



8605 CONTROLLER

OPERATOR'S MANUAL

DO NOT USE OR OPERATE THIS EQUIPMENT UNTIL THIS MANUAL
HAS BEEN READ AND THOROUGHLY UNDERSTOOD

PART NUMBER 39300018 Rev. E

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SAFETY



THIS IS THE SAFETY ALERT SYMBOL. IT ALERTS AN OPERATOR TO INFORMATION CONCERNING PERSONAL SAFETY. ALWAYS OBSERVE, AND HEED THESE SYMBOLS AND INSTRUCTIONS, OTHERWISE DEATH, OR SERIOUS INJURY CAN RESULT!

Operator safety is a principle concern in equipment design and distribution. However, many accidents occur because a few seconds of thought, and a more careful approach to handling, were ignored.

Throughout this manual, and on all safety related decals, a safety alert symbol, along with the signal word CAUTION, WARNING, or DANGER will be found. These are defined as follows:



CAUTION: A reminder for proper safety practices and directs attention to following them. Decals of this class are yellow and black.



WARNING: A reminder for proper safety practices and what can happen if they are ignored. This has a more serious consequence than CAUTION. Decals of this class are yellow and black.



DANGER: Denotes the most serious safety hazard. It is a reminder for observing the stated precautions and what can happen if they are ignored. Decals of this class are red and white.



CAUTION: For your own protection we very strongly recommend that you read, understand, and heed the following information.



CAUTION: If you and your operator(s) are not intimately familiar with proper handling procedures for Anhydrous Ammonia, contact your supplier for information, and read all safety precautions found in the “HINIKER ANHYDROUS AMMONIA MONITORING AND CONTROL SYSTEM MANUAL”, Refer to manual Part No. 360-000-246 Revision E or higher for Heat Exchangers manufactured prior to 2007. These are painted Gray.

**or
Refer to manual Part No. 39300035 for Heat exchangers manufactured in 2007 or after. These are painted White Additional manuals may be obtained from your local dealer.**

ACCIDENTS CAN BE AVOIDED BY KNOWING, AND FOLLOWING, THE PRECAUTIONS CITED IN THIS MANUAL.

GENERAL

1. If the Operator's Manual is missing from this equipment, obtain a replacement from your HINIKER dealer. If you sell this equipment, ensure the new owner acknowledges receipt of this manual.
2. Read this manual thoroughly. Make sure the operator understands it and knows how to operate this equipment safely. Farm equipment can kill or injure an untrained, or careless operator.
3. Do not attempt to handle and service this equipment, or direct others to do the same, unless you know how to do it safely.
4. Don't be in a hurry.

Hiniker Company reserves the right to change prices, standard features, specifications or designs, and options at any time without notice and without incurring the obligation to install such changes on machines previously manufactured.

TO THE PURCHASER

Congratulations for joining the ranks of agribusinessmen who acknowledge the importance of accurate and controllable application of chemicals.

This product will insure that the proper recommended application rate is maintained. This will not only save you money lost by overapplication, but safeguard that your yields are not being adversely affected by underapplication.

As an added bonus your operation will become more environmentally responsible, by you being able to know that only the proper amounts of chemicals required for your application are being used.

This product is designed and manufactured to give years of dependable service, when used for the purpose for which it was intended.

Never allow anyone to operate this equipment until they fully understand the complete contents of the manual. It is the responsibility of the owner's who do not operate this equipment, to insure that the operator is fully instructed, and is fully aware, and understands, the contents of this manual.

Important information is contained in this manual to help insure safe and efficient operations.

If you have any questions about this manual, or equipment discussed therein, contact your HINIKER dealer.



THIS IS THE SAFETY ALERT SYMBOL. IT ALERTS AN OPERATOR TO INFORMATION CONCERNING PERSONAL SAFETY. ALWAYS OBSERVE, AND HEED THESE INSTRUCTIONS, OTHERWISE DEATH, OR SERIOUS INJURY CAN RESULT.

NOTE: All references to "LEFT" and "RIGHT" are meant to mean viewing the equipment from the rear and facing the tractor.

ALWAYS OBTAIN ORIGINAL HINIKER SERVICE PARTS BECAUSE SUBSTITUTE PARTS COULD ADVERSELY AFFECT EQUIPMENT PERFORMANCE AND WARRANTY.

Record the following information for later reference when obtaining service parts.

Purchase Date _____
Name _____
Dealer's Name _____
Console Serial No. _____
Flowmeter Serial No. _____
Servo Valve Serial No. _____

OPERATION

SYSTEM OVERVIEW

The Hiniker 8605 controller is a computerized system that will enable you to apply liquid chemicals, including Anhydrous Ammonia at any given rate.

The 8605 controller allows you to set up a system individually calibrated to your specific needs.

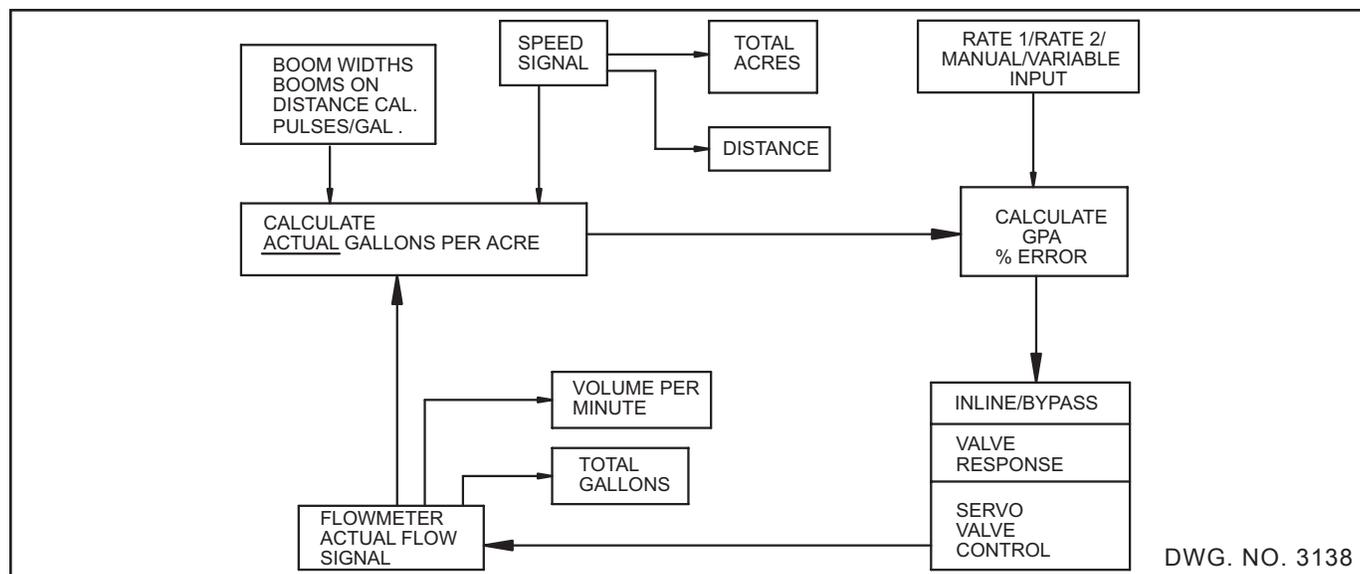
The 8605 controller in conjunction with a Speed Sensor, Flowmeter, and Servo Valve performs the necessary calculations to perform "on-the-go" adjustments to the rate of application of chemicals.

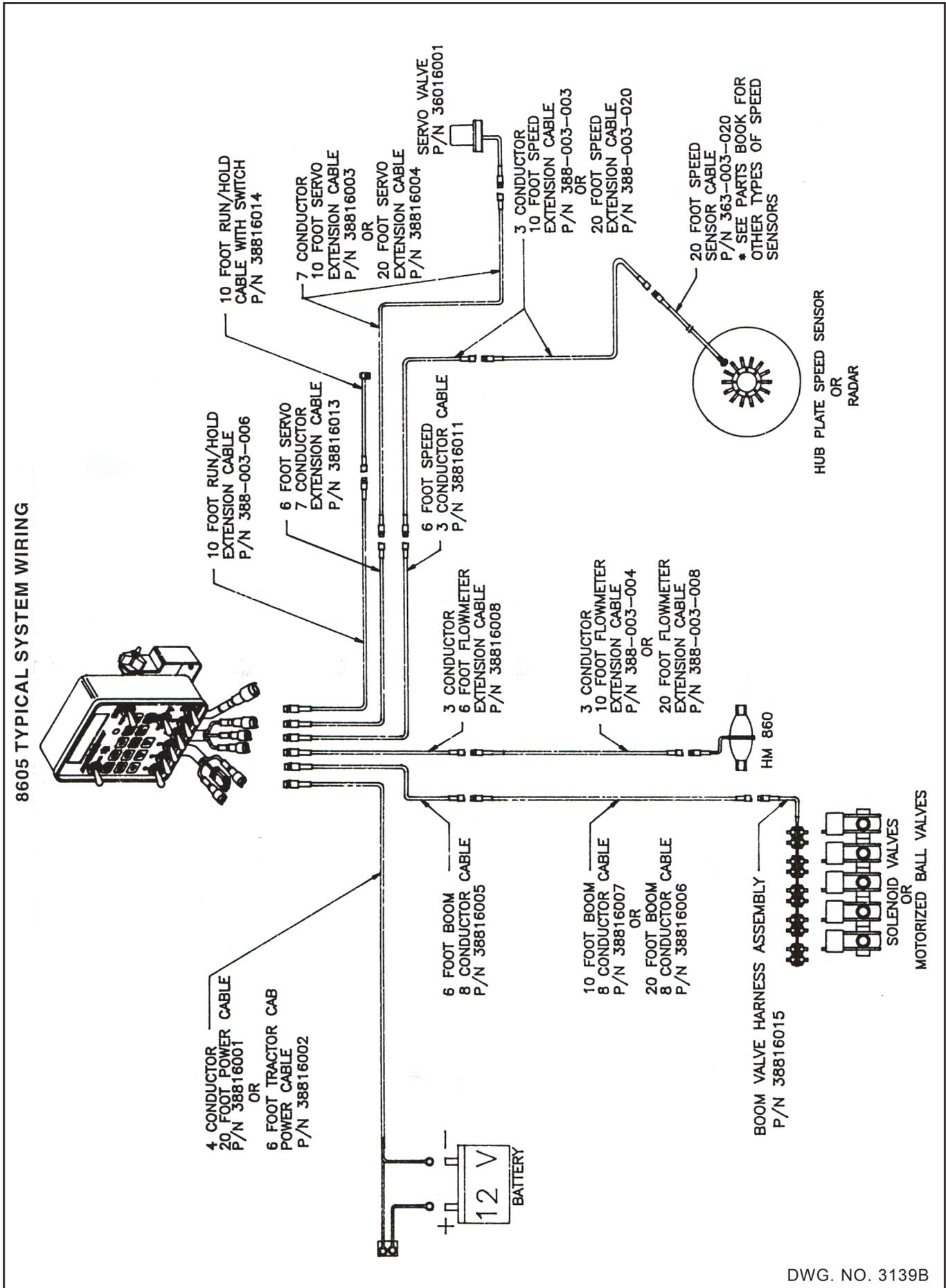
The controller uses the inputs of actual flow, speed, and user selected functions to calculate the actual application rate in GPA (Gallons Per Acre of liquid) or PPA (Pounds Per Acre of nitrogen). This is then compared to the target rate selected by the operator to generate an adjustment amount. The adjustment is sent to the Servo Valve which, in turn, adjusts the actual flow. This process continues until the actual rate matches the target rate. The following figure is a block diagram showing the basic operation.

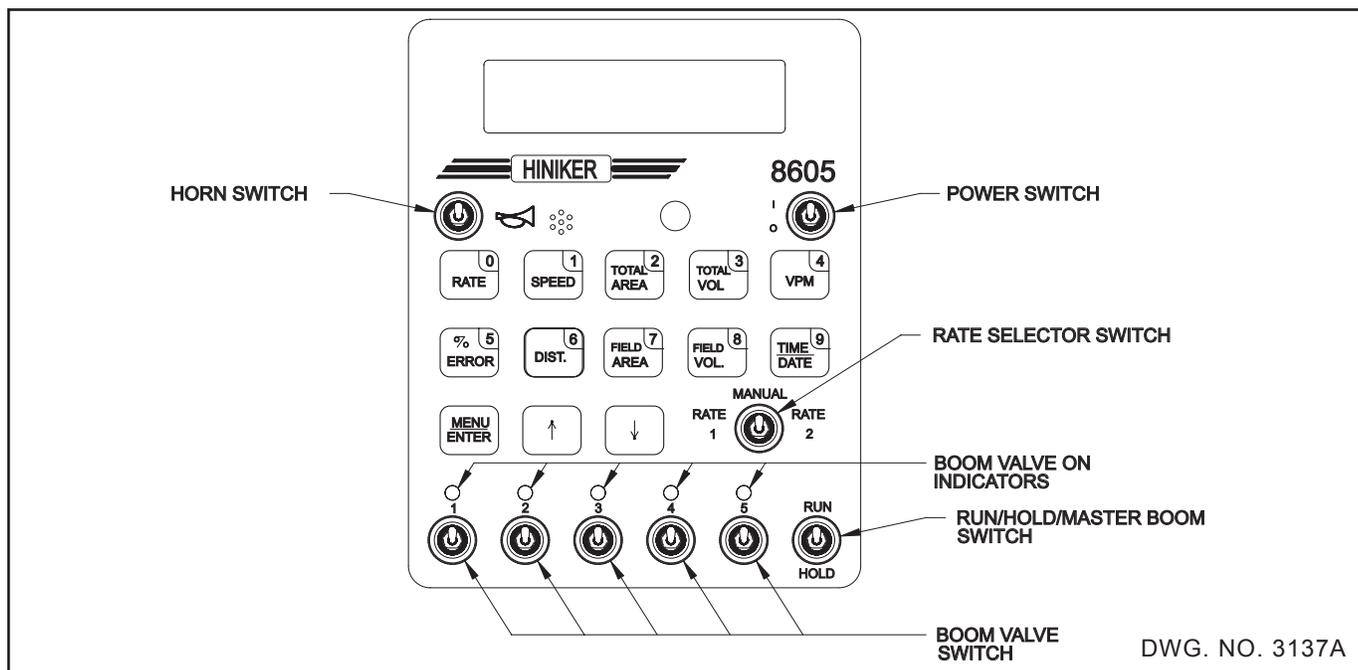
The following is a list of features available with this system.

- Anhydrous Ammonia System Configuration.
- Inline or Bypass System Configuration.
- Stepper Motor Valve Control.
- Up to five section control of electric solenoid valves or motorized ball valves for individual boom control.

- Boom section widths may be individually set.
- Selection of Rate 1, Rate 2, Manual, or External Rate Control.
- Adjustable Minimum Flow Limit.
- Adjust Rate 1, Rate 2, on the Go.
- Warning Lamp and audible alarm when the application error is greater than 10%.
- Low battery indicator.
- Local Run/Hold.
- Remote Run/Hold Option.
- Dual line Sunlight Readable Display - any two selections displayed at once.
- Ten Display Selections are Available - Rate, Percent Error, Speed, Distance, Volume per Minute, Field Area, Total Area, Field Volume, Total Volume, and Time/Date.
- Simplified System Distance Calibration.
- Easy Min./Max. GPM Determination.
- Non-Volatile Memory for setup data retention.
- Non-Volatile memory for storage of field acres, field volume, and date/time for up to 99 fields and 16 different chemicals per field.







The 8605 controller will enable you to set up and control a system tailored to your specific needs.

POWER SWITCH

The power switch is a two position toggle switch used to apply power to the 8605 controller.

Placing the switch in the UP position applies power and placing the switch in the DOWN position removes power from the system. All calibration and application data is retained even with power turned off.

HORN SWITCH

The horn switch is a two position toggle switch used to control the audible alarm.

The horn is enabled with the switch in the UP position and disabled when the switch is in the DOWN position. Turning off the horn DOES NOT turn off the visual alarm (yellow light).

RUN/HOLD SWITCH

The Run/Hold switch is a two position toggle switch used to control power to the individual boom valve control system.

RATE SELECTOR SWITCH

The Rate switch is a three position toggle switch that is used to select Rate 1, Manual or Rate 2.

The application rates for Rate 1 and Rate 2, are set up in calibration mode and can be adjusted “on the go” by pressing the Up, or Down arrow keys.

When the Rate switch is in Manual (center position), the Servo Valve can be adjusted manually by pressing the Up, or Down arrow keys.

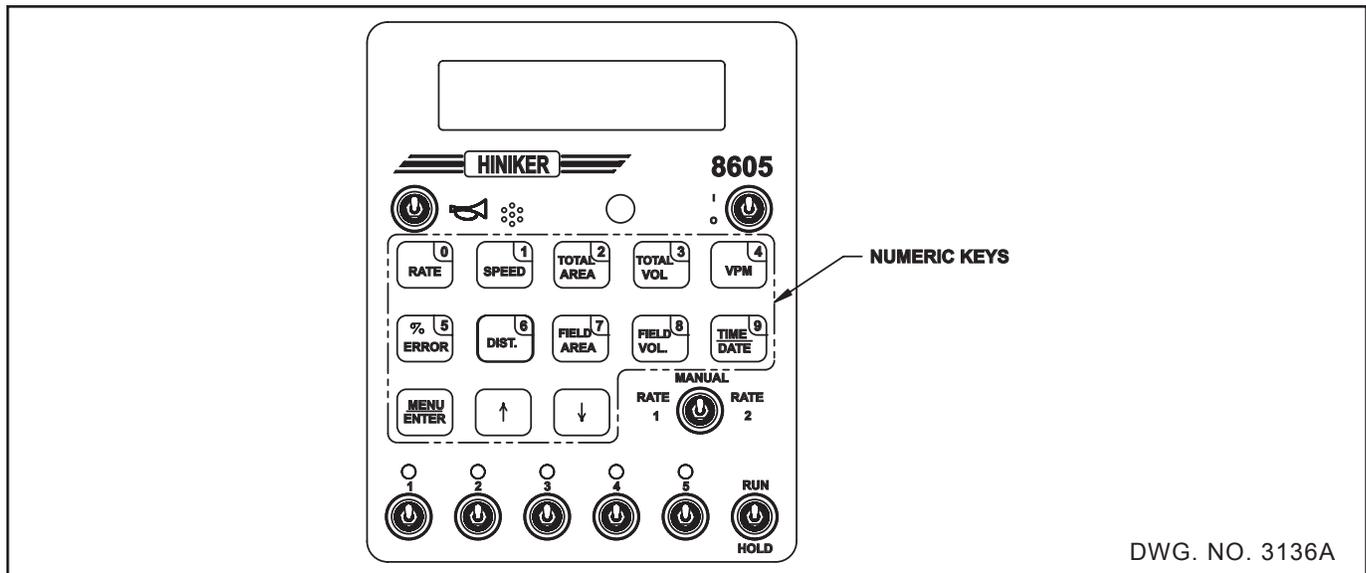
When in Rate 1, the 8605 controller supports the use of an external application rate source, such as GPS (Global Positioning Satellite) based equipment. For specific details on serial communications refer to the Appendix.

BOOM SWITCHES

Five separate Boom switches are available to control up to five electric solenoid valves or motorized ball valves.

The width of each Boom is set in the calibration mode. If any Boom is not needed, set its width to zero or leave the Boom switch off. In the Automatic and Variable Rate modes, the rate is automatically adjusted as the Boom switches are turned on and off. When all Boom switches are turned off, the controller will stop automatic control and be in the HOLD mode.

Acres are only calculated and counted for Boom widths that are selected.



KEYPAD

The keypad is used for operator entry during Calibration and operation. The number keys are used for Calibration. The audible alarm is used with the keypad to indicate data entry into the controller. Each key press of the keypad results in a single “beep” to signify acknowledgement of the key press.

Keypad operation is described below.

TOTAL VOLUME

Press TOTAL VOL key to view the total gallons or pounds of actual nitrogen applied. Total Volume accumulates only when the console is in RUN. Total Volume will not accumulate in HOLD.

Total Volume may be cleared to zero by depressing the TOTAL VOL key for three seconds.

A solid tone will warn that Total Volume is about to be cleared, release the key to abort. Total volume is cleared at the end of the tone.

TOTAL AREA

Press TOTAL AREA key to view total acres.

Total Acres accumulate only when the console is in RUN. Total Acres will not accumulate when in HOLD.

The 8605 will automatically correct for the change in implement width while calculating area when any of the boom switches are turned off or on.

Total Area may be cleared to zero by depressing the TOTAL AREA key for three seconds.

A solid tone will warn that Total Area is about to be cleared, release the key to abort. Total Area is cleared at the end of the tone.

FIELD VOLUME

Pressing the FIELD VOL key displays the current Field and Chemical numbers along with the Date/Time Stamp. After three seconds Gallons or actual Nitrogen applied for the current selection will be displayed.

Field volume may be cleared to zero by depressing the FIELD VOL key for three seconds. This will clear the Field Volume data accumulated to date for the currently selected field and chemical numbers.

A solid tone will warn that volume is about to be cleared, release the key to abort. Field Volume is cleared at the end of the tone.

