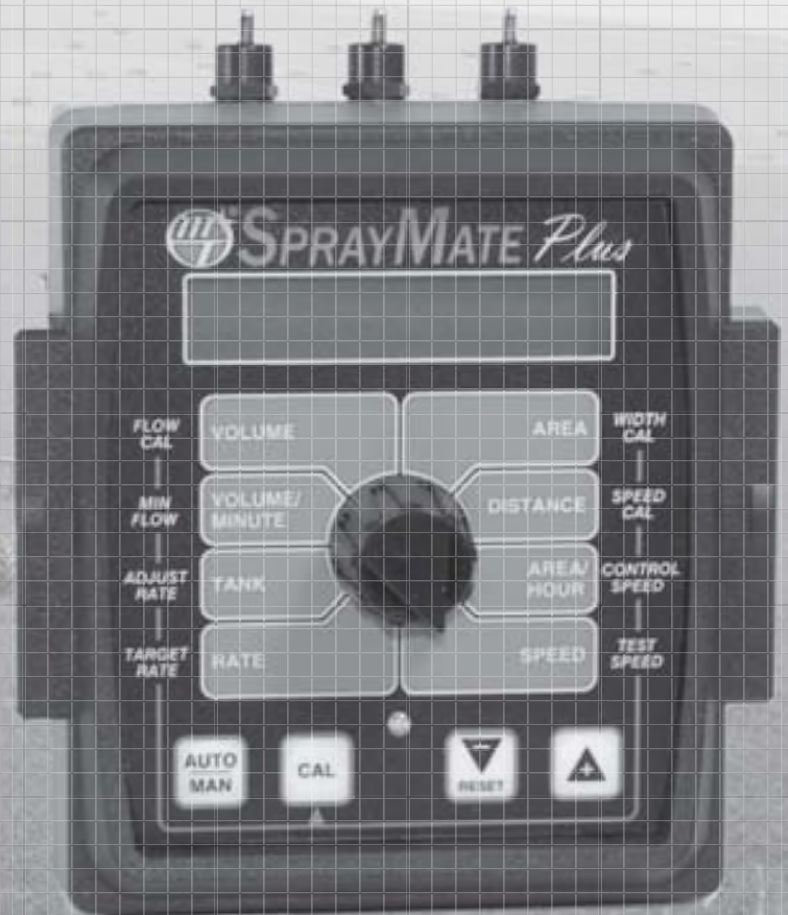


SPRAYMATE™ *Plus*

AUTOMATIC RATE CONTROLLER



REFERENCE MANUAL



MICRO-TRAK®
SYSTEMS, INC.

SPRAYMATE™ *Plus*

AUTOMATIC RATE CONTROLLER REFERENCE MANUAL

The SprayMate Plus console is an enhanced version of the SprayMate II. The Spray Mate Plus adds features to broaden the usage in the vegetable (fumigant) markets. The SprayMate Plus is an electronic control system that can help you achieve maximum yields and operate more cost-effectively by providing the information you need to maintain proper application rates of liquid chemicals and fertilizer. SprayMate Plus has been designed for easy installation and operation. However, since each installation will vary depending on your equipment, please take time to familiarize yourself with this manual and the actual components before beginning. Following the procedures described in this manual will ensure proper performance and help avoid problems or questions once you are in the field.

This manual is written for the SprayMate Plus, which may be used for either English, Metric or Turf measurement. Please read the manual carefully and follow the instructions as they apply to your usage.

If you do encounter a problem that cannot be corrected by reviewing this manual, consult your dealer or distributor, or contact a Micro-Trak technician for assistance.

Toll Free in U.S. or Canada: (800) 328-9613 or (507) 257-3600

Fax: 507-257-3001

www.micro-trak.com • trakmail@micro-trak.com



**MICRO-TRAK®
SYSTEMS, INC.**

**P.O. Box 99
111 East LeRay Avenue
Eagle Lake, MN 56024-0099**

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Micro-Trak® Warranty

Micro-Trak (herein "Seller") warrants to the original purchaser (herein "Buyer") that, if any product or part of the product (herein "part") proves to be defective in material or workmanship, upon inspection and examination by Seller, within one (1) year from the original date-of-purchase, and is returned to Seller with dated proof-of-purchase, transportation prepaid, within thirty (30) days after such defect is discovered, Seller will, at their option and sole discretion, either repair or replace said part, except that the warranty for expendable parts, including but not limited to, light bulbs and batteries shall be thirty (30) days from the original date-of-purchase. Said warranty is valid only when the part has been installed, operated and maintained in strict accordance with the procedures outlined in the manual. Any damage or failure to said part resulting from abuse, misuse, neglect, accidental or improper installation or maintenance, unauthorized modification, use with other products or attributable to acts of God, as determined solely by the Seller, will invalidate the warranty. Said part will not be considered defective if it substantially fulfills the performance specification. Buyer shall be responsible for all maintenance services, if any, all in strict accordance with the procedures outlined in the manual. The warranty does not include labor, installation, replacement parts or repairs, delivery of replacement parts or repairs or time and travel. Said warranty is nontransferable.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF MERCHANTABILITY, FITNESS FOR PURPOSE AND OF ANY OTHER TYPE, WHETHER EXPRESS OR IMPLIED. The Seller's liability, whether in contract, in tort, under any warranty, in negligence or otherwise, shall not exceed the return of the amount of the purchase price paid by the Buyer, and under no circumstance shall the Seller be liable for special, indirect or consequential damages. Seller neither assumes nor authorizes anyone to assume for it any other obligation or liability in connection with said part. No action, regardless of form, arising out of the transactions under this agreement may be brought by the Buyer more than one (1) year after the cause of action has occurred.

Seller agrees to extend the term of the foregoing warranty period should the Buyer return completed warranty registration information, with dated proof-of-purchase, to the Seller within one (1) year from the original date-of-purchase. All conditions and limitations of said foregoing warranty, except the term of said foregoing warranty, shall apply. Said term shall be extended to a total of three (3) years from the original date-of purchase on display consoles and network communication modules, as defined by Seller, and said term shall be extended to a total of two (2) years from the original date-of-purchase on all other parts, except that the warranty for expendable parts, including but not limited to, light bulbs and batteries shall be thirty (30) days from the original date-of-purchase, and except that the warranty for parts manufactured by someone other than the Seller, including but not limited to, shutoff and control valves, DGPS receivers, memory cards and drives, mapping software, flowmeters and pressure sensors shall be one (1) year from the original date-of-purchase.

Units under warranty should be sent prepaid, with dated proof-of-purchase, within 30 days of discovering defect, to the address below:

MAIL and UPS:

Micro-Trak Systems, Inc.
ATTN: Service Department
P.O. Box 99
111 East LeRay Avenue
Eagle Lake, MN 56024-0099

Extended Warranty Option

It's simple! Just complete the registration for this product **ONLINE** at www.micro-trak.com and we'll extend your warranty for up to three years*, at no additional charge.

Registration information is for internal use only.

* Some limitations apply. See warranty statement for details.

At Micro-Trak Systems, we believe a product that delivers quality and performance at a low cost is what is needed to help today's operator and the operator of the future compete in the world market.

It is our goal to provide operators with a line of electronic equipment that will help build and maintain an efficient and profitable operation that can be passed on to future generations.

We thank you for your purchase and hope that we can be of service to you in the future.

Micro-Trak Systems, Inc.

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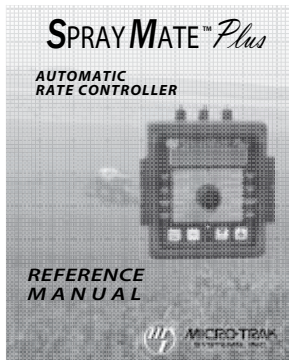
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Component Parts and Assembly Hardware

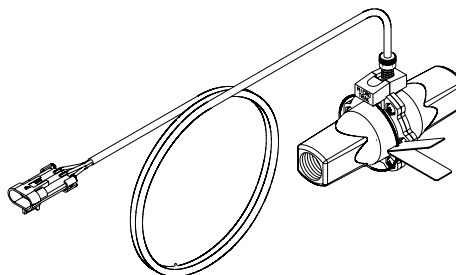
Before beginning installation, check the carton contents for the following items:



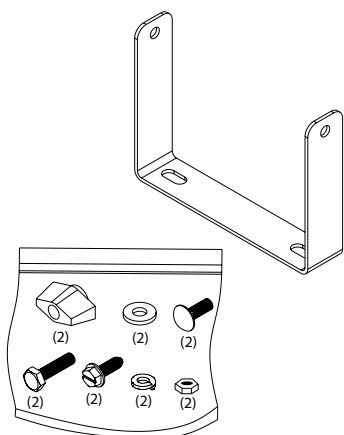
SprayMate™ Plus Console
P/N 18109



Owner's Manual
P/N 50356



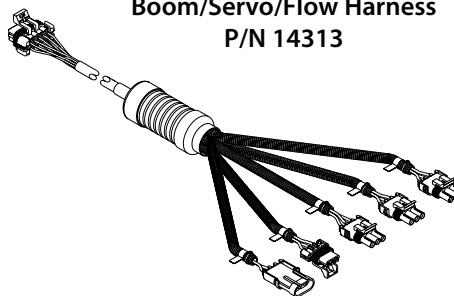
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P/N 01501



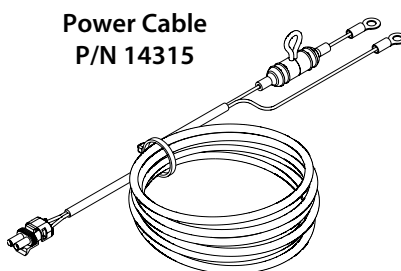
Console Mount Kit
P/N 13181



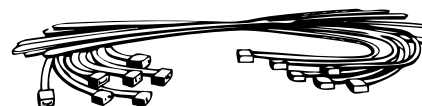
M-T 1" Electric Servo Valve
P/N 14928



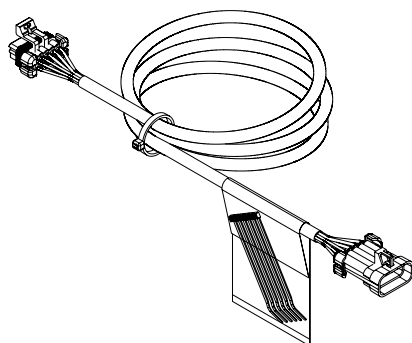
Boom/Servo/Flow Harness
P/N 14313



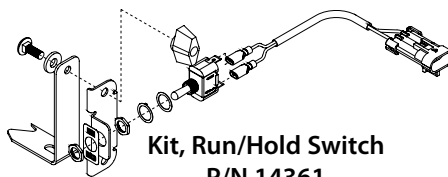
Power Cable
P/N 14315



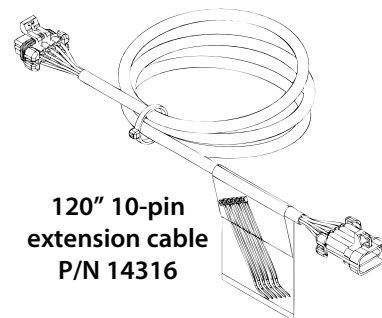
14" Nylon cable ties (10)
P/N 12910



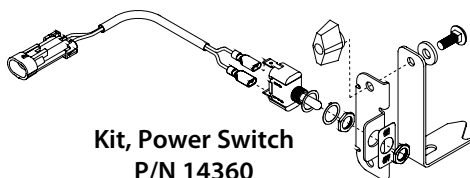
10' 10-Pin Extension Cable
P/N 13221



Kit, Run/Hold Switch
P/N 14361



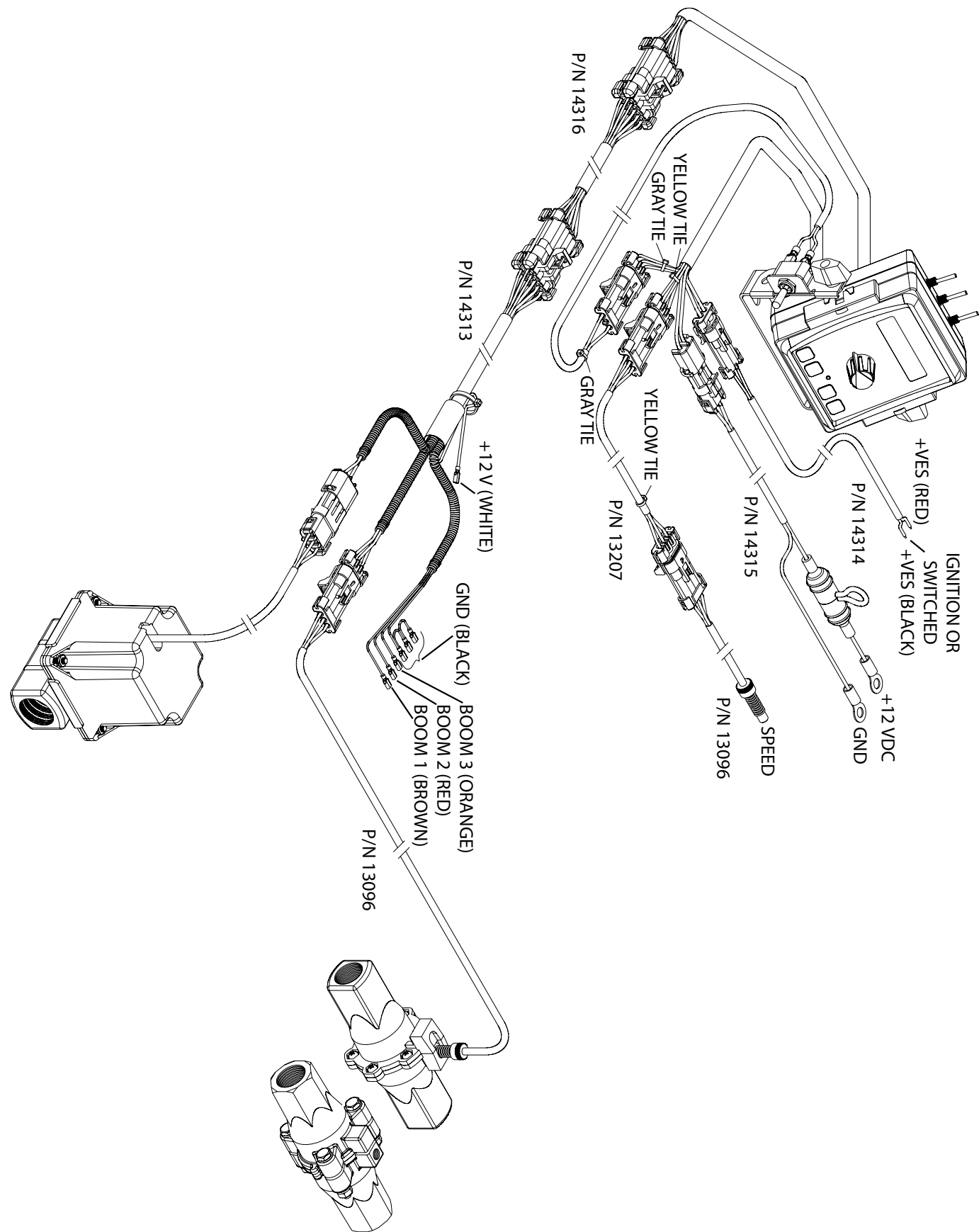
120" 10-pin extension cable
P/N 14316



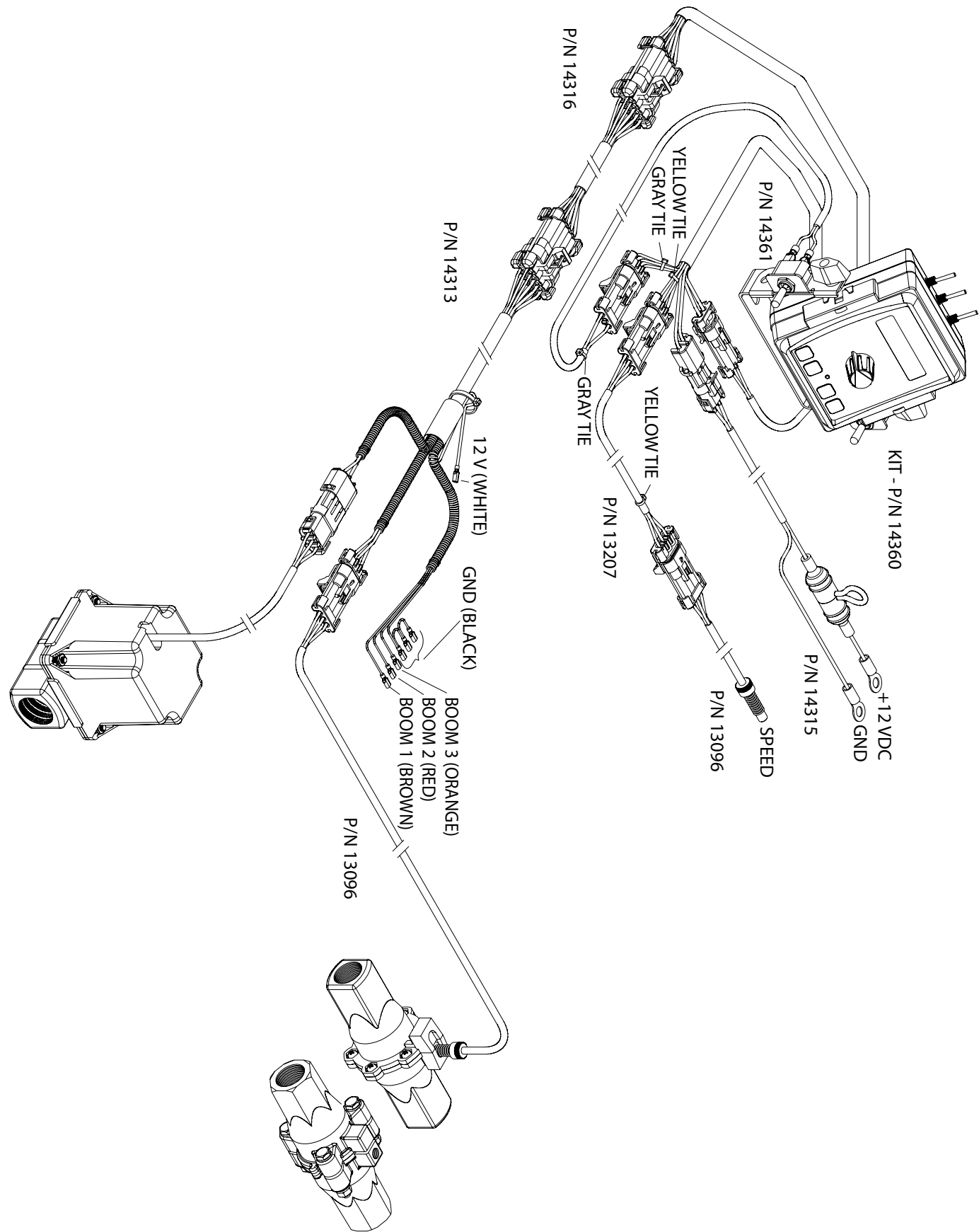
Kit, Power Switch
P/N 14360

SprayMate™ Plus System Overview

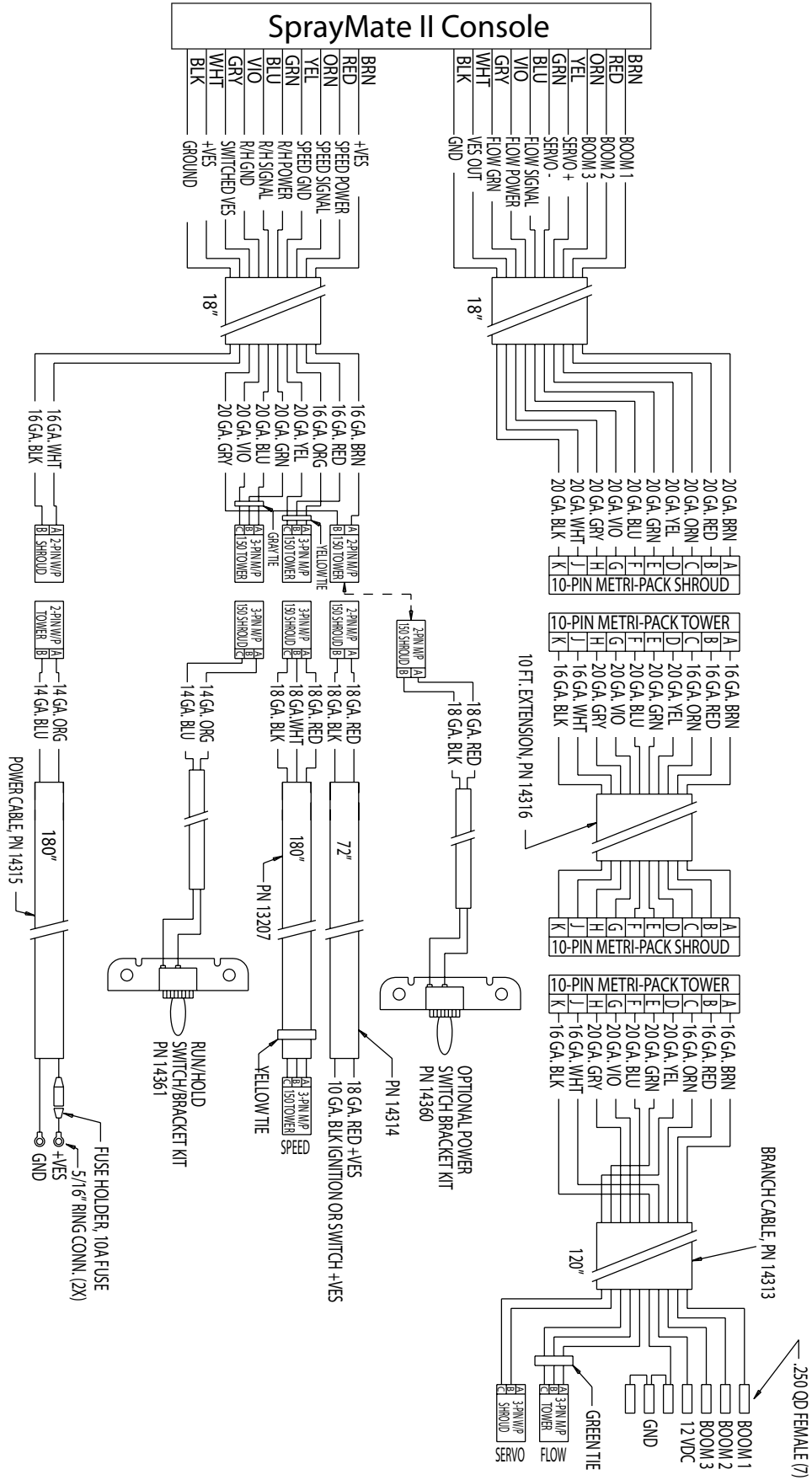
with Ignition Switch Hookup



SprayMate™ Plus System Overview
with Optional Power Switch



SprayMate™ Plus Wiring Diagram



Installation

Mounting the Display Console

Select a mounting location which seems most workable, and best fits your needs. It should be convenient to reach and highly visible to the operator. **DO NOT INSTALL IN A POSITION THAT OBSTRUCTS THE VIEW OF THE ROAD OR WORK AREA.** Whenever possible, avoid locations that expose the console to direct sunlight, high temperature, strong chemicals or rain.

Place the mounting bracket in the selected location, mark holes, drill $\frac{1}{4}$ " (7mm) holes and mount bracket with bolts, lock washers and nuts provided. (Use self-tapping screws if not practical to use bolts.) *See Illustration 1A.*

Put rubber washers on carriage bolts and put the bolts through the bracket holes from the inside out. Place console over carriage bolt heads.

Install the switch brackets over the carriage bolts and alongside the console bracket. Install the mount knobs on the carriage bolts and tighten to secure the console and switch brackets in place. *See Illustration 1B.*

Install the switches in the brackets and attach the quick disconnects on the switch harnesses to the switches (see wiring diagram). Then install the switch harness connectors into the mating connectors on the console harness. Typically the power On/Off switch (Kit 14360) is mounted on the left and the Run/Hold switch (Kit 14361) is mounted on the right. *See Illustration Below.*

Illustration 1A

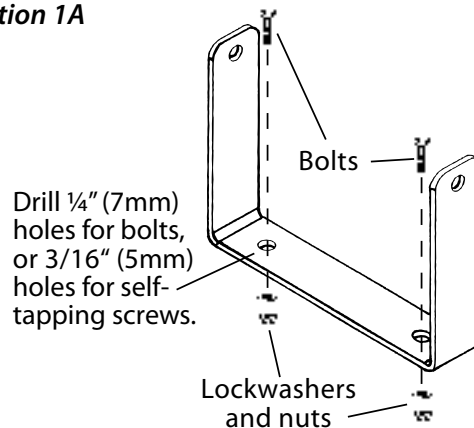
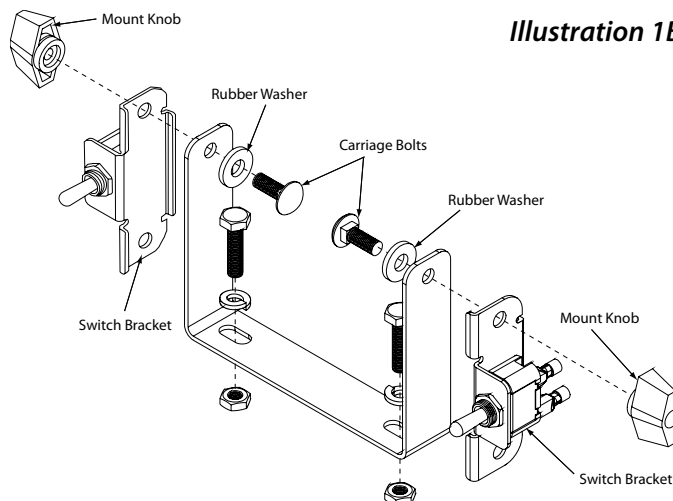
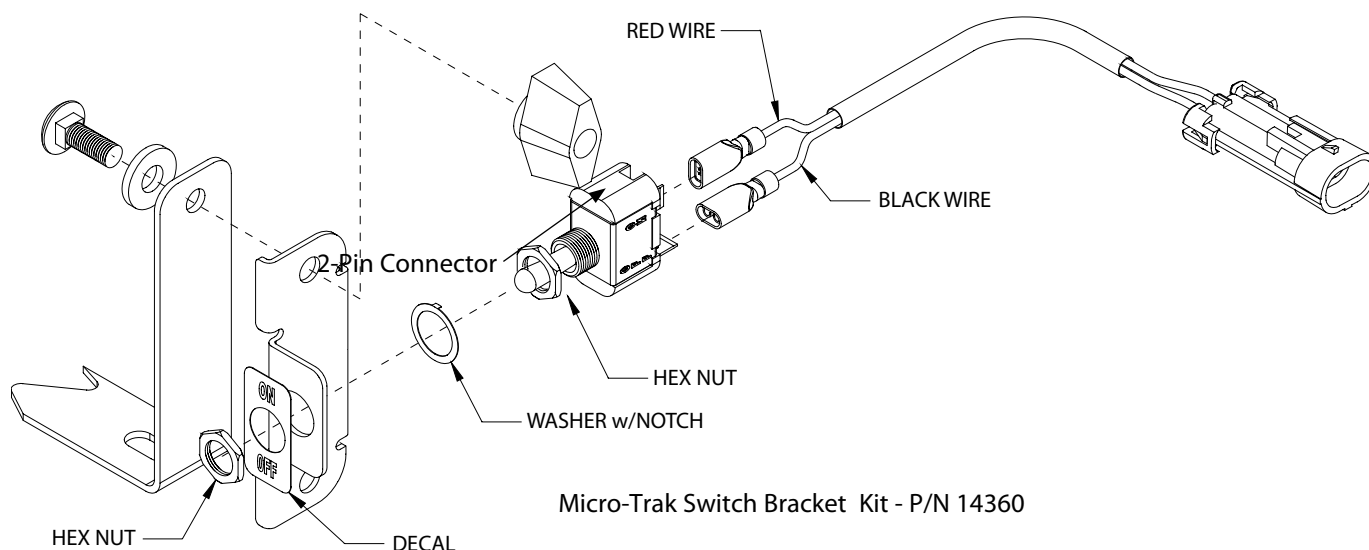


Illustration 1B



Console Power Switch Bracket



Installation (cont)

Electrical Installation

This section explains how to hook-up your SprayMate™ Plus to a 12-volt power connection, and how to connect your boom shut-off valves.

The SprayMate™ Plus must be connected to a 12-volt DC negative ground electrical system.

POWER/BATTERY CONNECTION

Locate the power cable lead on the SprayMate™ Plus harness and route to the battery. In routing cable to console, avoid areas where the cable may be subjected to abrasion or excessive heat. Attach the BLUE wire (ground) to a screw or bolt on the equipment frame. *See Illustration 2.* Be sure there is a good metal-to-metal contact. Connect the ORANGE wire to the positive battery terminal.

