HINIKER

8160

OPERATOR'S MANUAL

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

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39300030 Rev. E   **12/10**   **Manual/39300030RevE**

SAFETY

THIS IS THE SAFETY ALERT SYMBOL. IT ALERTS AN OPERATOR TO INFOR-MATION CONCERNING PERSONAL SAFETY. ALWAYS OBSERVE, AND HEED THESE SYMBOLS AND INSTRUCTIONS, OTH-ERWISE 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 MONI-TORING AND CONTROL SYSTEM MANUAL" Refer to manual part number 360-000-246 Revision E or later for heat exchanger manufactured prior to 2007. These are painted gray. Or, refer to manual part number 39300035 for heat exchanger manufactured in 2007 or after. These are painted white. Additional manuals may be obtained from your local dealer.

ACCIDENTS CAN BE AVOIDED BY KNOW-ING, 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._____

SYSTEM OVERVIEW

The Hiniker 8160 is a computerized system that will enable you to apply liquid chemicals, including Anhydrous Ammonia at a predetermined rate.

The 8160 console allows you to individually set up and calibrate two separate console configurations, one for spray applications and one for NH3 applications. There is no need to recalibrate when changing applications. All data and Set-Up information is permanently stored for each application.

The 8160 console in conjunction with a speed sensor, flowmeter, and servo valve perform the necessary calculations and adjustments to perform "on-the-go" adjustments to the selected rate of application.

The console uses the inputs of actual flow, speed, and user selected functions to calculate the actual Volume Per Area (VPA). This is then compared to the rate selected by the operator to generate a percent-error signal. This signal then causes the Servo Valve to make corrections to the flow. This continues until the VPA error is zero. See drawing 5791.

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

– Dual Modes: Set-Up, Calibration, and Data are stored separately for Spray and NH3 modes.

– Non-Volatile Memory; Set-Up Data, Volume and Area are stored in permanent memory; no external power is required.

– Inline and bypass system configurations.

– The Servo Valve response rate is adjustable.

– One, two, or three section control using motorized ball valves or electric solenoids for individual boom control.

– Boom section widths are individually set.

– Selection of Rate 1, Rate 2, Manual or Variable Rate control.

– Display smoothing adjustable from 1 to 10%.

– Warning lamp and horn activates when application error is greater than 10%.

– A settable minimum flow to prevent poor spray patterns when slowing down at low speeds.

– A built in speed simulator for setting up the sprayer.

– Diagnostics for testing the Speed, Flow, and Run/Hold inputs.

– The ability to measure Distance.

– Run/Hold feature.

– The Remote Run/Hold option is available at the console and the implement.

– A 2 line display with five display selections available. Target Rate (Always Displayed), Actual Rate, % Error, Speed, Volume, and Area.

– The 8160 is backward compatible with the 8150 system wiring and bracket using a simple adapter.

