 10 o'clock and 6 o'clock sockets with a "short-no short" motion. This should cause a speed reading to be displayed in the Console. Each time a contact is made, the DISTANCE total should increment up 1 or more counts.

- 4) If DISTANCE does not count up, remove the section of cable and repeat test at connector next closest to Console. Replace defective cable as required.

- 5) Perform above voltage checks.

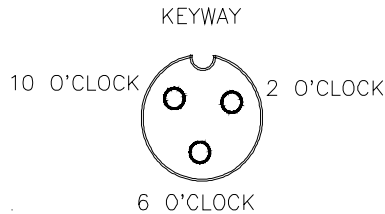
- 6) If all cables test good, replace speed sensor.

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

## APPENDIX 3

### 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:



- 1) 2 o'clock socket is ground.
- 2) 10 o'clock socket is power.
- 3) 6 o'clock socket is signal.

#### VOLTAGE READINGS

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

Procedure to check cable:

- 1) Enter a METER CAL number of one (1) in key labelled:



- 2) Depress key labelled:



- 3) Place BOOM switches ON.

4) With small jumper wire (or paper clip), short between 2 o'clock and 6 o'clock sockets with a "short-no short" motion. Each time a contact is made, the TOTAL VOLUME should increment up 1 or more counts.

5) If TOTAL VOLUME does not count up, remove the section of cable and repeat test at connector next closest to Console. Replace defective cable as required.

6) Perform above voltage checks.

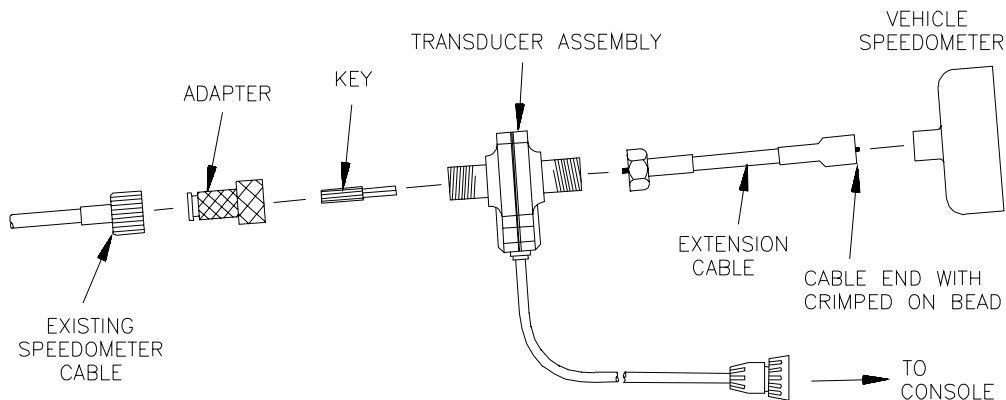
7) If all cables test good, replace Flow Sensor.




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

## APPENDIX 4

# SPEEDOMETER DRIVE SPEED SENSOR INSTALLATION AND CALIBRATION

- 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. The unit is now ready for calibration with your vehicle.
- 7) Complete INITIAL CONSOLE PROGRAMMING before doing this procedure.
- 8) Enter "0" in key labelled: 
- 9) Enter 612 [155] in key labelled: 
- 10) Drive 1 mile [1 km]. (**CAUTION:** Do not use vehicle odometer to determine distance. Use section lines or Highway markers).
- 11) Read DISTANCE by depressing key labelled: 



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].

If the DISTANCE display reads any other value, divide SPEED CAL by the value observed in DISTANCE, then multiply by 5280 [1000]. This will give you the correct value to enter for SPEED CAL. You must round off to the nearest 3 digit number.

**EXAMPLE:** Assume DISTANCE read 5000 [980].

ENGLISH UNITS:

$$\frac{612 \times 5280}{5000} = 646.3$$

METRIC UNITS:

$$\frac{[155] \times 1000}{980} = 158.1$$

**12)** The number to enter for SPEED CAL is 646 [158].

**13)** Recheck the new SPEED CAL derived above.

a) Zero out DISTANCE display as in Step 8.

b) Enter the new SPEED CAL number as in Step 9.

c) Repeat steps 10, 11, and 12.

