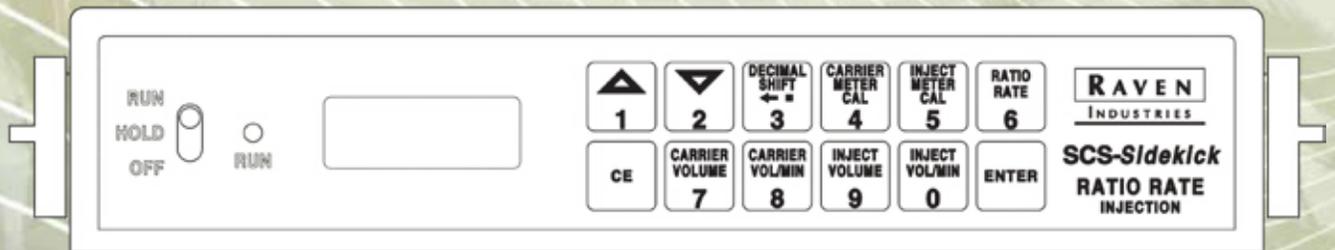


**RAVEN**

*Simply improving your position.<sup>SM</sup>*

# Installation & Operation Manual



**SCS Sidekick™ Ratio Rate Injection System**

### NOTICE

1. The SCS SIDEKICK RATIO RATE INJECTION system is intended to be used with only chemicals that are classified as EC's (Emulsifiable Concentrates).
2. Always flush system with water when changing chemicals or when system is not going to be used for several days. This includes tank, all inlet plumbing, injection pump, the plumbing between pump and injection point, and chemical in the carrier system including booms.

### WARNING

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

# TABLE OF CONTENTS

SYSTEM SPECIFICATIONS .....	2
SYMBOL DEFINITION .....	2
INTRODUCTION .....	3
OPERATION .....	4
SYSTEM DIAGRAMS .....	5
INSTALLATION	
1. INJECTION MODULE .....	8
2. PLUMBING .....	9
3. CONSOLE .....	11
4. CABLING .....	12
BATTERY CONNECTIONS .....	13
CONSOLE FEATURES .....	14
CONSOLE PROGRAMMING .....	15
1. CALCULATING "CARRIER METER CAL" .....	16
2. CALCULATING "INJECT METER CAL" .....	16
3. CALCULATING "VALVE CAL" .....	16
4. CALCULATING INJECTION SYSTEM ENABLE RATE .....	17
5. CONSOLE CALIBRATION .....	17
6. ENTERING CARRIER METER CAL .....	18
7. ENTERING INJECT METER CAL .....	18
8. ENTERING RATIO RATE .....	18
9. DECIMAL SHIFT .....	18
10. OTHER DISPLAY FEATURES .....	18
HIDDEN FEATURES .....	19
INITIAL INJECTION SET-UP .....	28
PREVENTIVE MAINTENANCE .....	29

---

## APPENDIXES

---

1. SIDEKICK INJECTION SYSTEM TROUBLESHOOTING FLOWCHART .....	30
2. PROCEDURE TO TEST CONSOLE ENABLE .....	31
3. PROCEDURE TO TEST CABLES .....	32
4. PROCEDURE TO TEST METERING SENSOR CABLES .....	33
5. PROCEDURE TO TEST TACH GENERATOR .....	34
6. PROCEDURE TO TEST METERING SENSOR .....	35
7. PROCEDURE TO RE-CALIBRATE PUMP .....	36
8. PROCEDURE TO TEST FLOW MONITOR SENSOR .....	37
9. SENSITIVITY ADJUSTMENT PROCEDURE, MANIFOLD FLOW MONITOR SENSOR .....	38
10. PROCEDURE TO TEST VACUUM SWITCH .....	39
11. ALTERNATE TANK SELECTION .....	40
12. SERIAL INTERFACE .....	41
13. SCS-SIDEKICK COMMUNICATION STRINGS .....	42

# SYSTEM SPECIFICATIONS

## CONSOLE:

4 Digit Display  
Keyboard Data Entry System  
Microprocessor Based  
PWM Motor Control W/Tach Feedback  
Automatic Control

## CABLES:

15' Console Cable P/N 115-0171-130  
27' Product Cable P/N 115-0171-138  
Extension Cables Available

## MODULE:

Pump: Piston  
150 PSI Max

Capacity: 5-200 oz/min Hi Volume  
1-40 oz/min Lo Volume

# SYMBOL DEFINITION

lit - Liters  
dl - Deciliter  
ml - Milliliter  
[ ] - Metric Numbers

## Meter Cal Conversions

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

### EXAMPLE:

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

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

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

## Liquid Conversions

U.S. Gallons x 128 = Fluid Ounces  
U.S. Gallons x 3.785 = Liters  
U.S. Gallons x 0.83267 = Imperial Gallons  
U.S. Gallons x 8.37 = Pounds (Water)

# INTRODUCTION

The Raven SCS SIDEKICK RATIO RATE INJECTION SYSTEM is designed to improve the accuracy and uniformity of spray applications. Its performance relies on the installation and preventive maintenance of the complete sprayer. It is important that this Installation and Operation Manual be reviewed thoroughly before operating the system. This Manual provides a simple step-by-step procedure for installing and operating this system.

The SCS SIDEKICK RATIO RATE INJECTION SYSTEM consists of a computer based Control Console, one Injection Module, an In-Line Mixer and cables.

The Injection Module mounts to the framework of the sprayer. The In-Line Mixer mounts just before the Boom On/Off Valves. Appropriate cabling is furnished for field installation.

The operator sets the target application rate to be injected per unit of carrier volume and the SCS SIDEKICK RATIO RATE automatically maintains the flow regardless of vehicle speed or gear selection.

The SCS SIDEKICK RATIO RATE Console controls the Injection System based on carrier flow volume. Application rates are programmed as ounces [Milliliters] of chemical per gallon [liter] of carrier.

**NOTE:** When programmed in SI, the Inject Meter Cal number is the number of Pulses per Deciliter. Inject Volume reads out in Deciliters. RATIO RATE is programmed as Milliliters per Liter.

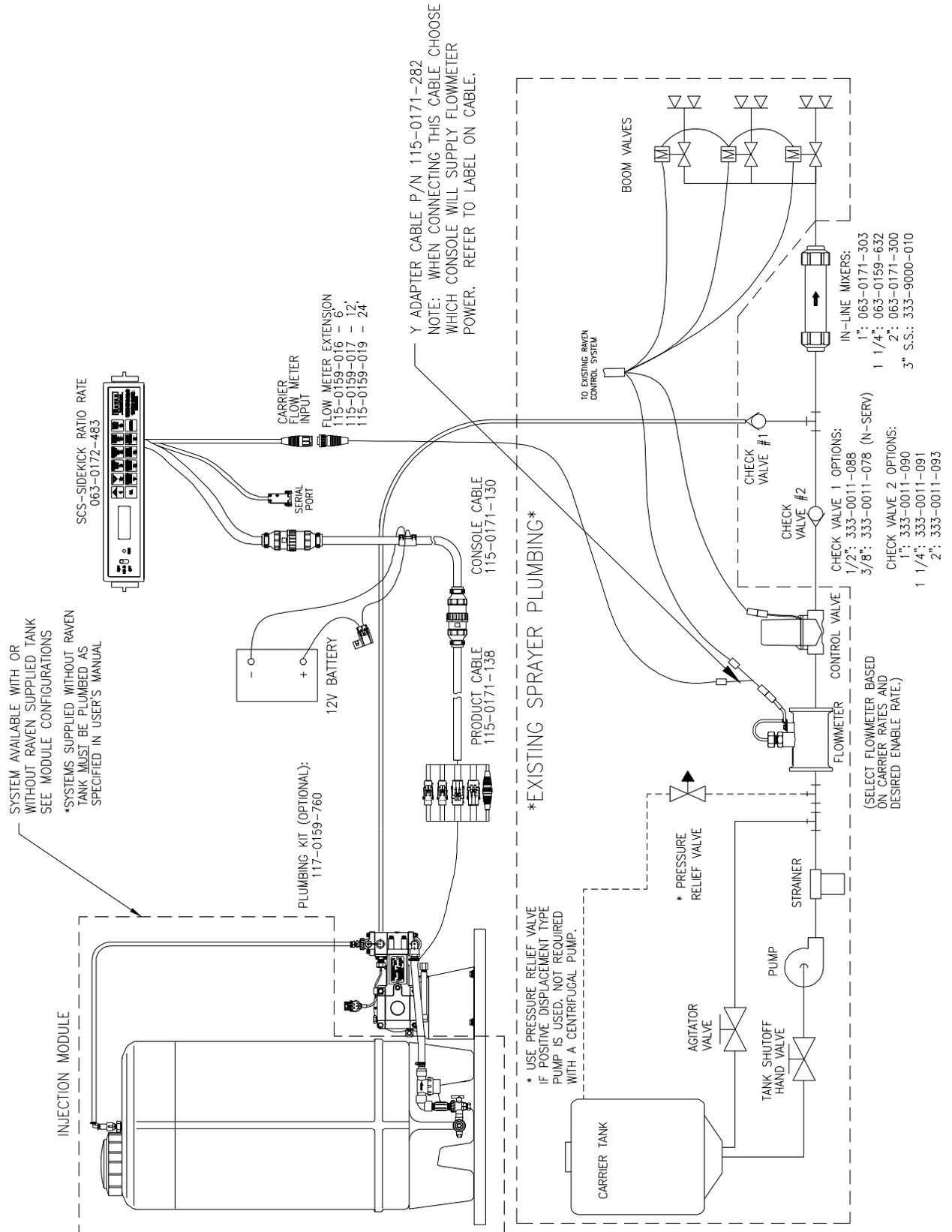
# OPERATION

The SCS SIDEKICK RATIO RATE console enables the Injection module by the frequency of the carrier flowmeter. The enable rate will be determined by size of the carrier flowmeter and its meter cal number. The console automatically calculates the enable rate based on the meter cal of the carrier flowmeter. The injection module is enabled when the frequency output of the carrier flowmeter reaches 3 Hertz.

To operate the Sidekick Ratio Rate system, place the OFF/HOLD/RUN switch to RUN. Whenever the carrier is ON and the enable rate has been reached, the injection module will run. To stop injecting chemical, place the OFF/HOLD/RUN switch to HOLD. This will flush the carrier of the chemical being injected. If the carrier is shut off, this will shut off the injection module and leave the chemical to carrier ratio as programmed. When the system is not to be used, shut off the carrier and the OFF/HOLD/RUN switch. Refer to Initial System Setup.