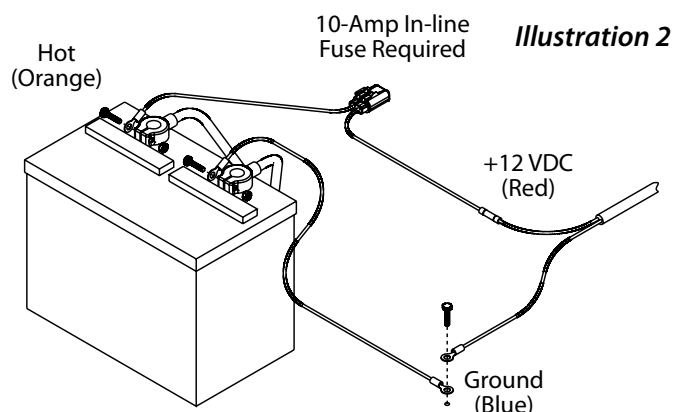
Connect the power to the SprayMate™ Plus console by plugging the 2-pin W/P tower on the power cable into the 2-pin W/P shroud of the display console.

ON/OFF SWITCH CONNECTION

The SprayMate™ Plus system harness includes a provision for either using a switched (ignition) source or the included power switch to turn the system on.

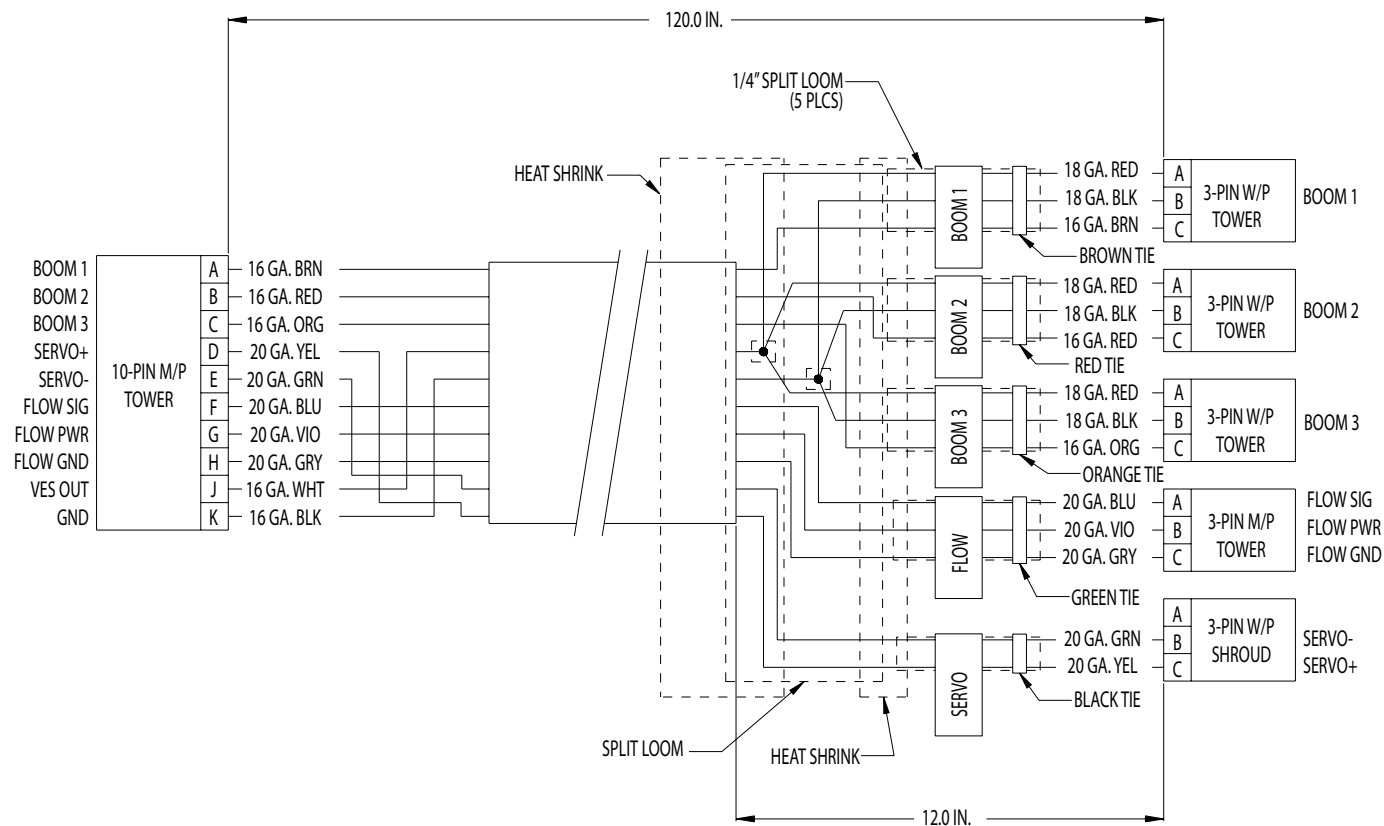
If the switch is used, simply mount the switch bracket as shown on page 11, and plug the connector into the mating cable from the console. If you want to use the ignition switch to turn the system on and off, using the 72" 2-wire extension cable, plug the connector into the mating plug for the console and connect the black wire to the switched power source (terminal or wire). **DO NOT** connect the red wire.

Your SprayMate™ Plus is equipped with an electronic memory which does not require a constant supply of power to retain daily totals or calibration values. This type of memory conserves battery power and will not discharge the vehicle's battery when equipment is not in use.



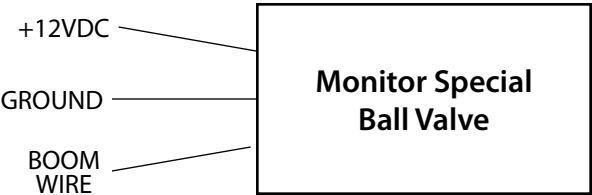
Installation (cont)
SprayMate™ Plus Boom Connections

Illustration 4A



If using 2-wire ball valves, contact a Micro-Trak representative for assistance.

Illustration 4B



Installation (cont)

Speed Sensor Installation

Magnets

Please read the following information about magnet spacing and polarity.

The number of magnets that must be used depends on the size of your tire and where you mount the sensor. On tractor or implement wheels the general rule of thumb is one magnet for each wheel bolt (minimum of two, and always an even number). For drive shafts or small wheels (ATV's), two magnets are usually adequate.

Some installations may require that more than two magnets be installed. To determine the number of magnets required, measure the distance traveled of one revolution of the sensor equipped wheel in inches (meters). Divide that measurement by 20 for English and Turf units, or by .5 for Metric units, and then round up to the nearest even number (always use an even number of magnets). That number will be the minimum number of magnets required for the installation.

Example in English/Turf units: If your revolution measurement is 97 inches, dividing that number by 20 gives you a value of 4.85. Rounding 4.85 up to the nearest even number is 6. For this example, the minimum number of magnets required is 6.

Example in Metric units: If your revolution measurement is 2.5 meters, dividing that number by .5 gives you a value of 5. Rounding 5 up to the nearest even number is 6. For this example, the minimum number of magnets required is 6.

The magnets provided by Micro-Trak are marked with a punched dashed line on the SOUTH pole side of the magnet. **See Illustration 5A.**

Always use an even number of magnets, and always alternate the polarities of the magnets as you go around the wheel hub or drive shaft.

To install, mount the first magnet with the SOUTH pole side (dashed line) facing toward the hub or shaft. Mount the second magnet with the NORTH pole side facing toward the hub or shaft. **See Illustration 5B.**

For proper operation, the magnets must be evenly spaced around the wheel or drive shaft. The magnets must be at least 1" apart. **See Illustration 5C.**

Attaching Magnets

The magnets are attached to a wheel hub or drive shaft and the speed sensor is mounted directly over the magnet. When the wheel or drive shaft begins turning, a speed impulse is sent to the SprayMate™ Plus console every time a magnet passes by the tip of the speed sensor. For the speed sensor to operate properly, the spacing between the magnets and the tip of the sensor must always remain constant. Before permanently mounting any parts, be sure that the location you have selected will meet the following requirements. **See Illustration 6.**

NOTE: Observe magnet polarities (see previous page).

Locate the Following Parts

- Speed Sensor Cable (Black Body)
- Mounting "L" Bracket
- Magnet Clips
- Magnets
- Cable Ties

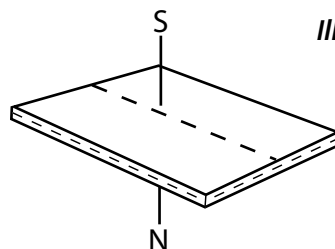


Illustration 5A

Illustration 5B

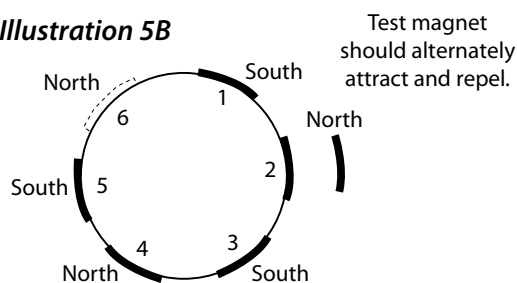
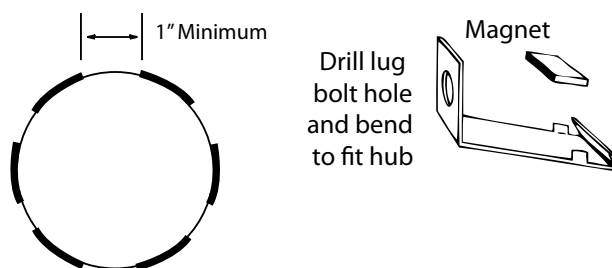


Illustration 5C



Refer to the diagram on the following page for general mounting instructions. **For specific mounting instructions, refer to Appendix A in the back of this manual.**

NOTE: Magnets may be attached mechanically as shown or adhered with epoxy or other high quality adhesive. When using adhesive, thoroughly clean the area of dirt and oil.

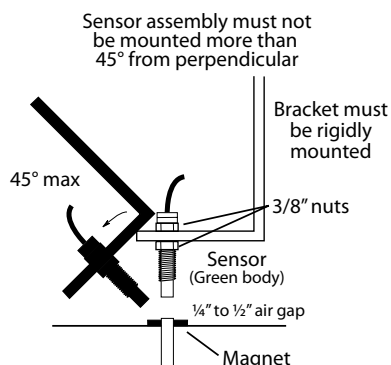


Illustration 6

Installation (cont)

Speed Sensor Installation (cont)

Connecting the Speed Sensor Cable

The speed sensor cable has a GREEN sensor body and mates with the main harness cable having a YELLOW cable tie near the 3-pin M/P connector. Make certain that you install the correct sensor cable and connect it to the correct connector on the main harness. The speed sensor and the flow sensor are identical, but must be connected to the proper harness connector. The speed sensor always connects to the main harness lead with the YELLOW tie and flow sensor always connects to the main harness lead with the GREEN tie. *See SprayMate™ Plus Wiring Diagram on page 10.*

The optional Run/hold sensor, also uses the same type of connector as the speed and flow sensors. However, the Run/hold sensor has a GRAY tie near the 3-pin connector, the sensor body is BLACK, and it always connects to the main harness lead with the GRAY tie. *See SprayMate™ Plus Wiring Diagram on page 10.*

SENSOR IDENTIFICATION CHART

SENSOR	SENSOR BODY COLOR	MAIN HARNESS TIE COLOR
Speed	Green	Yellow
Flow	Green	Green
Run/Hold	Black	Gray

Speed Sensor Options

NOTE: In addition to the standard Hall-effect magnetic speed sensor, the SprayMate™ Plus may be interfaced with a variety of other speed sensing equipment. Several options are listed below.

ASTRO SERIES OR OTHER GPS SPEED SENSOR INTERFACES

The SprayMate™ Plus may also be used with most GPS speed sensors that output a pulsed signal, such as the Micro-Trak Astro II and 5, SkyTrak or Dickey-John GPS speed sensors. An adapter cable may be required.

VANSCO™ RADAR SPEED SENSOR

The Vansco radar speed sensor uses a microwave (radar) signal to deliver a reliable, accurate speed signal for electronic equipment. It features state-of-the-art electronic design/manufacturing, rugged aluminum housing and complete testing and certification.

RADAR INTERFACE

The SprayMate™ Plus may also be interfaced with most popular radar ground speed sensors. An adapter cable is required for proper interface.

SEE APPENDIX I FOR LIST OF ADAPTER CABLES FOR RADAR.



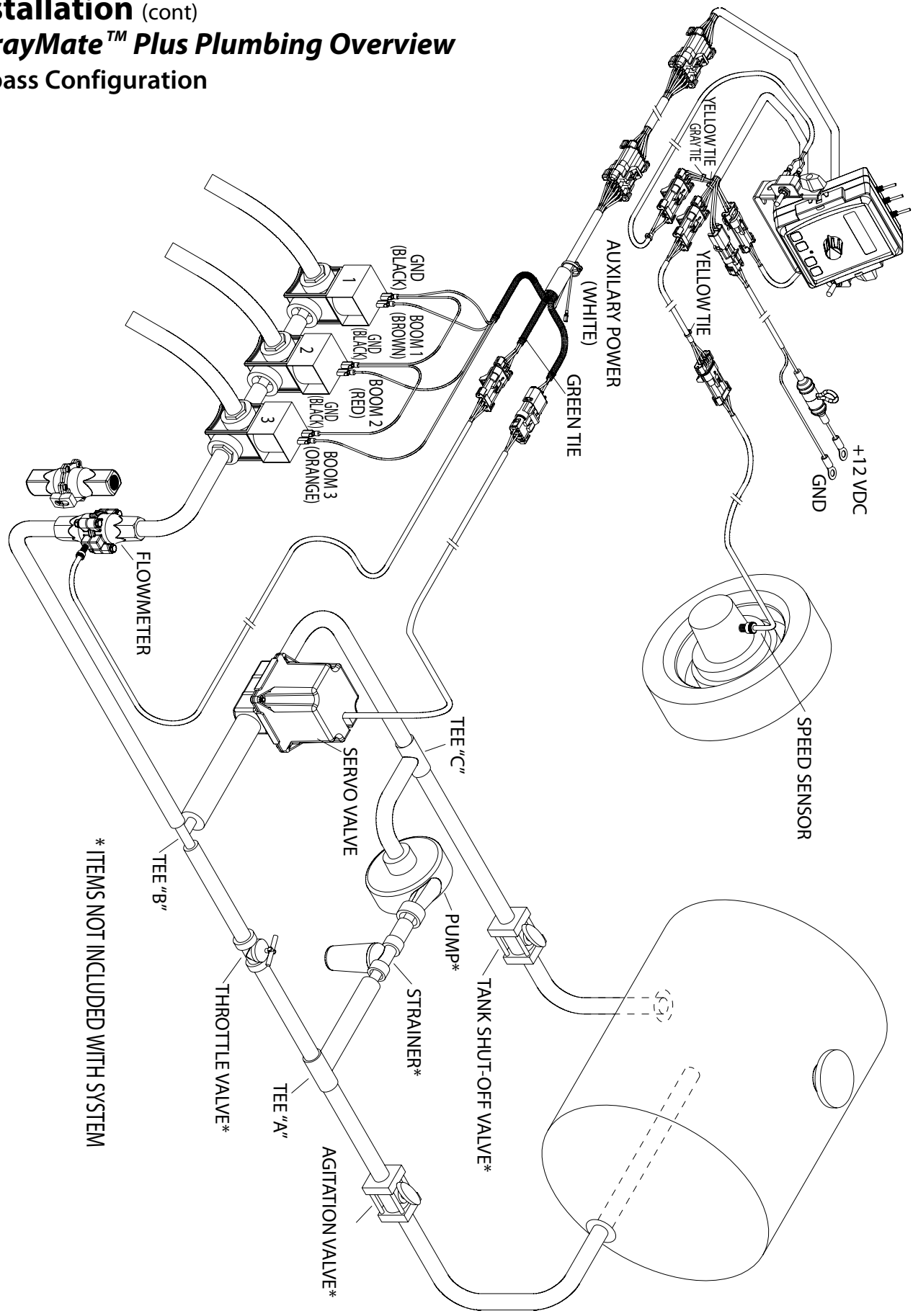
Astro 5 GPS Speed Sensor



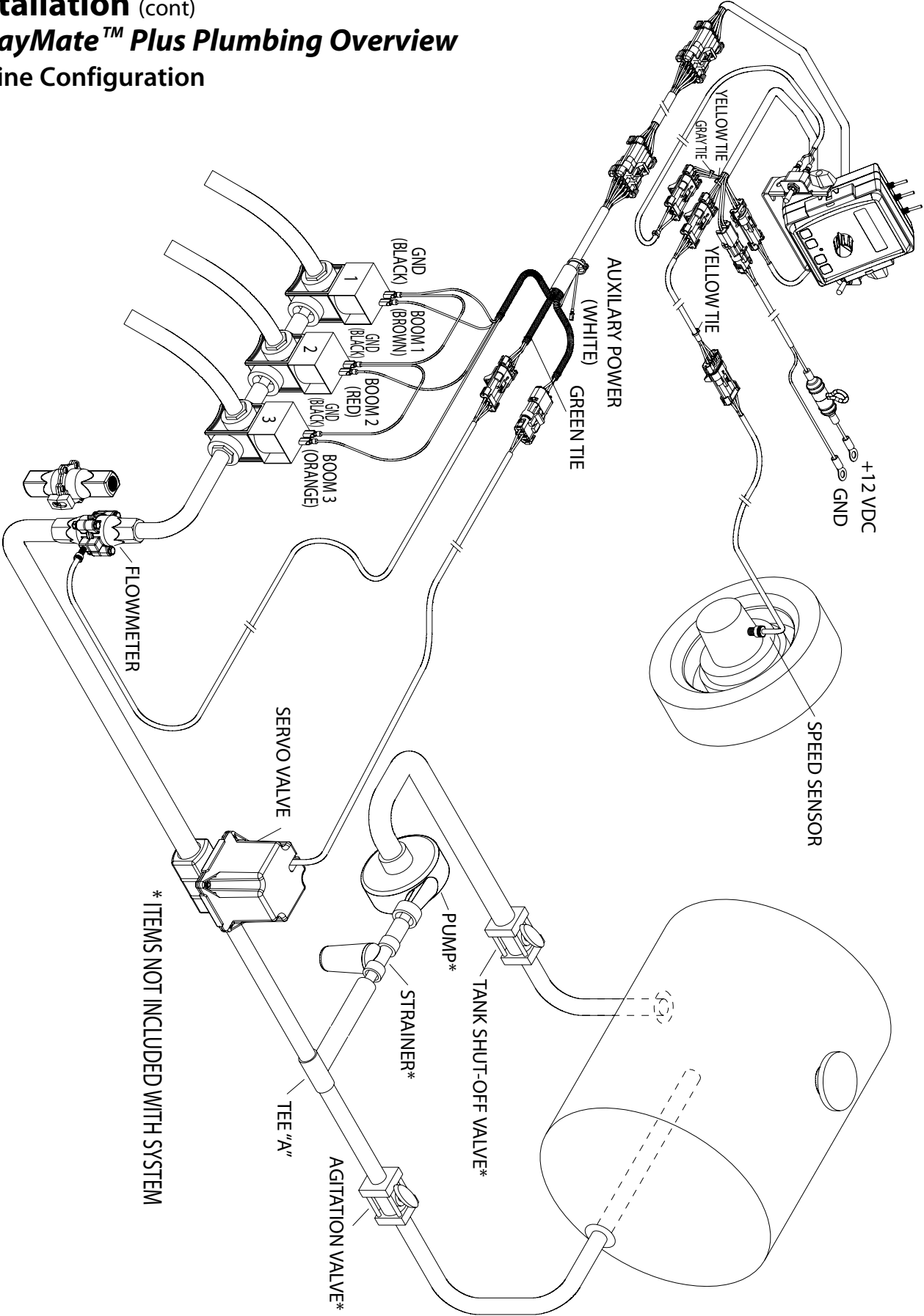
Vansco Radar Speed Sensor

Contact a Micro-Trak sales representative for details on any of these products,
or call Micro-Trak Systems, Inc. at 1-800-328-9613.

Installation (cont)
SprayMate™ Plus Plumbing Overview
Bypass Configuration



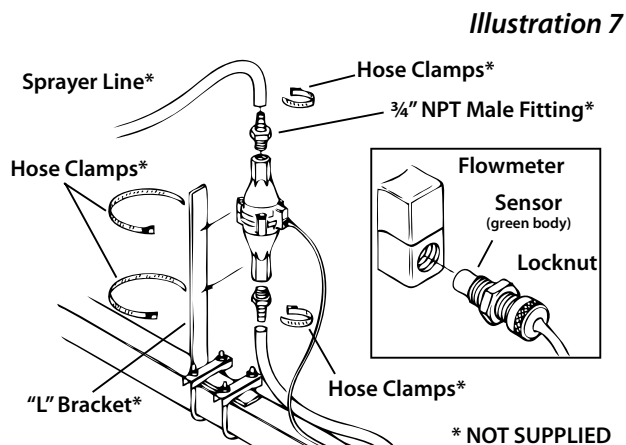
Installation (cont)
SprayMate™ Plus Plumbing Overview
In-Line Configuration



Installation (cont)

Mounting and Plumbing Flowmeter

The Flowmeter must be installed in the main boom line after any strainers, return lines, or valves. Securely mount flowmeter (hardware not supplied) in a vertical position in an area away from intense vibration. **DO NOT install flowmeter closer than 12" to the servo valve or the boom shut-off valves.** The flow meter is a bidirectional meter (*Exception: Polmac's 1 1/2"—3"*). Liquid can flow in either direction, but up is preferred, especially at rates below 5 GPM (19 lpm). Make connections using appropriate fittings without the use of reducers, elbows or sharp bends for a minimum of six inches (15 cm) either side of meter. *See Illustration 7.* Save plastic plugs to protect flowmeter during storage. *(The flowmeter may need periodic cleaning, so it should be easy to remove.)*



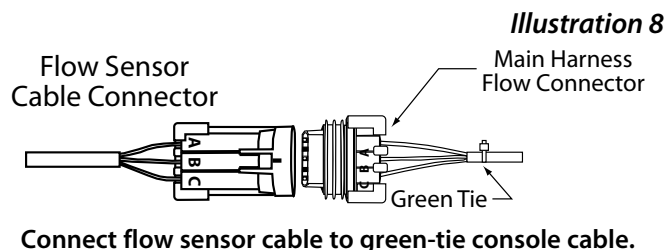
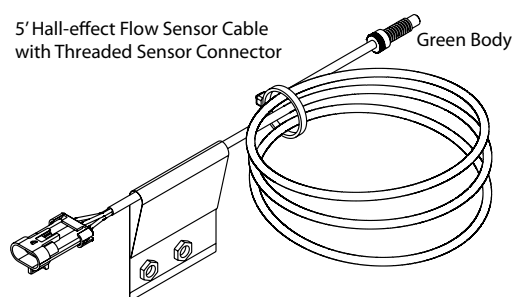
Installing Flow Sensor Cable

With the flowmeter in place, install the flow sensor cable.

The flow sensor cable has a GREEN sensor body and mates with the 3-pin connector on the main harness marked with a GREEN cable tie. Screw sensor all the way into hole of flowmeter. Tighten 3/8" jam nut to secure sensor in place.

Uncoil flow sensor cable and carefully route it to meet the main harness flow connector marked with GREEN tie. Align connectors and press firmly together until locking tab clicks into place. Secure cable with ties provided. *See Illustration 8 and SprayMate™ Plus Wiring Diagram on page 10.*

NOTE: Sensors with GREEN bodies can be used for either SPEED or FLOW but not for RUN/HOLD.

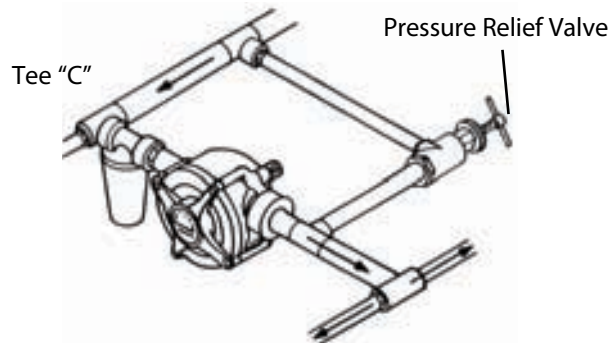


Manual Pressure Relief Valve

If you have a positive displacement pump or a centrifugal pump capable of generating excessive pressure, you must install a pressure relief valve and adjust it to a safe maximum pressure. If a positive displacement pump is operated without a pressure relief valve, damage may result to pump or other plumbing component. *See Illustration 9.*

For positive displacement pumps

Illustration 9

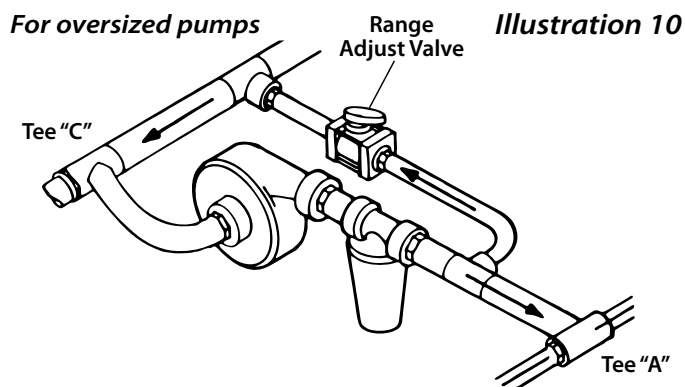


Installation (cont)

Mounting and Plumbing Flowmeter (cont)

Range Adjust Valve

With oversized pumps, it may be necessary to install a range adjust valve. The range adjust valve will reduce the pump's output to the rest of the system. **Adjustment of this valve is covered in the Pre-Field System Checkout, pages 43-44. See Illustration 10.**

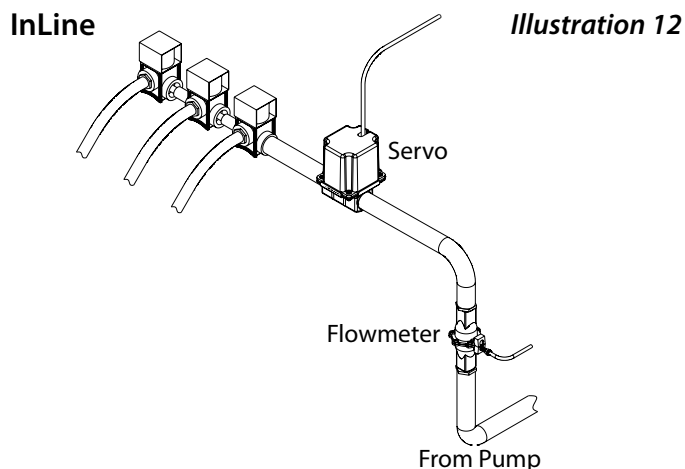
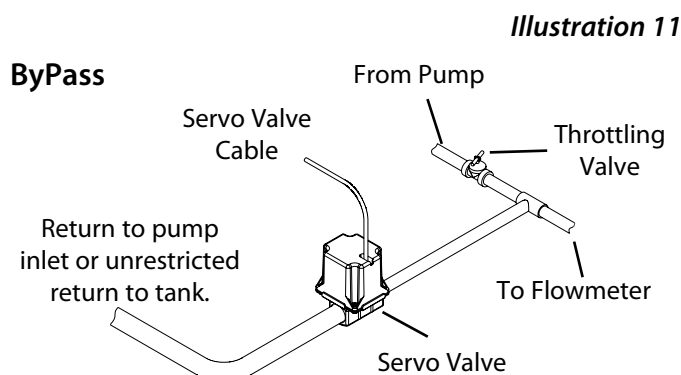


Servo, Throttling Valves

For BYPASS installations, the servo valve installs in an unrestricted return line to the inlet of the pump or directly into the tank. The console must be calibrated for bypass operation, *see Calibration section*. **DO NOT install the servo valve closer than 12" to the flowmeter.** The servo valve has a flow direction decal on it. Make certain that the actual flow direction matches the decal on the servo valve. **DO NOT** install the servo valve in the agitation line. Slow response time and marginal operation may result. The return line should tee from the main line just after the throttling valve. *See Illustration 11.* The throttling valve is used to limit the output (set maximum output) of the pump to the flowmeter and servo valve. The throttling valve is adjusted to put the servo valve in its optimal operating range. *Please refer to Pre-Field System Checkout on page 43-44 for proper valve adjustment procedure.*

The servo valve connects directly to the 3-pin connector on the main harness. If more length is required, use a 3-pin W/P extension cable of the appropriate length.