Clearing the Field Volume also signals that this is the start of a new Field/Chemical application record. The record will be stamped with the current date and time to indicate when the new application record was started. If you are in NH₃ mode, the new record will be tagged as an NH₃ record. The print out of NH₃ application records show the field volume as pounds of actual nitrogen rather than as gallons of liquid.

Field Volume accumulates only when the controller is in Run. Field Volume will not accumulate in HOLD.

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FIELD AREA

Pressing the FIELD AREA key displays the current Field and Chemical numbers along with the Date/Time Stamp. After three seconds Field Acres for the current selection will be displayed.

Clearing Field Acres to zero may be done by depressing the Field Area key for three seconds.

A solid tone will warn that Field Area is about to be cleared, release the key to abort. Field Area is cleared at the end of the tone.

Field Acres accumulate only when the controller is in RUN. Acres will not accumulate when in HOLD.

The 8605 will automatically correct for the change in implement width when one or more of the boom switches are turned off or on.

NOTE: The 8605 will accumulate volume and acres for the current field until the field number or chemical number is changed. Changing the field number saves the current values in memory and begins accumulating volume and acres for the new field.

VPM (Volume Per Minute)

Press the VPM key to view the current volume per minute (flow rate) in gallons or pounds. VPM will read 0 in Hold.

DISTANCE

The 8605 will calculate and display distance anytime the DIST key is pressed. Accumulated distance may be cleared by depressing the DIST key for three seconds.

Distance does not accumulate in HOLD mode. The distance must be calibrated before attempting to use the controller. An incorrect distance calibration will affect all computations except FIELD VOLUME and TOTAL VOLUME. It is recommended that the Distance Calibration be performed prior to system Calibration.

SPEED

The 8605 will calculate and display speed in miles per hour anytime the SPEED key is pressed. An incorrect distance calibration factor will affect speed calculations.

MENU/ENTER Key

Press the  or  keys to scroll through the following choices:

Press the Enter key to choose a selection. The MENU / ENTER key is used to view the menu choices.

1. CHANGE FIELD & CHEMICAL # See steps 2 and 3, page 17.
2. CALIBRATION MODE See page 16.
3. DISTANCE CALIBRATION See page 16.
4. SET MINIMUM RATE See page 19.
5. VARIABLE RATE SETUP
6. PRINT RECORD See page 14.
7. PRINT ALL FIELD HISTORY See page 14.
8. CHANGE DATE & TIME

This is used to set date and time as follows. The display will show TIME HH:MM and either AM or PM. Enter the new time in HH: MM format where HH=hours (01-12) and MM = minutes (00-59). Note that setting the time requires that four digits are to be entered (for example enter "0205" for 2:05). Use the up Arrow or Down Arrow key to change between AM and PM.

Press enter to advance to Date. The display will show DATE MM/DD/YY Enter the new date in MMDDYY format where MM=month (01-12), DD = date (01-31), and YY = the last two digits of the year (00-99). Note that setting the date requires that six digits be entered (for example, enter "010811" for January 8, 2011).

8. EXIT V3.00

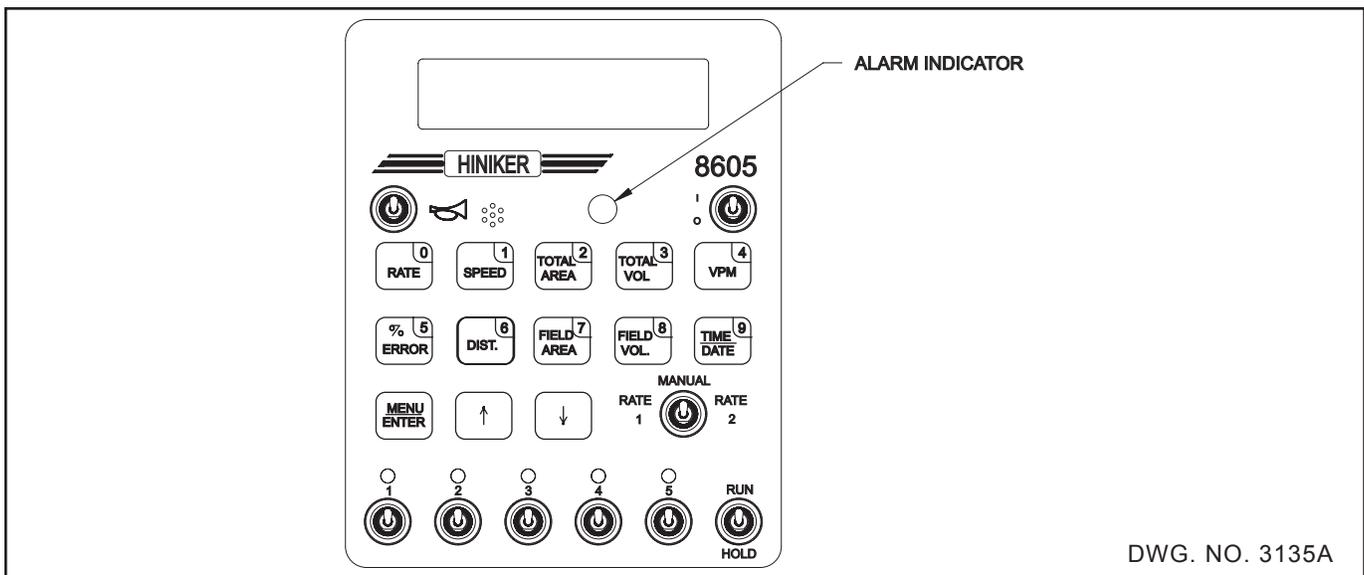
This exits the menu and shows software version number.

KEYS

The   keys have four uses. In the Menu the keys are used to scroll through the selections. In Calibration the keys increment or decrement calibration values. In Manual the keys adjust the servo valve. When RATE or % ERROR is being displayed the keys adjust the selected application rate.

TIME /DATE

Press the TIME / DATE key to view the current date and time. This key is a "toggle" key, press it once and the time is displayed, press it again and the date is displayed.



RATE

When RATE is selected, target and actual gallons per acre or pounds of Nitrogen per acre being applied are displayed.

% ERROR

The purpose of % ERROR is to make it very easy for the operator to see how close the actual application rate is to the desired or target application rate.

This function computes and displays the percent error. Therefore, if the actual rate is exactly equal to the desired rate, it will display 0% error. If, for example, the actual rate was high by 5% then it would display +5%. If the actual rate was low by 7% then it would display -7% (note the negative sign).

A quick glance at the display using this mode will let you know that it is working. Under normal conditions the error will stay less than 10% (positive or negative) which should be considered acceptable. Quick speed changes such as shifting gears on a hillside will obviously cause a significant error. However, the 8605 will immediately start correcting and the "% ERROR" display will show this.

The 8605 will start making flow adjustments as soon as the error reaches plus or minus 1%. If the error exceeds 10% the alarm indicator will flash and the audible alarm will sound.

The 8605 will then start driving the Servo Valve at a much faster rate and will soon have the error less than 10% again. The alarm light will stop flashing and the audible alarm will stop "beeping" when the error is less than 10%.

This is a handy feature since the operator can "see" and "hear" when the error exceeds 10% and "see" and "hear" when the 8605 automatically corrects it.

The 8605 performs the Error (% Error) calculation very quickly. Therefore, it is normal to see this mode fluctuate, especially in rough ground conditions where the speed naturally makes many small changes. For example, a change of 1/4 MPH above or below 5 MPH would be detected and correctly computed as a 5% error. When the speed makes these small changes, the % error display will usually show 1 or 2 positive error readings followed by 1 or 2 negative readings. It is easy to see that the average error is 0% and the intermediate fluctuating readings should not be considered alarming. Both the applicator and the 8605 are operating properly.

DATA STORAGE

The 8605 has the capability to store 1584 different applications. These are divided into 99 fields with 16 chemicals per field. Field Area, Field Volume, Time and Date are saved for each Field/Chemical combination.

Field and Chemical numbers can be selected in Change Field & Chemical # (Menu selection 1) or in Calibration mode (Menu selection 2). The Field/Chemical application record will be stamped with the current date and time when Field Volume is cleared to indicate when the new application record was started. It will also be tagged as an NH₃ record if Field Volume is cleared while in NH₃ mode. The print out of NH₃ application records show the field volume as pounds of actual nitrogen rather than as gallons of liquid. To view information on the current Field/Chemical record, press Field Area or Field Volume.

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DISPLAY

During Calibration the display allows you to see and adjust all calibration numbers. Upon completion of Calibration, the controller displays the “initializing Servo Valve” message and sets the valve to a starting position that depends on the “Inline” or “Bypass” location of the Servo Valve.

During normal operation any two of the ten function keys may be displayed. Pressing one of the ten keys, % ERROR, RATE, VPM, TOTAL AREA, TOTAL VOL, SPEED, DISTANCE, FIELD AREA, FIELD VOL or DATE/TIME will display that selected function on the bottom line of the display. The previous bottom line function will now be shifted to the top line of the display.

The following is a list of display messages and their meanings.

HOLD

Reminds the operator that the 8605 is not automatically controlling the sprayer, that all boom valves are closed and the distance, acre and gallon counters have stopped accumulating. Hold is only displayed in Rate or % Error.

ERR

This stands for percent of error. The percent difference between the rate selected (RATE 1, RATE 2 or VARIABLE) and the rate being measured by the combination of speed and flow signals. If the Rate Selector Switch is in the Manual Position, MAN. ERR will be displayed.

LOW BATTERY POWER

This is a warning that the battery power supplied to the 8605 is less than 10 VDC. This condition causes the 8605 to suspend operation. The 8605 will remain in this mode until battery power is 10 VDC or more.

NO-SPD

This is a warning that the speed signal is missing or that the speed is too slow for the 8605 to operate in the RATE 1, RATE 2 or VARIABLE RATE modes. Either increase your speed or switch to manual operation. No-SPD is only displayed in Rate or % Error.

ZERO WIDTH ENTERED

This is a warning that the Booms have zero entered for implement width. Enter the correct width values.

NO-FLO

This is a warning that the flow signal is missing or that the flow is too low for the 8605 to operate in the Rate 1, Rate 2 or variable rate modes. Either increase flow by increasing speed or application rate or switch to manual operation. No-flo is only displayed in Rate or % Error.

TOT VOL

This is your total accumulated volume. This is measured as gallons or pounds of actual Nitrogen.

TOT AREA

This is your total accumulated area counter and is measured in acres.

FLD AREA

This is the accumulated area for the current field, and chemical number. It is measured in acres.

FLD VOL

This is the accumulated volume for the current field number and chemical number. It is measured in gallons or pounds of actual Nitrogen.

SPEED

Displayed as “MPH” (Miles per hour).

DIST

This is your accumulated distance traveled in feet.

RATE (GPA or PPA)

This is your actual application rate measured in gallons per acre or actual pounds of Nitrogen per acre. The left side of the display shows the TARGET RATE and the right side shows the ACTUAL RATE.

MIN

Indicates Minimum flow to the booms caused by the servo valve at the end. Displayed only during Rate or % Error.

MAX

Indicates Maximum flow to the booms caused by the servo valve at the end. Displayed only during Rate or % Error.

LIM

Lim stands for limit. LIM is flashed on the display if the Minimum Flow Rate feature has been enabled and the actual flow rate falls to the value set. It is only displayed if RATE or % ERROR has been selected.

GUIDELINES

The purpose of this section is to provide some general guidelines and recommendations for operating the 8605 in the field.

The 8605 has 13 keys labeled with 10 functions. All of the functions are working at all times. However, only two can be displayed at a time. Pressing one of the ten function keys will display that function. The operator is free to select whichever function he or she desires, however, the following is a list of recommendations.

When first installed, it is important to insure that the 8605 is indeed controlling your sprayer properly.

The RATE and % ERROR keys will show this. Pressing the RATE key will display the actual application rate in gallons per acre (pounds per acre). Pressing the % ERROR key will display the actual error between the actual and target rates. This is displayed as a percentage.

When the controller is in Hold then HOLD will be displayed. The console must be in RUN and actively working to show correct RATE and % ERROR data.

The Error, Hold, No-spd, No-flo, Min. and Max. are only displayed when Rate or % Error is being displayed.

It is important to remember that any errors less than 10% are considered good. You will note, however, that the 8605 will continue controlling the Servo Valve until the error falls to zero. The warning light will flash and the audible alarm will sound when the error exceeds $\pm 10\%$.

The 8605 will automatically adjust the sprayer flow whenever Rate 1 or Rate 2 is selected or when an external rate input is received. Putting the Rate switch in the center position will turn the automatic control off and the application rate can then be adjusted manually.

Switching between Rate 1 and Rate 2 can be done at any time and as often as desired. The 8605 will change to the new application rate and maintain that rate.

The  and  keys will adjust the application rate selected if Rate or % Error is being displayed.

Driving too fast or too slow will cause the servo valve to end stop (either full open or full close).

When this happens, the pressure gauge will show minimum or maximum PSI and the Controller will display either MAX or MIN. This indicates that you are exceeding the limits of your applicator and the 8605 can no longer maintain a constant rate per acre.

Sometimes it is necessary to slow down to a very slow speed in the field or on an end row. (Small area or rough spot, etc.) The 8605 will try to maintain a constant rate lowering the pressure even though it is far below the minimum acceptable pressure for the nozzles. This will probably result in a trickle of spray out of the nozzles causing very poor weed control.

To prevent a "MIN" message as you slow down the 8605 can automatically stop reducing the flow at a preset minimum flow rate. This prevents a poor spray pattern from your nozzles. This option can be turned on and the Minimum Flow Rate set in the main menu under Set Minimum Flow. This is only available for the Spray Mode. Keep in mind that you are OVER APPLYING to maintain a spray pattern at very low speeds. Whenever the flow is reduced to the Minimum Flow level, the display will flash "LIM" to indicate that the console will not reduce the flow any further.

NOTE: The following procedure can be used as an alternative to using the Minimum Rate feature.

As you slow down, watch your pressure gauge. When a minimum acceptable pressure (determined by nozzle selection) is reached, switch the console into MANUAL mode. (RATE 1 and RATE 2 switch in center position.) This will freeze the servo valve at that position and maintain the pressure at that MINIMUM amount instead of dropping it to zero.

After passing through the bad spot or making the turn, simply switch back to Rate 1 or Rate 2 as you again increase your speed.

Keep in mind that you are OVERAPPLYING to maintain a spray pattern at very low speeds.

It is highly recommended that the operator take advantage of the dual rate control. Significant chemical savings can be made if Rate 2 is programmed to a higher rate for weedy spots, and ONLY used when field conditions require it. All the rest of the time the operator can stay in the lower Rate 1 mode and save chemicals.

PRE-SPRAYING SYSTEM CHECK

It is highly recommended that the following checklist be used before going to the field to spray.

1. Park sprayer, use clear water.
2. Select Rate and VPM. Turn booms on by selecting RUN.
3. Select Manual mode on the Rate Switch (center position).
4. Hold the \uparrow key until the display flashes "MAX". (This will move the valve to the maximum pressure position.)
5. Start the sprayer pump and run at operating RPM.
6. Assure that all boom valves are operational.
7. Note Maximum Volume per Minute.
8. Note Maximum pressure.
9. Hold the \downarrow key until the display starts to flash "MIN".
10. Note Minimum pressure.
11. Note Minimum Volume per Minute.
12. Perform "Minimum Flow Rate" procedure now if using this feature.
13. Press the \uparrow key until the pressure is at some typical amount or about the middle of the range.
14. Put controller in HOLD and turn pump off.
15. Set the desired field number and chemical number. Double check that you have the correct target Gallons Per Acre programmed in for RATE 1 and RATE 2.
16. Clear both ACRE counts to zero, if desired.
17. Clear both VOLUME counts to zero, if desired.

You are now ready to go to the field and begin spraying.

To adjust this maximum and minimum flow rate and pressure, open or close any manual series valve, bypass valve, etc., to achieve a desired flow rate and pressure range.

In general, a 4 to 1 pressure range can be used on most nozzles. For example, 10 PSI to 40 PSI can be used on flood-jet nozzles. Be sure to consult your pressure nozzle charts. Using pressures that are too low will generate a poor spray pattern. Very high pressures will cause "misting" and also increase nozzle wear-out rate.

A 4-to-1 change in pressure will only cause a 2-to-1 change in the flow rate. Therefore, the speed change must be limited to 2-to-1. For example, a pressure change of 10 PSI to 40 PSI (4:1) will double the flow rate. This means the speed can also double (4 MPH to 8 MPH) and still maintain a constant GPA (gallons per acre).

Minimum and Maximum speed can be calculated as follows using the formula:

$$\text{Speed} = \frac{\text{VPM} \times 495}{\text{Width (in feet)} \times \text{Rate (in Gallons/Acre)}}$$

Example: Using an application rate of 20 GPA and a width of 60 feet, a minimum flow rate of 3.5 gallons per minute would allow a minimum speed of 1.44 mph.

$$\text{Minimum Speed} = \frac{\text{Minimum VPM} \times 495}{\text{Width} \times \text{Rate}}$$

$$\text{Minimum Speed} = \frac{3.5 \times 495}{60 \times 20}$$

$$\text{Minimum Speed} = 1.4 \text{ mph}$$

Changing to a maximum flow rate of 70 gallons per minute will allow a maximum speed of 28.8 mph.

$$\text{Maximum Speed} = \frac{\text{Maximum VPM} \times 495}{\text{Width} \times \text{Rate}}$$

$$\text{Maximum Speed} = \frac{70 \times 495}{60 \times 20}$$

$$\text{Maximum Speed} = 28.9 \text{ mph}$$

Calculation should be done for both Rate 1 and Rate 2.

REMEMBER, OPERATING OUTSIDE THE SPEED RANGE FOUND IN THIS PROCEDURE (TOO FAST OR TOO SLOW) MAY RESULT IN EXCEEDING THE MINIMUM OR MAXIMUM RECOMMENDED OPERATING PRESSURES FOR YOUR NOZZLE. THIS COULD RESULT IN POOR WEED CONTROL, ETC.

When a desired pressure cannot be obtained the usual cause is low pump capacity. Other possible problems are long runs of small diameter hose, low capacity boom valves and excessive agitation flow.

PROCEDURE FOR PRINTING 8605 REPORTS

The 8605 controller can send Field/Chemical report information to a wide variety of serial printers. The following describes the report printing procedure in general. See Appendix A on serial communications for details on printer specifications. Information for an individual Field/Chemical record can be printed by performing the following steps:

1. Press the Menu key and select the 4. PRINT RECORD option.
2. Select the Field Number by entering it on the keypad or adjusting the displayed field number with the Up or Down Arrow key.
3. Press Enter when Field Number selection is completed.
4. Select the Chemical Number by entering it on the keypad or adjusting the displayed chemical number with the Up or Down Arrow key.
5. Press Enter when Chemical Number selection is completed.
6. The printer should produce a report similar to the following:

```

┌───┬───┬───┬───┬───┬───┬───┬───┬───┬───┐
│           Field/Chemical Application Record           │
│           As of 1:18 pm, 09/18/11                     │
│                                                       │
│ Start Date: 09/18/11           Time: 10:08 AM.       │
│                                                       │
│ Farm:..... Field: 01                               │
│ Field Desc:.....                               │
│ Applicator:.....                               │
│ Chemical 01.....                               │
│ Amount Applied:           00153.6 Gallons           │
│ Acres:                   0016.4 Acres              │
│ Weather Conditions: .....                               │
│ Wind Speed/Direction...../.....                     │
│ Temperature:..... Humidity: .....                 │
│                                                       │
│ NOTES:                                               │
│ .....                                               │
│ .....                                               │
└───┬───┬───┬───┬───┬───┬───┬───┬───┬───┘
┌───┬───┬───┬───┬───┬───┬───┬───┬───┬───┐
│           Sample Field/Chemical Application Record Report           │
└───┬───┬───┬───┬───┬───┬───┬───┬───┬───┘

```

Information on all previously used Field/Chemical records can be printed by performing the following steps:

1. Press the Menu key and select the 5. PRINT ALL FIELD HISTORY option.
2. The printer should produce a report similar to the following:

```

┌───┬───┬───┬───┬───┬───┬───┬───┬───┬───┐
│           Field/chemical History Report                 │
│           As of 1:18 pm, 09/18/11                     │
│                                                       │
│ Field: 1 Area 138.9 Acres                               │
│ Chemical: 1 Vol: 1214.9 Gallons                       │
│ Date: 09/18/11 Time: 10:08 AM                       │
│                                                       │
│ Field: 1 Area 92.2 Acres                               │
│ Chemical: 2 Vol: 1182.4 Gallons                       │
│ Date: 09/16/11 Time: 08:12 AM                       │
│                                                       │
│ Field: 3 Area 22.1 Acres                               │
│ Chemical: 1 Vol: 1214.9 Gallons                       │
│ Date: 09/15/11 Time: 08:44 AM                       │
│                                                       │
│ Field: 6 Area 133.5 Acres                               │
│ Chemical: 2 Vol: 1102.1 Gallons                       │
│ Date: 09/10/11 Time: 09:11 AM                       │
│                                                       │
│ Field: 7 Area 44.3 Acres                               │
│ Chemical: 1 Vol: 88.6 Gallons                         │
│ Date: 09/01/11 Time: 09:16 AM                       │
│                                                       │
│ NOTES:                                               │
│ .....                                               │
│ .....                                               │
└───┬───┬───┬───┬───┬───┬───┬───┬───┬───┘
┌───┬───┬───┬───┬───┬───┬───┬───┬───┬───┐
│           Sample Field/Chemical History Report         │
└───┬───┬───┬───┬───┬───┬───┬───┬───┬───┘

```

USING THE 8605 CONSOLE WITH AN EXTERNAL RATE INPUT

- The external rate input will override the pre-programmed RATE 1 data.
- The external rate message protocol as explained in the Appendix. Your computer must provide the variable rate data to the controller in one of these formats.
- The controller will continue to apply at the rate specified in the last received message until it receives a new message specifying a new application rate.
- Switching to MANUAL or RATE 2 on the controller will override the external rate input.
- Entering CALIBRATION MODE will reset the variable rate data to the RATE 1 data as displayed during Calibration step 4.
- The "Generic Protocol" is only available in software version 3.0 or higher. If you have earlier versions the 8605 will need to have the software updated.