DWG. NO. 5791

8160 CONSOLE

DWG. NO. 5795
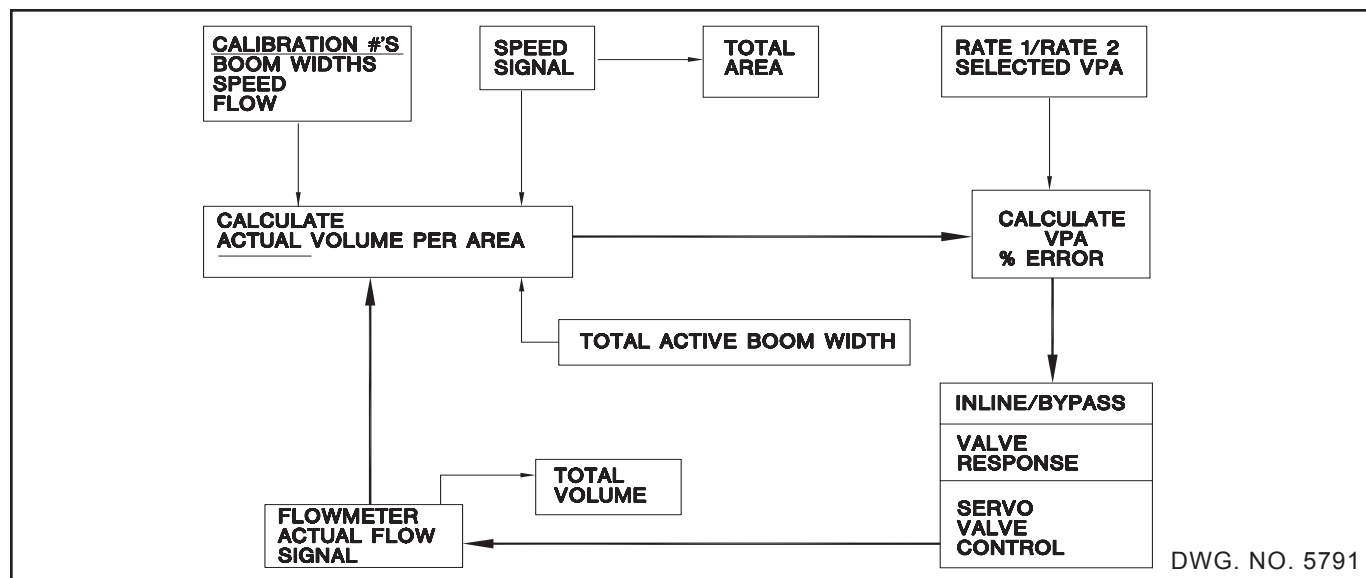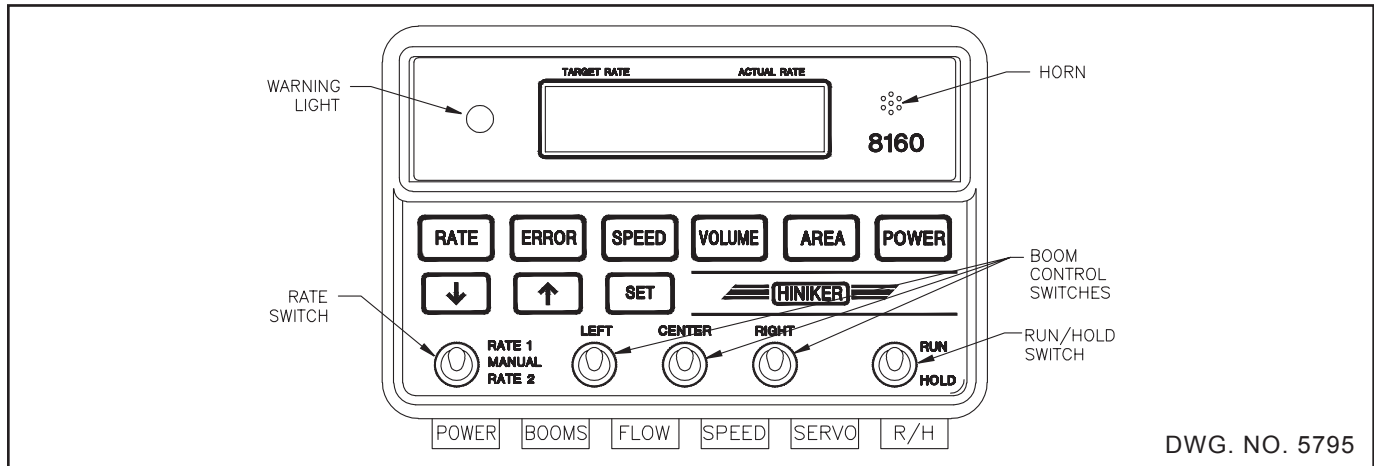
SWITCH AND INDICATORS

The 8160 control console has all the necessary functions to allow you to set-up and control systems tailored to your specific needs. A detailed description of the console follows.

BOOM SWITCHES

Three separate Boom Switches are available to control three motorized ball valves or three electric solenoid valves. The width of each boom is programmed in during Set-Up.

