



**MICRO-TRAK<sup>®</sup>**  
**SYSTEMS, INC.**

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# DrillMaster™

## Auto Seed Rate Controller

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### System Manual

# *DrillMaster*<sup>™</sup>

Automatic Seed Rate Controller for Grain Drills

The DrillMaster is designed to drive a Proportional Flow Control Valve using a PWM output. The Valve controls the flow in 1 to 3 Hydraulic Motors so it can be used with 1 to 3 Section Grain Drills or Fertilizer Applicators. All Motors are in series so they all rotate at the same speed and apply the same amount of Seed or Fertilizer. Three toggle switches (top of Console) turn the Sections off, bypassing a Motor, so the RPM of the remaining motors do not change.

The DrillMaster operates as a “ground speed based controller” using seed flow (from 1 of the 3 Sections) and a speed sensor input to maintain a Target lbs/Acre of Seed as ground speed varies. An external Module is used to multiplex the Flow signal so a different Section is used when a section is turned off. Going to Hold, turning all Sections Off, or zero speed will stop auto control and will also stop the PWM Valve drive if “Auto Shut Off” is turned on (enabled). All Sections are automatically turned off if the Speed goes to zero while in Auto mode. Seed flow is measured indirectly by measuring the Seed Drive Shaft RPM instead of counting seed. It is assumed the Drill uses a one-point adjustable seed cup that is recognized as the most accurate and trouble free available for a wide variety of agricultural seeds. DrillMaster also provides an early warning when Seed bins are nearly empty by flashing a “FILL” message.

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Buyer accepts these warranty terms and limitations unless the part is returned to Seller, via proper distribution channels and approved return authorization, with dated proof-of-purchase, transportation prepaid, within sixty (60) days from the date-of-purchase for refund of the purchase price.

Doc: MTS Warranty Statement\_010119a Rev 2\_01012019

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P.O. Box 99  
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Eagle Lake, MN 56024-0099**

At Micro-Trak® Systems, we believe a product that delivers quality and performance at a reasonable 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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# Component Parts and Assembly Hardware

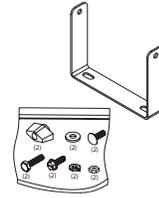
Before beginning installation, check the carton contents for the following items:



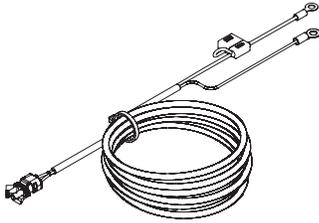
**DrillMaster Console**  
P/N 17899



**System Manual**  
P/N 50318



**Console Mount Kit**  
P/N 13181



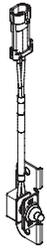
**Power Cable**  
P/N 14315



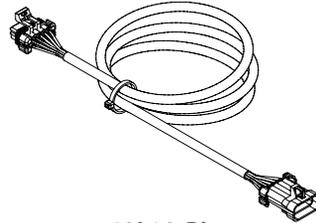
**14" Nylon cable ties (10)**  
P/N 12910



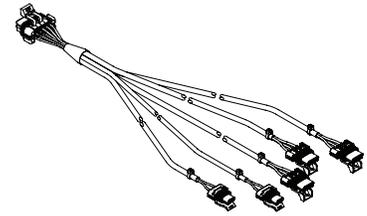
**Run/Hold Switch**  
P/N 21778



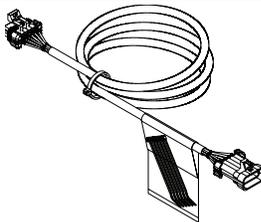
**Power Switch**  
P/N 21779



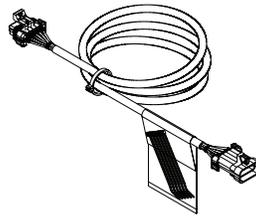
**40' 10-Pin  
Extension Cable**  
P/N 17096



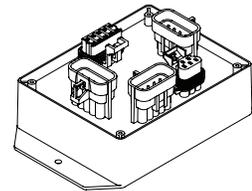
**DrillMaster Cable  
(Single Section)**  
P/N 17894



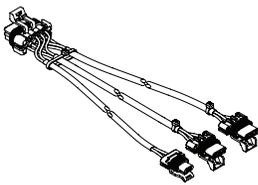
**15' Extension Cable  
(Single Section)**  
P/N 13222



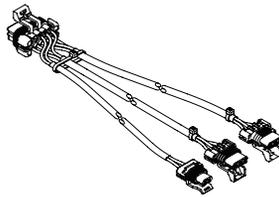
**10' Extension Cable  
(Single & Multi Section)**  
P/N 13221



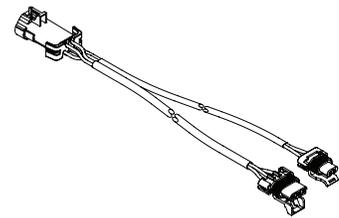
**DrillMaster Module  
(Multi Section)**  
P/N 21612



**DrillMaster Cable  
(Multi Sections 1 & 3)**  
P/N 17881



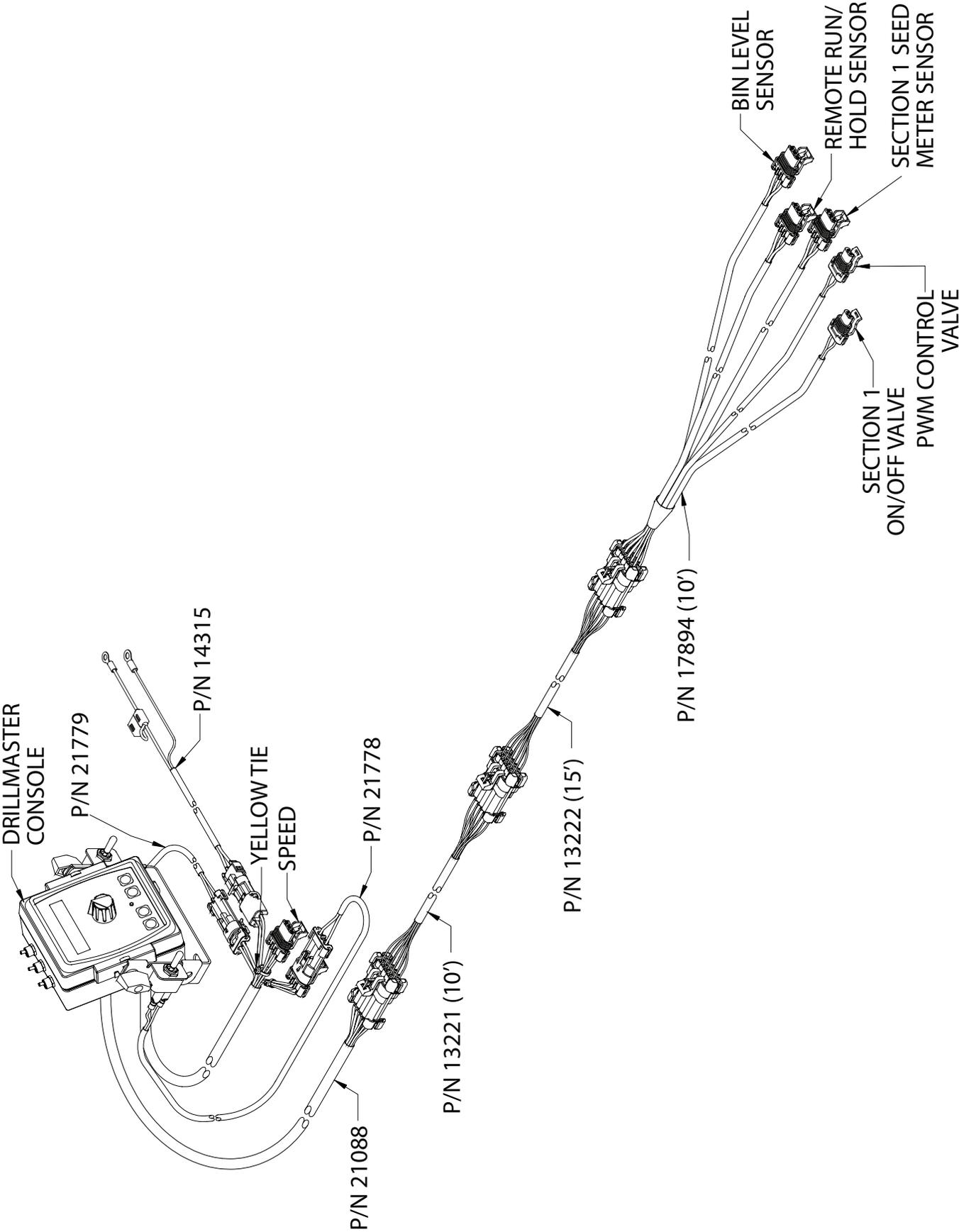
**DrillMaster Cable  
(Multi Section 2)**  
P/N 17882