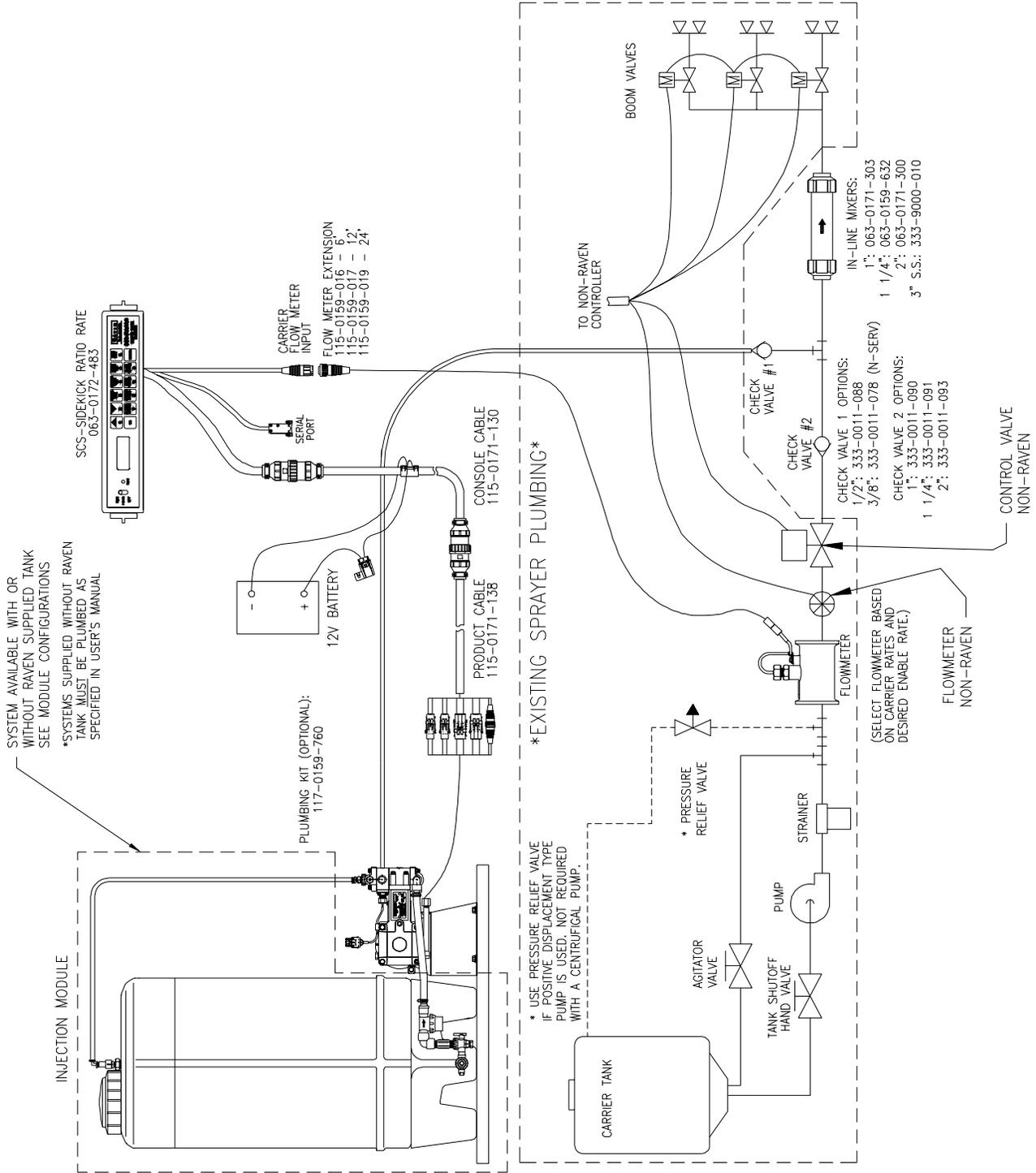
# RATIO RATE SIDEKICK SYSTEM DIAGRAM I

## USED WITH A RAVEN CARRIER CONTROL SYSTEM



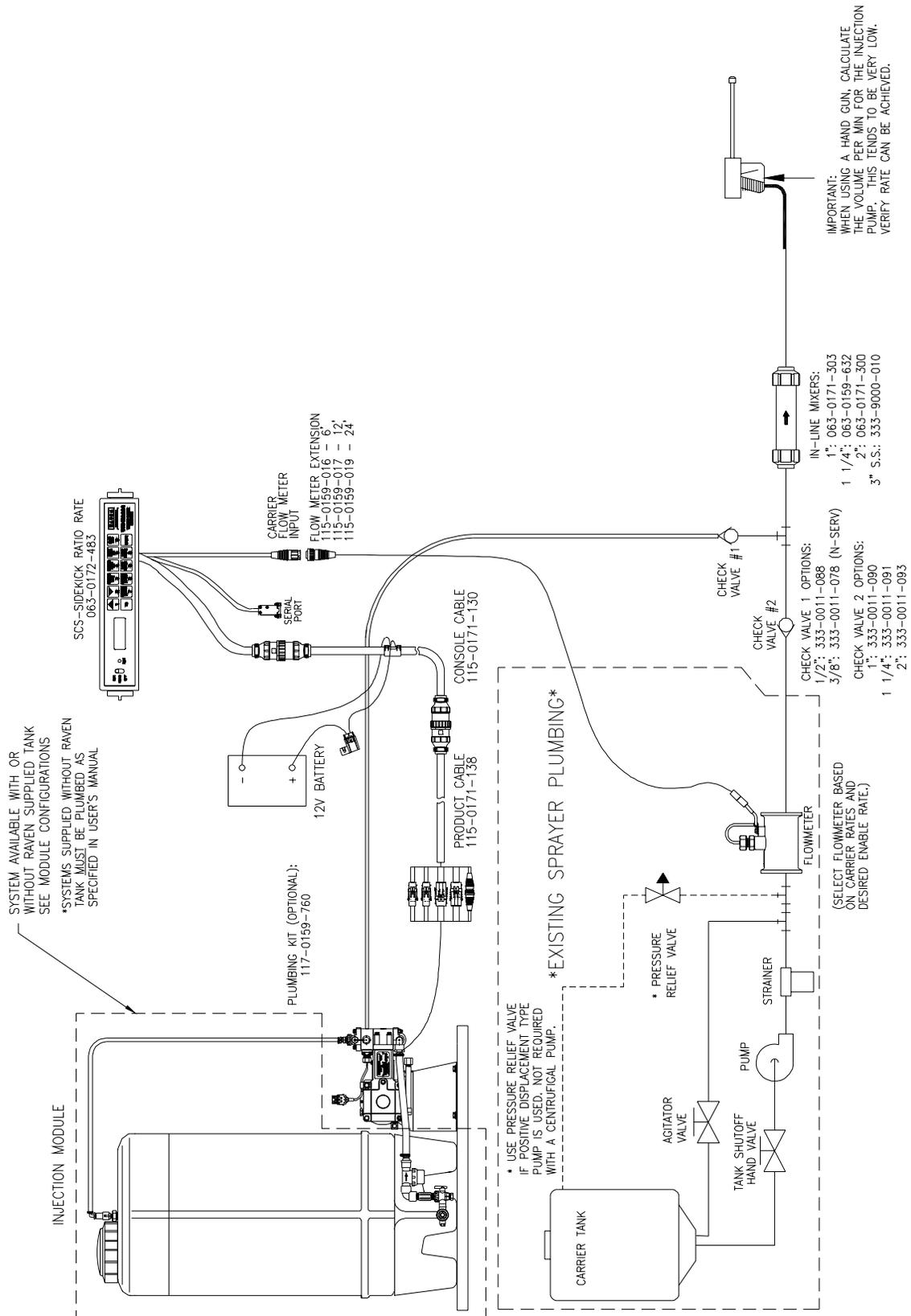
# RATIO RATE SIDEKICK SYSTEM DIAGRAM II

## USED WITH NON-RAVEN CARRIER CONTROL SYSTEM



# RATIO RATE SIDEKICK SYSTEM DIAGRAM III

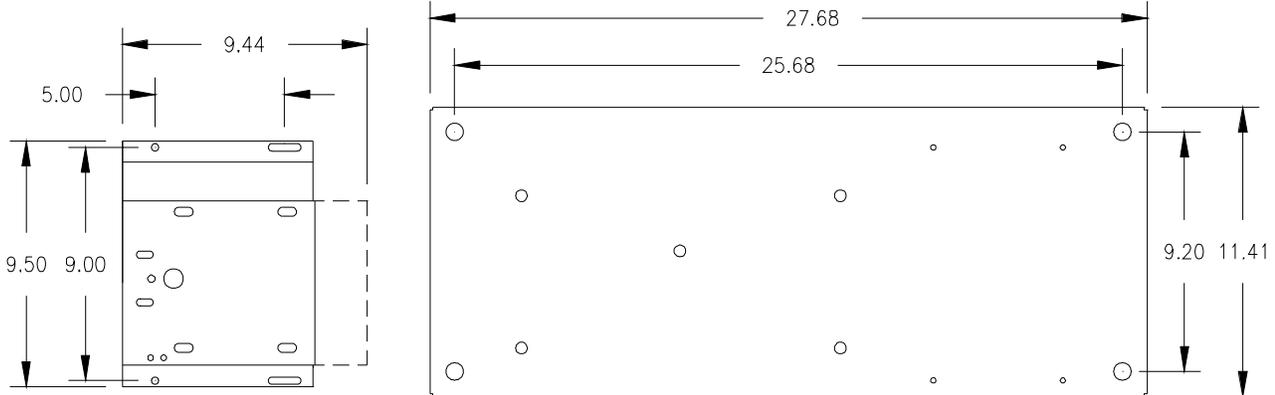
USED WITH HAND GUN



# INSTALLATION

## 1. INJECTION MODULE

- a. Select an area that is close to the Boom Valves. This will keep the amount of chemical in the line between the Injection Module and the carrier line as small as possible.
- b. Reference the platform dimensions. This is the size of the Injection Module.



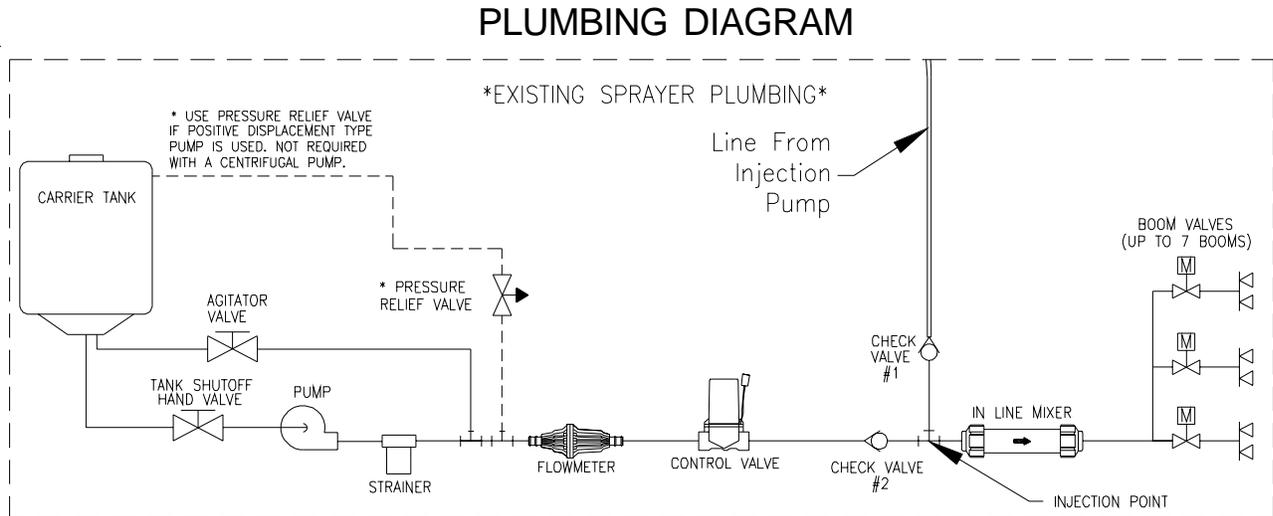
\*DIMENSIONS OF PUMP PLATFORM.  
PLATFORM USED WHEN ORDERED  
WITHOUT RAVEN SUPPLIED TANK.

\*DIMENSIONS OF PUMP/TANK PLATFORM.  
PLATFORM USED WHEN SYSTEM ORDERED  
WITH RAVEN SUPPLIED 8, 16, 24 GALLON  
TANK CONFIGURATIONS.

- c. Take into consideration the location of the injection module's hand valves and drain. **DO NOT BLOCK THESE.**
- d. Position the Injection Module for access to the Injection Pump to perform periodic maintenance. Example: Changing oil.