CALIBRATION

DISTANCE CALIBRATION

The purpose of this step is to match the console distance calibration factor to the distance measuring device you are using, including RADAR. This calibration process is extremely simple and fast, involving nothing more than driving a pre-measured distance with the Console in the DISTANCE CALIBRATION mode.

Distance Calibration is not required when using the Hiniker GPS Speed Sensor. Enter 2.00 as the Calibration number.

Normally you will only have to do this procedure once for each implement used, unless the same implement is used in considerably different ground condition. (Spring, summer and fall operations). This procedure should be completed prior to the Calibration procedure.

1. Measure 500 feet in your field and mark start and finish with flags.
2. Stop at the first flag. Line up some convenient part of the tractor with the first flag.
3. Select Distance Calibration in the Main Menu. Press Enter, the display will read "Drive 500 Feet and Stop".
4. Drive at normal speeds in a straight line with the tank 1/2 full. Display will read "Press Enter Key When Done".
5. Slow down and stop when the second flag lines up. DO NOT BACK UP! Press the Enter Key.
6. The console now will compute the distance calibration factor and display:

THE NEW DIST CAL FACTOR = XX.XX
Where XX.XX is equal to your systems calibration number.

This number is automatically stored in the controller memory.

7. Your distance calibration is now complete, you may now operate the system or perform the Calibration procedure.

GENERAL

The Calibration procedure is used to set up the controller to your particular system configuration.

The Calibration Mode can be entered at any time by pressing the MENU KEY and selecting CALIBRATION.

Before starting the calibration procedure please familiarize yourself with the questions and any number values required.

The controller has a memory retention feature that saves calibration data during power off.

For Anhydrous Ammonia applications see Calibration Procedures for Anhydrous Ammonia.

When all calibration steps are completed, the 8605 runs the servo valve to a home position, therefore, the servo valve should be connected to the controller during calibration. Failure to have the servo valve connected will result in the 8605 displaying "Check Servo Valve" then exiting calibration. This allows you to use the 8605 as a monitor if the servo valve is disconnected.

Field and chemical numbers can be changed without performing the entire calibration procedure by selecting menu selection 1. CHANGE FIELD & CHEMICAL # and performing calibration steps 2 and 3.

CALIBRATION PROCEDURES - SPRAY APPLICATIONS		
STEP	DISPLAYED	ACTION YOU TAKE
1	CALIBRATION MODE	Select Calibration Mode from the Main Menu.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
2	FIELD NUMBER	Use numeric keys to enter field number. (1-99) or
		Press ↑ key to increase number.
		Press ↓ key to decrease number.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
3	CHEMICAL NUMBER	Use numeric keys to enter chemical number. (1-16) or
		Press ↑ key to increase chemical number.
		Press ↓ key to decrease chemical number
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
4	APPLICATION:	
	1. SPRAY	Press ↑ , ↓ keys to make selection.
	2. NH ₃	Select 1. Spray
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
5	SERVO LOCATION:	Press ↑ , ↓ keys to make selection.
	1. INLINE	Select Inline if the servo valve is installed inline with the flow to the booms.
	2. BYPASS	Select Bypass if the servo valve is installed in a return or agitation line back to the tank or pump inlet.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
6	APPLY RATE 1 10.0 GAL/ACRE	Use numeric keys to set value or
		Press ↑ key to increase the gallon per acre for Rate 1.
		Press ↓ key to decrease the gallon per acre for Rate 1.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
7	APPLY RATE 2 20.0 GAL/ACRE	Use numeric keys to set desired value or
		Press ↑ key to increase gallon per acre for rate 2.
		Press ↓ key to decrease gallon per acre for rate 2.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.

STEP	DISPLAYED	ACTION YOU TAKE
8	VALVE RESPONSE 5	Set value for valve response in automatic 1 to 9.
		Use numeric keys or the ↑ or ↓ key.
		Larger number = faster response.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
9	FLOW METER CALIBRATE 72.0	This number must match the pulses per gallon number on the decal on the flowmeter.
		Use numeric keys to set value or
		Press ↑ key to increase number.
		Press ↓ key to decrease number.
		IMPORTANT: Make sure you enter the <u>pulses per gallon</u> calibration number.
		17.0 PULSES/LB PULSES/Gal 72.0
	PRESS ENTER KEY TO ADVANCE TO NEXT STEP.	
10	DIST. CALIBRATION FACTOR 2.00	Use numeric keys to set value or
		Press ↑ key to increase calibration factor.
		Press ↓ key to decrease calibration factor.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
If you have not performed the distance calibration procedures as outlined on page 16. You must do so to determine what the distance calibration factor is. By performing the distance calibration on page 16 the 8605 will automatically enter the distance calibration factor for step 10. If using a Hiniker GPS Speed Sensor enter 2.00 as the Calibration number.		
11	BOOM #1 WIDTH 240 INCHES	Use numeric keys to set value or
		Press ↑ key to increase the total width in inches for boom #1.
		Press ↓ key to decrease the total width in inches for boom #1.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
12	BOOM #2 WIDTH 240 INCHES	Use numeric keys to set value or
		Press ↑ key to increase the total width in inches for boom #2.
		Press ↓ key to decrease the total width in inches for boom #2.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
13	BOOM #3 WIDTH 240 INCHES	Use numeric keys to set value or
		Press ↑ key to increase the total width in inches for boom #3.
		Press ↓ key to decrease the total width in inches for boom #3.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.

STEP	DISPLAYED	ACTION YOU TAKE
14	BOOM #4 WIDTH 0 INCHES	Use numeric keys to set value or
		Press ↑ key to increase the total width in inches for boom #4.
		Press ↓ key to decrease the total width in inches for boom #4.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
15	BOOM #5 WIDTH 0 INCHES	Use numeric keys to set value or
		Press ↑ key to increase the total width in inches for boom #5.
		Press ↓ key to decrease the total width in inches for boom #5.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
16	INITIALIZING SERVO VALVE	THE SYSTEM WILL AUTOMATICLY EXIT CALIBRATION AND INITIALIZE THE SERVO VALVE TO THE MINIMUM FLOW POSITION AND BEGIN OPERATION.

MINIMUM FLOW RATE

The MINIMUM FLOW RATE procedure can be entered at any time by pressing the MENU key and selecting 4. MINIMUM FLOW RATE.

The MINIMUM FLOW RATE is a setting that will cause the 8605 to stop reducing the flow below this minimum limit as you slow down. This prevents a poor spray pattern from your nozzles by keeping the pressure at an acceptable level.

NOTE: the MINIMUM FLOW RATE is only available in the SPRAY MODE. It is not available for NH3 applications.

STEP	DISPLAYED	ACTION YOU TAKE
1	MIN FLOW SETUP MIN FLOW IS OFF	Press ↑ to turn the minimum flow feature on Press ↓ to turn the minimum flow feature off
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
2	MIN FLOW SETUP SET MIN FLOW? N	Press ↑ to change to yes "Y" Press ↓ to change to no "N"
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
3	ADJUST PRESSURE THEN PRESS ENTER	Pump and booms must be on. Use ↑ ↓ keys to adjust for minimum pressure while still maintaining a good spray pattern.
		PRESS ENTER TO SET THE LIMIT AND EXIT

CALIBRATION PROCEDURES - ANHYDROUS AMMONIA

Read General Calibration page 16.

This calibration procedure is used to set up the controller to be used with an applicator for applying Anhydrous Ammonia. Application rates are in actual pounds of nitrogen applied.



CAUTION: If you and your operator(s) are not intimately familiar with proper handling procedures for Anhydrous Ammonia, contact your supplier for information, and read all safety precautions found in the

“HINIKER ANHYDROUS AMMONIA MONITORING AND CONTROL SYSTEM MANUAL.” Part number 360-000-246. Additional manuals may be obtained from your local dealer.

Refer to manual Part No. 360-000-246 Revision E or higher for Heat Exchangers manufactured prior to 2007. These are painted Gray.
or
Refer to manual Part No. 39300035 for Heat exchangers manufactured in 2007 or after. These are painted White Additional manuals may be obtained from your local dealer.

CALIBRATION PROCEDURES - ANHYDROUS AMMONIA		
STEP	DISPLAYED	ACTION YOU TAKE
1	CALIBRATION MODE	Select Calibration Mode from the Main Menu.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
2	FIELD NUMBER	Use numeric keys to enter field number. (1-99) or
		Press ↑ key to increase number.
		Press ↓ key to decrease number.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
3	CHEMICAL NUMBER	Use numeric keys to enter chemical number. (1-16) or
		Press ↑ key to increase chemical number.
		Press ↓ key to decrease chemical number
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
4	APPLICATION:	Press ↑ , ↓ keys to make selection.
	1. SPRAY	
	2. NH ₃	Select 2. NH ₃
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
5	APPLY RATE 1 100.0 LBS/ACRE	Use numeric keys to set value or
		Press ↑ key to increase the gallon per acre for Rate 1.
		Press ↓ key to decrease the gallon per acre for Rate 1.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
6	APPLY RATE 2 200.0 LBS/ACRE	Use numeric keys to set value or
		Press ↑ key to increase the gallon per acre for Rate 2.
		Press ↓ key to decrease the gallon per acre for Rate 2.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.

STEP	DISPLAYED	ACTION YOU TAKE
7	VALVE RESPONSE 5	Set value for valve response in automatic 1 to 9.
		Use numeric keys ↑ or the ↓ key.
		Larger number = faster response.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
8	FLOW METER CALIBRATE 72.0	This number must match the pulses per gallon number on the decal on the flowmeter.(Do not use the pulse per pound number).
		Use numeric keys to set value or
		Press ↑ key to increase number.
		Press ↓ key to decrease number.
		IMPORTANT: Make sure you enter the <u>pulses per gallon</u> calibration number.
		17.0 PULSES/LB PULSES/Gal 72.0
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
9	DIST. CALIBRATION FACTOR 2.00	Use numeric keys to set value or
		Press ↑ key to increase calibration factor.
		Press ↓ key to decrease calibration factor.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
	If you have not performed the distance calibration procedures as outlined on page 16. You must do so to determine what the distance calibration factor is. By performing the distance calibration on page 16 the 8605 will automatically enter the distance calibration factor for step 9. If using a Hiniker GPS Speed Sensor enter 2.00 as the Calibration number.	
10	BOOM #1 WIDTH 240 INCHES	Enter width of applicator section #1 or total machine width if only 1 section. (Use numeric keys to set valve or)
		Press ↑ key to increase the width of applicator, in inches, for section #1.
		Press ↓ key to decrease the width of applicator, in inches, for section #1.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
11	BOOM #2 WIDTH 240 INCHES	Enter width of applicator section #2 or 0 if total machine width was entered in step #10. (Use numeric keys to set valve or)
		Press ↑ key to increase the width of applicator, in inches, for section #2.
		Press ↓ key to decrease the width of applicator, in inches, for section #2.
		PRESS ENTER KEY TO ADVANCE TO NEXT STEP.
12	INITIALIZING SERVO VALVE	THE SYSTEM WILL AUTOMATICLY EXIT CALIBRATION AND INITIALIZE THE SERVO VALVE TO THE MINIMUM FLOW POSITION AND BEGIN OPERATION.

INSTALLATION - BASIC UNIT

CONTROLLER MOUNTING

Select a convenient location to mount the 8605 controller.

This location should provide the operator with a good view of the controller display and easy access to all switches.

There are 7 cables connecting the controller to the other parts of the system. They are listed in the table. The controller location should allow easy routing of these cables.

CABLE	CONNECTED TO
POWER	BATTERY OR CAB POWER OUTLET
SERVO	SERVO VALVE
SPEED	SPEED SENSOR
FLOW	FLOWMETER
BOOM	BOOM VALVES
REMOTE RUN/HOLD	REMOTE RUN HOLD SWITCH
I/O	EXTERNAL RATE INPUT OR PRINTER

Install the "U" shaped mounting bracket as shown in Figure 1, using the hardware supplied.

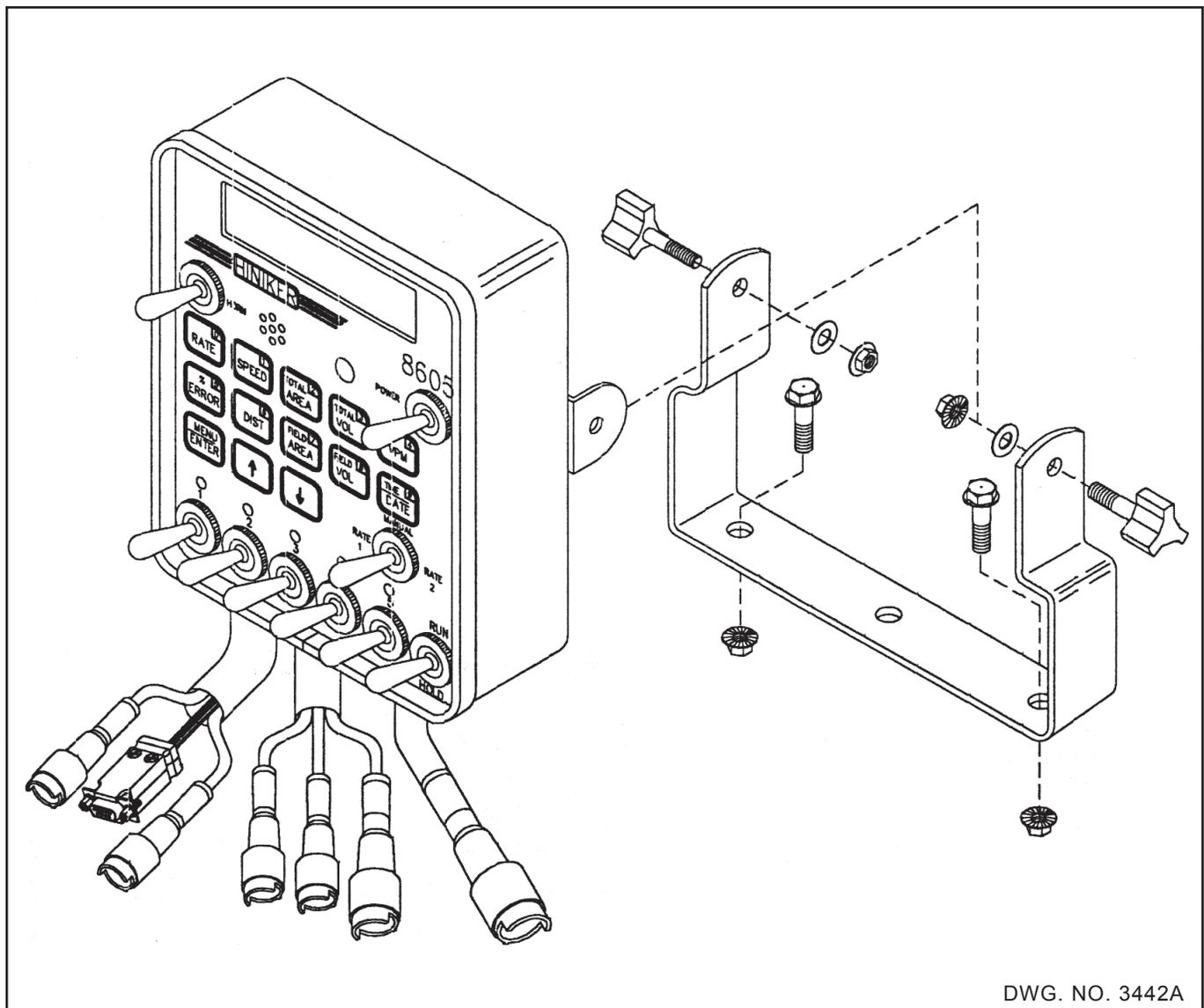


Figure 1

POWER CABLE CONNECTION

The 20-foot 4-conductor battery cable should be routed to the battery and secured with cable ties. Care must be taken to route this cable away from moving or hot parts. The battery cable must be connected directly to the battery post. Be sure the battery is in good condition and the connecting posts are clean. Connect the lead with the automotive fuse to the positive terminal and the black lead to the negative terminal. Be sure it is connected to 12 volts. Plug the other end of the cable into the controller connector labeled POWER.

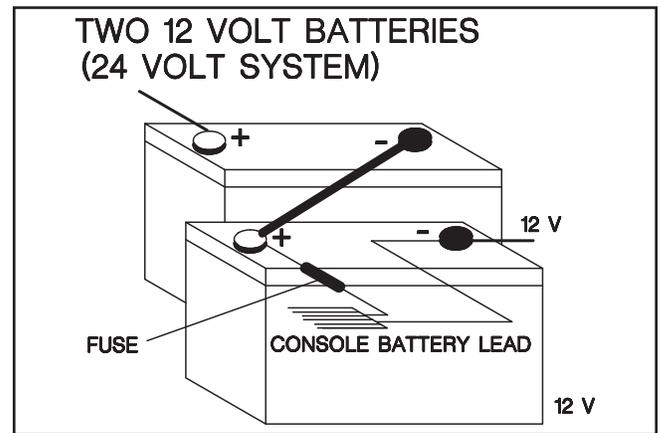
If there is any doubt as to whether or not you have a 12 volt system use a volt meter to check it.

DO NOT connect the battery cable to the tractor starter motor, or alternator. Connect directly to battery.

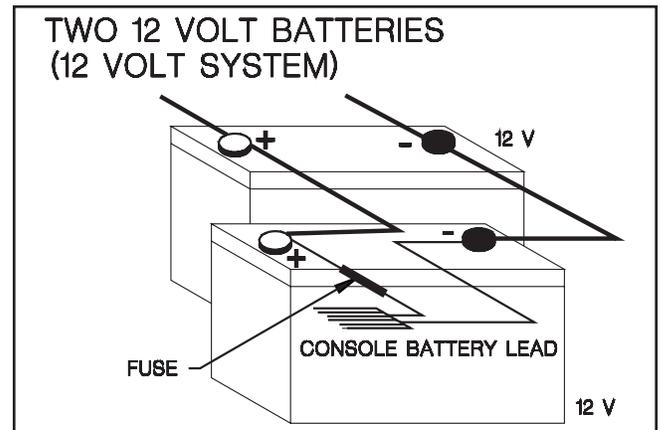
IMPORTANT: Make sure the power switch on controller is in the OFF position when jump starting the tractor or charging the battery. Failure to do this may cause damage to the controller.

Alternate Power Cable

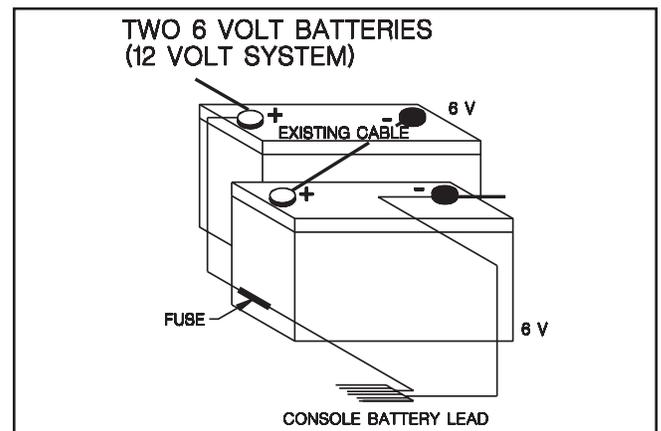
An Alternate Power Cable is available for use with the standard 3 conductor cab auxiliary power socket. This cable is 5 feet long and plugs into the auxiliary power socket.



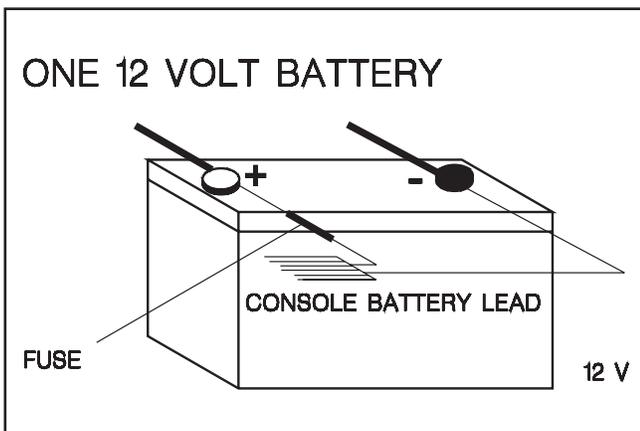
DWG. NO. 3445



DWG. NO. 3443



DWG. NO. 3444



DWG. NO. 3446

INSTALLATION - SPEED SENSOR

HUB PLATE SPEED SENSOR

The hub plate speed sensor may be installed either on the tractor or the implement. Do not install the sensor on a driven wheel. This will cause readings to be incorrect due to wheel slippage.