**DrillMaster Cable  
(Multi Sect. PWM & R/H)**  
P/N 17883

# DrillMaster System Layout

## Mounted Single Section



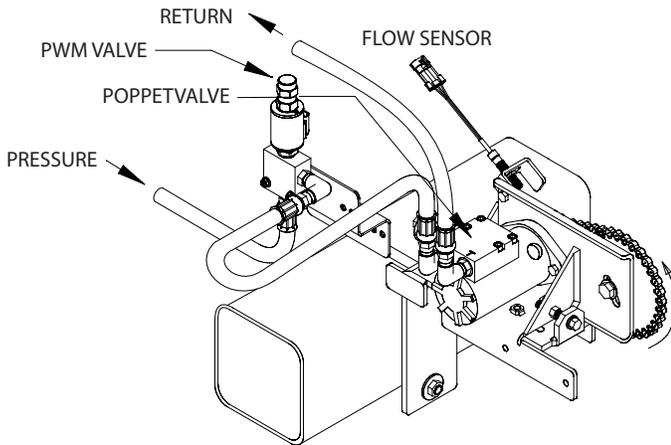




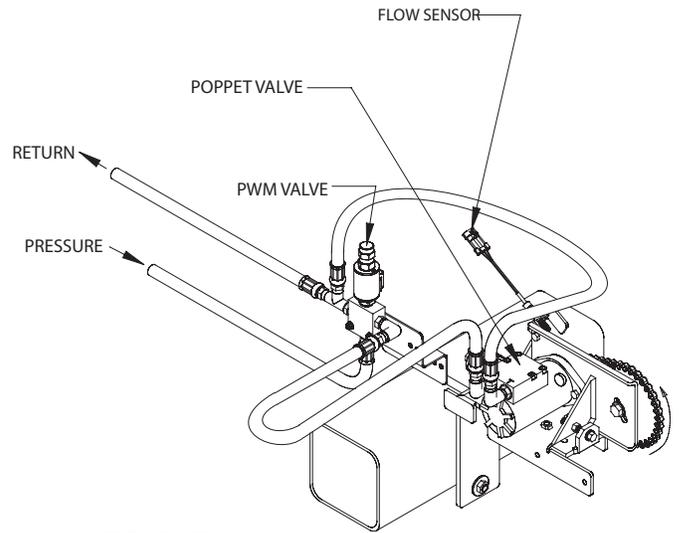


# DrillMaster Seed Rate Controllers

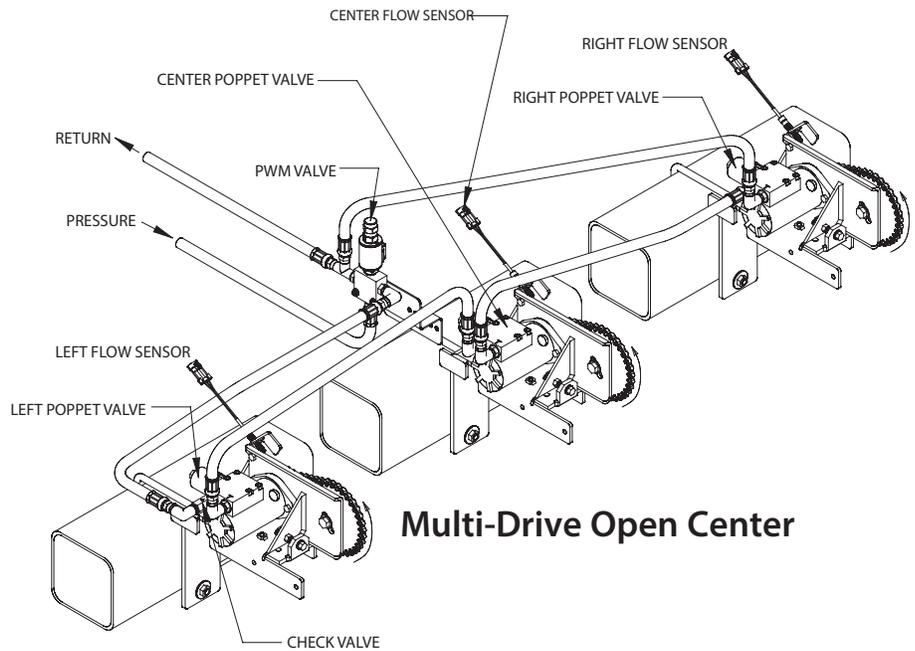
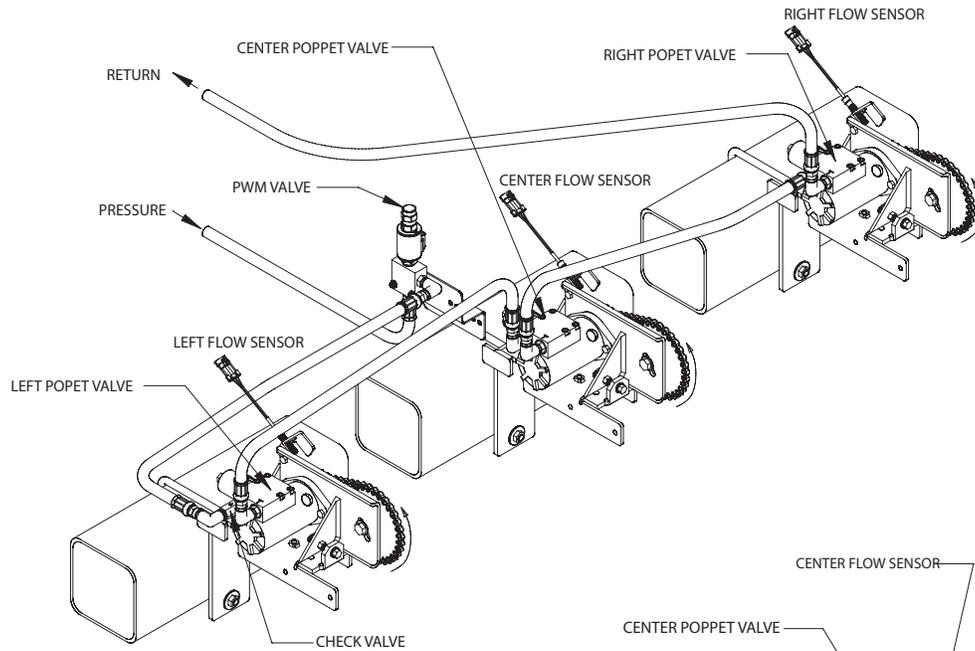
## Single Drive Closed Center



## Single Drive Open Center



## Multi-Drive Closed Center



## Multi-Drive Open Center

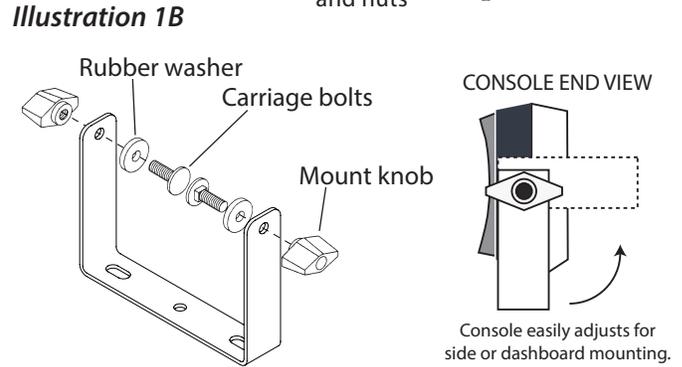
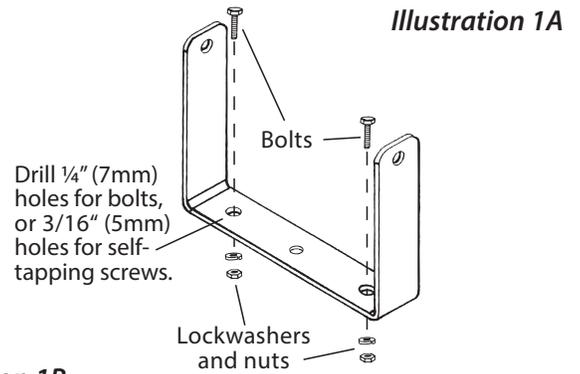
# Installation

## 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, lockwashers 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.*

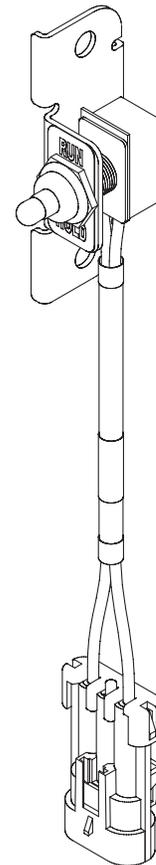


## Installing Run/Hold and Power Control Switches

Install the Run/Hold switch assembly into the bracket using the steps below:

1. Remove the mount knob from right side of the console.
2. Install the bracket over the carriage bolt and along side the console bracket.
3. Install the mount knob on the carriage bolt and tighten to secure the console and run/hold switch bracket in place.
4. Mate the switch harness connector into the corresponding connector (gray tie) on the console harness.

**NOTE:** Install Power Switch on the left side of console, same general steps as described above. Then, connect the Power Switch cable connector (2 pin) to the mating connector on the console harness.



Console Run/Hold Switch PN 21778

Illustration 2

## Installation (cont)

### Electrical Installation

This section explains how to connect your DrillMaster to a 12-volt power source, and how to connect your oil bypass valves or dump valves.

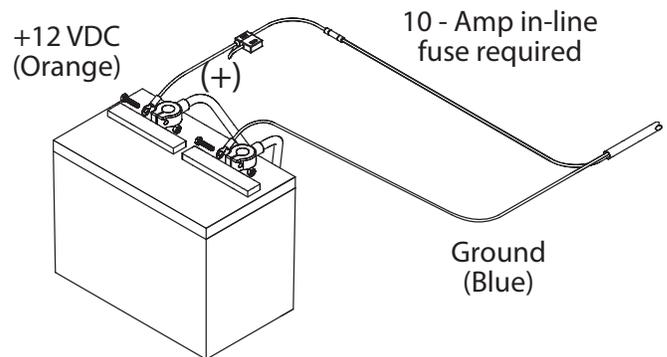
**NOTE: The DrillMaster must be connected to a 12-volt DC negative ground electrical system.**

#### POWER/BATTERY CONNECTION

Locate the power cable for the DrillMaster 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 3.* Be sure there is a good metal-to-metal contact. Connect the ORANGE wire to the positive battery terminal.

Connect the power to the DrillMaster 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 3*



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## Speed Sensor Options

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

### Astro 5 or other GPS Speed Sensor Interface

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

### Vansco™ Radar Speed Sensor

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

### Radar Interface

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

**SEE APPENDIX E FOR LIST OF ADAPTER CABLES FOR RADAR.**

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



**Astro 5 GPS Speed Sensor**



**Vansco Radar Speed Sensor**

## Installation (cont)

### Remote Run/Hold

**NOTE:** An optional remote run/hold sensor can be used in place of the provided Run/Hold switch.

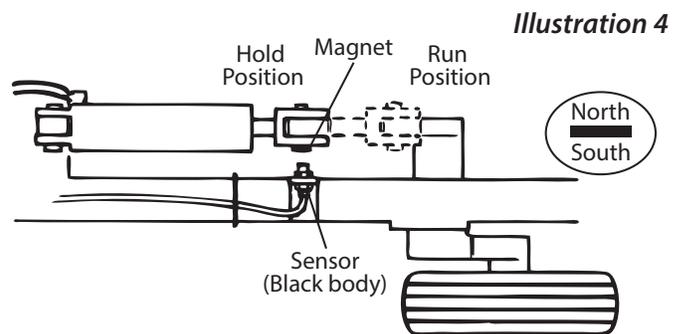
The run/hold sensor cable has a BLACK body and mates with the main harness cable having a GRAY cable tie near the 3-pin M/P connector. Make certain that you install the correct sensor cable and connect it to the correct connector on the main harness.

#### IMPORTANT

- 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 near the sensor, the console will be in HOLD and the area and distance counting functions will be disabled.

#### Hydraulic Cylinder Mounting

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



## DrillMaster Care and Maintenance

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.

# DrillMaster Console Functions

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

**SECTION ON/OFF:** The Console has three Section ON/OFF toggle switches on top of the Console. The toggle switches turn Drill Sections on and off directly and also signal the Console which Sections are on or off.