If any boom is not needed set its width to zero and leave the boom switch off.

In the Automatic mode, the rate is automatically adjusted as the Boom Switches are turned on and off. When all three Boom switches are turned off, the Boom valves will shut off and the console will be in the Hold Mode.

Area is only counted for Booms that are on. Area is not counted while in the Hold Mode.

RUN/HOLD SWITCH

The Run/Hold switch is the master control switch. When "Run" is selected, power is applied to the boom switches and the console is in the "Run Mode". This is the normal operating mode.

When "Hold" is selected, power is removed from the Boom switches and the console is in the "Hold Mode". This is the standby mode where there is no automatic control and the Volume and Area totals stop accumulating.

RATE SELECTOR SWITCH

The Rate switch allows you to select one of two application rates or manual operation. The application rate for Rate 1 and Rate 2 is programmed in during Set-Up. When the selector switch is in the center position (Manual), the automatic control is off and the Servo Valve can then be adjusted manually. To make this adjustment, press and hold the "⇧" or "⇩" keys.

The Rate Switch must be in Rate 1 to use the Variable Rate Mode.

WARNING LIGHT

The warning light will flash whenever the console is in the Run Mode, and the difference between the Target and Actual application rate is greater then +-10% error.

The light will also flash when the errors that cause suspension of the Run Mode such as LOW FLOW, LOW SPEED, and ZERO WIDTH are being displayed.

The warning light will be on steadily when the console is in Hold Mode.

HORN

The horn will beep under the same conditions as the Warning light with the exception that it is not on during the Hold mode.

The horn will also beep each time a key is pressed to acknowledge the key press.

The horn may be turned off for the error conditions by selecting HORN IS OFF in the options menu.

DWG. NO. 5801
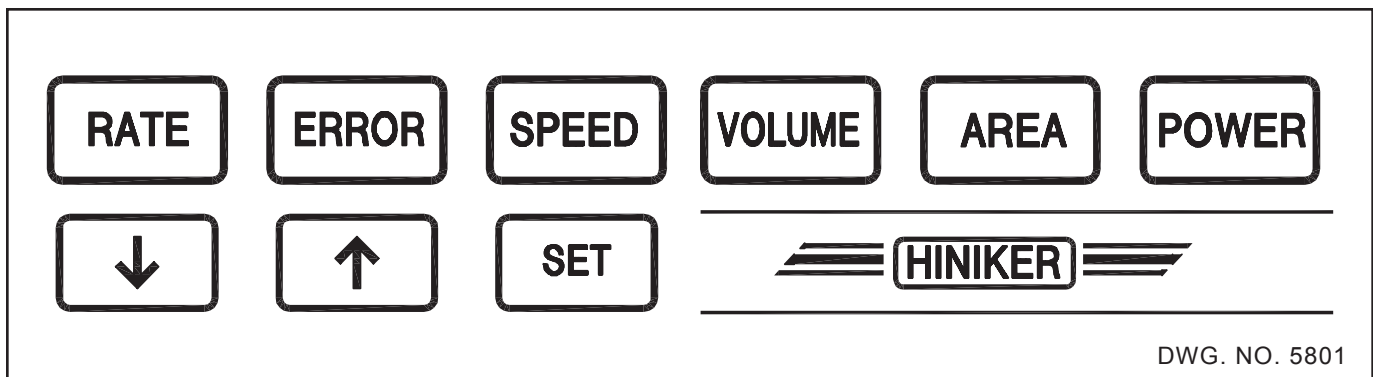
KEYBOARD

POWER KEY

To power up the console, press and hold the POWER key for two seconds. Then release the key when the warning light flashes and the horn beeps.

To power down the console, press and hold the POWER key for two seconds while the console is powered on.

VOLUME KEY

The Volume key has two functions, the first time it is pressed it will display Total Volume, pressed again and it will display Flow in Volume Per Minute.

Press the VOLUME key to view the Total Volume. The 8160 will always keep track of the Total Volume applied. Volume will not accumulate when in the Hold Mode. To clear Total Volume to zero press and hold the VOLUME key until the displayed Volume is zero. The horn and the warning light will warn you that you are about to clear the data.