## 2. PLUMBING

### a. Reference Plumbing diagram



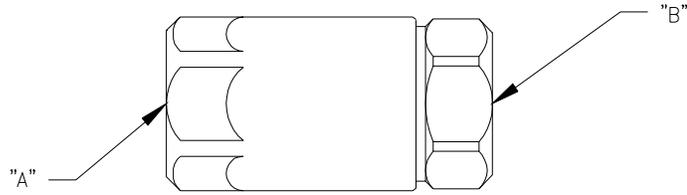
- b. It will be necessary to add the following components to the existing carrier plumbing. These components shall be plumbed as shown above.

CK Valve #1  
CK Valve #2  
In-Line Mixer

**NOTE:** Check Valves and In-Line Mixers are not included in kits. Must be ordered separately. See page 8 for selections.

- c. CK Valve #2 and the In-Line Mixer must be sized large enough to avoid excessive pressure drop. See Figure above.
- d. The Injection Point should be as close to the Boom Valves as possible.

# FIGURE 1 CHECK VALVE SELECTION CHART



	RAVEN PART NO.	"A" NPT	"B" NPT	Cv*	
CHECK VALVE #1	333-0011-078	3/8"	3/8"	5	FOR USE WITH NH3 & N-SERVE
	333-0011-088	1/2"	1/2"	8	
CHECK VALVE #2	333-0011-090	1"	1"	14	
	333-0011-091	1 1/4"	1 1/4"	22	
	333-0011-093	2"	2"	70	
	333-0011-094	3"	3"	110	
	333-0011-095	4"	4"	175	

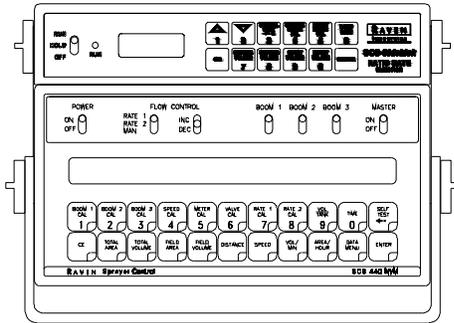
\* Cv = GALLONS OF WATER PER MINUTE THAT VALVE WILL PASS WITH 1 psig PRESSURE DROP.

## IN-LINE MIXER SELECTION CHART

	RAVEN PART NO.	"A" NPT	"B" NPT	Cv*	
POLY PROPYLENE	063-0171-303	1"	1"	25	
	063-0159-632	1 1/4"	1 1/4"	25	
	063-0171-300	2"	2"	25	
STAINLESS STEEL	333-9000-010	3"	3"	60	
CAST IRON	063-0171-784	1"	1"	25	FOR USE WITH NH3 & N-SERVE

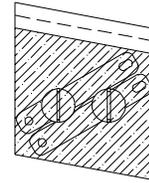
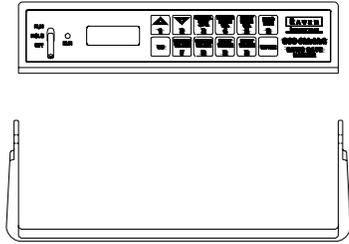
### 3. CONSOLE

The SCS RATIO RATE SIDEKICK Console can be mounted on top of a Raven 440 family console or it can be mounted alone. Use the brackets provided.



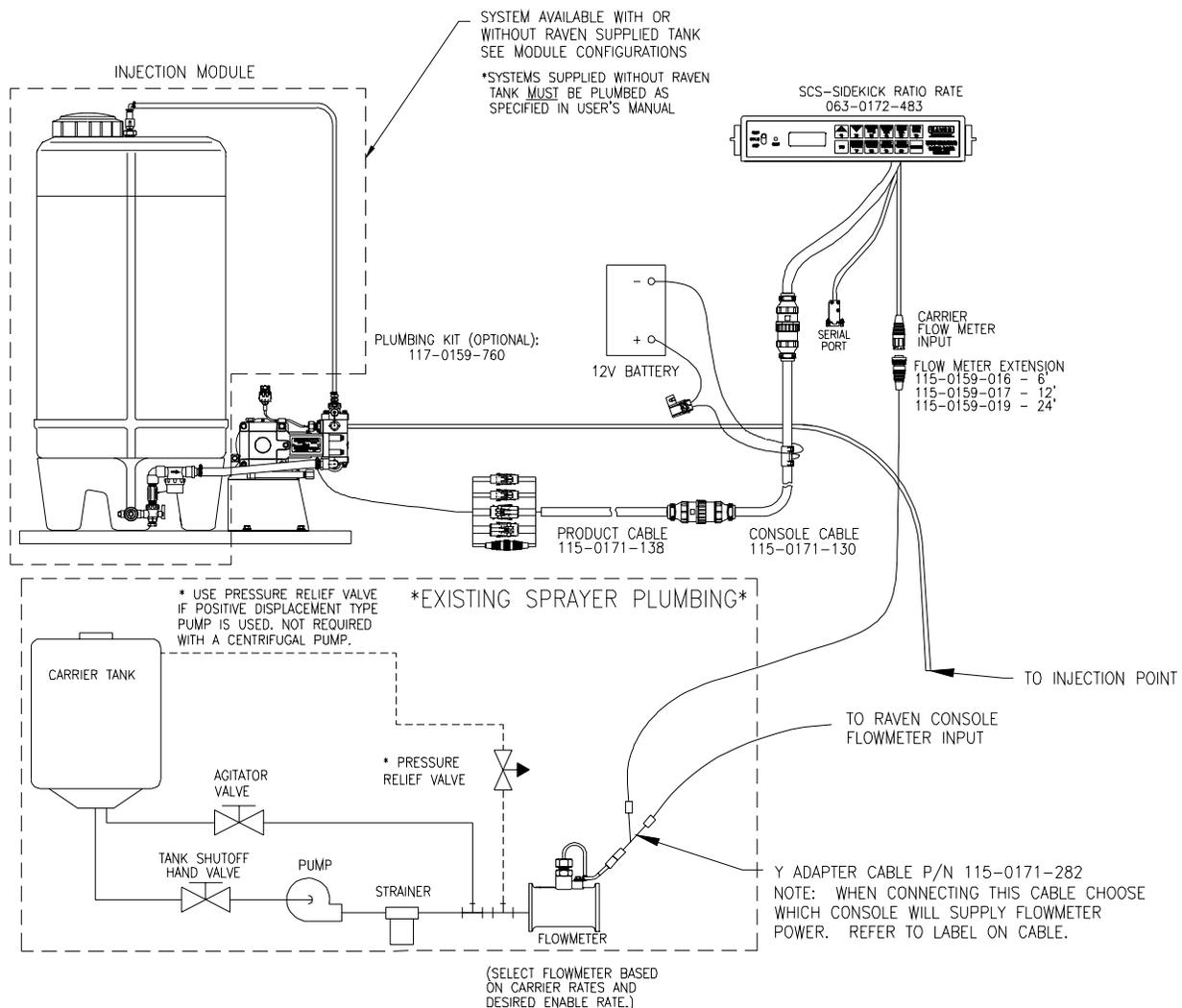
SCS SIDEKICK  
RATIO RATE CONSOLE

EXISTING RAVEN  
CONSOLE

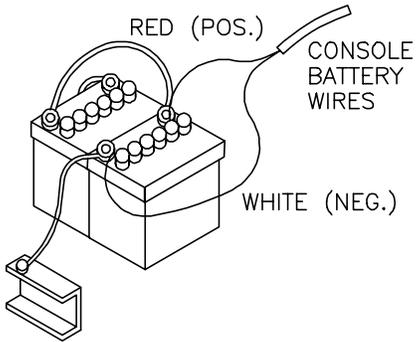
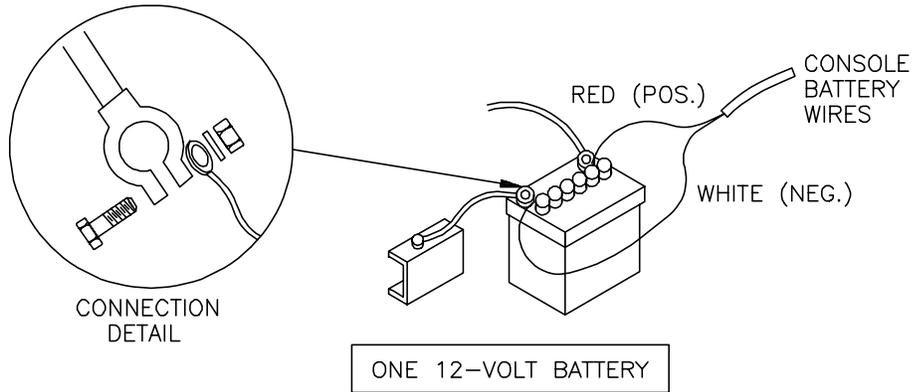


## 4. CABLING

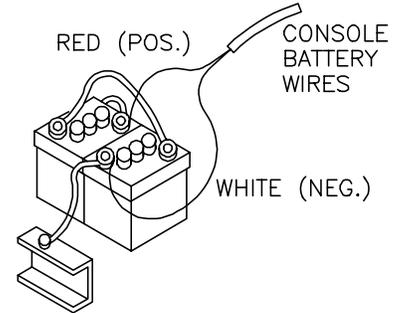
- Connect a Flow extension cable from the SCS SIDEKICK RATIO RATE Console to the Carrier Console. If the Carrier flowmeter is sharing signal with a Raven console, use "Y" Adapter cable P/N 115-0171-282.
- Connect the Red and White Power Wires from the console directly to the vehicle battery. **SEE BATTERY CONNECTIONS.**
- Route the SCS SIDEKICK cables out of the vehicle cab.
- Connect the 15 foot Console Control Cable to the 27' Product Cable. Use di-electric grease provided.
- Turn OFF/HOLD/RUN switch to OFF and route the Red and White battery wires to the 12-volt vehicle battery. Attach the White battery wire to the NEGATIVE(-) battery terminal and the Red battery wire directly to the POSITIVE (+) battery terminal. (See below) (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. Connect the Product cable to the Injection Module. Use di-electric grease provided.



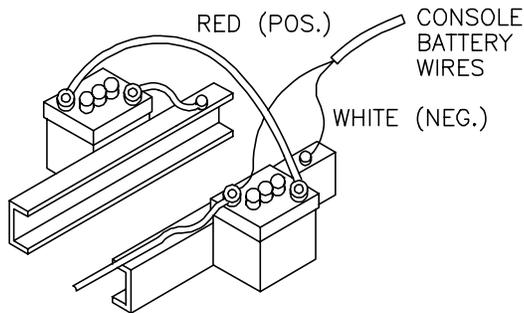
# BATTERY CONNECTIONS



24-VOLT SYSTEM USING TWO 12-VOLT BATTERIES



12-VOLT SYSTEM USING TWO 6-VOLT BATTERIES



12-VOLT SYSTEM USING TWO 6-VOLT BATTERIES

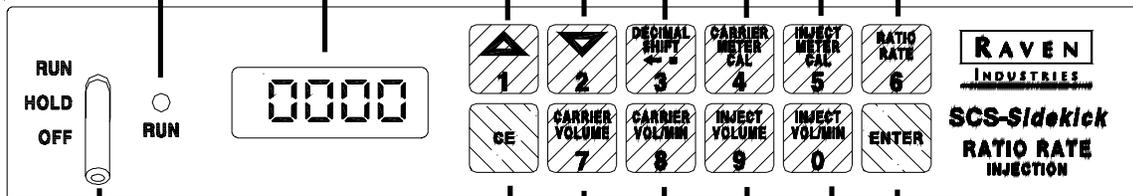
# CONSOLE FEATURES

**IMPORTANT:** This Console requires selection of **US** (oz/gal), **SI** (Milliliters/Liter). (See Console Calibration) Hold INJECT VOL/MIN key to view selections.