**WEIGHT TOTALS (1) (2) (3) :** Displays total product lbs. (kg) applied. Tons (metric tons) on rollover. May be reset. **(NOTE: WEIGHT and AREA counters work in pairs, if WEIGHT counter 1 is reset, it also resets AREA counter 1).**

**AREA TOTALS (1) (2) (3):** Keeps a running count of the total acres, hectares or kFt<sup>2</sup> worked. May be reset. **(NOTE: WEIGHT and AREA counters work in pairs, if AREA counter 1 is reset, it also resets WEIGHT counter 1).**

**WEIGHT/MINUTE:** Displays lbs. (kg) of product dispensed per minute.

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

**AREA/HOUR:** Displays Acres/Hour (Eng), Hectares/Hour (Metric) or kFt<sup>2</sup>/Hour (Turf).

**METER RPM:** Displays Seed Drive shaft RPM.

**RATE:** Displays application rate in lbs. /acre, kg/hectares or lbs./kFt<sup>2</sup>.

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



## Calibration Positions

## Calibration Positions

**METER CAL:** Used in calibration mode to enter the Meter Cal in Pulses/Lbs/Row (English/Turf) or Pulses/Kg/Row (Metric).

**ROWS SECTION:** Used in calibration mode to enter the Rows per Section from 0 to 255 rows for the Section selected.

**ROW SPACING:** Used in the calibration mode to enter the Row Spacing in inches (cm).

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

**ADJUST RATE:** Used in calibration mode to enter an amount of change for on-the-go adjustments to the target rate lbs/acre (kg/hectares).

**CAL TEST:** Not a true "Calibrate Factor" but rather a method of testing the Drill to determine if the correct Meter Cal factor is being used and to test if each Row is dispensing the correct amount of seed.

**TARGET RATE:** Used in calibration mode to enter the target application rate Lbs/Acre (Eng). Kg/Hectares (Metric) or Lbs/KFt<sup>2</sup> (Turf).

**TEST SPEED:** Not a true "Calibrate Factor" but rather a method of testing the Drill. Typically it is used to confirm that **Auto Control** can be maintained across a range of expected ground Speeds.

## Soft Key Functions



Key which changes operation from automatic control to manual valve control.



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. Adjusts Target Rate in AUTO or Application Rate in MAN.

# Calibration

## Selecting Measurement Units

### English, Metric or Turf?

The DrillMaster is capable of displaying information in American English or standard Metric measurement. The DrillMaster is shipped from the factory programmed for English.

**NOTE:** 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 Sections OFF to enter Cal. To activate the Metric mode, turn power OFF and place the rotary switch at **“AREA TOTALS.”** Hold down both the **“CAL”** and **“-”** keys and turn power ON. See *Illustration 5*. 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 **WEIGHT TOTALS** 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.

**NOTE:** You MUST exit CAL to lock in English units.

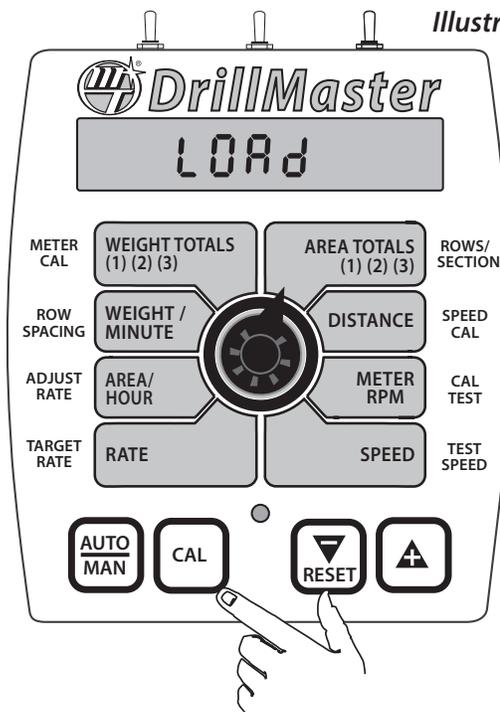
Exit CAL by pressing and holding the “CAL” key until CAL disappears from the display (*approximately 1 second*).

#### TURF

- Selected only in “Special” Calibration. See Page 23.

**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.

Illustration 5



# Calibration (cont)

## Entering Calibration Values

To enter or change any of the system’s calibration values, turn all used Sections 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, for safety reasons, 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.

**NOTE:** The Console must be in Hold or all used Sections OFF in order to toggle Calibrate Mode on, however, it can be in Run, Hold or Sections ON or OFF to toggle Calibrate Mode off.

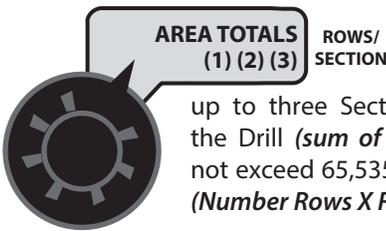
Once in calibration mode, you may change any one, all, or none of the values, in any order.\* To select a calibration position, simply turn the rotary selector to the desired position. Calibration positions are identified by the White labeling on each side of the rotary selector. All values are entered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

\* Test speed must be last.

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.

**ROWS/SECTION:** This displays the Rows Per Section from 0 to 255 rows for the Section selected. Unused Sections must be programmed to zero rows. The DrillMaster can have up to three Sections. The total width of the Drill (sum of all Section widths) must not exceed 65,535 inches or 65.535 meters (Number Rows X Row Spacing).



To adjust the number of Rows of a particular Section simply turn that Section on and all others Off. The corresponding Section Icon 1 - 3 will turn on and the number of rows in that section can be adjusted. Actually the first Section turned on, from left to right, will be selected. For example if Section 1 is off and Sections 2 and 3 are on, then Section 2 is selected since it is the “first” Section on, and Section 2 Rows can be adjusted. If no Sections are turned on, it will display “no SECTn” (alternating “no” and “Section”) to remind the user to turn a Section on, and/or select RUN to enable the Sections.

**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 details for determining SPEED CAL on page 17.



**CAL TEST:** This is not a true “Calibrate Factor” but rather a method of testing the Drill to determine if the correct Meter Cal factor is being used and to test if a particular Row is dispensing the correct amount of seed. When RUN is selected it will use Test Speed and AUTO control to dispense Sample Size amount of Seed per row and then automatically stop.



The “Cal Test” is recommended for a quick spot check to ensure proper operation. It can be used to:

- Test the accuracy of ‘Meter Cal’ (make sure it matches what the Drill is actually planting).
- Test one Row, or many Rows, or the entire Drill at once.
- Test the consistency of the Rows (see variation from one row to another).
- Find the minimum and maximum Row (lowest and highest planting rate).
- Find the AVERAGE planting rate for the entire Drill.

This procedure is different than the “Fine Tuning” found in the Meter Cal section in the following ways:

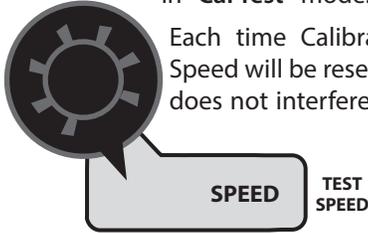
1. This procedure is a quick method to test the accuracy of Meter Cal. It DOES NOT require weighing entire Drill. Instead only a small sample from one Row is needed and it can be performed in the field. But it can also test multiple Rows at once if desired.
2. This procedure uses AUTO to make sure the planter is running at the Target Speed. This is important because the Seed Meter planting mechanism is speed sensitive so it must be tested at the proper speed. In the Meter Cal Fine Tuning procedure, the user can use AUTO or MANUAL mode and use a lower or higher speed if desired.
3. This procedure uses a fixed Sample Size (another cal factor) making it more repeatable. In the Meter Cal Fine Tuning procedure the sample size is up to the operator and can be any size.
4. This procedure automatically stops when the sample size is reached. In the Meter Cal Fine Tuning procedure the operator must stop the test at the appropriate time.
5. This procedure will not affect or change any of the three Weight Totals counters. In the Meter Cal Fine Tuning procedure one of the three Weight Totals counters must be cleared.

**NOTE:** See the Cal Test Fine Tuning procedure in Appendix C.

# Calibration (cont)

## Entering Calibration Values (cont)

**TEST SPEED:** Test Speed is not a true “calibrate factor” but rather a method of testing the Drill. Typically it is used to confirm that Auto Control can be maintained across a range of expected ground Speeds. In addition, the Test Speed is used in “Cal Test” mode.



Each time Calibration is selected the Test Speed will be reset to 0 mph (**turned off**) so it does not interfere with any other calibration procedures. If the operator wants to use a Test Speed he must select the Speed position and then use the “+” key to

adjust it above zero mph. Any non-zero Test Speed will make the CAL icon flash to remind the operator that a “Test Speed” is running and Calibration is no longer fully operating. He can no longer change any Calibrate factors. Instead, the normal operating modes are enabled except they will all use the Test Speed instead of the actual speed input. The WARN LED will remain on, as reminder that Test Speed is selected. Hold will operate normally and Speed will operate using the Test Speed and Weight, Area/Hour, Rate, and Weight/Minute will also operate. The Area and Distance will not change while in the Test Speed Mode.

If AUTO is selected the Console will try to run the PWM Valve to reach the Target Rate (lbs/Acre). The “+”/“-” keys can be used as normal to change the Target Rate in steps equal to the “Adjust Rate”.

To exit “Test Speed” the user must hold the CAL key for 1 second (**or turn the Console off**) and the CAL icon will stop flashing, the WARN LED will turn off and it will exit Test Speed and CAL Mode. The Test Speed cannot be turned off by reducing it to zero because the minimum Test Speed is 0.1 mph.

**TARGET RATE:** Enter the value for the desired or Target Rate in Lbs/Acre (English) or Lbs/ kFt<sup>2</sup> (Turf) or kg/hectare (Metric) with one or more decimal places as follows. It can range from 0.00 to 99,999. This is the application rate that the console will lock onto when operating in AUTO.



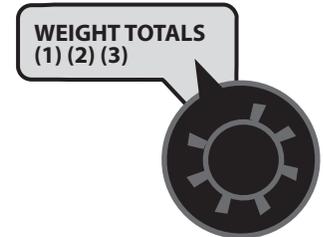
**ADJUST RATE:** Enter the value for the desired amount of change in lbs. per acre, kg per hectare or lbs./ kFt<sup>2</sup> to be used for making on-the-go rate adjustments when operating in AUTO. For example, if a value “1.0” is entered, you will be able to increase or decrease your application rate in one-lb. (kg) increments during operation in AUTO. To disable this feature, simply enter “.0” for a value.



**ROW SPACING:** Adjusts Row Setting value to the nearest tenth of an inch (tenth of a centimeter).



**METER CAL:** Adjusts MeterCal value from 1 to 65,535 Pulses/Lbs/Row (English, Turf) or Pulse/Kg/ Row (Metric). **NOTE:** See Appendix D for additional information.