Note: Once cleared the data cannot be recovered.

VOLUME has an additional feature, which enables it to recalculate the Total Volume whenever the Flowmeter Calibration Number is changed.

AREA KEY

The 8160 will keep track of the Total Area. To view the Total Area, press the AREA key. Area is accumulated only when the console is in the Run Mode. Area will not accumulate when in the Hold Mode. The 8160 will automatically correct for the change in implement width when one or two of the Boom switches are turned off.

Area has an additional feature, which enables it to recalculate the Total Area whenever the Speed Sensor Calibration Number is changed.

To clear Total Area to zero press and hold the AREA key until the displayed Area is zero. The horn and the warning light will warn you that you are about to clear the data.

Note: Once cleared the data cannot be recovered

SPEED KEY

The 8160 will calculate and display speed any time the SPEED key is pressed.

The console must be calibrated to the speed sensor before using. An incorrect speed calibration will affect Speed, Rate, Percent Error, and Area computations.

SET, ⇧, ⇩, KEYS

The SET key is used to enter the MAIN MENU. To do so, press and hold the SET key for two seconds. The SET key is also used as an "Enter" key to select the displayed options or answers.

The ⇧ and ⇩ keys are used to change values and answers. The ⇧ or ⇩ keys are also used during manual operation to control the Servo Valve.

RATE KEY

To display the Actual Rate being applied press the RATE key.

ERROR KEY

To display the Percent Error press the ERROR key This ERROR function computes and displays the difference between the Actual and Target application rate as a percentage.

DISPLAY

The display is used to provide to the user important information on the operation of the system and its components.

TARGET RATE

The left side of the top line on the display will normally show the Target Application Rate. The Target Application Rate is determined by the selected position of the Rate Switch, either Rate 1 or Rate 2. The Target Rate will change to show the current rate when using the Variable Rate feature.
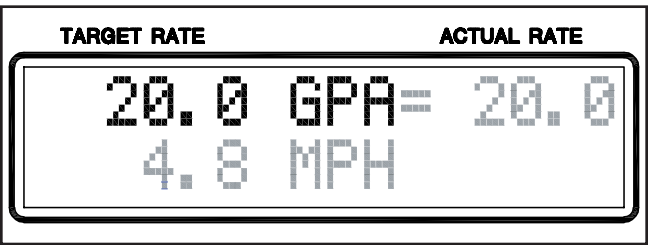
```
  TARGET RATE          ACTUAL RATE
  20.0 GPA=  20.0
       4.8 MPH
```
DWG. NO. 5804

MANUAL

In Manual position MANUAL will be displayed.
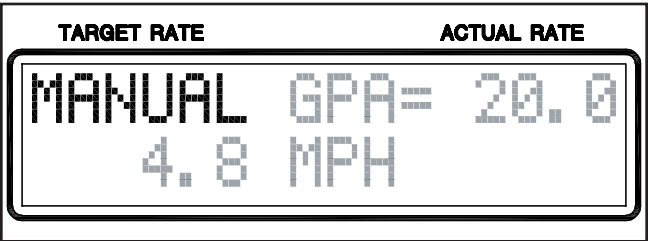
```
  TARGET RATE          ACTUAL RATE
 MANUAL GPA=  20.0
       4.8 MPH
```
DWG. NO. 5805