NOTE: The servo valve may be installed in the main spray line as shown in Illustration 12. For In-line installations, you will need to calibrate the system for INLINE operation, see page 44.



Installation (cont)

Remote Run/Hold

The run/hold sensor cable has a BLACK body and mates with the main harness cable having a GRAY cable tie near the 3-pin M/P connector. Make certain that you install the correct sensor cable and connect it to the correct connector on the main harness. *See Illustrations to the right.*

IMPORTANT:

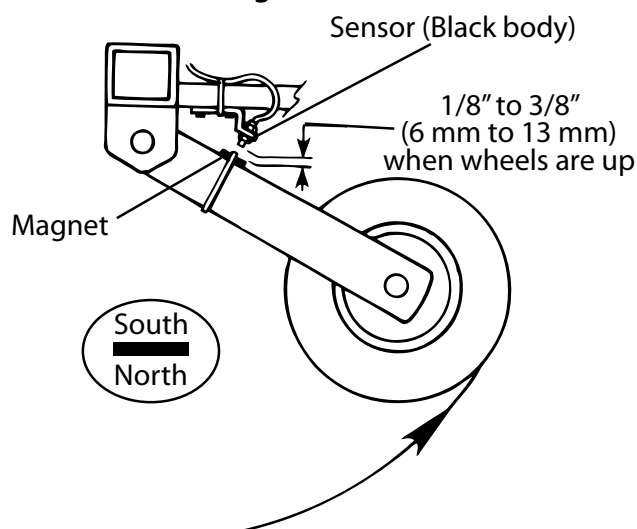
If not using Run/Hold cable for remote use, make certain a dust cover with jumper is installed.

- The basic idea is to attach a magnet to a lever or some part of the equipment that moves when the implement is raised and lowered. The Hall-effect Run/Hold sensor is sensitive only to the south pole of the magnet. Install the magnet with the dashed line facing the sensor. When the magnet is away from the sensor, the console will be in HOLD and the area and distance counting functions will be disabled. **NOTE: The Run/Hold Kit includes a 5' sensor cable and 10' extension.** You may require additional extension cables which are available in 5 ft. (1.5 m), 10 ft. (3 m), 15 ft. (4.5 m), 20 ft. (6 m) and 25 ft. (7.6 m) lengths.
- You may also use a toggle or other type switch. Simply cut the black jumper wire in the dust cover and splice on an appropriate length of wire to reach your switch. Do not connect to a switch with power.

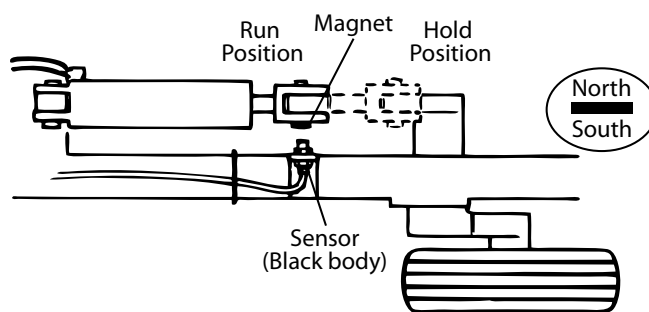
When switch is closed, console is in RUN. When the switch is open, the console is in HOLD.

Run/Hold polarity is selectable with the SprayMate™ Plus. *See page 29.*

Lift Wheel Mounting



Hydraulic Cylinder Mounting



Remote Run sensor on hydraulic cylinder. Magnet and sensor are in line when equipment is lowered and operating.

Care and Maintenance of your SprayMate™ Plus

Console

Store the console in a cool dry location if it will not be used for an extended period of time, such as during the off-season. As with any electronic equipment, use care in cleaning so that water or other liquids do not enter the case. Thoroughly flush Flowmeter with clean water, install plastic shipping plugs and keep from freezing.

Precautions

- The input pressure on the glass-filled nylon flowmeter FM750 GFN should not exceed 100 PSI (689 kpa).
- Do not expose the flowmeter to liquid temperatures exceeding 130 degrees F (55 degrees C).
- Some chemicals may damage the turbine material. If you are in doubt, contact the chemical manufacturer.

SprayMate™ Plus Console Functions

The SprayMate™ Plus features a large, easy-to-read liquid crystal display, easy-to-use rotary dial and lighted panel for night use.

VOLUME: Displays the volume pumped in gallons if English/ Turf units or liters if Metric units

VOLUME/MINUTE: Displays total gallons (liters) of liquid applied per minute, or lbs. (kg) NH3 per minute.

TANK: Displays gallons (liters) of liquid remaining or lbs. (kg) of NH3 remaining.

RATE: Displays application rate in the following units of measurement based on the UNITS and MATERIAL settings.

	Liquid	NH ₃
English	Gallons/Acre	lbs-N/acre
Metric	liters/hectare	kg-N/hectare
Turf	Gallons/1000 Ft ²	lbs-N/ 1000 Ft ²

AREA (1) (2) (3): Keeps a running count of the total acres (hectares) worked. May be reset. (Note: VOLUME and AREA counters work in pairs, if AREA counter 1 is reset, it also resets VOLUME counter 1.

DISTANCE: Displays Distance traveled in 0.1 increments from 0 to 9,999.9 feet or meters and then in increments of 1 from 10,000 to 99,999.. May be reset.

AREA/HOUR: displays Acres / Hour in English units or Hectares / Hour in Metric or 1000 Ft² / Hour in Turf Units.

SPEED: Displays ground speed in miles per hour (kilometers per hour).



WARNING LIGHT: Indicates over or under application of 10% of the Target Rate. Also lit when in CAL.

Calibration Positions

FLOW CAL: Used in calibration mode to enter the calibration value assigned to your flowmeter (*see flowmeter tag.*)

MIN FLOW: Not used for Open Loop PWM drive systems. Instead, the user is expected to set the “Minimum Pulse Width” factor to prevent operation at a rate that is too low for proper operation. The PWM output will never drop below the MIN PW factor no matter how slow the ground speed becomes.

ADJUST RATE: Used in calibration mode to enter an amount of change for on-the-go adjustments to the target rate (GPA/LPH), or lbs/acre (kg/hectare) N.

TARGET RATE: Used in calibration mode to enter the target application rate (GPA/LPH) or lbs/acre (kg/hectare) N.

Calibration Positions

WIDTH CAL: Used in calibration mode to enter the working width of your sprayer booms or other equipment.

SPEED CAL: Used in calibration mode to enter the speed calibration number in inches (cm) per pulse.

CONTROL SPEED: allows the user to either decrease or increase the CONTROL RESPONSE for his particular system.

TEST SPEED: Used in calibration mode to enter a test speed in miles per hour (kilometers per hour).

Soft Key Functions



Key which changes operation from automatic control to manual.



This key is used to enter & exit the calibration mode.

PROGRAM KEYS: Used to increment and decrement the different calibration values.



- RESET when not in CAL, clears the selected counter when held for two seconds.



- When in CAL, the “+” key increases and the “-” decreases the value displayed.

Calibration

Entering Calibration

The SprayMate™ Plus is capable of displaying information in American English, standard Metric or Turf measurements. The SprayMate™ Plus is shipped from the factory programmed for English.

NOTE: Since changing UNITS will load defaults, the UNITS should always be set (in Special Calibrate) before changing any other factors.

There are eight CALIBRATE factors as shown around the outside perimeter of the rotary switch (white labels on black).

To start CALIBRATE, the following conditions must be met:

- *LIVE CALIBRATE, SPECIAL CALIBRATE and UNLOAD are not active*
- *Must be stopped (zero speed).*
- *Must be in HOLD, or all non-zero width sections turned off.*
- *Hold the CAL switch for 1 second.*

The CAL icon will turn on and any of the eight CALIBRATE factors can be viewed.

If the Console is unlocked, the Warning LED will also turn on and any of the CALIBRATE factors can be adjusted.

If the Console is locked, the Warning LED will not turn on and the CALIBRATE factors can only be viewed and cannot be adjusted.

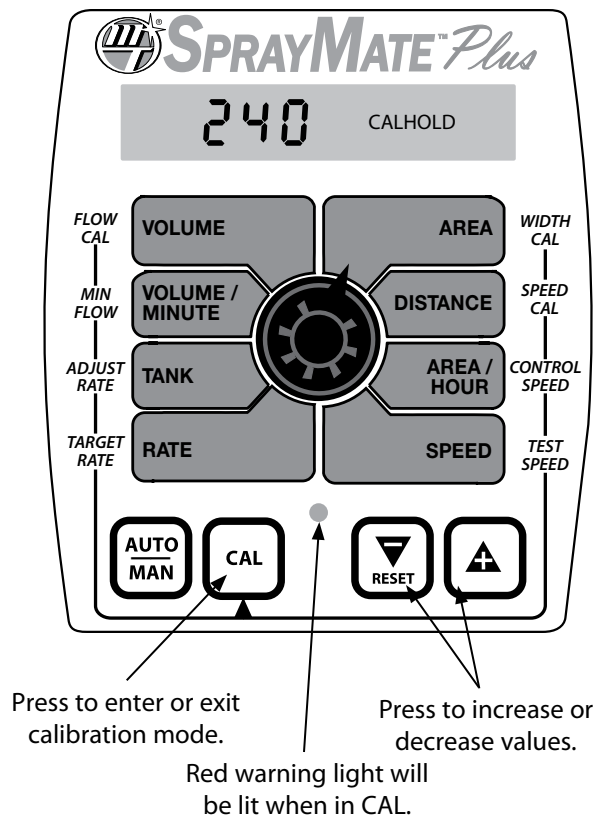
Once CALIBRATE is started, it will remain in CALIBRATE regardless of Section, Speed or HOLD status.

CALIBRATE is exited by holding the CAL switch for 1 second, also regardless of Section, Speed or HOLD status.

The CALIBRATE factors will be stored when exiting CALIBRATE. They will not be saved when power is turned off so if a user accidentally makes a change, power can be cycled to abort any changes. A Brown Out will not exit CALIBRATE and therefore will not store the CALIBRATE factors.

The + or – (RESET) keys are used to adjust the CALIBRATE factors if the console is unlocked. The longer the key is pressed the faster the value will change.

Illustration 14



Calibration (cont)

Entering Calibration Values

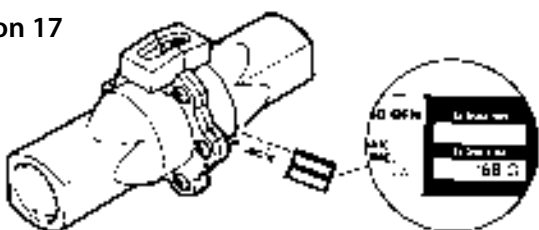
To enter or change any of the system's calibration values, you must enter calibration mode. To enter calibration mode, STOP the vehicle, turn all booms OFF or put the console in HOLD and press and hold the CAL button until the "CAL" icon appears (approximately one second). (NOTE: Calibration may be entered while moving, but it is not recommended to attempt calibration while the vehicle is moving.) The console will remain in calibration mode, with the RED warning light illuminated until you exit calibration or turn power OFF.

Once in calibration mode, you may change any one, all, or none of the values, in any order.* To select a calibration position, simply turn the rotary selector to the desired position. Calibration positions are identified by the WHITE labeling on each side of the rotary selector. All values are entered and adjusted using the "+" and "-" buttons on the front panel.

* TEST SPEED MUST BE LAST.

FLOW CAL: This position is used to calibrate the flowmeter for accurate liquid measurement. Every flowmeter is calibrated with water at the factory and assigned a "FLOW CAL" value to make it operate properly with the SprayMate™ Plus console. This number is stamped on the plastic tag attached to the flowmeter. See *Illustration 17*. This is a starting point only. If your spray solution has a specific gravity or viscosity that is different than water, flowmeter calibration should be done for the specific solution (Please refer to Fine-Tuning Flowmeter Calibration in Appendix C on page 45.)

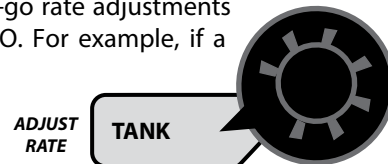
Illustration 17



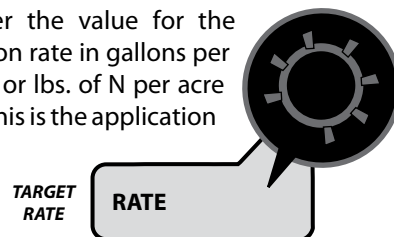
MIN FLOW: The purpose of this calibration value is to prevent the system from applying below the recommended minimum rate for the nozzles. The minimum flow rate in gallons per minute (liters per minute) based on the nozzles being used, for the entire boom on the sprayer. DO NOT enter the actual flow of your spray application. For example: If the minimum flow rate for the nozzle you are using is .22 GPM at their minimum recommended pressure and your boom has 20 nozzles, enter 4.4 as the MIN FLOW value (.22 x 20 = 4.4). The system WILL NOT apply at a rate lower than this value when spraying in AUTO. This value should be checked/ changed for each different nozzle that you use.

APPLICATION NOTE: Over-application may occur with MIN FLOW set if ground speed is too slow.

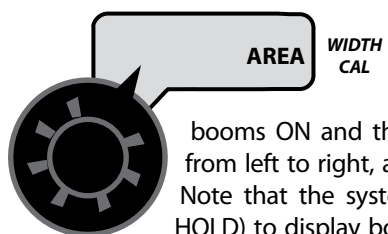
ADJUST RATE: Enter the value for the desired amount of change in gallons per acre (liters per hectare) to be used for making on-the-go rate adjustments when operating in AUTO. For example, if a value "1.0" is entered, you will be able to increase or decrease your application rate in one-gallon (liter) or lb. (kg) increments during operation in AUTO. To disable this feature, simply enter ".0" for a value.



TARGET RATE: Enter the value for the desired target application rate in gallons per acre (liters per hectare) or lbs. of N per acre (kgs of N per hectare). This is the application rate that the console will lock onto when operating in AUTO.

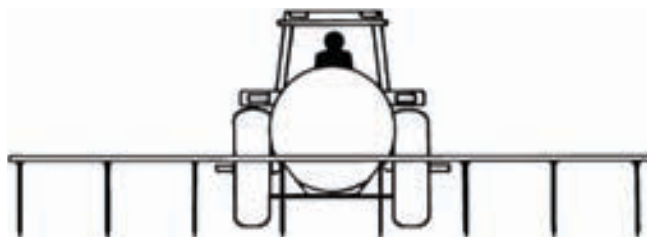


WIDTH CAL: Enter the effective working width, in inches (meters) for the boom section currently shown on the display. It is simplest to start with all booms ON and then turn each boom OFF, from left to right, after calibrating the width. Note that the system must be in RUN (not HOLD) to display boom numbers. Repeat this procedure for each boom section. Enter a value of "0" (.000) for any unused boom sections.



Your "working" width per boom section will be the number of nozzles on the boom section times the nozzle spacing in inches (mm). For example, if you have 8 nozzles spaced at 12 inches, the working width of the boom section is 96 inches. See *Illustration below*.

CAUTION: If spray-lines are pressurized, nozzles may spray during this step.



Calibration (cont)

Entering Calibration Values (cont)

Determining the SPEED CAL (Skip this section if using radar or GPS speed sensor)

Illustration 15

SPEED CAL: This position is used to calibrate the speed sensor for accurate speed and distance measurement. When this position is selected, the display will show THE SPEED CAL value. The SPEED CAL value is the number shown along with "CAL" on the display. See Illustration 15.

SPEED CAL FOR RADAR OR GPS SPEED SENSORS

See the following table for SPEED CAL numbers to enter for various radar models or GPS speed sensors. *To fine tune the SPEED CAL number, see Appendix B on page 43-44.*

Radar or GPS Speed Sensor Calibration

Radars	English Cal #	Metric Cal #	Hz/MPH
Vansco	.150	.38	58.90
Raven	.148	.38	59.80
Magnavox	.154	.39	57.40
Dickey-john (NOTE: Dickey-john radars may be factory calibrated for any of these four settings).	.149	.38	58.94
	.199	.51	44.21
	.319	.81	27.64
	.518	1.32	17.034
GPS Speed			
Astro 5	.189	.48	46.56
SkyTrak (Std)	.150	.38	58.94
SkyTrak (MT)	.910	2.31	9.82
Dickey-john	.210	.53	42.00
John Deere (In-cab speed signal)	.197	.50	44.70

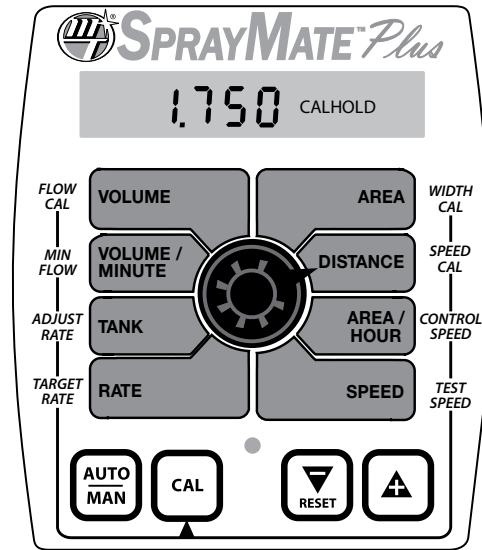
Drive Shaft Speed Sensor Calibration

NOTE: If you have mounted the magnetic speed sensor on a wheel, skip this step and go on to Fine Tuning Speed/Distance Calibration Values.

Because of the difference in wheel-to-drive shaft ratios, it is difficult to determine a calibration value for installation on a drive shaft by measuring a wheel. You must start with an estimated calibration value and then fine-tune the calibration.

Any number between 10 and 15 (255 mm to 380 mm) is a good starting value.

NOTE: For fine-tuning the SPEED CAL value, see Appendix B on pages 43-44.



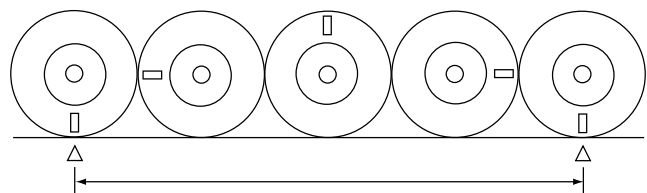
For the console to calculate the correct speed and measure distance accurately, the circumference of the sensor-equipped wheel must be entered. Determine the circumference of the sensor-mounted wheel to the nearest tenth of an inch (tenth of a centimeter) with the following method:

METHOD: Mark the tire with a piece of chalk and measure the distance traveled on the ground for one complete revolution. See Illustration 16. For improved accuracy, it is recommended that you perform this function in field conditions, measure several revolutions, and take the average.

Divide the measured revolution by the number of magnets installed to get your starting SPEED CAL calibration value. Once calibration of the system is complete, this number should be fine-tuned for optimum accuracy.

NOTE: For fine-tuning the SPEED CAL value, see Appendix B on pages 43-44.

Illustration 16

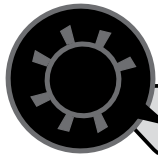


To determine SPEED CAL, measure the distance of one complete wheel revolution and divide by the number of magnets installed.

Calibration (cont)

Entering Calibration Values (cont)

CONTROL SPEED: Selecting AREA / HOUR allows the user to change the CONTROL RESPONSE. Pressing the + or - (RESET)



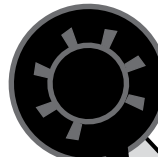
AREA /
HOUR

CONTROL
SPEED

will adjust the CONTROL RESPONSE from -12 to 3. It is normally set in the middle (-1) but if needed, it allows the user to

either decrease or increase the CONTROL RESPONSE for his particular system.

TEST SPEED: TEST SPEED is not a true CALIBRATE factor but rather a method of testing the sprayer. Typically it is used to confirm that AUTO control can be maintained across a range of expected ground speeds. The Test Speed can still be used even if the Console is locked. Test speed is a built-in ground speed simulator that is used in performing pre-field checks. When a typical operating speed is entered, the SprayMate Plus will respond as if you were actually driving that speed. It allows you to simulate your spraying application with water, while remaining stationary, to make certain that all of the equipment is operating properly and



SPEED

TEST
SPEED

that your sprayer can actually perform the intended application. Test speed is cancelled by exiting CAL. Test speed will not accumulate Distance or Area measurements.

EXITING CALIBRATION

Upon completion of the calibration process, exit calibration by pressing and holding the CAL button until the RED warning light turns off (approximately three seconds). Basic calibration is now complete. BEFORE beginning application, confirm that the system is set up to do the job that you want it to.

Please refer to Pre-Field System Checkout to confirm calibration settings, nozzle selection and overall system performance.

NOTE: YOU MUST EXIT CAL TO SAVE ANY CHANGES.

Factory-Loaded Calibration Values

Calibration Factor	Measurements Affected	Default Values	
		English	Metric
TARGET RATE	Application Rate in Auto	10.0 Gallons/Acre	100.0 liters/hectare
ADJUST RATE	Amount of increase or decrease per +/- press (in auto)	1.00 Gallons/Acre	10.0 liters/hectare
BOOMS 1-3 WIDTH	Area, Application Rate	240 inches	6.00 meters
SPEED CAL	Distance, Area, Application Rate, Area/Hour	1.750 inches	4.44 centimeters
MINIMUM FLOW	Application Rate, Lowest allowable flow rate	0.0 Gallons/Minute	0.0 liters/minute
FLOW CALIBRATION	Flow/Application Rates, Volume	145.0 pulses/gal	145 pulses/gallon
CONTROL SPEED	Application Rate	-1	-1

“Special” Calibration

Entering Calibration Values

NOTE: Since changing UNITS will load defaults, the UNITS should always be set (in Special Calibrate) before changing any other factors.

The “Special” Calibration mode is used to set up system parameters that rarely need to be changed or adjusted.

To prevent accidental changes to SPECIAL CALIBRATE settings, the user must turn the power on while holding the CAL switch to start SPECIAL CALIBRATE. The console will

display *SPEC* for 1.5 seconds after the CAL switch is released and then CAL icon and the Number 1 icon indicating the first page of SPECIAL CALIBRATE factors is being displayed. Each time the CAL switch is pressed it will step through pages 1, 2, 3 and 4 (Number icons indicate page) and back to 1.

To exit Special Calibration, press and hold the CAL button for 2 seconds. The console will store any changes and revert to normal operation.

NOTE: You must exit “Special” Calibration to save changes.

Special Cal Page 4	Special Cal Page 3	Special Cal Page 2	Special Cal Page 1
FTW	Manual Enable	Hold State	Tank Fill Level
Flow @ Min PW	Serial Protocol	Start Time	Tank Alarm Level
Min PW	Min Alarm Speed	Start % / Auto Shutoff	Start Speed Time
Valve Polarity	Alarm Enable	Auto Delay Time	Start Speed

Diagram of the SPRAYMATE Plus console showing the SPECIAL CALIBRATE mode. The display shows "SPEC". The rotary switch is in the "SPEED" position. A hand is pressing the "CAL" button. The console has buttons for VOLUME, AREA, DISTANCE, TANK, RATE, SPEED, AUTO MAN, CAL, RESET, and a warning LED.

Special Cal Page 1	Special Cal Page 2	Special Cal Page 3	Special Cal Page 4
Units	Set Year	Dual Boom Threshold	PWM Freq.
Material	Set Month	Multifunction Output	Flow @ Max PW
PWM or DC	Set Date	Flush Delay Time	Maximum PW
Vehicle Number	Set Time	Flush Time	Closed/ Open Loop

There are Four (4) pages of “SPECIAL” CALIBRATE factors (total of 25 for Standard drive, 31 for PWM drive), selected by the rotary switch as shown. Those in **BOLD** are for Standard DC Drive only and those in **BOLD ITALIC** are for PWM drive only and those in black are used in both. Unused factors can be left at the Factory Default setting. All are set to factory default values each time UNITS is changed.

If the Console is unlocked, the Warning LED will also turn on and any of the “SPECIAL” CALIBRATE Factors can be adjusted.

If the Console is locked, the Warning LED will not turn on and the “SPECIAL” CALIBRATE Factors can only be viewed and cannot be adjusted.

Page 1 will always be selected when “SPECIAL” CALIBRATE is first started.

The **BOLD** and **BOLD ITALIC** factors (Standard and PWM drive) can be located in the same position since they cannot be used at the same time.

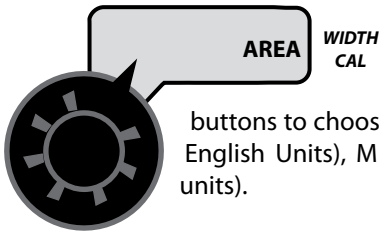
The display will show ----- when in an unused position.

The + or – (RESET) keys are used to adjust the “SPECIAL” CALIBRATE factors if the console is unlocked. The longer the key is pressed the faster the value will change.

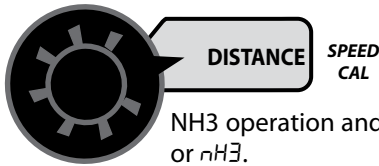
The “SPECIAL” CALIBRATE factors will be stored in when exiting (press CAL for 1 sec). They will not be saved when power is turned off, so if a user accidentally makes a change, turning the power off will abort any changes.

“Special” Calibration (cont) **Entering Calibration Values** (cont) Page One

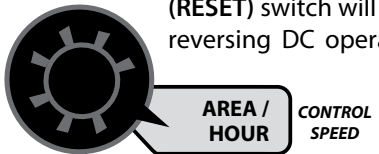
UNITS: Choose the system of units desired. Turf units are the same as English units except Area is in thousands of square feet. Use the “+” and “-” buttons to choose between EnG (American English Units), MEt (Metric) and TurF (Turf units).



MATERIAL: Selecting DISTANCE allows the user to change the Material. Pressing the + or - (RESET) switch will toggle between Liquid and NH3 operation and the display will show H₂O or nH₃.

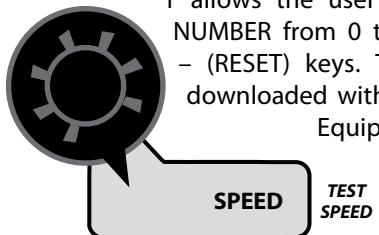


PWM OR DC: Selecting AREA/HOUR allows the user to change the valve drive method. Pressing the + or - (RESET) switch will toggle between PWM and reversing DC operation and the display will show PULSE or Std.

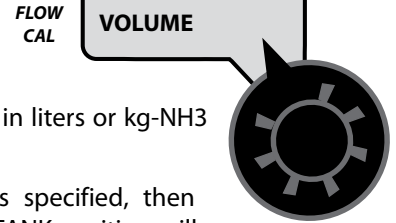


The SprayMate Plus supports both Standard ±DC and Pulse Width Modulated (PWM) control. “SPECIAL” CALIBRATE will change based on the DRIVE TYPE selected so only factors that apply will be available. Factors which are common to the two drives will be located in the same rotary selector position regardless of the DRIVE TYPE setting. The positions used for values unique to a particular DRIVE TYPE will be shared.

VEHICLE NUMBER: Selecting the SPEED position on page 1 allows the user to change the VEHICLE NUMBER from 0 to 255 by using the + or - (RESET) keys. The VEHICLE NUMBER is downloaded with the Totals Data List and Equipment List.

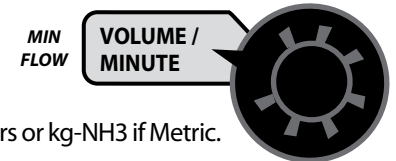


FILL TANK LEVEL: Selecting VOLUME on page 1 allows the user to enter a TANK FILL LEVEL which can be toggled to OFF or 1 to 65535, using the + or - (RESET) keys. The TANK FILL LEVEL is in Gallons or pounds-NH₃ if English or Turf or in liters or kg-NH₃ if Metric.



If a TANK FILL LEVEL is specified, then pressing + while in the TANK position will set the Tank level value to TANK FILL LEVEL for quick reloading. If desired, the value can be decreased from there but it cannot be increased above TANK FILL LEVEL. If no TANK FILL LEVEL is specified, then the + or - (RESET) keys can be used to adjust Tank Level to any value from 0 to 65535.

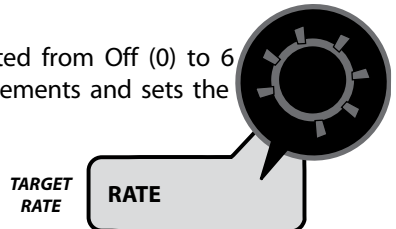
TANK ALARM LEVEL: Selecting VOLUME / MINUTE on page 1 allows a TANK ALARM LEVEL to be entered. This can be set to OFF or 1 to 65535 using the + or - (RESET) switch. The TANK ALARM LEVEL is in Gallons or pounds-NH₃ if English or Turf or liters or kg-NH₃ if Metric.