Calibration Factor	Default Values	
	English	Metric
TARGET RATE	60.0 lbs/acre	70.0 kg/hectare
ADJUST RATE	1.0 lbs/acre	1.0 kg/hectare
ROW SPACING	10.0 inches	25.4 centimeters
SPEED CAL	0.189 in/edge	.48 cm/edge
METER CAL	2767 Pulses/Lbs/Row	6104 Pulses/Kg/Row
Distance	0	0
Area 1, 2, 3	0	0
Volume 1, 2, 3	0	0
ROWS/SECTION 1, 2, 3	12	12



## Calibration (cont)

### Speed Cal for Radar or GPS Speed Sensors

See the table below for SPEED CAL numbers to enter for various radar models or GPS speed sensors. *To fine tune the SPEED CAL number, see Appendix B.*

#### 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
<b>GPS Speed</b>			
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

# “Special” Calibration

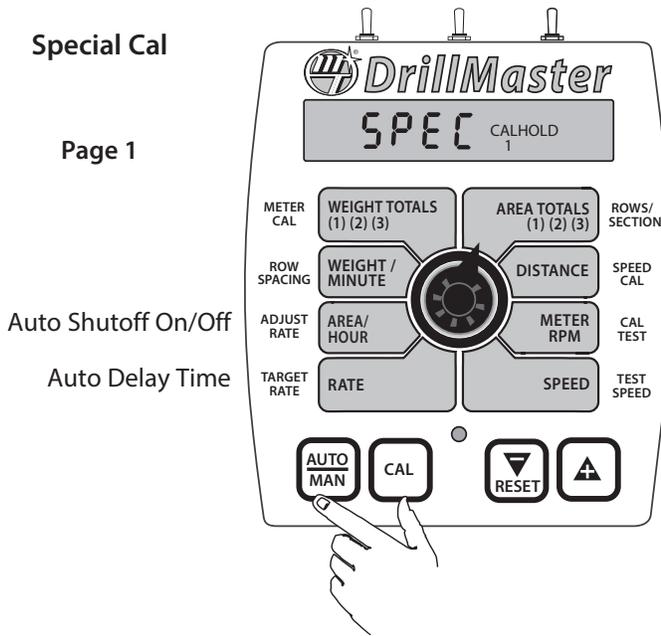
## Entering “Special” Calibration

“Special” Calibration 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 “Special” Calibration. Release the **AUTO/MAN** and **CAL** buttons. The **CAL** icon and Warn LED will turn on. The number 1 will also appear in the lower right display area to indicate that page 1 of Special Cal is selected. To select page 2 of Special Cal, momentarily

press the **CAL** button and the number 2 will appear in the lower right display area. To go back to page 1, momentarily press the **CAL** button again. The desired “Special” Calibration parameter(s) can then be accessed with the rotary switch. *See 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.**



Special Cal	PWM Version
Page 1	Page 2
Units	PWM Frequency
Sample Size	Max PWM
Control Speed	Min PWM
Shaft CAL	

The following table describes the “Special” Cal parameters and shows the factory settings. More detailed descriptions follow the table.

“Special” Calibration Parameter	Default Factory Setting	
	English	Metric
Units	0 (Ἐνῶ) (English)	1 (μετρ) (Metric)
Sample Size	1.00 Lbs	0.50 Kg
Control Speed	-1	-1
Shaft Cal	60	60
Auto Shutoff	On	On
Auto Delay Time	1 Sec	1 Sec
PWM Frequency	100 Hz	100 Hz
Max. PWM	90%	90%
Min PWM	30%	30%

# “Special” Calibration (cont)

## Entering Page 1 “Special” Calibration Values

**UNITS:** Chooses 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). **NOTE: Always Check ALL Calibration Factors after changing UNITS.**

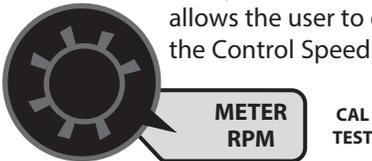


**SAMPLE SIZE:** Sample Size can be adjusted from 0.00 to 655.35 lbs or kg. This will determine how much seed is dispensed per Row during the Cal Test. The default is 1.00 pound (0.50 Kg) but it can be adjusted for various Seed types.

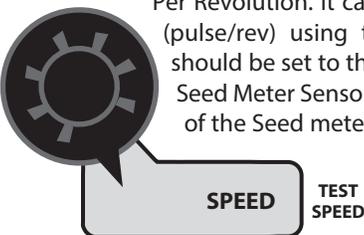


When the Sample Size is set to 0.00 it will stop the “Cal Test” as soon as it is started. This effectively disables it so the user can not accidentally run the “Cal Test”.

**CONTROL SPEED:** Control Speed can be adjusted from -4 to 3. It is normally set in the middle (-1) but if needed, it allows the user to either decrease or increase the Control Speed for his particular system.



**SHAFT CAL:** Allows the user to enter the Shaft Cal in Pulses Per Revolution. It can be changed from 1 to 255 (pulse/rev) using the “+”/“-” (RESET) keys. It should be set to the number of pulses from the Seed Meter Sensor that result in one revolution of the Seed meter Shaft.



**AUTO SHUTOFF ON/OFF:** Area/Hour allows the user to turn the Auto Shut Off feature On or Off by using the “+”/“-” (RESET) keys and the display will show or .

### ON - OPERATION

While in AUTO mode, when the “Auto Shut Off” feature is turned on (typical), it will automatically turn the PWM Valve off when HOLD is selected, or when all used Sections are turned off, or when Speed goes to zero. Zero speed has the same effect as turning all Sections off because of the “Automatic Section Off” feature (**Sections automatically turn off when speed goes to zero**). This is useful in most systems where HOLD must stop hydraulic flow to a drive shaft. The “Auto Shut Off” feature also operates while in Test Speed mode, it just skips the test for zero speed since Test Speed can’t be set to zero.



### OFF - OPERATION

While in AUTO mode, when the “Auto Shut Off” feature is turned off, it will stop automatic control and simply “maintain” the PWM Valve at the current flow when HOLD is selected, or when all used Sections are turned off, or when Speed goes to zero.

**NOTE: In the MANUAL mode, selecting Hold, or turning all used Sections off, will override the Auto Shut feature and always stop the PWM output independent of Auto Shut Off setting.**

**AUTO DELAY TIME:** Allows the user to change the Auto Delay Time. Pressing “+” and “-” buttons will adjust the Delay Time from 0 (Off) to 1, 2, 3, or 4 seconds.

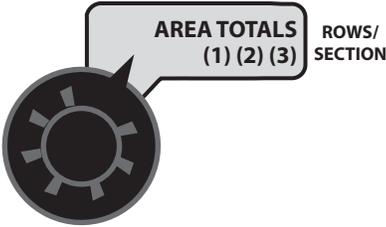
Automatic control is delayed for “Delay Time” seconds when going from Hold to Run or from all used Sections off to one or more Sections on. This provides time for motorized valves to operate and allows the flow to stabilize.



## “Special” Calibration (cont)

### Entering Page 2 “Special” Calibration Values

**PWM FREQUENCY:** It can be adjusted from 50 Hz to 500 Hz in 1.0 Hz steps. It should be set to the optimum frequency for the particular valve being used.

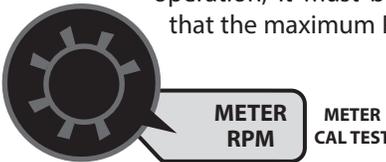


**MAX PWM:** It can be adjusted from 0% to 100% in 1% steps. The PWM duty cycle will remain below this limit in both manual and auto operation, when in Run. For proper operation, it should be



set to some value greater than the Minimum PWM duty cycle. The maximum PWM function can be used to ensure the hydraulic flow never exceeds a maximum amount. This could be used to make sure a drive shaft never exceeds a maximum RPM, etc. It can also be used to optimize operation with a particular PWM valve. For example, if a valve is at max flow when the duty cycle is at 85%, then the max PWM should be set to 85%.

**MIN PWM:** It can be adjusted from 0 to 100% in 1% steps. The PWM duty cycle will remain above this limit in both Manual and Auto operation, when in Run. For proper operation, it must be set to some value less than the maximum PWM duty cycle.



The minimum PWM function can be used to ensure the hydraulic flow never drops below a set amount. This could be used to make sure a drive shaft never stops turning, etc. It can also be used to optimize operation with a particular PWM valve. For example, if a valve is set at minimum flow when the duty cycle is 35%, then Min PWM should be set to 35%.

# Operation

## Console Switches and Buttons

Make sure your system is properly calibrated before beginning to apply product. We also recommend completion of Pre-Field System Checkout described on *page 27* prior to beginning any field operations.

### CONSOLE POWER/SYSTEM ON/OFF

The system can be turned ON and OFF by using the ON/OFF switch and bracket kit. When the console is turned on, it will display the number of hours of operation for 1.5 seconds, then it will display **PULSE** for 1.5 seconds and then displays the Software Number and Software Revision for 1.5 seconds. The Sections will be disabled (*turned off*) and the PWM output will remain off.

### 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 6 to the right*. With **RATE** selected, the console will display the Application Rate in units in lbs/acre, kg/hectares or lbs./kFt<sup>2</sup>. See **Rotary Positions** on the next page for additional information about data displayed.

### RUN/HOLD SWITCH

The RUN/HOLD is the master switch for turning all (active) sections on and off.

**NOTE: The DrillMaster system can be operated in either Manual (MAN) or Automatic (AUTO) mode. The following contains additional information.**

### 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.**

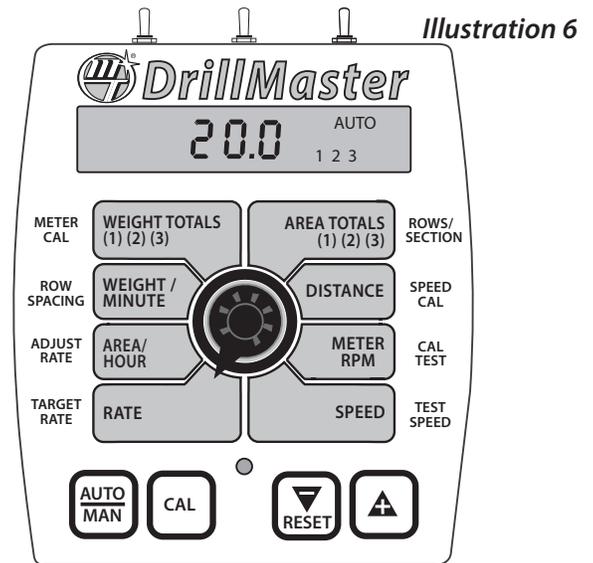
### MANUAL

In **MAN**, Select **RATE** then the PWM can be adjusted using the **“+”** and **“-”** (**Reset**) buttons from **Min PWM to Max PWM** in 0.1% steps. The longer the **“+”** and **“-”** (**Reset**) key is pressed the faster the PWM is changed.

### AUTOMATIC

To turn on the **AUTO** mode, press **AUTO/MAN** button so the **AUTO** icon appears in upper right portion of display. *See Illustration 10*. In automatic mode, the system will control the flow rate to maintain the calibrated application rate when the vehicle speed changes, or when sections are turned on or off. To operate the system in automatic mode, simply turn on the hydraulic system, turn on the desired number of sections, place the **RUN/HOLD** switch in the **RUN** position and drive.