To install the hub plate, jack the implement up and block. Remove the wheel from the hub. NOTE: In some special cases it may be easier to split the hub plate (saw in half) and install one-half at a time without removing the wheel from the hub.

Refer to drawing 123. Place the hub disk onto the hub with the fingers facing as shown in Figure A.

Assemble the hardware as shown in Figure B. DO NOT tighten the set screws at this time.

Mount the speed sensor in the sensor bracket using the two nylon nuts. **Be sure the sensor protrudes at least 1/2 inch through the bracket hole. See Figure C.**

Use the 4-1/2 inch hose clamp to fasten the entire assembly to the axle or some framework.

Position the entire assembly on the implement. Adjust the L rod and sensor bracket as required so the sensor **is 1/4 inch or less** from the hub disc fingers. See Figure C. Make the installation as strong and rigid as possible. Cut off any excess length from the L rod.

Tighten all whiz bolts and set screws once it is adjusted.

Connect the 20 and 10 foot cables labeled speed as shown in Figure D, using the cable ties provided. Secure all cables to prevent dragging and chafing.

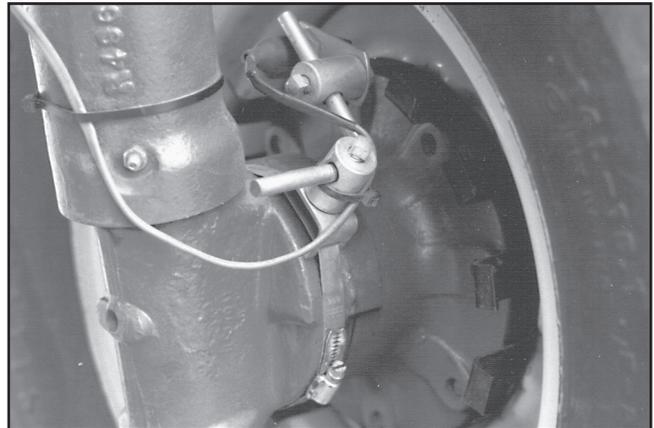
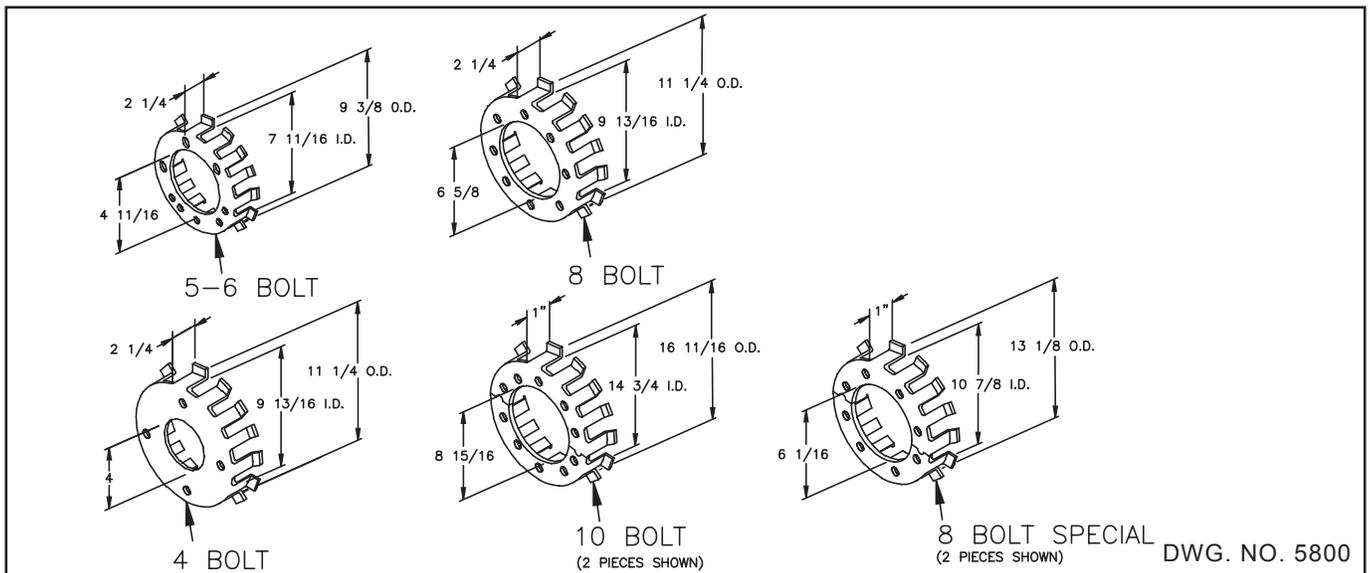
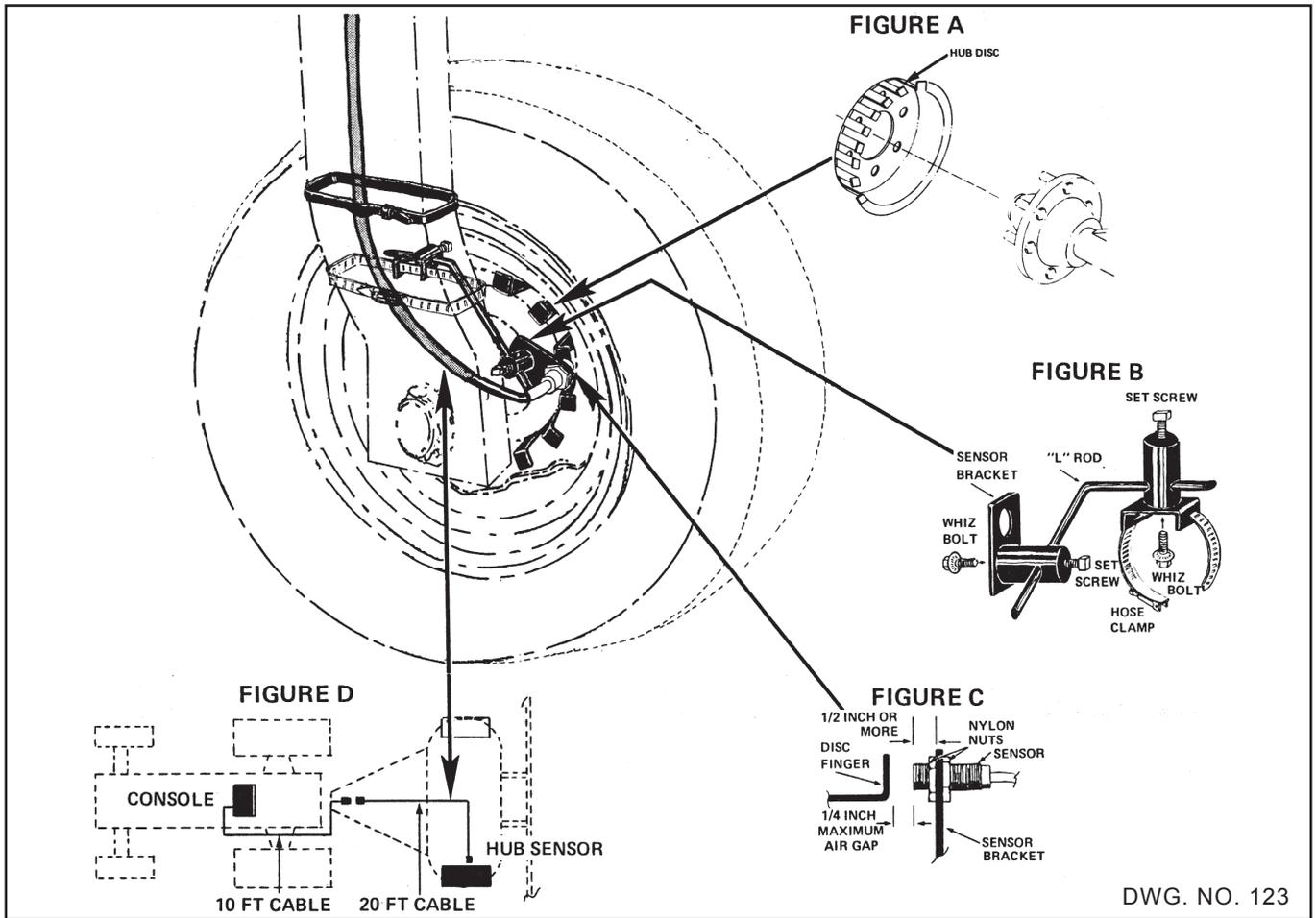


PHOTO NO. 2439



The 4 bolt hub plate is for (4) 9/16 inch bolts on a 5-inch bolt circle.

The 5 bolt hub plate is for (5) 9/16 inch bolts on a 5 1/2 inch bolt circle.

The 6 bolt hub plate is for (6) 9/16 inch bolts on a 6-inch bolt circle.

The 8 bolt hub plate is for (8) 5/8 inch bolts on a 8-inch bolt circle.

The 10-bolt hub plate is for (10) 3/4 inch bolts on an 11 1/4 inch bolt circle.

The 8 bolt hub plate (for adjustable axial) is for (8) 5/8 inch bolts on an 8 inch bolt circle.

RADAR INTERFACES:

Most commercially available radar units may be used with the Hiniker system. This will require installing a Radar Interface between the radar and the Hiniker system.

Listed below are the Radar Interfaces and their proper hook up.

PART #363-008-003

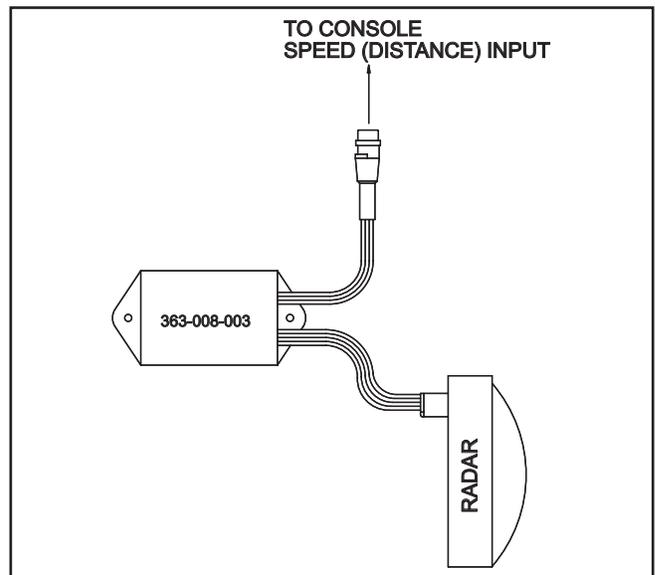
This standard interface is used to connect a Magnavox/Phillips radar to the 8605 console in a stand-alone mode. In the stand-alone mode the radar is not connected to any other system.

To install, connect the interface to the radar and mount in a convenient location. Connect the speed cable to the console using a speed extension cable (not included).

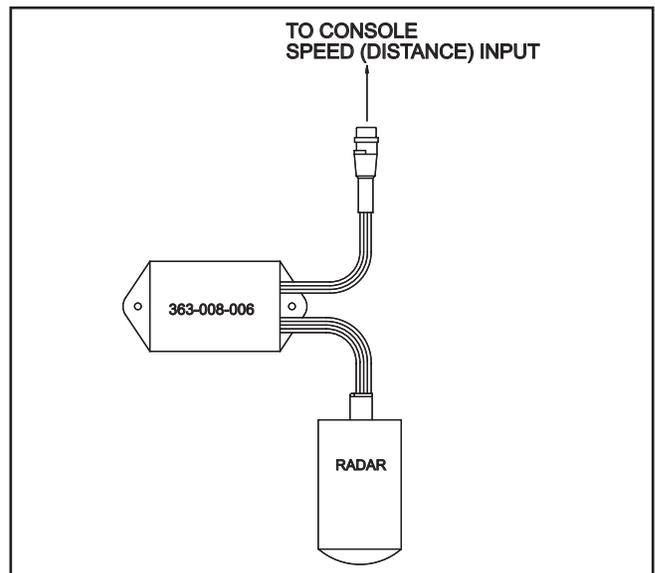
PART #363-008-006

This standard interface is used to connect a Dickey John Radar with AMP connector to the 8605 console in a stand-alone mode. In the stand-alone mode the radar is not connected to any other system.

To install, connect the interface to the radar and mount in a convenient location. Connect the speed cable to the console using a speed extension cable (not included).



DWG. NO. 2750



DWG. NO. 3062

ADAPTIVE INTERFACE

The Adaptive Radar Interface is a universal radar interface intended to connect existing radar systems to the Hiniker system.

The Adaptive Radar Interface when used with the proper adapter cable will work with any radar system. The interface will not effect the performance of the radar system and totally isolates the two systems electronically.

How it works

The Adaptive Interface consists of the interface module and the proper adapter cable. The adapter cable is a "T" type feed thru cable with the proper connector to interface to your system. **As long as the connector mates with the connector at the radar, the interface will work.** No more wiring errors! The Adaptive Interface will **find** the proper wires for power, signal, and ground, and provide high isolation between the dash and the Hiniker system. The interface divides the signal, enhances it and routes it to the Hiniker system. Adapter cables are available for all radars.

To install

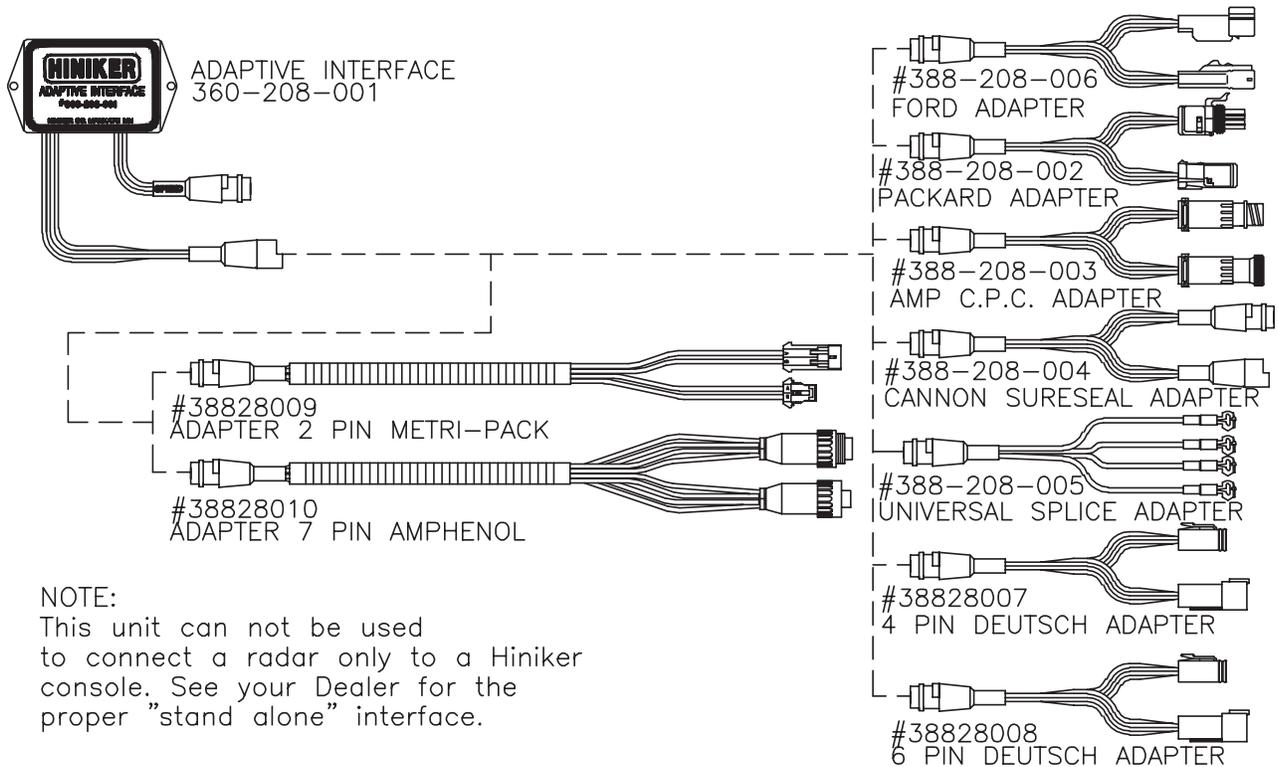
Disconnect the radar cable from the radar and connect it to the Adaptive Interface adapter cable.

Next plug the adapter cable into the radar. Connect the Adaptive interface to the adapter cable and mount in a convenient location with wires facing down. Connect the cable marked speed to the SPEED input of the Hiniker console using the proper length speed extension cable. Route all cables away from hot or moving parts, and secure with wire ties.

Adapters # 38828009 and # 38828010 are for interfacing to optional radar connections inside the cab. Only plug one of the Y-connectors to the optional radar connector. The other is used for expansion to another system.

To install the universal splice adapter cable, first apply the blue wire taps to the wires at the radar using a pair of pliers, one tap to each wire. Next connect the adapter to the interface and mount as described above.

If you are using the Ford adapter and your Radar is equipped with the same connector only black instead of gray, then perform the following: On the male shells only, clip off the small indexing tab that prevents the mating of a black and gray shell together. This must be done on both male shells, one black and one gray.



NOTE:
This unit can not be used to connect a radar only to a Hiniker console. See your Dealer for the proper "stand alone" interface.

HINIKER GPS GROUND SPEED SENSOR INSTALLATION:

LOCATION:

The sensor should be placed as high as possible with the least obstructed view of the horizon. Placing the sensor along the centerline of the tractor cab (front to back and side to side) will provide for optimal reception when traveling on hilly ground. The sensor has a 16-foot cable that will need to be routed to the console(s) using the GPS speed sensor. Route the cable before mounting your sensor. After determining the location, select the sensor mounting method best suited for your application.

MAGNETIC MOUNT:

A magnet incorporated into the back of the GPS sensor can be used for attaching the sensor to metal surfaces. Simply place the sensor on the metal structure and check for proper holding force. If the sensor is easily removed from the structure, then select an alternative method for mounting.

VELCRO MOUNT:

A 1 1/2 x 4 1/2 inch piece of hook and loop Velcro is included for attaching the sensor and Hiniker module. Cut a piece of Velcro 1 1/2 x 2 inches long for mounting the sensor. Clean the mounting location of all dirt and oils.

All surfaces must be clean and dry. Do not apply to cold surfaces. Apply the hook and loop to the back of the sensor after first removing the backing from one side. Remove the backing from the other side then press the sensor, with the hook and loop attached, against the clean mounting location.

ADHESIVE MOUNT:

The sensor may be mounted using an adhesive designated for outside use. Follow the adhesive manufacturer's recommendations for using their product. Allow enough time for the adhesive to cure fully before putting vehicle into service.

RIGID MOUNT:

The sensor has a threaded insert centrally located in its back. It will accept a metric M3 threaded bolt. The depth of the insert is approximately 4mm (5/32-inch). Select the proper length of a M3 bolt based on the thickness of the material the sensor is being mounted to. Drill a 9/64-inch hole in the center of the selected mounting area. Thread the bolt through the hole and into the threaded insert and tighten. Use washers under the head of the bolt to prevent the bolt from bottoming out in the insert.

IMPORTANT: Do not over-tighten the bolt. Over-tightening will cause the insert to be pulled from the plastic housing.

CONNECTIONS:

Route the cable from the sensor down to the location of the console(s) using the speed signal. Secure the cable with cable ties (supplied) to prevent it from being entangled or pulled loose.

Mount the Hiniker module to allow for direct viewing of the indicator lights. The supplied Velcro may be used for mounting the Hiniker module to the top or sides of your console.

HINIKER SPEED OUTPUT:

The Hiniker speed output can be connected directly to the Hiniker 8605 console's speed input.

It is not necessary to perform the Distance Calibration when using the HINIKER GPS Speed Sensor. Enter 2.00 Pulses/Ft for the Distance Calibration number during Set-up.

SECOND OUTPUT CHANNEL:

A second speed output is provided for connecting to the speed inputs of other manufacturer's consoles. The output consists of three wires. Connect them according to the following information.

Black wire to Ground

Tan wire to the Speed Signal input

Red wire to +12 volts

Connector kits for most applications are available from your Hiniker dealer.

Weather-Pack square 4-pin. Kit # 36028003

Weather-Pack 3-pin.....Kit # 36028004

Weather-Pack 2-pin.....Kit # 36028005

Deutsch 4 pin.....Kit # 36028006

Amp 4 pin CPC..... Kit # 36028007

Conxall 3-pin 2-wire..... Kit # 36028008

Refer to the console's Operating and Installation Manuals for the proper connector pin-out.

OPERATION:

There are two indicator lights on the Hiniker module. The green light is the satellite lock indicator. It flashes once per second when the module is communicating with the GPS sensor, but the sensor has not yet obtained a position lock on the satellites. The green indicator will stop blinking and stay on when the sensor starts sending speed information to the module. The red indicator flashes when the module is outputting speed pulses on the two speed outputs. At higher speeds this indicator may look as if it is always on. Speed pulses are not output for speeds below .3 MPH.