LCD DIGITAL READOUT - 4-digit read-out of all functions.

When "CAL" appears in the display, it indicates that the system needs to be calibrated.

Flashes relative to the speed of the injection pump while running



**OFF/HOLD/RUN** - Place switch in RUN position to apply product. Place switch in HOLD position when shutting the Injection Pump off. To Turn off all power to the Console, place switch in OFF position. Turning Console OFF does not affect data stored in the console.

## FUNCTION KEYS

**ENTER** - Used only to enter data into the Console.

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

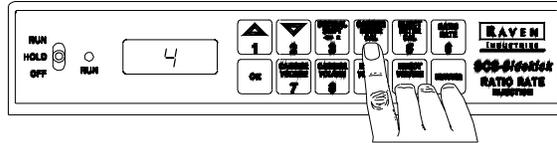
## FUNCTION KEYS --

- |                     |  |
|---------------------|--|
| Decimal Shift Key   | - Used to shift decimal for more resolution.             |
| Carrier Meter Cal   | - Enter meter cal from Carrier flowmeter cal tag.        |
| Injection Meter Cal | - Enter meter cal from injection pump meter cal tag.     |
| Ratio Rate          | - Enter desired ounces [Milliliters] per gallon [liter]. |
| Carrier Volume      | - Total volume of carrier recorded.                      |
| Carrier Vol/Min     | - Flow rate of carrier.                                  |
| Inject Volume       | - Total volume of carrier recorded.                      |
| Inject Vol/Min      | - Flow rate of injected chemical.                        |

# CONSOLE PROGRAMMING

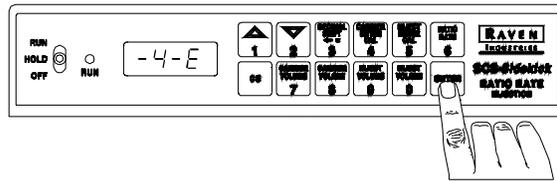
When entering data into the Console computer, the entry sequence is always the same.

## STEP 1



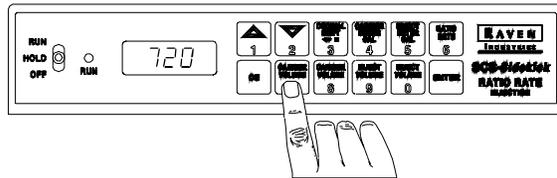
Depress the key in which you wish to enter data. The number of the key will be displayed.

## STEP 2



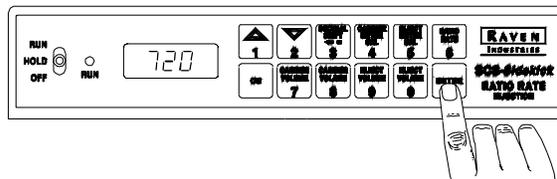
Depress the "Enter" key. 4-E will now flash in the digital display.

## STEP 3



Depress the keys corresponding to the number you wish to enter (i.e. "7", "2", "0"). The numbers will flash in the digital display as they are entered.

## STEP 4



Complete the entry by again depressing the "Enter" key. Display stops flashing.



## 4. CALCULATING INJECTION SYSTEM ENABLE RATE

The SCS SIDEKICK RATIO RATE Console automatically calculates the enable rate based on the Carrier Meter Cal. To view this rate, see HIDDEN FEATURES.

The Enable rate is defined as the vol/min required from the carrier flowmeter to turn on the injection pump. The frequency for the enable rate is 3 Hz  $\pm$  10%.

To calculate the enable rate for a particular flowmeter, use the following formula. This will help the user to choose a carrier flowmeter to fit the application.

$$\frac{600}{\text{Carrier Flowmeter Meter Cal}} \times 3 = \text{Enable Rate}$$

Example:  $\frac{600}{720} \times 3 = 2.5 \text{ gpm.}$

Listed below are approximate enable rates for some Raven flowmeters. Perform above calculation to determine the most reliable enable rate.

FLOWMETER	RAVEN PART NUMBER	ENABLE RATE
RFM 15	063-0172-040	1.0 GPM
RFM 55	063-0159-571	2.5 GPM
RFM 60P	063-0171-793	2.5 GPM
RFM 60S	063-0171-666	2.5 GPM
RFM 100	063-0171-066	2.6 GPM
RFM 200P	063-0159-751	11 GPM
RFM 400	063-0159-966	24 GPM

## 5. CONSOLE CALIBRATION

When console power is first turned on after all installation procedures have been completed, the console will display "US" in the display window. This means the console must be calibrated or programmed before it can be operated. This is a one-time operation which does not have to be repeated. Turning OFF the power switch does not affect the console memory. All data is retained.

**IMPORTANT:** If an entry selection error is made during steps 1-2, place the OFF/HOLD/RUN switch to the OFF position. Depress the  key and hold while placing the OFF/HOLD/RUN switch to HOLD or RUN. This will "reset" the console.

The following steps must be followed:

- 1) Display US (ounces per gallon) or SI [milliliters per liter]
  - a) Depressing momentarily  steps the display from US to SI.
  - b) Depressing momentarily  steps the display from SI to US.

2) Selecting US or SI

- a) To select US or SI, step  until the desired code is displayed.
- b) Momentarily depress  . The display will now display CAL.

## 6. ENTERING CARRIER METER CAL

Enter Carrier Meter cal in key labelled  . This number can be found on the calibration tag of the flowmeter in the carrier line.

## 7. ENTERING INJECT METER CAL

Enter Inject Meter cal in the key labelled  . This number can be found on the calibration tag of the Injection pump.

## 8. ENTERING RATIO RATE

Enter Ratio Rate in key labelled  . When programmed in US, enter Ratio Rate as ounces per gallon. When programmed in SI, enter Ratio Rate as milliliters per liter.

**NOTE:** If programmed in US units, a decimal point is displayed automatically. Therefore 1.00 ounces per gallon is entered as 1.00 not .01.

### YOU HAVE NOW COMPLETED PROGRAMMING THE CONSOLE

The display of "CAL" will now extinguish and the console will begin to display data. If not, repeat procedure starting at step 5.

## 9. DECIMAL SHIFT

A decimal shift function is available to see greater resolution under keys  and  . To operate, first press either  or  . Then each time key  is pressed, the decimal for that register will shift to the left 1 place but not more than 2 places total.

## 10. OTHER DISPLAY FEATURES

- 1. To display CARRIER VOLUME APPLIED, depress key labelled  .  
To "zero out" this total at any time, enter a "0" in this key.  
US = Gallons            SI = Liters
- 2. To display CARRIER VOL/MIN, depress key labelled  .  
US = Gallons/Min.    SI = Liters/Min.
- 3. To display TOTAL INJECTED VOLUME, depress key labelled  .  
To "zero out" this total at any time, enter a "0" in this key.  
US = Ounces            SI = Deciliters

4. To display INJECTED VOL/MIN depress key labelled  .  
 US = Ounces/Min. SI = Milliliters/Min.

## HIDDEN FEATURES

The SCS-SIDEKICK RATIO RATE Console is equipped with many hidden features. Several Console keys have multiple features located under them. The amount of time a key is held down determines the feature that will be displayed. The display will flash the coded name of the feature that is being programmed. These features and their display codes are outlined below: (A detailed explanation of the feature follows this page.)

Console Key	Depress 5 seconds for:	Depress 7 seconds for:	Depress 9 seconds for:
	Data Lock flashing "nEu.1" or "old"		
	(Alarm Menu) "A on" / "AoFF"	Display Smoothing "d on" / "doFF"	(Flo and VAC Alarm) "u on" / "uoFF"
	Program Part Number "###"	Program Revision Letter "P #"	
	Off Target Alarm "or" (off Rate)	Dual Sensor Alarm Percent "dF"	
	Control Delay "dLAY"	Enable Rate "Errt"	
	Valve Cal "uCAL"		
	Automatic Rate + / - "dELt"	Low Limit Alarm "LL"	
	Automatic/Manual Control "C on" / "CoFF"		
	SELF TEST (simulated carrier Vol/Min) "tEST"		
	DATA MENU Ref. Data Menu Feature		
	Display Units "US" or "SI"		
			

5. To display INJECTED APPLICATION FLOW RATE in ounces/gallon [Milliliters/Liter], place the RUN/HOLD/OFF switch to RUN and depress key labelled . **NOTE:** Carrier must be ON to enable Injection Module to show a rate.

To display TARGET APPLICATION FLOW RATE, place the RUN/HOLD/OFF switch to HOLD, and depress key labelled .

6. To view any of the set calibration numbers, depress the corresponding calibration keys.

## FEATURES UNDER

### 1) SEQUENCE TO ACTIVATE DATA-LOCK

- a) Depress  for 5 seconds, NEW CODE message will appear.
- b) Enter 4 digit code within 15 seconds:

**EXAMPLE:** For 1234, depress:     and .

### 2) SEQUENCE TO CHANGE DATA-LOCK

- a) Depress  for 5 seconds, OLD CODE message will appear.
- b) Enter 4 digit code with 15 seconds:     and .

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

**EXAMPLE:** For 4321, depress:     and .

### 3) ENTER MODE SEQUENCE WITH ACTIVATED DATA-LOCK

- a) Depress the key into which you wish to enter data.
- b) 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 enter of data without first entering the DATA-LOCK CODE. If DATA-LOCK is not desired, omit steps above. The DATA-LOCK CODE may be cleared by entering a code of "0" or be resetting console.

## FEATURES UNDER

### 4) ALARMMENU

- a) To display ALARM MENU, depress key labelled  for 5 seconds. "A on" will show in the display.
- 1) Momentarily depressing  toggles the display between "A on" and "AoFF". "A on" means alarm is enabled, "A oFF" means alarm is disabled.
- b) To display setting for display smoothing, press and hold key labelled  for 7 seconds. The display will show "d on" or "doFF". Selecting "d on" means the window displays target rate when actual rate is within 10% of target rate. Selecting "doFF" means the window displays actual rate. Console defaults to "d on".
- 1) Momentarily depressing  toggles the display between "d on" and "doFF".
- c) FLO AND VAC ALARM  
The SCS SIDEKICK Injection system features a Flow Monitor and a Vacuum Monitor to alert the operator in case the system malfunctions. A FLO message in the display indicates an under application of chemical. See PROCEDURE TO RE-CALIBRATE PUMP. A VAC message in the display indicates a high vacuum condition on the inlet to the injection pump. This may cause under application.
- 1) To enable or disable VAC and Flow Monitor alarms, press and hold the key labelled  for 9 seconds or until "u on" or "uoFF" is displayed. "u on" = VAC and Flow alarm is ON. "uoFF" = VAC and Flow alarm is OFF.
- 2) Momentarily depressing  toggles the display between "u on" and "uoFF".

## FEATURES UNDER

### 5. DISPLAYING PROGRAM NUMBER or PROGRAM REV.

- a) To display Console Program number, depress key labelled  for 5 seconds.
- b) To display Console Program revision, depress key labelled  for 7 seconds.

## FEATURES UNDER

### 6. OFF TARGET ALARM

Alarm sounds when the actual rate is off from the target rate by a specified percentage. The Off Target value is preset to 30%, but may be changed to a different number.

#### a) Adjusting Off Target Value.

- 1) Depress  for 5 seconds. Display will show "or". Enter desired new number for OFF TARGET ALARM.
- 2) Depress  to store selection.

