

SprayMate™ II

AUTOMATIC RATE CONTROLLER



REFERENCE MANUAL



MICRO-TRAK®
SYSTEMS, INC.

SprayMate™ II

AUTOMATIC RATE CONTROLLER

REFERENCE MANUAL

SprayMate™ II 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™ II 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™ II, 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

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MICRO-TRAK®
SYSTEMS, INC.

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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.

Buyer accepts these terms and warranty limitations unless the product is returned to Seller, via proper distribution channels and approved return authorization, with dated proof-of-purchase, transportation prepaid, within fifteen (15) days from the date-of-purchase for refund of the purchase price.

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 enclosed registration card(s) for this product and mail it in and we'll extend your warranty for up to three years*, at no additional charge.

MAIL IN YOUR REGISTRATION CARD(S) TODAY!

Registration Card 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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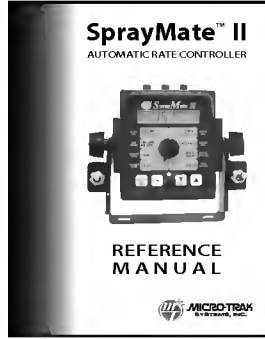
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Component Parts and Assembly Hardware

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

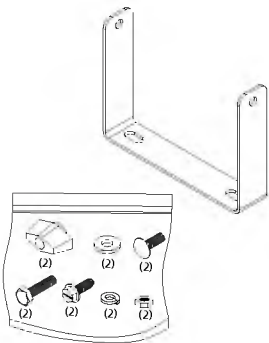


SprayMate™ II Console
P/N 14869

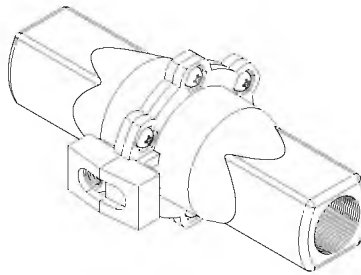


Owner's Manual
P/N 14943

5' Hall-effect Flow Sensor Cable with threaded sensor - P/N 13096



Console Mount Kit
P/N 13181



FM750 GFN Flowmeter
(P/N 11501)

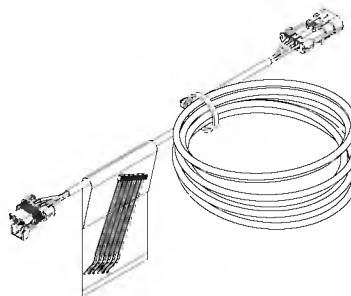


M-T 1" Electric Servo Valve
P/N 14928

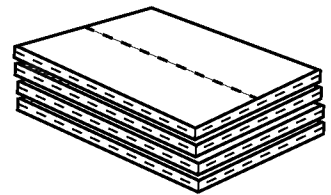
Speed Sensor Kit P/N 01531 (1)

Including items A-F, below:

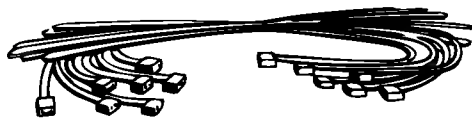
A. 5' Hall-effect Speed/Flow Sensor Cable - P/N 13096



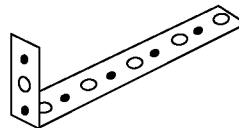
E. Magnets (6) - P/N 12069 (2 in hardware bag)



C. 15' 3-Pin Extension Cable M/P 150 - P/N 13207



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

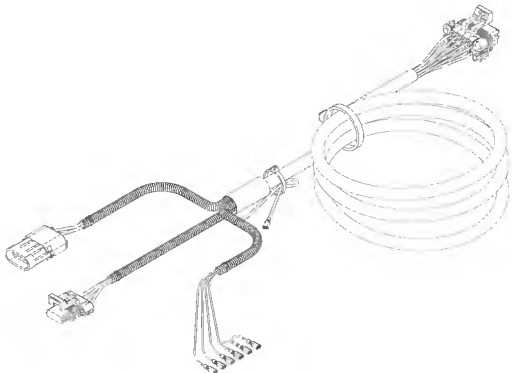


D. Speed sensor mounting bracket P/N 10013

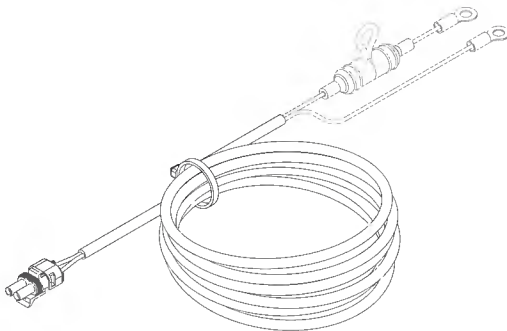


F. Hardware Bag P/N 13251

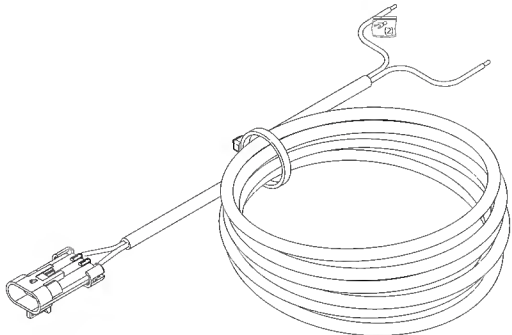
Component Parts and Assembly Hardware (cont)



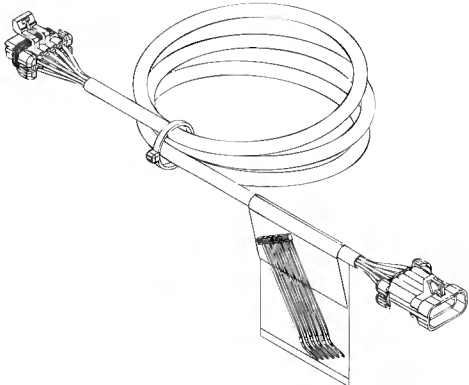
Boom/ Servo/Flow Harness
P/N 14313



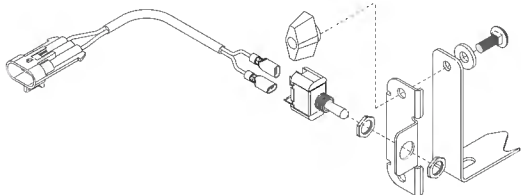
Power Cable
P/N 14315



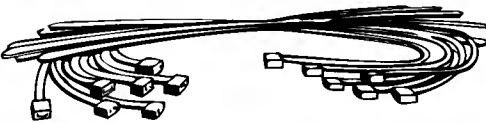
72" Ignition Cable
P/N 14314



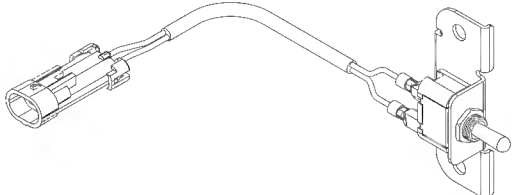
120" 10-pin extension cable
P/N 14316



Kit, Run/Hold Switch
P/N 14361

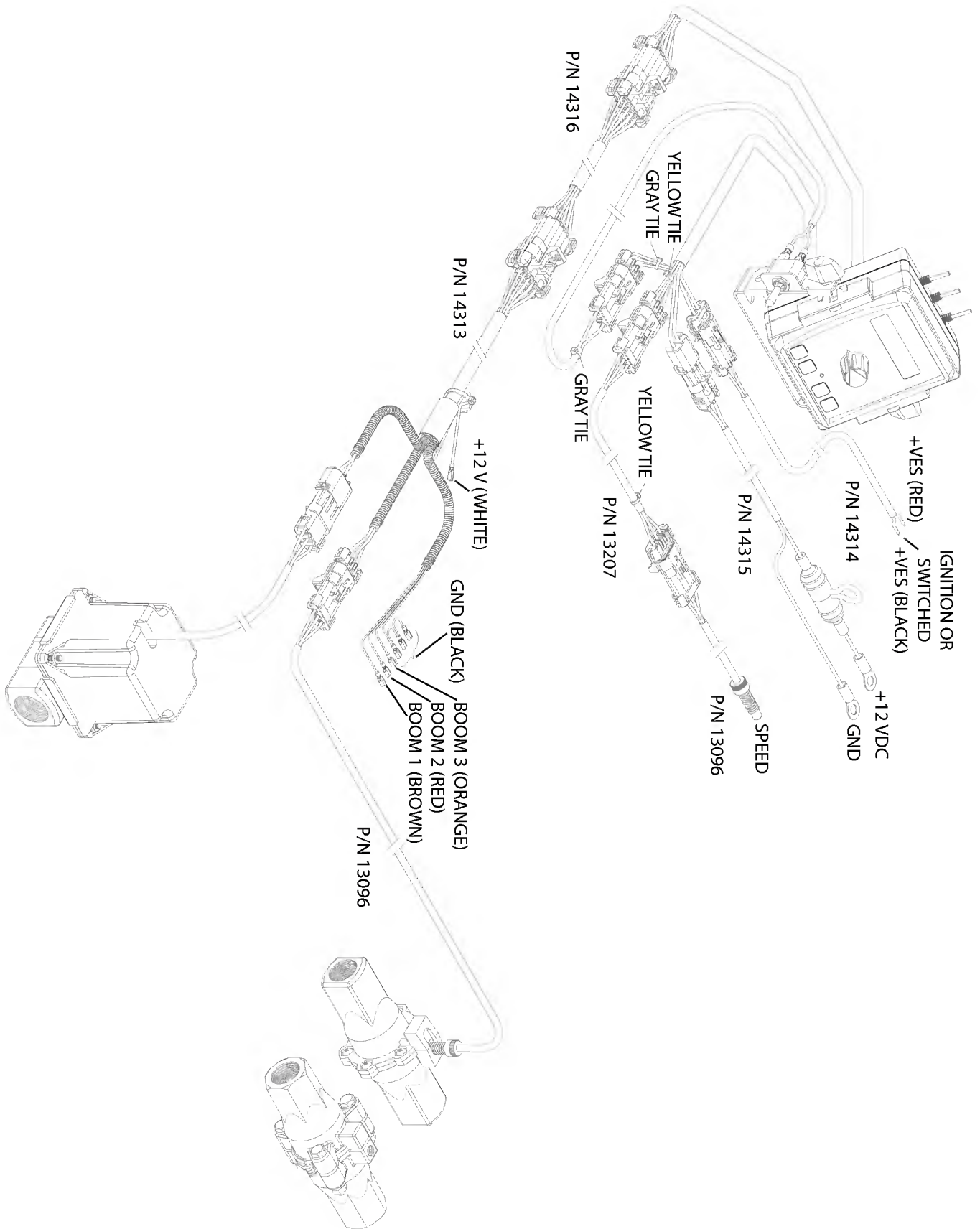


14" Nylon cable ties (10)
P/N 12910

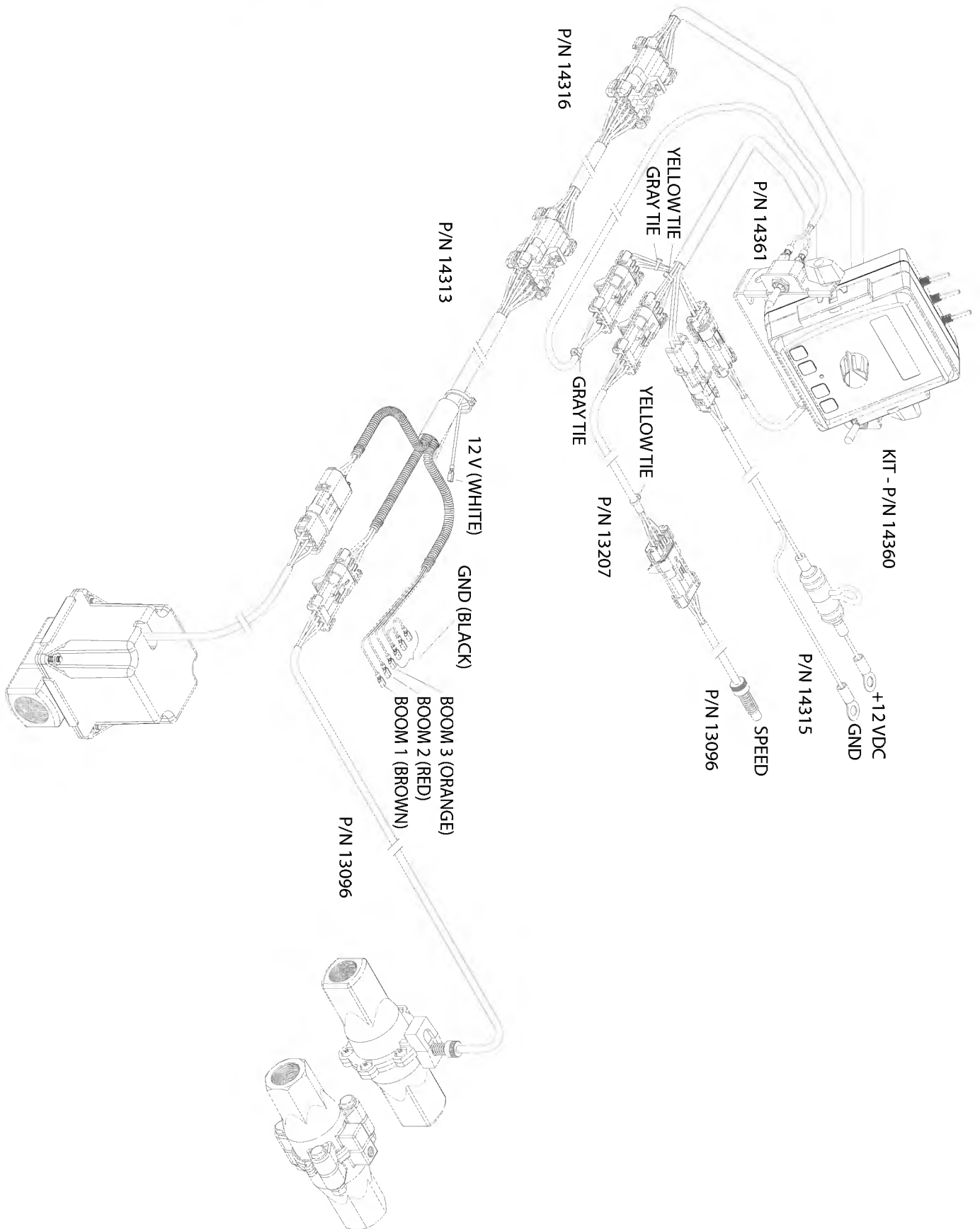


Kit, Power Switch
P/N 14360

SprayMate™ II System Diagram (with ignition switch hookup)



SprayMate™ II System Diagram (with optional Power switch)



Installation

Mounting the Display Console

Select a mounting location which seems most workable, and that 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 selected location, mark holes, drill 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. Loosely attach the mount knobs onto the bolts. Place console over carriage bolt heads and tighten knobs to secure the console. See *Illustration 1B*.

Tools Needed to Install SprayMate II™	
• Screwdrivers	• Pliers
• Set of Wrenches	• Wire Cutter
• Electric Drill and Bits	• Center Punch
• 12-Volt Test Light	• Hammer

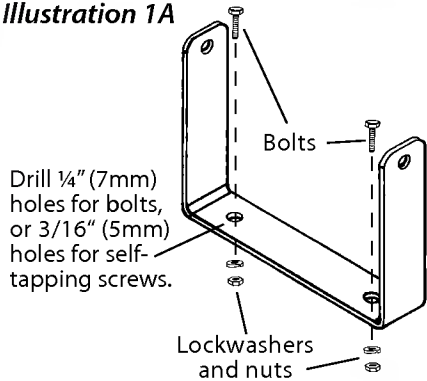
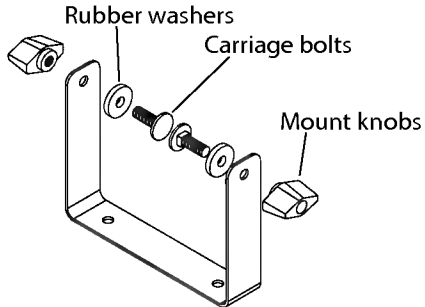
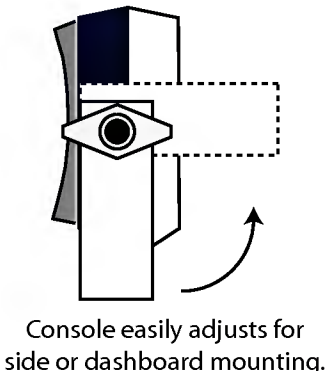


Illustration 1B



CONSOLE END VIEW

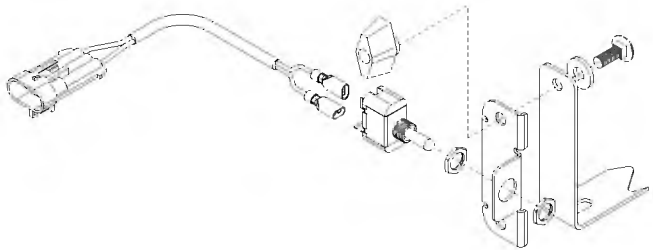


Attaching the Power and Run/Hold Control Switches

Mounting the Run/Hold Switch Kit

Remove the mount knob from either side of the console. Install the bracket over the carriage bolt and along side the console bracket. Install the mount knob on the carriage bolt and tighten to secure the console and run/hold switch bracket in place.

Install the switch in the bracket and attach the quick disconnects on the switch harness to the switch. Then install the switch harness connector into the mating connector (*gray tie*) on the console harness. Install the Console Power Switch (P/N 14360) in the same fashion.



Console Run/Hold Switch Bracket

Installation (cont)

Electrical

This section explains how to connect your SprayMate™ II to a 12-volt power source, and how to connect your boom shut-off valves.

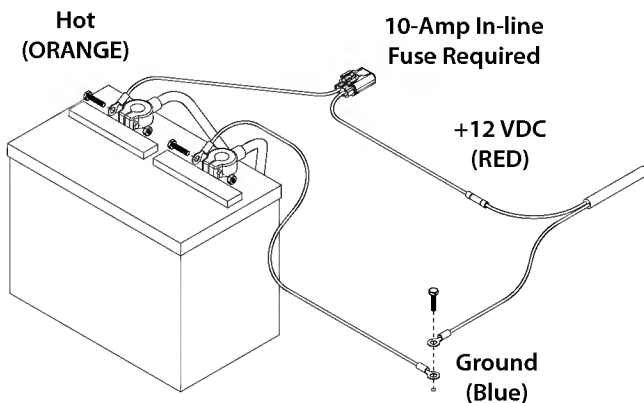
NOTE: The SprayMate™ II must be connected to a 12-volt DC negative ground electrical system.

POWER/BATTERY CONNECTION:

Locate the power cable for the SprayMate II and route to the battery. When 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™ II console by plugging the 2-pin W/P tower on the power cable into the 2-pin W/P shroud of the display console.

Illustration 2



Carefully route power cable to a 12VDC source

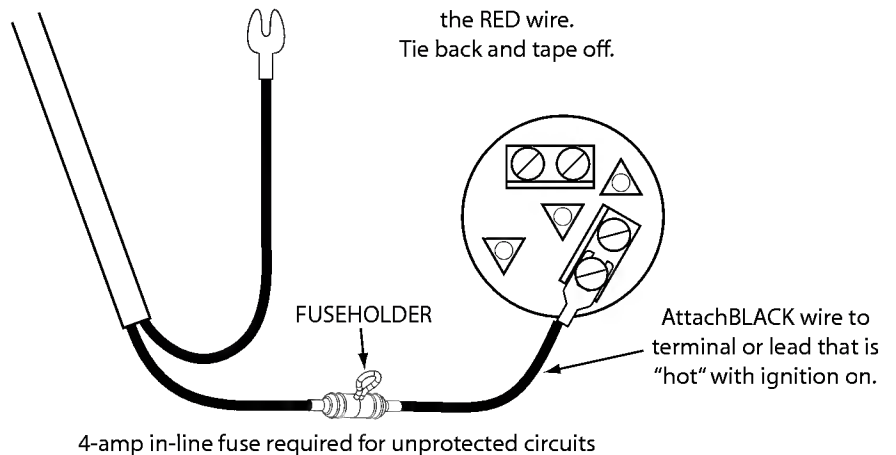


Illustration 3

ON/OFF SWITCH CONNECTION

The SprayMate™ II system includes a provision for either using a switched (ignition) source or an optional power switch to turn the system on.

If the optional power switch is used, simply mount the switch bracket as shown on page 7, 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, route the ignition cable (P/N 14314) from the console to the switched source, plug the connector into the mating plug for the console and connect the black wire to the switched power source as shown in *Illustration 3* (terminal or wire). Do NOT connect the red wire. Use your test light to locate a terminal or wire connected to your ignition switch which is "hot" when the ignition is turned on and "dead" when the ignition is off.

Your SprayMate™ II is equipped with a non-volatile 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.

Connecting to ignition to turn SprayMate II system on/off.