When first powered on, the module attempts to communicate with the GPS sensor. This causes both indicators to alternately flash. The red indicator will go off (no speed output) and the green will flash once per second until the GPS sensor sends the module valid speed information (including 0 mph). The green indicator light will then be on steady. This is the satellite lock condition indicator. This process may take up to five minutes depending on how much valid information the GPS sensor has from the last time the sensor was operating. If it was last operated recently and in close proximity to the current position, it may only take a few seconds. **Always check for the green satellite lock indicator to be on steady before driving.**

INSTALLATION – SPRAY CONTROL

INTRODUCTION

This section describes how to plumb a sprayer for use with the Hiniker 8605 controller.

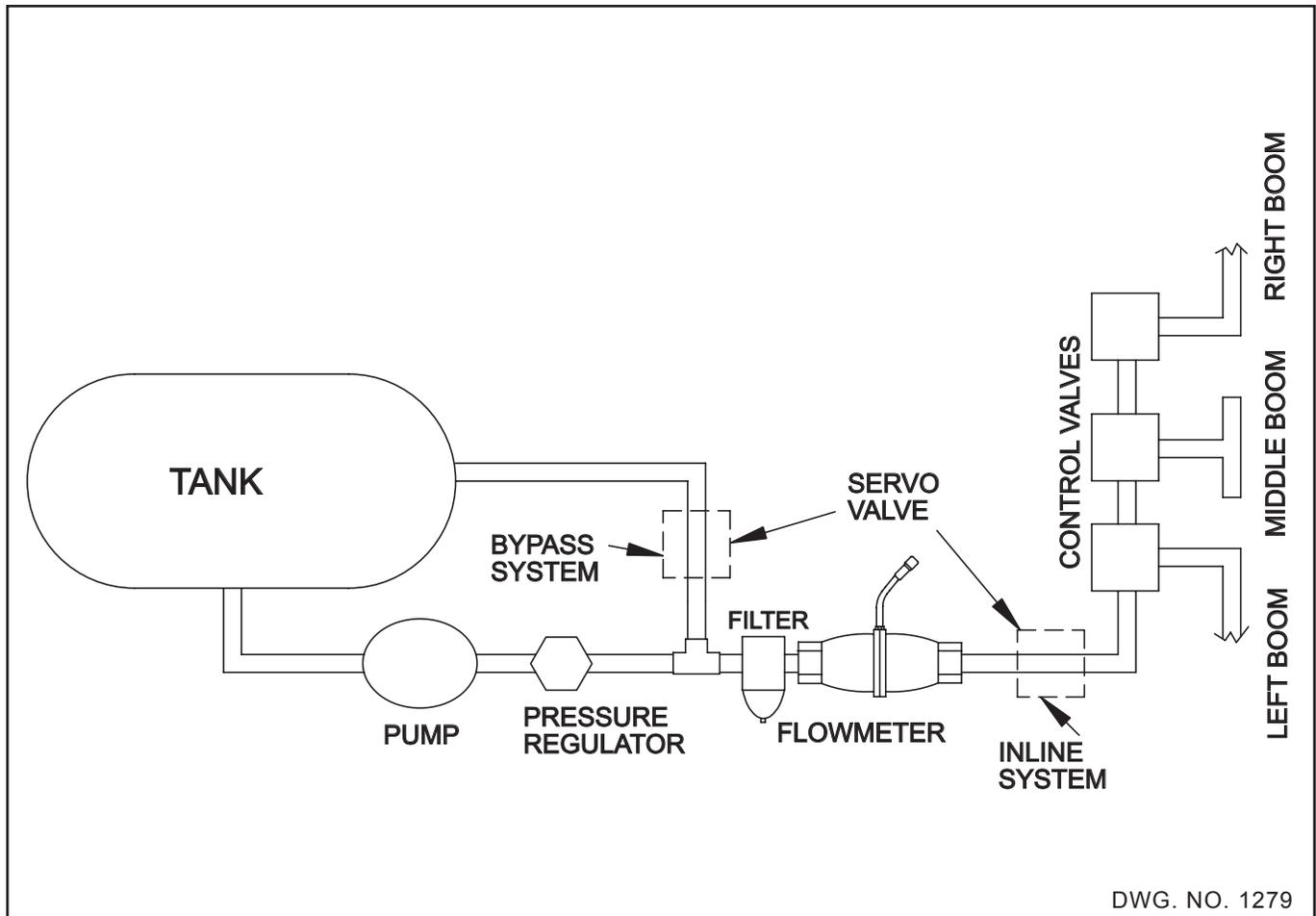
There are two basic configurations. The Inline system and the Bypass system. The Inline system is when the Servo Valve controls the flow to the nozzles. The Bypass system configuration has the Servo Valve controlling the return flow to the tank or pump.

The Bypass system is better suited for flow rates under 5 gallons per minute, where the Inline system is better suited for higher flow rates. The vast majority of flow rates are between 5 and 30 gallons per minute. For these rates it is recommended to use the Inline system.

To determine required gallons per minute with your sprayer, use this formula.

$$\text{GPM} = \frac{\text{GPA} \times \text{MPH} \times \text{Width (ft.)}}{495}$$

NOTE: THIS SECTION ONLY DESCRIBES SYSTEMS USING THE HM860 FLOWMETER AND THE NEW STEPPER MOTOR SERVO VALVE. THE 8605 CONTROLLER CANNOT BE USED WITH OTHER SERVO VALVES.



INLINE SYSTEMS

In an Inline System the Flowmeter and Servo Control Valve **MUST** be after all agitation and Bypass lines and inline with all the flow to the booms.

THE FLOWMETER MUST ONLY MEASURE THE FLOW TO THE BOOMS. THEREFORE, IT MUST BE AFTER ANY RETURN LINES.

THE FLOWMETER MUST MEASURE THE FLOW TO THE ENTIRE BOOM. THEREFORE, IT MUST BE BEFORE THE BOOM CONTROL VALVES.

The Bypass or Agitation line should be a minimum of 1-inch and contain a manual control valve. This valve is required to make overall sprayer adjustments.

An optional Bypass line may be installed to increase Bypass for high capacity pumps. This line **MUST** have a manual control valve.

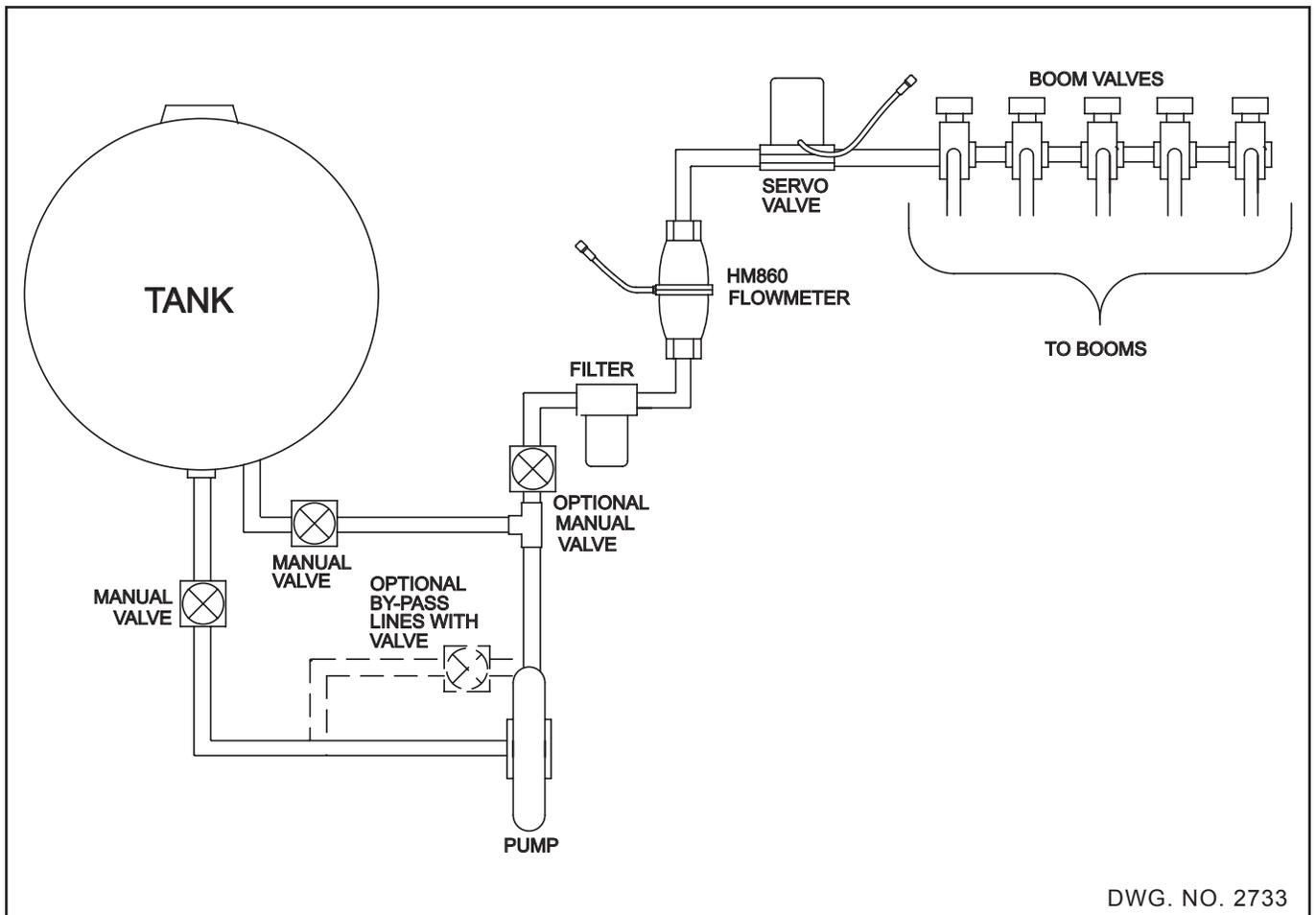
A filter is recommended before the flowmeter.

Recommended mounting for the HM860 Flowmeter is vertical with the arrow pointing up.

The Servo Valve should be mounted horizontally with the cover up to prevent dirt and water from accumulating inside the cover.

All lines up to the Boom Control Valves should be a minimum of 1-inch diameter. Smaller than 1-inch diameter lines may restrict the flow and limit the speed in which you may be able to spray.

NOTE: AT 55 PSI INPUT PRESSURE, THE SERVO VALVE MAY LEAK UP TO 2.5 GALLONS PER MINUTE. THERE IS NO CONTROLLING BELOW THIS RATE. FOR VERY LOW FLOW RATES A "BYPASS INSTALLATION" IS RECOMMENDED.



BYPASS SYSTEMS

In a Bypass System the Flowmeter measures all the flow to the booms, but the Servo Valve controls the flow bypassed back to the Tank (or pump inlet).

This type of system is only used for low flow rates.

This configuration is shown below.

THE FLOWMETER MUST ONLY MEASURE THE FLOW TO THE BOOMS. THEREFORE, IT MUST BE AFTER ANY RETURN LINES.

THE FLOWMETER MUST MEASURE THE FLOW TO THE ENTIRE BOOM. THEREFORE, IT MUST BE BEFORE THE BOOM CONTROL VALVES.

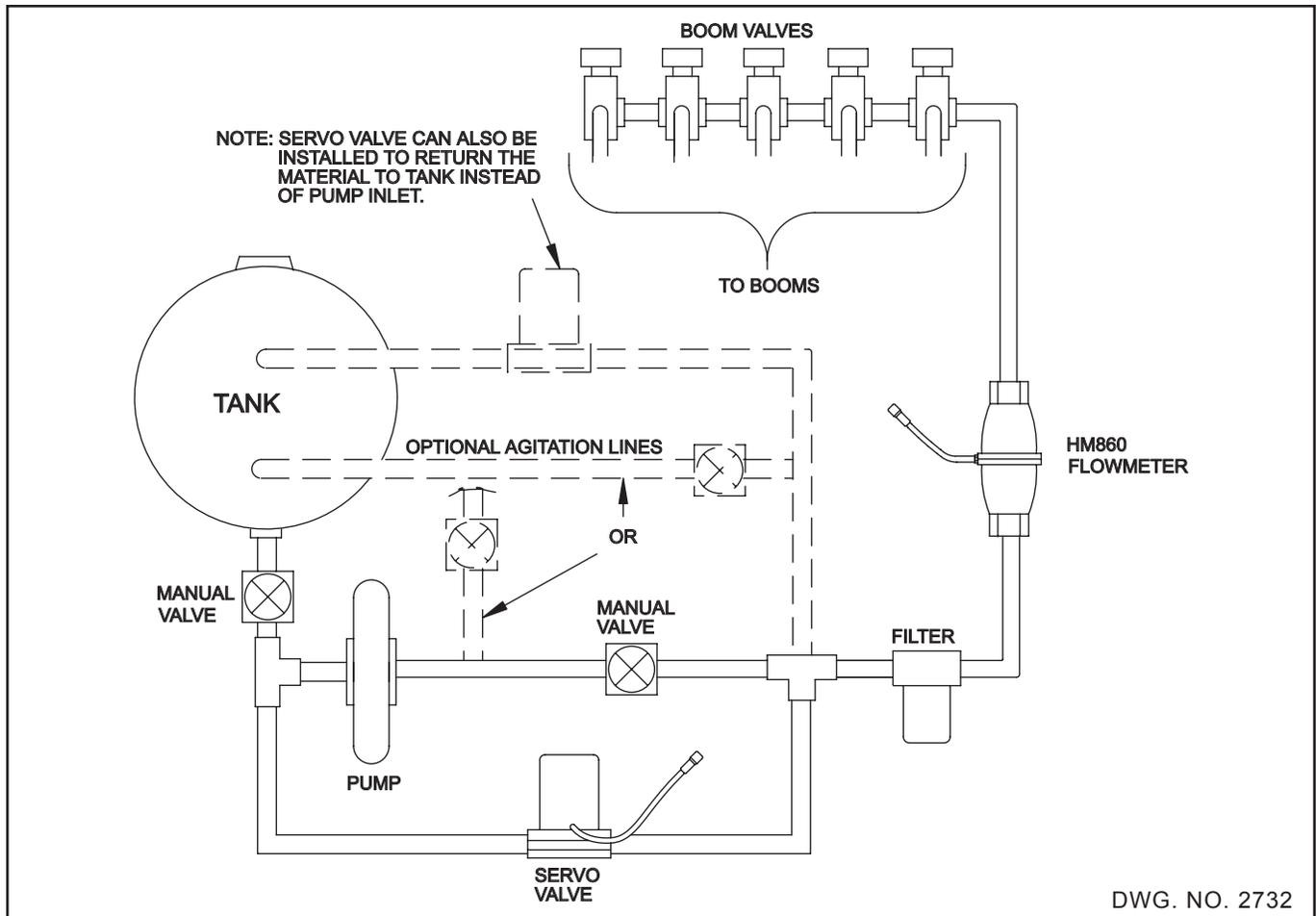
It is highly recommended to install the flowmeter after the filter, as shown below.

If the Servo Valve is mounted in an existing bypass line or agitation line, be sure to remove any parts that may restrict the flow. For example, some agitation lines have nozzles inside the tank; this would severely limit the range of the Servo Valve and must not be used. If a new bypass line is going to be installed, keep it as big as possible.

A minimum of 1-inch diameter hose should be used. Try to mount it so the total length is as short as possible.

A manual valve **MUST** be located after the pump and before the bypass line as shown. This valve is required to make overall sprayer pressure adjustments.

Additional bypass lines for agitation are optional. If used, they must include a manual valve for initial pressure adjustments. Low capacity pumps may require closing these valves.



HM860 FLOWMETER

The HM860 FLOWMETER has an output signal proportional to the flow through it. There are decals on the meter with the calibration numbers needed to calibrate the controller. These calibration numbers are in "PULSES PER GALLON" and "PULSES PER POUND OF ACTUAL NITROGEN." Only the pulses per gallon number is used by the 8605.

Although the HM860 FLOWMETER was designed to be operated while mounted in any direction, when used in applications with flow of 5 gallons per minute or less, it is recommended to install the HM860 FLOWMETER in the vertical position with the flow direction up (arrow on meter pointing up).

Do not install the HM860 FLOWMETER near strong magnetic fields such as those created by solenoids or motors. Keep all electrical wiring at least 1-foot away from meter.

INSTALLATION

Refer to the figure for the proper installation of the HM860 FLOWMETER.

STEP 1 Find a convenient location (vertical for low flow rates) on your sprayer to mount the flowmeter.

NOTE: Use pipe sealant on all pipe connections.

IMPORTANT: The pipe adapter (item 4) must be installed on the inlet side of the flowmeter. It's purpose is to reduce turbulence caused by hoses, elbows, and reducers. Failure to use at least 4 inches of straight 1 1/4 inch pipe may cause the flowmeter to be inaccurate.

STEP 2 Install pipe adapters (items 4, 5, 6, 7) on the flowmeter.

STEP 3 Install mounting bracket (item 1) to flowmeter assembly using the three 1/4 inch nuts supplied (item 9).

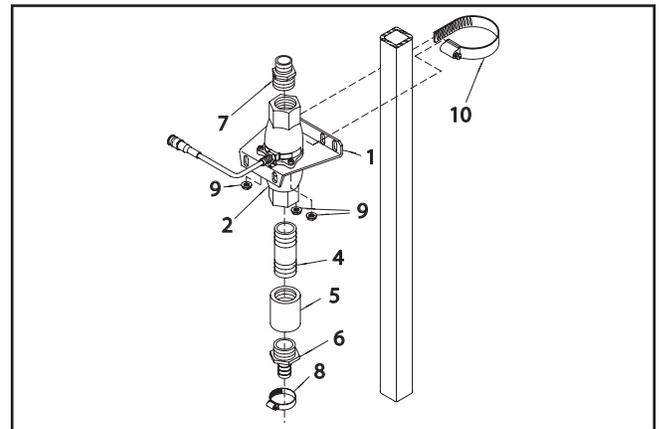
NOTE: Make sure arrow on the flowmeter is pointing in the direction of the flow.

STEP 4 Connect the input hose to the flowmeter by pressing hose firmly on to the hose barb and securing with hose clamp (item 8).

STEP 5 Connect the output to the Servo Valve or use a 1 1/4 inch by 1-inch hose barb and attach to the output hose. Secure with a 1 1/16 hose clamp.

STEP 6 Install the mounting bracket assembly to the sprayer using the 4 inch hose clamp, (item 10) or drill two 1/4 inch diameter holes, and use the 5/16 self-tapping screws.

STEP 7 Connect your flowmeter to the controller using the 10 foot and 20 foot cables. Route them away from moving or hot parts, using the cable ties provided. Both cables are labeled for easy identification. Connect the cable into the controller receptacle labeled "Flow."



DWG. NO. 2729

SERVO VALVE

The Servo Valve is a stepper motor driven Butterfly control valve that is used to control the flow in the system as directed by the 8605 controller.

Determine Valve placement for either an Inline system or Bypass system.

IMPORTANT - If you have a very low application rate the Servo Valve must be installed in bypass.

In general, any mechanical pressure regulator already on the sprayer does NOT have to be removed. However, specific adjustments to this regulator are usually required and are described under sprayer set-up.

The Servo Valve has a 1 inch female NPT on both ends. If required, reducing bushings may be used; however, keep the bypass line as big in diameter as possible. Using 1/2 inch line may severely limit the effective range of the Servo Valve.

If the Servo Valve is mounted in an existing bypass line or agitation line, be sure to remove any parts that may restrict the flow. For example, some agitation lines have nozzles inside the tank; this would severely limit the range of the Servo Valve and must not be used.

Flow direction through the Servo Valve is not critical, there is no "in" and "out" installation requirement.

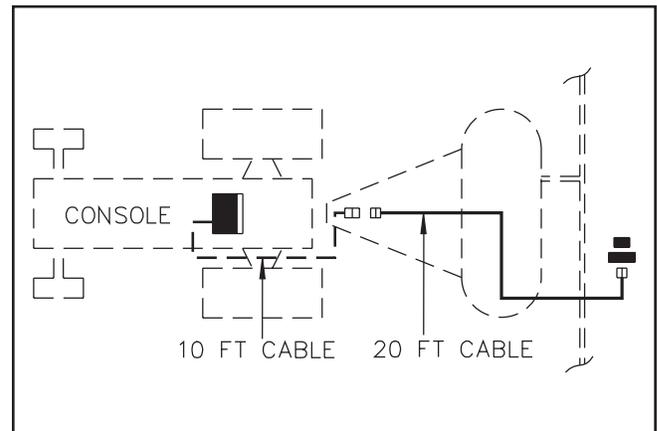
The Servo Valve can be mounted at any angle. If possible, mount it with the cover upwards so it will limit the accumulation of rain and dirt.

The Servo Valve is stainless steel. Maximum operating pressure is 400 PSI.

Be sure to use pipe thread sealer on all connections to prevent leaks.

The Servo Valve comes with a 20 foot cable which should be long enough to reach the tractor hitch. A 10 foot cable is provided to go from the hitch to the 8605 controller. Be sure to connect the 10 foot cable to the receptacle labeled "Servo." Both cables are labeled "Servo" for easy identification.

Extension cables are available, if required. Be sure to route all cables away from moving or hot parts. Use the cable ties provided.