ACTUAL RATE / %ERROR

The right side of the top line will display either the Actual Rate or % Error depending on whether the RATE or ERROR key was pressed.

```
  TARGET RATE          ACTUAL RATE
  20.0 GPA=  20.0
       4.8 MPH
```
DWG. NO. 5806
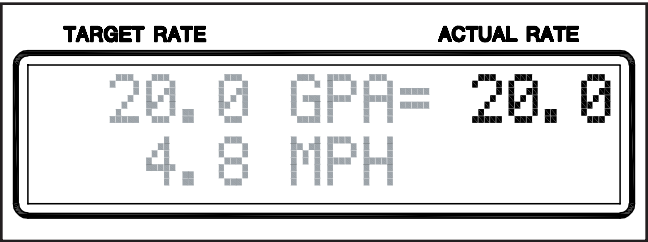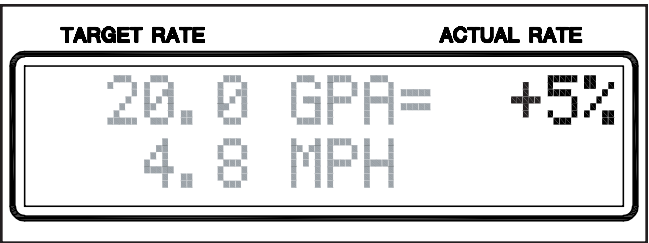
```
  TARGET RATE          ACTUAL RATE
  20.0 GPA=    +5%
       4.8 MPH
```
DWG. NO. 5807

SPEED/VOLUME/AREA

Speed, Volume, or Area data will be displayed on the bottom line depending on whether the SPEED, VOLUME, or AREA key was pressed.

```
  TARGET RATE          ACTUAL RATE
  20.0 GPA=  20.0
       4.8 MPH
```
DWG. NO. 5808

```
  TARGET RATE          ACTUAL RATE
  20.0 GPA=  20.0
       486 GAL
```
DWG. NO. 5809

```
  TARGET RATE          ACTUAL RATE
  20.0 GPA=  20.0
       16.2 GPM
```
DWG. NO. 5859
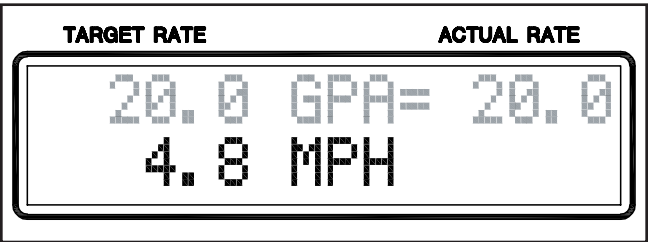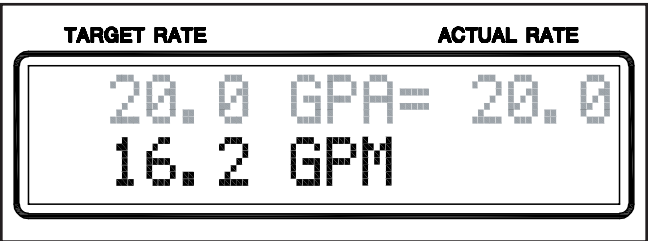
```
  TARGET RATE          ACTUAL RATE
  20.0 GPA=  20.0
      141.3 ACR
```
DWG. NO. 5810

ERROR MESSAGES

Most error messages are displayed on the right half of the display to inform the operator of specific conditions. Following is a description of those messages.

LOW BATTERY CONDITION

This message is displayed whenever the battery voltage at the console drops below ten volts. The console suspends all operations until the normal operating voltage level is resumed.
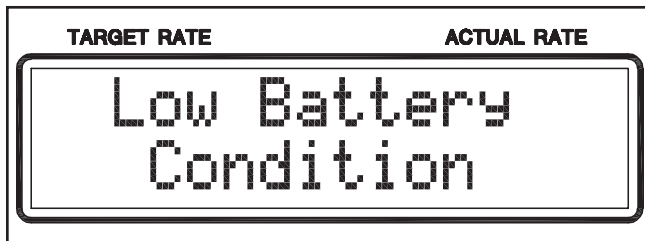
```
TARGET RATE           ACTUAL RATE
      Low Battery
       Condition
```
DWG. NO. 5811

HOLD

When displayed this reminds the operator that the 8160 is in the Hold Mode and is no longer doing any control. All boom valves are turned off and Area and Volume stop accumulating.

```
TARGET RATE           ACTUAL RATE
   20.0 GPA=  HOLD
        486 GAL
```
DWG. NO. 5812