Installation (cont)

SprayMate II Boom Connections

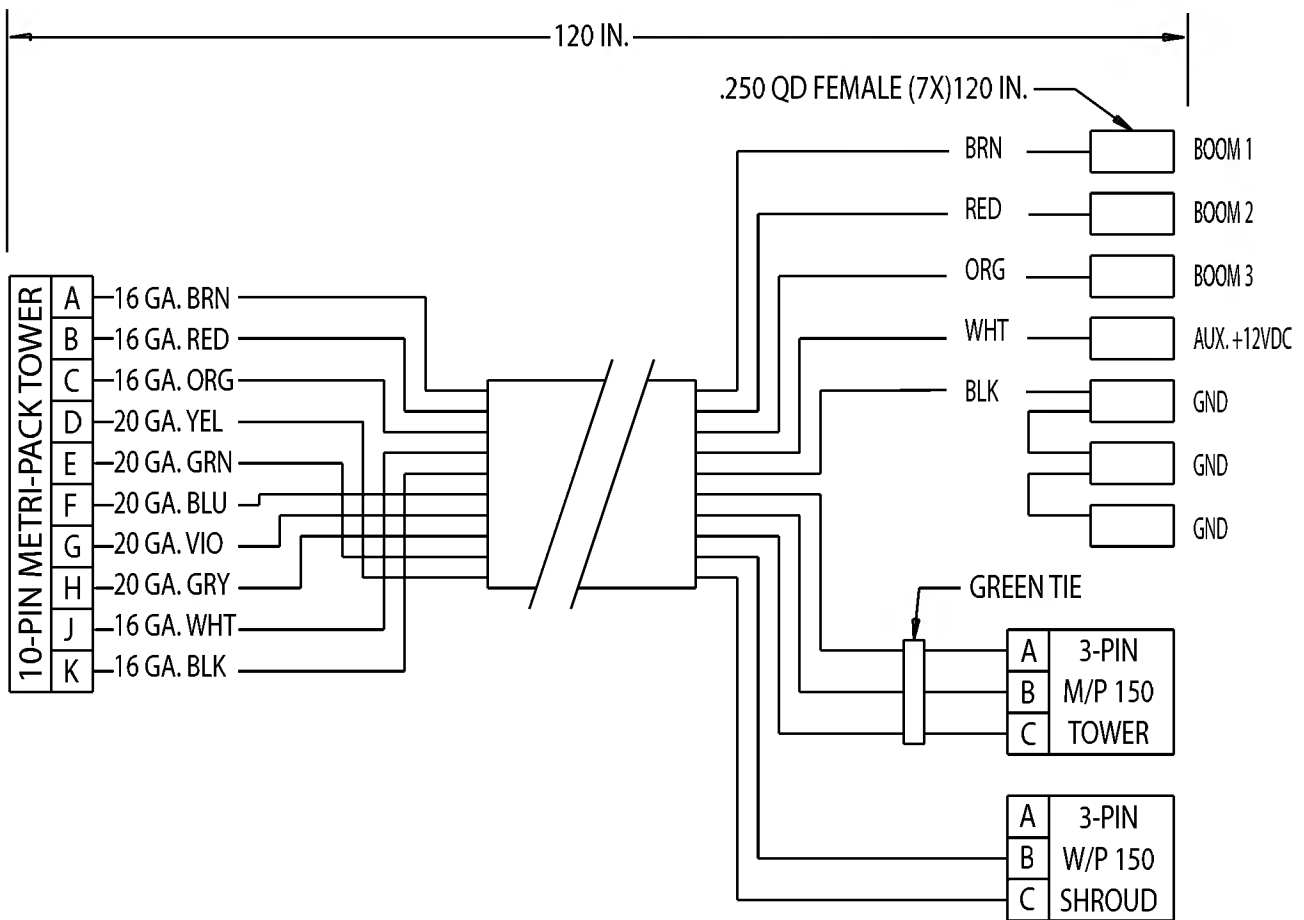
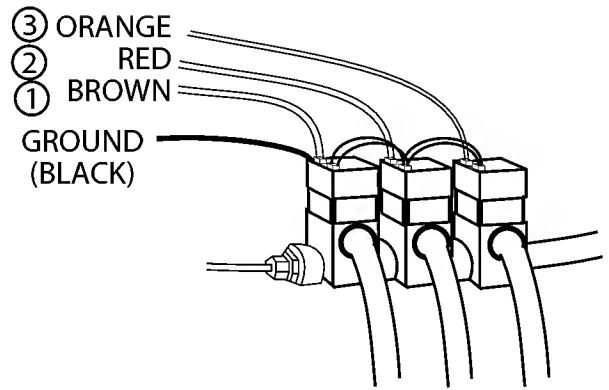
BOOM SHUT-OFF VALVES

Locate solenoid boom valve wires. Connect cables to appropriate booms. Apply silicone grease to solenoid terminals to avoid corrosion.

Connect ground wire tabs to ground connections on valves.

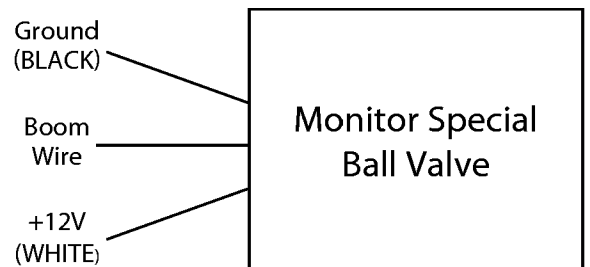
Note: 16-gauge WHITE wire is auxiliary power for use with motorized ball valves ONLY. Tie back and tape off to avoid shorting (if not used).

Illustration 4A



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

Illustration 4B



Installation (cont)

Speed Sensor Installation

Please Note: If you have purchased an Astro GPS Speed Sensor or a Vansco radar speed sensor, disregard the following section on magnetic speed sensors and install the speed sensor as described in the instructions included with the unit. You may need an adapter cable to connect to some radars, see Appendix E.

Locations where the sensor may be installed:

1. Non-driven wheel on tractor, vehicle or implement. This is less susceptible to errors resulting from wheel slip.
2. Tractor, vehicle or planter drive shaft. This type of mounting is recommended for trucks, four-wheel drive tractors or other equipment that has poor or no access to a non-driven wheel.

Locate the Following Parts

- Speed sensor cable (Green body)
- Mounting "L" bracket
- Magnets
- Cable ties

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 (centimeters).

See the following tables to find the minimum number of magnets required (always an even number)

English or Turf (inches)

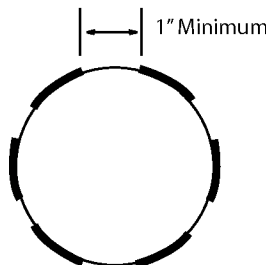
Wheel Circumference	40	80	120	160	200
Number of Magnets	2	4	6	8	10

Metric (cm)

Wheel Circumference	100	200	300	400	500
Number of Magnets	2	4	6	8	10

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

Illustration 5C



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.**

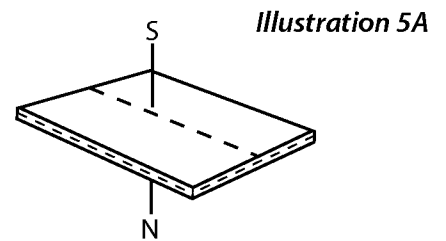
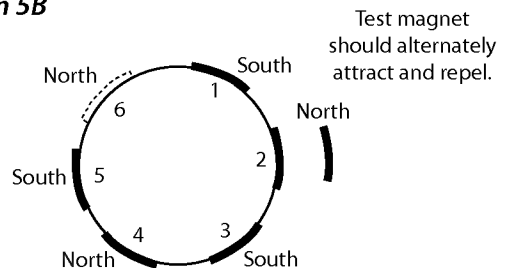


Illustration 5B



Installation (cont)

Speed Sensor Installation (cont)

Attaching the Speed Sensor

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™ II 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 requirements shown in *Illustration 6*.

NOTE: Observe magnet polarities (see previous section).

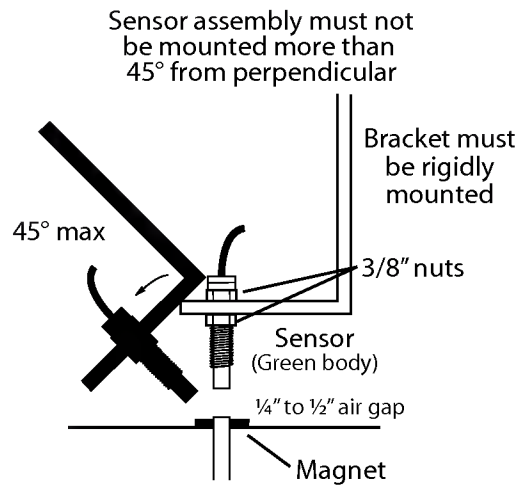


Illustration 6

Connecting the Speed Sensor Cable

The speed sensor cable has a GREEN sensor body and mates with the 3-pin connector which is marked with a yellow cable tie. 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 3-pin M/P connector with the YELLOW tie and flow sensor always connects to the 3-pin M/P connector with the GREEN tie. See *SprayMate II 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™ II 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

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

Astro GPS Speed Sensor

The Astro is an easy-to-install economical alternate to radar speed sensors. The Astro is available with either a 1 HZ or 5 HZ GPS receiver. The sensor converts GPS signals to a pulsed speed signal, providing an accurate speed input even in conditions where radar does not perform well.

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.

GPS Speed Sensor Interface

The SprayMate™ II may also be used with most other GPS speed sensors that output a pulsed signal, such as SkyTrak or Dickey-John GPS speed sensors. An adapter cable may be required.

SEE APPENDIX E FOR LIST OF ADAPTER CABLES FOR RADAR.



Astro GPS Speed Sensor



Vansco Radar Speed Sensor

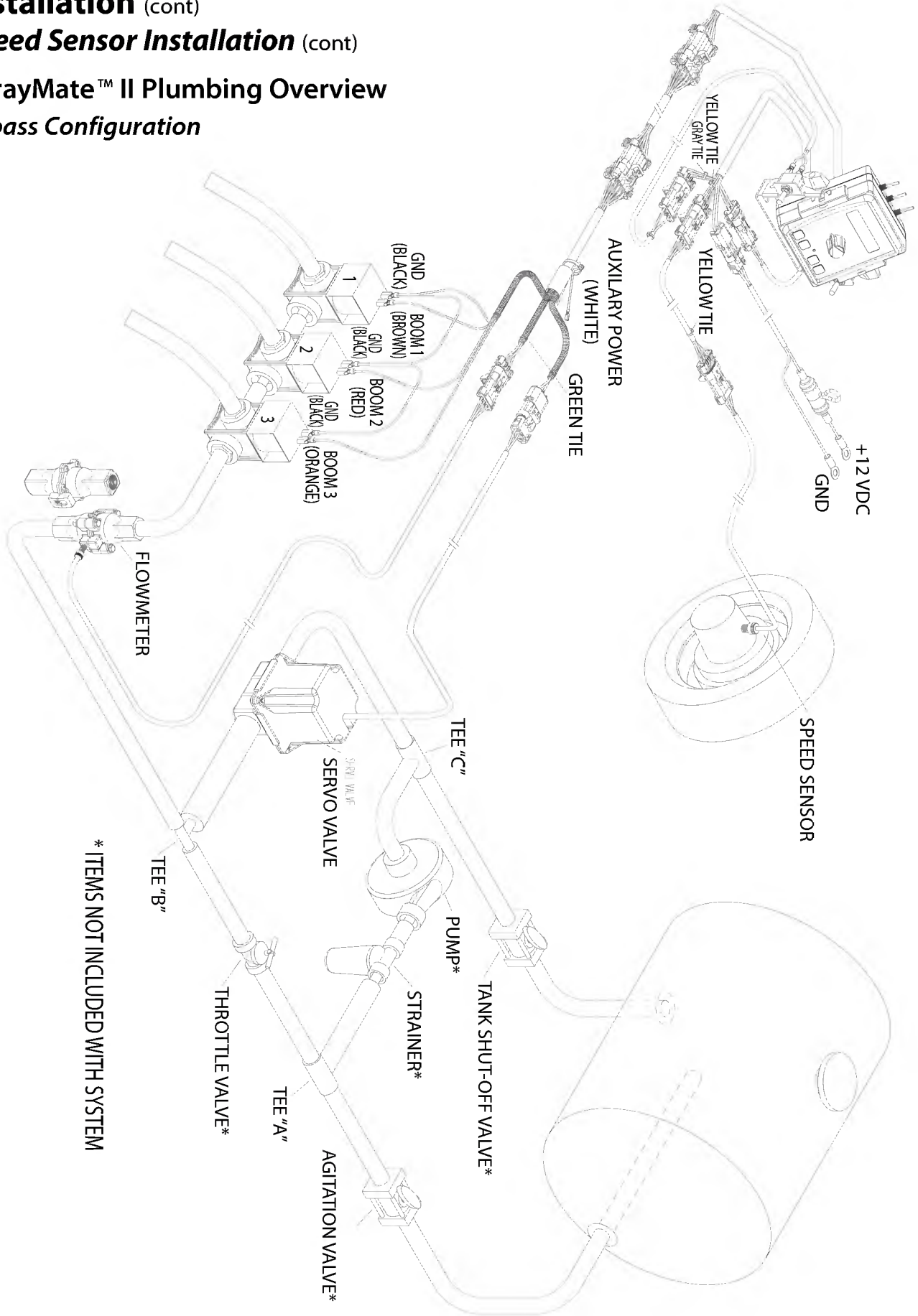
Contact a Micro-Trak sales representative for details on any of these products, or call Micro-Trak Systems, Inc. at 1-800-328-9613.

Installation (cont)

Speed Sensor Installation (cont)

SprayMate™ II Plumbing Overview

Bypass Configuration

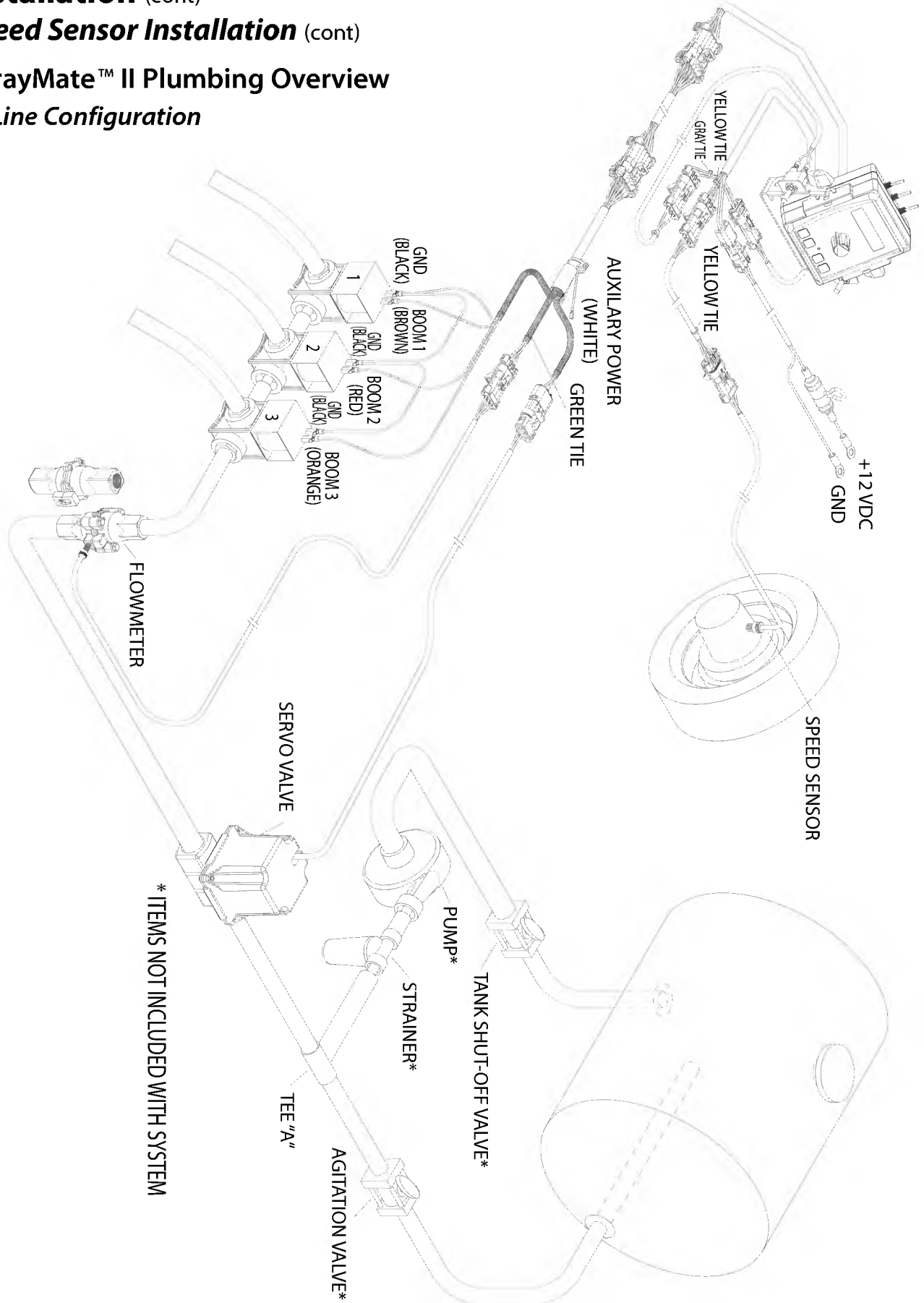


Installation (cont)

Speed Sensor Installation (cont)

SprayMate™ II Plumbing Overview

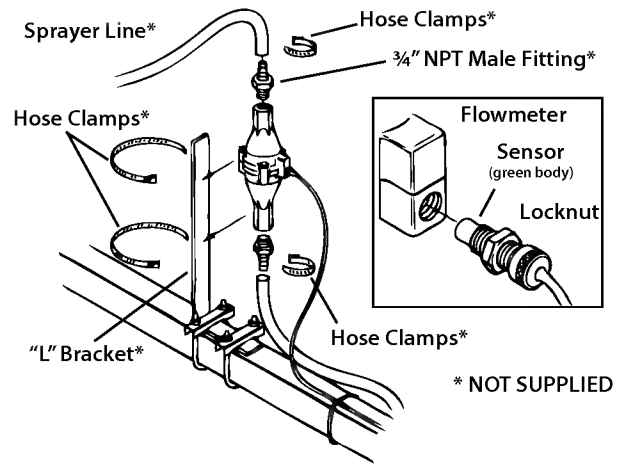
In-Line Configuration



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.*)



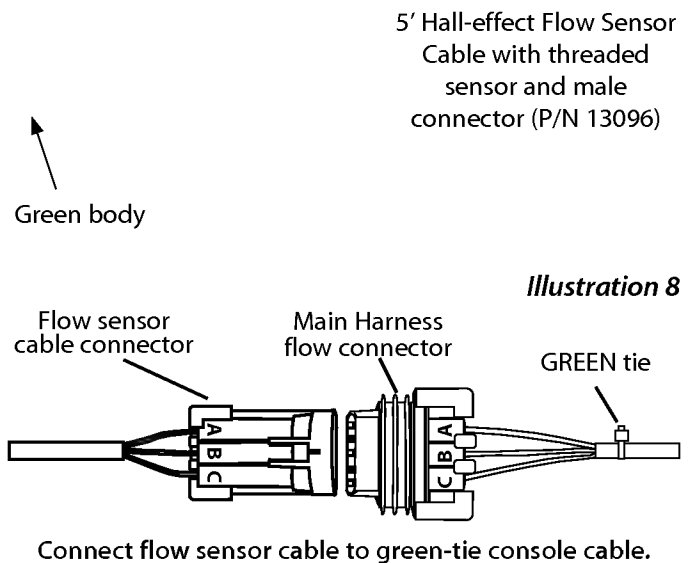
Installing Flow Sensor Cable

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.

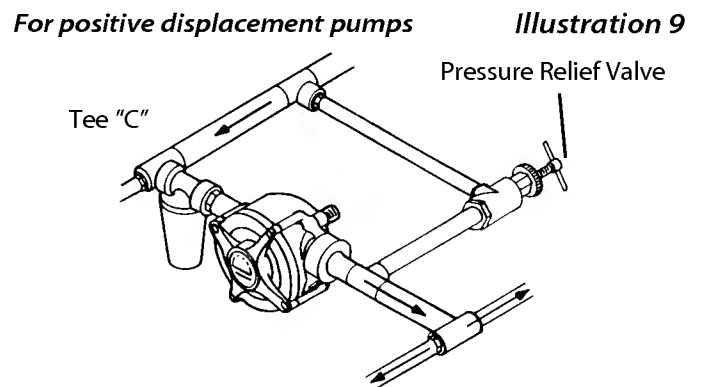
Uncoil flow sensor cable and carefully route it to meet the main harness flow connector marked with GREEN tie. Align connectors and press firmly together until locking tab clicks into place. Secure cable with ties provided. *See Illustration 8 and SprayMate™ II Wiring Diagram on page 10.*

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.*

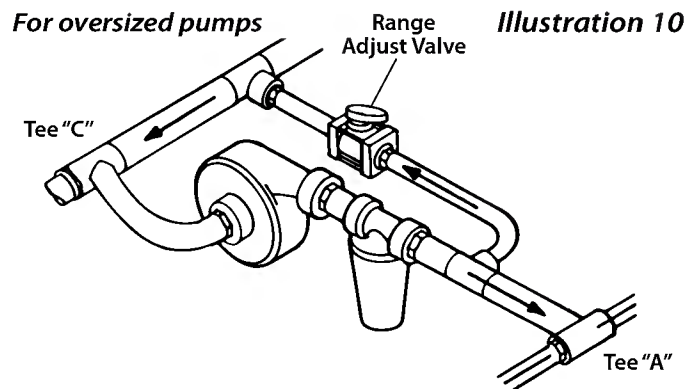


Installation (cont)

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 33-34. See *Illustration 10*.