DWG. NO. 111

REMOTE RUN/HOLD

For applications requiring remote RUN/HOLD a switch can be connected to the RUN/HOLD connector on the controller. Normally with no switch connected, the controller will be in RUN (provided switch on controller is in RUN). With the "normally open" RUN/HOLD switch connected, the controller will be in RUN. When the switch is pressed, the controller will enter the HOLD mode.



DANGER: USE EXTREME CAUTION WHEN USING THE REMOTE RUN/HOLD FEATURE. ALWAYS SWITCH THE CONSOLE OFF BEFORE LEAVING THE TRACTOR OR ALLOWING ANYONE NEAR THE IMPLEMENT. FAILURE TO DO SO COULD CAUSE INJURY OR DEATH.

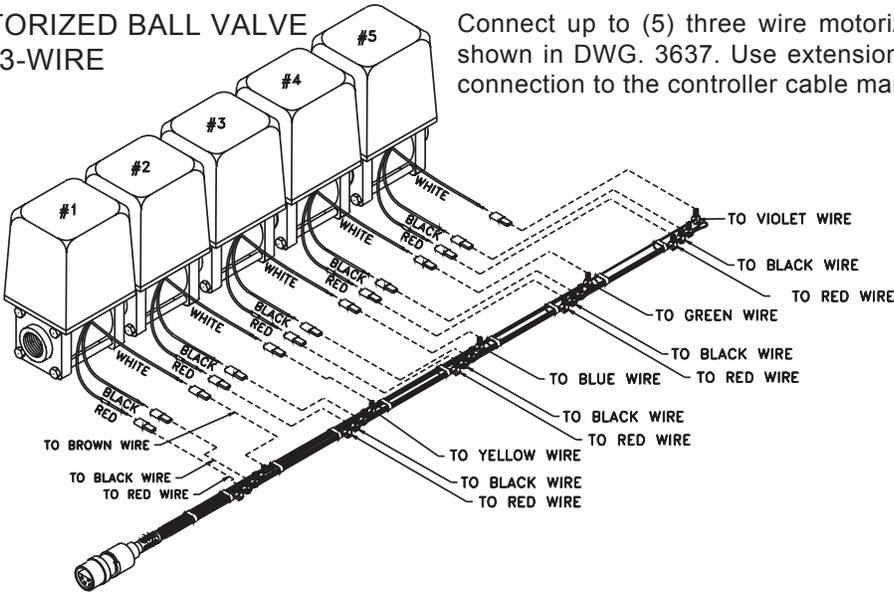
WIRING - GENERAL

For most applications a 10 foot extension cable is connected to the controller, this will usually reach the hitch area. A 20 foot extension cable is usually sufficient to reach the valves and flowmeter mounted on the sprayer.

Remember to secure all cables away from hot parts or where they may become tangled.

**WIRING - MOTORIZED BALL VALVE
3-WIRE**

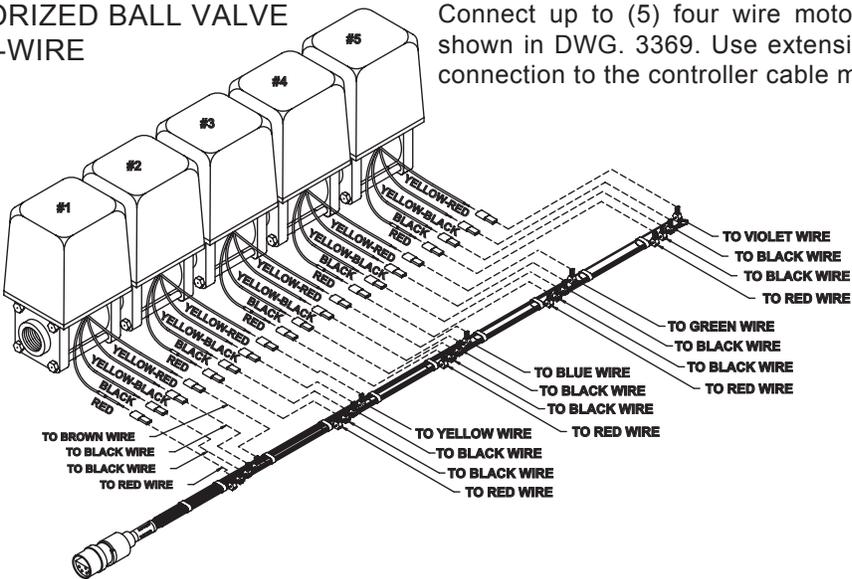
Connect up to (5) three wire motorized ball valves as shown in DWG. 3637. Use extension cables and make connection to the controller cable marked "Boom."



DWG. NO. 3637

**WIRING - MOTORIZED BALL VALVE
4-WIRE**

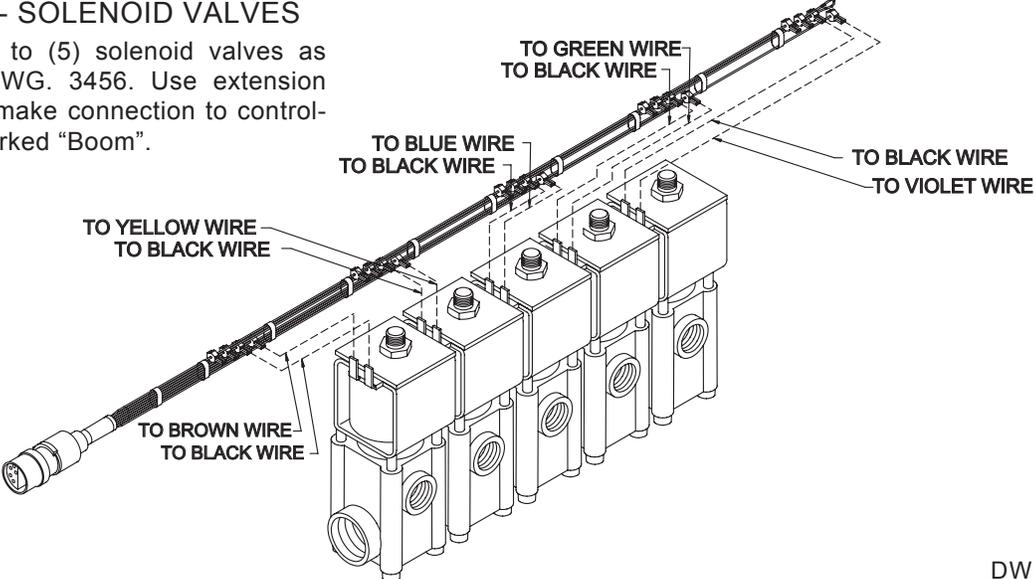
Connect up to (5) four wire motorized ball valves as shown in DWG. 3369. Use extension cables and make connection to the controller cable marked "Boom."



DWG. NO. 3369

WIRING - SOLENOID VALVES

Connect up to (5) solenoid valves as shown in DWG. 3456. Use extension cables and make connection to controller cable marked "Boom".



DWG. NO. 3456

INSTALLATION - ANHYDROUS AMMONIA



CAUTION: If you and your operator(s) are not intimately familiar with the proper handling procedures for Anhydrous Ammonia, contact your supplier for information, and read all safety precautions found in the “HINIKER ANHYDROUS AMMONIA MONITORING AND CONTROL SYSTEM MANUAL”

Refer to manual Part No. 360-000-246 Revision E or higher for Heat Exchangers manufactured prior to 2007. These are painted Gray.

or
Refer to manual Part No. 39300035 for Heat exchangers manufactured in 2007 or after. These are painted White. Additional manuals may be obtained from your local dealer.

Refer to the “HINIKER ANHYDROUS AMMONIA MONITORING AND CONTROL SYSTEM MANUAL” for Installation of Anhydrous Ammonia systems.

Refer to this manual for installing the Controller, Speed Sensor, Cables, and Remote Run/Hold feature.

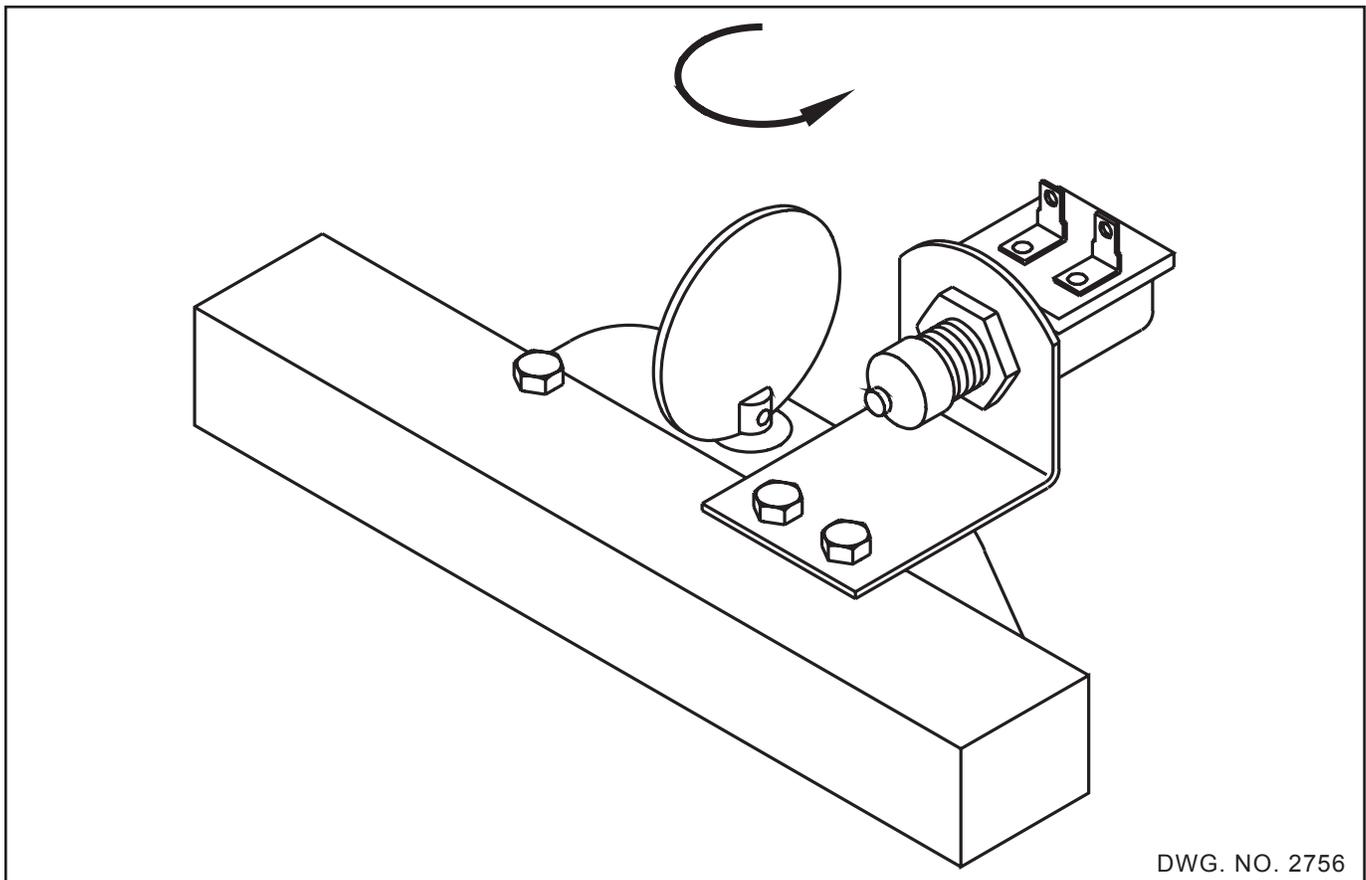
REMOTE RUN/HOLD



DANGER: Do NOT use the Remote Run/Hold switch when wired to an electric shutoff valve. Unintentional activation of the remote switch could cause a discharge of Ammonia.

IMPORTANT: The controller must be switched to HOLD whenever the Anhydrous is turned off.

The Remote Run/Hold switch can be used with Hydraulic shutoff valves. Position the switch on the shutoff valve in a manner so that the exposed Shaft or Flag will depress the switch when the valve is turned OFF. See figure below.



DWG. NO. 2756

TROUBLESHOOTING

Do not overlook the obvious. Check pump, boom control valves, hoses, improper installation, etc.

The 8605 is easy to troubleshoot if you approach it in an organized manner. There are four primary parts. 1) The 8605 Controller, 2) The Speed Sensor, 3) The Flowmeter, and 4) The Servo Valve. Your main objective when troubleshooting is to isolate the problem and find out which of the four parts is defective.

The 8605 has been designed with internal and external protective circuitry. These protective circuits protect the controller from damage due to shorts caused by pinched wires, or connectors being plugged in wrong. Excessive current draw from the servo valve is also protected.

If the controller display shows “Low Battery Power” or is dead, turn the power switch to the off (down) position for 1 or 2 minutes, then back on. If the display is still dead, then disconnect all cables except power from the controller and try again. By trial and error you can find the bad cable or device.

If your RATE or % ERROR becomes erratic, one possible cause could be the servo valve is starting to require excessive current to operate. The controller will begin to protect itself by limiting this current.

Extreme overheating of the controller will cause it to shut itself off until the temperature is reduced.

The following table will help you avoid unnecessary testing by isolating the affected sensor(s) and calibration numbers used for each mode.

The next step is to narrow the problem(s) down to one of the two sensors. The top half of the following table indicates which sensors are used for the various modes.

For example, assume Total Gallons is not working properly. From the table we can see that only one calibration number is used, the Pulses Per Gallon.

First double check the calibration number, making sure that it is programmed in correctly, then check the flowmeter.

If the table indicates two sensors are used for a mode, such as Rate Gal/Acre, then you can isolate the faulty sensor by testing other modes which depend upon only one of the sensors. Using the AREA or SPEED or DISTANCE modes will test the speed sensor accuracy.

TROUBLE SHOOTING CHART								
SELECTED MODE		SPEED MPH	VOLUME TOTAL GALLON	AREA TOTAL ACRE	RATE GAL/ACRE	GPA% ERROR	DISTANCE	VPM
SENSOR USED	SPEED SENSOR	X		X	X	X	X	
	FLOWMETER		X		X	X		X
CALIBRATION NUMBERS	DISTANCE CAL. FACTOR	X		X	X	X	X	
	PULSES/GALLON		X		X	X		X
	BOOM WIDTH			X	X	X		

CONSOLE - SYMPTOMS	POSSIBLE CAUSE
A. Is completely dead. 1, 2, 3, 4, 6, 14.	1. Battery voltage is below 10.0 volts.
B. Controller displays "LOW BATTERY POWER". 1, 4, 6.	2. Bad power cable or power cable fuse blown.
C. Displays HOLD or switches will not operate boom valves. 2, 4, 5, 7.	3. Battery connections reversed or not connected directly to battery.
D. Displays "NO SPD." 4, 9, 14.	4. Defective controller.
F. Displays "NO FLO." 4, 11, 14.	5. Remote run/hold switch is closed instead of open.
G. Gallons per acre inaccurate. 4, 8, 9, 10, 11, 12, 14.	6. Solenoid valve coil is drawing too much current (unplug solenoid).
H. Gallons per acre fluctuates excessively or RATE 1 or RATE 2 will not control normally. 4, 9, 11, 13, 14, 15, 16, 17, 18.	7. Remote RUN/HOLD switch is not functioning.
I. Acres inaccurate or does not count. 4, 5, 7, 8, 9, 10, 14, 19.	8. Boom width is not entered correctly, or boom switch is not turned on.
J. Total gallons inaccurate or does not count. 4, 5, 7, 11, 12, 14, 19.	9. Speed sensor problem; see speed sensor trouble shooting.
K. % ERROR reading fluctuates plus or minus by more than 10%, or % ERROR continually reads high or low by large percentage. 4, 9, 11, 13, 14, 15, 16, 17, 18.	10. Distance calibration factor not correctly entered.
L. Miles per hour inaccurate or reads 0. 4, 9, 10, 14.	11. Flowmeter problem; see Flowmeter trouble shooting.
M. Controller will not retain calibration or application date. 4, 20.	12. Flowmeter calibration not correctly entered.
	13. Servo valve not functioning properly; see servo valve troubleshooting.
	14. Bad cable.
	15. Pump or pump hoses are surging or sucking air.
	16. Incorrect nozzle size, or driving too fast or too slow.
	17. Target applicable rate is set beyond the range of your system; go to page 13 (pre-spraying system check).
	18. Calibration question number 5 "Servo Location?" answered incorrectly.
	19. Total gallons, or acres over 9999.
	20. Controller memory is defective.

CABLE AND CONNECTOR TROUBLESHOOTING

NOTE: Splices in cables are not recommended. If a splice is necessary to eliminate down time, the wires should be individually soldered and taped. (Use rosin core solder only.)

NOTE: All three wire cables are interchangeable. **EXAMPLE:** A flowmeter cable can interchange with a speed cable.

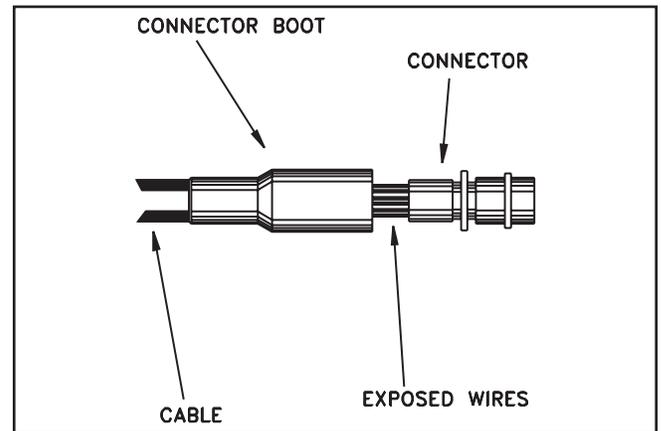
NOTE: The 4 conductor power cable contains a 20 AMP automotive type fuse in the positive (+12VDC) line.

1. Visibly check the routing of all cables to make sure the cables are plugged into the proper components and the correct connector on the controller. Look for any cut, pinched, burned, stretched or corroded wires which may be the source of the problem.
2. Check all connections, including controller connectors. Make sure pins are not bent, and are mating properly with the sockets. An indentation in the rubber next to a socket is a good indication that the pin is not aligned properly. Look for moisture, dirt, corrosion, etc., on the pins or sockets. To clean, spray LPS contact cleaner in the connector. Plug and unplug the connector several times and wipe dry.

NOTE: A speed sensor cable has only one socket.

3. Check crimp connections; the crimp connection in all connectors is where the wire is joined to the pin or the socket. Start by sliding the connector boot back to expose the wires (Figure A). Gently tug on each of the wires. If the wires do not pull out of the connector the connection should be good. Look for moisture or corrosion build-up inside the connector boot area as this could be the source of the problem.

FIGURE A



DWG. NO. 1290

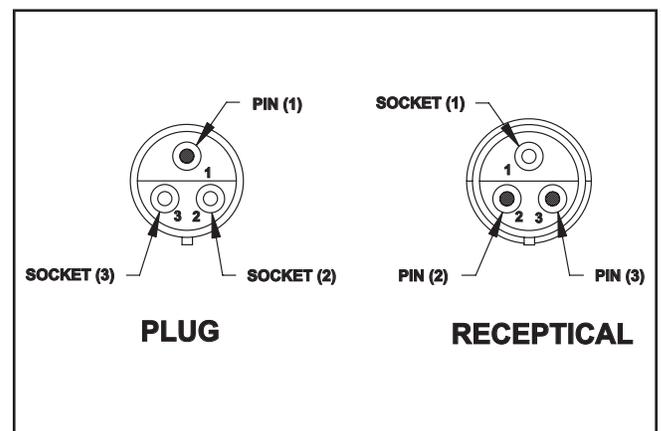
4. In general, a continuity check on the cable is a good check; however, it may not find an intermittent short or open in one of the cables.

CONTROLLER/CABLE CONNECTORS

In the connector there are numbers stamped in the rubber next to each socket and pin. Each connector is listed on the next pages. The list includes pin and socket numbers, color of wire, and purpose or function of wire.

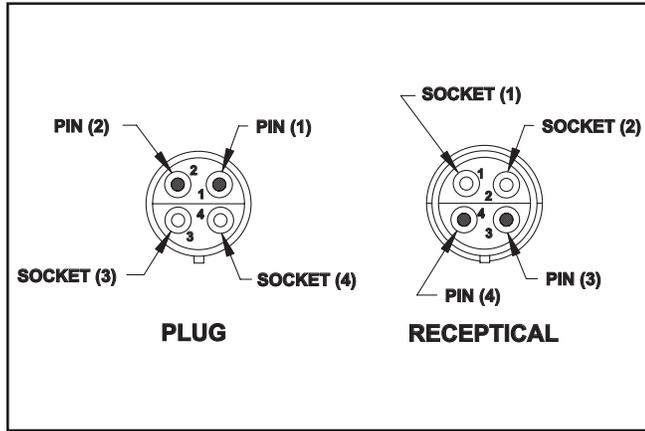
By using a voltmeter you can check to make sure cables are working properly. Always make sure of the pin and socket numbers before you start testing. Make sure pins are not bent or the connector is not twisted.