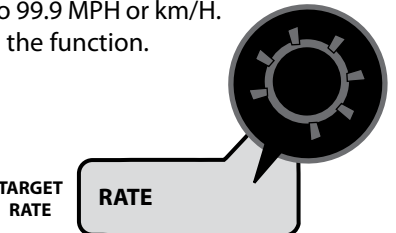
When ‘Off’ no alarm will be given as the Tank is emptied. If set, the Warn LED will flash and the audible alarm will sound (if enabled) and the display will alternate between FILL and normal, when the Tank volume reaches or falls below the TANK ALARM SET POINT. The audible alarm can be temporarily disabled (snooze) by the user, see AREA / HOUR.

START SPEED TIME: Selecting the TANK position on page 1 displays and allows the user to adjust the START SPEED TIME.

This factor can be adjusted from Off (0) to 6 seconds in 1 second increments and sets the time after a HOLD to RUN transition that the Start Speed setting is active before real speed calculation begins. Setting to Off will disable the function.



START SPEED: Selecting the RATE position on page 1 displays and allows the user to set the START SPEED. This can be adjusted from Off (0) to 99.9 MPH or km/H. Setting to Off will disable the function.

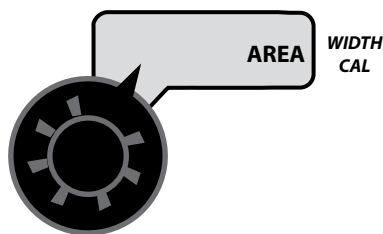


“Special” Calibration (cont)

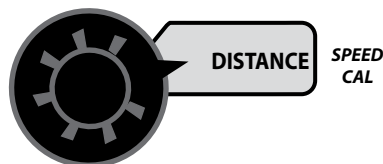
Entering Calibration Values (cont)

Page Two

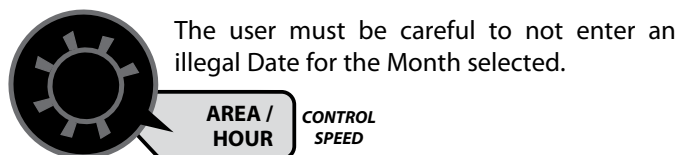
SET YEAR: Selecting the AREA position on page 2 allows the YEAR to be set from 07 to 99 for 2007 to 2099 by using the + or – (RESET) keys.



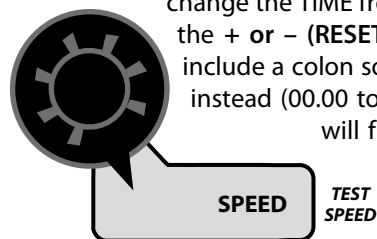
SET MONTH: Selecting the DISTANCE position on Page 2 allows the MONTH to be set from 01 to 12 (Jan to Dec) by using the + or – (RESET) keys.



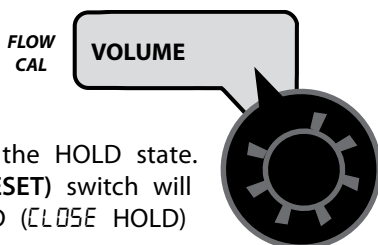
SET DATE: Selecting AREA / HOUR on Page 2 allows the DATE to be set from 01 to 31 by using the + or – (RESET) keys.



SET TIME: Selecting SPEED on Page 2 allows the user to change the TIME from 00:00 to 23:59 by using the + or – (RESET) keys. The LCD does not include a colon so the decimal point is used instead (00.00 to 23.59). The decimal point will flash at a 1 Hz rate (0.5 sec on and off).

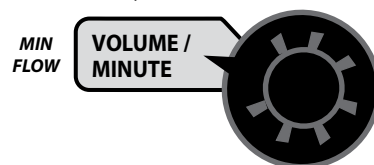


HOLD INPUT STATE: Selecting VOLUME on page 2 allows the user to change the input state which represents the HOLD state. Pressing the + or – (RESET) switch will toggle between CLOSED (CLOSE HOLD) and (OPEN HOLD).



Selecting the Closed setting will place the SprayMate™ Plus into HOLD if the input is low (switch/sensor closed to ground) or selecting the Open setting will place the SprayMate™ Plus into HOLD if the input is high (input open or pulled high).

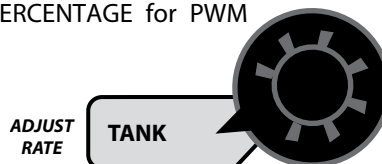
START TIME (QUICK START): Selecting VOLUME/MINUTE on page 2 allows the user to change the START TIME for the control valve in Standard drive systems and is used in conjunction with START PERCENTAGE for PWM control output. Both are used to provide a “Quick Start” capability.



On some Standard DC drive and all PWM systems, the control valve is used to completely stop the hydraulic flow when HOLD is selected, all non-zero width sections are off or if ground speed is 0 in AUTO (Automatic Section Off feature). In those systems there may be an undesirable delay for the Servo or PWM valve (which may “stick” off) to return to normal operating flow again. The START TIME cal factor can be used to reduce this delay and help make the system reach the target application rate sooner, when it is in AUTO control (similar to START PERCENTAGE in PWM Drive systems).

START% (PWM Drive ONLY): If DRIVE TYPE is set to PWM, selecting the TANK position on page 2 allows the user to change the START PERCENTAGE for PWM drive systems only.

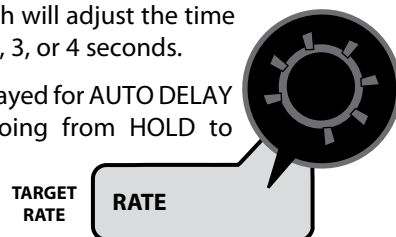
On PWM systems, the output is used to completely stop the flow when HOLD is selected, all non-zero width sections are off or if ground speed is 0 in AUTO. In those systems there may be an undesirable delay for the flow to start again and return to normal operation again. The START PERCENTAGE factor can be used to reduce this delay and help make the system reach the target application rate sooner, when it is in AUTO control (similar to Quick Start in Standard Drive).



AUTO SHUTOFF (Std Drive ONLY): If DRIVE TYPE is set to standard DC, selecting the TANK position on page 2 allows the user to turn the AUTO SHUT OFF feature On or Off by using the + or – (RESET) keys and the display will show $\square n$ or $\square FF$.

AUTO DELAY TIME: Selecting the RATE position on page 2 allows the user to change the AUTO DELAY TIME. Pressing the + or – (RESET) switch will adjust the time from 0 (no delay) to 1, 2, 3, or 4 seconds.

Automatic control is delayed for AUTO DELAY TIME seconds when going from HOLD to RUN or from all non-zero width sections off to one or more section on. This provides time for motorized valves to operate and allows the flow to stabilize before AUTO control begins. The Auto Delay function operates in both Standard Drive and both Open Loop and Closed Loop PWM Drive.



“Special” Calibration (cont)

Entering Calibration Values (cont)

Page Three

DUAL BOOM THRESHOLD: If the multifunction output function is set to Dual, selecting the AREA position on page 3 allows the user to enter the desired THRESHOLD. As described below, the units of THRESHOLD change depending on which Dual Boom function is selected *dUALF* (Flow based) or *dUALS* (Speed based).

FLOW BASED THRESHOLD: When *dUALF* (Flow based) is selected then the threshold is the Volume / Minute (10th's of liter, gallons, lbs or kg) where the multifunction output should turn on if the total applicator width is active. The threshold is adjusted proportionally during operation for the actual active width.

The output will turn off when the total Volume / Minute is reduced to 95 % of the THRESHOLD. This fixed margin is maintained to reduce on/off cycling if the system is operating at or near the THRESHOLD setting.

For example, if the system consists of 3 sections of equal width and THRESHOLD is set for 15.0 GPM, if all sections are on, the multifunction output will turn on when total Volume / Minute is 15.0 GPM and greater and turn off if the Volume / Minute is reduced to 14.25 GPM.

If 1 of the 3 sections is turned off (2/3's of total width active), the multifunction output will turn on when total Volume / Minute is 10.0 GPM or greater (2/3's of the THRESHOLD setting) and turn off when the Volume / Minute is reduced to 9.5 GPM (95 % of 10.0 GPM).

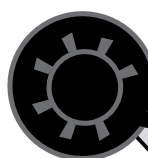
If 2 of the 3 equal sections are turned off (1/3 of total width active), the multifunction output will turn on when total Volume / Minute is 5.0 GPM or greater (1/3 of the THRESHOLD setting) and turn off when the Volume / Minute is reduced to 4.75 GPM (95 % of 5.0 GPM).

Speed Based Threshold : When *dUALS* (Speed based) is selected then THRESHOLD is the Speed (10th's of mph or kph) where the multifunction output should turn on.

The output will turn off when the “Current Velocity” is reduced to 95 % of the THRESHOLD. This fixed margin is maintained to reduce on/off cycling if the system is operating at or near the THRESHOLD setting.

MULTIFUNCTION OUTPUT: Selecting **DISTANCE** on page 3 allows the user to enter the desired **OUTPUT FUNCTION**. The setting can be cycled through 7 positions: *OFF* (always off), *ON* (always on), *ON HOLD* (On in Hold), *OFF HOLD* (Off in Hold), *FLUSH* and *dUAL* (Flow based) and *dUALS* (Speed based). See Dual Boom Threshold, Flush Delay Time and Flush Time for more details.

FLUSH DELAY TIME: If the multifunction output is set to flush, selecting the AREA/HOUR position on page 3 displays and allows the user to set the FLUSH DELAY TIME.

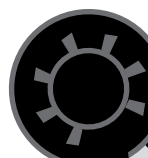


AREA /
HOUR

CONTROL
SPEED

This factor can be adjusted from OFF to 6 seconds in 1 second increments and sets the delay between a RUN to HOLD transition and the start of the Flush timer. This delay is optional and if set to Off, the Flush output will become active immediately.

FLUSH TIME: If the multifunction output is set to flush, selecting the SPEED position on page 3 displays and allows the user to set the FLUSH TIME.



SPEED

TEST
SPEED

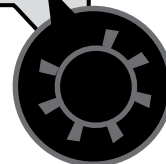
This factor can be adjusted from OFF (0) to 12 seconds in 1 second increments and is the flush time (output in the active state).

MANUAL CONTROL ENABLE: Selecting the VOLUME position on page 3 displays and allows the user to turn the MANUAL CONTROL ENABLE On or Off by using the + or - (RESET) keys and the display will show *ON* or *OFF*.

FLOW
CAL

VOLUME

Setting MANUAL CONTROL ENABLE to Off disables Manual control. Pressing the AUTO|MAN switch will be ignored and the console will only operate in AUTO.



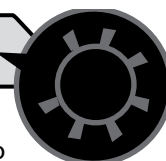
Setting MANUAL CONTROL ENABLE to On enables Manual control. Pressing the AUTO|MAN switch will cause the console to switch between AUTO and MANUAL control.

VRA PROTOCOL:

Selecting Volume/Minute on Page 3 will display the 'VRA Protocol' which can be set to *Micro* (Micro Trak) or *Raven* (Raven 660).

MIN
FLOW

VOLUME /
MINUTE



The SprayMate Plus will always simulate the Raven Model 660 so it always uses the Raven 660 ID string of “\$R126C”.

“Special” Calibration (cont)

Entering Calibration Values (cont)

Page Three (cont)

MINIMUM ALARM SPEED: Selecting the TANK position on page 3 displays and allows adjustment of the MINIMUM ALARM SPEED. Pressing the + or – (RESET) key will adjust the MINIMUM ALARM SPEED from $\overline{0}FF$ or 0.1 to 99.9 mph or kph.

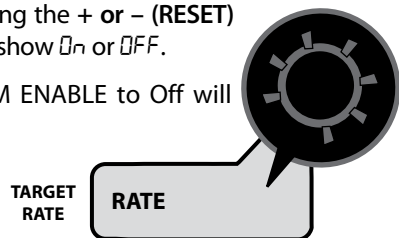
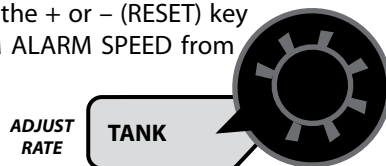
When the ground speed is below the

MINIMUM ALARM SPEED then an Application Rate error will not generate an Audible Alarm. The Tank Level alarm is not disabled, and below Minimum Flow does not generate an audible alarm.

Setting the MINIMUM ALARM SPEED to $\overline{0}FF$ will disable the function and allow warnings and errors at any speed.

AUDIBLE ALARM ENABLE: Selecting the RATE position on page 3 displays and allows the user to turn the AUDIBLE ALARM ENABLE On or Off by using the + or – (RESET) keys and the display will show $\overline{0}n$ or $\overline{0}FF$.

Setting AUDIBLE ALARM ENABLE to Off will disable all audible Alarms under all conditions except the short alert at the completion of a Pause/Flush cycle.

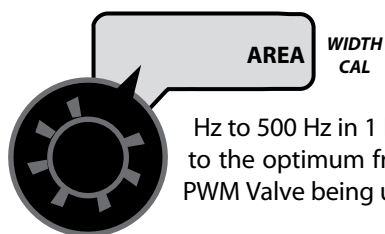


“Special” Calibration (cont)

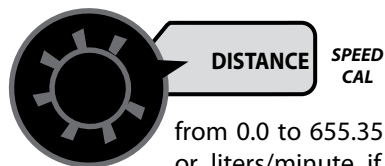
Entering Calibration Values (cont)

Page Four

PWM FREQUENCY: If DRIVE TYPE is set to PWM, selecting the AREA position on page 4 will display the PWM FREQUENCY. It can be adjusted from 50 Hz to 500 Hz in 1 Hz steps and should be set to the optimum frequency for the particular PWM Valve being used. **PWM Drive ONLY.**

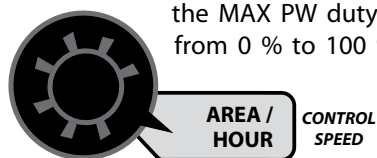


FLOW @ MAX PWM: If DRIVE TYPE is set to PWM, selecting the DISTANCE position on page 4 will display and allow adjustment of the FLOW @ MAX PW from 0.0 to 655.35 Gallons/minute if English or liters/minute if Metric UNITS. The PWM Valve can only be mounted Inline so FLOW @ MAX PW must be larger than FLOW @ MIN PW or auto control will fail. If in AUTO and FLOW @ MAX PW is equal or less than FLOW @ MIN PW then it will display *Error*.



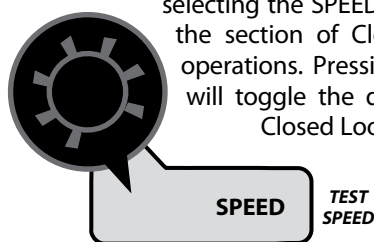
FLOW @ MAX PW is the Volume/Minute applied when the PWM control valve is operating at MAX PW duty cycle independent of the number of sections turned on (due to positive displacement pump). A typical value is 30.00 gpm but it could be 10.00 to 200.00 gpm. FLOW @ MAX PW must include all nozzles on the sprayer. **PWM Drive ONLY.**

MAXIMUM PULSE WIDTH: If DRIVE TYPE is set to PWM, selecting the AREA / HOUR position on page 4 will display the MAX PW duty cycle. It can be adjusted from 0 % to 100 % in 1% steps. The PWM duty cycle will remain at or below this limit in both MANUAL and AUTO operation, when in RUN. For proper operation it must be set to some value greater than the MIN PW duty cycle.



Typically the PWM Open Loop control is used on single Section applicators. In that case the Maximum PWM setting can be used to ensure the hydraulic flow never exceeds a maximum amount. This could be used to make sure a hydraulic motor never exceeds a maximum RPM or application pressure does not exceed the maximum rating for the nozzles being used. It can also be used to optimize operation with a particular PWM Valve and set of nozzles. For example if the maximum flow rate or pressure occurs when the PWM duty cycle output is 85 % then MAX PW should be set to 85 %. It is up to the installer to determine if the setup is appropriate.

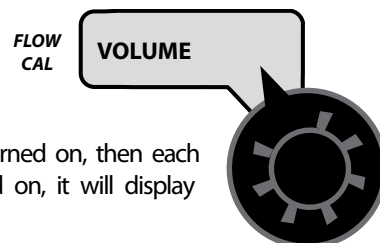
CLOSED/OPEN LOOP: If DRIVE TYPE is set to PWM, selecting the SPEED position on page 4 allows the section of Closed Loop or Open Loop operations. Pressing the + or – (RESET) key will toggle the display between *CLOSE* for Closed Loop and *OPEN* for Open Loop.



Closed Loop operation uses feedback from a flow meter or motor RPM sensor and FLOW CAL to calculate and adjust the application rate based on ground speed.

Open Loop (or CLOSED LOOP OVERRIDE) operation uses an estimated flow rate (FLOW @ MIN PW, FLOW @ MAX PW) based on the PWM duty cycle (MIN PW, MAX PW) to adjust the application rate based on ground speed. **PWM Drive ONLY.**

FTW MODE: Selecting Volume on Page 4 will display the “FTW mode” which can be *OFF* or *3 WAY*. If FTW mode is turned on, then each time the console is turned on, it will display *3 WAY* (as a reminder).



EXAMPLE - FTW FOR LIQUID PRODUCT APPLICATION: When FTW is on, it uses 3-Way valves (1 Input 2 Outputs) to provide extra agitation to the Tank and help ensure the flow rate does not drop too low for the flowmeter. With 3-Way Valves, when a Section is turned off, the Total Flow does not change. Instead the flow is redirected back to the Tank (agitation). It is assumed the Section Return line contains a nozzle that exactly duplicates the Section. If a manual valve is used in the return line (instead of a nozzle) then some error will be introduced because the manual valve will only duplicate the Section flow at one pressure.

EXAMPLE - FTW FOR SEED PLANTING: If SprayMate Plus is used to drive a Planter, when a section is shut off the seed rate should not change. For sections still on the seed meter needs to run at the same RPM to maintain the same seed population rate. For example, the Target Seed Meter rpm for a 12 row planter set on 30 inch centers running 5 mph might be 30 rpm and if 4 of the row units were turned off the Target Seed Meter rpm would still be 30 rpm but the Volume (Seeds) and Area would only accumulate for the row units remaining on. The Volume per Minute (Seeds per Minute) would also reflect a value that represents only the remaining row units that are on.

“Special” Calibration (cont)

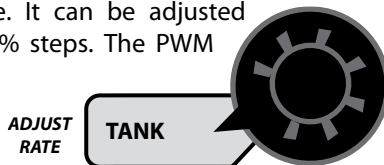
Entering Calibration Values (cont)

Page Four (cont)

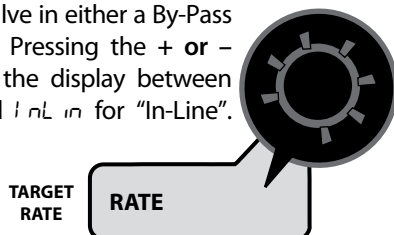
FLOW @ MINIMUM PULSE WIDTH: If DRIVE TYPE is set to PWM, selecting the VOLUME/MINUTE position on page 4 will display and allow adjustment of the FLOW @ MIN PW from 0.0 to 655.35 Gallons/minute if English or liters/minute if Metric UNITS. The PWM Valve can only be mounted in-line so FLOW @ MIN PW must be smaller than FLOW @ MAX PW or auto control will fail. If in AUTO and FLOW @ MIN PW is equal or greater than FLOW @ MAX PW then it will display Error. **PWM Drive ONLY.**



MINIMUM PULSE WIDTH: If DRIVE TYPE is set to PWM, selecting the AREA / HOUR position on page 4 will display the MAX PW duty cycle. It can be adjusted from 0 % to 100 % in 1% steps. The PWM duty cycle will remain at or below this limit in both MANUAL and AUTO operation, when in RUN. For proper operation it must be set to some value greater than the MIN PW duty cycle. **PWM Drive ONLY.**



VALVE POLARITY: If DRIVE TYPE is set to standard DC, selecting the RATE position on page 4 allows the operator to install the flow control valve in either a By-Pass or In-Line configuration. Pressing the + or - (RESET) key will toggle the display between *byPASS* for “By-Pass” and *inLine* for “In-Line”. **Std Drive ONLY.**



To exit Special Calibration, press and hold the CAL button for 1 second. The console will store any changes and revert to normal operation.

NOTE: You must exit Special Calibration to save changes.

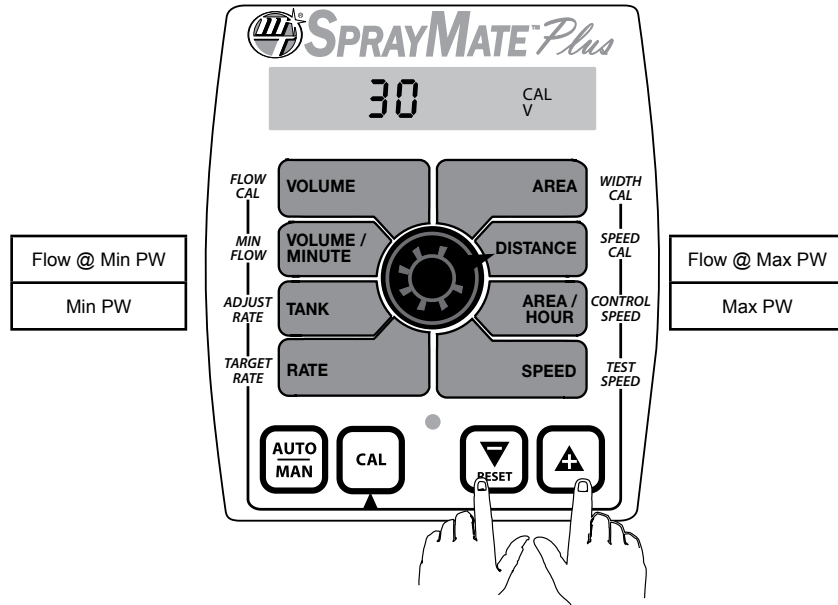
Pulse Width Modulation (PWM) Live Calibrate

LIVE CALIBRATE is only used in PWM Drive. See "SPECIAL" CALIBRATE for information on setting the output to PWM and selecting Open or Closed Loop operation.

If the user already knows the FLOW @ MIN PW, MIN PW, FLOW @ MAX PW and MAX PW factors, they can be entered directly in "SPECIAL CALIBRATE". However if those factors are unknown then the interactive LIVE CALIBRATE is used to determine the correct value for each.

In **Closed Loop**, LIVE CALIBRATE allows the user to adjust the Min or Max PW factor and then immediately see how that affects the Flow at Min or Max PW, without the need to repeatedly enter and exit "SPECIAL" CALIBRATE.

In **Open Loop**, a flowmeter is not available to measure the flow so LIVE CALIBRATE provides a convenient 30 second timer and automatic section shut off to make it easier to capture the flow in a calibrated container to manually determine the flow.



THE FOLLOWING APPLIES TO BOTH CLOSED AND OPEN LOOP OPERATION.

If DRIVE TYPE is set to PWM and the console is unlocked and in HOLD (or all non-zero width sections Off) and no ground speed is present and not in CALIBRATE, "SPECIAL" CALIBRATE or UNLOAD, then holding the + and - (RESET) keys for 1 second will enter LIVE CALIBRATE and the V and CAL icons and the Warning LED will turn on and the Counter/Boom icons are always off.

Once LIVE CALIBRATE is started, it will remain in LIVE CALIBRATE regardless of Boom, Speed or HOLD status.

LIVE CALIBRATE is exited and the factors saved by holding the + and - (RESET) keys for 1 second regardless of section, Speed, Lock or HOLD status.

Factors will not be saved if power is lost or during a brown out, so unwanted changes can be discarded by removing power.

The display will show ---- when in an unused position (see figure above) but the V and CAL icons will remain on.

PWM output drive will be set to Minimum PWM duty cycle when in the two "min" (left) positions and will be set to Maximum PWM when in the two "max" (right) positions (see illustration above).

When in one of the four USED positions, momentarily pressing the CAL switch will toggle the Pump on and off (at the selected min or MAX PW rate). The Section Output Enable will always remain on so the Section Switches are active and can be read.

The pump is always turned off, in all UNUSED positions, or if all non-zero width sections are turned off. If all sections are turned off, then the pump will turn off but it will turn back on as soon as a section is turned on. However, if an unused position is selected then the pump is "toggled off" (as if the CAL switch was used) and it will stay off even when a used position is selected. Normally all nonzero width sections should be turned on but the user may be setting up for special conditions where only some of the sections will be used. Turning all sections off can be used as an emergency off, as well as toggling the pump off with the CAL switch.

Whenever FLOW @ MIN PW or FLOW @ MAX PW is being displayed it will always be displayed with two decimal places (no auto decimal shift) so the operator can see all digits of the value that will be stored, just like using "SPECIAL" CALIBRATE (0.01 to 655.35).

NOTE: The following pages give details on the operation and adjustments when in Closed or Open Loop Operations.

Pulse Width Modulation (PWM)

Live Calibrate

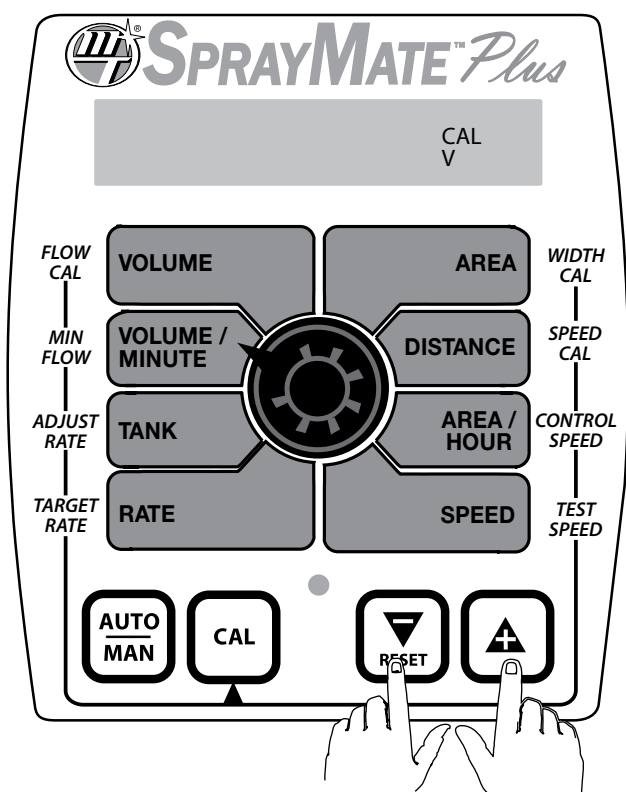
Closed Loop Operation

In Closed Loop operation, a flowmeter is available to measure the flow so all four calibrate factors can be programmed interactively using the following procedure.

NOTE: LIVE CALIBRATE is only used in PWM Drive. If the Console does not display "PULSE" during power up, this procedure does not apply.

1. Park the applicator in a safe location and configure the section as required for application.
2. Make sure all section have the correct nozzles installed.
3. Fill applicator with water. **NOTE:** All counters including Volume and Tank will not count (change) during this procedure.
4. Remain parked, unlock the console, place it in Hold (or turn all sections off) and hold the "+" and "-" (Reset) switch for 1 second. *See Illustration 12.* This will start **LIVE CALIBRATE** and the V and CAL icons and the Warning LED will turn on. The pump will remain off until the **CAL** key is pressed. *See Illustration 13.*
5. Turn all section switches that will be used on. The Remote Hold is ignored during this procedure so it can be left in either Run or Hold position.

Illustration 12

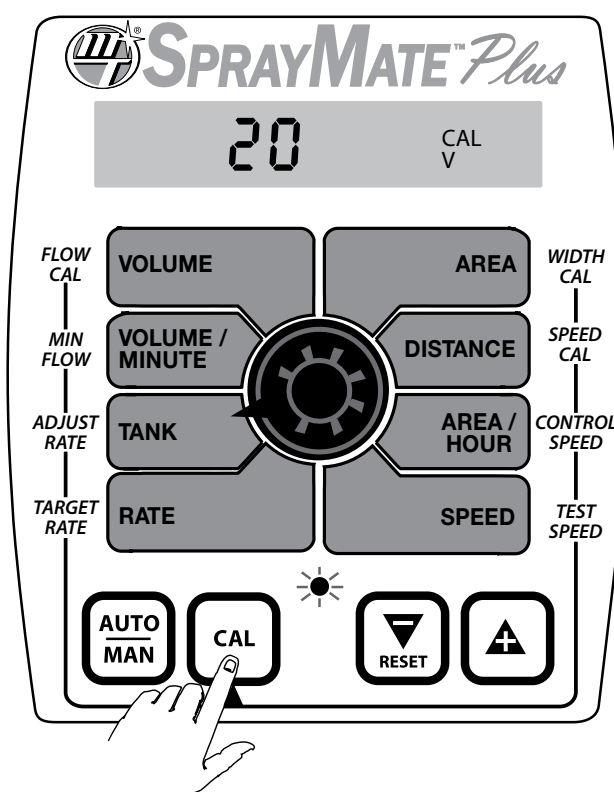


MINIMUM SETTINGS

Skip Steps 6 through 9 if the Minimum settings are already correct.