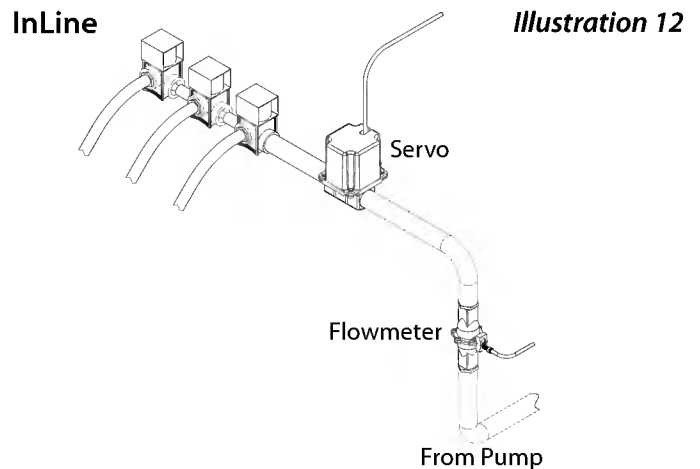
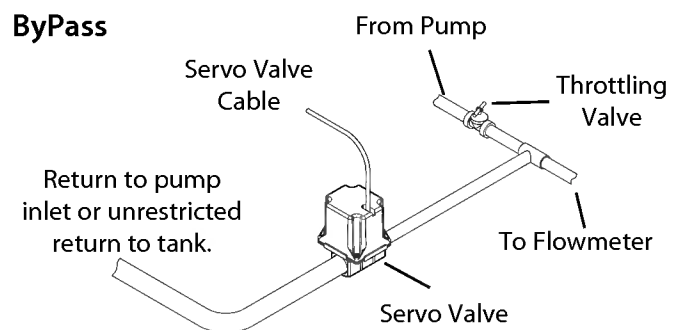
Servo, Throttling Valves

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 33-34 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.

IMPORTANT NOTE: If using the SprayMate™ II with an old-style Micro-Trak servo valve, the valve voltage must be set to 8 volts. See Special Calibration Valve Voltage section on page 28.

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 23.



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 *Illustration 14*.

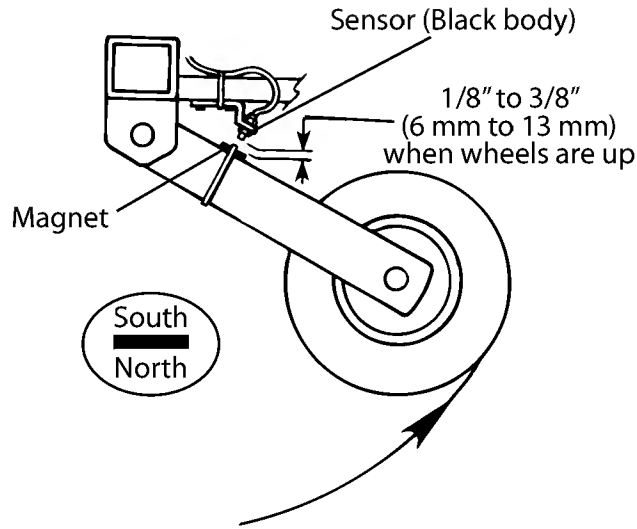
IMPORTANT:

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

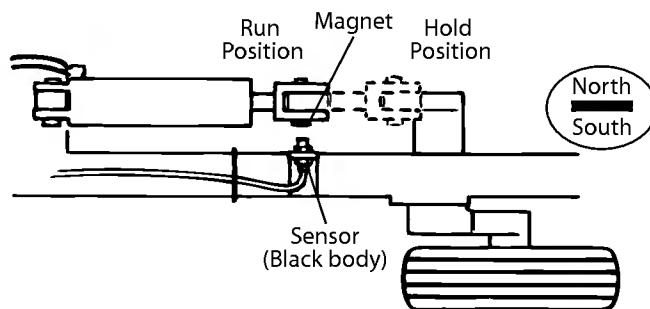
- The basic idea is to attach a magnet to a lever or some part of the equipment that moves when the implement is raised and lowered. The Hall-effect Run/Hold sensor is sensitive only to the south pole of the magnet. Install the magnet with the dashed line facing the sensor. When the magnet is away from 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.

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 II

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™ II Console Functions

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

VOLUME (1) (2) (3): Displays total gallons (liters) or lbs. (kg) of NH₃ applied. May be reset. (Note: VOLUME and AREA counters work in pairs, if VOLUME counter 1 is reset, it also resets AREA counter 1.

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.

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

DISTANCE: Displays distance traveled in feet (meters). May be reset.

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

AREA/HOUR: Displays current work rate in acres per hour (hectares per hour).

RATE: Displays application rate GPA(LPH), or lbs. N/acre (kg of N/hectare).

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

Calibration Positions

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

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

MIN FLOW: Used in the calibration mode to enter the minimum flow rate (GPM/LPM) of the spray boom.

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

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.

INLINE/BYPASS: For establishing servo polarity. (If servo is in the main spray line, select "Inline". If servo is installed in a return line, select "Bypass".)

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

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

English or Metric?

The SprayMate™ II is capable of displaying information in American English or standard Metric measurement. The SprayMate™ II is shipped from the factory programmed for English. Note that the following procedures will also load factory default calibration values. To simply change units without loading defaults, see the "Special Calibration" section.

METRIC

- You must be in HOLD or have all booms OFF to enter Cal. To activate the Metric mode, turn power OFF and place the rotary switch at "AREA." Hold down both the "CAL" and "-" keys and turn power ON. *See Illustration 13.* The console will display LOAD for two seconds. Once LOAD is displayed, release the two keys. To "lock-in" Metric mode you must enter and exit calibration. Press and hold the CAL key until "CAL" icon appears on the display. The console is now in calibration and Metric mode is selected. Exit CAL by pressing and holding the "CAL" key until CAL disappears from the display (approximately 1 second). **NOTE: you must exit CAL to lock in Metric units.**

ENGLISH

- You must be in HOLD or have all booms OFF to enter Cal. To activate the English mode, turn power OFF and place the rotary switch in the VOLUME position. Hold down both the "CAL" and "-" keys and turn power ON. The console will display LOAD. Once LOAD is displayed, release the two keys. To "lock-in" English mode you must enter and exit calibration. Press and hold the CAL key until "CAL" lights on the display. The console is now in calibration and English mode is selected. Exit CAL by pressing and holding the "CAL" key until CAL disappears from the display (approximately 1 second). **NOTE: you must exit CAL to lock in English units.**

NOTE: In metric, the width will have a decimal point, in English there is no decimal point. Also, changing from English to Metric mode may change or alter any previously entered calibration values. After switching measurement modes, confirm that all calibration values are correct.

IN ALL CALIBRATION OPERATIONS:

- Turn all boom switches OFF or put system in "HOLD".
- Press and hold the "CAL" key for 1 second to select the calibration mode. The console display will display the "CAL" icon, the currently selected calibration value, and the red warning light will turn on.
- Turn the rotary dial to the desired "CAL" position. Then use the "+" or "-" key to adjust the displayed value up or down as needed. Adjust ALL necessary values. *See Illustration 14.*
- Hold the "CAL" key again for 1 second to exit calibration. "CAL" will disappear from the display.

NOTE: You must exit CAL to save changes.

Illustration 13

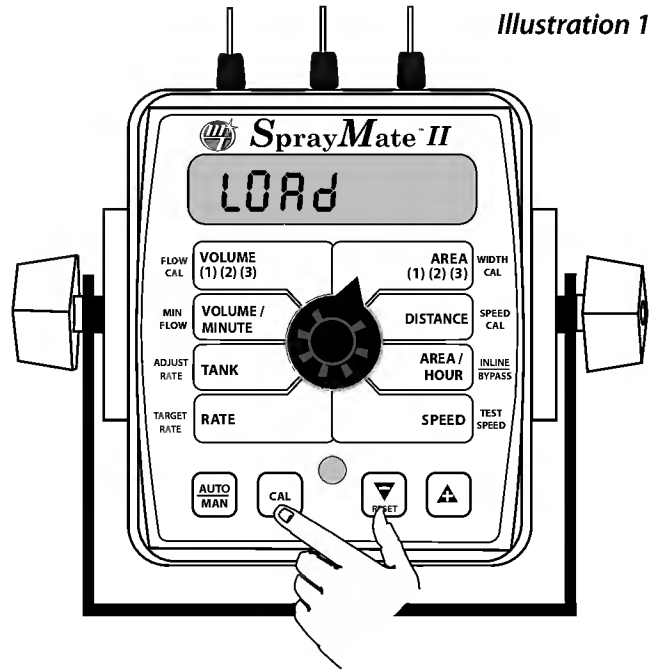
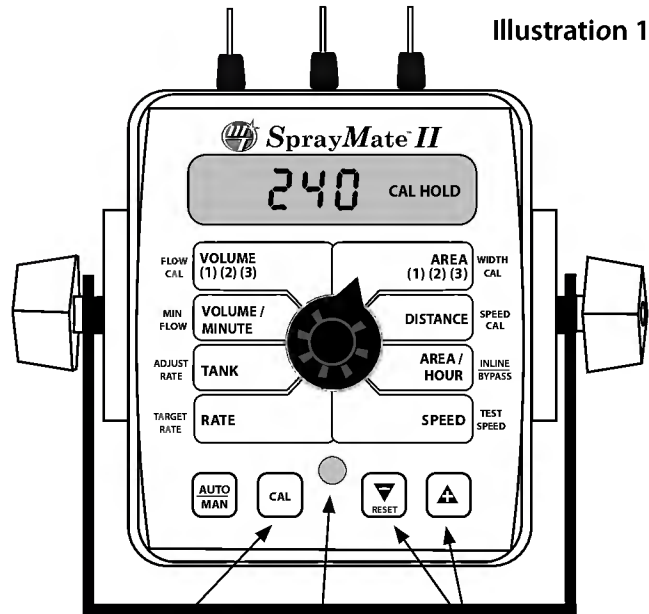


Illustration 14



Press to enter or exit calibration mode.

Press to increase or decrease values.

Red warning light will be lit when in CAL.

Calibration (cont)

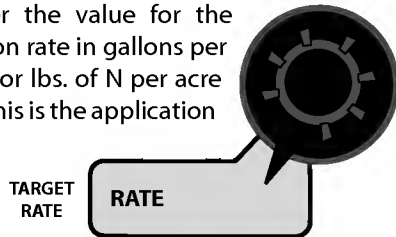
Entering Calibration Values

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.

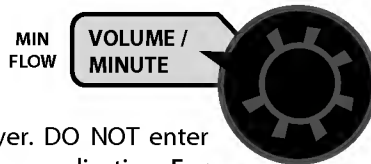
TARGET RATE: Enter the value for the desired target application rate in gallons per acre (liters per hectare) or lbs. of N per acre (kgs of N per hectare). This is the application rate that the console will lock onto when operating in AUTO.



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.



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.

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 II console. This number is stamped on the metal 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 46.)

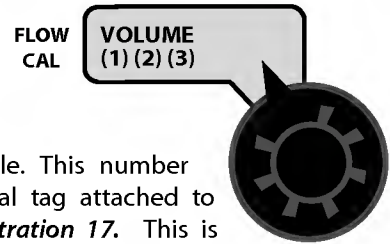
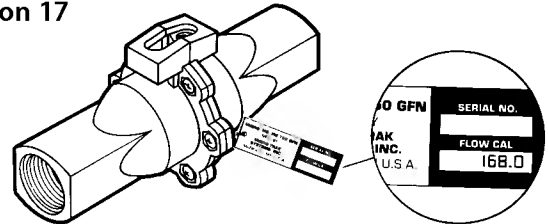
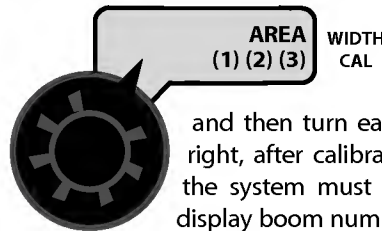


Illustration 17

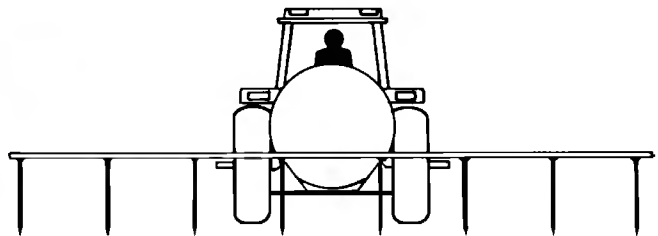


WIDTH: Enter the effective working width, in inches (meters) for the boom section currently shown on the display. It is simplest to start with all booms ON and then turn each boom OFF, from left to right, after calibrating the width. Note that the system must be in RUN (not HOLD) to display boom numbers. 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)

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*.

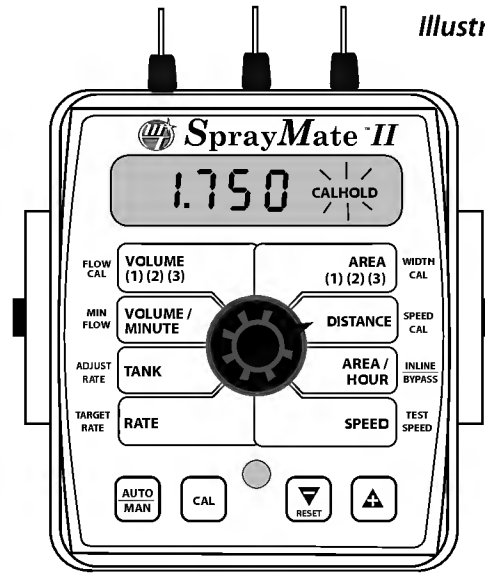


Illustration 15

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 44-45.

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

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 44-45.

Drive Shaft Speed Sensor Calibration

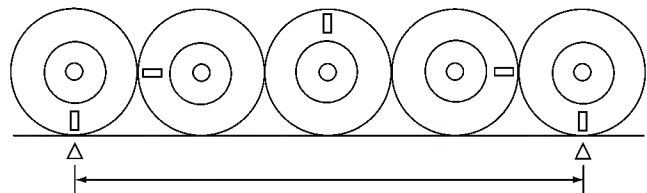
NOTE: If you have mounted the magnetic speed sensor on a wheel, skip this step and go on to Fine Tuning Speed/Distance Calibration Values.

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 44-45.

Illustration 16



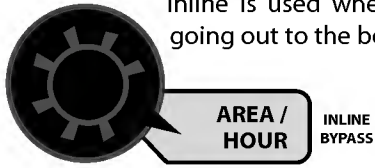
To determine SPEED CAL, measure the distance of one complete wheel revolution and divide by the number of magnets installed.

Calibration (cont)

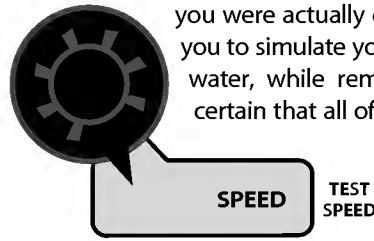
Entering Calibration Values (cont)

INLINE/BYPASS: The display will show InLinE or bYPASS. Use the "+" or "-" buttons to toggle to desired selection.

Inline is used when the servo is in the line going out to the booms; Bypass is used when the servo is in a return line. **NOTE: If used on an NH3 system, it must be set to Bypass.**



TEST SPEED: 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 II 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 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

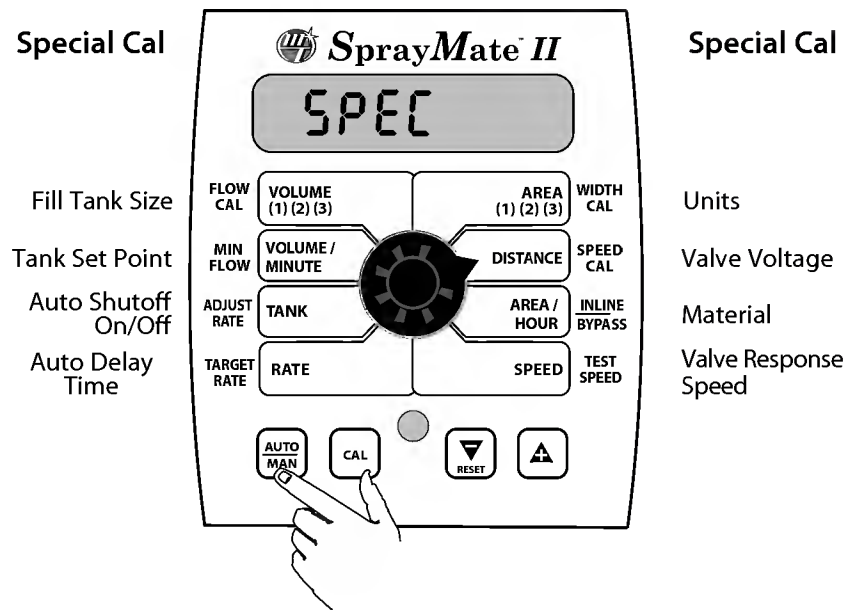
Calibration Factor	Measurements Affected	Default Values	
		English	Metric
TARGET RATE	Application Rate in Auto	10.0 Gallons/Acre	100.0 liters/hectare
ADJUST RATE	Amount of increase or decrease per +/- press (in auto)	1.00 Gallons/Acre	10.0 liters/hectare
BOOMS 1-3 WIDTH	Area, Application Rate	240 inches	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
INLINE/BYPASS	Application Rate	Bypass	Bypass

“Special” Calibration

Entering Calibration Values

The “Special” calibration mode is used to set up system parameters that rarely need to be changed or adjusted. To enter Special Cal, put the system in HOLD, turn the console OFF, press and hold both the AUTO/MAN button and CAL button while turning console ON. The console will display SPEC for 2 seconds to show that the console is in the Special Calibration mode. Release the AUTO/MAN and CAL buttons. The CAL icon and Warn LED will turn on. The desired Special Calibration parameter(s) can then be accessed with the rotary switch per the illustration below. 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.



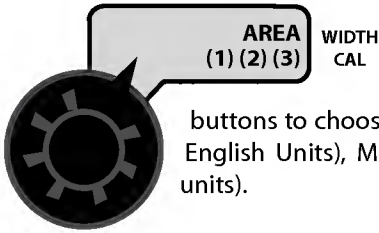
NOTE: The following table describes the special cal parameters and shows the factory settings. More detailed descriptions follow the table.

Parameter	Description	Factory Setting
Units	System of units: EnG (English) / mEt (Metric) /TurF (Turf)	EnG (English)
Valve Voltage	Servo Valve Drive Voltage (8/12)	12
Material	Choose Liquid (H ₂ O or Anhydrous (NH ₃))	H ₂ O
Valve Response Time	Set Valve Response (-4 to 3)	0
Fill Tank Size	Size (volume) of Full Tank (Off or 1-65,535)	Off
Tank (Norm) Set Point	Sets alarm point if using Tank Function (Off or 1-65,535)	Off
Auto Shutoff	Runs servo toward minimum when in hold (On/Off)	Off
Auto Time Delay	Delay servo response when going from Hold to Run (Off to 4 sec.) <i>Allows slow shutoff valves to open before adjusting servo</i>	1

“Special” Calibration (cont)

Entering Calibration Values (cont)

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).



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).

VALVE VOLTAGE: Selects the operating voltage for the servo valve. Factory setting is 12 volts. Use the “+” and “-” buttons to toggle between 8 and 12 on display. *NOTE: if using an old style Micro-Trak servo valve, (see illustration), set to 8 volts.*



1" Old Servo
8 Volts

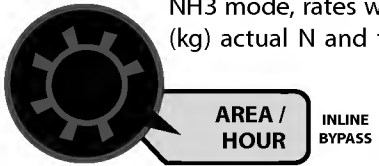


3/4" Old Servo
8 Volts

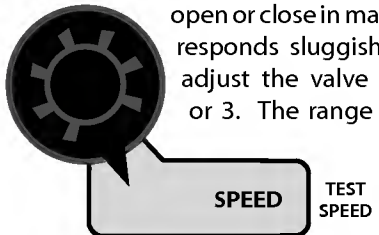


New Servo
12 Volts

MATERIAL: Use “+” and “-” buttons to select between liquid (H2O displayed) or anhydrous ammonia (NH3 displayed). If in NH3 mode, rates will be displayed in pounds (kg) actual N and totals will be displayed in pounds (kg) anhydrous ammonia (NH3).



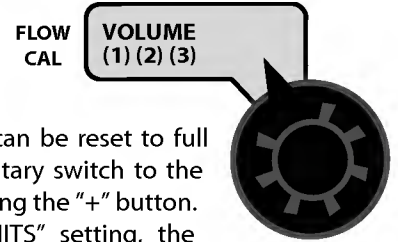
VALVE RESPONSE SPEED: Allows adjustment of response to “tune” the system for use with very fast or slow valves. For example, if using a ball valve that takes several seconds to open or close in manual mode, and the system responds sluggishly, use the “+” button to adjust the valve response number to 1, 2 or 3. The range of adjustment is -4 to +3, factory setting is zero.