3 PIN CONNECTOR



DWG. NO. 2763

4 PIN CONNECTOR



DWG. NO. 2764

12 VOLT DC BATTERY CONNECTOR OR CABLE			
Pin or Socket Numbers	Controller Cable Wire Color	Battery Cable Wire Color	Description
1.	Black	Black	Negative (-) of 12 Volt Battery
2.	Black	Green	Negative (-) of 12 Volt Battery
3.	Red	Red	Positive (+) of 12 Volt Battery
4.	Red	White	Positive (+) of 12 Volt Battery

7-PIN SERVO VALVE CONNECTOR OR CABLE				
Pin or Socket Numbers	Controller Cable Wire Color	Extension Cable Wire Color	Servo Cable Wire Color	Description
1.	Brown	Brown	Brown	Switch
2.	Yellow	Yellow	Yellow	Motor Phase A
3.	Green	Green	Green	Motor Phase C
4.	Red	Red	Red	+ 12VDC
5.	Blue	Blue	Blue	Motor Phase D
6.	Violet	Orange	Orange	Motor Phase B
7.	Black	Black	Black	Switch Return

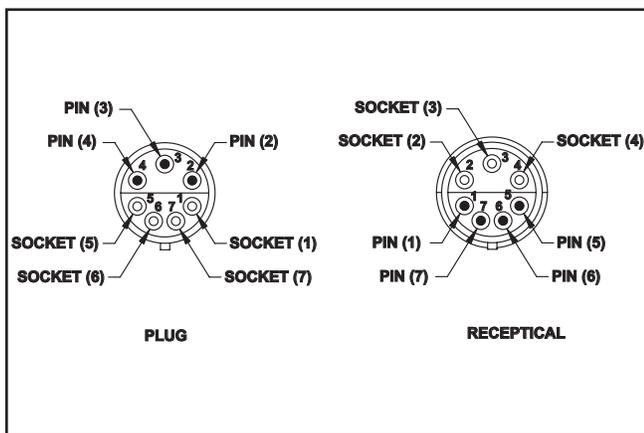
FLOWMETER CONNECTOR OR CABLE			
Pin or Socket Numbers	Controller Cable Wire Color	Extension Cable Wire Color	Description
1.	Black	Black	Ground or Negative of 12 Volt
2.	White	White	Signal Line
3.	Orange	Red	+ 12 Volts

SPEED-SENSOR CONNECTOR OR CABLE			
Pin or Socket Numbers	Controller Cable Wire Color	Extension Cable Wire Color	Description
1.	Black	Black	Ground or Negative of 12 Volt Battery
2.	Tan	White	Signal Line
3.	Orange	Red	+ 12 Volts

On the 20 foot Speed Sensor, the green wire replaces the white wire.

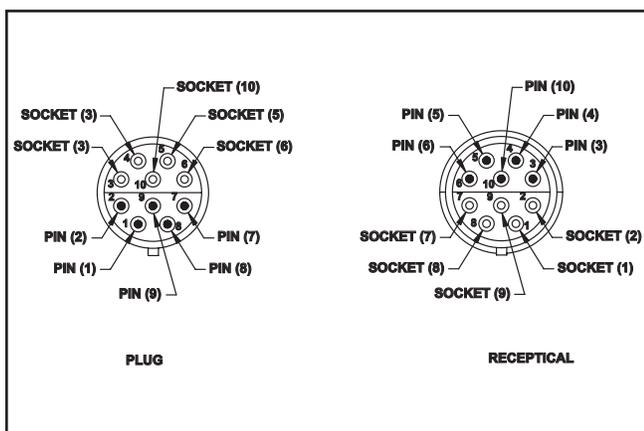
10-PIN BOOM CONNECTOR/CABLE				
Pin or Socket Numbers	Controller Cable Wire Color	Extension Cable Wire Color	Boom Cable Wire Color	Description
1.	Red	Red	Red	+ 12VDC
2.	Brown	Brown	Brown	Boom #1
3.	Yellow	Yellow	Yellow	Boom #2
4.	Blue	Blue	Blue	Boom #3
5.	Black	Orange	Black	Ground
6.	Black	Black	Black	Ground
7.	Green	Green	Green	Boom #4
8.	Violet	Violet	Violet	Boom #5
9.	NC	NC	NC	
10.	NV	NC	NC	

7 PIN CONNECTOR



DWG. NO. 3131

10 PIN CONNECTOR



DWG. NO. 3132

SPEED SENSOR TROUBLESHOOTING

Check the distance calibration factor and boom widths. Make sure the controller is not in HOLD. Select DISTANCE on the controller then drive. The display for distance should be counting up.

To check the controller set your pulses per gallon number to 1, and plug the speed sensor into the input marked FLOW. Drive again, if the GALLONS counts up, the problem is the console. Alternately the Flowmeter can be plugged into the SPEED input to verify the speed input works properly. While spraying the distance should count up.

To check the wiring, see wiring troubleshooting or substitute any three conductor cable for the speed cable. The Flowmeter cable is commonly used.

To check a hub plate installation first:

Check installation on the speed sensor. The Sensor and bracket should be mounted very rigid. The Sensor should be mounted through the holding bracket at least 1/2 inch. The Sensor end should be no further away from sensing plate tabs than 1/4 inch. If one tab is bent so it is more than 1/4 inch away from the face of the sensor, the 8605 SPEED or RATE readout may fluctuate. On a hard surface road while traveling at a constant speed the 8605 MPH should not vary by more than two tenths of a MPH. A loose wheel bearing could also cause fluctuating readouts.

The speed sensor can also be checked by the Controller. Program your distance calibration number to 1.00 (one) and select and clear distance by pressing DIST key for three seconds. Put console into RUN. Now each time metal passes in front of the sensor the feet on the display will count up. If you drive one revolution of the distance wheel with a standard hub plate, the distance count should indicate 14 as a standard hub plate has 14 metal tabs on it.

In a "ground speed radar installation" check to see if the "tractor dash speed" reading is working correctly. With the Hiniker interface removed the "tractor speed" must work. If you have determined the radar is working a new radar interface and / or adapter may be substituted to locate the problem.

FLOWMETER TROUBLESHOOTING

The flowmeter is a very important component in the 8605 system. If the flowmeter is not functioning properly, it will have an adverse effect on the operation of the controller. Rate Per Acre, Total Volume, Percent Error, and Volume Per Minute will all be inaccurate if the flowmeter is not functioning properly.

1. Make sure the controller is not in "HOLD".
2. Check the controller calibration pulses per gallon against the number on the flowmeter, remember the decimal point is one digit from the right.
3. Check flowmeter cables and connectors, reference the cable, and connector troubleshooting section.
4. Check flowmeter installation. Make sure flowmeter is mounted in the line to the booms and after any agitation or return lines. Also make sure direction of flow (arrow on flowmeter) is correct.

HM860 FLOWMETER

For all applications, except anhydrous ammonia, the HM860 FLOWMETER should be thoroughly flushed with clean water immediately after each use.

Periodic disassembly and cleaning of the HM860 FLOWMETER is recommended for maximum lifetime and accuracy. Some chemicals may tend to curdle or become gummy and may require frequent flushing, especially at low flow rates. Do not allow the flowmeter to dry out before it has been thoroughly flushed.



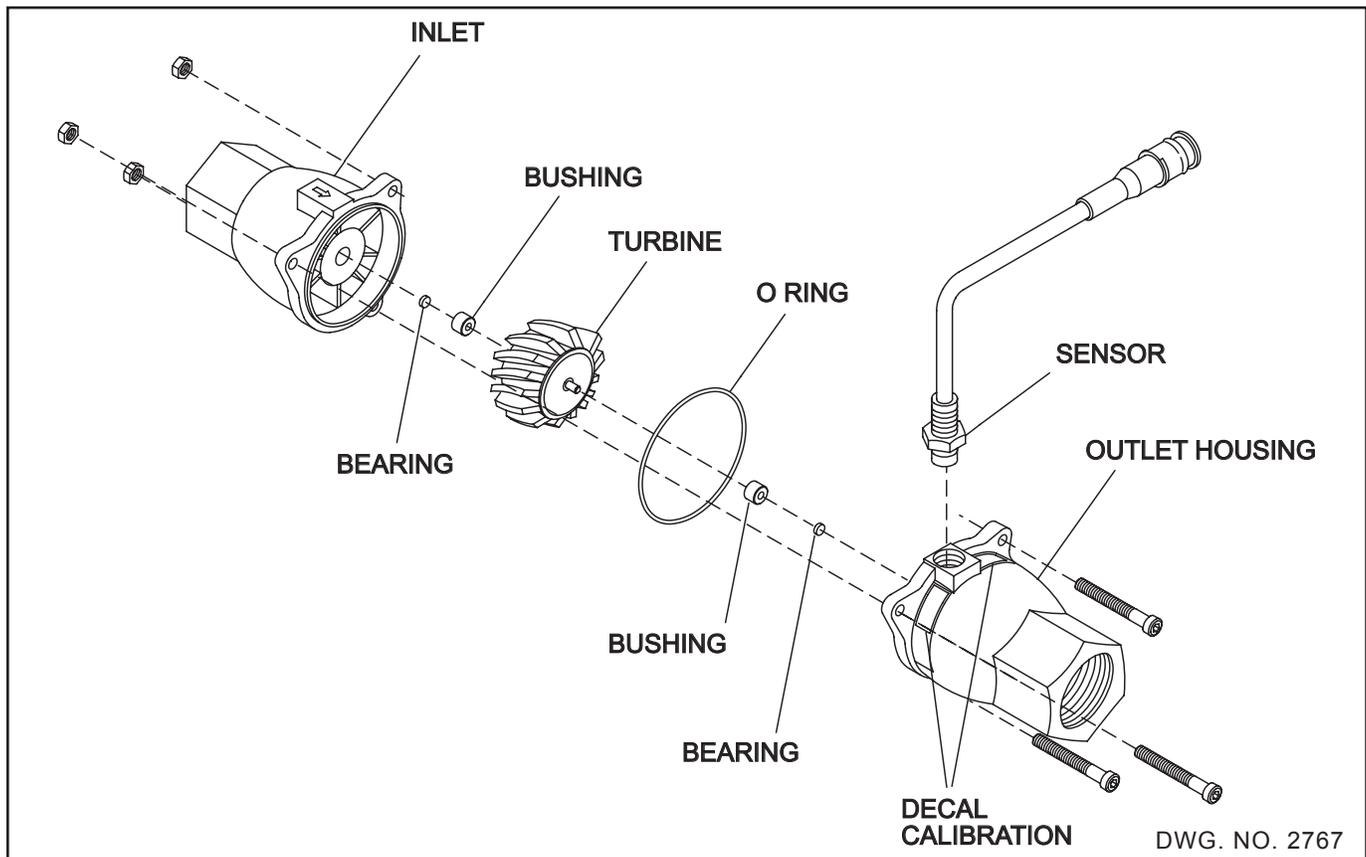
CAUTION: ALWAYS FOLLOW MANUFACTURER'S RECOMMENDATIONS WHEN WORKING WITH CHEMICALS.

1. The HM860 FLOWMETER SENSOR will output a pulse, as the North and South poles on a magnet pass over the sensor's end.

To check the sensor, plug the sensor cable into the 8605 controller flow input. Set the flow meter calibration to 1.00. Clear the total volume display by depressing the Total Volume key for 3 seconds.

The controller total volume display should count up by one each time a magnet is passed under the bottom of the sensor (sensor is removed from flowmeter).

2. Make sure direction of flow (arrow on flowmeter) is correct.
3. Check flowmeter for debris slowing or stopping the turbine. For the flowmeter to measure accurately it must be kept very clean.
4. For application rates under 5 gallons per minute, the flowmeter should be mounted vertically with the flow going up.
5. Make sure magnet on turbine is positioned under sensor.
6. Make sure sensor is inserted fully into meter.
7. Flowmeter operation may be affected by strong magnetic fields such as those created by motors and solenoid valves.



DISASSEMBLY

Refer to figure 4 for proper parts placement. Remove the three nuts holding the two flowmeter halves together.

Carefully pull the two halves straight apart, if flowmeter is not pulled apart straight, damage to bushings and shaft may result.

Remove any chemical or rust residue. Flush thoroughly with water. NOT WITH DIESEL FUEL.

TURBINE - Inspect the turbine and shaft for damage or excessive wear.

BUSHINGS - Inspect the two graphite bushings. The inside diameter should not be oval.

BEARINGS - Inspect the two sapphire end bearings. Cracked bearings should be replaced. These "glass" bearings are held in place by the "pressed in" graphite bushings.

To replace a bushing or bearing, gently insert by hand a #6 sheet metal screw into the graphite bushing and pull.

NOTE: Damage may result to the sapphire bearing if the screw is inserted too far.

Do not reuse graphite bushings after removal. Use new bushings.

O-RING - Some chemicals may slightly deform the o-ring. Replace if necessary.

ASSEMBLY

Place the turbine and o-ring into the housing half without the sensor, with magnet end of the turbine showing.

Carefully mate the flowmeter halves together. Install the three 1/4 inch stainless steel screws.

IMPORTANT: Torque the three 1/4 inch nylock nuts equally to 8.3 foot pounds (100 inch pounds).

The turbine should spin freely when a very small amount of air is directed into the flowmeter.

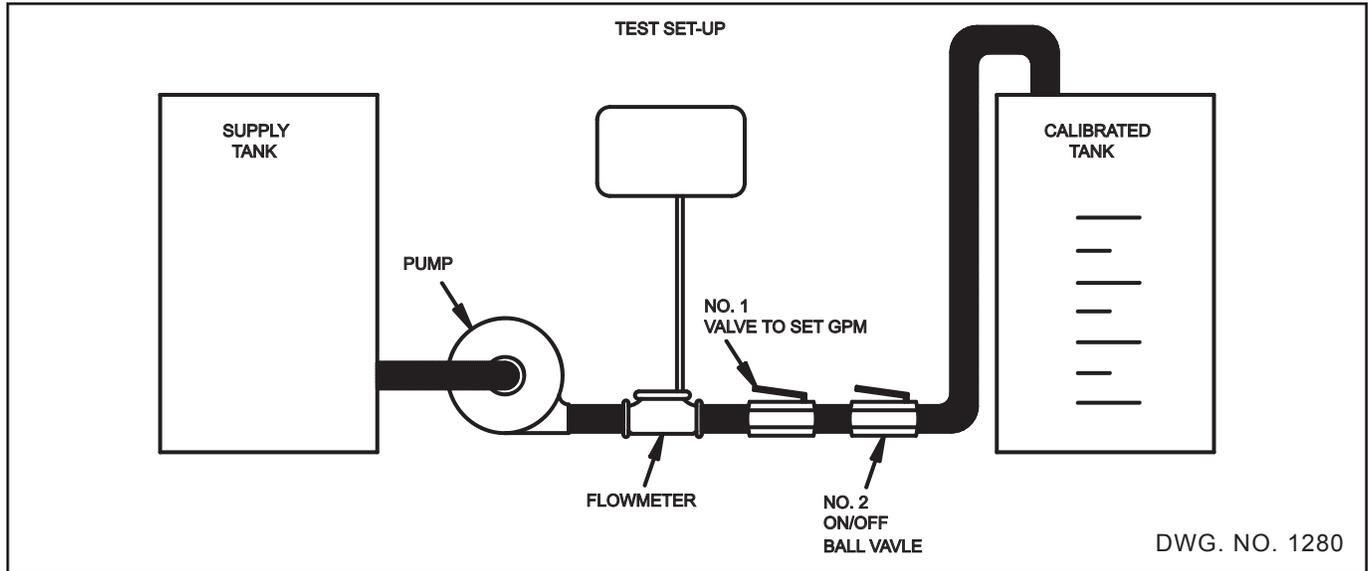
FLOWMETER CALIBRATION TEST

All flowmeters are factory calibrated and should measure GALLONS with at least 98% accuracy. If you feel the flowmeter is inaccurate and would like to test it, you may do so using the following procedure and test setup.

- A. Enter Setup/Calibration Mode. Plug the flow meter cable into the flow connector on the 8605 controller. Set the flowmeter calibration number to 1.00. Clear the display to zero by depressing the Total Volume key for 3 seconds.
- B. Proceed to pump water into a calibrated container. It is very important that this calibrated container have markings that are at least 99% accurate or this test will not be valid.
- C. NOTE: Each time the flowmeter generates a pulse, GALLONS will count up by 1. Therefore, the console is counting the total number of pulses generated for a known amount of water flowing through the flowmeter.
- D. To determine the PULSES/GALLON, simply take the count displayed in GALLONS and divide it by the amount of water pumped through the flowmeter into the calibrated tank. The result is the new PULSES/GALLON calibration number.
- E. Compare the new PULSES/GALLON with the factory calibration number. If the new number deviates more than 10% from the factory number, the flowmeter is in need of repair and should be returned to your dealer.

TEST SETUP

1. Set valve No. 1 for the GPM of the test.
2. Stop flow with valve No. 2.
3. Clear Total Volume display counter to 0, put the controller in "RUN."
4. Open valve No. 2 (use a ball valve, it will give you fast ON/OFF times).
5. Shut valve No. 2 when tank reaches selected volume.
6. Refer to Step D to determine the Pulse/Gallon.



SERVO BUTTERFLY VALVE TROUBLESHOOTING

The Servo Valve does the actual controlling or adjusting of the flow rate. If the Servo Valve is not functioning properly the gallons-per-acre readout will fluctuate by more than +/-10% or the RATE per acre will remain extremely low or high. If the Servo Valve is not functioning correctly, the 8605 can still be used as a monitor by putting the RATE 1, RATE 2 switch in the MANUAL (center) position.

1. See cable and connector trouble shooting.
2. Check calibration question, "Servo location?" If the question was answered yes, then when in MANUAL, the ↑ key should OPEN the valve to increase flow to the boom. If the question was answered no, then the valve is mounted in a return line to the tank. In this case, the ↓ key should CLOSE the valve to increase flow to the boom.

3. Select manual on the Rate 1, Rate 2 switch. Turn the sprayer pump and valves on, and press the ↑ key. The controller will now send pulses to the valve. Drive the valve fully open until the display reads MAX. Select the VPM display. The console will now read the maximum gallons per minute that your sprayer will pump (note this figure). Press and hold the ↓ key until the display reads MIN (approximately 10 seconds). Select the VPM display. This is the minimum gallons per minute your sprayer will pump (Note this figure). Now calculate your desired gallons per minute.

$$\frac{\text{MPH} \times \text{WIDTH} \times \text{GPA}}{\text{DIVIDE BY 495}} = \text{GPM}$$

MPH = Miles Per Hour
 WIDTH = Width of Implement in feet
 GPA = Gallons Per Acre
 GPM = Gallons Per Minute

Your calculated gallons per minute should be in a mid-range between your maximum gallons per minute and your minimum gallons per minute.

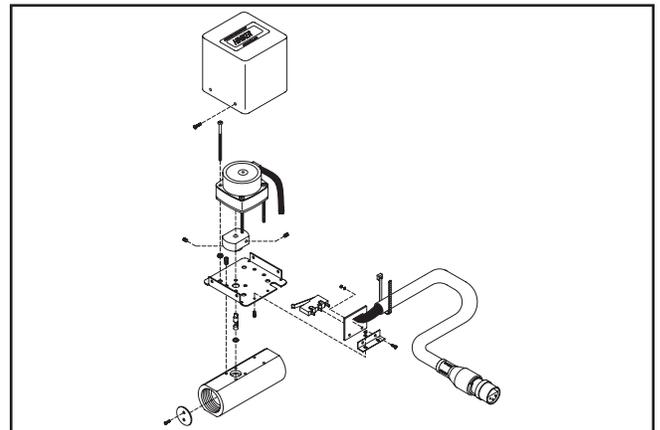
Example: If your maximum GPM was 7 and your minimum GPM was 1 you would be running at 4 GPM (Calculated GPM). This would mean your Servo Valve would be operating somewhere around the mid-point. So, if you increased your speed it could increase your flow, or if you decrease your speed it can decrease the flow. If the calculated GPM is close to or exceeds the minimum or maximum GPM readouts, then the problem is not with the Servo Valve. The sprayer, pump, hand valves, nozzles or speed require adjustments.

- To see if the stepper motor and position switch are functioning properly put the RATE 1/MAN/RATE 2 switch in the center (manual) position and press and hold the \uparrow or \downarrow key. This should drive the valve in one direction. When the switch cam turns far enough to activate the position switch the stepper motor should stop and the display will read MAX or MIN.