**NOTE: In AUTO mode, the system will not turn the sections or conveyors on until it has a speed signal. Use either the RUN/HOLD switch to turn the system off and on when turning around or to stop spreading at any time. See the following sections for operation details.**



Turn rotary dial to display desired readout.

### “+” AND “-” BUTTONS

During normal operation, when automatic **“AUTO”** control 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).

During normal operation, when **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 via the control valve.

During normal operation, when either automatic (**AUTO**) or manual (**MAN**) is active, the RUN/HOLD switch is in the **HOLD** position and the rotary switch is turned to **WEIGHT / MINUTE**, pressing the **“+”** or **“-”** (**Reset**) button will increase or decrease weight/minute rate.

### ON-THE-GO “DELTA” RATE ADJUSTMENTS (ADJUST RATE)

The calibrated target rate in lbs./acre, kg/hectare or lbs./ kFt<sup>2</sup> represents the amount of product 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 be in automatic **“AUTO”** mode active and the rotary switch must be set to the **RATE** position.

### EXAMPLE: Adjust Rate = 50.00 and Target Rate = 500

With **AUTO** selected and the rotary selector turned to **RATE**, pressing the **“+”** key once will increase the target rate from 500 to 550. The display will momentarily show the new target rate of 550 and then show the actual application rate. Pressing the **“-”** key once will decrease the target from 550 to 500.

**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 the unit is turned off.**

## Operation (cont)

### Console Switches and Inputs

#### SECTION ON/OFF

The Console has three Section On/Off toggle switches on top of the Console. The toggle switches turn Drill Sections **ON** and **OFF** directly and also signal the Console which Sections are on or off.

Sections are **NOT** under software control and **CAN NOT** be turned on and off with VRA control.

When in the RATE mode then the Number Icons (1, 2, 3) will indicate which Sections are turned on. However, if a Section has zero Rows/Section then the icon for that Section will remain off (*except during calibration*) even if the toggle switch is accidentally turned on.

If using a multi-section adaptor module to control more than one section, the output of the switches is used by the module to determine if a flow signal should be present. If the module senses a Section On signal, a Flow signal is expected from the corresponding section.

**NOTE: To avoid having unused sections cause a No Flow or Emergency Stop condition, the unused section switches must remain off.**

Turning all used Sections off will not select the Hold mode. Distance will continue to operate but Area counters will not change since the Width is zero with all used Sections off.

When all used Sections are turned off the Console will stop accumulating Weight even if a Seed Shaft (flow) signal is present.

Turning all used Sections off may or may not turn the PWM Valve off (stop hydraulic flow) depending on the setting of the AUTO SHUT OFF cal factor (*see AUTO SHUT OFF information on page 21*).

Turning all used Sections off will disable Automatic Control (even if PWM output continues).

#### WIRELESS INPUT

An optional Wireless Remote Module can be added to provide Wireless Run, Hold and +/- functions.

#### BIN LEVEL SENSOR INPUT

When the Bin Level Sensor input goes low, the Seed Bin is near empty and the Console will begin to flash "F LL" (alternating with normal display data).

When used with a single Section Drill (*single Seed Bin*) the Bin Level Sensor drives the Bin Level Sensor input directly.

When used with a three Section Drill, then an external Module is used to multiplex up to three Bin Level Sensors (*three separate Seed Bins*). When any one of the three Bin Level Sensor inputs are low, the Module will signal the console flash "F LL".

#### SEED SIGNAL (Flow) INPUT

When used with a single Section Drill (*single Seed Bin*) there is only one Seed Meter drive shaft. The Sensor on that shaft drives the Seed Signal input directly.

When used with a three Section Drill there are three Bins and three Seed Meter drive shafts and they can be turned on and off independently. In that case an external Module is used to select one of the three possible Seed signals. The Module will normally use the Seed Signal from Section 1 but if that Section is turned off then the Module will automatically select one of the other two Seed Signals (*which ever is still running*).

It should be noted that Seed Signal (flow) input does not count Seeds directly and blocked Seed tubes or empty bins (no Seeds) will not be detected.

#### PWM OUTPUT

The Console is designed to drive a Proportional Flow Control Valve. The PWM duty cycle will vary from the **Min PWM** to **Max PWM** calibrate values.

The Proportional Valve controls the hydraulic flow in 1 to 3 Hydraulic Motors so it can be used with 1 to 3 Section Grain Drills or Fertilizer Applicators.

**NOTE: All hydraulic Motors MUST BE plumbed in series so they all rotate at the same speed so all Sections dispense the same amount of seed per revolution of the Seed drive shaft.**

## Operation (cont)

### General Information

#### WARNING DEVICE

The console is equipped with a RED warning light. In AUTO, the light will flash when the actual application is plus or minus 10 percent of the calibrated target rate. In MAN the light will flash when the Seed Flow signal is lost. The RED warning light will also be illuminated when calibration is active on the console.

#### EMERGENCY STOP

If the Seed Shaft (flow) Sensor ever breaks (*or is disconnected*) it is possible the user will not see the “no SEED” warning message. In Automatic control, the Console will automatically increase the planting rate to maximum, trying to compensate for low Rate. This can create a severe over application that will waste seed. The *Emergency Stop* feature helps protect against this condition.

### Rotary Switch Positions

#### ROTARY SWITCH

During normal operation, you can view any one of eight monitored functions by turning the rotary switch to the appropriate position. The functions that are active during normal operation are the GREEN boxes. Calibration positions are identified by the WHITE labeling on each side of the rotary selector (*please refer to Calibration section starting on page 17 for details*).

#### RATE

Rate displays the planting rate in lbs/Acre or lbs/kFt<sup>2</sup> or kg/hectare with one or more decimal places depending on the planting rate as follows. It can range from 0.01 to 99999. The Number icons (1-3) will indicate which Sections are turned on.

**NOTE:** Rate will display .00 when in Hold or when all used Sections are turned off even if there is a flow signal.

#### AREA/HOUR

Area/Hour is computed in Acres/Hour if English Units, or hectares/Hour if Metric Units, or kFt<sup>2</sup>/Hour if Turf Units.

Area/Hour is normally displayed in 0.1 increments. However when in English or Metric units the decimal point is dropped when Area/Hour exceeds 655.3 and returns when Area/Hour drops below 491.5. When in Turf units the decimal point is dropped when Area/Hour exceeds 6553.5 and returns when Area/Hour drops below 4915.2.

#### WEIGHT/MINUTE

Displays the pounds (kg) per minute being applied.

#### WEIGHT TOTALS (1) (2) (3)

Displays the pounds (kg) applied since the active counter was last reset to zero. To select a pair of AREA and WEIGHT 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 24.*) This active pair of counters may be reset to zero independent of other system counters. When the counter(s) reach 99,999 lbs (English or Turf) or Kg (Metric), then the counter automatically switches to Tons (English/Turf) or Metric Tons (Metric). When this change occurs, the letter “t” will be displayed in the left most position of the display. Once the counter reaches “t9999” Tons (Metric Tons), OFL will be displayed.

#### AREA TOTALS (1) (2) (3)

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 WEIGHT 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 24.*) The selected pair of counters may be reset to zero independent of other system counters.

#### DISTANCE

Shows Distance traveled in 0.1 increments from 0 to 9,999.9 feet or meters and then in 1 Foot or Meter increments from 10,000 to 99,999. Once it reaches 99,999 it will display “OFL” (Overflow) and stop counting. The user must clear the counter to resume counting.

#### METER RPM

Meter RPM will display the Seed Drive shaft RPM from 0.01 to 9,999 rpm independent of Run or Hold.

The Number Icons are turned off in the Meter RPM Mode.

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

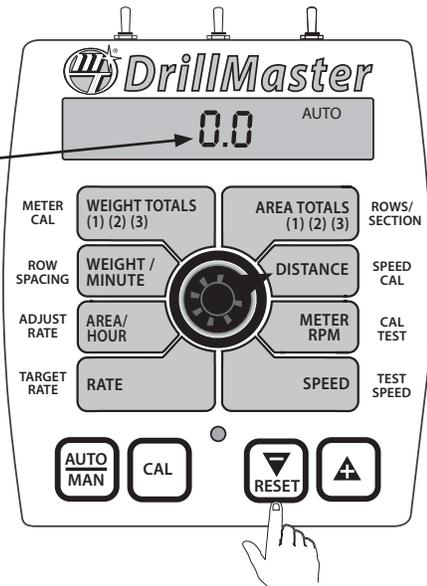
**IMPORTANT:** All sections automatically shut off if system is in “HOLD” or if in AUTO with NO SPEED.

## Operation (cont)

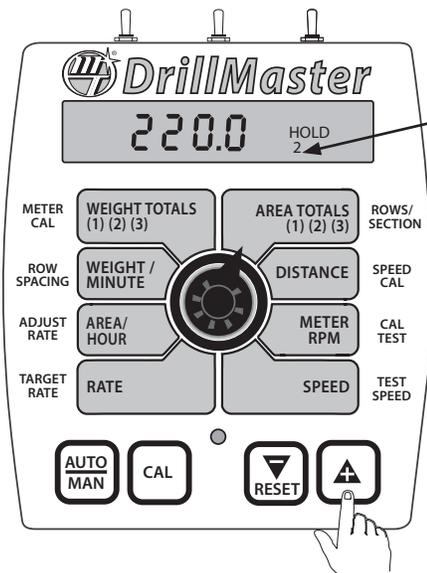
### Resetting System Counters

The AREA, DISTANCE and WEIGHT totals 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.

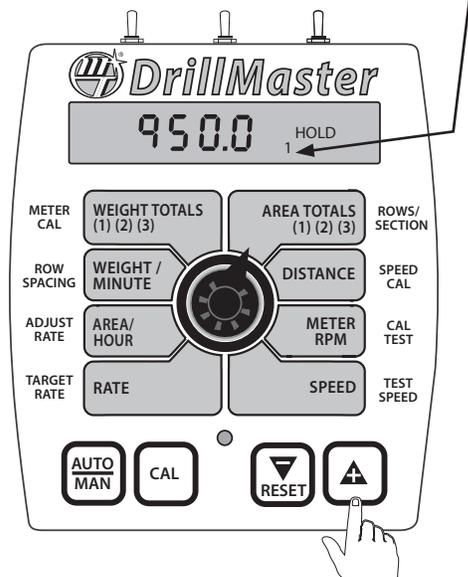
1. Turn the sections **OFF** or put the system in **HOLD**.
2. Turn the rotary switch to the counter to be reset.
3. To reset distance turn the rotary switch to **DISTANCE** and simply press and hold the **RESET** button until the display reads zero. The display will show the word **CLER** during this process, and will show 0.0 when reset to zero is complete.
4. To reset the weight and area counters; there are three independent **AREA** counters, paired with three **WEIGHT** 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 **WEIGHT TOTALS** 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 1 second. If the "-" button is accidentally pressed, the console will display **CLER** to alert the user that the counters will be cleared. If the user continues to hold the "-" button for 1 second **CLER** will disappear and be replaced by 0.0, indicating that the selected pair of counters has been cleared.