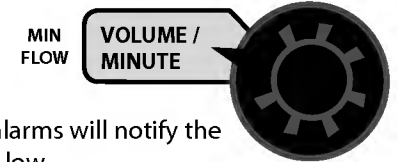
NOTE: exercise caution when increasing the valve response speed.

If using a relatively fast valve (1-3 seconds open-to-close), the system may become unstable with higher valve response speed numbers entered.

FILL TANK SIZE: If using the Tank feature, this setting can be used to enter the volume of the tank. Use the “+” and “-” buttons to choose OFF or any value from 1-65,535. Then when the tank is filled, the tank counter can be reset to full by simply turning the rotary switch to the TANK position and pressing the “+” button. Depending on the “UNITS” setting, the TANK SIZE units will be either gallons or liters. If “material” is set to NH3, the Tank Size will be in lbs. or kg. Anhydrous Ammonia (NH3).



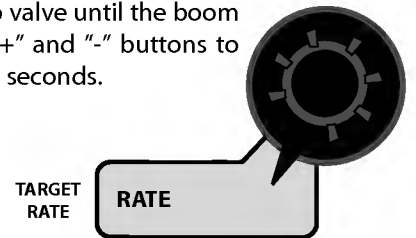
TANK ALARM SET POINT: Use the “+” and “-” buttons to set the level where the Warning LED starts flashing and the word “FILL” flashes on the display. Range is OFF or 1-65,535. When the tank value drops below the set point, the alarms will notify the user that the tank level is low.



AUTO SHUTOFF ON/OFF: When Auto Shutoff is enabled (ON) the servo will run toward minimum flow for 4 seconds any time the system is put in HOLD or all booms are turned off, or if in AUTO mode and speed goes to zero. This feature is normally used only in Dry Application systems where the HOLD condition must stop a hydraulic auger or conveyor belt.



AUTO DELAY TIME: Typically used when using relatively slow ball valves for boom shut-off, this feature delays adjustment of the servo valve until the boom valves are open. Use “+” and “-” buttons to set from zero (OFF) to 4 seconds.



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.

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 33-34 prior to beginning any field operations.

The SprayMate™ II 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.

To turn on the AUTO mode, press AUTO/MAN button so the AUTO icon appears in upper right portion of display. In automatic mode, the system will control the flow rate to maintain the calibrated application rate (GPA/LPH) when the vehicle speed changes, or booms are turned on or off. To operate the system in automatic mode, simply start the pump, turn on the desired number of booms, place the RUN/HOLD switch (if used) in the RUN position and drive. **NOTE: In AUTO mode, the system will not turn the booms on until it has a speed signal. Use either the RUN/HOLD switch or remote RUN/HOLD sensor to turn the system off and on when turning around or to stop spraying at any time. See the following sections for operation details.**

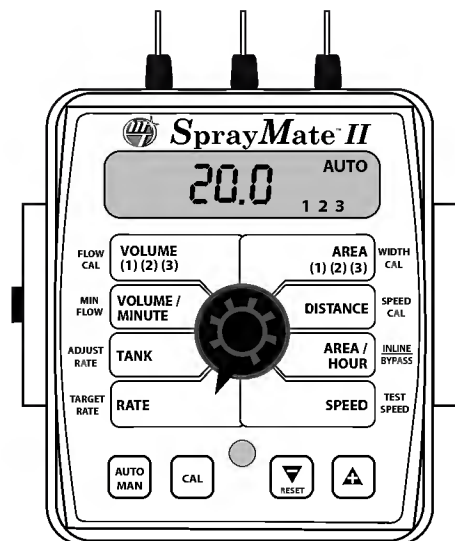
CONSOLE POWER/SYSTEM ON/OFF: The system can be turned ON and OFF by either the ignition switch, if the provided wire is connected to a power source switched by the ignition, or by using the optional ON/OFF switch and bracket kit. When the console is turned on, it will display the number of hours of operation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

DISPLAY: During normal operation, the console will display information selected by the rotary switch position. Typically the rotary switch will be set on RATE, as shown in illustration to the right. With RATE selected, the console will display the Application Rate in units of gallons per acre (liters per hectare). *See DATA DESCRIPTION on next page for additional information about data displayed.*

RUN/HOLD SWITCH: The RUN/HOLD is the master switch for turning all (active) booms on and off. This function can be done either manually with the included RUN/HOLD switch, or automatically, using the optional RUN/HOLD sensor kit.

AUTO/MAN BUTTON: This button will switch the control status of the system from fully automatic to manual control. Each press of the button will change the status. The display will show the AUTO icon when automatic control mode is active and the MAN icon when manual control mode is active. **NOTE: IF IN “AUTO” MODE AND NO SPEED SIGNAL IS PRESENT, SYSTEM WILL SHUT OFF THE BOOMS AUTOMATICALLY.**

“+” AND “-” BUTTONS: During normal operation, when automatic “AUTO” control mode is active and the rotary dial is set to RATE, each press of the “+” or “-” buttons will increase or decrease the target application rate by the amount of the calibrated adjust rate (Delta). *See On-The-Go Delta Rate Adjustment section on the right for more information.*



Turn rotary dial to display desired readout.

During normal operation, when manual “MAN” control mode is active and the Run/Hold switch is in the RUN position, pressing the “+” or “-” buttons will increase or decrease the application rate by opening or closing the servo valve (control valve).

During normal operation, when either automatic or manual mode is active, the RUN/HOLD switch is in the HOLD position and the rotary switch is turned to VOLUME/MINUTE, pressing the “+” or “-” button will increase or decrease the flow rate without having the boom valves turned on, by opening and closing the servo valve (control valve). This can be useful for system pressure checking.

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.

Operation (cont)

Console Switches & Buttons (cont)

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.

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*).

Rotary Switch Positions

RATE: Displays the actual number of gallons per acre (liters per hectare) being applied. When the SprayMate™ II 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™ II 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™ II 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 31.*) 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 31.*) 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.

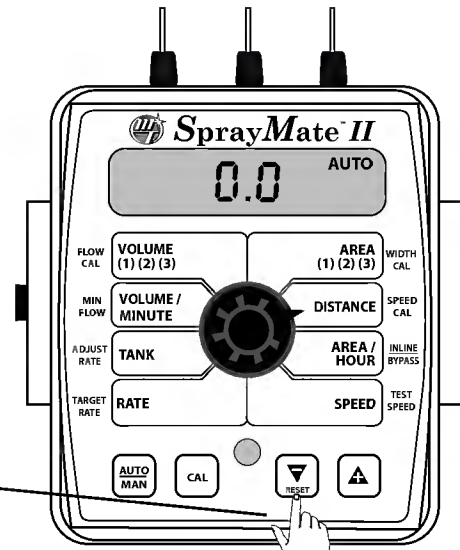
Operation (cont)

Resetting System Counters

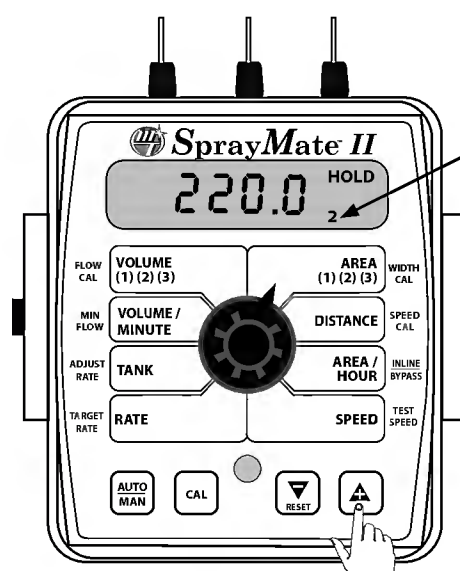
The AREA, DISTANCE and VOLUME counters maintain a running count during operation regardless of the position of the rotary switch. When any of these counters reach their maximum capacity, or when you want to start a new count, the value may be reset to zero by performing the following routine. Counters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

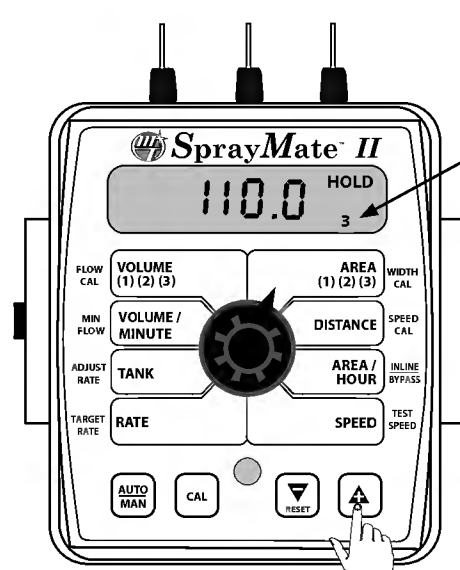
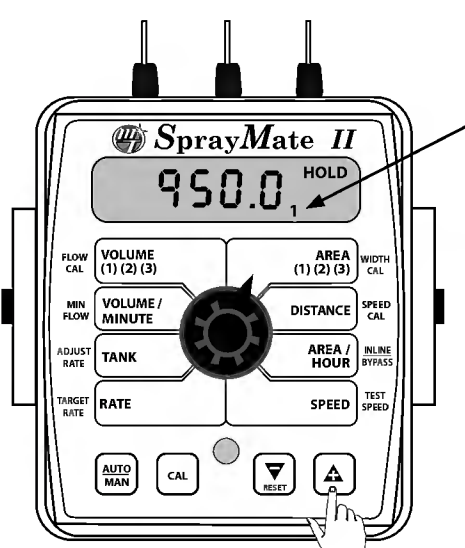


Display indicates that counter pair #2 is selected



Display indicates that counter pair #3 is selected

Display indicates that counter pair #1 is selected



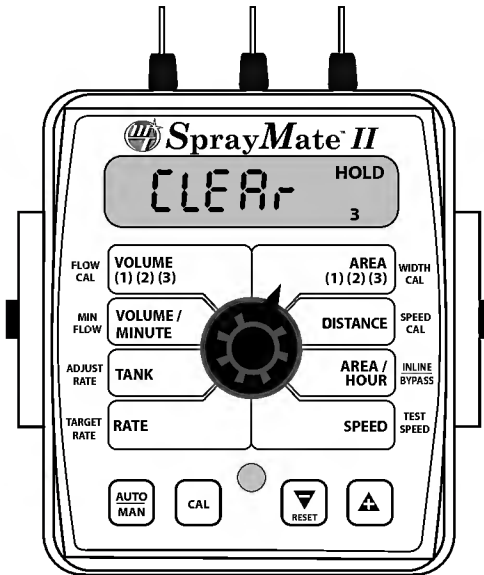
Operation (cont)

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™ II 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™ II 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). **NOTE:** *Assume servo is plumbed in a bypass line. (Maximum bypass allowed - minimum flow output to booms.)*

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 39.**

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™ II 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™ II 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 39.*

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



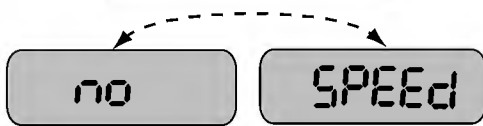
Typically indicates that defaults were entered by powering up with the CAL and "-" buttons held, but calibration mode was not entered and exited. Cycling power will not clear the bad CAL message, it can only be cleared by entering and exiting calibration mode.



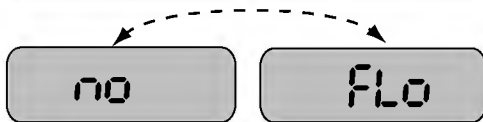
Low Power. Check all power and ground connections.



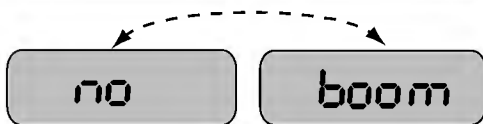
Has loaded Default Cal factors (appears when default calibration factors are loaded by holding CAL and "-" buttons while turning the console on).



Will flash in display if rotary switch is in RATE position and there is no Speed signal regardless of all other conditions. Check speed sensor and connections per Troubleshooting section.



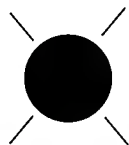
Will flash in display if rotary switch is in RATE position and should have flow (In Run, some booms on, speed greater than 0) but no flow is detected. Check flowmeter and flow harness connections per Troubleshooting section.



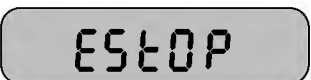
Will flash in display if rotary switch is in Width position, system is in Cal mode and no booms are turned on. Make sure system is in run and a boom switch is turned on, also check Run/Hold switch or sensor and connections.



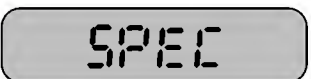
Rotary switch in any position, FILL will flash if tank level is equal to or less than tank set point. Fill tank and reset TANK counter by setting the rotary switch at the TANK position and pressing the "+" button for one second. Check to make sure TANK set point is properly calibrated.



Warn LED flashes when the Rate error is over 10% or Volume/Minute is below the Minimum, or Tank is less than Tank Set Point. It is on steady when in CAL mode or SPECIAL CAL mode or Test Speed.



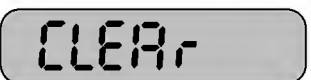
Had an Emergency Stop. Check flowmeter. Verify there is liquid flow and the tank is not empty.



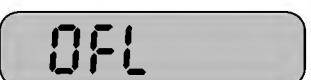
Special Calibration mode is active. Appears when entering Special Calibration mode (hold AUTO/MAN and CAL buttons while turning console on).



The "V" icon shows that a 12v control valve (not 8v) is currently selected. On startup, the "V" is also displayed next to the software version #. (Console hours displayed first.)



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.



Counters (DISTANCE or AREA or VOLUME) have overflowed their maximum. RESET (see pages 31-32) to clear counters and resume counting.

Troubleshooting (cont)

General

All SprayMate™ II 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 37.*

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™ II cables away from the radio, its antenna and power cable.

Ignition wires may be causing the console to malfunction. Keep SprayMate™ II 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). *See page 22 for instructions.*

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 11.*

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).

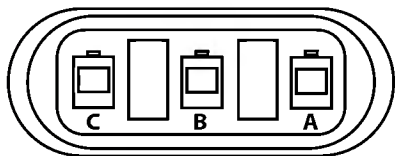
SPEED INPUT

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 18*). 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 18



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 47 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 II 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 39 - 40.*

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 II 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 1 1/4" 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 3/4" 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 II 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 33 and 34.** 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 33-34.**

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.

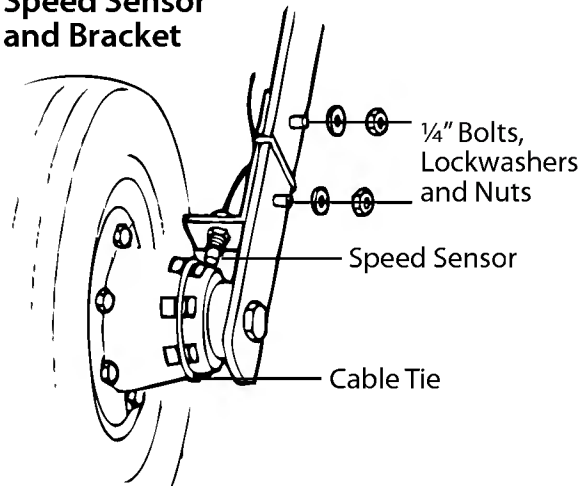
Appendices

Appendix A - Optional Speed Sensor Mounting Installation

Implement Wheels

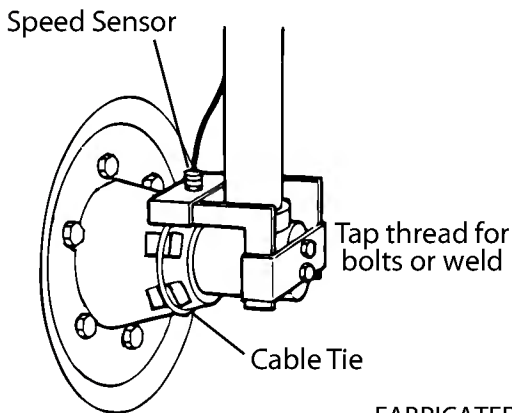
1. Secure magnets mechanically or with epoxy.
2. Rigidly mount sensor mounting bracket to the wheel assembly. Cut or bend "L" bracket as required for proper positioning of sensor.
3. Install sensor, adjust to correct spacing (1/4" to 1/2" or 6 to 13 mm is recommended), and secure with 3/8" locking nuts.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

Speed Sensor and Bracket

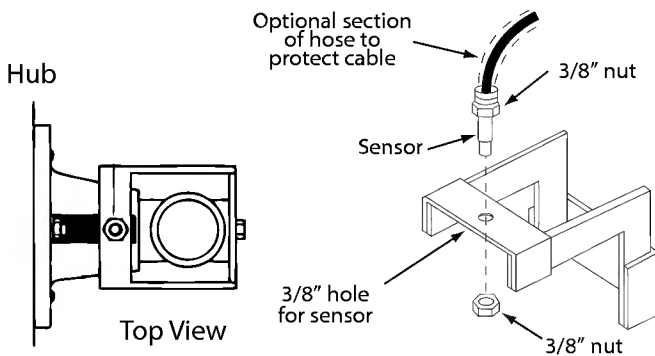


Front Tractor Wheel

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 (1/4" to 1/2" or 6 to 13 mm is recommended), and secure with 3/8" locking nuts. *See Illustration below.*



FABRICATED BRACKET

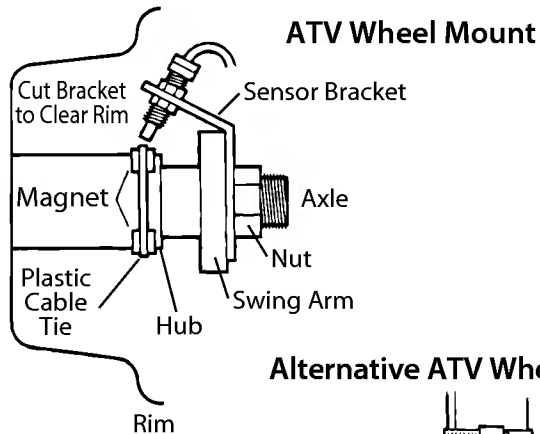


ATV Wheels

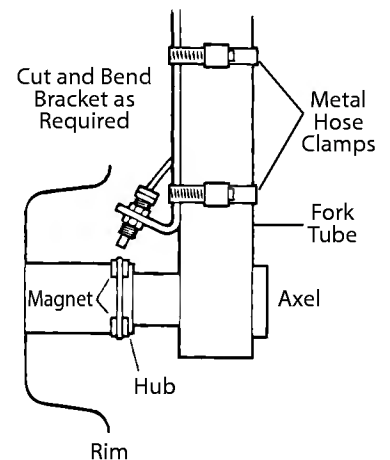
Two mounting examples are illustrated.

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 (1/4" to 1/2" or 6 to 13 mm) and secure with 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

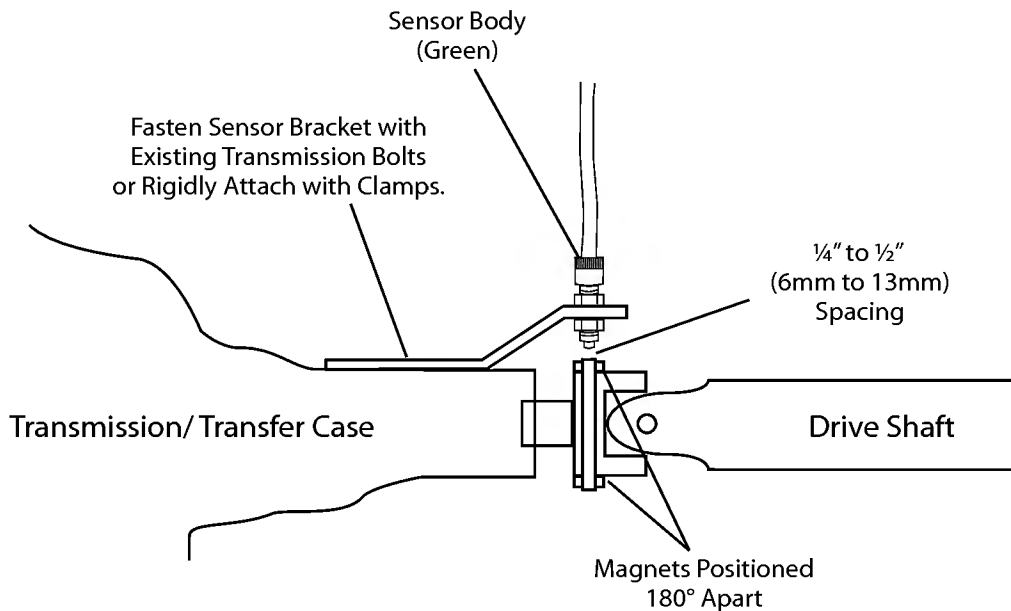
NOTE: This is an optional method generally used on pickups or custom vehicles. It may also be necessary on any other vehicles where access to the wheels is limited. This installation requires a fine tuning procedure, see pages 44-45.

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 (1/4" to 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 (With Run/Hold Switch Kit Installed)

This procedure is used to verify the calibration of systems WITH the Run/Hold Switch Kit or an optional remote run/hold 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 not have a run/hold switch kit or remote Run/Hold sensor installed, refer to next page 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.