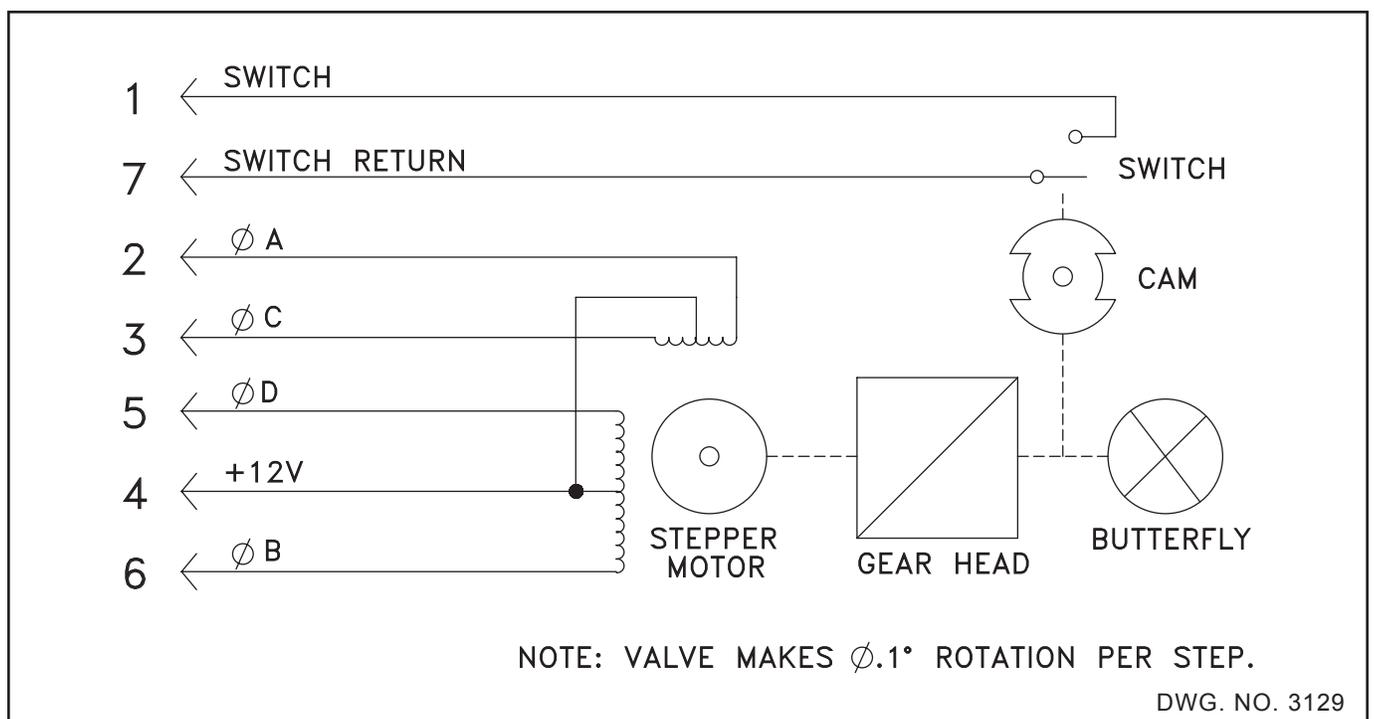
If the valve does not stop its direction of travel when the switch is activated, the valve should be replaced. The valve should respond to both the \uparrow and \downarrow keys.

- The Controller provides + 12V to the motor and also pulses the four phase lines to ground in sequence to cause the motor to rotate. The butterfly valve will step 1/10 degree for each motor pulse.

The position switch closes to indicate both open and closed valve positions to the console. The motor can NOT be checked by applying a voltage to the wires.



DWG. NO. 3142B



DWG. NO. 3129

APPENDIX

HINIKER SERIAL COMMUNICATIONS SPECIFICATIONS

Serial Specifications

The Hiniker console transmits and receives standard RS232C serial data at a baud rate of 9600 BPS. The transmitted characters consist of 1 start bit, 8 data bits, no parity bit, and 1 stop bit for the "Hiniker" protocol and 2 stop bits for the "Generic" protocol.

Serial Connection Specifications

The Hiniker console transmits and receives standard RS232C serial data through a 9 pin, female, sub D connector. The use of XON/XOFF software handshaking allows the number of connections to be kept to the minimum required for a serial communications channel. They are listed below.

Pin 2 - Received Data (RXD)

The Hiniker console uses the RXD line to receive in external rate messages and data request during automatic operation.

Pin 3 - Transmitted Data (TXD)

The Hiniker console uses the TXD line to send requested data to another device.

Pin 5 - Ground

This provides a common signal reference between the Hiniker console and other devices.

Serial Printer Specifications

The 8605 can be connected to serial printers that support the above protocol and support XON/XOFF software handshaking. The reports generated by the 8605 are in standard ASCII and formatted for a line length of 40 characters. Printers with shorter line lengths will wrap the report lines causing a distortion of the report format. Printers with a longer line length will reproduce the report format correctly with some wasted space.

SERIAL PROTOCOLS

There are two serial protocols available with the 8605. The "HINIKER" protocol is our original serial communication standard. The "GENERIC" protocol was developed to easily allow the 8605 to communicate to most mapping systems.

"HINIKER" PROTOCOL

"HINIKER" External Rate Message Format

NOTE: Messages should not be sent faster than approximately 1 per second. If messages are sent too quickly, the second message may overwrite the first before it has been processed.

The following is an example of a valid external rate message. It would instruct the Hiniker console to apply 34.5 units per acre. The Hiniker console would view this as gallons per acre if it is in spray mode or as pounds per acre of actual nitrogen if it is in NH3 mode.

Character	Hex Code	ASCII
1	24	"\$"
2	F1	N/A
3	07	N/A
4	01	N/A
5	30	"0"
6	33	"3"
7	34	"4"
8	2E	."
9	35	"5"
10	00	N/A
11	3E	N/A

Character 1 - This is always an ASCII dollar sign (24 Hex) which acts as SOM (Start Of Message) character. The Hiniker console recognizes this as the start of a new message packet.

Character 2 - This will be a hex value in the range of F1 through FA denoting the Hiniker hardware device being impacted by the data message. In the case of the Hiniker console, this will always be F1 Hex to indicate servo valve 1.

Character 3 - This will be a hex value that indicates the number of bytes in the data message. This will always be 07 Hex.

Character 4 - This will be a hex value that indicates which target application rate will be overlaid with the data. For the Hiniker console this will always be 01 Hex.

Character 5 - This will be a hex value in the range of 30 through 39 (ASCII characters "0" through "9")

which denotes the hundreds value of the target application rate.

Character 6 - This will be a hex value in the range of 30 through 39 (ASCII characters “0” through “9”) which denotes the tens value of the target application rate.

Character 7 - This will be a hex value in the range of 30 through 39 (ASCII characters “0” through “9”) which denotes the units value of the target application rate.

Character 8 - This will be the hex value 2E (ASCII “.”) denoting the decimal point separating units and tenths of the target application rate.

Character 9 - This will be a hex value in the range of 30 through 39 (ASCII characters “0” through “9”) which denotes the tenths value of the target application rate.

Character 10 - This will always be 00 Hex (Null) to indicate the end of the data message.

Character 11 - This is a single byte checksum generated by using byte length arithmetic. The byte values of characters 1 through 10 are added together, ignoring any carry. Their sum is then subtracted from 55 hex ignoring any borrow

“HINIKER” Additional Messages

While the 8605 can recognize and react to the following messages as described, they are not required. The only message that is required for external rate control is the external rate message.

1. Write Channel 1 Target Rate With Snapshot Reply(24 F1 07 03...)

The breakdown is as follows:

24 = Start of Message
 F1 = Channel 1 Data
 07 = Data Field Size
 03 = indicates target rate data and a requested snapshot
 XX = Target Data hundreds digit
 XX = Target Data tens digit
 XX = Target Data units digit
 2E = decimal point

XX = Target Data tenths digit
 00 = ASCII NULL character
 XX = Checksum

The GPS Parser will install the Target Data as Rate 1. Rate 1 will continue to be impacted by these messages even if Manual or Rate 2 is selected. Once the parser installs the new rate it will transmit the following snap shot of actual rate, speed in MPH, and active boom width in inches.

Snapshot Reply Message

24 = Start of Message
 F1 = Channel 1 Data
 13 = Data Field Size 7F = set target rate reply
 XX = Current GPA/PPA Hundreds digit
 XX = Current GPA/PPA Tens digit
 XX = Current GPA/PPA Units digit
 2E = Decimal Point
 XX = Current GPA/PPA Tenths digit
 00 = NULL
 2C = Comma
 XX = Current Ground Speed (mph) Tens digit
 XX = Current Ground Speed (mph) Units digit
 2E = Decimal Point
 XX = Current Ground Speed (mph) Tenths digit
 00 = NULL
 2C = Comma
 XX = Current Active Boom width (inches) Thousands digit
 XX = Current Active Boom width (inches) Hundreds digit
 XX = Current Active Boom width (inches) Tens digit
 XX = Current Active Boom width (inches) Units digit
 00 = NULL
 XX = Checksum

The “current active boom width” will represent the total width of all boom sections that are turned on. If the Run/Hold switch is in the hold position, the boom width returned will be zero.

2. Initialization Message (24 F0 01 01)

24 = Start of message
 F0 = System Message
 01 = One Character Message
 01 = Initialize
 Checksum = 3F

The 8605 will transmit a Status Reply message (shown below under Read Status Message) in response to an initialization message. It will claim that there are no transmission errors and no unsatisfied read errors. No actual initialization is performed.

3. Read Status Message (24 06 02 F0 02)

24 = Start of message
 06 = Read Message
 02 = Two Character Message
 F0 = System
 02 = Status
 Checksum = 37

The 8605 will transmit the following Status Reply message in response to a Read Status message. It will claim that there are no transmission errors and no unsatisfied read errors.

Transmitted Status Reply Message

24 = Start of Message
 F0 = System Data Group
 03 = Data Field Size
 02 = Status Data Element
 00 = No Transmission Errors
 00 = No Unsatisfied Read Errors
 Checksum (based on no errors) = 3C

4. Read Maximum Channels (24 06 02 F0 06)

24 = Start of message
 06 = Read Message
 02 = Two Character Message
 F0 = System
 06 = Maximum Number of Channels
 Checksum = 33

The 8605 will transmit a Maximum Channels Reply message in response to a Read Maximum Channels message. It will claim that it supports a maximum of one channel.

Transmitted Maximum Channels Reply

24 = Start of Message
 F0 = System Message
 02 = Two Character Message
 06 = Maximum Channels
 01 = Maximum Channels = 1
 Checksum = 38

5. Read Channel 1 Target Rate (24 06 02 F1 01)

24 = Start of message
 06 = Read Message
 02 = Two Character Message
 F1 = Channel 1 (F1 through FA possible)
 01 = Target Rate
 Checksum = 37

The 8605 will transmit a Target Rate Reply message in response to a Read Target Rate message. It will reflect the current target rate 1.

Transmitted Target Rate Reply Message

24 = Start of Message
 F1 = Channel 1 Data
 07 = Data Field Size
 01 = indicates target rate data
 XX = Target Rate 1 hundreds digit
 XX = Target Rate 1 tens digit
 XX = Target Rate 1 units digit
 2E = decimal point
 XX = Target Rate 1 tenths digit
 00 = ASCII NULL
 Checksum = Undetermined

6. Read Channel 1 Actual Rate (24 06 02 F1 02)

24 = Start of message
 06 = Read Message
 02 = Two Character Message
 F1 = Channel 1
 02 = Actual Rate
 Checksum = 36

The 8605 will transmit an Actual Rate Reply message in response to a Read Actual Rate message. It will reflect the actual rate being applied in either gallons per acre or pounds per acre depending on which mode the controller is in.

Transmitted Actual Rate Reply Message

24 = Start of Message
 F1 = Channel 1 Data
 07 = Data Field Size
 02 = actual rate data
 XX = Current GPA or PPA Hundreds digit
 XX = Current GPA or PPA Tens digit

XX = Current GPA or PPA Units digit
 2E = Decimal Point
 XX = Current GPA or PPA Tenths digit
 00 = NULL
 Checksum = undetermined

7. Read Channel 1 Type (24 06 02 F1 03)

24 = Start of message
 06 = Read Message
 02 = Two Character Message
 F1 = Channel 1
 03 = Channel Type
 Checksum = 35

The 8605 will transmit a Channel Type Reply message in response to a Read Channel Type message. It will reflect that the channel is either a liquid type or an NH3 type depending what is selected.

Transmitted Channel Type Reply Message

24 = Start of Message
 F1 = Channel 1 Data
 02 = Data Field Size
 03 = Channel Type Info

Depending on which mode the 8160 is in the remaining characters of the message will be:

Spray Mode
 02 = Channel 1 liquid Type
 39 = Checksum for Liquid

OR

NH3 Mode
 03 = Channel 1 NH3 type
 38 = Checksum for NH3

8. Read System Statistics - Proprietary (24 06 02 F0 FF)

The breakdown is as follows:

24 = Start of message
 06 = Read Message
 02 = Two Character Message
 F0 = System
 FF = System Statistics
 3A = Checksum

When received, the parser will transmit the following snap shot of actual rate, speed in MPH, and active boom width in inches.

Snapshot Reply Message

24 = Start of Message
 F1 = Channel 1 Data 13 = Data Field Size
 7F = set target rate reply
 XX = Current GPA/PPA Hundreds digit
 XX = Current GPA/PPA Tens digit
 XX = Current GPA/PPA Units digit
 2E = Decimal Point
 XX = Current GPA/PPA Tenths digit
 00 = NULL
 2C = Comma
 XX = Current Ground Speed (mph) Tens digit
 XX = Current Ground Speed (mph) Units digit
 2E = Decimal Point
 XX = Current Ground Speed (mph) Tenths digit
 00 = NULL
 2C = Comma
 XX = Current Active Boom width (inches) Thousands digit
 XX = Current Active Boom width (inches) Hundreds digit
 XX = Current Active Boom width (inches) Tens digit
 XX = Current Active Boom width (inches) Units digit
 00 = NULL
 XX = Checksum

The “current active boom width” should represent the total width of all boom sections that are turned on. If the Run/Hold switch is in the hold position, the boom width returned should be zero.

“GENERIC” PROTOCOL

The “Generic Protocol” is only available in software version 3.0 or higher. If you have earlier versions the 8605 will need to have the software updated.

If the “GENERIC” protocol is selected the 8605 will prompt you to turn Logging “ON” or “OFF”. Selecting “LOGGING = ON” will instruct the 8605 to start sending data to the serial port once per second. “LOGGING = OFF” turns this feature off. For most applications this is turned on. The “GENERIC” protocol will use the current field number as the field identification that is sent to the mapping system.

When using the 8605 with most mapping systems you should select the "GENERIC" protocol. From the mapping systems menu select "RAVEN 450" as the serial controller. Follow the set-up instructions for setting up a 450.

The 8605 data logger uses the communications strings listed to pass data out through the serial port. With data logging turned on data is triggered to be sent once every second

Upon each trigger, the Actual Rate string, Data Strings 1, 2, and 3, and the Time/Date string are sent, in that order.

When a Console calibration value is changed, the Console will automatically send out the C1, C2, and C3 calibration strings.

When a Console switch is changed, the D1, D2, D3, TD, C1, C2, and C3 strings will be sent by the Console.

With Data Logging on sending the 8605 an RC message that changes Rate1 to a rate different than the current rate will result in the C1, C2, and C3 strings being transmitted.. With Data Logging off sending the 8605 an RC message will cause a rate change to occur but there will be no C1, C2, and C3 strings transmitted.

The Data and Calibration strings can also be requested from the 8605 using the DR and CR request strings.

All request strings begin with \$R (24 52)

Rate 1 Change Request (RC)

Format = \$R,RC,<rate_1_cal><CR><LF>

The value of the <rate_1_cal> field can vary from 0 to 9999. There is an understood decimal point prior to the last digit in the field. This means that Rate 1 can be changed from 0.0 to 999.9. The field expands to fit the value of the change.

Example:

To change RATE 1 to 123.4 the stream \$R,RC,1234<CR><LF> is sent.

The hex values for the ASCII stream to change Rate 1 to 23.5 would be:

24 52 2C 52 43 2C 32 33 35 0D 0A
(\$ R , R C , 2 3 5 <CR> <LF>)

Calibration String Request (CR)

Format: = \$R,CR<CR><LF>

With Data Logging on sending the 8605 a CR message will result in the C1, C2, and C3 strings being transmitted. With Data Logging off a CR message will not result in a response.

Data String Request (DR)

Format:=\$R,DR<CR><LF>

With Data Logging on, sending the 8605 a DR message will result in the D1, D2, D3, and TD strings being transmitted. With Data Logging off a DR message will not result in a response.

8605 CONSOLE OUTPUT STRINGS

All console output strings begin with \$R124F

C1 Calibration String (C1)

The C1 calibration string contains boom switch status, boom width, and speed calibration number information.

Format:

\$R124F,C1,<switch_byte_1>,<switch_byte 2>,<boom_1_cal>,<boom 2 cal>,<boom 3 cal>,<boom 4 cal>,<boom 5_cal>,<0>,<0>,<speed cal> <CR><LF>

<Switch_Byte_1 > is a byte consisting of a binary 1 in bit_7 position, a binary 0 in bits 6 and 5 positions, and Boom Flags in the remaining bit positions. A binary 1 indicates that the boom switch is on and a 0 indicates that it is off.

Format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	But 2	Bit 1	Bit 0
1	0	0	(LB)	B4	B3	B2	(RB)

<Switch_Byte_2> is a byte consisting of a binary 1 in bit 7 position, a binary 0 in bit 6 position, a binary 0 in bit 5 position, Rate2 Flag in bit 4 position, Rate1 Flag in bit 3 position, and a binary 0 in the remaining bit positions. A binary 1 for a Rate Flag, indicates that the rate is selected. If Rate1 and Rate2 are both zero, the console is in Manual.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	But 2	Bit 1	Bit 0
1	0	0	R2	R1	0	0	0

The <boom_X_cal> field can run from 0 to 999. It denotes the boom width in inches for that boom regardless of the status of the corresponding boom switch. The field expands to fit the number. A change trips off the transmission of the C1, C2, and C3 calibration strings.

The <speed_cal> field can run from 0.00 to 99.99. It denotes the speed calibration number being used. The field expands to fit the number. A change trips off the transmission of the C1, C2, and C3 calibration strings.

C2 Calibration String

The C2 calibration string contains (flow) meter calibration number information.

Format:

\$R124F,C2,<meter_cal><CR><LF>

The <meter_cal> field can run from 0.0 to 999.9. It denotes the flow calibration number being used. The field expands to fit the number. A change trips off the transmission of the C1, C2, and C3 calibration strings.

C3 Calibration String (C3)

The C3 calibration string contains valve type, Rate1, and Rate2 information.

Format:

\$R124F,C3,<valve_cal>,<rate_1_cal>,<rate_2_cal><CR><LF>

The <valve_cal> field is always sent out as 2123

The <rate_X_cal> field reflects the value of Rate1 or Rate2. The field can run from 0.0 to 999.9. The field expands to fit the number.

D1 Data String (D1)

The D1 data string contains total area and field area information.

Format:

\$R124F,D1,<total_area>,<field_area><CR><LF>

The <total_area> field will always be 0.0.

The <field_area> field can run between 0.0 to 999.9. The field expands to fit the number. 999.9 rolls over to 0.0 and continues to accumulate.

this field will contain the existing area data of the 8605

D2 Data String (D2)

The D2 data string contains total volume and field volume information.

Format:

\$R124F,D2,<total_volume>,<field_volume><CR><LF>

The <total_volume> field will always be 0.0

The <field_volume> field runs from 0 to 9999. The field expands to fit the number. 9999 rolls over to 0 and continues to accumulate this field will contain the existing volume data for the 8605.

D3 Data String (D3)

The D3 data string contains tank volume and distance information.

Format:

\$124F,D3,<tank_volume>,<distance><CR><LF>

The <tank_volume> field will always be 0.

The <distance> field will always be 0.

Actual Rate String (AR)

Format:

\$R124F,AR,<actual_rate><CR><LF>

The <actual_rate> can run from 0.0 to 999.9. The field expands to fit the number.

Time/Date String (TD)

Format:

\$124F,TD,<hr:min>,<month/day/year>,<field_reference><CR><LF>

The <hr:min> field, will always be 0:00.

The <month/day/year> field will always be 1/1/08.

The <field_reference> field can run from 0 to 9999. The Field expands to fit the number. Field Reference allows user to enter up to a four-digit number to represent a field.

HINIKER WARRANTY

The only warranty Hiniker Company (Hiniker) gives and the only warranty the dealer is authorized to give is as follows:

We warranty new products sold by Hiniker or authorized Hiniker dealers to be in accordance with our published specifications or those specifications agreed to by us in writing at time of sale. Our obligation and liability under this warranty is expressly limited to repairing or replacing, at our option, within one year after date of retail delivery, to the original purchaser, any product not meeting the specification. **WE MAKE NO OTHER WARRANTY, EXPRESS OR IMPLIED AND MAKE NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE.** Our obligation under this warranty shall not include any transportation charges or costs or any liability for direct, indirect or consequential damage or delay. If requested by Hiniker Company, products or parts for which a warranty claim is made are to be returned freight prepaid to our factory. Any improper use, operation beyond rated capacity, substitution of parts not approved by Hiniker Company, or any alteration or repair by others in such manner as in our judgement affects the product materially and adversely shall void this warranty. **NO EMPLOYEE OR REPRESENTATIVE IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY.**

HINIKER reserves the right to make improvement changes on any of our products without notice.

HINIKER does not warrant the following:

1. Used products
2. Any product that has been repaired modified or altered in a way not approved by Hiniker Company.
3. Depreciation or damage caused by normal wear, lack of reasonable and proper maintenance, failure to follow Operator Manual Instructions, misuse, lack of proper protection during storage, or accident.
4. Parts replacement and service necessitated by normal wear or maintenance including, but not limited to, belts, cutting parts, and ground engaging parts.

A DELIVERY REPORT FORM must be filled out and received by HINIKER COMPANY to initiate the warranty coverage.

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