Display indicates counter pair #2 is selected



Display indicates counter pair #1 is selected



Display indicates counter pair #3 is selected



## Operation (cont)

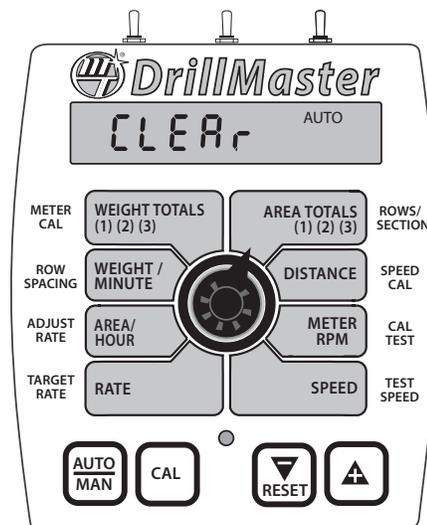
### Clearing System Counters

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

**WARNING:** Holding the “-” (RESET) button for 12 seconds will clear both the #3 AREA counter AND the #3 WEIGHT counter whether the rotary switch is in the AREA or the WEIGHT TOTALS position.

If the “-” button is released before 1 second has 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 1 second, the CLEAR message will be replaced by 0.0, indicating that counter pair #3 has been cleared. See *Illustration below*.



## Pre-Field System Checkout

Before beginning actual planting, perform the following “Pre-field” procedure to ensure that your settings, oil flow and desired speed range will allow the DrillMaster to provide the required application control. This procedure should be repeated for each application rate or setting change. By performing all of the steps listed below, you set up your system to allow the DrillMaster to perform at optimum level.

**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” will be flashing on the display.

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

### ENTER MAXIMUM APPLICATION TEST SPEED INTO CONSOLE

With console in **HOLD**, enter Calibrate by pushing and holding **CAL** button. The **CAL** icon will appear on display and the 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 and turn the appropriate section switches on. Turn rotary switch to **RATE** position and hold “+” button for approximately 30 seconds to completely open the PWM valve (control valve).

### CAN'T GET THERE?

If you can't get to the desired application rate, you may need to increase the volume of hydraulic oil available to the motors.

### 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.

Turn the appropriate section switches **ON (make certain system is in MANUAL)**, turn rotary switch to **RATE** position and hold “-” button until you achieve 10% less than your desired application rate.

It is not normally a problem if the application rate goes all the way to zero when holding the “-” button for 5 seconds or more, 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 the Troubleshooting section on page 31.

# 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.



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



Had an Emergency Stop. Check Seed Shaft (Flow) Sensor. Cleared by turning all used Sections off, going to **HOLD** or cycling power.



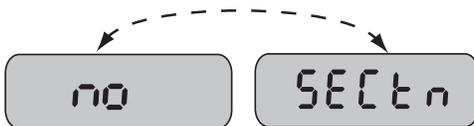
One or more Seed Bins are near empty.



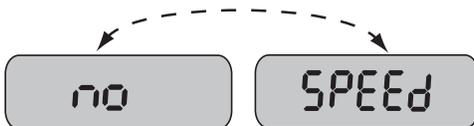
Low Power. Check all power and ground connections.



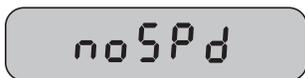
Has loaded Default Cal factors (appears when default calibration factors are loaded by holding CAL and “-” buttons while turning the console on).



In Rows/Section Cal Mode, and no Sections are turned on.



In RATE mode and have no Speed, regardless of all other conditions.



In METER CAL TEST but have not yet enter a Test Speed.



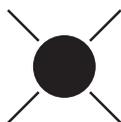
Counters (DISTANCE or AREA or WEIGHT) have overflowed their maximum. RESET (see pages 26-27) to clear counters and resume counting.



Displays for 1.5 seconds upon powering up.



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



Warn LED flashes when the Rate error is over 10% in **AUTO** or if no flow input (when there should be) in **MAN**. On steady when in **CALIBRATE** or “**SPECIAL**”**CALIBRATE** or **Test Speed**.

# Troubleshooting (cont)

## General

All DrillMaster consoles 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 to 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 pages 30-31*.

### 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:

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

### NO READOUT OF POUNDS (KG), OR POUNDS (KG) PER MINUTE

Check to see that the hydraulic system and equipment is operating properly.

Check cable for breaks or incomplete connection.

Flow rate may be too low to register a reading.

### SECTIONS SHUT-OFF

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

### CONSOLE IS ERRATIC IN OPERATION

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

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

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

Check the **CONTROL SPEED** calibration number in "Special" Calibration. If the **RATE** tends to overshoot or oscillate, the **CONTROL SPEED** setting may be too high for the control valve being used; reduce the **CONTROL 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 14 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

Increase the **CONTROL SPEED** setting in "Special" Calibration.

# 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 7 and 9.*

### 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 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).

### 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

Carefully check your installation and operating instructions. The following are tips for troubleshooting;

1. Disconnect the radar adapter cable from the console harness.
2. 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.
3. 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.
4. Reconnect the radar adapter cable to the main harness speed connection (yellow tie).
5. Disconnect the radar from the radar adapter cable.
6. 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.
7. 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.
8. 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).

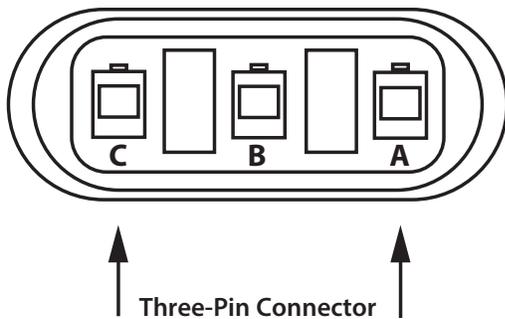
#### SPEED INPUT

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 7*). The console should respond with some speed reading.

#### FLOW INPUT

Turn rotary switch to **WEIGHT/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 7



#### REMOTE RUN/HOLD INPUT

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

Check for 12 volts between pins B (white) and C (black) 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 (red) and C (black) of the main harness run/hold connector (gray tie) should turn ON the "HOLD" icon on the console display. Removing the jumper should turn OFF the "HOLD" icon on the console display.

### PWM 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, connect the positive lead from the test light or voltmeter to Pin A on the PWM Control Valve connector and the other lead to Pin B. Holding the "+" button should cause the voltmeter voltage to increase from about 4 volts to about 12 volts and the test light should go from dim to bright.

### PWM VALVE

To operate the valve in a manual mode remove the cover on top of the cartridge assembly using a 1 1/16" wrench.

The knurled stem on top should be turned counter clockwise against the stop for normal operation of the PWM cartridge. To adjust the hydraulic oil flow manually turn the stem clockwise until the desired hydraulic motor RPM is achieved. Turn clockwise approximately 1 turn to reach start point. Continue another approximately 5 turns for maximum oil flow.

### RPM Flow Control Valve Description

A solenoid-operated, electrically-variable, three port, pressure-compensated, spool-type, normally closed when de-energized, proportional flow control valve.

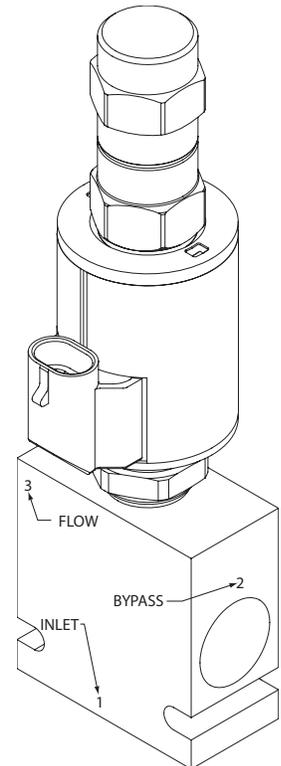
#### Porting:

- 1 - Inlet
- 2 - Bypass
- 3 - Regulated Flow

In an open center configuration the Bypass post can be blocked.

To test the electrically-variable shift of the spool, remove the manual override feature on top of the cartridge assembly using a 1 1/16" wrench. At the console set the system to manual mode (MAN) and turn the rotary switch to the RATE position. Turn at least on section switch ON and hold the "+" for ten (10) seconds. While holding your finger firmly on the top of the cartridge assembly, have someone toggle the console HOLD switch and you should feel the spool shift slightly, about .040".

To test the solenoid resistance connect at the solenoid exposing two male terminals.. Using an ohmmeter measure the resistance across the terminals. The reading should be approximately 4.0 ohms.



# Appendices

# Appendix A

## 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.

### 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.**

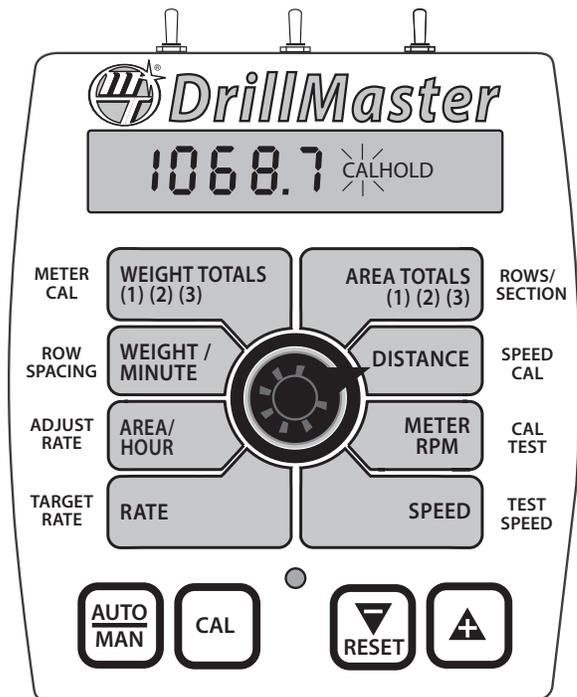
- Measure a distance of 1000 feet (500 meters). Clearly mark the beginning and end points with flags or something highly visible to the operator.

### 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 **CLER** 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

### Cal Test Fine Tuning Calibration Values

For maximum accuracy the user must follow the steps below.

1. Before starting the test make sure all cal factors including Target Lbs/Acre and Sample Size are correct for the Seed being used. Fill the Drill with enough Seed to perform the test.
2. Select HOLD (Remote or Wireless), or turn all Sections off on the Console.

**OPTIONAL:** At least one Row must be used. However for improved accuracy the operator can use multiple containers and perform the test on several rows (in parallel) to obtain a better average or to test the variation from one row to another. If comparison of Rows is not needed and just an overall average is desired then a tarp can be used to catch the seed from multiple Rows or the entire Drill but the user will need to divide the total weight measured by the number of Rows used, to obtain the 'Weight per Row'.