#### b) Dual Sensor Alarm Percent

When controlling a Raven Sidekick Injection Pump, the console monitors the rate sensor and the flow monitor sensor. If there is an unreasonable difference between rate sensor and the flow monitor sensor, the console will sound an alarm and the console will display FLO. This means the injection pump is not metering accurately. Refer to troubleshooting guide for possible causes. The console automatically calculates this value upon entry of Inject Meter Cal. Do NOT change this value unless required. Changing this value may result in Flo alarm being on all the time or degrade performance of this feature. To access this feature, press

and hold  for 7 seconds until displays "dF". Press any key to exit.

## FEATURES UNDER

### 7) CONTROL DELAY

Depress key labelled  for 5 seconds. "dLAY" will be displayed.


  
 Control Delay Digit

The Control Delay number is a 4 digit number. The first digit in the Control Delay number represents the time (in seconds) between when the carrier is turned ON and when the Console actually 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. The remaining 3 digits are always zero. The Control Delay feature only operates when the carrier is OFF or ON in intervals of 30 seconds or less.

### 8) ENABLE RATE

Depress and hold key labelled  for 7 seconds. "ENTER" will be displayed. This is the minimum flow rate required from the carrier flowmeter to enable the Injection Module. This number can be changed to a greater value but can not be changed to a lesser value. To change this value, press

 . Press the corresponding keys for the desired value, then press  .

## FEATURES UNDER

### 9) VALVE CAL

To display current VALVE CAL setting, depress key labelled  for 5 seconds. Display will change to "uCAL". Release the key to current valve cal setting. Console defaults to a valve cal number of 123.

## FEATURES UNDER

### 10) AUTOMATIC RATE +/-

This feature sets the increment at which flow is increased or decreased in the Auto mode of operation.

Select RATE +/- for product by depressing  for 7 seconds. The display will show "dELt". Enter the desired amount for +/-.

**EXAMPLE:** If flow rate is to be changed by "1.0":

Enter a value of 1.0 for RATE +/- . When in Auto, each time the  or  key is depressed, the target flow rate for that product will increase or decrease by "1.0".

### 11) LOW LIMIT SET POINT AND LOW LIMIT ALARM

- a) To display the Low Limit Flow Set Point, depress key labelled  for 9 seconds. Display will show "LL" and low limit flow rate will appear in the display. A low limit flow rate may now be entered.
- b) If the actual volume per minute falls below the set limit, the Control stops closing, an alarm sounds (if enabled) and the display flashes "-LL-".

## FEATURES UNDER

### 12) AUTOMATIC/MANUAL CONTROL

The console defaults to Automatic control.

- a) To place console in Manual Control, depress key labelled  for 5 seconds. "C on" will show in the display.
- 1) Momentarily depressing  toggles the display between "C on" and "CoFF". "CoFF" means control is in the manual mode.

## FEATURES UNDER



### 13) SELF TEST FEATURE

**NOTE:** When using self test for testing the system, place the Injection Modules hand valves in the recirculation position.

SELF TEST allows simulation of carrier flow for testing the system. Enter the simulated operating vol/min by depressing the key labelled  for 2 seconds. Display will show "tEst". If 6 GPM [22.7 LPM] is desired, enter 6.0 [22.7] (See CONSOLE PROGRAMMING). The SELF TEST FLOW RATE will clear itself when carrier flow is detected by the carrier flowmeter.

## FEATURES UNDER



### 14) TOTAL VOLUME

The following are brief descriptions of features available under the TOTAL VOLUME key.

<u>DISPLAY</u>	<u>DESCRIPTION</u>
<i>P r n</i> <i>b E g n</i>	Sends data through serial port to attached optional printer to print field begin and field end pages.
<i>r A t E</i> <i>o n</i>	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.
<i>F r E F</i> <i>0</i>	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.
<i>b A u d</i> <i>9 6 0 0</i>	Used in data logging mode. Selectable between 1200 or 9600 baud.
<i>t r i g</i> <i>0</i>	Used in data logging mode. The trigger determines how often actual rate data string (See Appendix 10 for Data Communication String Formats) is sent to the serial port. The trigger may be either feet [meters] or seconds.
<i>u n i t</i> <i>F t</i>	Used in data logging mode. The trigger unit is selectable between feet [meters] or seconds.
<i>d L o g</i> <i>o F F</i>	Turns data logger ON or OFF.
<i>t i m e</i>	Sets time.
<i>m o n t h</i>	Sets month.
<i>d a y</i>	Sets day.
<i>y e a r</i>	Sets year.

**DISPLAY**

**DESCRIPTION**

*Pdn* Sets power down days wait.

A) Definition of Data Menu Options:



Depressing this key for 5 seconds displays selected Data Menu features.



Depressing these keys after selecting DATA MENU increments through desired features.



**EXAMPLE:** "Prn" "bEgn", "rAtE" "on", "FILE" "1", etc....

B) CONSOLE DATA PRINTOUT

a) Display will alternate between *Prn* and *bEgn* (Print Begin).

1) To Print Field Begin, depress key labelled .

b) Display will now alternate between *Prn* and *End* (Print End).

1) To Print Field End, depress key labelled .

2) While *End* is displayed, if Field Begin is required, depress key labelled to toggle display to *bEgn*.

c) Momentarily depress to advance to RATE CHANGE ALARM ON/OFF.

C) RATE CHANGE ALARM ON/OFF

a) Display will alternate between *rAtE* and *on* (Rate Change Alarm On).

b) Depressing momentarily changes the 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 FIELD REFERENCE.

D) FIELD REFERENCE

a) Display will alternate between *FREF* and *0* (Field Reference 0).

b) Enter the field number.

c) Momentarily depress to advance to BAUD RATE.

E) BAUD RATE

a) Display will alternate between *bAud* and *9600* (Baud Rate 9600).

b) Depressing momentarily changes the display between *9600* and *1200*.

c) Momentarily depress to advance to DATA LOGGER TRIGGER VALUE.

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

- F) DATA LOGGER TRIGGER VALUE
- Display will alternate between *t r i g* and *0* (Data Log Trigger Value 0).
  - Enter the TRIGGER VALUE.
  - Momentarily depress  to advance to DATA LOGGER TRIGGER UNITS.
- G) DATA LOGGER TRIGGER UNITS
- Display will alternate between *U n i t* and *F t* (Data Log Trigger Units Feet).
  - Depressing  momentarily changes the display between *F t [n E t r]* and *S E C*. A value that has been chosen as the unit of measurement for the TRIGGER VALUE programmed previously. (*S E C* means seconds has been chosen as the unit of measure.)
  - Momentarily depress  to advance to DATA LOGGER.
- H) DATA LOGGER ON/OFF
- The DATA LOGGER uses the communications strings listed in Appendix 13 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 10.
  - Display will alternate between *d L o g* and *o f f* (Data Log Off).
  - Depressing  momentarily changes the display between *o f f* and *o n*. A value of *o f f* means DATA LOGGER is disabled; a value of *o n* means DATA LOGGER is enabled.
  - Momentarily depress  to advance to TIME.
- I) ENTER TIME
- Select TIME.
  - Enter TIME when display flashes *t i m e*.
  - Momentarily depress  to advance to MONTH.
- J) ENTER MONTH
- Select MONTH.
  - Enter MONTH when display flashes *M o n t h*.
  - Momentarily depress  to advance to DAY.

- K) ENTER DAY
- Select DAY.
  - Enter DAY when display flashes *DAY*.
  - Momentarily depress  to advance to YEAR.
- L) ENTER YEAR
- Select YEAR.
  - Enter YEAR when display flashes *YEAR*.
  - Momentarily depress  to advance to PRINT FIELD BEGIN.
- M) POWER DOWN  
Sets number of days of inactivity before console goes into low power consumption mode and time settings are lost.

## FEATURES UNDER KEY

To display information relating to the initial programming of the console, press and hold key  for 5 seconds. The display will scroll through the settings for the following: US or SI

# INITIAL INJECTION SET-UP

- 1) Fill Injection Module Tank with water. Fill carrier tank with water.
- 2) Place the 3-way valve handle on Injection Pump to the "injection" position on Injection Module.
- 3) Place OFF/HOLD/RUN switch to HOLD on SCS SIDEKICK.
- 4) Verify correct CARRIER METER CAL, INJECT METER CAL and RATE CALS have been entered into the Console.
- 5) Run main carrier pump at normal operating RPM.
- 6) Verify that each BOOM ON/OFF Valve operates or Hand Gun operates and that no nozzles are plugged.
- 7) Place all BOOM ON/OFF switches to ON.
- 8) Set injection Rate on SCS SIDEKICK RATIO RATE for desired oz/gallon [ml/l] of application.
- 9) Place SCS SIDEKICK OFF/HOLD/RUN switch to RUN. The SCS SIDEKICK Console display should display a reading. Verify Injection Module turns on at desired enable rate.
- 10) The system will seek the desired rate.
- 11) Turn one BOOM ON/OFF switch to OFF position. The system will automatically correct for this change in carrier flow rate. Verify the Injection Module shuts off when carrier flow is shut off.
- 12) To verify at any time that the Injection Pump is properly calibrated, refer to PROCEDURE TO RE-CALIBRATE PUMP.
- 13) If you have verified the pumps calibration, drain water from Injection Module Tank and add product.

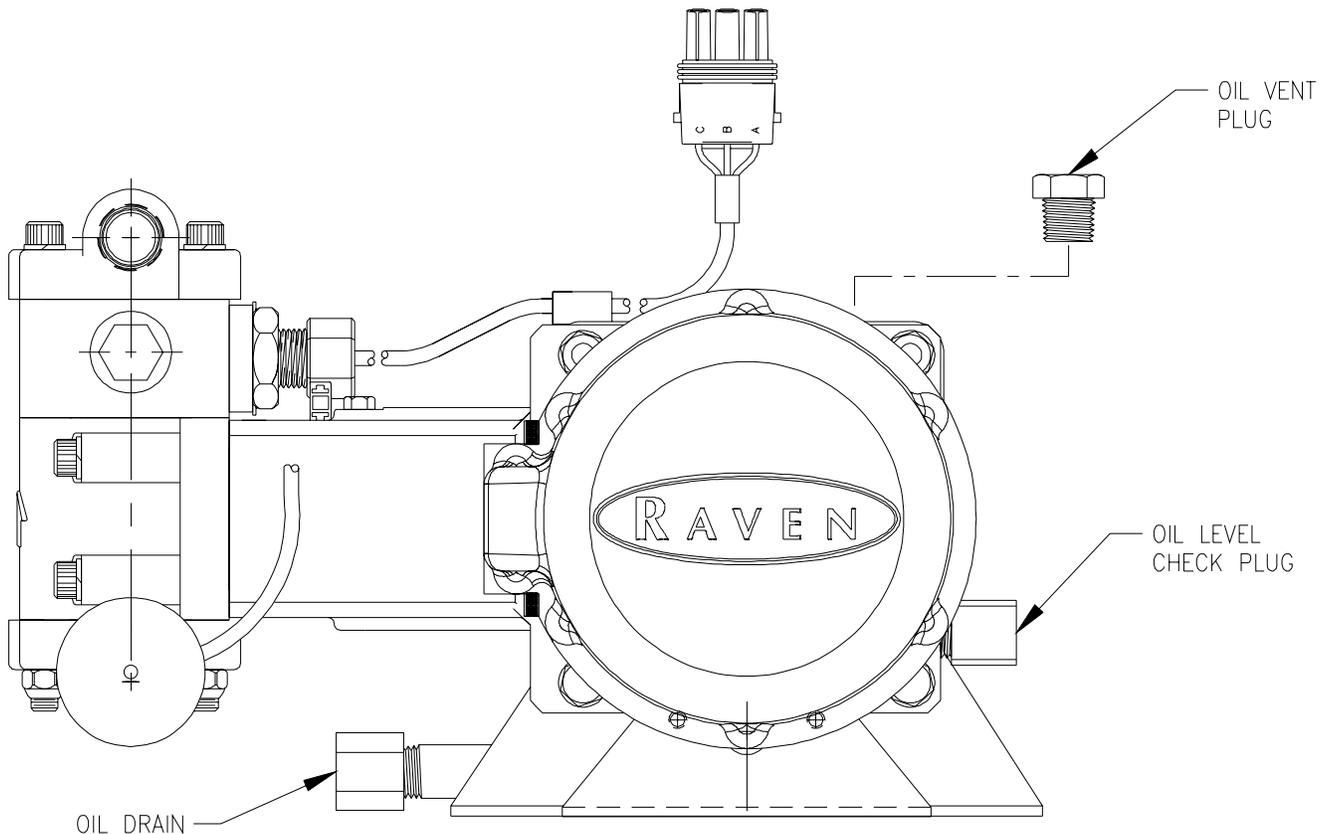
# PREVENTIVE MAINTENANCE

Preventive maintenance is most important to assure long life of the system. The following maintenance procedures should be followed on a regular basis:

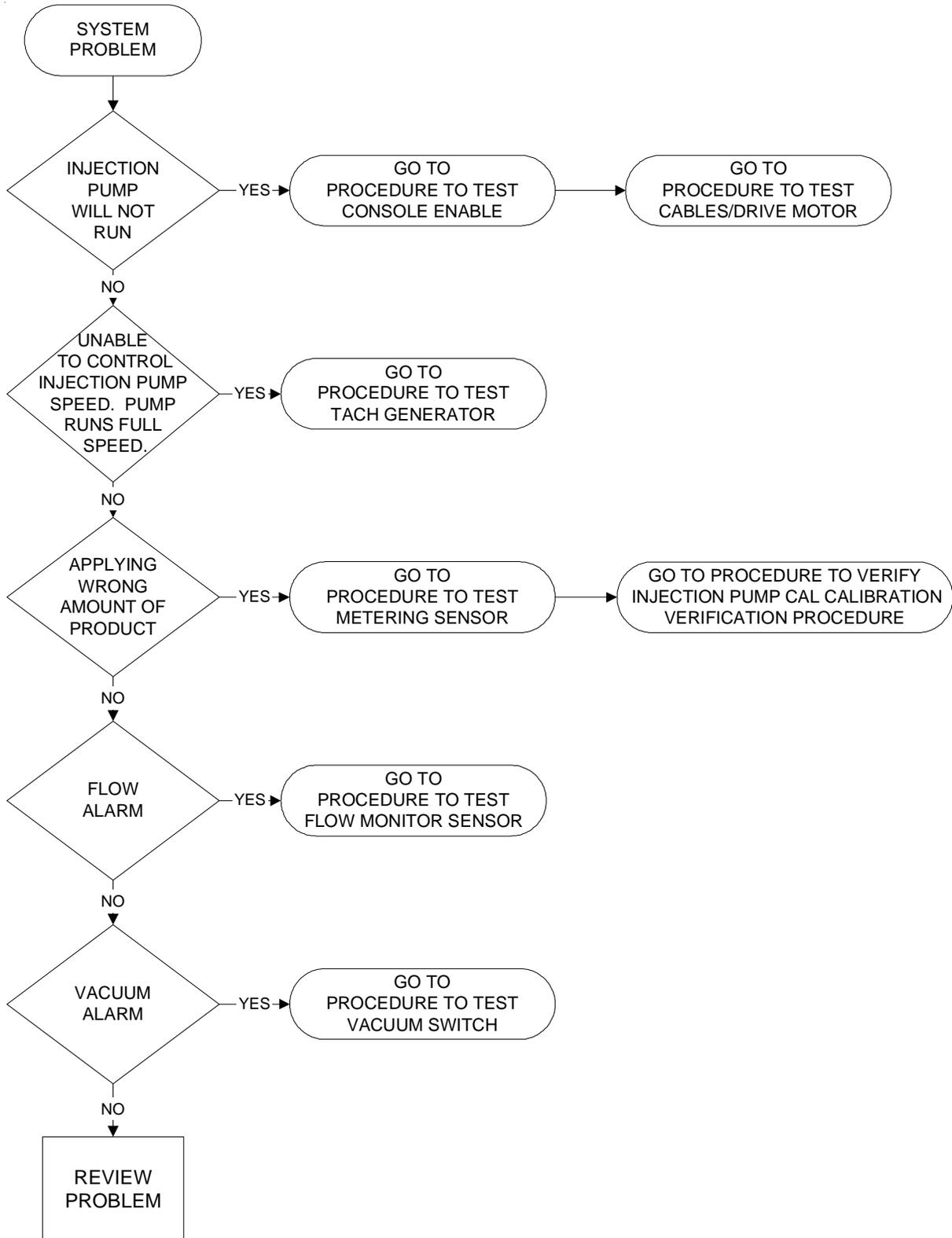
- 1) Flush Injection system with clean water after use. Failure to clean system can result in crystallization of products which may foul pump check valves. This may also cause under application.
- 2) Flush and drain system before storing.

**IMPORTANT:** Freezing temperature may damage system if water is not drained.

- 3) Periodically clean strainer on Injection Module.
- 4) Check oil level in Injection Pump daily. If addition of oil is required, add Mobil #1 (5W30) ONLY. Drain and refill the pump after every 150 hours of operation. (See below).
- 5) Flush Injection system by using flush system (See "RECOMMENDED INJECTION PUMP FLUSH SYSTEM") or by recirculating water through Injection Module until pump is clear of product. When storing at the end of season, recirculate RV antifreeze during the last flush.



# APPENDIX 1 SIDEKICK INJECTION SYSTEM TROUBLESHOOTING FLOWCHART

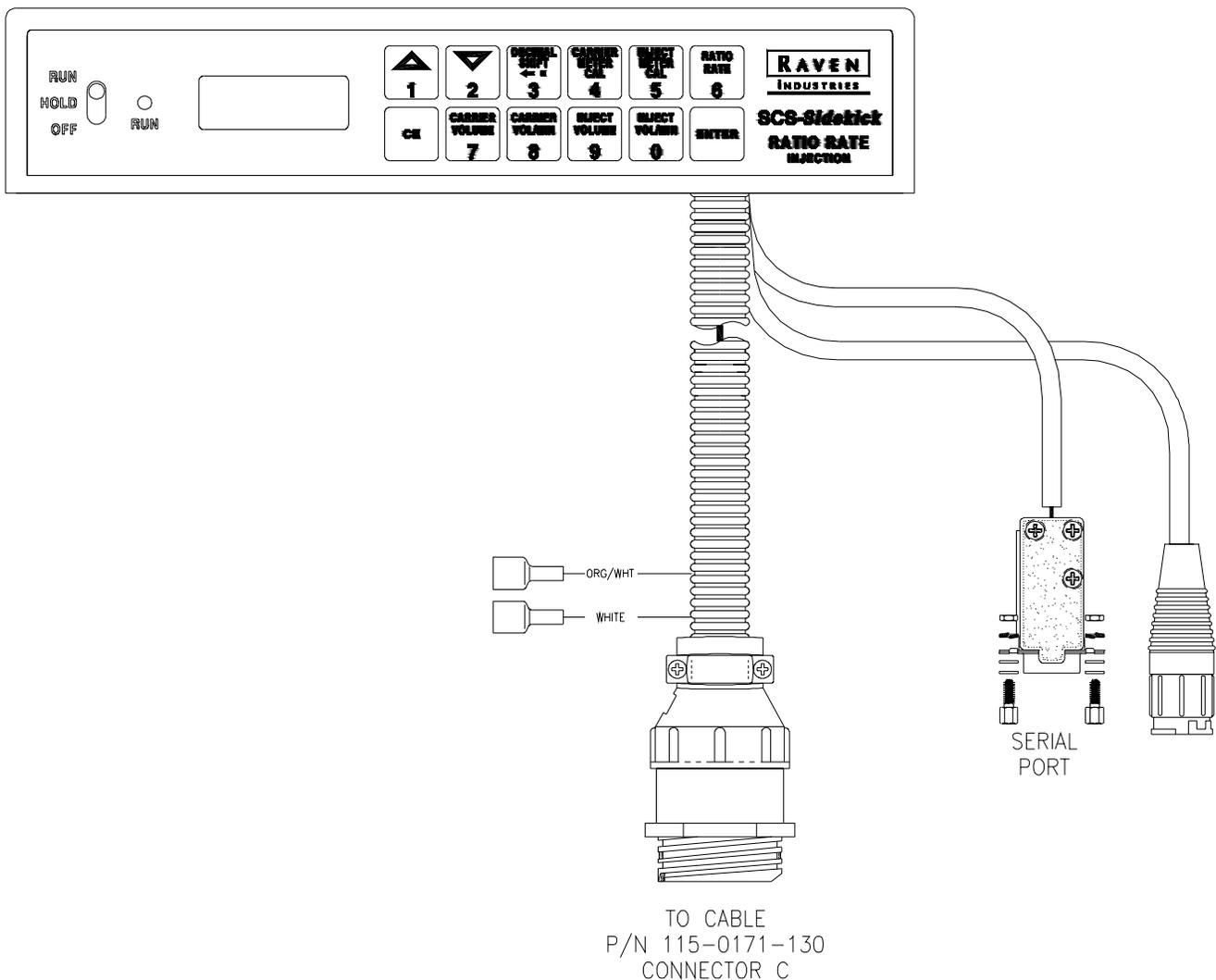


# APPENDIX 2

## PROCEDURE TO TEST CONSOLE ENABLE

- 1) INJECTION PUMP WILL NOT RUN
  - A) Place Injection Module's 3-way valves in the recirculate position.
  - B) Enter a simulated carrier flow in the self test (Refer to SELF TEST FEATURE). This value must be above the enable rate. The enable rate is determined by the carrier meter cal. Refer to CALCULATING INJECTION SYSTEM ENABLE RATE.
  - C) Place the OFF/HOLD/RUN switch to RUN. The Injection Module should run.
  - D) Enter a Self Test rate below the Enable rate. The Injection Module should shut off.

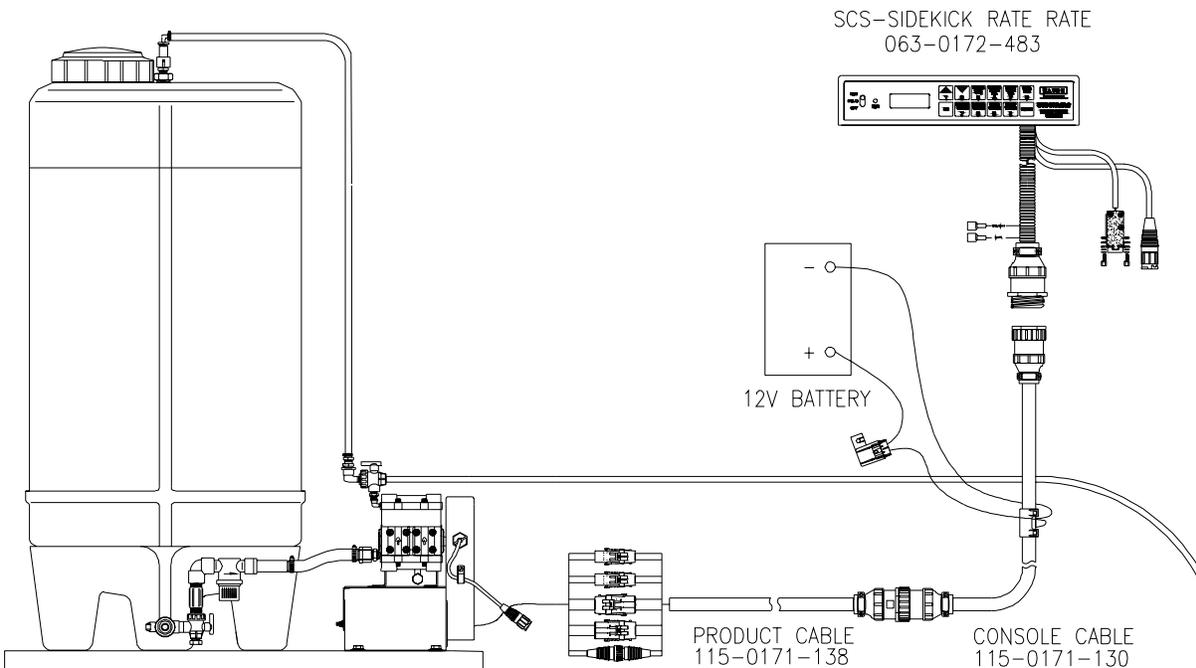
**NOTE:** This procedure may also be done with actual carrier flow. It is recommended that water be used as a carrier for this test.