6. Select the FLOW @ MIN PW (VOLUME/MINUTE) or the MIN PW (TANK) rotary position.
7. Press the **CAL** switch and the pump will begin to run at the default or last set MIN PW rate. FLOW @ MIN PW (VOLUME/MINUTE) position will display the measured flow in Gallons/Minute and MIN PW (TANK) position will show the PWM duty cycle (0 to 100%). This allows the PWM output to be adjusted while observing the change in flow rate. To stop spraying simply press the CAL switch again (but it will continue to display the last used FLOW @ MIN PW or MIN PW).
8. While running, press the + or - (RESET) keys to adjust the pump speed until the desired minimum flow rate, or minimum pressure, or minimum RPM, or minimum PWM duty cycle is reached. The user may want to adjust the rate until it matches the minimum flow for the nozzles installed (minimum pressure) or he may want to adjust it until it reaches the lower limit of the Hydraulic drive. During this adjustment the pump can be toggled on and off as desired using the **CAL** switch and the rotary can be changed between FLOW@MIN PW (VOLUME/MINUTE) or the MIN PW (TANK) as desired. The + or - (RESET) keys have no affect when the pump is turned off (via CAL switch or section switches) so neither Cal factor can be changed without the other being updated. This keeps MIN PW and FLOW@MIN PW in sync with each other during LIVE CALIBRATE. To make adjustments to just one factor without affecting the other, then "SPECIAL" CALIBRATE should be used, instead of LIVE CALIBRATE.
9. When satisfied with the minimum flow rate and minimum PWM then press the **CAL** switch to toggle the pump off. If desired, the FLOW @ MIN PW and MIN PW can be written down for future reference (later, they will be stored in E2PROM automatically).

Illustration 13



Pulse Width Modulation (PWM) Live Calibrate (cont)

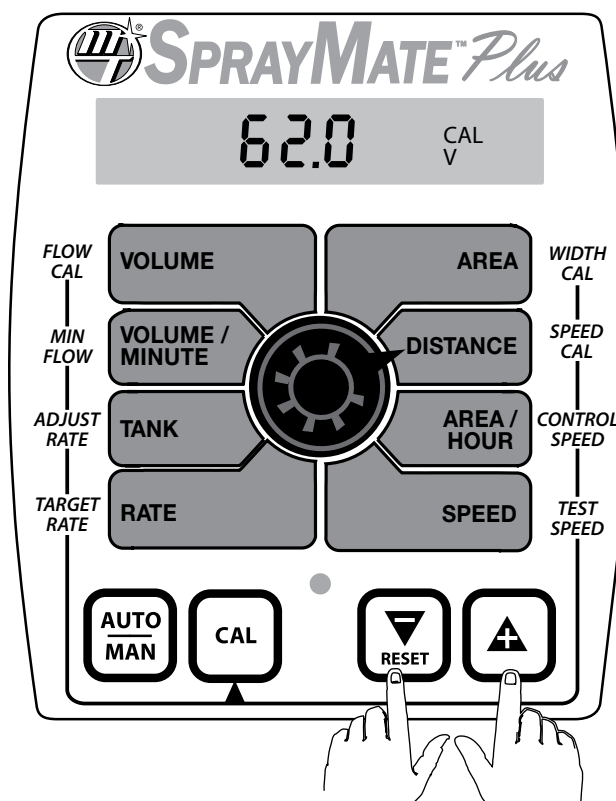
Closed Loop Operation (cont)

MAXIMUM SETTINGS

NOTE: Skip Steps 11 through 14 if the Maximum settings are already correct.

10. Change the rotary to FLOW @ MAX PW (DISTANCE) or the MAX PW (AREA/HOUR) position.
11. Press the **CAL** switch and the pump will begin to run at the default or last set MAX PW rate. FLOW @ MAX PW (DISTANCE) position will display the measured flow in Gallons/Minute and MAX PW (AREA/HOUR) position will show the PWM duty cycle (0 to 100%). This allows the PWM output to be adjusted while observing the change in flow rate. To stop spraying simply press the CAL switch again (but it will continue to display the last used FLOW @ MAX PW or MAX PW).
12. While running, press the + or – (RESET) keys to adjust the pump speed until the desired maximum flow rate, or maximum pressure, or maximum RPM, or maximum PWM duty cycle is reached. The user may want to adjust the rate until it matches the maximum flow for the nozzles installed (maximum pressure) or he may want to adjust it until it reaches the upper limit of the Hydraulic drive. During this adjustment the pump can be toggled on and off as desired using the CAL switch and the rotary can be changed between FLOW @ MAX PW (DISTANCE) or the MAX PW (AREA/HOUR) as desired. The + or – (RESET) keys have no affect when the pump is turned off (via CAL switch or section switches) so neither Cal factor can be changed without the other being updated. This keeps MAX PW and FLOW @ MAX PW in sync with each other during LIVE CALIBRATE. To make adjustments to just one cal factor without affecting the other, then the “SPECIAL” CALIBRATE should be used, instead of LIVE CALIBRATE.
13. When satisfied with the maximum flow rate and maximum PWM then press the **CAL** switch to toggle the pump off. If desired, the FLOW @ MAX PW and MAX PW can be written down for future reference (later, they will be stored automatically).

Illustration 14



STORE SETTINGS

14. If desired, the Minimum settings can be changed again by repeating steps 7 to 10 or the maximum settings can be changed by repeating steps 11 to 14. When satisfied with all four factors, press the + and – (RESET) key for 1 second to exit LIVE CALIBRATE and store all four factors. To abort any changes to the factors simply turn the power off.

NOTE: It is recommended (see Step 10 and 14), but not required, to turn the Pump off before switching between minimum and maximum factors. When an unused position is selected (displays dashes) the Pump will turn off automatically and when a minimum or maximum factor is selected again the pump can be toggled on again. Data collected while in a minimum or maximum position will be retained (even when a new position is selected), but it will not be stored until the user exits LIVE CALIBRATE.

Pulse Width Modulation (PWM)

Live Calibrate

Open Loop Operation

In Open Loop operation, a flowmeter is not available to measure the flow so a calibrated container must be used to measure the actual flow using the following procedure.

1. Park the applicator in a safe location and configure the sections as required for application.
2. Make sure all sections have the correct nozzles installed.
3. Fill applicator with water. NOTE: all counters including Volume and Tank will not count (change) during this procedure.
4. Remain parked, unlock the console, place it in Hold (or turn all Booms off), and hold the + and – (RESET) keys for 1 second. This will start LIVE CALIBRATE and the V and CAL icons and the Warning LED will turn on. The pump will remain off until the CAL switch is pressed.
5. Turn all section switches on (or the section switches that will be used). The Hold input is ignored during this procedure so it can be left in either Run or Hold position.

Illustration 15

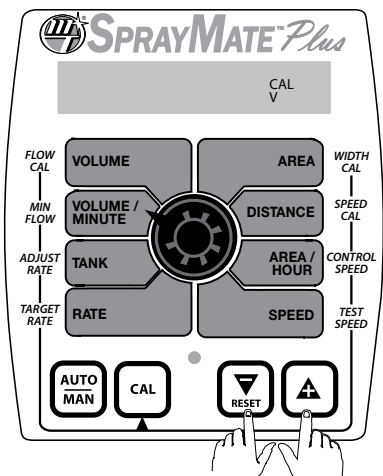
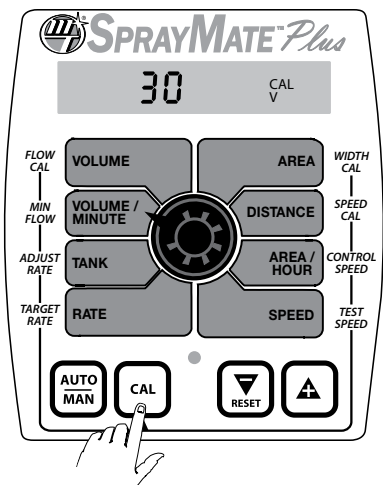


Illustration 16



MINIMUM SETTINGS

NOTE: Skip Steps 7 through 15 if the Minimum settings are already correct.

6. Select the MIN PW (Tank Level) rotary position. The FLOW @ MIN PW (Volume/Minute) position cannot be used because no flowmeter is available to measure the flow.
 7. Press the CAL switch and the pump will begin to run at the default or last set MIN PW rate and it will display MIN PW (0 to 100%). To stop spraying simply press the CAL switch again (but it will continue to display the MIN PW).
 8. While running, press the + or – (RESET) keys to adjust the pump speed until the desired minimum pressure (using an external Pressure Gauge), or minimum RPM (using an external RPM Indicator), or minimum PWM duty cycle (displayed on console) is reached. The user may want to adjust the rate until it matches the minimum flow for the nozzles installed (minimum pressure) or he may want to adjust it until it reaches the lower limit of the Hydraulic drive. During this adjustment the pump can be toggled on and off as desired using the CAL switch but the rotary should not be changed to the FLOW @ MIN PW (VOLUME/MINUTE) position because that starts a 30 second Timer. If the FLOW @ MIN PW (VOLUME/MINUTE) position is accidentally selected then returning to the MIN PW (TANK LEVEL) position will reset the Timer. The + or – (RESET) keys will still change MIN PW even with the pump turned off.
 9. When satisfied that MIN PW has been set correctly then press the CAL switch to toggle the pump off. If desired, the MIN PW can be written down for future reference (later, it will be stored automatically).
 10. Place a calibrated container under one of the nozzles, or for maximum accuracy, capture all the flow from all the nozzles.
 11. Select the FLOW @ MIN PW (VOLUME/MINUTE) position. This will enable a 30 second Timer when the pump is started, and it will display 30.
 12. Press the CAL switch and the pump will begin to run at the previously set MIN PW rate and the display will show a 30 second timer that counts down. When it reaches zero it will automatically stop the pump and begin to display FLOW @ MIN PW. The 30 second run can be aborted by pressing the CAL switch or by changing the rotary to the MIN PW (TANK LEVEL) position or an unused position. This will reset the 30 second timer so it can be started over, after emptying the calibrated containers.
 13. Use volume collected in the calibrated container to compute FLOW @ MIN PW as follows * If the flow from all nozzles was collected then convert it to gallons (or liters). * If the flow from a single nozzle was collected then multiply it times the number of nozzles and convert it to gallons (or liters).
- NOTE:** * Compute FLOW @ MIN PW = Gallons/0.5 or Liters /0.5.
14. Use the + or – (RESET) keys to adjust the FLOW @ MIN PW to the value computed above. Be sure to complete this step before changing the rotary position since any changes will reset the 30 second timer and prevent changes to FLOW @ MIN PW.

Pulse Width Modulation (PWM) Live Calibrate (cont)

Open Loop Operation (cont)

MAXIMUM SETTINGS

NOTE: Skip Steps 16 through 24 if the Maximum settings are already correct.

15. Select the MAX PW (AREA/HOUR) rotary position. The FLOW @ MAX PW (DISTANCE) position cannot be used because no flowmeter is available to measure the flow.
16. Press the **CAL** switch and the pump will begin to run at the default or last used MAX PW rate and it will display MAX PW (0 to 100 %). To stop spraying simply press the **CAL** switch again (but it will continue to display the MAX PW).
17. While running, press the + or – (**RESET**) keys to adjust the pump speed until the desired maximum pressure (using an external Pressure Gauge), or maximum RPM (using an external RPM Indicator), or maximum PWM duty cycle (displayed on console) is reached. The user may want to adjust the rate until it matches the maximum flow for the nozzles installed (maximum pressure) or he may want to adjust it until it reaches the upper limit of the Hydraulic drive. During this adjustment the pump can be toggled on and off as desired using the **CAL** switch but the rotary should not be changed to the FLOW @ MAX PW (DISTANCE) position because that starts a 30 second Timer. If the FLOW @ MAX PW (DISTANCE) position is accidentally selected then returning to the MAX PW (AREA/HOUR) position will reset the Timer. The + or – (**RESET**) keys will still change MAX PW even with the pump turned off.
18. When satisfied that MAX PW has been set correctly, press the CAL switch to toggle the pump off. If desired, the MAX PW can be written down for future reference (later, it will be stored automatically).
19. Place a calibrated container under one of the nozzles, or for maximum accuracy, capture all the flow from all the nozzles.
20. Select the FLOW @ MAX PW (DISTANCE) position. This will enable a 30 second Timer when the pump is started, and it will display 30.
21. Press the **CAL** switch and the pump will begin to run at the default or last set MAX PW rate and the display will show a 30 second timer that counts down. When it reaches zero it will automatically stop the pump and begin to display FLOW @ MAX PW. The 30 second run can be aborted by pressing the **CAL** switch or by changing the rotary to the MAX PW (AREA/HOUR) position or an unused position. This will reset the 30 second timer so it can be started over, after emptying the calibrated containers.
22. Use volume collected in the calibrated container to compute FLOW @ MAX PW as follows * If the flow from all nozzles was collected then convert it to gallons (or liters). * If the flow from a single nozzle was collected then multiply it times the number of nozzles and convert it to gallons (or liters).

NOTE: * Compute FLOW @ MAX PW = Gallons/0.5 or Liters /0.5.

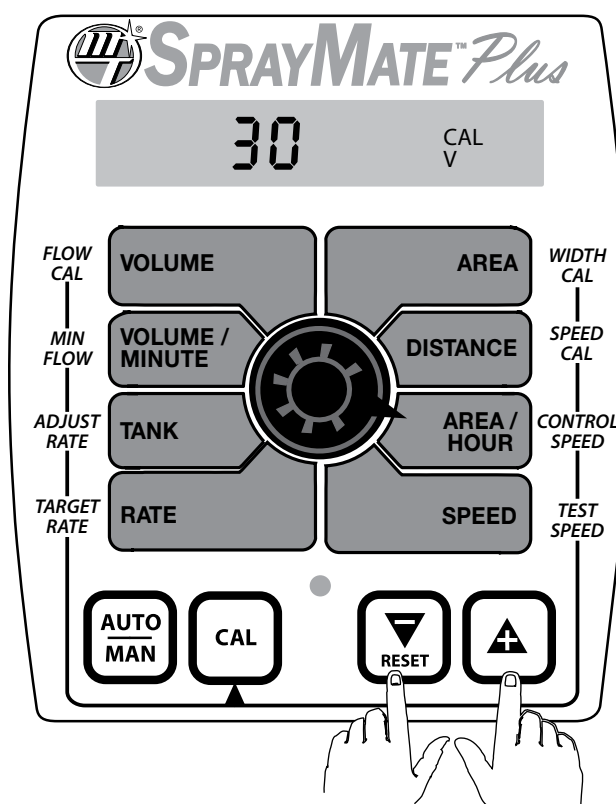
23. Use the + or – (**RESET**) keys to adjust the FLOW @ MAX PW to the value computed above. Be sure to complete this step before changing the rotary position since any changes will reset the 30 second timer and prevent changes to FLOW @ MAX PW.

STORE SETTINGS

24. If desired, the Minimum settings can be changed again by repeating steps 7 to 15 or the maximum settings can be changed by repeating steps 16 to 24. When satisfied with all four factors, press the + and – (**RESET**) keys for 1 second to exit LIVE CALIBRATE and store all four factors. To abort any changes to the factors simply turn the power off.

For maximum accuracy the 30 second runs should not be disrupted by turning the pump off or by changing the rotary (see Step 13 and 22). However the **CAL** switch or rotary or a section switch can be used for an emergency stop situation.

Illustration 17



Operation

Console Switches & Buttons

Make sure your system is properly calibrated before beginning to apply product. We also recommend completion of **Pre-Field System Checkout** described on pages 32-33 prior to beginning any field operations.

The SprayMate™ Plus system can be operated in either Manual or Automatic mode. In manual mode, the application rate (GPA or LPH) is set using the **“+”** and **“-”** buttons; the application rate will vary depending on the vehicle speed. The manual mode is useful for system set up, spot spraying, etc.

AUTO/MAN

If the MANUAL CONTROL ENABLE (“Special” calibrate factor) is turned on then pressing the **AUTO | MAN** switch will toggle between the Automatic and Manual control methods. This switch is active regardless of the RUN/HOLD and boom status.

The AUTO and MAN icons will indicate which control method has been selected.

The AUTO and MAN icons will be blanked if in CALIBRATE unless TEST SPEED is also selected.

“+” AND “-” (RESET) BUTTONS

AREA/HOUR: If the Alarm Output is active (see Audible Alarm section page 39), it can be disabled temporarily (snooze) while in the **AREA / HOUR** position by pressing the **- (RESET)** key for 1 second. The audible alarm will then be disabled until the condition which caused the alarm to sound is cleared or power is cycled. The audible alarm will then become active again. This has no effect on any displayed messages or the **WARN LED**.

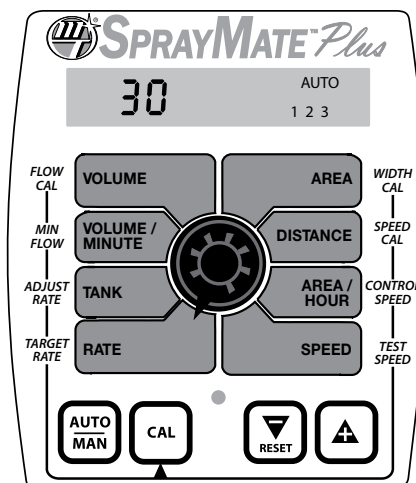
While the **UNLOAD** function is active and the SprayMate™ Plus is in RUN, the Duty Cycle can then be adjusted between the MINIMUM and MAXIMUM PWM DUTY CYCLE settings using the **+ | - (RESET)** switches.

See page 39 for further information on the Unload function.

SPEED: If in TEST SPEED and the **SPEED** position is selected, then the **+ and - (RESET)** keys will adjust the TEST SPEED. Selecting any other rotary position while in TEST SPEED will cause the **+ and - (RESET)** keys to operate as described in Normal operation below.

If not in TEST SPEED and the **SPEED** position is selected, then pressing the **+ key** selects the next data set and clears.

If not in TEST SPEED and the **SPEED** position is selected, then pressing the **- (RESET)** key will cycle the display from Current Speed to Average Speed for 2 seconds, then to Highest Speed for 2 seconds and back to Current Speed. The left most digit will display *A* for Average and *H* for Highest when the average and highest speed is being displayed. If the **+ key** is pressed while the Average or Highest is being displayed it will immediately abort the Average and Highest display (2 seconds each) and increment to the next Data Set. Changing the rotary position will also abort the 4 sec display (2 sec Ave plus 2 sec Highest) even if the rotary is returned to the **SPEED** position within 4 seconds.



Turn rotary dial to display desired readout.

TANK: While in AUTO or MANUAL, RUN or HOLD, the Tank level can be adjusted to any value from 0 to 65,535 using the **+ or - (RESET)** keys. If a TANK FILL LEVEL is specified (in “SPECIAL” CALIBRATE), then selecting **+** will make the Tank value jump to TANK FILL LEVEL value. If desired, the value can be decreased from there but it cannot be increased above the Fill size. If no TANK FILL LEVEL is specified, then the **+ or - (RESET)** keys can be used to adjust Tank to any value.

The Tank value cannot be changed while in CALIBRATE or “SPECIAL” CALIBRATE except it can be changed while TEST SPEED is set.

AREA, VOLUME or DISTANCE: When in **AREA, VOLUME or DISTANCE**, pressing the **+ key** will select the next data set for display (cycle from 1 to 3 and then back to 1 and clears the Display Timer so the LCD is updated).

When in **AREA, VOLUME, SPEED or DISTANCE**, in HOLD or all non-zero width sections are off or in AUTO with no ground speed input, the selected data set can be cleared by holding the **- (RESET)** key for 1 second. Since counters are treated as a set, all values in the set are cleared in any of the four positions.

If the Console is “Locked” then the user can only clear data set 1. The **- (RESET)** will be ignored if the console is locked and data sets 2 or 3 are selected. If not Locked, any of the 3 data sets can be cleared as described.

When the **- (RESET)** key is pressed it will immediately display *CLER* as a warning that it is about to clear a counter. This reduces the chance of accidentally clearing a counter when using the **+ key** to select 1 of 3 data sets and trying to use the **- (RESET)** key to select 1 of 3 data sets. If the **- (RESET)** key is released while displaying *CLER* then the counter remains unchanged. If the **- (RESET)** key is pressed for ³ 1 second, the *CLER* message disappears and is replaced with “0” to indicate the data set was cleared.

Operation (cont)

Console Switches & Buttons (cont)

“+” AND “-” (RESET) BUTTONS (Cont)

RATE: If MANUAL control is active, the operator can “manually” adjust the flow using the + and – (RESET) keys in the RATE position if the console is in RUN with at least 1 Boom on.

The longer a + or – (RESET) key is pressed, the faster the Servo valve will move to allow both rapid movement and fine adjustments to the Application Rate.

While in HOLD, or all non-zero width sections turned off, the + and – (RESET) keys will not adjust the Servo Valve.

If AUTO control is active, the operator may temporarily adjust the Target Rate using the + and – (RESET) keys with the Console in either RUN or HOLD, Booms on or off, speed or no speed.

Each time the + or – (RESET) key is pressed, the Target Rate will change in steps equal to the ADJUST RATE factor. When an adjustment is made, the new Target Rate will be displayed for 2 seconds. The new Target Rate is not stored and it does not change the original TARGET RATE factor. Turning the Console off, entering/exiting CALIBRATE or a Brown Out will restore the original TARGET RATE.

If the user has made a temporary change to the Target Rate and then wants to make it become a permanent change, enter CALIBRATE and change the TARGET RATE. When CALIBRATE is started, the temporary Target Rate will disappear and the original TARGET RATE factor will be displayed and the user can adjust it as desired (see Calibrate section for details).

VOLUME/MINUTE: In MANUAL control, the **VOLUME/MINUTE** position always allows the user to manually adjust a DC control valve with the console in RUN, HOLD or all non-zero width sections off. This is often used to change the amount of agitation in the Tank while stopped (in HOLD). However if using Standard DC Drive and AUTO SHUT OFF is turned “On” then manual adjustment is disabled during the 18 seconds that the valve is being closed.

In AUTO control, the **VOLUME/MINUTE** position allows the user to manually adjust a DC control valve with the console in HOLD or all non-zero width sections off or no speed. If the console is in RUN with at least one boom on and with ground or test speed input, the + or – (RESET) are disabled.

The longer the + or – (RESET) key is pressed the faster the control valve will move to allow both rapid movement and fine adjustments to the application rate.

A PWM control valve cannot be adjusted manually while in HOLD or all non-zero width sections off (since the control valve is always off).

CALIBRATE and “SPECIAL” CALIBRATE: In CALIBRATE and “SPECIAL” CALIBRATE, the + or – (RESET) switches are pressed to select settings or increase or decrease calibration values. The longer the key is pressed the faster the value will change.

CAL BUTTON

If the console is powered on and stopped (no speed input), and in HOLD or all non-zero width sections are off and LIVE CALIBRATE, SPECIAL CALIBRATE and UNLOAD are not active, then pressing and holding the CAL switch for > 1 second will start CALIBRATE (see Calibrate section).

If LIVE CALIBRATE is active, pressing CAL momentarily will toggle the PWM drive and the section outputs on and off.

If set for Closed Loop PWM drive, pressing CAL while EStop is displayed will activate “CLOSED LOOP OVERRIDE” and clear the message if FLOW @ MAX PW is set (not 0).

Pressing and holding the CAL switch while turning on power will start SPECIAL CALIBRATE.

If SPECIAL CALIBRATE is active, pressing and releasing the CAL switch will step through the pages.

If CALIBRATE or SPECIAL CALIBRATE are active, pressing and holding the CAL switch for > 1 second will exit CALIBRATE or SPECIAL CALIBRATE.

Operation (cont)

Console Switches & Buttons (cont)

NOTE: The following Table summarizes how the + and – (RESET) keys operate in various rotary positions and operating conditions for the SprayMate™ Plus. An “X” indicates a “Don’t Care”.

ROTARY SELECTOR	AUTO/MANUAL	SPEED	RUN/ HOLD	BOOM ON	+/- (RESET) OPERATION
Any (PWM)	X	0	Hold	X	+ and - (RESET) > 1 second starts Lice Cal
			X	0	
Area, Distance, Volume	X	X	X	X	+ selects a Data Set (1, 2, 3)
Area, Distance, Volume	Auto	0	X	X	- (RESET) clears Selected Data Set
	X	X	Hold	X	
		X	X	0	
Tank Level	X	X	X	X	+ increases Tank Level OR Sets Tank Level to TANK FILL LEVEL - (RESET) decreases Tank Level
Speed (Test Speed ON)	X	X	X	X	Adjusts TEST SPEED
Speed (Test Speed OFF)	X	X	X	X	+ selects a Data Set (1, 2, 3) - (RESET) displays Average and Highest Velocity
Application Rate Volume/Minute (PWM)	Manual	X	Run	<u>≥1</u>	Adjusts Flow (Overrides <i>no SPEED</i>)
			Hold	X	Nothing
			X	0	
Volume/Minute (DC) (Hold override position)	Manual	X	X	X	Adjusts the Flow
Application Rate	Auto	X	X	X	Changes Target by Adjust Amount (Displays Target for 2 Seconds)
Volume/Minute (DC)	Auto	>0	Run	<u>≥1</u>	Nothing
		0	X	X	Adjusts the Flow (Runs Servo)
		X	Hold	X	
		X	X	0	
Volume/Minute (PWM)	Auto	X	X	X	Nothing

Operation (cont)

Console Switches & Buttons (cont)

CONSOLE POWER/SYSTEM ON/OFF: The system can be turned ON and OFF by either the ignition switch, if the provided wire is connected to a power source switched by the ignition, or by using the optional ON/OFF switch and bracket kit. When the console is turned on, it will display the number of hours of operation for 2 seconds, then it will display the software version along with the “v” icon for 2 seconds before it begins normal operation.

ON-THE-GO “DELTA” RATE ADJUSTMENTS (ADJUST RATE): The calibrated target rate in gallons (liters) per acre represents the amount of solution that you typically want to apply. However, under certain conditions, you may want to increase or decrease this rate. This “DELTA” feature allows you to easily make on-the-go rate adjustments by simply using the “+” or “-” buttons. Each press of a button changes the calibrated target rate by the amount of calibrated adjust rate.

To use the “DELTA” feature, the console must have automatic “AUTO” mode active and the rotary switch must be set to the RATE position.

Example: Adjust Rate = 1.0 and Target Rate = 10.0

With AUTO selected and the rotary selector turned to RATE, pressing the “+” key once will increase the target rate from 10.0 to 11.0. The display will momentarily show the new target rate of 11.0 and then show the actual application rate. Pressing the “-” key once will decrease the target from 11.0 to 10.0.

NOTE: When you “DELTA” the target rate, the display will momentarily show you the new target rate (approximately two seconds) and then resume showing the actual application rate. The new target rate is maintained until further adjustments are made using the “DELTA” feature or calibration changes occur, or if the unit is turned off.

BOOM SWITCHES: The system monitors the status of the boom switches to determine whether they are ON or OFF. The console accumulates area based on the calibrated boom widths. When an individual boom is turned OFF, the respective width is subtracted from the total width to accumulate area based on the new active application width. If the rotary switch is in the RATE or AREA/HOUR position, the numbers 1, 2, and 3 on the display will light when their respective boom is ON.

WARNING DEVICE: The console is equipped with a RED warning light. The light will automatically turn on and flash when the actual application is plus or minus 10 percent of the calibrated target rate, or if the TANK alarm feature is activated and the tank is below the set point (display will also flash “FILL” message). If the light stays on while in AUTO, refer to the troubleshooting section of this manual. The RED warning light will also be illuminated when calibration mode is active on the console.

SNOOZE: The audible alert can be temporarily disabled (snooze) while in the AREA/HOUR position by pressing the – (RESET) key for 1 second while the alarm is sounding.

The audible alarm is activated for the following conditions:

- Completion of a Pause / Flush cycle (3/4 second).
- The calculated Tank level is below minimum level (TANK ALARM LEVEL).
- The Application Rate Error is greater than 10 % for more than 3 seconds (continuously) after the Auto Delay time and Start Up time (Standard or PWM Drive) have completed and automatic control is on and the ground speed is above the MINIMUM ALARM SPEED.

The audible alarm can be temporarily disabled (snooze), see **AREA/HOUR**, or permanently disabled (for all conditions except Pause / Flush cycle completion) by turning the ALARM ENABLE factor off

UNLOAD (PWM ONLY): In the PWM drive version (only) the Unload function is used to transfer material from the applicator to storage. It is a special function which allows the PWM valve (and pump) to be run without turning any boom switches on.