MAN ERR

This is displayed when the ERROR key is selected and the Rate switch is in the "Manual" position.
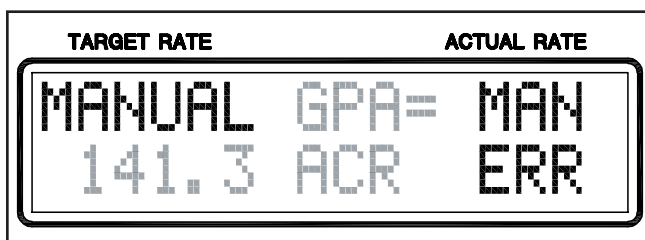
```
TARGET RATE           ACTUAL RATE
 MANUAL GPA=  MAN
      141.3 ACR  ERR
```
DWG. NO. 5813

+++%

With the ERROR key selected the +++% message will be displayed if the calculated percent error between the target rate and the actual rate is greater then +99%. In this condition you are over applying by more then 99%.
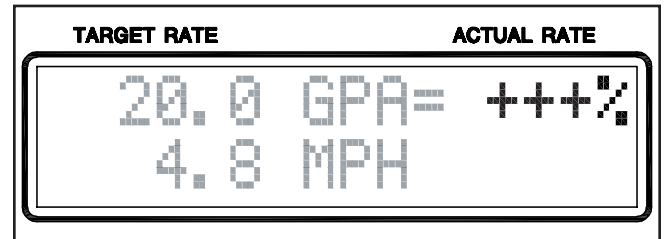
```
TARGET RATE           ACTUAL RATE
   20.0 GPA=  +++%
        4.8 MPH
```
DWG. NO. 5814

---%

With the ERROR key selected the ---% message will be displayed if the calculated percent error between the target rate and the actual rate is greater then -99%. In this condition you are under applying by more then 99%.
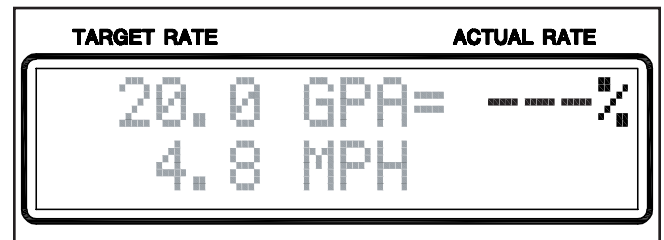
```
TARGET RATE           ACTUAL RATE
   20.0 GPA=  ---%
        4.8 MPH
```
DWG. NO. 5815

MIN

Whenever the flow is reduced to the Minimum Flow level, the display will flash "MIN" to indicate that the console will not reduce the flow any further. You will be over-applying to keep a good spray pattern.
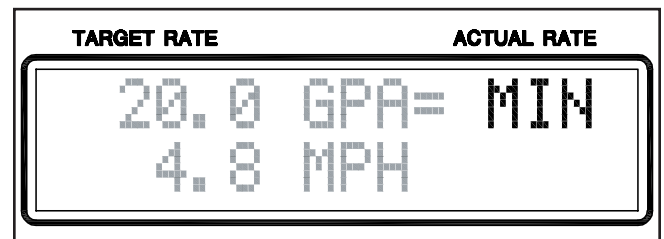
```
TARGET RATE           ACTUAL RATE
   20.0 GPA=  MIN
        4.8 MPH
```
DWG. NO. 5835

SIM

"SIM" will be displayed whenever the Speed Simulator has been activated. The Speed Simulator can be turned on and the speed set or turned off in the Options menu. The simulated speed will be displayed if the SPEED key is pressed.
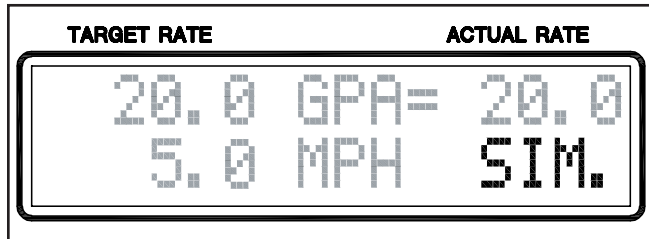
```
TARGET RATE          ACTUAL RATE
   20.0 GPA=  20.0
    5.0 MPH  SIM.
```
DWG. NO. 5836