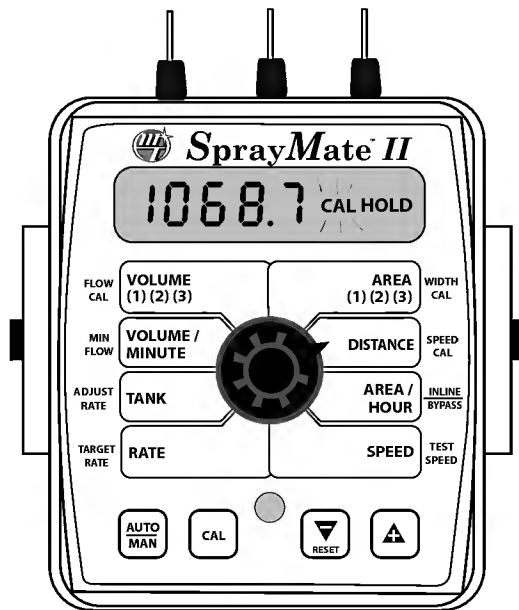
- Measure a distance of 1000 feet (500 meters). Clearly mark the beginning and end points with flags or something highly visible to the operator.

PROCEDURE

- With the console turned ON, place the Run/Hold switch in the HOLD position. The HOLD icon will be displayed. Turn the rotary dial to the "DISTANCE" position. Be sure the display shows 0. If not, reset the distance counter by pressing and holding "RESET" until the display returns to 0 (approximately one second). The word CLEAR will be displayed when reset is pressed.
- You are now ready to drive the measured course. Pick a location on the vehicle to use as a marker for starting and stopping the distance counting function (door handle, mirror, step, etc.). You should begin driving the course well ahead of the starting flag and drive past the ending flag, using the Run/Hold switch to start and stop the counting function. It is not recommended to start from a dead stop at the starting flag and stop at the ending flag.
- Place the Run/Hold switch in RUN when the marker on the vehicle passes the starting flag to activate the distance counting function. The console display numbers will increase, adding to the distance total as you drive. Drive the pre-measured course and place the Run/Hold switch in HOLD, when the marker on the vehicle passes the ending flag, to stop the distance counting function. The console display should read "HOLD". See *Illustration to the right*. Stop the vehicle in a level and safe area and continue with this procedure.

- With the rotary dial still at DISTANCE (SPEED CAL), press and hold the "CAL" key for one second. Once the console is in "CAL," CAL and the speed calibration value will be displayed. Momentarily press CAL and the word CAL will begin to flash and the distance travelled will be displayed. See *illustration below*.
- When the display shows distance ("CAL" is flashing), verify whether the number displayed is the exact distance you drove (within +/- 1 - 2 %). If not, press the "+" or "-" key to adjust the figure to match the distance you actually drove. If the display reads too high, use the "-" key to lower the displayed value. If the display reads too low, use the "+" key to raise the displayed value.
- When the number shown on the display matches (as closely as possible) the actual distance driven, you have arrived at the correct calibration value. If you cannot adjust the displayed distance to exactly match the actual distance driven, adjust the figure as close as possible to the actual distance. You may check the calibration number by momentarily pressing CAL. The word CAL and the SPEED CAL number will appear. Exit "CAL" by pressing "CAL" for one second.

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 B (cont)

Fine Tuning Speed/Distance Calibration Value (Without Run/Hold Switch Kit Installed)

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 44 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.

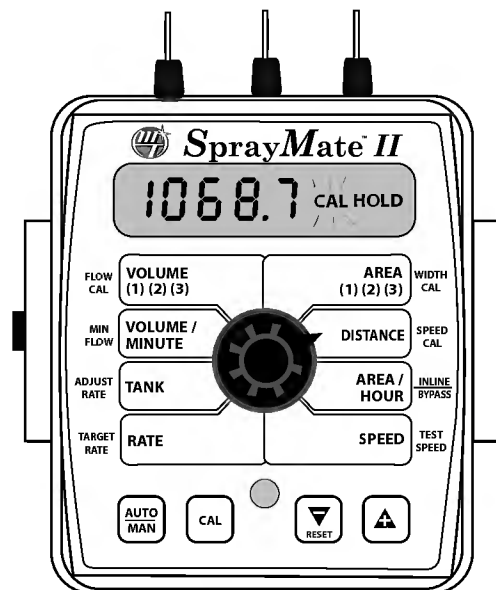
- Measure a distance of 1000 feet (500 meters). Clearly mark the beginning and end points with flags or something highly visible to the operator.

PROCEDURE

- You are now ready to drive the measured course. Pick a location on the vehicle to use as a marker for starting and stopping (door handle, mirror, step, etc.). Position the vehicle at the beginning of the measured course with the marker adjacent to the starting flag and STOP the vehicle. Turn all booms OFF.
- With the console turned ON, turn the rotary dial to the "DISTANCE" position. Be sure the display shows 0. If not, reset the distance counter by pressing and holding "RESET" until the display returns to 0 (approximately one second). Booms must be OFF. The word CLEAR will be displayed when reset is pressed.
- Begin driving the pre-measured course. The console display numbers will increase, adding to the distance total as you drive. STOP the vehicle when the marker is adjacent to the ending flag. The vehicle **MUST** not move until the remaining steps of this procedure have been completed.

- With the rotary dial still at DISTANCE (SPEED CAL), press and hold the "CAL" key for one second. When the CAL icon appears, the number displayed is the speed calibration value. Press and release the CAL button. The CAL icon will begin flashing and the display will show distance travelled.
- When the display shows distance ("CAL" is flashing), verify whether the number displayed is the exact distance you drove (within + or - 1 - 2 %). If not, while the display shows distance, press the "+" or "-" key to adjust the figure to match the distance you actually drove. If the display reads too high, use the "-" key to lower the displayed value. If the display reads too low, use the "+" key to raise the displayed value.
- When the number shown on the display matches (as closely as possible) the actual distance driven, you have arrived at the correct calibration value. If you cannot adjust the displayed distance to exactly match the actual distance driven, adjust the figure as close as possible to the actual distance. Exit "CAL" by pressing "CAL" for one second.

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

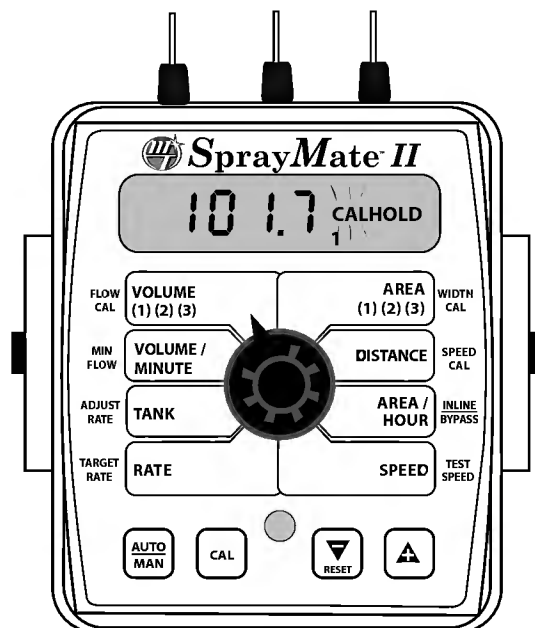
This procedure is used to verify and fine-tune the flowmeter calibration. Every flowmeter is calibrated with water at the factory and stamped with a calibration value. Enter that value as a starting point and use this procedure to fine-tune that value for your specific installation and spraying application. 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.
3. Turn console rotary selector to the VOLUME position. Select the counter (1-3) that you want to use. Press and hold the RESET button until the display reads 0 (*About 2 seconds*).
4. Turn on all booms, and run a known amount of water (*Preferably 100 gallons or more*). *
5. Turn off all booms. Compare the console's VOLUME reading with the known amount of water run. *See Illustration*. If the two amounts are within one or two percent, no fine tuning is required. If the two amounts are more than two or three percent different, continue with the next step.
6. With the console still in the VOLUME position, enter calibration (*Boom switches OFF, hold the CAL button until red warning light comes on; about one second*). The display will show the flowmeter calibration value and the CAL icon.

7. Momentarily press the CAL button. The CAL icon will begin to flash and the total volume will be displayed.
8. When the TOTAL FLOW value is displayed, use the "+" or "-" button to adjust the value to match the amount of water run.
9. Momentarily press the CAL button. The word CAL and the flowmeter calibration number will be displayed. You will notice that the flowmeter calibration value has changed. Write down the new flowmeter calibration value. This is your "fine tuned" calibration value, keep it for future reference.
10. Exit calibration by holding the "CAL" button until the red warning light goes out (about one second).

* 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 19* shows you what a new shaft looks like. When the shaft is worn to the point of drag, the turbine must be replaced.

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

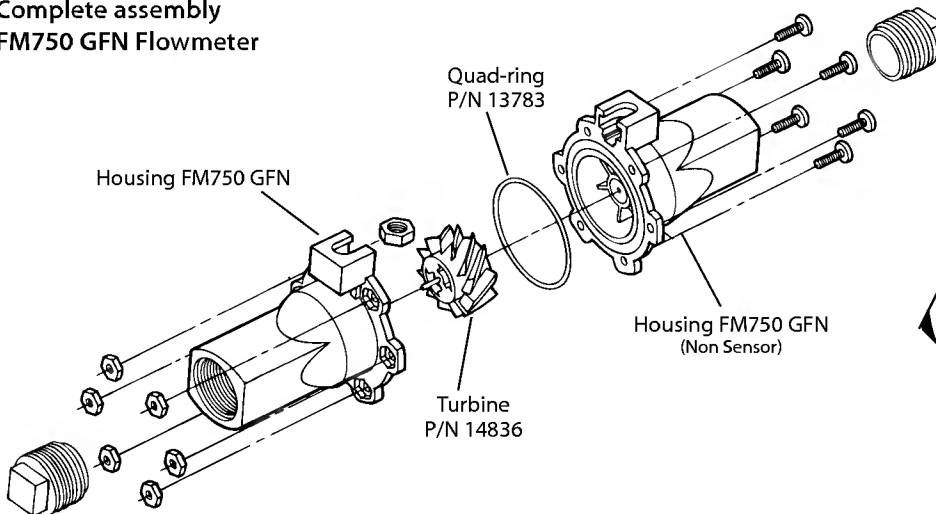
Stainless steel meters use a Teflon gasket. Sealants are normally not required. Plastic meters use an o-ring (Quad-ring). Apply a small amount of silicon grease for lubrication. Gaskets and o-rings may be reused several times but eventually may need replacement.

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.

Complete assembly
FM750 GFN Flowmeter



Complete assembly
FM750 SS Flowmeter

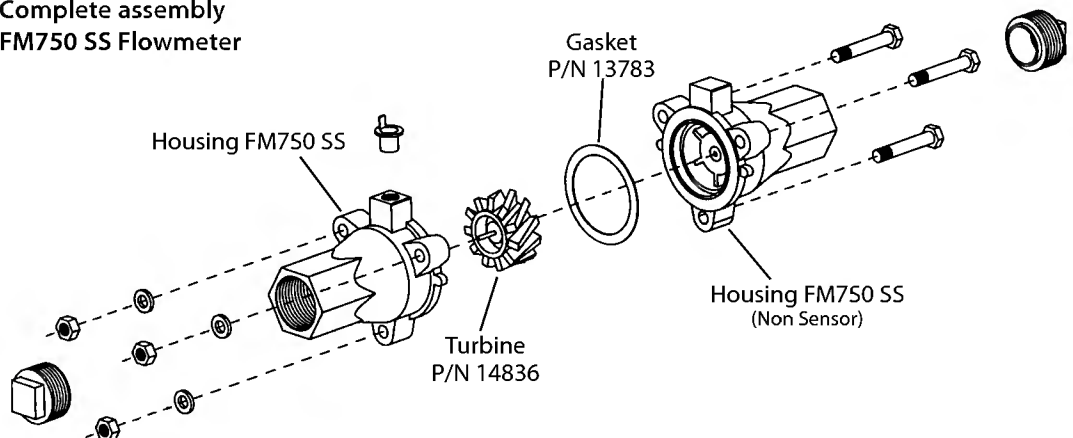
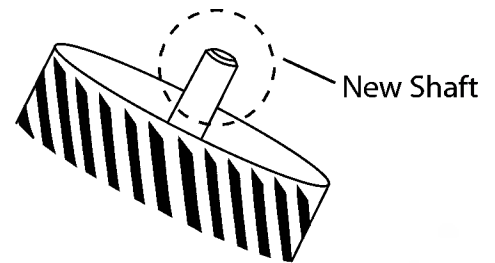


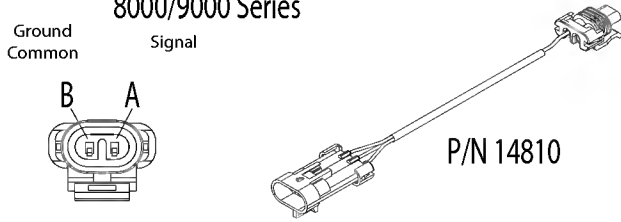
Illustration 19



Appendix E

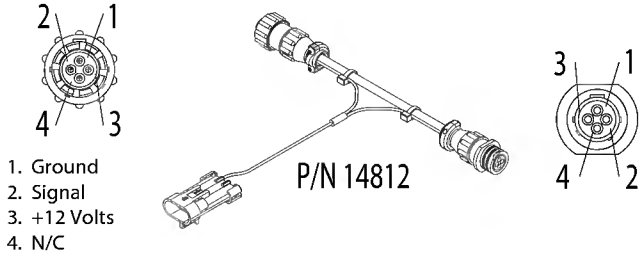
Radar Adapter Cables

In-Cab John Deere Metri-Pack Connector
8000/9000 Series

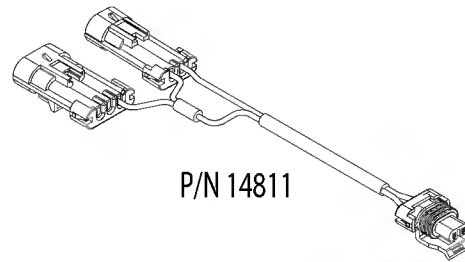


RADAR	CONNECTOR	SIGNAL PIN
DICKEY-john	Amp	2
DICKEY-john	Cannon	3
DICKEY-john	Deutsch	3
DICKEY-john	Ford	2
DICKEY-john	Packard	B
In-Cab JD (8000 & 9000's)	Metri-Pack	A
Magnavox & Phillips	Packard	C
Raven	Conxall	3
Vansco	Amp	2

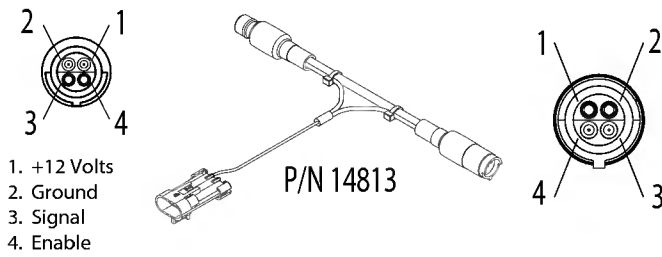
DICKEY-john Radar Amp Connector



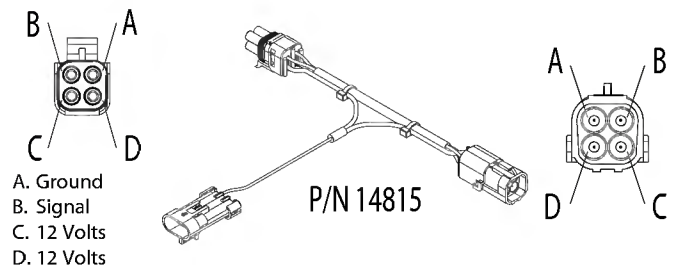
In-Cab John Deere "Y" Connector



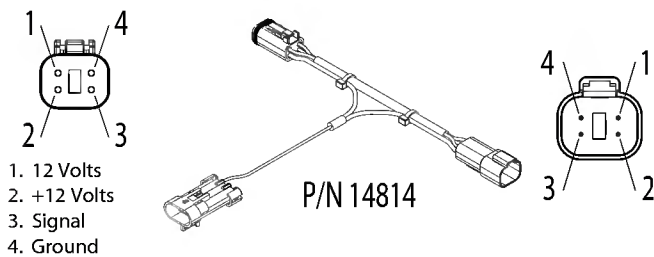
DICKEY-john Radar Cannon Connector



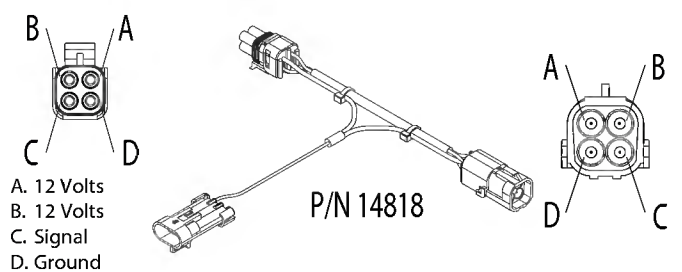
DICKEY-john Radar Packard Connector



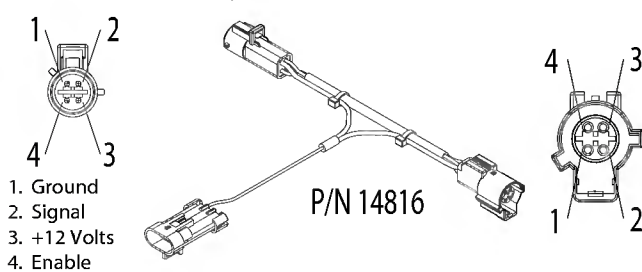
DICKEY-john Radar Deutsch Connector



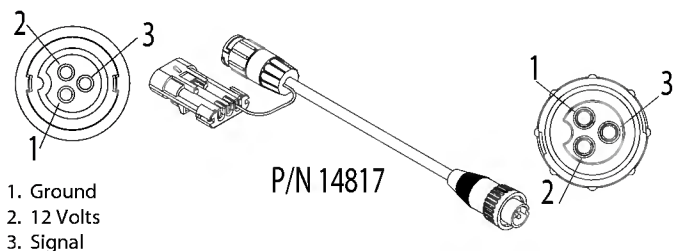
Magnavox & Phillips Radar Packard Connector