## APPENDIX 3

### PROCEDURE TO TEST CABLES

- 2) INJECTION PUMP WILL NOT RUN (continued)
- A) Ref. cable 115-0171-130 & 115-0171-138 wiring diagram (console cable & product cable).
    - 1) Verify 30 amp fuse is good.
    - 2) Verify 12 volts to fuse holder. Verify white wires connected to battery negative.
  - B) Check connectors for corrosion.
  - C) Verify 12 VDC at Pin A of connector of the Drive Motor. Use Pin B for the negative voltage reference.



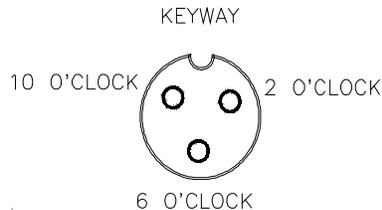
Pin B of the connector going to the Drive Motor is pulsed when the motor is running. This is how the speed of the motor is changed. A pulse that holds pin B to 0 volts for a long time will cause the motor to run faster than a pulse that holds pin B to 0 VDC for a short time.

- D) Drive Motor Test
  - 1) Use the OHM meter function of a multi-meter to measure the resistance of the Drive Motor. It should measure less than 3 ohms.
- E) An other way to test the Drive Motor is to apply 12 VDC to the motor +12 VDC to pin A, 0 VDC to pin B. The motor should run at full rpm.

# APPENDIX 4

## PROCEDURE TO TEST METERING SENSOR CABLES

Disconnect cable from Metering Sensor. Hold Metering 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 and MASTER switch of mating console to ON. Enter a self test greater than the Enable Rate (Ref. CALCULATING ENABLE RATE).
- 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) Perform above voltage checks.
- 6) 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.
- 7) If all cables test good, replace Metering Sensor.

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

# APPENDIX 5

## PROCEDURE TO TEST TACH GENERATOR

P/N 063-0159-784 OR P/N 063-0172-312

To locate Tach Generator location, see PUMP/MOTOR ASSEMBLY REPLACEMENT PARTS sheet.

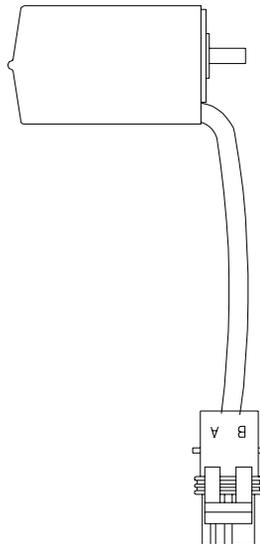
- 1) Flush injection system with water. Ensure that system is free of all chemicals and that there is water in chemical tank. Place Injection Module hand valves to the re-circulate position.

**NOTE:** Position console switches as follows:

Program in a self test greater than the Enable Rate (Ref. Calculating Enable Rate).  
SCS SIDEKICK, OFF/HOLD/RUN switch to "RUN". Program the SCS Sidekick in manual control.

- 2) Injection module should now be running. If you can change pump speed by using the  and  keys, the Tach Generator is good. If you can not, proceed to step 3. Refer to Automatic Rate +/- in console programming.
- 3) Position the Master switch to "OFF". Disconnect the cable coming from the Feedback Generator. Connect a DC volt meter to the Tach Generator leads, positive to pin A, negative to pin B. Position the Master switch to "ON". The volt meter should read at least 9 volts. If not, replace the Feedback Generator.

**NOTE:** If the Feedback Generator is good and the injection module was not running at full speed before the Feedback Generator was disconnected, it is normal for the injection module to run at full speed with the Tach Generator disconnected.



# APPENDIX 6

## PROCEDURE TO TEST METERING SENSOR

063-0171-669 or 063-0172-351

To verify Metering Sensor location see REPLACEMENT PARTS sheet for PUMP/MOTOR ASSEMBLY.

**NOTE:** A cable test should be performed on the main harness prior to testing the Metering Sensor. A cable test is identical to the "Procedure to Test Product Flow Cables".

Disconnect the 2 pin connector of Motor from the Product Cable. This is done as a safety measure to guard against the chance of starting the Injection Module during the test.

- 1) Enter a METER CAL number of "10" in key labelled .
- 2) Program a self test greater than the Enable Rate (Ref. Calculating Enable Rate). Place the OFF/HOLD/RUN switch of the SCS Sidekick Console to RUN
- 3) Rotate pump by hand.
- 4) Depress  and display should increment by 2 per revolution of the pump. If not, replace the Metering Sensor.

**NOTE:** If Injection Module is over-applying or under-applying product, it may be necessary to clean the intake and discharge valves. Verify programming calibration numbers when either over-applying or under-applying.

# APPENDIX 7

## PROCEDURE TO RE-CALIBRATE PUMP

- 1) Enter 50 into the METER CAL key on the SCS SIDEKICK Console.
- 2) Place 3-way valve handle on Injection Pump to recirculate position.
- 3) Program a self test greater than the Enable Rate (Ref. Calculating Enable Rate). Place the OFF/HOLD/RUN switch to RUN.
- 4) Run pump until liquid appears from tank return hose. Place OFF/HOLD/RUN switch to HOLD.
- 5) Enter "0" into TOTAL VOLUME key.
- 6) Place tank return hose into measuring container.
- 7) Place OFF/HOLD/RUN switch to RUN until 50 ounces of measured product is pumped. The number displayed in TOTAL VOLUME is the new METER CAL.
- 8) Enter this new METER CAL number in METER CAL key.
- 9) Enter "0" in TOTAL VOLUME key.
- 10) Place OFF/HOLD/RUN switch to RUN until 50 ounces of measured product is pumped.
- 11) The number in TOTAL VOLUME should be 49, 50, or 51. If not, repeat calibration procedures.
- 12) Empty tank return hose into measuring container.
- 13) Pour product caught in measuring container back into Injection Module Tank.

**NOTE:**

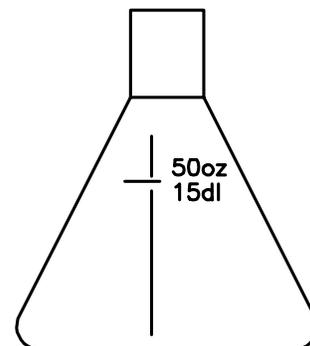
A. Typical causes for Injection System to under apply are:

1. Fouled Pump Check Valves.
2. Air leaks on Injection Pump inlet plumbing.
3. Air entrained in chemical.
4. Plugged inlet strainer.
5. Chemical is too thick to flow thru inlet plumbing.

B. Typical cause for over application:  
Incorrect calibration data entered into Console.

**NOTE:**When programmed in SI, the Inject Meter Cal # is the number of Pulses per Deciliter x 10. Inject Volume reads out in Deciliters. RATIO RATE is programmed as Milliliters per Liter.