To start the Unload function, the console must be set to PWM drive and in the **AREA/HOUR** position, the applicator must be stopped (ground speed = 0), all nonzero boom switches turned off and in HOLD and not in CALIBRATE, SPECIAL CALIBRATE or LIVE CALIBRATE. Pressing and holding the **AUTO | MAN** switch for 3 seconds starts the function and displays *UnLd* in all rotary positions and selects Manual control, but the MAN and AUTO icons remain off. The **VOLUME, TANK LEVEL, DISTANCE and AREA** counters are disabled (will not change), and cannot be cleared, while the Unload function is active. While displaying *UnLd* all number icons will remain off in all rotary positions.

Setting the SprayMate™ Plus to RUN will start the valve at Minimum PWM Duty Cycle, even if all nonzero boom switches are turned off. The Duty Cycle can then be adjusted up and down between the MINIMUM and MAXIMUM PWM DUTY CYCLE settings using the + | - (RESET) switches and the valve can be stopped and started by switching between RUN and HOLD. While displaying *UnLd* the AUTO | MAN switch will no longer select Automatic control and the MAN and AUTO icons will remain off.

To prevent chemical spills, or waste, the section outputs are always disabled while the Unload function is active in case the user accidentally turns a section switch on.

Exit the Unload function by pressing and holding the **AUTO | MAN** switch for 3 seconds while in any rotary position. The display and console will return to normal operation.

Operation (cont)

Console Switches & Buttons (cont)

AREA COUNTERS: When in the AREA position, the selected data set is indicated by the Number icon (1, 2, 3) and a different set can be selected.

AREA is displayed in acres (English and Turf) or hectares (Metric).

AREA shows the area covered up to 99,99. Once the display reaches 99,999 it will display **OFFL** (Overflow) and stops counting area. The user must clear the data set to resume counting.

In English and Turf units, it counts from 0.1 to 9,999.9 Acres or Turfs and then drops the decimal point to count up to 99,999 Acres or Turfs.

In Metric, it counts from 0.01 to 999.99 hectares then shifts the decimal to count up to 9,999.9 hectares and then drops the decimal point to count up to 99,999 hectares.

SYSTEM FLUSH: The System Flush setting has two related settings, an optional FLUSH DELAY TIME and the FLUSH TIME. This output function is used to drain or flush (using a flushing agent) hazardous materials from the applicator system and to notify the operator when the cycle is complete.

The flush cycle is initiated by a RUN to HOLD transition on the Hold input. If the FLUSH DELAY TIME is set, the cycle will pause for the set number of seconds to allow the hazardous material to drain. At the end of the pause period, the multifunction output will be set to the high state for the number of seconds specified by FLUSH TIME. This output may be used to control a valve or pumping system which introduces a flushing agent to purge any remaining hazardous materials from the applicator. Upon completion of the flush time, the output will return to the low state and the audible alarm will sound a short alert 3 seconds later to indicate the cycle is complete.

If at any time in the pause or flush periods the SprayMate Plus is returned to the RUN state, the flush cycle will be terminated and normal operation will resume.

Alternate function: If the FLUSH DELAY TIME is set to a value > 0 and the FLUSH TIME is set to 0, the audible alarm will sound as soon as the FLUSH DELAY TIME expires, without the 3 second delay. This can be used where the system is simply allowed to drain without using a flush agent.

EMERGENCY STOP (ERROR MESSAGE): If the flow feedback stops, it is possible the user will not see the **no FLo** warning message. The SprayMate Plus will automatically increase the flow to maximum, trying to compensate for a low Application Rate. This can empty the tank quickly and create a severe over application. An Emergency Stop feature helps protect against this “chemical spill”.

When in AUTO and in RUN with one or more section switches on with Sections Enabled and the Ground Speed is greater than 0.45 MPH or km/H, if the Flow signal ever stops for 5 seconds or more, it will display **ESLoP** and turn the sections off and then automatically reduce the flow to a minimum displayed to notify the user of the Emergency Stop. If the Flow signal returns after **ESLoP** is displayed, it will continue to reduce the flow and remain latched in the Emergency stop.

Operation (cont)

Rotary Switch Positions

ROTARY SWITCH: During normal operation, you can view any one of eight monitored functions by turning the rotary switch to the appropriate position. The functions that are active during normal operation are the TAN boxes. Calibration positions are identified by the WHITE labeling on each side of the rotary selector (*Please refer to Calibration section for details*).

RATE: Displays the actual number of gallons per acre (liters per hectare) being applied. When the SprayMate™ Plus is used in conjunction with a Micro-Trak NH3 control kit, and NH3 has been selected in **“Special” Calibration**, the console display will read pounds (kg) of actual “N” per acre (hectare) being applied.

TANK: Displays amount remaining in the tank. When the tank is refilled, and the tank volume has been entered in “Special” Cal, the TANK amount can be reset to a full tank by simply pressing the “+” button for 1 second while the rotary switch is in the TANK position. The amount in the tank can be decreased by using the “-” button.

VOLUME/MINUTE: Displays the actual gallons (liters) per minute being applied. When the SprayMate™ Plus is used in conjunction with a Micro-Trak NH3 control kit, the console display will read total pounds (kg) of NH3 per minute being applied.

VOLUME: Displays the total gallons (liters) applied since the active counter was last reset to zero. When the SprayMate™ Plus is used in conjunction with a Micro-Trak NH3 control kit, the console display will read total pounds (kg) of NH3 applied since the counter was last reset. To select a pair of AREA and VOLUME counters, use the “+” button to select set 1, 2 or 3, indicated by the small numbers in the lower right on the display. **Do NOT** use the “-” button to select counters because the button will clear them. (*See Resetting System Counters on page 42.*) This active pair of counters may be reset to zero independent of other system counters.

AREA: Displays the acres (hectares) covered since the counter was last reset to zero. The area counters do not accumulate area when the console is in HOLD or if all booms are turned OFF. To select a pair of AREA and VOLUME counters, use the “+” button to select set 1, 2 or 3, indicated by the small numbers in the lower right on the display. **Do NOT use the “-” button to select counters because the button will clear them.** (*See Resetting System Counters on page 30.*) The selected pair of counters may be reset to zero independent of other system counters.

DISTANCE: Displays the feet (meters) driven since the counter was last reset to zero. This counter does not accumulate when the console is in HOLD. This counter may be reset to zero independent of other system counters.

AREA/HOUR: Displays acres per hour (hectare per hour) (thousands of square feet per hour) being covered.

SPEED: Displays the ground speed in miles (kilometers) per hour. **IMPORTANT:** All booms automatically shut off if system is in “hold” or if in AUTO with NO SPEED.

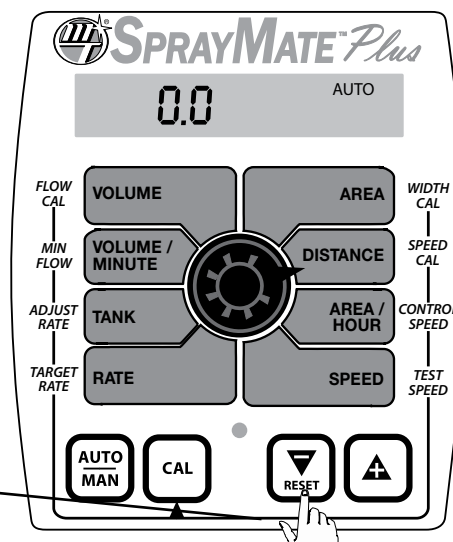
Operation (cont)

Resetting System Counters

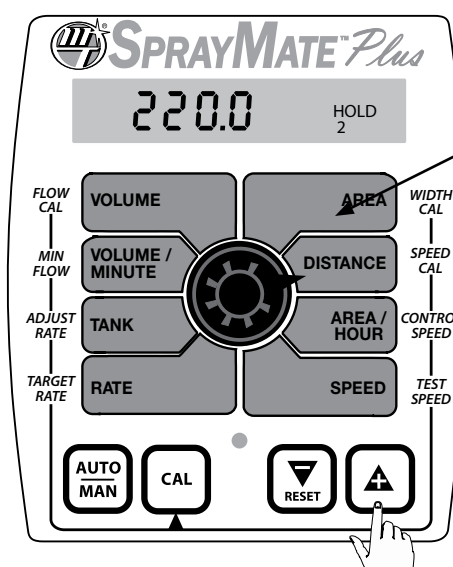
The AREA, DISTANCE and VOLUME counters maintain a running count during operation regardless of the position of the rotary switch. When any of these counters reach their maximum capacity, or when you want to start a new count, the value may be reset to zero by performing the following routine. Counters may be reset independently of each other.

1. Turn the booms OFF or put the system in HOLD.
2. Turn the rotary switch to the counter to be reset.
3. To reset distance turn the rotary switch to DISTANCE and simply press and hold the RESET button until the display reads zero. The display will show the word "CLEAR" during this process, and will show 0.0 when reset to zero is complete.
4. To reset the volume and area counters; there are three independent AREA counters, paired with three VOLUME counters. The active pair of counters is indicated by the small numbers in the lower right area of the display (1,2, or 3) when the rotary switch is in the AREA or VOLUME position. Select the pair of counters you want to use by pressing the "+" button. The small number will increment each time the "+" button is pressed (from 1 to 3, then rolls back to 1). DO NOT attempt to select the counter number by using the "-" button, because that will clear the active pair of counters if held for 2 seconds. If the "-" button is accidentally pressed, the console will display "CLEAR" to alert the user that the counters will be cleared. If the user continues to hold the "-" button for 2 seconds "CLEAR" will disappear and be replaced by 0.0, indicating that the selected pair of counters has been cleared.

NOTE: To select a pair of AREA and VOLUME counters: Verify that the desired counter pair is selected, or use the "+" button to select.

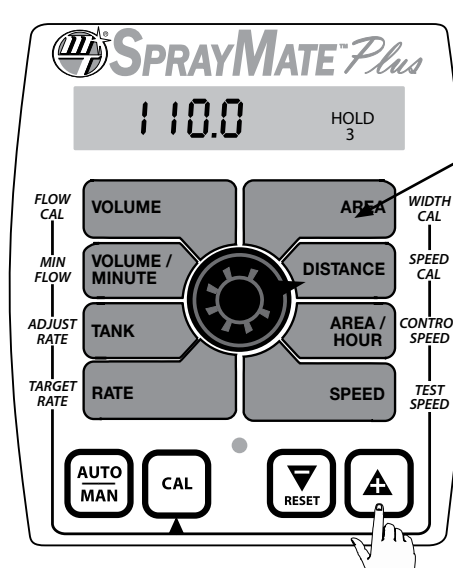
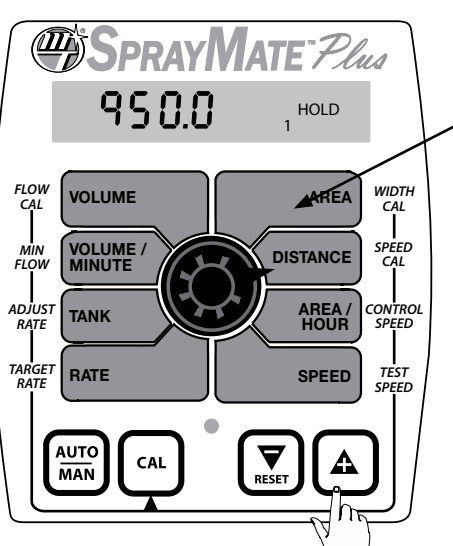


Display indicates that counter pair #2 is selected



Display indicates that counter pair #3 is selected

Display indicates that counter pair #1 is selected



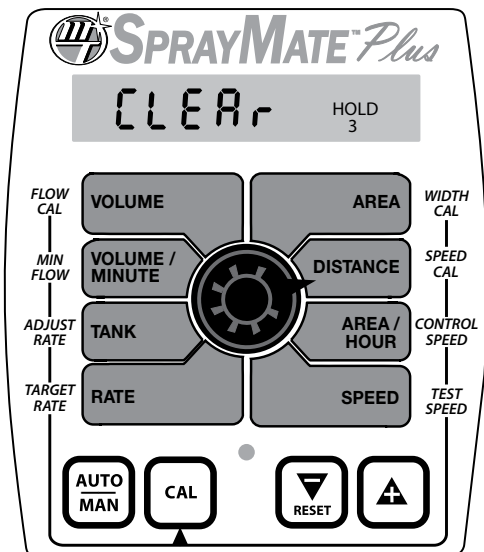
Operation (cont)

Clearing System Counters

When the desired counter number is displayed, press the “-” (RESET) button and “CLEAR” will be displayed.

NOTE: holding the “-” (RESET) button for 2 seconds will clear both the #3 AREA counter *AND* the #3 VOLUME counter whether the rotary switch is in the AREA or the VOLUME position. If the “-” button is released before 2 seconds have elapsed, the counters will not be cleared and the “CLEAR” message will be replaced with the previous total.

After the “-” (RESET) button has been held for 3 seconds, the “CLEAR” message will be replaced by 0.0, indicating that counter pair #3 has been cleared.



Pre-Field System Checkout

Bypass Servo

Before beginning actual spraying, perform the following “Pre-Field” procedure to ensure that your valve settings, nozzle selection and desired speed range will allow the SprayMate™ Plus to provide the required application control. This procedure should be repeated for each new nozzle selection and/or application rate. By performing all of the steps listed below, you set up your system to allow the SprayMate™ Plus to perform at optimum level. Fill your sprayer tank with clean water. **DO NOT** use chemicals until the entire system is completely checked out and operating properly.

IMPORTANT NOTE: *Most nozzles will maintain a good pattern over a maximum speed range of two to one. (For example, if your maximum speed is 12, your minimum speed shouldn't go below 6.)*

NOTE: Pre-Field System Checkout is a procedure performed while the console is in the CAL mode. The Red WARNING light will be lit during the procedure and “CAL” on the display will be flashing.

Completely close range adjust valve (if installed), and agitation valve (if installed). Completely open throttle valve (**Must be installed**).

Start vehicle and pump, bring the engine up to normal operating RPM. Do NOT exceed safe system pressure.

ENTER MAXIMUM APPLICATION TEST SPEED INTO CONSOLE. With console in HOLD, enter calibration mode. Push and hold (CAL) button. The CAL icon will appear on display and red light will be on. Turn rotary switch to TEST SPEED position. Use “+” or “-” button to enter maximum application speed. Do not exit calibration mode. CAL will flash on the display indicating TEST SPEED mode.

Select manual “MAN” control mode and turn all booms ON.

Turn rotary switch to RATE position and hold “+” button for approximately 30 seconds to completely close the servo valve (control valve).

CAN'T GET THERE? If you can't get to the desired application rate, you may need different nozzles, pump, or you may need to make modifications to your plumbing configuration. *Please refer to Troubleshooting Plumbing on page 38.*

Adjust agitation valve for desired agitation. If range valve is installed, adjust range valve until display reads 20% higher than the desired application rate.

Slowly close the throttle valve until the display reads slightly higher (5% to 10%) than the desired application rate. If the throttle valve is more than two-thirds closed, install range valve and perform pre-field again.

NOTE: *Now is a good time to confirm that GPA, GPM, MPH, WIDTH and PSI all coincide with the nozzle manufacturer's charts. PSI may be slightly higher than indicated by the charts due to pressure drop across the solenoid valves, nozzle diaphragm check valves, nozzle screens, etc.*

ENTER MINIMUM APPLICATION TEST SPEED INTO CONSOLE. Turn rotary switch to TEST SPEED position. Use the “+” or “-” button to enter minimum application speed. Do not exit calibration mode. (**Remember, the minimum application speed is not normally less than half of the maximum application speed.**)

Turn booms ON (**Make certain system is in Manual mode**), turn rotary switch to RATE position and hold “-” button for approximately 30 seconds to completely open the servo valve (control valve). **NOTE:** *Assume servo is plumbed in a bypass line. (Maximum bypass allowed - minimum flow output to booms.) The display should now read less than the desired application rate.*

NOTE: It is not normally a problem if the application rate goes all the way to zero when holding the “-” button for 30 seconds, as long as it goes back up when the “+” button is held.

CAN'T GET THERE? If holding the “-” button does not get the application rate to go below the desired application rate, please refer to Troubleshooting Plumbing.

Pre-Field System Checkout

Inline Servo

Before beginning actual spraying, perform the following “Pre-Field” procedure to ensure that your valve settings, nozzle selection and desired speed range will allow the SprayMate™ Plus to provide the required application control. This procedure should be repeated for each new nozzle selection and/or application rate. By performing all of the steps listed below, you set up your system to allow the SprayMate™ Plus to perform at optimum level. Fill your sprayer tank with clean water. **DO NOT** use chemicals until the entire system is completely checked out and operating properly.

IMPORTANT NOTE: Most nozzles will maintain a good pattern over a maximum speed range of two to one. (For example, if your maximum speed is 12, your minimum speed shouldn't go below 6.)

NOTE: Pre-field System Checkout is a procedure performed while the console is in the CAL mode. The Red WARNING light will be lit during the procedure and “CAL” on the display will be flashing.

Completely close range adjust valve (if installed), and agitation valve (if installed).

Start vehicle and pump, bring the engine up to normal operating RPM. Do NOT exceed safe system pressure.

ENTER MAXIMUM APPLICATION TEST SPEED INTO CONSOLE. With console in HOLD, enter calibration mode. Push and hold (CAL) button. The CAL icon will appear on display and red light will be on. Turn rotary switch to TEST SPEED position. Use “+” or “-” button to enter maximum application speed. Do not exit calibration mode. CAL will flash on the display indicating TEST SPEED mode.

Select manual “MAN” control mode and turn all booms ON.

Turn rotary switch to APP. RATE position and hold “+” button for approximately 30 seconds to completely open the servo valve (control valve).

CAN'T GET THERE? If you can't get to the desired application rate, you may need different nozzles, pump, or you may need to make modifications to your plumbing configuration. *Please refer to Troubleshooting Plumbing on page 38.*

Adjust agitation valve for desired agitation. If range valve is installed, adjust range valve until display reads 10% higher than the desired application rate.

NOTE: Now is a good time to confirm that GPA, GPM, MPH, WIDTH and PSI all coincide with the nozzle manufacturer's charts. PSI may be slightly higher than indicated by the charts due to pressure drop across the solenoid valves, nozzle diaphragm check valves, nozzle screens, etc.

ENTER MINIMUM APPLICATION TEST SPEED INTO CONSOLE. Turn rotary switch to TEST SPEED position. Use the “+” or “-” button to enter minimum application speed. Do not exit calibration mode. (Remember, the minimum application speed is not normally less than half of the maximum application speed.)

Turn booms ON (Make certain system is in Manual mode), turn rotary switch to APP. RATE position and hold “-” button for approximately 30 seconds to completely close the servo valve (control valve). The display should now read less than the desired application rate.

NOTE: It is not normally a problem if the application rate goes all the way to zero when holding the “-” button for 30 seconds, as long as it goes back up when the “+” button is held.

CAN'T GET THERE? If holding the “-” button does not get the application rate to go below the desired application rate, please refer to Troubleshooting Plumbing.

Pre-Field System Checkout

Bypass & Inline Servo

ENTER TARGET APPLICATION TEST SPEED INTO CONSOLE: Turn booms OFF. Turn rotary switch to TEST SPEED position. Use the “+” or “-” button to enter target application speed. Do not exit calibration mode.

Select automatic “AUTO” control mode, turn booms ON and turn rotary switch to APP. RATE position. The console should take control and lock-on to your calibrated target application rate.

NOTE: If you calibrated your ADJUST RATE to zero (.0), disregard the following steps.

1. Press the “+” button and release. The display will momentarily show the new target rate (target rate + adjust rate) and then lock on to that rate.
2. Press the “-” button and release. The display will momentarily show the new target rate (target rate - adjust rate) and then lock on to that rate.

NOTE: If the application rate was correctly displayed during manual “MAN” control mode, but registered too high in automatic “AUTO” control mode, the calibration value for MIN FLOW is set too high.

At this point, the Pre-Field System Check-Out is complete. TEST SPEED will automatically cancel when you exit the CAL mode or when power to the console is turned OFF.

Troubleshooting

Messages/Warnings



Average Speed (for selected Data Set) is being displayed for 2 seconds.



Check Sum equals zero or failed at power up.



The message alerts the user that the currently selected counter will be cleared if held for 2 seconds. Also serves as a reminder to use "+" button to select counters.



Had an Emergency Stop. Check flowmeter. Verify there is liquid flow and the tank is not empty.



Trying to select Open Loop while Flow @ Max PW = 0 or In AUTO Open Loop or Override and Flow @ Max PW < Flow @ Min PW



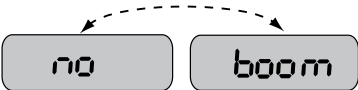
Calculated Tank Level is equal to or less then TANK SET POINT



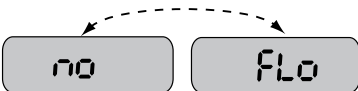
Highest Speed (for selected Data Set) is being displayed fo4r 2 seconds.



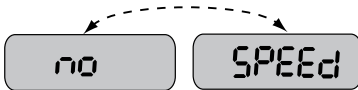
Low Power. Check all power and ground connections.



In WIDTH CAL and ne sections switches are turned on



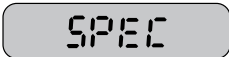
In RATE and should have flow (In RUN, 1 or more booms on, Speed is > 0 but no Flow is detected.



In RATE and hve no speed, regardless of all other conditions. RUN, HOLD, AUTO, MANUAL, Booms On/Off.



Overflow in any display (greater than 99999), or Area/Hour exceeds 23 bits.



Special Calibration mode is active.



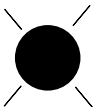
An unused Special Calibrate or Licve Calibrate position



The Unload function (PWM Only) is active



Console is in Live Calibrate



Warn LED flashes when Application Rate Error is > 10% (disable by setting TARGET RATE to zero) or Volume/Minute is below MIN FLOW, or Calculated Tank Level is £ TANK SET POINT.

Warn LED is on steady when in CALIBRATE or SPECIAL CALIBRATE or LIVE CALIBRATE or TEST SPEED if Console is un-locked.

Troubleshooting (cont)

General

All SprayMate™ Plus consoles, flowmeters and servo valves are tested prior to packaging, so unless there has been damage in shipment you can be confident that everything will be operational when you receive it.

However, if you do encounter a problem that appears to be related to equipment failure, **PLEASE DO NOT OPEN THE CONSOLE.** Your system is protected by a warranty, and Micro-Trak will gladly correct any defect.

Many problems are the result of mistakes in installation or operation. Before returning any parts for service, carefully check your installation and review the operating instructions. *For easy-to-follow guidelines, refer to the troubleshooting section which follows.*

CONSOLE APPEARS DEAD

Using your test light, check for 12 volts at the power source. Also check for damaged power cable or reversed terminals. (**Console requires 12 volts for proper operation**). Check connections of ignition or power switch.

SPEED IS ALWAYS ZERO OR ERRATIC

Check for properly calibrated wheel circumference.

Review speed sensor installation. Check for proper mounting, alignment and spacing of speed sensor in relationship to magnet assembly. Make sure magnet polarities are alternated. Also check cable for breaks or incomplete connection. *For more suggestions on solutions to speed problems, see Hall-effect sensors and console inputs on page 36.*

DISTANCE COUNT IS INACCURATE

Wheel circumference was incorrectly measured or entered. Review calibration, re-adjust and test.

AREA COUNT IS INACCURATE

Implement width or wheel circumference was measured incorrectly or programmed incorrectly. Go back through the original procedures, make changes, and test for acre (hectare) count again. (**Make sure no width is entered for unused booms.**) Verify accuracy with formula:

$$\begin{aligned}\text{Acres} &= \text{Distance} \times \text{Width in feet} / 43560 \\ \text{Hectares} &= \text{Distance} \times \text{Width in meters} / 10,000\end{aligned}$$

NO READOUT OF GALLONS (LITERS), OR GALLONS (LITERS) PER MINUTE

Check to see that the sprayer pump and equipment are operating properly. If liquid is moving through the line, check the flow sensor to be sure it is screwed all the way into the flowmeter.

Check to see that a FLOW CAL number has been entered. Also check cable for breaks or incomplete connection.

If the flowmeter is new or has not been used for a long period of time, the turbine may be sticky. Flushing the system out with water should make the turbine spin freely.

Flow rate may be too low to register a reading, or foreign material may be lodged in the flowmeter.

BOOMS SHUT-OFF

If you are in AUTO with no speed, the booms will shut-off.

TOTAL LIQUID USED IS INACCURATE

This may result from an incorrectly-entered "FLOW CAL" value. Check the number stamped on the flowmeter tag, and be sure this is entered in the console's "FLOW CAL" position. If the meter has been used for some time, wear may have changed the Flow Cal value. *See Fine-Tuning Flowmeter Calibration in Appendix C.*

Check the mounting position of the flowmeter. With lower flow rates, the meter should be mounted vertically. Also check to see that the flow sensor is screwed all the way into the flowmeter.

Other causes may be inaccurate sprayer tank markings, a flow rate too low to register, or foreign material lodged in the flowmeter.

CONSOLE IS ERRATIC IN OPERATION

If you have a two-way radio, it may be mounted too close to the console. Keep all SprayMate™ Plus cables away from the radio, its antenna and power cable.

Ignition wires may be causing the console to malfunction. Keep SprayMate™ Plus cables away from ignition wires, or install ignition suppressor.

Reroute all cable away from electric solenoids, air conditioning clutches and similar equipment.

Check the VALVE SPEED calibration number in "Special" Calibration. If the RATE tends to overshoot or oscillate, the VALVE SPEED setting may be too high for the control valve being used; reduce the VALVE SPEED setting by 1 (range is -4 to +3).

DISPLAYED MEASUREMENTS DO NOT MAKE SENSE

The console may be in the incorrect measurement mode (English or metric).

DISPLAY READS "OFL"

DISTANCE, AREA, and VOLUME counters read OFL when they have exceeded their maximum count. Reset to zero to resume counting.

SYSTEM OPERATION (CONTROL) IS SLUGGISH IN AUTOMATIC MODE

Check the VALVE SPEED setting in Special Calibration. If using a slow valve (4 seconds or more, close to open) increase the VALVE SPEED setting.

Troubleshooting (cont)

Checking Individual Components

CONSOLE

The only way to field test a console is to connect it to a harness on a vehicle with a known working console or install it on an E-POP (Electronic Point of Purchase) display stand.

HARNESS

The harness can be checked using an ohmmeter or continuity tester. The main wiring diagram shows the pin out of all connectors. *See page 10.*

ELECTRICAL INTERFERENCE

Erratic operation of the system may be the result of electrical interference from ignition wires or inductive loads (electrical clutch, fan, solenoid, etc.). Always try to route wires as far away from suspect areas as possible. If problems occur, you may need to relocate the console and/or wiring harness, or install a noise suppressor.

POWER

Check power source with the MT-101 or a test light. If there is no power, trace cable toward battery looking for breaks. Also check any fuses or circuit breakers that supply power to the console.

ACCESSORY POWER

The speed, flow and run/hold cables all have an accessory power wire. Check for 12 volts between B (usually white) and C (usually black) of these connectors. If power is not present, make sure the accessory power wire is not open or shorted to ground or to another wire. If this wire has a problem, the console may exhibit erratic behavior or not function at all.

RUN/HOLD HALL-EFFECT SENSOR

Caution: Improper connection or voltage could damage the Hall-Effect sensor. The Hall-effect sensor works similar to a reed switch, but requires power in order to function. This particular type of Hall-effect sensor “closes” when near the south pole of a magnet and is otherwise “open”.

Ground pin C (black) and connect clean 12 volts to pin B (white) of the Hall-effect sensor cable. Connect the positive lead (red) of an ohmmeter or continuity tester to pin A (red) and the negative lead (black) of the ohmmeter or continuity tester to pin C (black) of the Hall-effect sensor cable.

Holding the tip of the sensor up to the south pole of a magnet should result in a very low resistance (around 300 ohms). Taking the sensor away from the magnet should result in a very high resistance (infinite).

RUN/HOLD JUMPER DUST COVER

To test for proper continuity on the jumper wire, connect the ohmmeter to the pins of the dust cover with the jumper wire. There should be continuity — near zero ohms.

MAGNETIC HALL-EFFECT SPEED AND FLOW SENSORS

Caution: Improper connection or voltage could damage the Hall-effect sensor. The Hall-effect sensor works similar to a reed switch, but requires power in order to function. Also, this particular type of Hall-effect sensor requires alternating magnetic polarities in order to switch. This means that the north pole of a magnet will “open” the Hall effect and the south pole of a magnet will “close” the Hall effect.

Ground pin C (black) and connect clean 12 volts to pin B (white) of the Hall-effect sensor cable. Connect the positive lead (red) of an ohmmeter or continuity tester to pin A (red) and the negative lead (black) of the ohmmeter or continuity tester to pin C of the Hall-effect sensor cable.