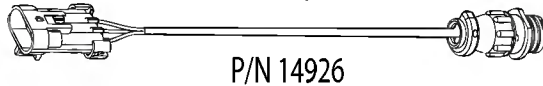
DICKEY-john Radar Ford Connector



Raven Radar Conxall Connector

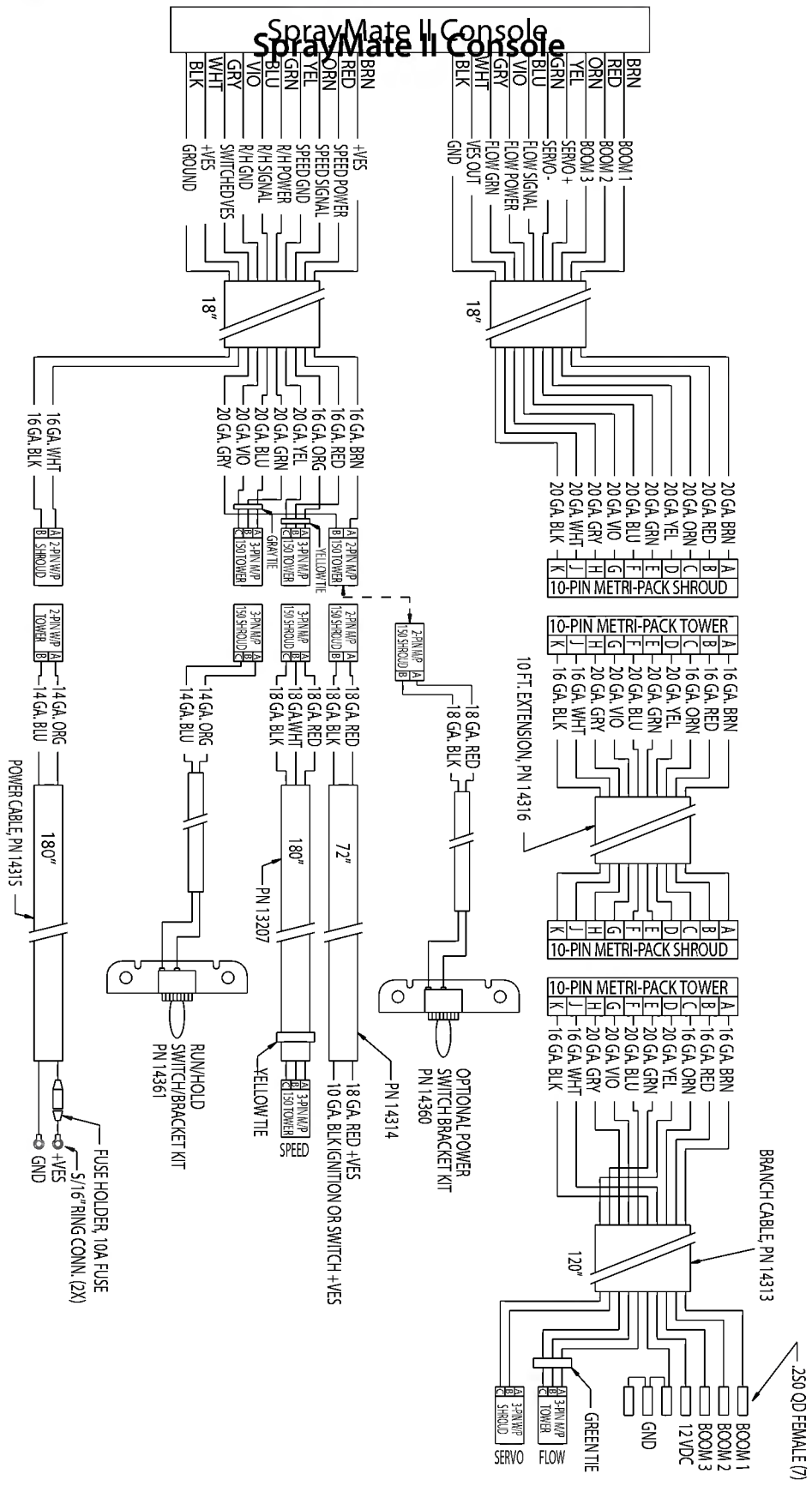


Vansco Radar Amp Connector



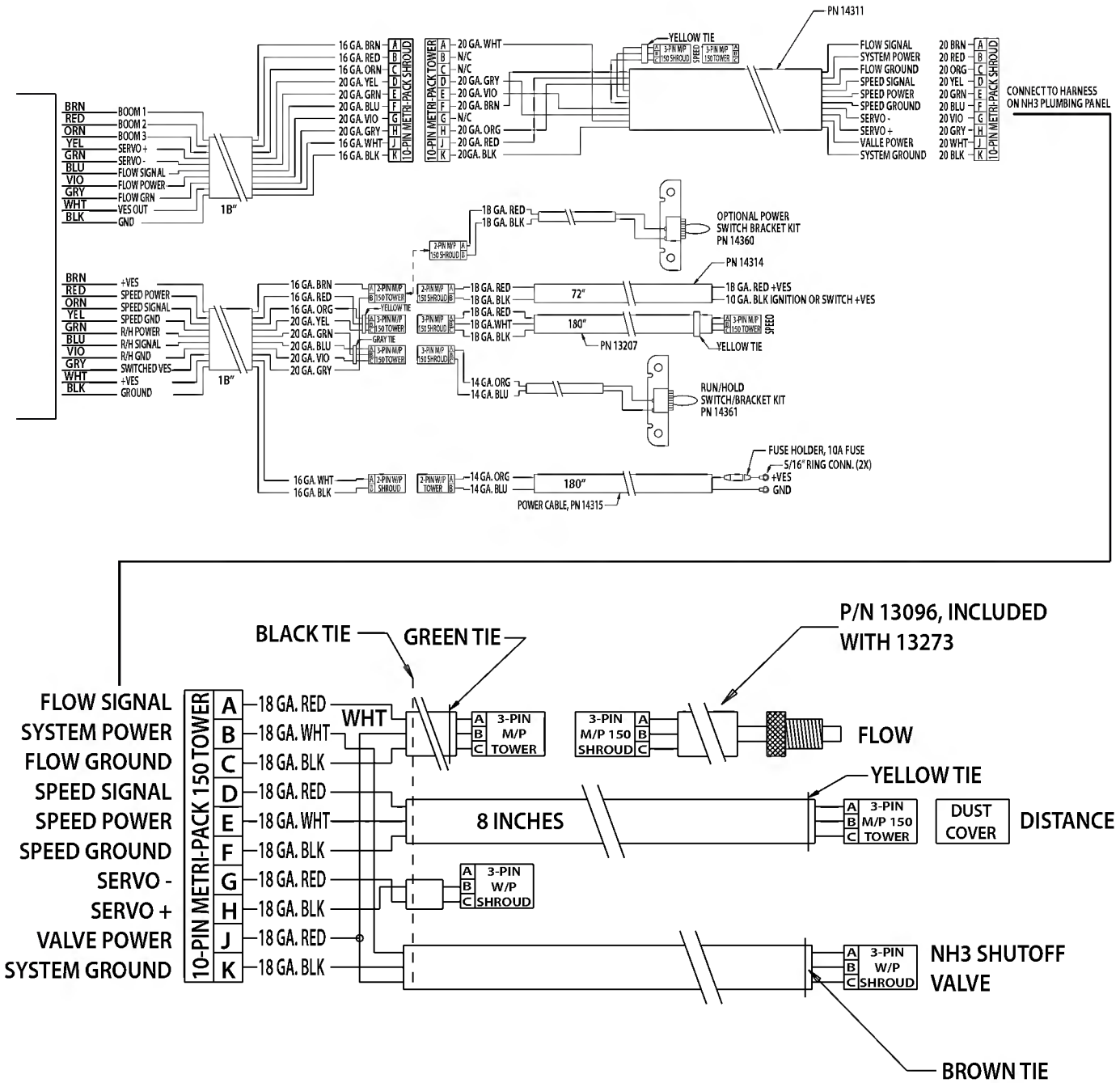
Appendix F

SprayMate II Wiring Diagram



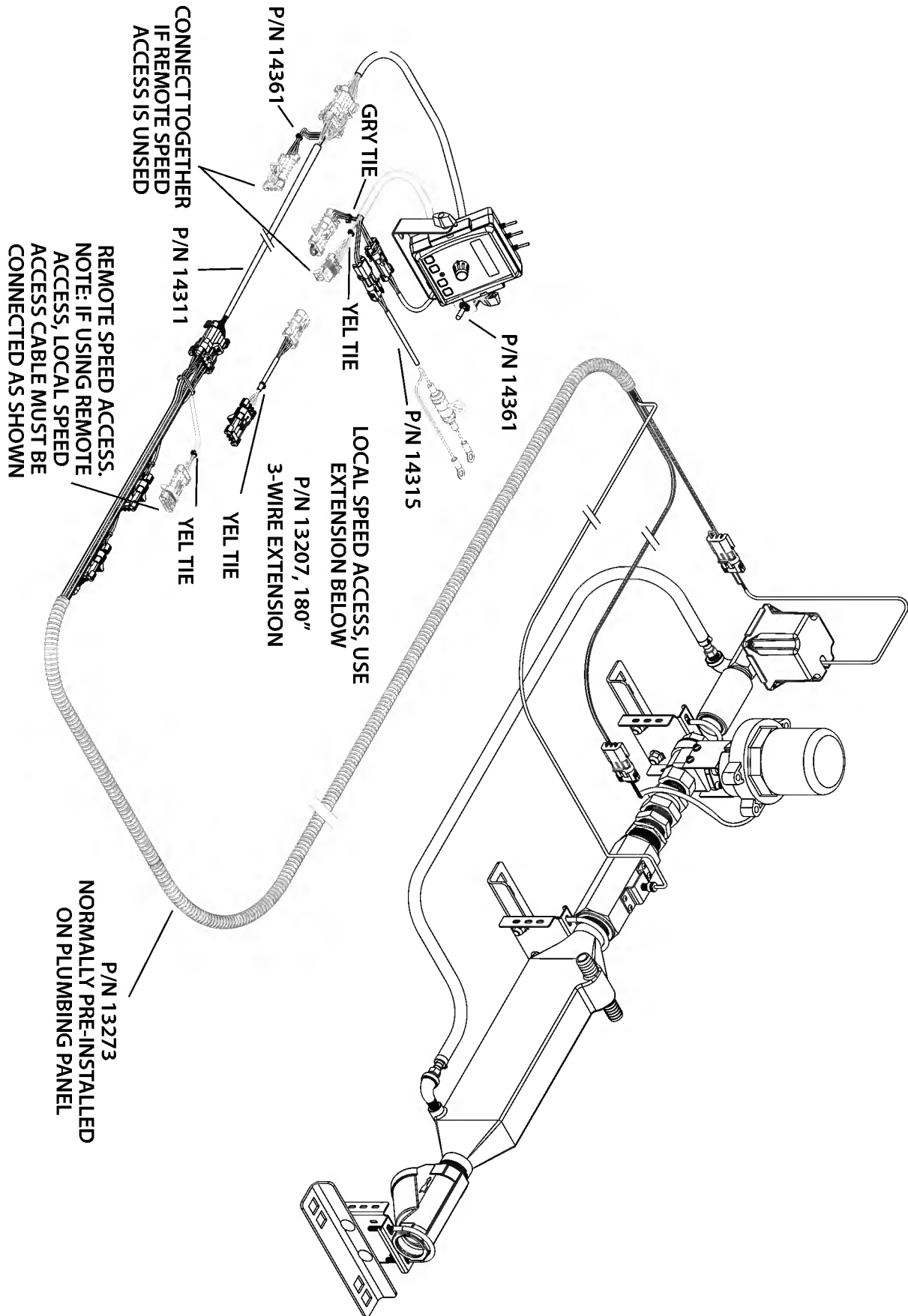
Appendix G

SprayMate II Wiring Diagram for NH3



Appendix G (cont)

SprayMate II System Diagram for NH3



Appendix G (cont)

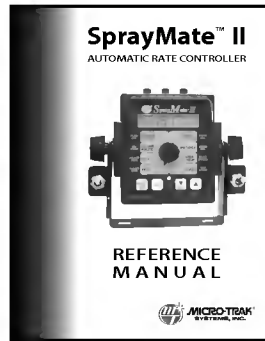
SprayMate II NH3 Specific

Component Parts & Hardware

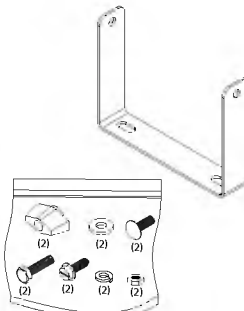
Before beginning installation, check the carton contents for the following items:



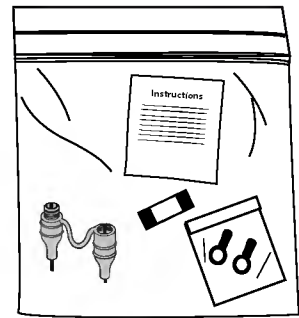
SprayMate™ II Console
P/N 14869



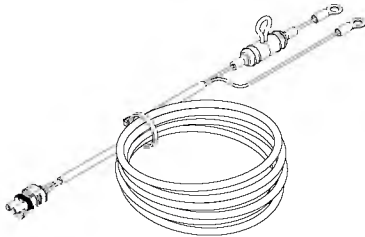
Owner's Manual
P/N 14943



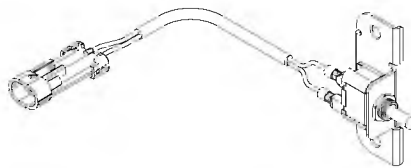
Console Mount Kit
P/N 13181



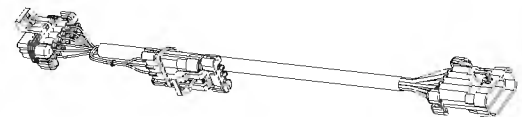
Terminal Kit
P/N 13632



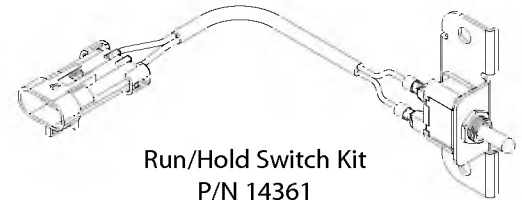
Power Cable
P/N 14315



Optional Power Switch Kit
P/N 14360



10 ft. NH3 Adapter Cable
P/N 14311

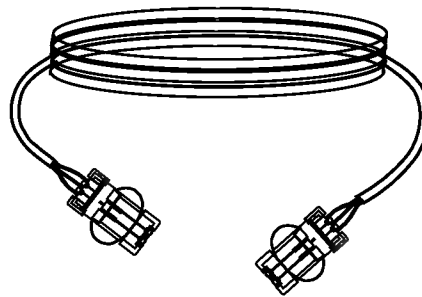


Run/Hold Switch Kit
P/N 14361

Speed Sensor Kit P/N 01531 (1)

Including items A-F, below:

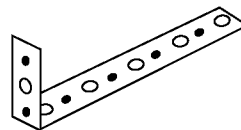
A. 5' Hall-effect Speed/Flow
Sensor Cable - P/N 13096



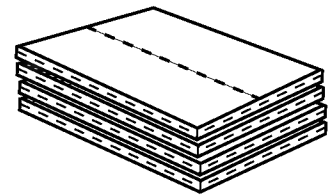
C. 15' 3-Pin Extension Cable
M/P 150 - P/N 13207



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



D. Speed sensor mounting bracket
P/N 10013



E. Magnets (6) - P/N 12069
(2 in hardware bag)



F. Hardware Bag
P/N 13251

Appendix G (cont)

SprayMate II NH3 Specific (cont)

Installation

MOUNTING THE DISPLAY CONSOLE

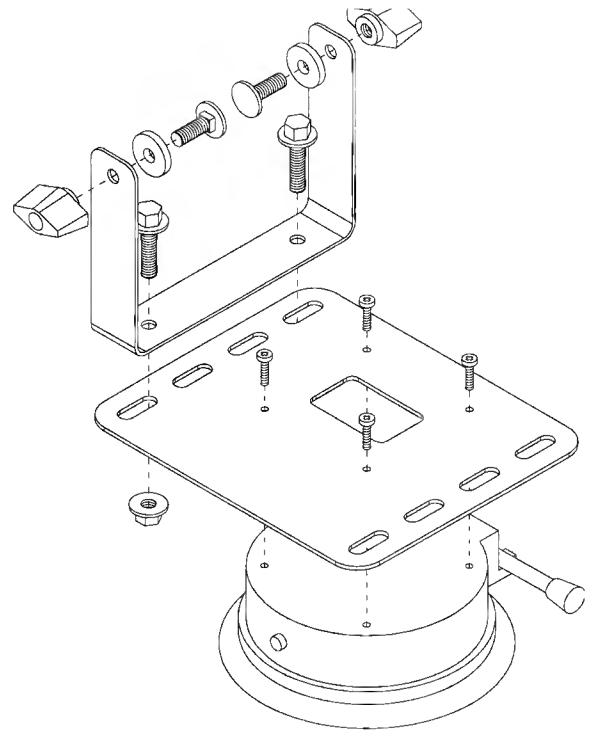
See installation section at front of manual for installation of console, cables, speed, sensor, etc. The following sections describe installation of NH3-specific items only.

OPTIONAL MOUNTING: BASE PLATE/SUCTION CUP

Match the four holes on the base plate to the corresponding holes on the suction cup. Fasten with the four 1/2" screws. Make sure the plate is positioned (it will appear off-center) so that the suction cup lever is free to open and close. Mount U-bracket to the suction cup base plate with bolts, lock-washers and nuts provided. *See Illustration 20.*

NOTE: The suction cup will adhere to almost any clean, non-porous surface. It may be mounted onto the glass on a vehicle or almost any flat metal.

Illustration 20



Appendix G (cont)

SprayMate II NH3 Specific (cont)

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 connect to the main harness lead with the GREEN tie. See Illustration 21.

INSTALLATION NOTE: The main harness provides two connection points for the speed sensor. For speed sensor installations in the cab or near the control console, it may be more practical to use the local access connector on the console end of the main harness (longer of the two cables with YELLOW tie). Using this connection point will disable the connection point on the implement end of the main harness. For speed sensor installations on implements, it may be more practical to use the speed connector on the implement end of the main harness. When using this connection point, make certain that the local access connector for speed/distance is mated together. (Connectors with YELLOW ties on console end of main harness mated together.)

SENSOR IDENTIFICATION CHART

Sensor	Sensor Body Color	Main Harness Tie Color
Speed	Green	Yellow
Flow	Green	Green

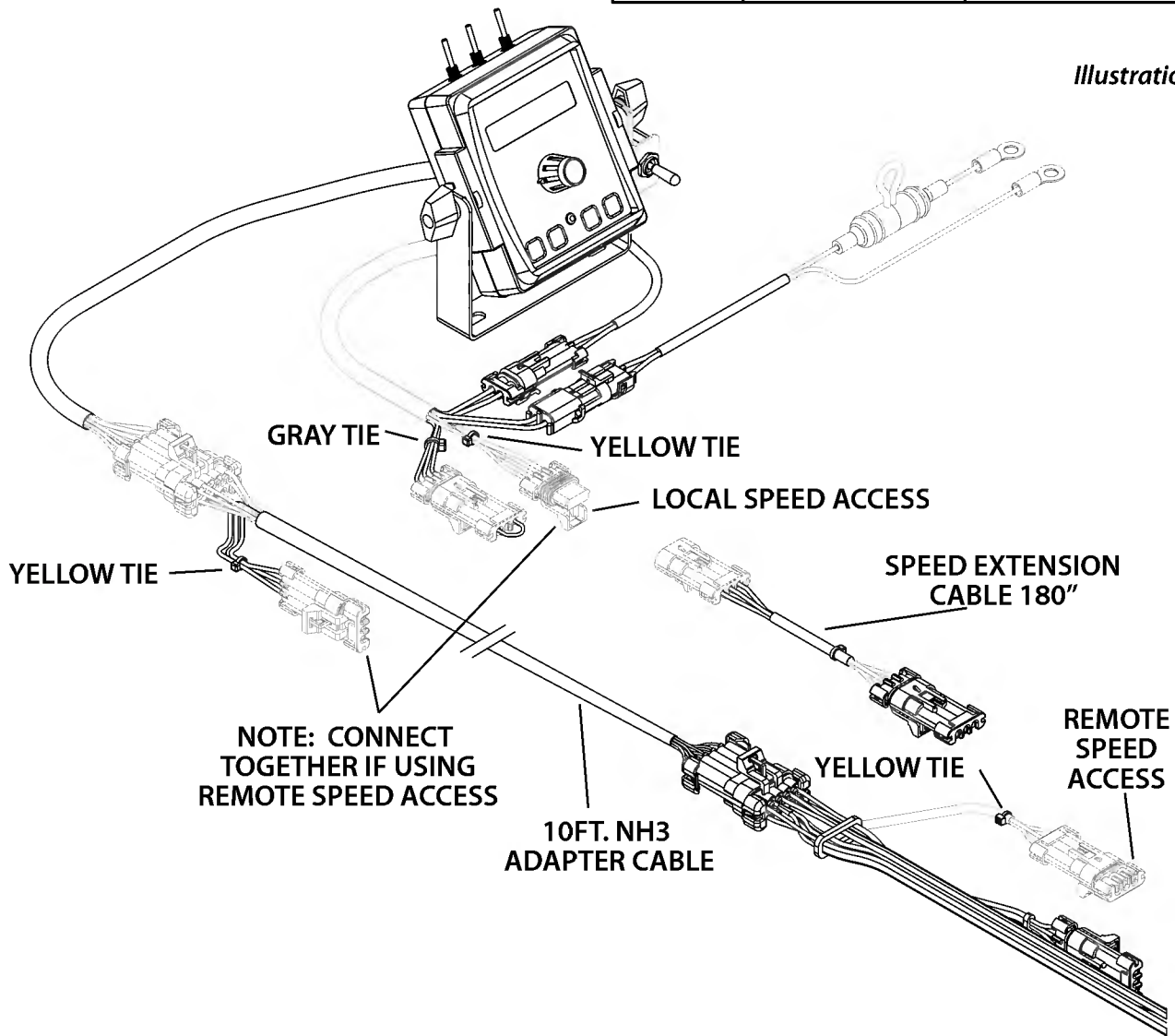


Illustration 21

Appendix G (cont)

SprayMate II NH3 Specific (cont)

NH3500 Kit Installation

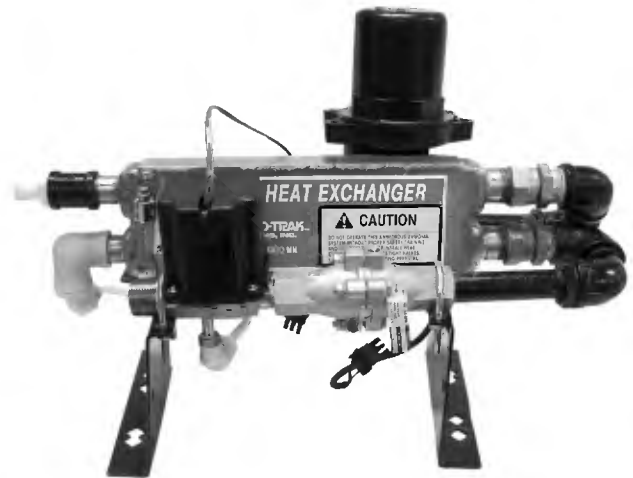
Remove any existing metering valves. If the old metering valve has a built-in manifold, it is recommended to install a separate new manifold for the NH3500 kit. Another option, although not recommended, is to use the existing manifold, making certain the old metering valve is in the maximum open position to allow for minimal restriction of flow through the plumbing. There also should not be any positive shut-off valves installed in the plumbing between the NH3500 kit shut-off valve and the knives.

Locate a convenient area on the applicator to install the NH3500 plumbing panel. When selecting an installation location, keep in mind that the hose from the break-away coupler must reach the strainer inlet with enough length to allow for proper operation of the break-away coupler disconnect mechanism and prevent kinking of the hose at hinge points. Also, the strainer's clean-out plug should be accessible for regular cleaning. Make certain that the area selected allows for enough length of the manifold hose, between the manifold and the servo valve outlet, to prevent kinking at hinge points.