PART NUMBER: 063-0171-393

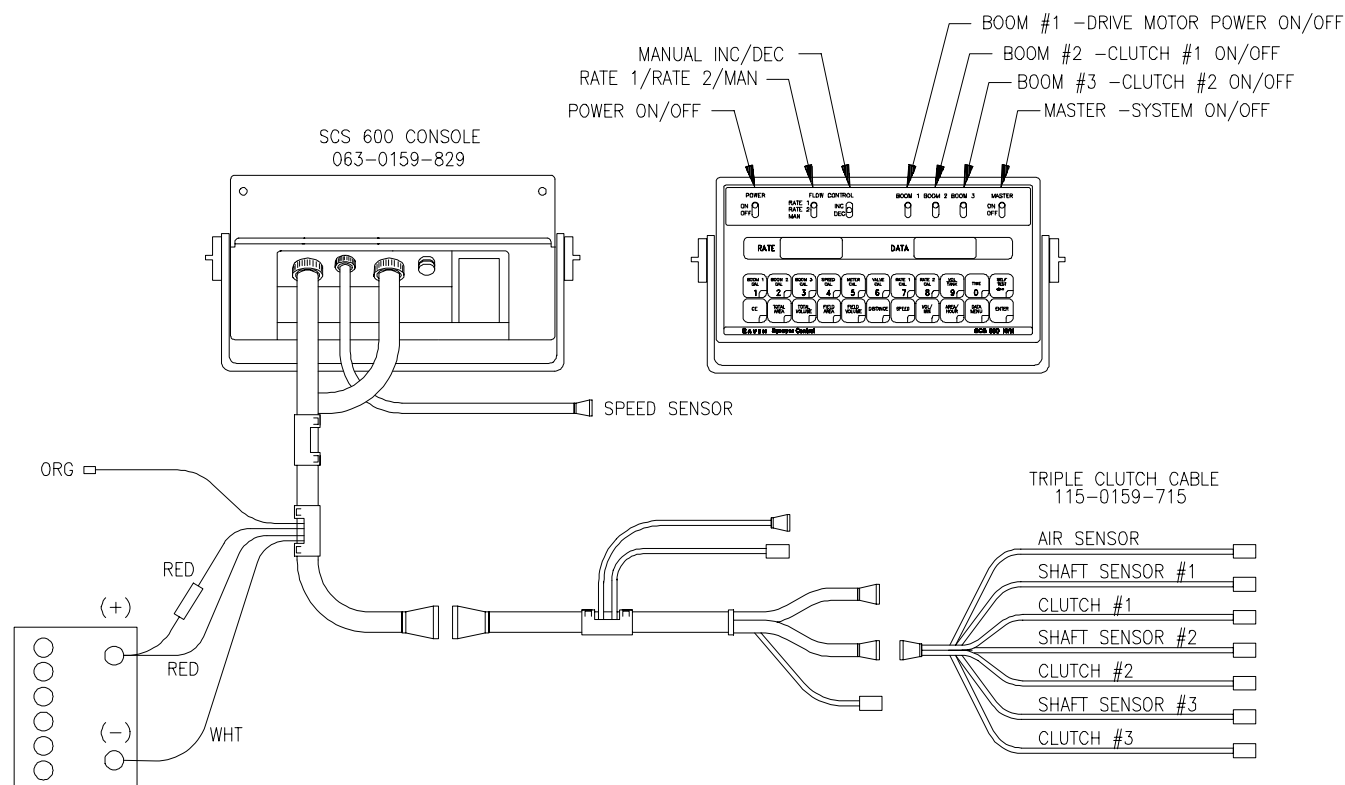
[illegible]

- 32

## APPENDIX 6

### TRIPLE CLUTCH OPTION

- 1) Mount the Console to a secure support inside the cab of the vehicle.
- 2) Connect the 10 foot [3 m] Console Control Cable to the plug in the back of the Console. Run the Control Cable out of the vehicle cab and connect with 6-foot [1.8 m] Flow Control Cable on the sprayer. (Extension cables are available from your Dealer).



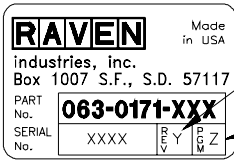
- 3) Turn POWER ON/OFF switch OFF and route the Red and White battery wires to a 12-volt battery. Attach the White battery wire to the **NEGATIVE (-)** terminal and the Red battery wire directly to the **POSITIVE (+)** battery terminal. See Figure 8 on page 8. **(DO NOT CONNECT RED OR WHITE WIRES TO 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.