3. Select CALIBRATE (hold the CAL key for 1 second) and then select the CAL TEST position. It will display "OFF" indicating it is still inactive.
4. To initialize or start the CAL TEST press the "+" key and the display will jump to the Sample Size weight (1.00 pound typical) for 4 seconds. This "reminder" confirms the Sample Size and the operator must use containers large enough to catch that much seed from the Row under test. This step will also automatically select AUTO (AUTO icon on) because the CAL TEST must always be performed in AUTO. After 4 seconds it will display "no SPd" (no Speed) as a reminder to do the next step.
5. While still in CALIBRATE, rotate to the 'Test Speed' position and enter a Test Speed equal to the desired speed in the field. The CAL icon will flash to indicate the 'Test Speed' mode is active. All rotary positions will operate normally (see Test Speed), except the METER RPM position will now display the "test weight" (instead of RPM).
6. Select the CAL TEST position. This position will display "no SPd" (no Speed) if a Test Speed was not entered (Step 5 was skipped). It will display 0.00 lbs if a Test Speed has been entered and it is ready to count up to the Sample Size when RUN is selected. Unlike the normal WEIGHT, it displays the weight with two decimal places so it can display 1.00 pounds with 1% resolution for improved accuracy.
7. Place an empty catch pail under the Row (or Rows) to be tested. **OPTIONAL:** Use a Tarp if the whole Drill is being tested for an overall "average".
8. Run engine at normal operating speed to generate normal hydraulic pressure.
9. Place the Console in Run, or turn the desired Section (or Sections) on. Auto control will run the Seed Drive Shaft at the Target Rate and it will continue to run until it has dispensed Sample Size of seed per row (typically 1 pound) and then it will stop (PWM output will go to zero). During

this time the Weight displayed in the CAL TEST (METER RPM) position will count up to something close to the Sample Size (instead of displaying RPM).

10. The Console will automatically stop after dispensing the Sample Size (Do not select Hold yet).
11. Weigh the Seeds in the Catch pail and it should equal the value shown in the display (close to the Sample Size).

**OPTIONAL:** If multiple Rows were used then each Row should equal the value shown in the display (close to the Sample Size). If multiple Rows were used then record the Weight for each Row. Add all Rows together and divide by the number of Rows to obtain an Average Weight per Row. Each Row can then be compared to the Average to compute the percent variation between Rows and find the highest and lowest.

If a tarp was used to capture multiple Rows, or the entire Drill, then divide the Total weight by the number of Rows used to obtain the Average Weight per Row. This will provide a very accurate average but this method cannot be used to find the variation between Rows.

12. Use the "+"/"-" keys to adjust the displayed weight until it matches the actual sample weight measured. This will adjust the Meter Cal value. Press the Cal Key to exit the Cal Test Mode.

In Step 9 the displayed weight will not equal the Sample Size exactly. Some error should be expected due to start up and stopping delays plus inertia and friction etc. It is much more important that the Seeds captured from each Row weigh the same as the displayed weight rather than the Sample Size. When the Console is first placed in Run in step 9, it may take a little time for auto control to reach target. This should have minimal affect on the results.

In Step 11, if there is a wide variation between Rows, or between Sections, then the Seed Metering mechanism may be improperly set (wrong Slot width etc.) or some Rows may be dirty or worn so they miss or add some seeds. The operator should clean and/or repair those Rows or adjust the Slot width and repeat the above test.

For improved accuracy the Sample Size can be increased. For example increasing the Sample Size from 1.00 pounds to 10.00 pounds increases the resolution from 1.0% to 0.1 %. The scale used to weigh the seed must also be accurate and have the same or greater resolution.

It should be noted that steps 4 and 5 cannot be reversed. If Test Speed is selected first then it will simply perform the normal 'Test Speed' functions (including the display of RPM), and the "Cal Test" mode cannot be started. However, when "Cal Test" is started first (step 4) then when "Test Speed" is selected (step 6) it will operate a little different. Instead of displaying RPM it will display the Cal Test weight as described above.

## Appendix C

### Meter Cal Fine Tuning Calibration Values

1. Back the applicator up to a material pile for unloading or lay out a tarp to catch the seed or place a container under each Row. Make all adjustments to the Drill are complete and the same for all Rows.
2. Select the **WEIGHT/MINUTE** position and use the **MANUAL CONTROL** to adjust the rate to a typical value for your application, then select Hold.  
**RECOMMENDED - Use Test Speed and allow the controller to reach your Target Rate using Auto control then select Hold.**
3. Weigh the applicator carefully noting this as the "Beginning Weight" and back the applicator up to a material pile (or tarp or containers) for unloading again.
4. Clear a Weight counter by selecting the Weight position and pressing "-" (Reset) key for 1 second (while still in Hold). **NOTE: Any of the 3 Weight counters can be used.** Empty the containers if they are were used.
5. Go to Run and allow at least ten pounds of material to unload, which will be recorded in Weight. A display of 10.0 lbs will provide 1% resolution. If 100.0 lbs is dispensed then the resolution and accuracy increases to 0.1%. The Metering Slot mechanisms are speed sensitive therefore Test Speed and Auto mode should be used so the Drill runs at the Target rate for the desired ground speed.
6. Select **HOLD** to stop the applicator and weigh it again. Subtract this ending weight from the beginning weight to compute the actual weight of material that was unloaded. If containers were used then weigh each one and record the Weight per Row for each Row and add all Rows together to compute the Total Weight dispensed. **The WEIGHT counter should equal this amount and the following steps will fine-tune METER CAL so it does match.**
7. Start Calibrate. (*While in Hold, press CAL key for 1 sec.*)
8. Select the **METER CAL** position and the current **METER CAL** value will be displayed. Press the CAL key to toggle the display to show Weight.  
**NOTE: Pressing the CAL key will toggle between METER CAL value and Weight.**  
To remind the user he is still in the CAL Mode, the CAL icon will turn on when displaying the METER CAL value and it will flash when displaying Weight.
9. Use the "+" / "-" (Reset) keys to adjust the displayed Weight until it matches the actual weight computed above. This will automatically fine-tune the **METER CAL** value.
10. Press the CAL key again to toggle the display to show the **METER CAL** value and write it down for future reference when this Metering Slot and material is used again.  
If containers were used to catch the seed then add the weight of all Rows and divide by the number of Rows to compute the average Weight per Row. Then the weight for each row can be compared to the average to find the percent variation for each Row and find the lowest and highest Row. Rows that are extra high or low may need cleaning, repair or adjustment.  
To make it simpler and more intuitive, the METER CAL value is always displayed when the rotary switch is first turned to the METER CAL position.  
For example, assume the METER CAL value is displayed and the CAL key is pressed to toggle to the Weight value. Then the switch is rotated to some other Cal factor. When returned to the METER CAL position it will automatically switch back to displaying the METER CAL value rather than staying "stuck" in the Weight display (with the CAL icon flashing).

# Appendix D

## Bin Level Sensor Kit Installation

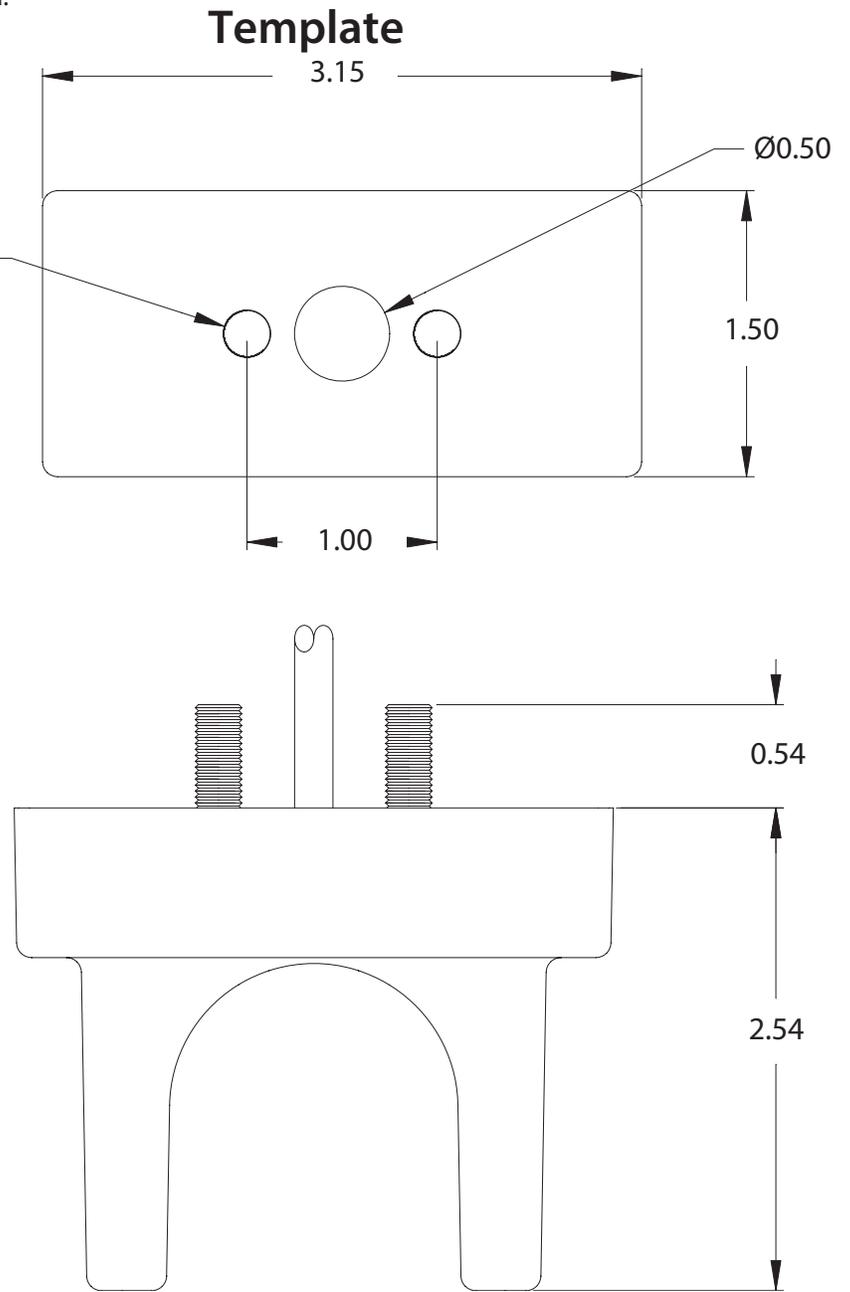
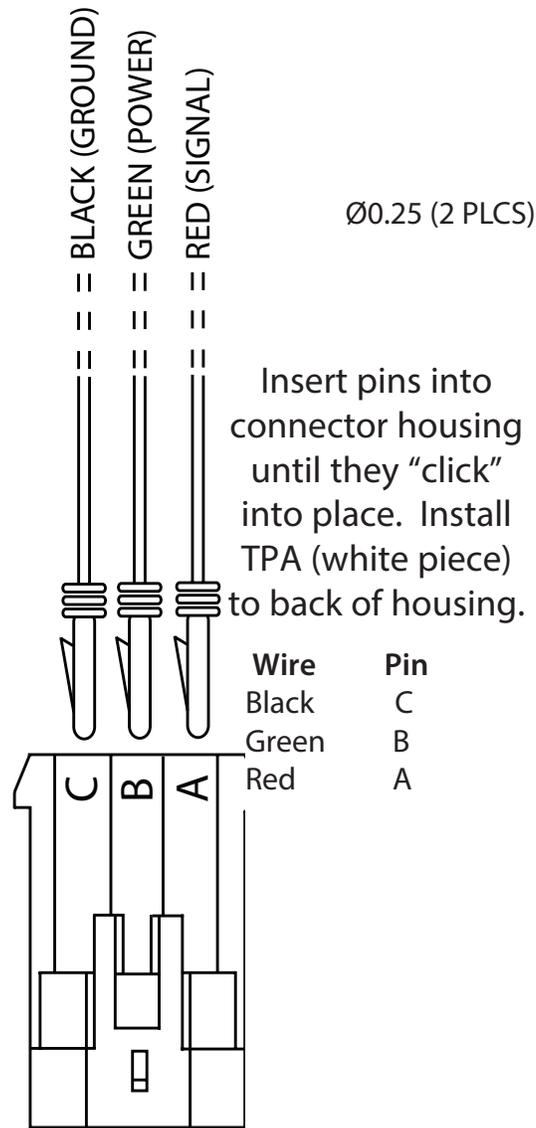
### INSTALLATION