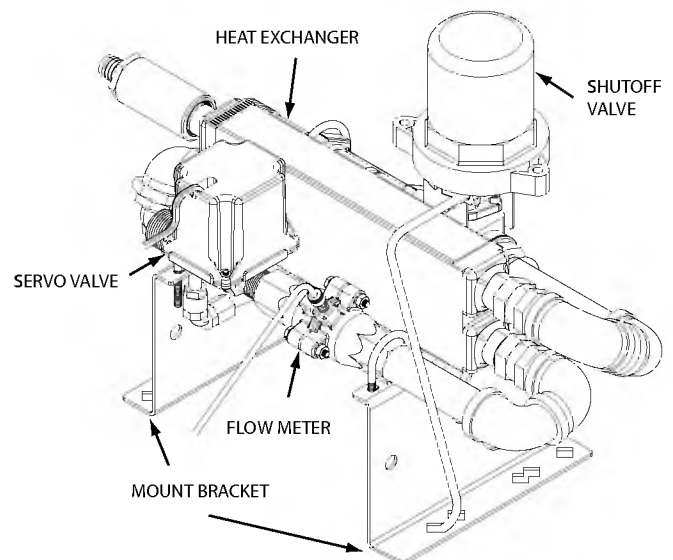
INSTALLATION NOTE: *It is recommended to use an NH3 compatible thread sealing compound such as "Slic-tite paste with Teflon", or a similar compound, on all pipe thread fittings. Slic-tite is manufactured by LA-CO Industries, Inc./Markal Company.*

Remove the NH3500 plumbing panel from the shipping board. Install the plumbing panel on the tool bar frame using the bottom brackets, carriage bolts and flange lock nuts. Trim any excess length off of the bolts if required. Attach the hose from the break-away coupler to the strainer inlet. Check hose length for proper operation of the break-away coupler disconnect mechanism. Next, connect the manifold hose to the servo valve outlet. Check for proper hose length to avoid kinking at hinge points.

Component Parts for SprayMate II for NH3 Kits



NH3500 Kit P/N 01120



Appendix G (cont)

SprayMate II NH3 Specific (cont)

Liquifier Installation

PRE-INSTALLATION: Remove the Liquifier plumbing panel from the shipping board. The Liquifier plumbing panel has been packaged with the “strainer end” mounting bracket in a shipping position. Before installing the unit on your applicator, move this bracket to the other side (inlet side) of the strainer to allow access to strainer clean-out plug for cleaning. After repositioning bracket, make sure all three brackets rest on a flat surface. If necessary, loosen all six carriage bolts (two per bracket) at base of brackets to allow all brackets to rest flat on mounting surface of tool bar. Tighten carriage bolts only after insuring that all three brackets rest on bar and unit does not “teeter” on center bracket.

LIQUIFIER KIT INSTALLATION: Remove any existing metering valves. If the old metering valve has a built-in manifold, it is recommended to install a separate new manifold for the Liquifier kit. Another option, although not recommended, is to use the existing manifold, making certain the old metering valve is in the maximum open position to allow for minimal restriction of flow through the plumbing. There should not be any positive shut-off valves installed in the plumbing between the Liquifier kit shut-off valve and the knives.

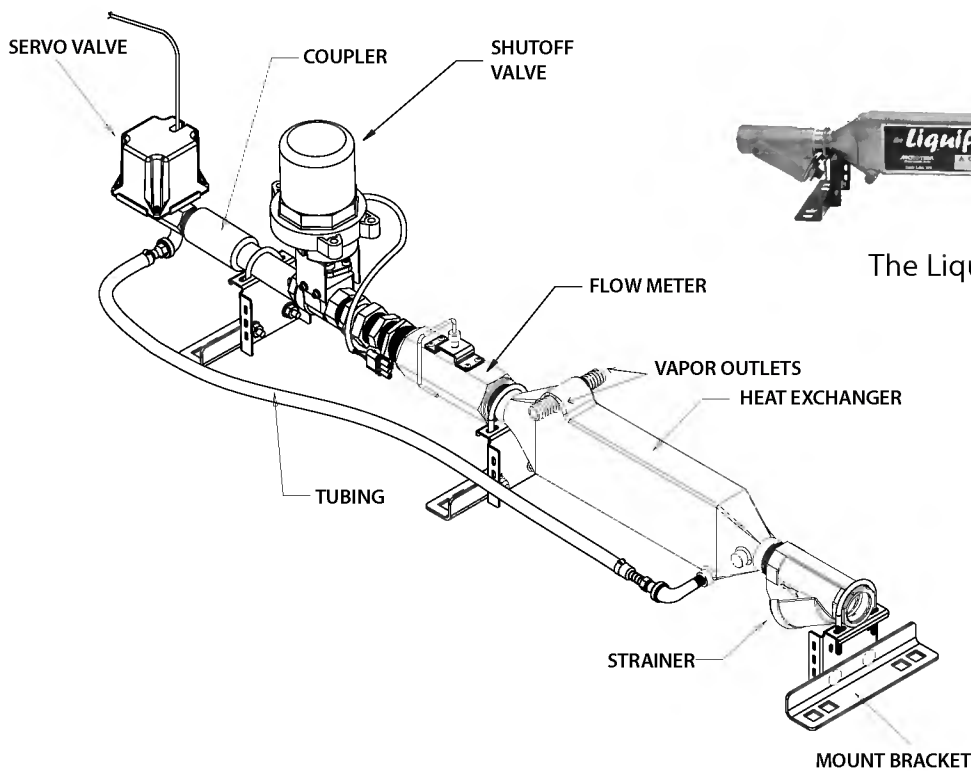
Install the plumbing panel on the tool bar frame using the carriage bolts and flange lock nuts through the top and bottom

brackets of the system. Trim any excess length off the bolts if required. Attach the hose from the breakaway coupler to the strainer inlet. Check for proper hose length for operation of the disconnect mechanism of the breakaway coupler. Connect the manifold hose to the servo valve outlet. Check for proper hose length to avoid kinking at the hinge points.

LIQUIFIER VAPOR TUBE INSTALLATION: Locate the 1/2” EVA vapor hose supplied with the kit. Starting on one half of the tool bar, connect the 1/2” hose to the outside steel vapor tube. Route the hose up the shank and along the tool bar frame to the inside steel vapor tube. Allow enough extra hose to avoid kinking at the hinge points. Cut the hose to length and attach to inside steel vapor tube. Install a 1 1/2” x 3/4” x 1/2” tee fitting approximately half way along this hose between outside and inside steel vapor tubes. *SEE ILLUSTRATION BELOW.*

Locate the 3/4” EVA hose supplied with the kit. Connect one end to the 1/2” x 3/4” x 1/2” tee fittings and route along the tool bar frame to the vapor outlet connections on the Liquifier. *SEE ILLUSTRATION BELOW.* Allow enough extra hose to avoid kinking at hinge points. Secure all hoses with properly sized hose clamps. Secure the hoses to the tool bar frame with cable ties.

INSTALLATION NOTE: It is recommended to use an NH3 compatible thread sealing compound on all pipe thread fittings.



Component Parts for SprayMate II for Liquifier Kits



The Liquifier™ Kit P/N 01097

Appendix G (cont)

SprayMate II NH3 Specific (cont)

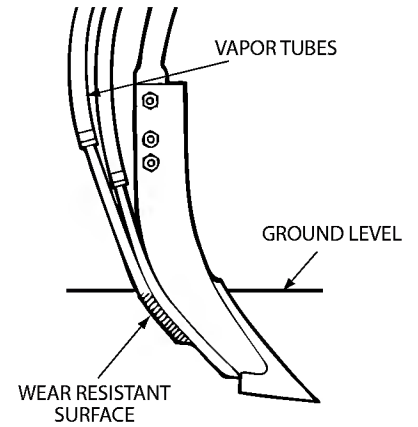
NH3500 Vapor Tube Installation

Locate the 1/2" EVA vapor hose supplied with the kit. Starting on one half of the tool bar, connect the 1/2" hose to the outside steel vapor tube. Route the hose up the shank and along the tool bar frame to the inside steel vapor tube. Allow enough extra hose to avoid kinking at hinge points. Cut the hose to length and attach to the inside steel vapor tube. Install a 1/2" x 3/4" x 1/2" tee fitting approximately halfway along this hose between the outside and inside steel vapor tubes. See Illustration below. Repeat the same procedure for the steel vapor tubes on the other half of the tool bar. Secure all hoses with properly sized hose clamps. Secure the hoses to the tool bar frame with cable ties.

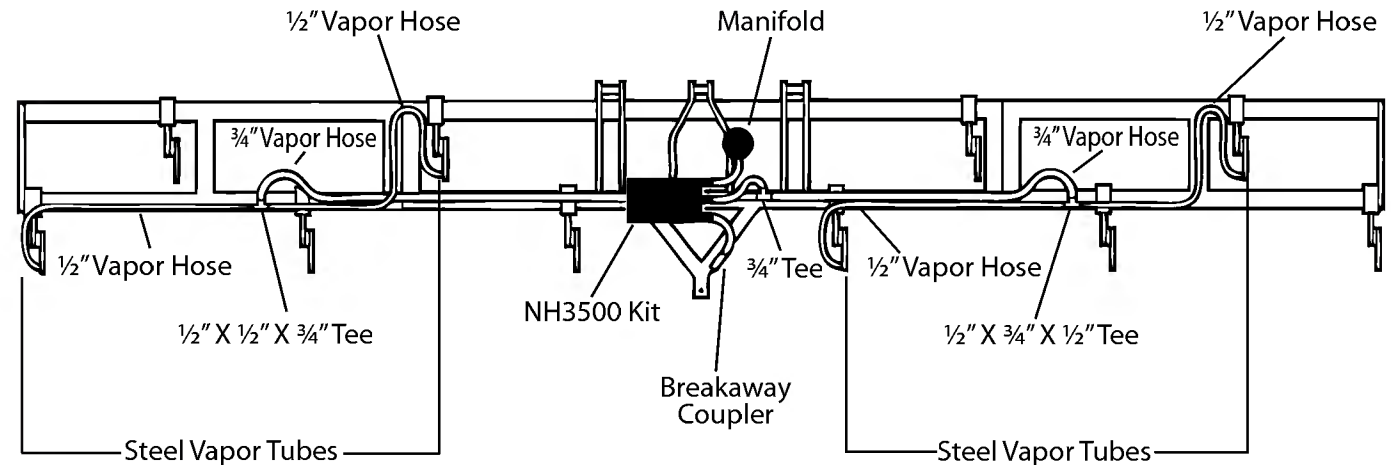
Locate the 3/4" EVA hose supplied with the kit. Connect to one of the 1/2" x 3/4" x 1/2" tee fittings and route along the tool bar frame to other 1/2" x 3/4" x 1/2" tee fitting. Cut to length and install on the tee fitting. Allow enough extra hose to avoid kinking at hinge points. Now install a 3/4" x 3/4" x 3/4" tee fitting approximately halfway along this hose (center of the tool bar) between the other two tee fittings. Using an appropriate length 3/4" hose, connect this tee fitting to the vapor tube connection on the NH3500 plumbing panel. Secure all hoses with properly sized hose clamps. Secure the hoses to the tool bar frame with cable ties.

FOR ALL NH3 KITS

Weld the steel vapor tubes to the back of your liquid tubes. All electronic equipment, including the console and radar speed sensor, **MUST BE DISCONNECTED BEFORE WELDING ON EQUIPMENT.** The four steel vapor tubes should be evenly spaced across the applicator (two per side) and installed so that only their wear resistant surface contacts the soil. Mount the tubes just high enough to avoid plugging.



NH3500 Kit — Vapor Line Installation



Electrical Connections

The main wiring harness is made specifically for use on anhydrous ammonia applicators. The harness combines the wires for the servo valve, flowmeter, shut-off valve and remote access speed connector into a single 10-pin connector.

PROCEDURE:

Plug the 10-pin tower of the main harness onto the main plumbing panel harness. Use 15' M/P extension cable (provided) if necessary. Optional extension cables are available.

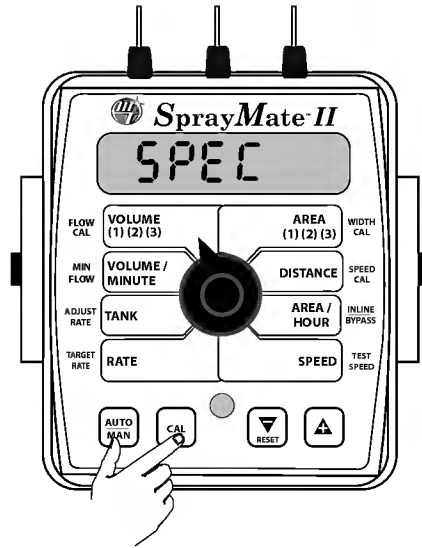
Appendix G (cont)

SprayMate II NH3 Specific (cont)

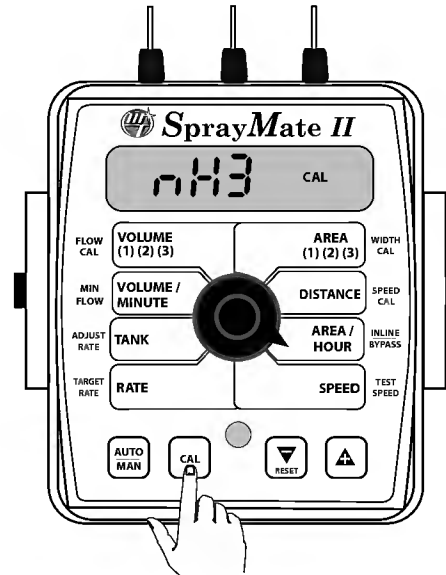
SprayMate-II Console Functions in NH3 Mode

CAUTION: DO NOT attempt to calibrate the system while the nurse tank is connected to the system.

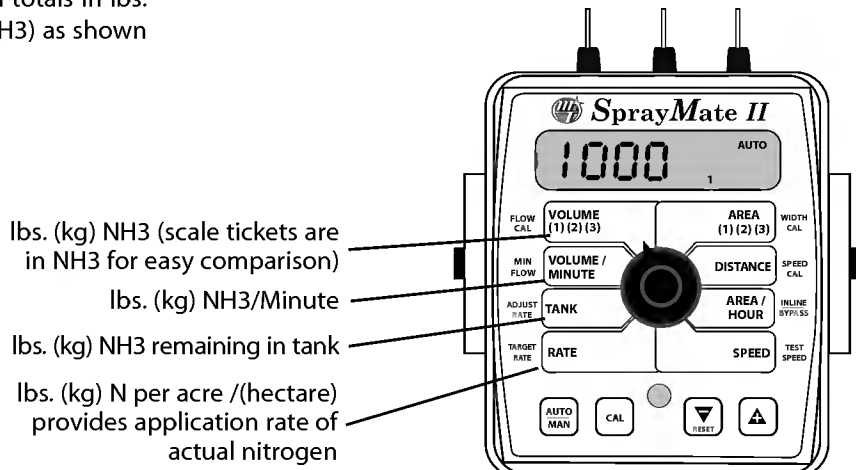
To put the SprayMate II in NH3 mode, turn the console OFF, turn the shutoff valve off and select Special Calibration by pressing the AUTO/MAN and CAL buttons while turning console power on. SPEC will appear in the display; release the AUTO/MAN and CAL buttons.



Turn the rotary switch to the AREA/HOUR position and use the "+" or "-" button to choose NH3. While in Special Calibration mode, other parameters can also be adjusted, see Special Calibration section on pages 27-28. NOTE: to save the values you changed, you MUST exit Calibration by pressing the CAL button for one second.



In NH3 mode, the console calculates rates and totals in lbs. (kg) of nitrogen (N) or anhydrous ammonia (NH3) as shown below.

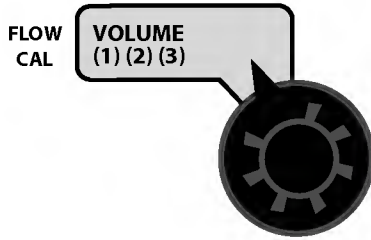


Appendix G (cont)

SprayMate II NH3 Specific (cont)

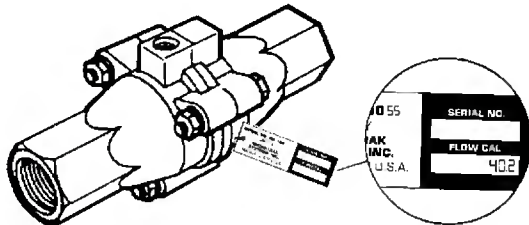
Calibration Factors for NH3

FLOW CAL: This position is used to calibrate the flowmeter for accurate liquid measurement. The flowmeter has been calibrated at the factory to read in pounds of actual "N".



To enter standard calibration mode, turn the shutoff valve off and press the CAL button for 1 second. Some of the calibration factors are the same as a liquid system, but there are some important differences:

Your Micro-Trak NH3 flowmeter has been tested at the factory and assigned a "FLOW CAL" value (pulses/lb N) to make it operate properly with the SprayMate II console. This number is stamped on the metal tag attached to the flowmeter. *See illustration below.* This is a starting point only. The value must be fine tuned. See Fine-Tuning Flowmeter Calibration for NH3 on page 61. When entering the flow cal value, take note of decimal point placement.



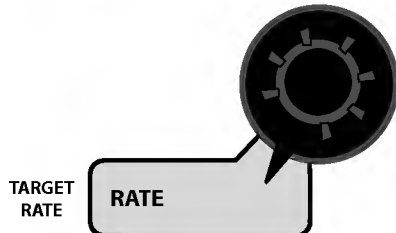
MINIMUM FLOW: Enter a minimum flow rate of 10.0 lbs. per minute (5.0 kg per minute) of NH3. This will prevent the system from applying below the recommended minimum rate for the Micro-Trak NH3 flowmeter.



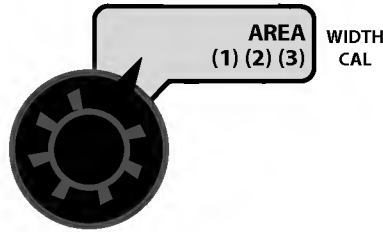
ADJUST RATE: Enter the desired amount of change in pounds (kg) of actual "N" applied per acre (hectare) for on-the-go adjustments to the Target Rate when operating in AUTOMATIC mode. Enter 0 to disable this feature.



TARGET RATE: Use the "+" and "-" buttons to enter the desired application rate in pounds (kg) of actual "N" applied per acre (hectare).

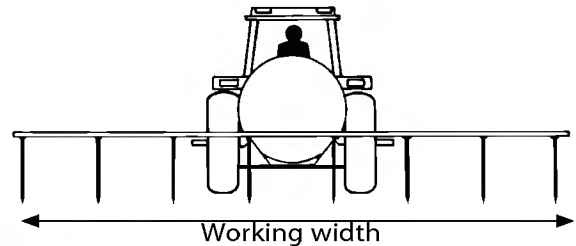


WIDTH: NOTE: To calibrate the implement width the nurse tank must NOT be connected to the system. Turn on valve switch. Use the "+" and "-" switches to adjust the number to the working width of your tool bar in inches (thousandths of meters).



SETTING TOOL BAR WIDTH: In order to accurately measure the pounds (kg) of "N" applied per acre (hectare), it is important to determine the correct "working" width. The "working" width is the width of ground being affected by any operation. This should be measured to the nearest inch (millimeter).

Your "working" width will be the number of knives times the knife spacing in inches (meters). For example, if you have 8 knives spaced at 30 inches, the working width is 240 inches. *See illustration below.*



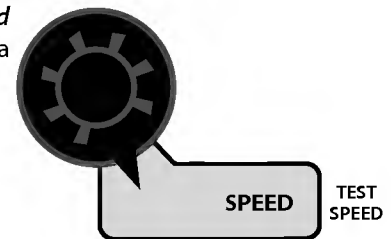
SPEED CAL: This position is used to calibrate the speed sensor for accurate speed and distance measurement. When this position is selected, the display will show the SPEED CAL value along with "CAL" on the display. *See Speed Calibration section (pages 13-15) for details.* To fine-tune the SPEED CAL, see Fine Tuning SPEED CAL for NH3 on pages 44-45.



INLINE/BYPASS: Set to BYPASS (harness reverses the wires so the servo will run correctly). NOTE: if used on a Micro-Trak NH3 system, it must be set to Bypass.



TEST SPEED: *Not used* for anhydrous ammonia application.



EXITING CALIBRATION: To save the changes you made, you MUST exit calibration by pressing and holding the CAL button until the CAL icon disappears and the warning light turns off.