Holding the tip of the sensor up to the north pole of a magnet should result in a very high resistance (infinite), while holding the tip of the sensor up to the south pole of a magnet should result in a very low resistance (around 300 ohms).

VANSCO RADAR SPEED SENSOR

1. Carefully check your installation and operating instructions. The following are tips for troubleshooting;
2. Disconnect the radar adapter cable from the console harness
3. Check for 12 VDC between pins B and C of the main harness connector (yellow tie). If not present, console or harness may be defective.
4. Using a jumper wire (paper clip bent into a “U”), rapidly short together positions A and C of the main harness speed connector (yellow tie) several times. The console should respond with some speed reading. If not, the console or harness may be defective.
5. Reconnect the radar adapter cable to the main harness speed connection (yellow tie).
6. Disconnect the radar from the radar adapter cable.
7. Check for 12 VDC between pins 1 and 3 of the radar adapter connector. If it is not present but was present in step 2, the radar adapter cable may be defective.
8. Using a jumper wire (paper clip bent into a “U”), rapidly short together positions 2 and 3 of the radar connector (round 4-pin) several times. The console should respond with some speed reading. If not but had a reading in step 3, the radar adapter cable may be defective.
9. If system passes all above tests, the radar may be defective.

Troubleshooting (cont)

Checking Console Inputs

CONSOLE INPUTS

If there is no response from any of the following tests, refer to the main wiring diagram to locate the next connector in line toward the console and repeat the test at that connector. If there is a response at that connector, the problem may be in the cable between the two connectors (or the connectors themselves).

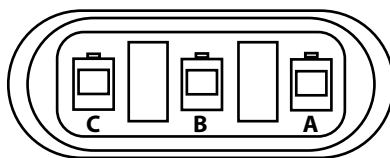
SPEED INPUT

Turn rotary switch to speed position and disconnect the speed sensor (yellow tie) from the main harness. Check for 12 volts between pins B (white) and C (black) of the main harness speed cable (yellow tie). Using a clip lead or other jumper wire (such as a paper clip bent in a “U”), several times rapidly short together pins A (red) and C (black) of the 3-pin connector (*See Illustration 17*). The console should respond with some speed reading.

FLOW INPUT

Turn rotary switch to VOLUME/MINUTE and disconnect the flow sensor (green tie) from the main harness. Check for 12 volts between pins B (white) and C (black) of the main harness flow cable (green tie). Using a clip lead or other jumper wire (paper clip bent in a “U”), several times rapidly short together pins A (red) and C (black) of the 3-pin connector. The console should respond with some flow rate reading.

Illustration 17



Three-Pin Connector

REMOTE RUN/HOLD INPUT

Disconnect the remote run/hold sensor (or jumper cover) from the main harness.

Check for 12 volts between pins B (green) and C (violet) of the main harness remote run/hold cable (grey tie). Placing a clip lead or other jumper wire (such as a paper clip bent in a “U”) between pins A (blue) and C (violet) of the main harness run/hold connector (grey tie) should turn off the “HOLD” icon on the console display. Removing the jumper should turn on the “HOLD” icon on the console display.

FLOWMETER

Shaking the Flowmeter end to end should produce a “rattling” sound (shaft end play). Blowing in the meter from either end should spin the turbine freely. If the turbine spins freely but the meter will not register flow with a known working sensor, the turbine may be defective. *See Flowmeter Assembly and cleaning on page XX for details.*

SERVO VALVE CONTROL SIGNAL

With the console turned ON, put the console in MANUAL mode, place the remote Run/Hold switch in the RUN position and turn at least one boom switch to ON. Using a voltmeter or simple test light, check from a good frame ground to each of the servo wires on the main harness connector. You should get 0 volts on each wire. Holding the “+” button should cause the RED wire to pulse toward 12 volts (light will pulse). Holding the “-” button should cause the BLACK wire to pulse toward 12 volts (light will pulse).

SERVO VALVE

The best way to test the servo valve is with a known working console. Turn console ON, put the console in MANUAL mode, place the remote Run/Hold in the RUN position, turn the rotary switch to RATE and turn at least one boom switch to ON. With the servo valve connected to the servo valve lead on the main harness, holding the “+” button should close the servo valve and holding the “-” button should open the servo valve. **NOTE: Assuming you are in bypass configuration (provided the console has passed the Servo Valve Control Signal test). The servo valve should operate smoothly in both directions, from fully open to fully closed.**

You may also use a 9-volt transistor battery. Connecting the battery to each terminal on the servo valve should cause the servo valve to run in one direction. Reversing the battery connections should cause the servo valve to run the other direction. The servo valve should operate smoothly in both directions, from fully open to fully closed.

PLUMBING

Proper plumbing is a very important factor in obtaining optimal performance from your SprayMate Plus system. The chart on the next page will help you determine what area of the plumbing may be causing your problem. At this point, it is assumed that your plumbing basically matches that of the system diagram and that the servo valve and flowmeter are known to be installed correctly and functioning properly. In addition, make certain that you have selected and installed the correct spray tips for the application, speed and spray rate that you intend to maintain. Don’t forget the obvious such as leaky fittings and hoses, pinched hoses and plugged or worn nozzles. ***If you need more detail than the chart provides, please refer to Plumbing Guidelines on pages 50-51.***

Plumbing Troubleshooting Chart

SYMPTOM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Loses pressure in MANUAL	<ul style="list-style-type: none"> Pump Air-lock 	<ul style="list-style-type: none"> Clean strainer Larger hoses
Little or no pressure adjustment in MANUAL	<ul style="list-style-type: none"> Too much restriction in servo loop 	<ul style="list-style-type: none"> Larger hoses and fittings No sharp bends
Pressure won't go high enough in MANUAL	<ul style="list-style-type: none"> Pump starved or too small Too much agitation Throttle, range adjust or pressure relief valves 	<ul style="list-style-type: none"> Larger hoses Reduce agitation Adjust
Pressure, Speed and Spray Rate don't check out according to charts	<ul style="list-style-type: none"> Inaccurate pressure reading Dirty or worn tips 	<ul style="list-style-type: none"> Use a different gauge and check each boom. Clean or place
Pressure always goes too high in AUTO	<ul style="list-style-type: none"> Minimum flow rate too high Inline/Bypass setting 	<ul style="list-style-type: none"> Re-calibrate Set appropriately
Pressure fluctuates greatly in AUTO	<ul style="list-style-type: none"> Sagging or kinked hoses Throttle valve too far closed Pump starved or too small Valve response speed set too high ("Special" Cal) 	<ul style="list-style-type: none"> Support or replace hoses Adjust throttle and range valves Larger hoses Larger pump Clean strainer Reduce valve speed setting

Plumbing Guidelines

General

In order for your sprayer to function properly, it must be correctly plumbed. The system diagrams (*On pages 16 and 17*) show the plumbing configuration that works best with the SprayMate™ Plus Sprayer Controller. This section will explain the purpose of each component, list some problems it can cause and recommend some possible solutions to those problems.

A word about pressure drops: All hose, valves and fittings (especially elbows) cause undesirable pressure losses. Keep hoses as large as practical. Don't use longer hoses than necessary. Avoid bends whenever possible. Use as few fittings as possible. Use full port valves or the next larger size valve. Long hoses should be supported to avoid sagging and kinking. Many spray tip manufacturers have charts showing pressure drop for various fittings and hose sizes.

Now let's break the system diagram into five sections and cover each one separately. The five sections are the pump inlet line, the agitation line, the flowmeter (boom) line, the servo line and the pump itself.

PUMP INLET

The hose connecting the tank to the pump should be at least as large as the pump inlet port. In most cases 1¼" is a good size. The valve in this line is for complete tank shut-off only and should always be fully open during operation. If this hose is too small or the valve is partially closed, you may not be able to reach your high end goals and pump damage could occur.

AGITATION

The size of the agitation line is dependent upon the amount of agitation required which is determined by the size of the tank and the type of chemical being used. In most cases a 1" hose is large enough.

SERVO

On the system diagram, the hose between tee "B" and the servo can usually be ¾" but 1" will also work. The hose between the servo and tee "C" should be at least as large as the servo. If these lines are too small, you may experience little or no pressure adjustment.

FLOWMETER

The line feeding the flowmeter and the boom shut-off valves should be at least as large as the flowmeter. The size of lines going from the shut-off valves to each boom section depends on the flow rate of each boom.

Plumbing Guidelines (cont)

General

PUMP

The pump must have enough capacity to satisfy the agitation, servo and flowmeter sections of the plumbing. To determine if your pump is large enough you must add up the gallons per minute of all three sections. The following example will take you through the steps involved.

EXAMPLE

Let's say our example sprayer has a 300-gallon tank with a Spraying Systems 6290 SC-8 Jet Agitator. The agitator uses 10.2 GPM at 40 PSI. The sprayer has a 40', three-section boom. Each section is 160" with four tips at 40" for a total of 12 tips. We plan to put on a 25 GPA at 5 MPH and in some areas of the fields we may want to use the Delta feature and increase our rate to 30 GPA and in other areas decrease to 15 GPA. After checking the tip charts we find that a TK-5 Floodjet has a range of 14.9 to 30 GPA at 5 MPH. According to the charts, to get 30 GPA at 5 MPH with a TK-5, the pressure must be 40 PSI. At 40 PSI a TK-5 will spray 1.0 GPM. So, 12 tips at 1.0 GPM each is a total of 12 GPM.

Now let's add everything together.

Agitation	10.2
Spray tips	12.0
Servo	5.0
<hr/>	
27.2 Total GPM	

The above addition shows that the system needs 27.2 GPM at 40 PSI. If we add a 10% margin ($27.2 \times 1 = 2.72$ and $27.2 + 2.72 = 29.92$), we have about 30 GPM. To be sure we have enough volume, the pump should be able to deliver 30 GPM or more at 40 PSI.

Valve Purpose and Adjustments

TANK SHUT-OFF VALVE

The tank shut-off valve is for convenience only. It allows you to work on the plumbing without draining the tank. It should always be fully open during operation.

AGITATION SHUT-OFF VALVE

The agitation shut-off valve is mostly for convenience. It allows you to work on the plumbing without draining the tank. It should normally be fully open during operation.

PRESSURE RELIEF VALVE

The pressure relief valve is used to avoid excessive pressure when the booms are turned off. Start with the handle screwed mostly out. Slowly bring pump up to operating RPM (make sure pressure does not go too high). Put the SprayMate Plus in MAN and turn boom on. Hold adjust switch to "+" for about 30 seconds to fully close servo valve. Turn booms OFF. Now slowly screw handle in until maximum desired pressure is reached. Lock handle in place with locking nut or collar.

Note: *Spraying Systems 144H DirectoValve has a maximum pressure rating of 100 PSI (7 bar).*

RANGE ADJUST VALVE

The range adjust valve is required when the pump is much larger than necessary. When the range valve is opened, some of the liquid will be bypassed around the pump to avoid "overloading" the rest of the system. The setting of the range adjust valve is determined by the throttle valve. **Start with the range valve fully closed and perform the Pre-Field System Checkout on pages 44 and 45.** If the throttle valve needs to be more than two thirds closed, open the Range valve slightly and perform the Pre-Field System Checkout again.

THROTTLE VALVE

The throttle valve limits your high end to maximize servo performance. Start with throttle valve fully open and perform the **Pre-Field System Checkout on page 44-45.**

EXAMPLE

With the throttle fully open and servo fully closed, you may be able to get 50 GPA at 5 MPH when you only want 25 GPA. If you were to simply open the servo you may be able to get down to 25 GPA, but if your speed should drop to 3 MPH, the servo can't open any farther and won't be able to maintain 25 GPA. Therefore, if you leave the servo closed and close the throttle until your high end has dropped from 50 GPA to about 30 GPA, the servo has a greater operating range.

The throttle valve pictured in the system diagram is a needle valve (Spraying Systems Type 12690 or 12795). A ball valve may be used but is more difficult to adjust and keep adjusted. Do not install a pressure regulator or relief as a throttle valve.

If the throttle valve is closed too much, PSI may fluctuate greatly in AUTO.

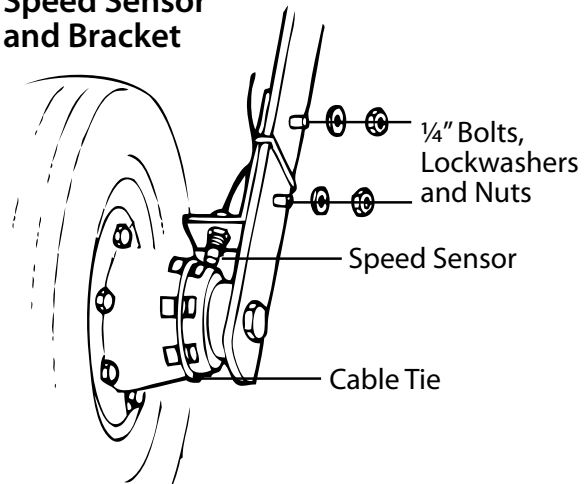
Appendices

Appendix A - Optional Speed Sensor Mounting Installation

Implement Wheels

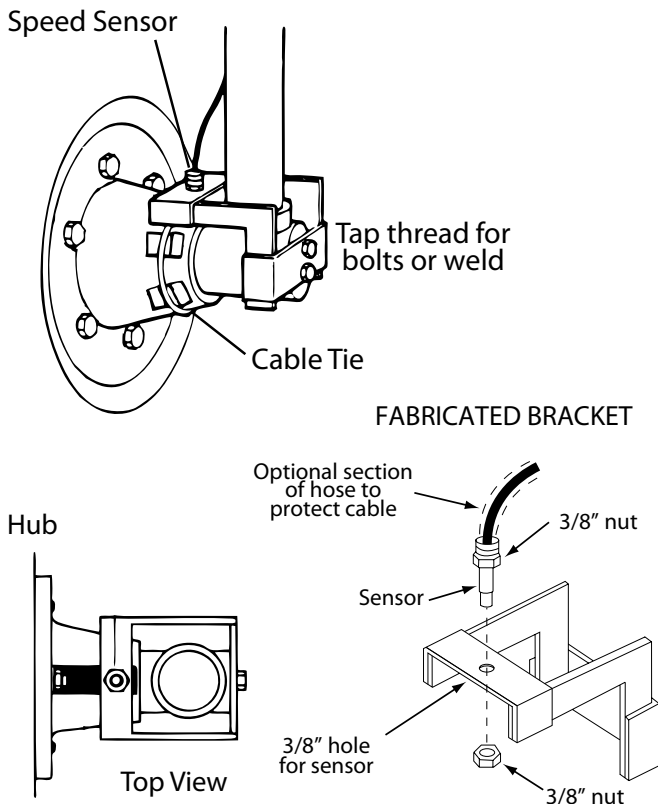
1. Secure magnets mechanically or with epoxy.
2. Rigidly mount sensor mounting bracket to the wheel assembly. Cut or bend "L" bracket as required for proper positioning of sensor.
3. Install sensor, adjust to correct spacing ($\frac{1}{4}$ " to $\frac{1}{2}$ " or 6 to 13 mm is recommended), and secure with $\frac{3}{8}$ " locking nuts. *See Illustration on the right.*

Speed Sensor and Bracket



Front Tractor Wheel

1. Magnets may also be secured with a cable tie and an adhesive such as epoxy.
2. Mount the speed sensor bracket to a part of the wheel assembly that does not change position to the hub when the wheels are turned. If the "L" bracket provided cannot be bent and mounted to properly position the sensor, make a bracket similar to the one shown at right.
3. Install sensor, adjust to correct spacing ($\frac{1}{4}$ " to $\frac{1}{2}$ " or 6 to 13 mm is recommended), and secure with $\frac{3}{8}$ " locking nuts. *See Illustration below.*

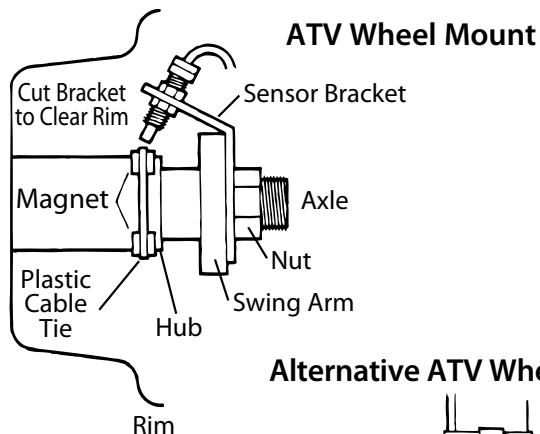


ATV Wheels

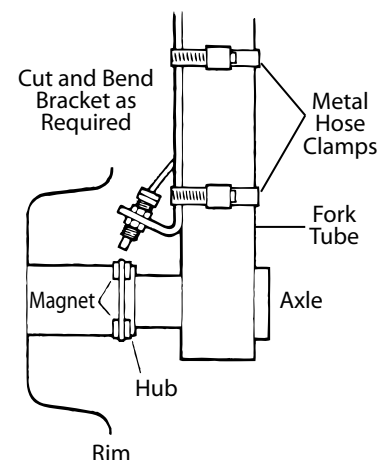
Two mounting examples are illustrated.

1. Using one cable tie (ribbed side toward magnets), secure two magnets to the wheel hub so they are exactly opposite each other. Alternate the magnets' polarities.
2. Cut and bend sensor mounting bracket as needed and rigidly mount.
3. Insert sensor, adjust spacing ($\frac{1}{4}$ " to $\frac{1}{2}$ " or 6 to 13 mm) and secure with $\frac{3}{8}$ " locking nuts.

CAUTION: Make sure valve stem cannot make contact with sensor or bracket.



Alternative ATV Wheel Mount



Appendix A (cont)

Optional Speed Sensor Mounting on Drive Shaft

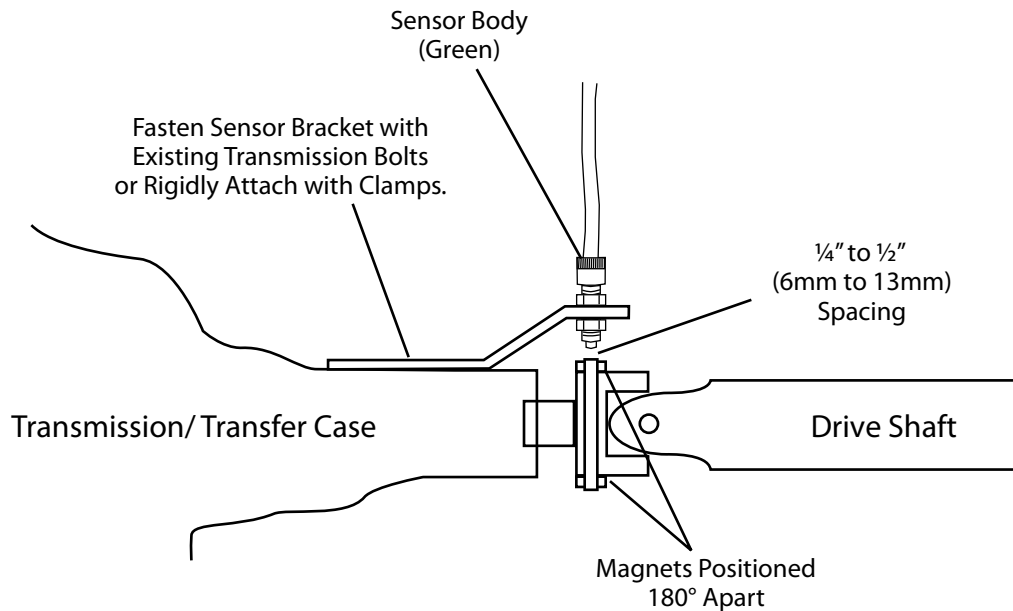
NOTE: This is an optional method generally used on pickups or custom vehicles. It may also be necessary on any other vehicles where access to the wheels is limited. This installation requires a fine tuning procedure, see pages 43-44.

Determine the best location for the magnets on drive shaft according to which is the most practical spot to attach sensor mounting bracket. This position should be no more than 12" (.30 meters) behind the front U-joint. For best results, mount "L" bracket to transmission and mount magnets on drive shaft as close to transmission as possible. This will ensure proper alignment if drive train shifts under heavy loading.

Two magnets are required for proper Hall-effect speed sensor operation. Position them exactly opposite each other (180 degrees apart). The polarity (north and south poles) detected by the Hall-effect speed sensor must alternate as the shaft is turned. The magnets provided by Micro-Trak are marked with a punched dashed line on the SOUTH pole side of the magnet.

- Attach magnets onto drive shaft, one NORTH pole side out and the other SOUTH (dashed) pole side out, by wrapping cable tie around shaft and magnets. Position each magnet so that its longest dimension moves in the direction of rotation. Pull cable tie tight and trim off excess. An adjustable, non-magnetic (stainless steel) band clamp may also be substituted.
- Attach sensor bracket to vehicle transmission. **See Illustration below.** Use either the short or long end of the bracket as a base.
- Turn one locking nut onto threaded sensor and insert sensor into large hole selected on mounting bracket. Turn on remaining locking nut. Set sensor to proper distance from magnets ($\frac{1}{4}"$ to $\frac{1}{2}"$, or 6mm to 13mm). When distance is set, tighten nuts to lock sensor in place.
- Secure sensor cable to frame with cable ties. Place first tie as close to sensor assembly as possible.

See SPEED CAL on page 24.



Appendix B

Fine Tuning Speed/Distance Calibration Value

This procedure is used to verify the calibration of systems **WITHOUT** run/hold switch kit installed. In order to achieve accurate measurements, each step in this fine tuning procedure should be performed as precisely as possible.

Note: If your system does have an optional run/hold switch kit installed, refer to page 43 for instructions.

PREPARATION

- Once the system is fully installed and calibrated, select a straight tract of ground that is similar to your actual field conditions and as level as possible.

NOTE: Using a course with a different ground surface, such as a hard-surface road, will result in different readings than exact field conditions.

- Measure a distance of 1000 feet (500 meters). Clearly mark the beginning and end points with flags or something highly visible to the operator.

PROCEDURE

To adjust the SPEED CAL factor.

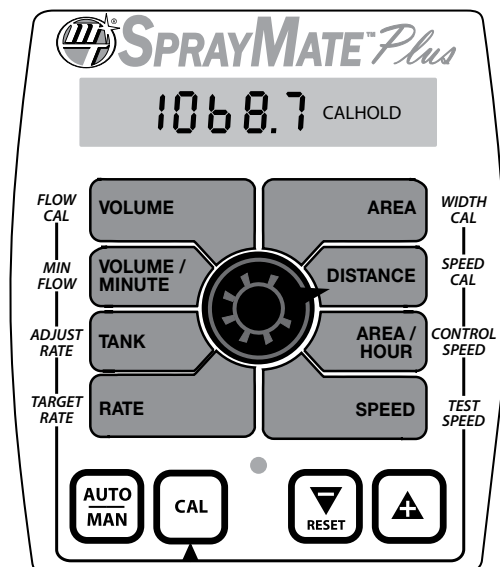
- Enter CALIBRATE. (Place console in HOLD or turn all non-zero width sections off, stop and then press CAL for 1 second).
- Select the DISTANCE position and use the + and – (RESET) keys to adjust the SPEED CAL.

To fine tune the SPEED CAL factor.

- Set up a course of a known distance with a beginning and end marker.
- Clear the first Distance counter.
- Turn off all non-zero width sections.
- Make sure pump is off or boom valves are disconnected so no accidental spraying will occur.
- As the vehicle passes the beginning marker, switch to RUN by turning on a boom switch and continue driving (it is not recommended to stop at the beginning or end marker).

- When the vehicle passes the end marker, turn off all boom switches and distance will stop accumulating.
- Stop in a safe place and enter CALIBRATE.
- Select the SPEED CAL position and the current SPEED CAL value will be displayed. Press the CAL switch to toggle the display to show Distance traveled (pressing the CAL switch will toggle between SPEED CAL value and Distance traveled. To remind the user, the CAL icon will turn on when displaying the SPEED CAL value and it will flash when displaying the Distance value).
- Use the + and – (RESET) switches to adjust the Distance displayed until it matches the actual distance traveled. This will automatically fine-tune the SPEED CAL value.
- Press the CAL switch again to toggle the display to show SPEED CAL value and record it for future reference. Repeat the test course to confirm the accuracy.

The speed sensor is now calibrated. To verify proper calibration, repeat the procedure a second time. Write down the new speed calibration number and keep it in a safe place. If the calibration values are ever accidentally changed, you can simply re-enter this number.



Appendix C

Fine Tuning Flowmeter Calibration Value

This procedure is used to verify and fine-tune the flowmeter calibration. Every flowmeter is calibrated with water at the factory and stamped with a calibration value. Enter that value as a starting point and use this procedure to fine-tune that value for your specific installation and spraying application. This procedure should be repeated each time a new solution is being applied (*Differing solutions will have a different specific gravities and different flow characteristics*) or when the flowmeter installation has been altered.

PROCEDURE

1. Put enough water in the sprayer tank to perform this test. *(Preferably 100 gallons or more. The larger the volume of water used, the more accurate will be the calibration.)*
2. Start sprayer pump and turn on booms. Run enough water to purge all air from lines. Turn off booms but leave pump running.

To adjust the FLOW CAL value.

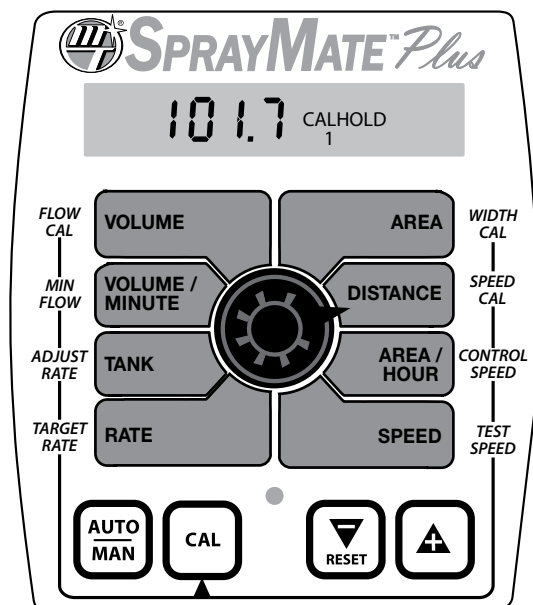
1. Start CALIBRATE (Place console in HOLD and hold CAL switch for 1 sec).
2. Select the FLOW CAL position and use the + and – (RESET) keys to adjust the value.

To fine tune the FLOW CAL value.

1. Set up a calibrated container to capture the flow.
2. Turn the Sprayer on and select the VOLUME/MINUTE position and use the MANUAL to adjust the flow rate to a typical value for your application, and then select Hold to stop the sprayer. (Optional, use TEST SPEED and AUTO to adjust to a typical flow rate.)
3. Empty the calibrated container.
4. Clear a Volume counter by selecting the Volume position and pressing – (RESET) key for 1 second (while still in HOLD). Any of the three Volume counters can be used.
5. Go to RUN to turn the sprayer on and capture the flow.
6. When the calibrated container is full, select HOLD to stop accumulating.
7. Start CALIBRATE (Place console in HOLD and hold CAL switch for 1 sec).

8. Select the FLOW CAL position and the current value will be displayed. Press the CAL switch to toggle the display to show the Volume counter. Pressing the CAL switch will toggle between FLOW CAL value and Volume counter. The CAL icon will turn on when displaying the FLOW CAL value and it will flash when displaying the Volume value.
9. Use the + and – (RESET) keys to adjust the Volume counter until it matches the volume in the calibrated container. This will automatically fine-tune the FLOW CAL value.
10. Press the CAL switch again to toggle the display to show the FLOW CAL value and record it for future reference. Repeat the test to confirm the accuracy.

✱ The most accurate method to measure the volume of water run is to place a container under EVERY nozzle and add together the amount from each nozzle. This assures that 100 percent of the water is collected and that all nozzles are spraying equally. It is important to perform this procedure at a flow rate similar to that which will be used in the field. It is also possible to disconnect the main boom line and run it to a large measuring container but a valve must be installed and properly adjusted to simulate actual field conditions.



Appendix D

Flowmeter Assembly

IMPORTANT: Opening the flowmeter will void the Flowmeter Calibration value assigned to your unit. However, you may need to take the flowmeter apart for periodic cleaning or to remove an obstruction.