Mount the bin level sensor(s) at the desired level in the bin(s). The connector body is supplied loose so a smaller access hole can be drilled in the bin. The wires (with pins) can be passed through the access hole, then the pins are inserted into the connector housing.

Using provided template (on outside of bin) drill two 1/4" holes 1" apart horizontally. Holes should be at least 2 inches above the bottom of the bin wall. Drill a 1/2" hole for the Bin Sensor Cable, centered between the two holes. Run the Bin Sensor Cable out through the 1/2" hole, from the inside of the bin. Fit the studs through the two 1/4" holes and stick the sensor to the inside of the bin. Fasten sensor down securely with #10 locknuts and washers provided.

### ELECTRICAL INSTALLATION

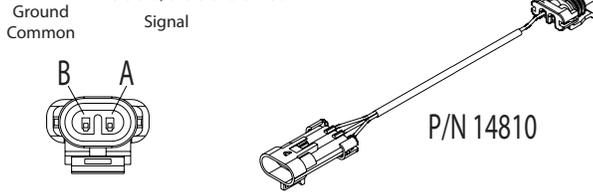
Insert the pins into the provided connector housing per the diagram below. Note that the pins must be inserted in the proper positions or damage may result.



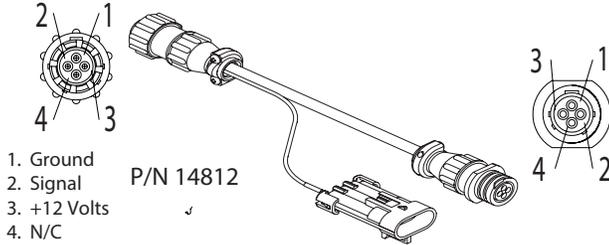
# Appendix E

## Radar Adapter Cables

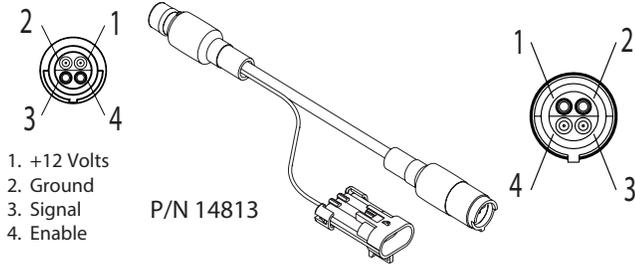
In-Cab John Deere Metri-Pack Connector  
8000/9000 Series



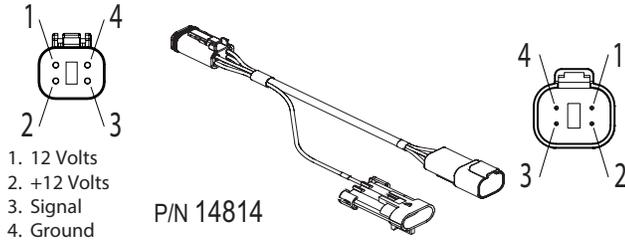
DICKEY-john Radar Amp Connector



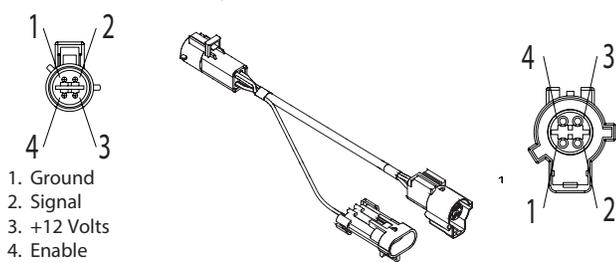
DICKEY-john Radar Cannon Connector



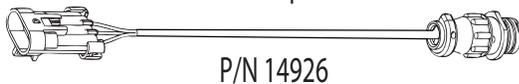
DICKEY-john Radar Deutsch Connector



DICKEY-john Radar Ford Connector

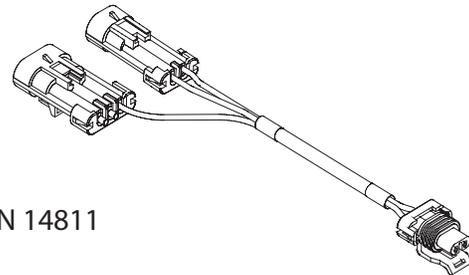


Vansco Radar Amp Connector

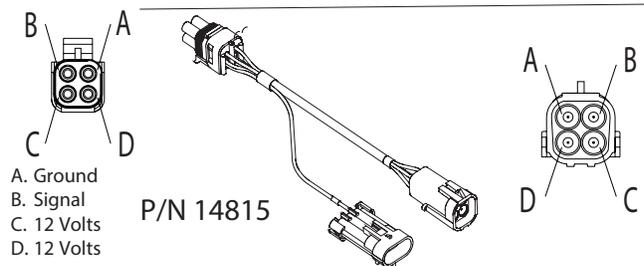


RADAR	CONNECTOR	SIGNAL PIN
DICKEY-john	Amp	2
DICKEY-john	Cannon	3
DICKEY-john	Deutsch	3
DICKEY-john	Ford	2
DICKEY-john	Packard	B
In-Cab JD (8000 & 9000's)	Metri-Pack	A
Magnavox & Phillips	Packard	C
Raven	Conxall	3
Vansco	Amp	2

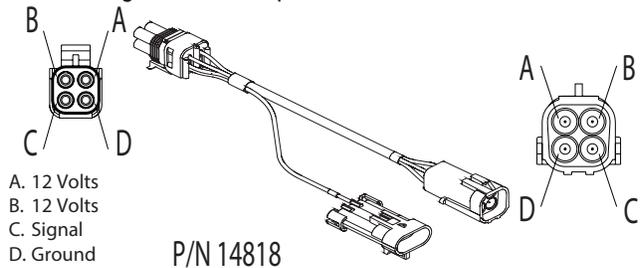
In-Cab John Deere "Y" Connector



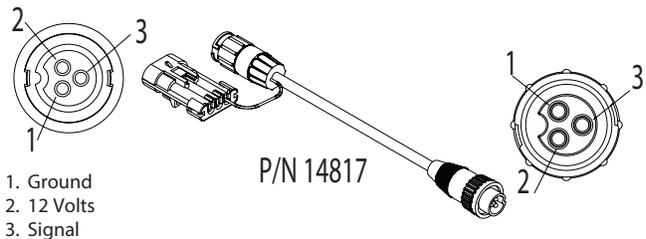
DICKEY-john Radar Packard Connector



Magnavox & Phillips Radar Packard Connector



Raven Radar Conxall Connector



# Appendix F

## Conversion Chart

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

Metric to English		
When You Know	Multiple By	To Find
<b>LINEAR MEASUREMENT</b>		
millimeters	.039	inches
meters	3.28	feet
meters	1.09	yards
kilometers	.62	miles
<b>LAND MEASUREMENT</b>		
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
<b>LIQUID MEASUREMENT</b>		
milliliters	0.034	fluid ounces
liters	0.529	pint
liters	0.264	quart
liters	2.64	gallons
<b>VOLUME</b>		
cubic meters	35.314	cubic feet
cubic meters	1.307	cubic yards
<b>DRY MEASUREMENT</b>		
liters	1.101	quart
liters	8.810	peck
liters	35.239	bushels
<b>FUEL CONSUMPTION</b>		
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 <sup>2</sup> = square millimeters
yd. = yards	gal. = gallon	m <sup>2</sup> = square meters
mi. = miles	ft <sup>3</sup> = cubic feet	ha = hectares
in <sup>2</sup> = square inches	yd <sup>3</sup> = cubic yards	km <sup>2</sup> square kilometers
ft <sup>2</sup> = square feet	pk. = peck	ml = milliliters
yd <sup>2</sup> = square yards	bu. = bushel	l = liters
mi <sup>2</sup> = square miles	mm = milliliters	dal = dekaliters (10 liters)
fl oz. = fluid ounces	m = meters	m <sup>3</sup> = cubic meters

# Appendix G

## Replacement Parts List

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

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
01531	Speed sensor kit
01535	Remote run/hold sensor kit
10013	Speed sensor mount bracket
12069	Magnet kit (6 magnets per kit)
12888	Console mount knob
12889	Console mount washer
12910	14" Black plastic cable ties (bag of 10)
13096	5-foot Hall-effect Speed/Flow Sensor Cable with threaded sensor, nut and female connector
13181	Console mount kit*
13226	5-foot remote run/hold sensor cable
14315	Power cable
17881	Cable, DrillMaster Section 1 & 3 - Multi Section
17882	Cable, DrillMaster Section 2 - Multi Section
17883	Cable, DrillMaster PWM and R/H - Multi Section
17884	Cable, DrillMaster - Single Section
17899	DrillMaster Console
21612	DrillMaster Multi-Section Module
21778	Kit, Run/Hold Switch
21779	Power Switch
50318	DrillMaster Reference Manual

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 10-Pin	Part No.	M/P 10-Pin
13200	5-foot	13205	5-foot	13220	5-foot	17095	30-foot
13201	10-foot	13206	10-foot	13221	10-foot	17096	40-foot
13202	15-foot	13207	15-foot	13222	15-foot	17269	45-foot
13203	20-foot	13208	20-foot	13223	20-foot	14142	50-foot
13204	25-foot	13209	25-foot	13224	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



**MICRO-TRAK<sup>®</sup>**  
**SYSTEMS, INC.**

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