Appendix G (cont)

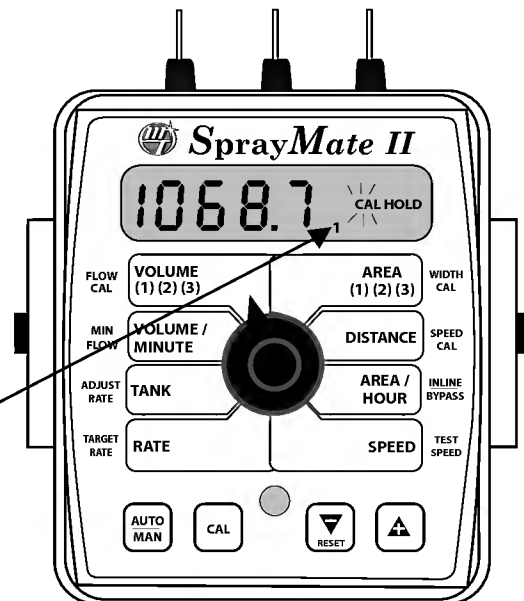
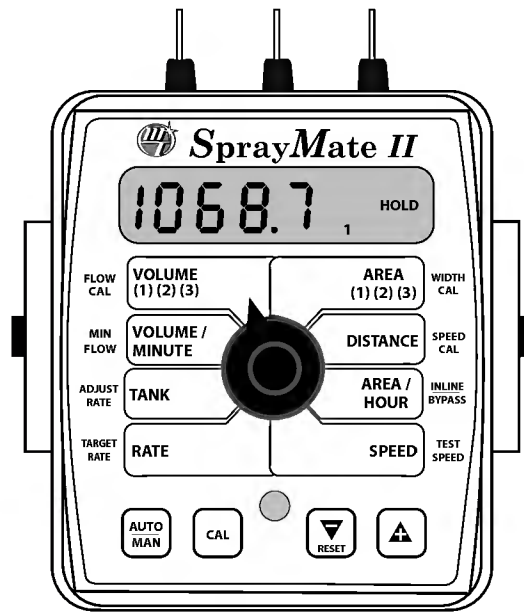
SprayMate II NH3 Specific (cont)

Fine Tuning Flow Calibration Value for NH3

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 NH3 application (please refer to **Entering Flowmeter Calibration Value**, page 26).

PROCEDURE:

1. Start with a full nurse tank. Make certain that you have an accurate scaled weight of the full tank. You will want to apply a minimum of 1,000 pounds of NH3 for this procedure. The larger the volume of NH3 used, the more accurate the calibration will be.
2. With Boom 1 switch turned OFF, turn the rotary selector to the VOLUME (1) (2) (3) position. Select which pair of VOLUME/AREA counters (1, 2, or 3) that you want to use by using the "+" button ONLY to select the pair of counters as identified by the small number in the lower right area of the left-hand display. If you attempt to use the "-" button, it will clear the selected counter pair (CLEAR will be displayed before the counters are cleared). After you have selected the counter pair number, press and hold the RESET button until the display reads 0.0.
3. Proceed to the field and perform actual application (turn Boom 1 switch to ON) until at least 1,000 pounds of NH3 has been applied. (One nurse tank is preferred). The larger the volume of NH3 applied, the more accurate the calibration will be. Obtain an accurate scaled weight of the partially used nurse tank. The difference between the starting and ending weight is your calibration weight.
4. Put Boom 1 switch in the OFF position. Compare the console's VOLUME reading with the known amount of NH3 run. If the two amounts are within one or two percent, no fine tuning is required. **If the two amounts are more than two or three percent different, continue with the next step.**
5. With the console still in the VOLUME position, enter calibration, hold the CAL button until red warning light comes on; about one second. The display will show the flowmeter calibration value and the CAL icon.
6. Momentarily press the CAL button. The CAL icon will begin to flash and the total volume will be displayed. **See Illustration to the right.**
7. When the TOTAL FLOW value is displayed, use the "+" or "-" button to adjust the value to match the amount of NH3 run.
8. Momentarily press the CAL button. The CAL icon and the flowmeter calibration number will be displayed. You will notice that the flowmeter calibration value has changed. Write down the new flowmeter calibration value. This is your "fine tuned" calibration value, keep it for future reference.
9. Exit calibration by holding the "CAL" button until the red warning light goes out (about one second).



Appendix G (cont)

SprayMate II NH3 Specific (cont)

Field Operation - Troubleshooting for NH3

Always follow accepted safety precautions. Make sure that equipment is in good operating order. Before connecting the nurse tank to the applicator, check the electric shut-off valve of the SprayMate II system for proper operation.

After changing nurse tanks or after other periods of long shut-down, operate the system in MAN until the application rate stabilizes. This allows the heat exchanger to reach operating temperature before selecting AUTO. Erratic operation may be experienced if AUTO is selected before operating temperature is reached.

Manifold pressure is very important for good distribution of NH3. Use barbed fittings with properly sized orifices or an adjustable manifold to maintain adequate pressure. If manifold back pressure is too low, proper cooling will not be achieved, vapor bubbles will be allowed to enter the flowmeter, and readings will be inaccurate. Typical manifold pressure ranges from 15 to 60 PSI (1 to 4 bar) depending on application rates and ambient temperature. If manifold pressure stops climbing but FLOW RATE continues to climb, vapor bubbles are present.

ADDITIONAL TROUBLESHOOTING TIPS FOR NH3:

See Troubleshooting section, starting on page 36.

In hilly or rough conditions the nurse tank dip tube will not remain submerged, allowing extra vapor in the system. This vapor is too much for the heat exchanger to condense and the system will exhibit erratic operation. If the dip tube remains out of liquid, operation may appear to be normal, but the system is simply metering vapor. If this occurs, you will notice extremely low manifold pressure. Change tanks before the NH3 level is low enough to cause these problems.

In NH3 control systems, location of the frost build-up is an indication of system performance. The NH3 kit will normally have frost on the output side of the servo valve and in some cases, a small amount on the bottom portion of the heat exchanger. Frost before the servo valve indicates excessive pressure drop in the delivery system or restricted vapor lines.

The strainer is a common source of excessive pressure drop and should be cleaned regularly. **AFTER COMPLETELY DRAINING THE SYSTEM**, remove the large plug and carefully clean the strainer's screen. Also, periodically check the vapor tubes for obstructions.

Appendix G (cont)

SprayMate II NH3 Specific (cont)

Flowmeter Assembly (FM-750 N)

IMPORTANT: Opening the flowmeter will void the Flow Calibration value assigned to your unit. However, you may need to take the flowmeter apart for periodic cleaning or to remove an obstruction. *See illustration below for flowmeter reassembly instructions.*

TO OPEN THE FLOWMETER:

Disconnect the hose from servo valve to manifold. Loosen the union hex closest to the heat exchanger. Remove the two "U" bolts that hold the servo/flowmeter assembly to the brackets. Unscrew the union from the heat exchanger and remove the servo/flowmeter assembly.

Use running water to rinse the assembly of any accumulated dirt. Remove the three flowmeter bolts, carefully open the flowmeter and remove the turbine. Thoroughly clean turbine and housings of any foreign material (dirt, pieces of teflon tape, rust on magnets, etc.).

Set and spin the turbine in each flowmeter housing half. It should spin freely. If not, remove the turbine, wipe the shaft and try again.

TO ASSEMBLE THE FLOWMETER:

Place the servo, flowmeter end up, in a vice or other suitable fixture. Set turbine in non-sensor housing. Properly position gasket on housing. (Gasket may be reused a few times but will eventually need to be replaced.) Pipe thread compound is not absolutely necessary but will insure a good seal. Be careful not to get compound inside flowmeter or turbine will stall. Carefully put other flowmeter housing (sensor half) in place. (Position the housing so that the two square lugs are lined up with each other.) Drop all three bolts into holes. Hold lock washers in place and finger tighten all three nuts. Nuts should be torqued to 120 in./lb. (13.56 nw/m). Attach tag by running wire between a bolt and the housings, and twisting.

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.

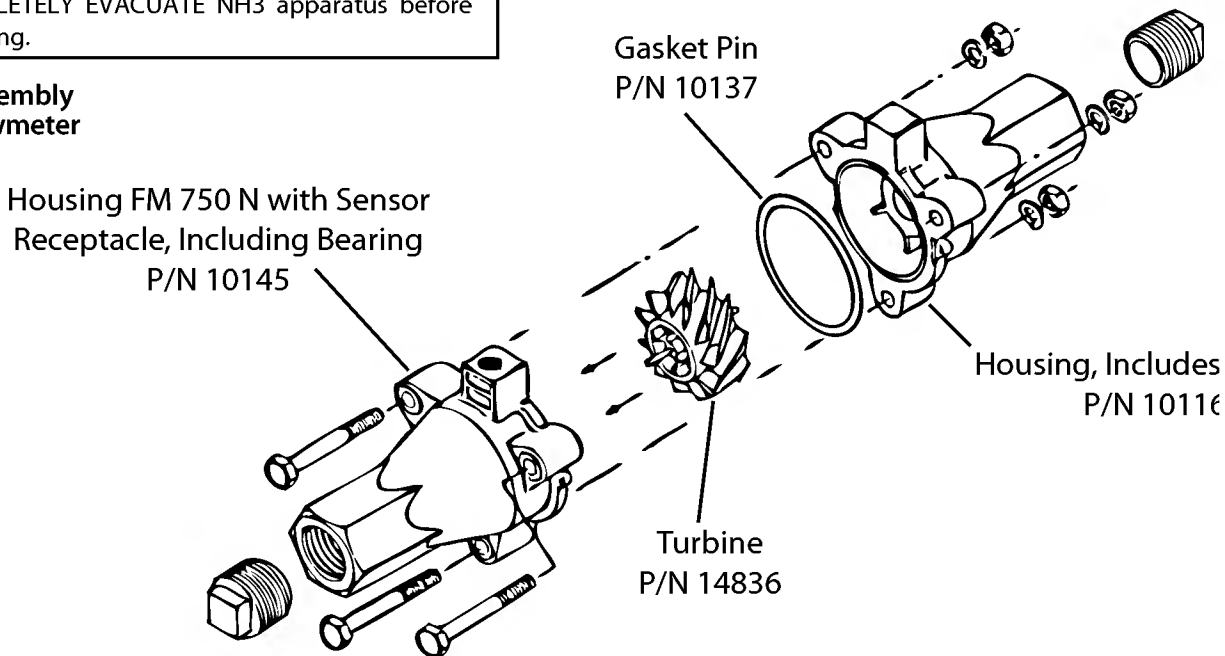
Start with original calibration number and follow procedure in manual for verifying flowmeter accuracy.

WARNING

TO PREVENT SERIOUS INJURY, DO THE FOLLOWING:

1. ALWAYS WEAR gloves, goggles, and other necessary equipment when handling NH3 apparatus.
2. DO NOT cross thread. Use anti-seize lead base thread compound.
3. THOROUGHLY BLEED hoses before disconnecting NH3 apparatus.
4. COMPLETELY EVACUATE NH3 apparatus before servicing.

Complete assembly
FM750 N Flowmeter
P/N 10899



Appendix G (cont)

SprayMate II NH3 Specific (cont)

Flowmeter Assembly (FM-1500 N)

IMPORTANT: Opening the flowmeter will void the Flow Calibration value assigned to your unit. However, you may need to take the flowmeter apart for periodic cleaning or to remove an obstruction. See *Illustration below for flowmeter reassembly instructions.*

TO REMOVE THE FLOWMETER:

Loosen two 1/2" bolts securing unit (shutoff valve end) to tool bar. Loosen union between flowmeter and shutoff valve. Slide shutoff valve away from flowmeter and unscrew flowmeter from heat exchanger.

To disassemble the flowmeter:

Remove retainer clip from one end and slide out internals. See *Illustration below.* Be careful not to bend turbine shaft.

Clean and inspect parts.

Assemble in reverse order.

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 liquid flows that direction.

If turbine does not spin freely, flowmeter may require repair. Turbines and bearing replacement kits are available.

Before reconnecting the union, loosen all six 3/8" carriage bolts at bottom of mounting bracket uprights. Tighten union then re-tighten 3/8" carriage bolts. This ensures that unit sits flat on tool bar and does not "teeter" on center bracket.

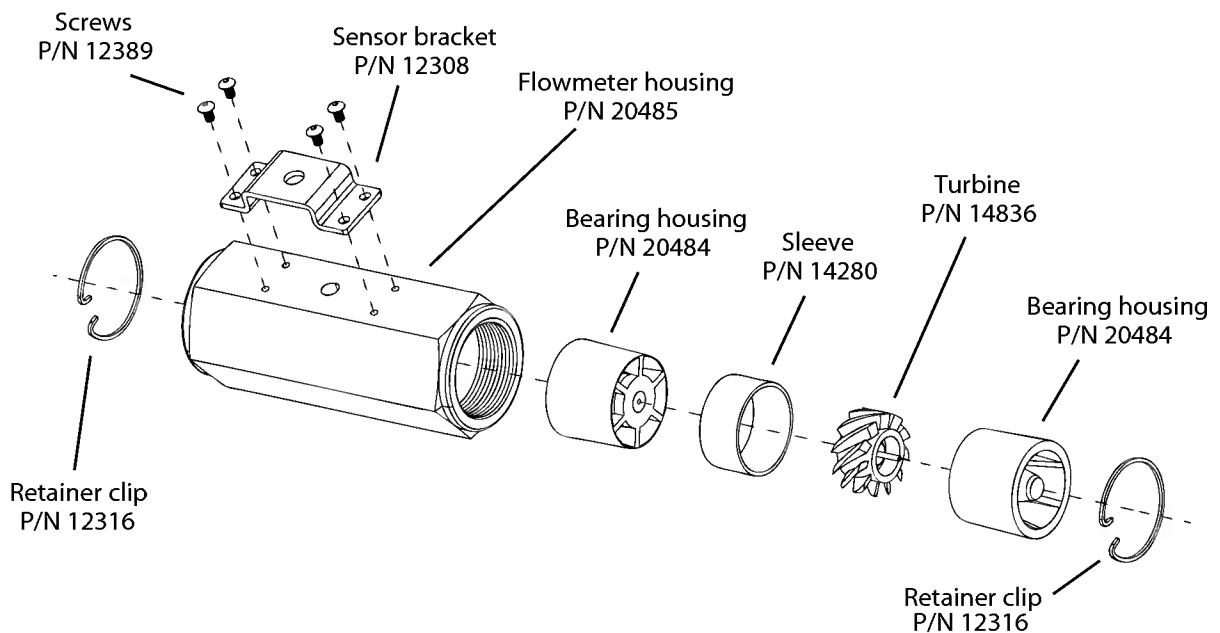
Start with original calibration number and follow procedure in manual for verifying flowmeter accuracy.

WARNING

TO PREVENT SERIOUS INJURY, DO THE FOLLOWING:

1. ALWAYS WEAR gloves, goggles, and other necessary equipment when handling NH3 apparatus.
2. DO NOT cross thread. Use anti-seize lead base thread compound.
3. THOROUGHLY BLEED hoses before disconnecting NH3 apparatus.
4. COMPLETELY EVACUATE NH3 apparatus before servicing.

**Complete assembly
FM1500 N Flowmeter
P/N 14348**

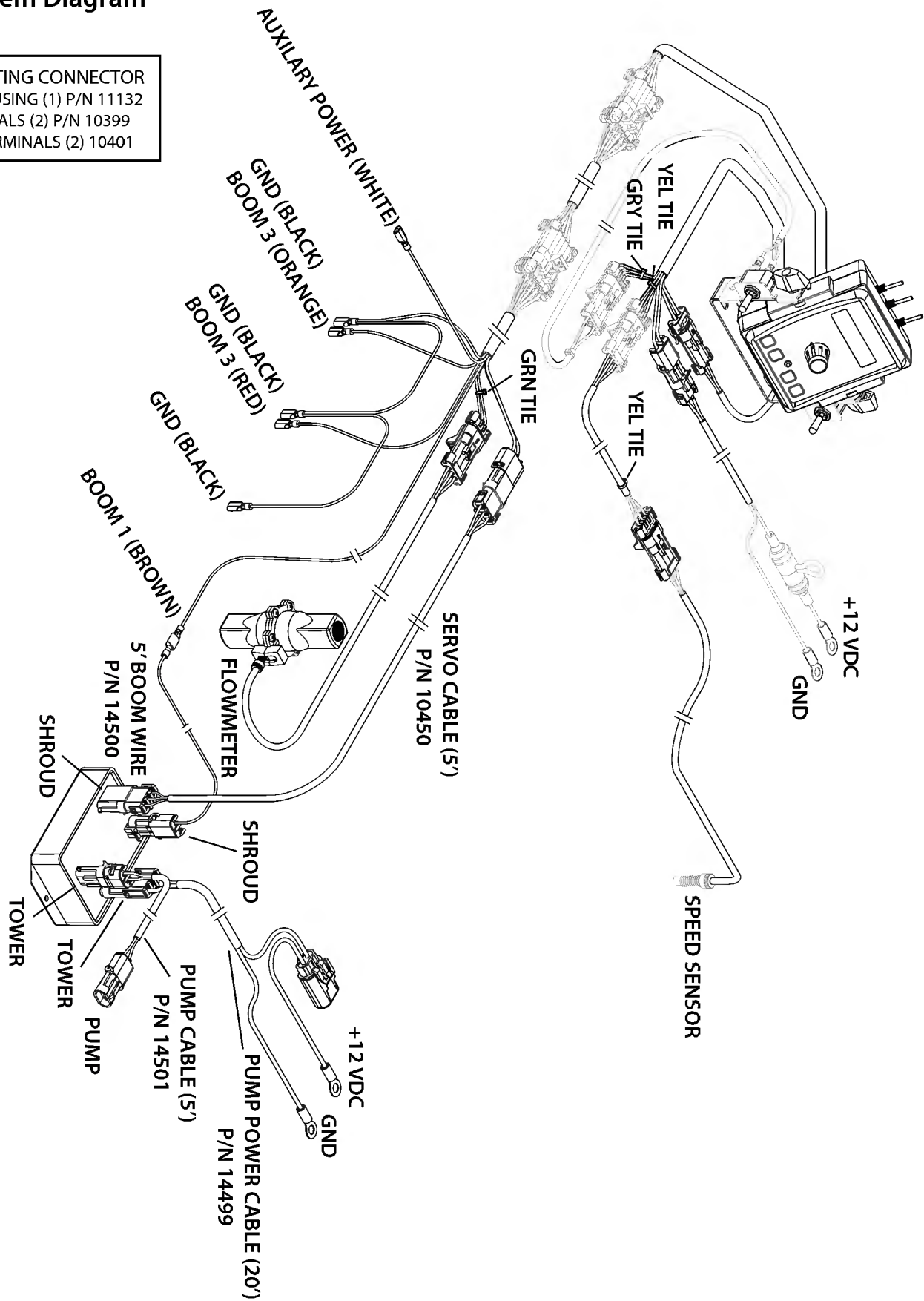


Appendix H

EPD (Electric Pump Driver) for SprayMate-II

System Diagram

MATING CONNECTOR
HOUSING (1) P/N 11132
SEALS (2) P/N 10399
TERMINALS (2) 10401



Appendix H (cont)

Pump Driver (EPD) Module

The Electric Pump Driver (EPD) 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 EPD working loose.*

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

ELECTRICAL INSTALLATION

This section explains how to connect your EPD to a 12-volt power source, and how to connect your EPD to your SprayMate II harness.

The EPD must be connected to a 12-volt DC negative ground electrical system.

BATTERY POWER CONNECTION:

Locate the power cable, P/N 14499 and route to the battery. In routing cable avoid areas where the cable may be subject to abrasion or excessive heat. Attach the BLACK wire (ground) to a screw or bolt on the equipment frame. *See Illustration below.* Be sure there is a good metal-to-metal contact. Connect the ORANGE wire to the positive battery terminal.

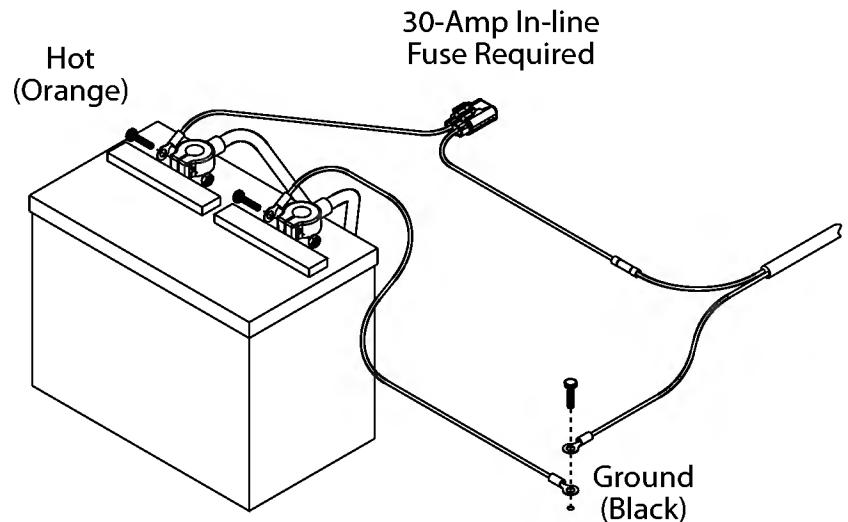
Connect the power to the EPD by plugging the 3-pin W/P tower on the power cable into the 3-pin W/P shroud of the EPD module.

Locate the boom wire, P/N 14500. Plug the 2-pin W/P shroud into the mating connector on the EPD module and plug the quick-disconnect into the mating connector on the brown wire on the SprayMate II harness.

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. Connect the 3-pin W/P shroud to the 3-pin W/P tower on the EPD module. Connect the other end of the cable to the mating connector on the SprayMate II harness.

Locate the pump cable P/N 14501. Plug the 2-pin W/P tower into the 2-pin W/P shroud on the EPD module. A mating connector is supplied to connect to the motor, or the connector on the pump cable can be removed and wire-to-wire connection can be made. Insure that the pump is running in the correct direction. If not, simply reverse the wires from the pump to the pump cable.



Appendix I

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 J

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	11462	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.

Manufactured in U.S.A. by:



111 East LeRay Ave., Box 99, Eagle Lake, MN 56024-0099

Toll-Free: 800-328-9613

507-257-3600 • Fax 507-257-3001

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

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