If you can shake the flowmeter from end-to-end to produce a “rattling” sound (shaft-end play), or if you can blow into the meter from either end and cause the turbine to spin freely, your flowmeter does not need cleaning. If you cannot hear the “rattling” sound or get the turbine to spin freely, your flowmeter needs to be cleaned. *See Illustrations below for reassembly instructions.*

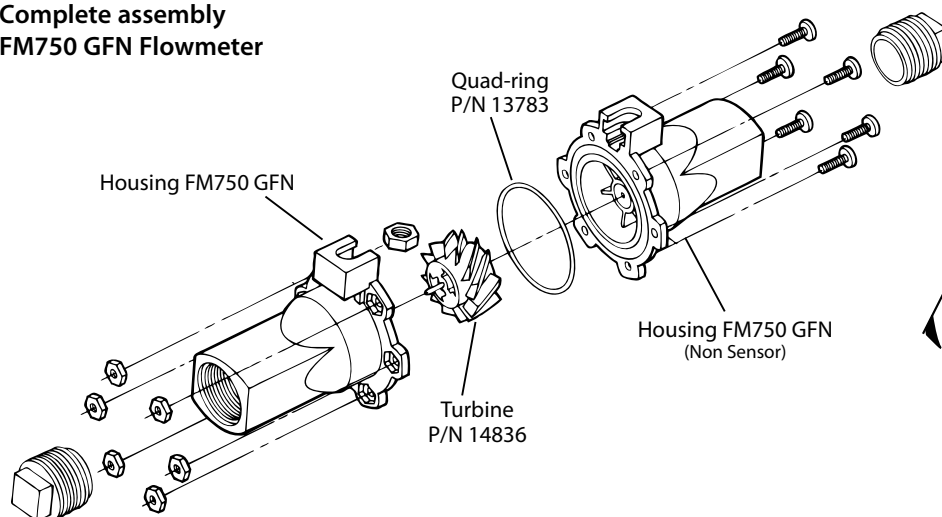
OPENING THE FLOWMETER

Cut the calibration tag retaining wire. Remove the screws and disassemble the flowmeter. **Do not attempt to remove the sleeve bearings from the flowmeter housing.**

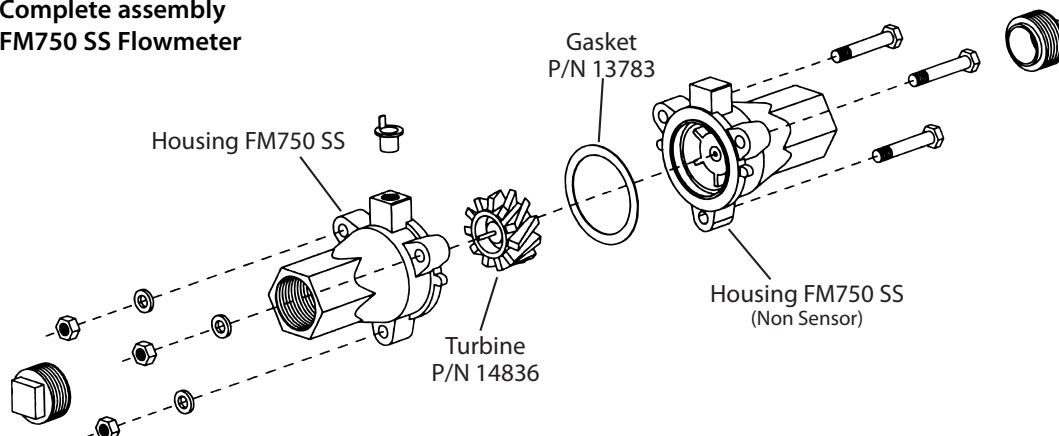
Use warm water and if necessary, a mild detergent and a soft bristle brush to clean all parts. **Do not use solvents or diesel fuel to clean the flowmeter.** A magnet works well for removing fine metallic particles from the turbine.

Inspect all parts. Check for excessive bearing or shaft wear. The shaft will wear shorter until the turbine drags on the housing. *Illustration 18* shows you what a new shaft looks like. When the shaft is worn to the point of drag, the turbine must be replaced.

Complete assembly FM750 GFN Flowmeter



Complete assembly FM750 SS Flowmeter



On a flat surface, place each housing half on end. Set and spin the turbine in each half. It should spin freely. If it does not spin freely, remove the turbine, wipe the shaft and try again. If it still does not spin freely, the shaft or bearings may have excessive wear. (Service may be necessary.)

ASSEMBLING THE FLOWMETER

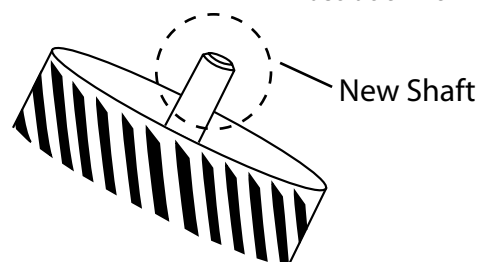
Stainless steel meters use a Teflon gasket. Sealants are normally not required. Plastic meters use an o-ring (Quad-ring). Apply a small amount of silicon grease for lubrication. Gaskets and o-rings may be reused several times but eventually may need replacement.

Place the turbine in the non-sensor housing. Position gasket/o-ring; carefully place sensor housing over turbine. Drop all screws into holes. Hold nuts (and lock washers on stainless meters) in place and finger-tighten screws. Ensure proper placement of gasket / o-ring and evenly tighten all screws. Attach tag.

After assembly, shaking flowmeter end-to-end should produce a “rattling” sound (shaft end play). Blowing into the meter from either end should cause the turbine to spin freely. If the turbine only spins from one direction, install the flowmeter so that the liquid flows in that direction (service may be required).

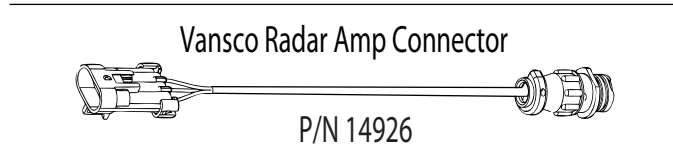
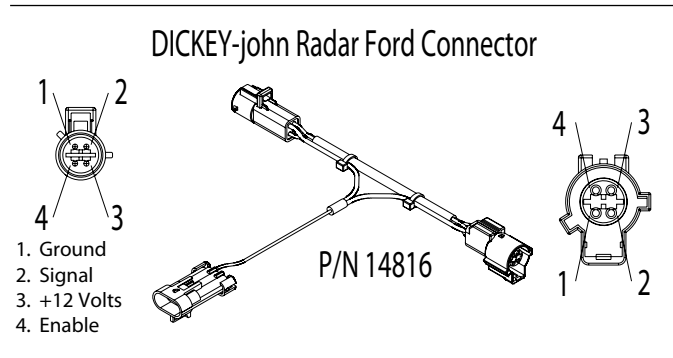
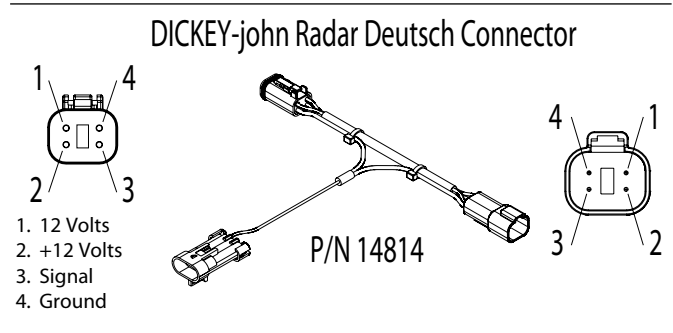
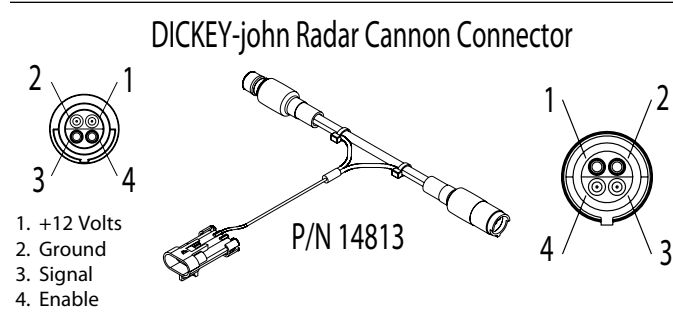
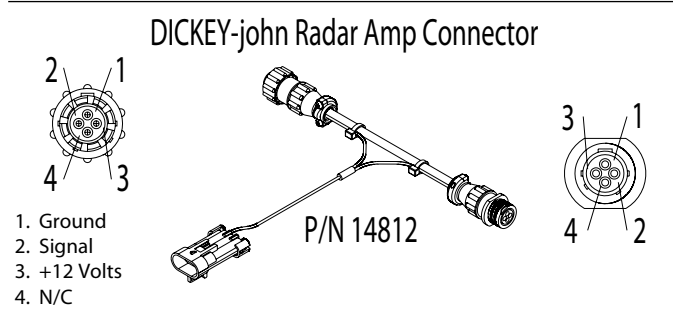
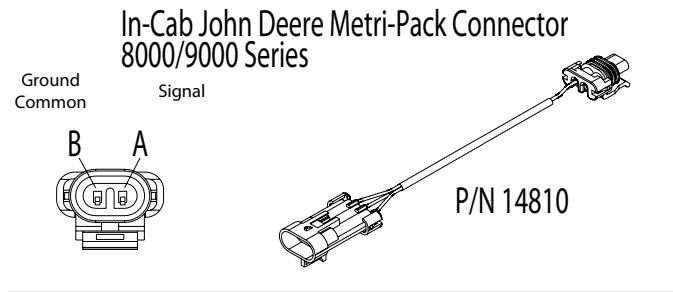
For maximum accuracy the flowmeter should be mounted in a vertical position. Recalibration is required before field operation.

Illustration 18

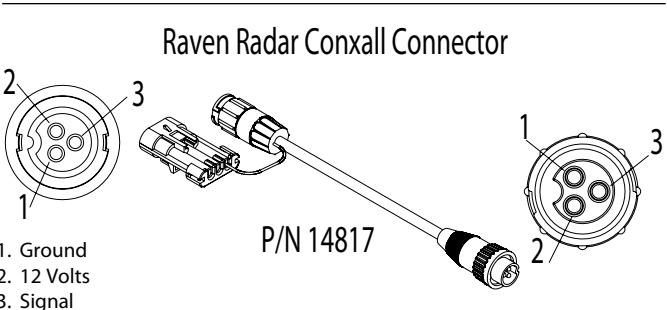
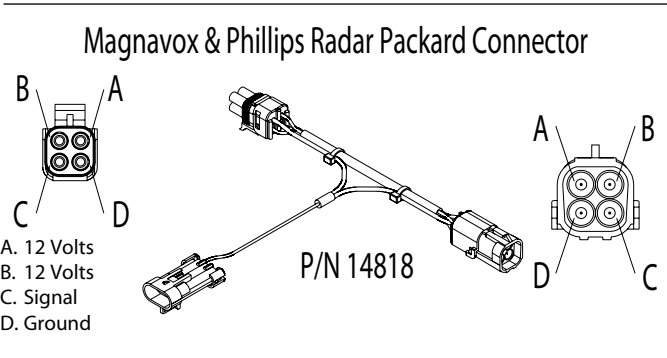
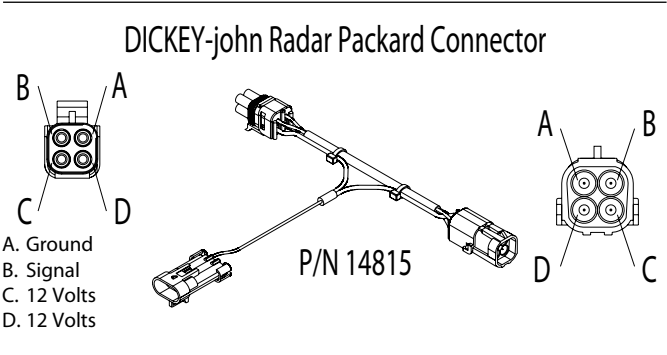
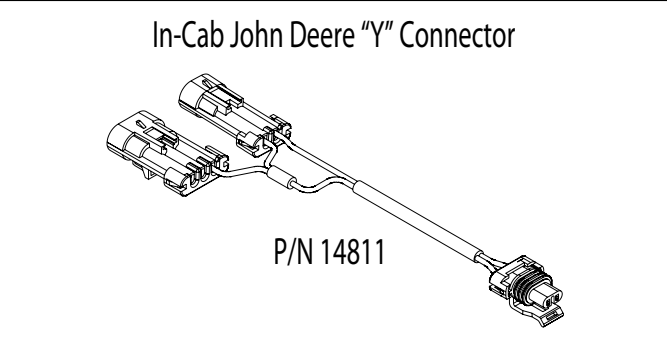


Appendix E

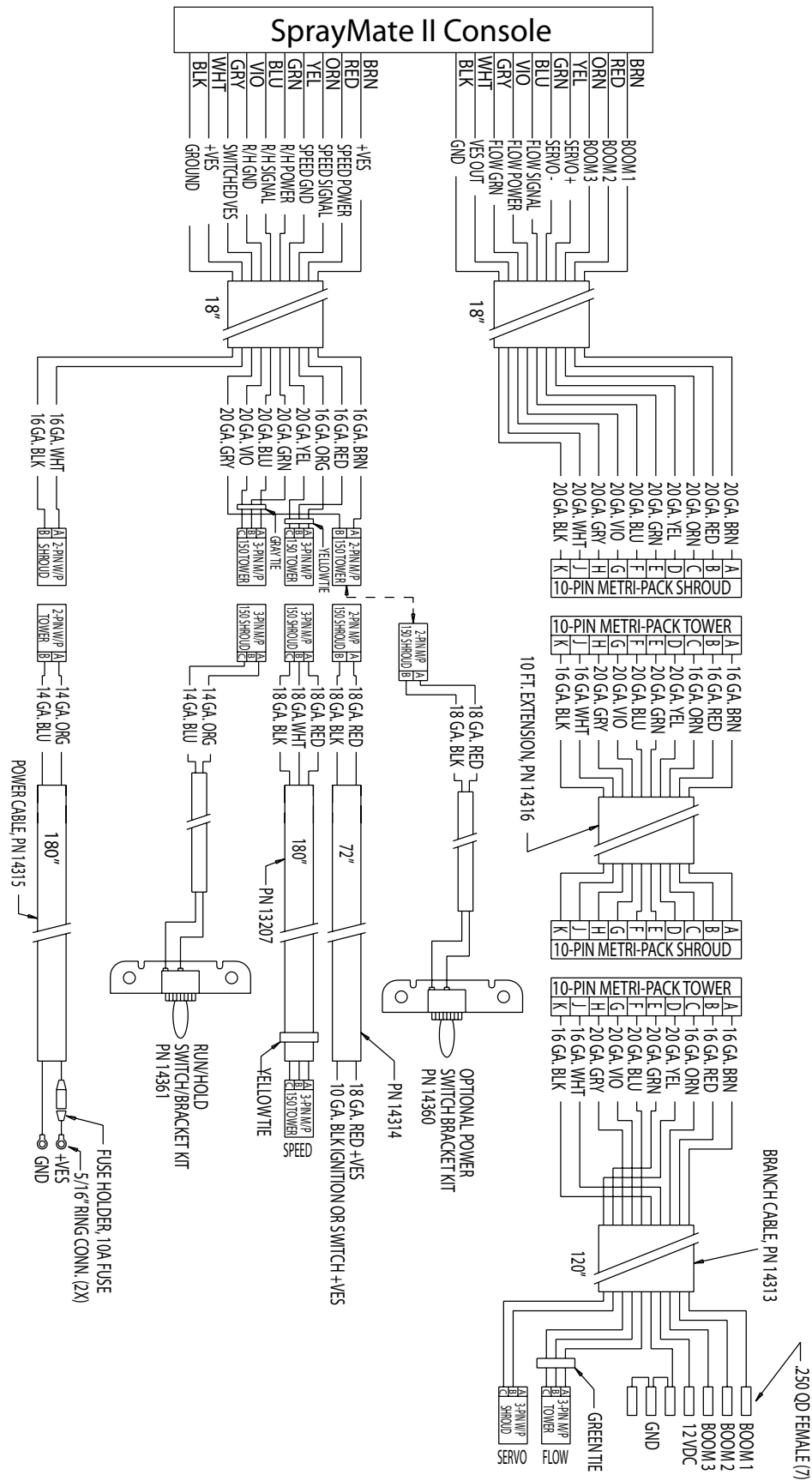
Radar Adapter Cables



RADAR	CONNECTOR	SIGNAL PIN
DICKEY-john	Amp	2
DICKEY-john	Cannon	3
DICKEY-john	Deutsch	3
DICKEY-john	Ford	2
DICKEY-john	Packard	B
In-Cab JD (8000 & 9000's)	Metri-Pack	A
Magnavox & Phillips	Packard	C
Raven	Conxall	3
Vansco	Amp	2



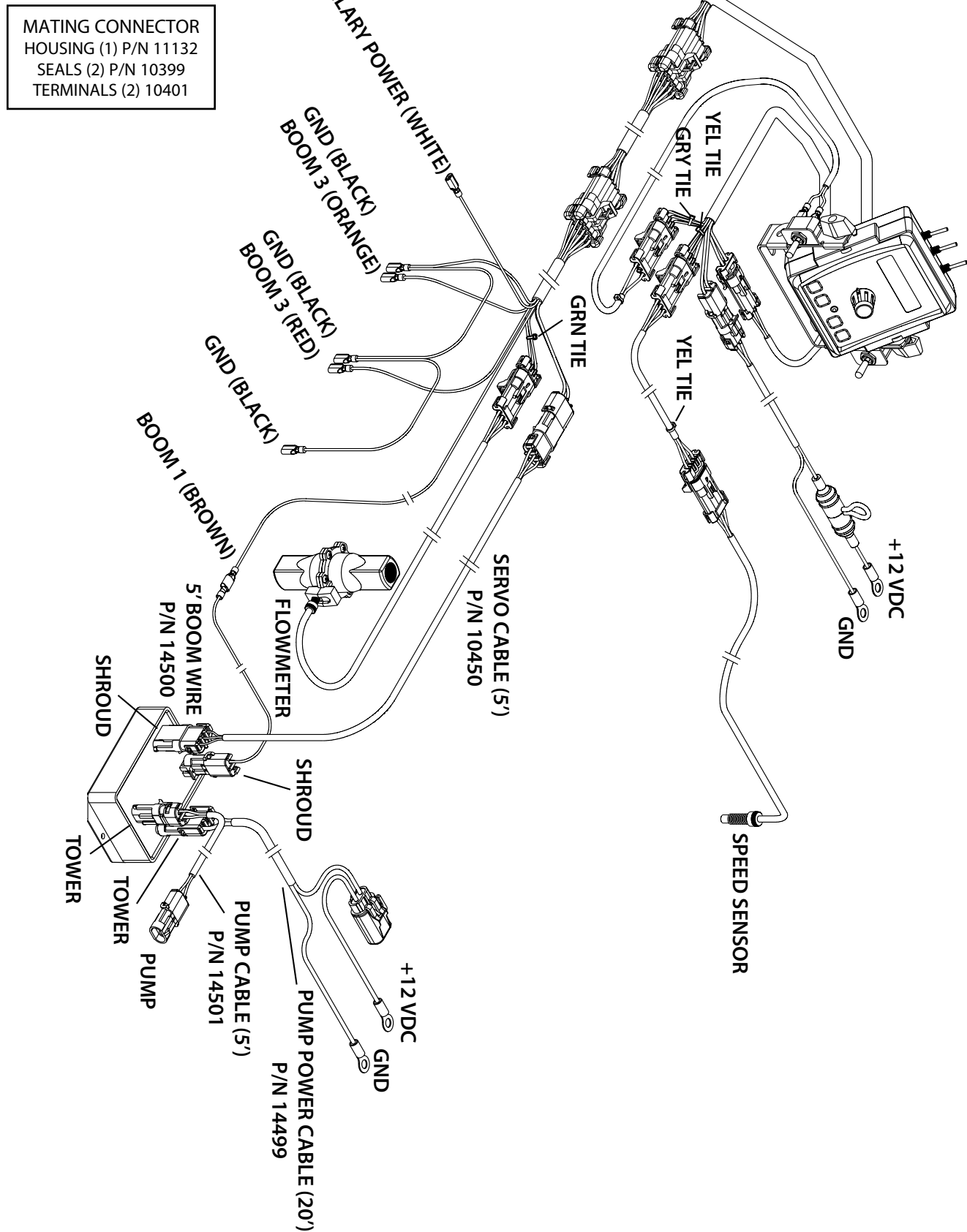
SprayMate™ Plus Wiring Diagram



Appendix G

EMD (Electric Motor Driver) SprayMate™ II

System Diagram



Appendix G (cont)

Pump Motor (EMD) Module 40 Amp Standard Version

The Electric Motor Driver Module (EMD) replaces the servo valve. System flow is controlled by regulating the pump speed.

MODULE INSTALLATION

NOTE: The mounting surface must be cleaned so it is free from dirt, moisture and oil residues. Failure to clean the mounting surface may result in the EMD working loose.

Remove the backing from the Dual-Lock™ fasteners and attach to the bottom of the EMD unit. Position the EMD where wiring will work the best. Extension cables are available. Firmly press the EMD into place. Secure the EMD to the equipment using plastic cable ties to prevent the EMD from coming into contact with moving parts if the Dual-Lock™ fasteners should work loose. If desired, the EMD can be fastened with screws, using the holes in the mounting flanges.

ELECTRICAL INSTALLATION

This section explains how to hook-up your EMD to a 12-volt power connection, and how to connect your EMD to your controller harness.

The EMD **MUST** be connected to a 12-volt DC negative ground electrical system.

POWER BATTERY CONNECTION

Locate the power cable, P/N 17871 and route to the battery. In routing cable avoid areas where the cable may be subjected to abrasion or excessive heat. Attach the BLACK wire (ground) to a screw or bolt on the equipment frame. See Illustration to the upper right. Be sure there is a good metal-to-metal contact. Connect the ORANGE wire to the positive battery terminal.

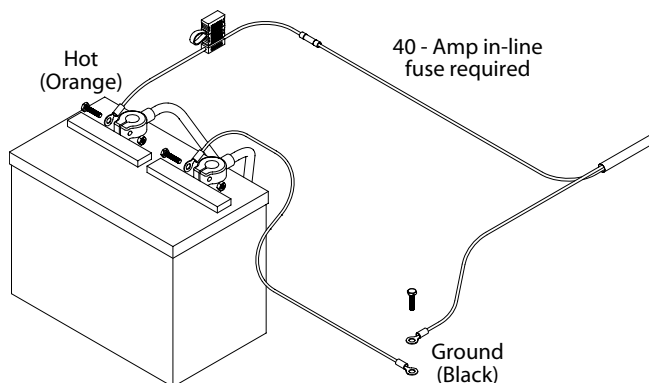
Connect the power to the EMD by plugging the 2-pin M/P tower on the power cable into the 2-pin M/P shroud of the EMD module.

SIGNAL AND MOTOR CONNECTIONS

Locate the boom wire, P/N 17279. Plug the 2-pin W/P shroud into the mating connector on the EMD module and plug the 3-pin W/P shroud into the Boom 1 connector on the controller harness. If necessary, remove the 3-pin W/P shroud and crimp P/N 10657 red quick-disconnect terminal into end of wire.

NOTE: be sure to route cables away from sharp edges, areas of high heat and moving parts. Secure all cables firmly with plastic cable ties.

Locate the servo cable P/N 10450. Connect the 3-pin W/P shroud to the 3-pin W/P tower on the EMD module. Connect the other end of the cable to the mating connector on the controller harness.



Locate the motor cable P/N 17872. Plug the 2-pin M/P 280 shroud into the 2-pin M/P 280 tower EMD module. Connect the other end to the pump. Ensure that the pump is running in the correct direction. If not, simply reverse the wires from the pump to the pump cable.

See next page for applicable diagram.

NOTE: MICRO-TRAK CONSOLE MUST BE SET FOR "BYPASS" OPERATION.

FUNCTIONS OF SYSTEM STATUS LED

1. On steadily if switch is on and controller is operating normally.
2. Flashes steadily when in **HOLD**.
3. If there is a problem with the wiring or motor, the light will flash to indicate the system status.
 - If the console shuts down due to thermal overload due to a shorted motor or motor leads, the lamp will flash twice, pause, flash twice, pause, etc.
 - If other system problems occur requiring a call to Micro-Trak Service, please count the number of flashes to help with troubleshooting.

NOTE: Micro-Trak Systems, Inc. can be reached at 800-328-9613.

FUNCTION OF CONTROL SIGNAL STATUS LEDS

- Green LED lights when servo signal is present and increasing
- Red LED lights when servo signal is present and decreasing

Appendix H

Conversion Chart

English to Metric		
When You Know	Multiple By	To Find
LINEAR MEASUREMENT		
inches	25.4	millimeters
feet	0.305	meters
yards	0.914	meters
miles	1.61	kilometers
LAND MEASUREMENT		
square inches	645.16	square millimeters
square feet	0.093	square meters
square yards	0.836	square meters
acres	.405	hectares
square miles	2.59	square kilometers
LIQUID MEASUREMENT		
fluid ounces	29.57	milliliters
pint	0.473	liters
quart	0.946	liters
gallons	3.785	liters
VOLUME		
cubic feet	0.028	cubic meters
cubic yards	0.765	cubic meters
DRY MEASUREMENT		
quart	1.101	liters
peck	8.810	liters
bushel	35.239	liters
FUEL CONSUMPTION		
10 miles per gallon = 4.25 kilometers per liter		

Metric to English		
When You Know	Multiple By	To Find
LINEAR MEASUREMENT		
millimeters	.039	inches
meters	3.28	feet
meters	1.09	yards
kilometers	.62	miles
LAND MEASUREMENT		
square millimeters	0.00155	square inches
square meters	10.764	square feet
square meters	1.195	square yards
hectares	2.47	acres
square kilometers	0.386	square miles
LIQUID MEASUREMENT		
milliliters	0.034	fluid ounces
liters	0.529	pint
liters	0.264	quart
liters	2.64	gallons
VOLUME		
cubic meters	35.314	cubic feet
cubic meters	1.307	cubic yards
DRY MEASUREMENT		
liters	1.101	quart
liters	8.810	peck
liters	35.239	bushels
FUEL CONSUMPTION		
10 kilometers per liter = 23.5 miles per gallon		

Conversion Abbreviations

Symbols	Symbols	Symbols
in. = inches	pt. = pint	km = kilometers
ft. = feet	qt. = quart	mm ² = square millimeters
yd. = yards	gal. = gallon	m ² = square meters
mi. = miles	ft ³ = cubic feet	ha = hectares
in ² = square inches	yd ³ = cubic yards	km ² square kilometers
ft ² = square feet	pk. = peck	ml = milliliters
yd ² = square yards	bu. = bushel	l = liters
mi ² = square miles	mm = milliliters	dal = dekaliters (10 liters)
fl oz. = fluid ounces	m = meters	m ³ = cubic meters

Appendix I

Replacement Parts List

The following replacement parts are available from your dealer or distributor or from:

Micro-Trak Systems, Inc.
P.O. Box 99, 111 East LeRay Avenue
Eagle Lake, MN 56024-0099

When ordering parts, please list the model number of your console, and the description and part number of each part that you want to order.

PART NUMBER DESCRIPTION

12069	Magnet kit (6 magnets per kit)
10013	Speed sensor mount bracket
12910	14" Black plastic cable ties (bag of 10)
13181	Console mount kit*
12888	Console mount knob
12889	Console mount washer
13096	5-foot Hall-effect Speed/Flow Sensor Cable with threaded sensor, nut and female connector
13226	5-foot remote run/hold sensor cable
01531	Speed sensor kit
01535	Remote run/hold sensor kit
14928	1" Micro-Trak electric servo valve
11501	FM750 GFN Flowmeter
10131	FN750 SS Flowmeter
14315	Power cable
14313	Flow, servo, boom harness
14314	6-foot Ignition Cable
14311	SprayMate™ II NH3 Adapter Cable
14360	SprayMate™ II Power (On/Off) Switch Kit
14361	SprayMate™ II Run/Hold Switch Kit
10899	FM750N Flowmeter - NH3 ONLY
14348	FM1500N Flowmeter - NH3/Liquifier
14958	NH3500 Servo
14959	Liquifier Servo
21353	NH3 Servo Gear-head Assembly

Optional 2-Pin, 3-Pin and 10-Pin Metri-Pack 150 extension cables:							
Part No.	M/P 2-Pin	Part No.	M/P 3-Pin	Part No.	M/P 5/5 10-Pin	Part No.	W/P 3-Pin
13200	5-foot	13205	5-foot	14363	5-foot	10450	5-foot
13201	10-foot	13206	10-foot	14316	10-foot	10449	10-foot
13202	15-foot	13207	15-foot	14317	15-foot	10876	15-foot
13203	20-foot	13208	20-foot	14364	20-foot	10829	20-foot
13204	25-foot	13209	25-foot	14365	25-foot	011462	25-foot

*The Console Mount Kit is available only as a kit, some parts are not available in individual components.
 Parts and design specifications subject to change without notice.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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