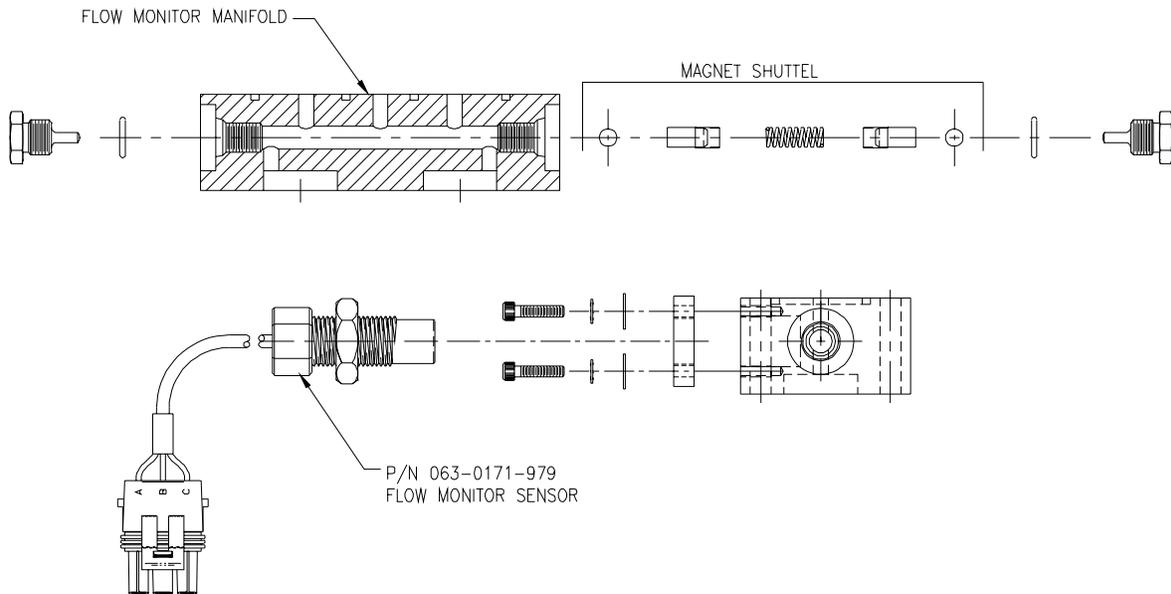
CALIBRATION FLASK  
106-0159-454



# APPENDIX 8

## PROCEDURE TO TEST FLOW MONITOR SENSOR

P/N 063-0171-979



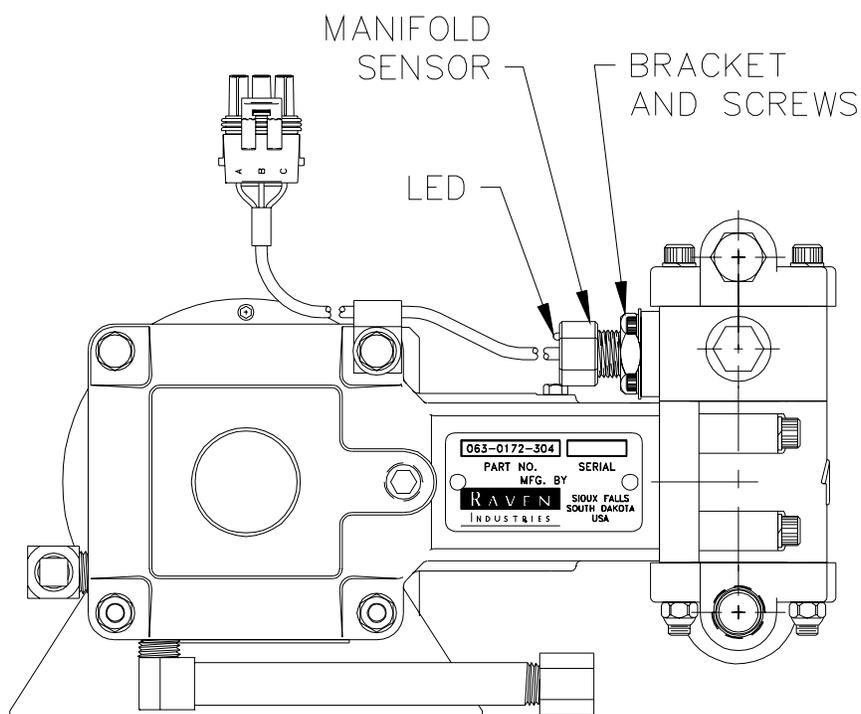
- 1) The above drawing represents the Flow Monitor Manifold found on the RAVEN SIDEKICK pump. In operation, the magnet shuttel moves back and forth inside the flow monitor manifold as fluid is pumped. The Flow Monitor Sensor detects the magnet's movement when a north and south pole pass by the face of the Flow Monitor Sensor. A red LED flashes, indicating the detection of the moving magnet shuttel.
- 2) The SCS SIDEKICK Console monitors the Flow Monitor Sensor output. In order for the flow alarm not to sound, the console must see a pulse from the Flow Monitor Sensor as indicated by the flashing LED on the sensor or also indicated by the run light on the console. If the LED is in a steady ON state or a steady OFF state, the flow alarm will be ON. In some cases, the problem can be solved by adjusting the Flow Monitor Sensor to the left or the right. In other cases, the magnetic shuttel may need to be cleaned. Refer to: SENSITIVITY ADJUSTMENT PROCEDURE, MANIFOLD FLOW MONITOR SENSOR.
- 3) To test the sensor by itself:
  - a) Remove the sensor from the manifold.
  - b) Disconnect the 2 pin connector from the drive motor.
  - c) Position the Sidekick's OFF/HOLD/RUN switch to RUN. Program a self test greater than the Enable Rate. The flow alarm on the Sidekick console will come on.
  - d) Using a magnet, alternate the north pole, then the south pole against the face of the sensor. As the Flow Monitor Sensor detects the magnets changing polarity, verify the LED on the sensor changes from ON to OFF. The flow alarm on the Console should also be silent as long as the Flow Monitor Sensor's LED flashes.
- 4) The pin out of the sensor is as follows:  
A = +12 VDC; B = Signal; C= 0 VDC
- 5) To test this portion of the cables, make and break a short between pins A and B. If the cable is good, the run LED on the console will flash.

## APPENDIX 9

### SENSITIVITY ADJUSTMENT PROCEDURE, MANIFOLD FLOW MONITOR SENSOR

- 1) Position injection modules hand valve to recirculate. Run pump to prime system. Inspect for any leaks. Repair as necessary.
- 2) Monitor volume per minute. Manually adjust pump output to 5 oz. per minute.
- 3) Visually monitor LED on manifold sensor. Adjust manifold sensor left or right until LED flashes. Tighten screws on bracket. See below.
- 4) Verify LED continues to flash.
- 5) Manually adjust pump output to 40 oz/min. Verify LED continues to flash.
- 6) During normal operation LED shall flash. If pump pumps on only one cylinder, LED will no longer flash. Flow error message will be displayed on console.
- 7) Return hand valve to injection position.

**NOTE:** To read vol/min, refer to SIDEKICK CONSOLE manual.



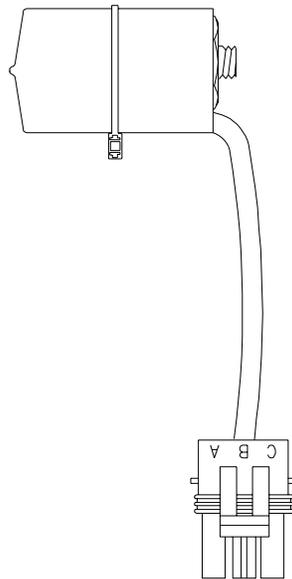
# APPENDIX 10

## PROCEDURE TO TEST VACUUM SWITCH

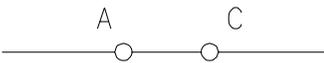
063-0171-035

To verify Vacuum Sensor location see ULTRA LOW VOLUME INJECTION MODULE ASSEMBLY REPLACEMENT PARTS sheet for low volume units or HIGH VOLUME INJECTION MODULE ASSEMBLY REPLACEMENT PARTS sheet for high volume units.

- 1) Disconnect the Vacuum Switch from product cable.
- 2) Test for continuity between pins A and C of the Vacuum Switch. If the OHM meter reads a short, the switch is good, if it reads an open, the Vacuum Switch is bad.



**NOTE:** The Vacuum Switch is a normally closed circuit.

Schematic Symbol:  (Pin B not used)

# APPENDIX 11

## ALTERNATIVE TANK SELECTION

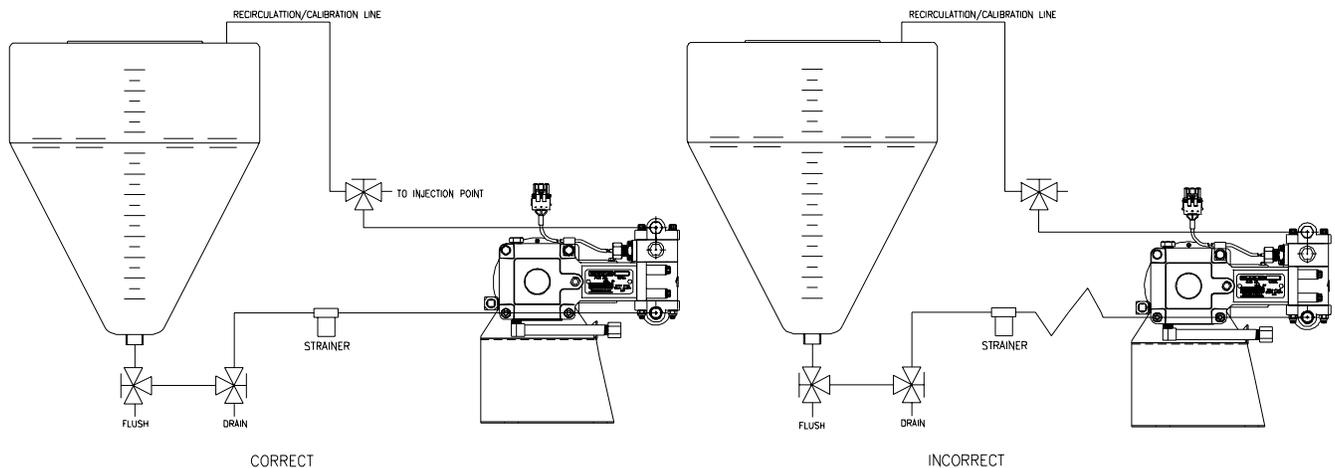
Tank must be of a shape and design that does not permit the tank outlet to un-cover when the vehicle goes up and down steep grades or when sloshing when product in tank is low.

The tank should be capable of complete drainage.

Generally speaking, a tall, narrow (length and width) tank is best. Cone bottom tanks work well also.

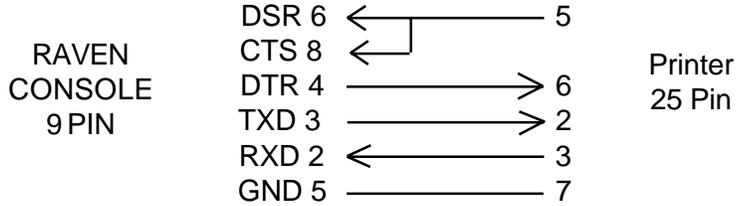
### PLUMBING TANK

- 1) Pump must be gravity fed with a flooded inlet.
- 2) Keep plumbing short and avoid running hose up and down. (See below) This will trap air and could cause pump to air lock.
- 3) Use 3/4" hose between tank and pump.
- 4) A strainer with 20 mesh screen must be used on pump inlet.
- 5) Provide for tank drainage and incorporate 3-way valves that will allow pump to be flushed with clean water. See below.
- 6) Provide a 3-way valve on pump outlet to allow for a recirculation/calibration position and an injection position.



# APPENDIX 12 SERIAL INTERFACE

- 1) Cable pinout (P/N 115-0159-994), supplied with Thermal Printer Kit (P/N 117-0159-529).

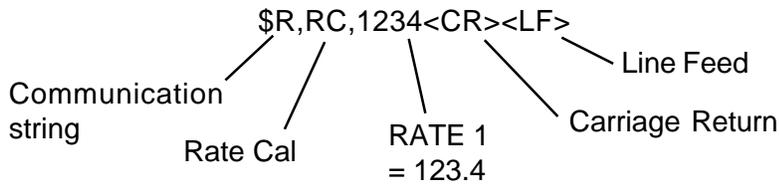


- 2) Changing RATE 1 CAL by remote computer.  
a) Configuration of RS-232C serial port:

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

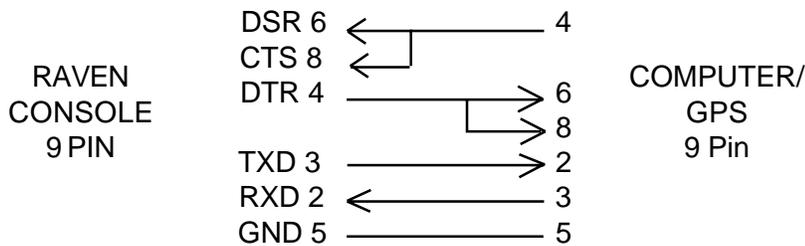
- b) Data stream to Raven Console.

**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 13

## SCS-SIDEKICK RATIO RATE COMMUNICATION STRINGS

### REMOTE COMPUTER TO SCS-SIDEKICK RATIO RATE 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>

**Time Request:**

\$R,TR<CR><LF>

**Time Acknowledge Request:**

\$R,TA<CR><LF>

### SCS-SIDEKICK RATIO RATE CONSOLE TO REMOTE COMPUTER

All console output strings begin with \$R122A, the \$R indicates a Raven communication string, the 122 is the last three digits of the current SCS-SIDEKICK programmed chip part number and A is the software revision number.

**Calibration Strings:**

\$R122E,C1,<n/a>,<n/a>,<n/a>,<n/a>,<n/a>,<n/a>,<n/a>,<n/a>,<carrier\_meter\_cal><CR><LF>

\$R122E,C2,<inject\_meter\_cal>,<CR><LF>

\$R122E,C3,<valve\_cal>,<ratio\_rate\_cal><CR><LF>

**Data Strings:**

\$R122E,D1,<n/a><CR><LF>

\$R122E,D2,<inject\_volume><CR><LF>

\$R122E,D3,<carrier\_volume><CR><LF>

**Actual Rate:**

\$R122E,AR,<actual\_rate><CR><LF>

**Time/Date:**

\$R122E,TD,<hr:min>,<month/day/year>,<field\_reference><CR><LF>





**RAVEN**

# **RAVEN INDUSTRIES**

## **Limited Warranty**

---

### ***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.

**R A V E N**

SCS Sidekick™ Ratio Rate Injection System  
Installation & Operation Manual  
(P/N 016-0159-958 Rev A 11/09)

*Simply improving your position.™*



Raven Industries  
Applied Technology Division  
P.O. Box 5107  
Sioux Falls, SD 57117-5107

Toll Free (U.S. and Canada): (800)-243-5435  
or Outside the U.S. :1 605-575-0722  
Fax: 605-331-0426  
[www.ravenprecision.com](http://www.ravenprecision.com)  
[atdinfo@ravenind.com](mailto:atdinfo@ravenind.com)

Notice: This document and the information provided are the property of Raven Industries, Inc. and may only be used as authorized by Raven Industries, Inc. All rights reserved under copyright laws.