**NOTE:** Whenever battery wires are disconnected, remove the optional 9-volt back-up battery from the Console.

- 4) Connect the Speed Sensor cable to the plug in the back of the Console.
- 5) Secure and tie the Speed Sensor Cable and the Flow Control Cable with plastic cable ties.
- 6) Initial installation of the system is now complete.

# CONSOLE FEATURES (TRIPLE CLUTCH ONLY)

**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; the selection of **GRAN** (granular) or **440** (spray monitor) operating modes; and also **C-Sd** (Standard), **C-F** (Fast), or **C-FC** (Fast Close Valve).



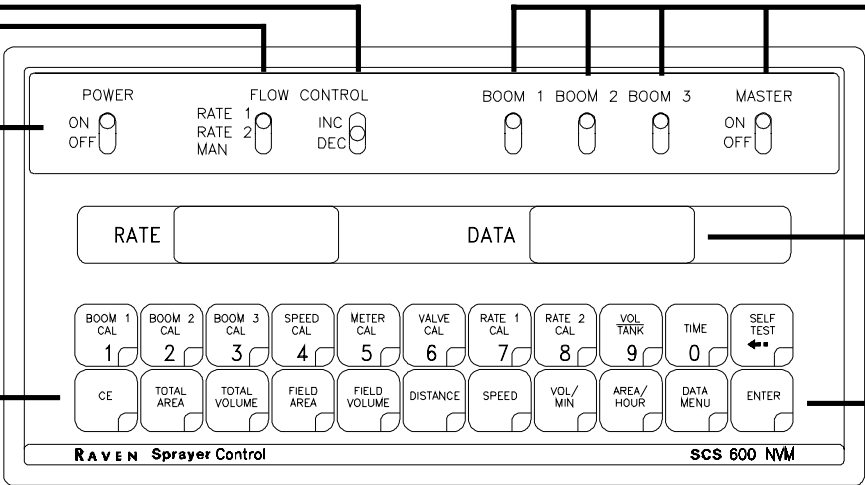
Console Revision can be determined by the letter stamped in REV box on label.

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

Selects manual or fully automatic control.

Manual override control provides capability for spot applications.

- BOOM 1 -Drive motor On/Off
- BOOM 2 -Clutch #1 On/Off
- BOOM 3 -Clutch #2 On/Off
- MASTER - System/Drive Motor On/Off



CE -Use like you do the CE key on a calculator. This key is also used to select features listed in IMPORTANT box above.

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

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.

FUNCTION KEYS -- Used to Display Data

- |            |    |  |
|------------|----|--|
| BOOM 1 CAL | -- | Length of Boom 1                             |
| BOOM 2 CAL | -- | Length of Boom 2                             |
| BOOM 3 CAL | -- | Length of Boom 3                             |
| SPEED CAL  | -- | Determined by Speed Sensor                   |
| METER CAL  | -- | Meter Calibration Number & Spreader Constant |
| VALVE CAL  | -- | Valve Response Time                          |
| RATE 1 CAL | -- | Target Application Rate                      |
| RATE 2 CAL | -- | Target Application Rate                      |

- |              |    |                               |
|--------------|----|-------------------------------|
| TOTAL AREA   | -- | Total Area Applied            |
| TOTAL VOLUME | -- | Total Volume Applied          |
| FIELD AREA   | -- | Field Area Applied            |
| FIELD VOLUME | -- | Volume Applied to Field       |
| DISTANCE     | -- | Distance Traveled             |
| SPEED        | -- | Speed of Vehicle              |
| VOL/MIN      | -- | Volume Per Minute             |
| TIME         | -- | 24 Hour Clock (Military Time) |
| DATA MENU    | -- | Printer Option                |





# RAVEN

## RAVEN INDUSTRIES

### Limited Warranty

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#### ***What Does this Warranty Cover?***

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

#### ***How Long is the Coverage Period?***

Raven Applied Technology Products are covered by this warranty for 12 months after the date of purchase. This warranty coverage applies only to the original owner and is nontransferable.

#### ***How Can I Get Service?***

Bring the defective part and proof of purchase to your Raven Dealer. If your Dealer agrees with the warranty claim, the Dealer will send the part and proof of purchase to their distributor or to Raven Industries for final approval.

#### ***What Will Raven Industries Do?***

Upon confirmation of the warranty claim, Raven Industries will, at our discretion, repair or replace the defective part and pay for return freight.

#### ***What is not Covered by this Warranty?***

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products 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 or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.