LOW SPEED

The LOW SPEED message will flash to warn that the console can no longer operate in the Run Mode. The Run Mode is suspended. The console will no longer control the servo valve automatically but all the "switched on" booms will be left on. Although Area does not accumulate, Volume will continue to accumulate while this message is displayed. Either increase your speed or switch to manual operation.

```
TARGET RATE          ACTUAL RATE
   20.0 GPA=  LOW
  141.3 ACR SPEED
```
DWG. NO. 5817

LOW FLOW

The LOW FLOW message will flash to warn that the console can no longer operate in the Run Mode. The Run Mode is suspended. The console will no longer control the servo valve automatically but all the "switched on" booms will be left on.
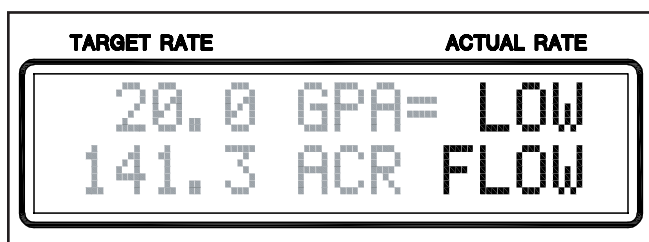
```
TARGET RATE          ACTUAL RATE
   20.0 GPA=  LOW
  141.3 ACR  FLOW
```
DWG. NO. 5818

Although Volume does not accumulate, Area will continue to accumulate while this message is displayed. Either increase flow (speed) or switch to manual.

Note: The LOW FLOW and LOW SPEED messages will alternately flash if both warnings are active.

ZERO WIDTH

The ZERO WIDTH message will flash to warn that the console can no longer operate in the Run Mode.

This message indicates that the total width of the "on" Boom switches is equal to zero. Zero inches was entered into one or more of the boom widths and these are the only boom switches turned on. This message is only displayed while in the Run Mode (including manual). The Run Mode is suspended. The console will no longer control the servo valve automatically but all the "switched on" booms will be left on. Although Area does not accumulate, Volume will continue to accumulate while this message is displayed.
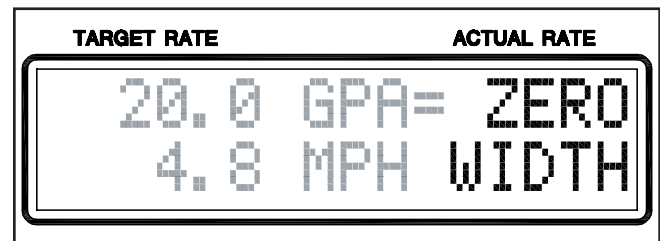
```
TARGET RATE          ACTUAL RATE
   20.0 GPA= ZERO
    4.8 MPH WIDTH
```
DWG. NO. 5816

OVER

This is short for overflow. This indicates the 8160 has calculated a number greater than allowed. Clear Area or Volume back to zero or ignore this message.
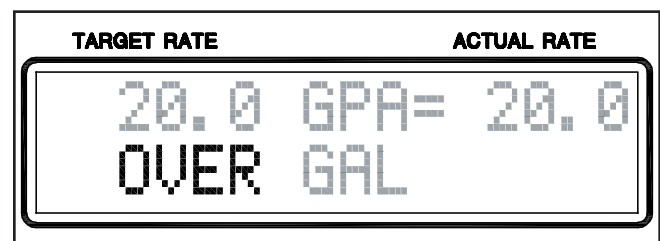
```
TARGET RATE          ACTUAL RATE
   20.0 GPA=  20.0
  OVER GAL
```
DWG. NO. 5819

SYSTEM CONNECTION

DWG. NO. 5802
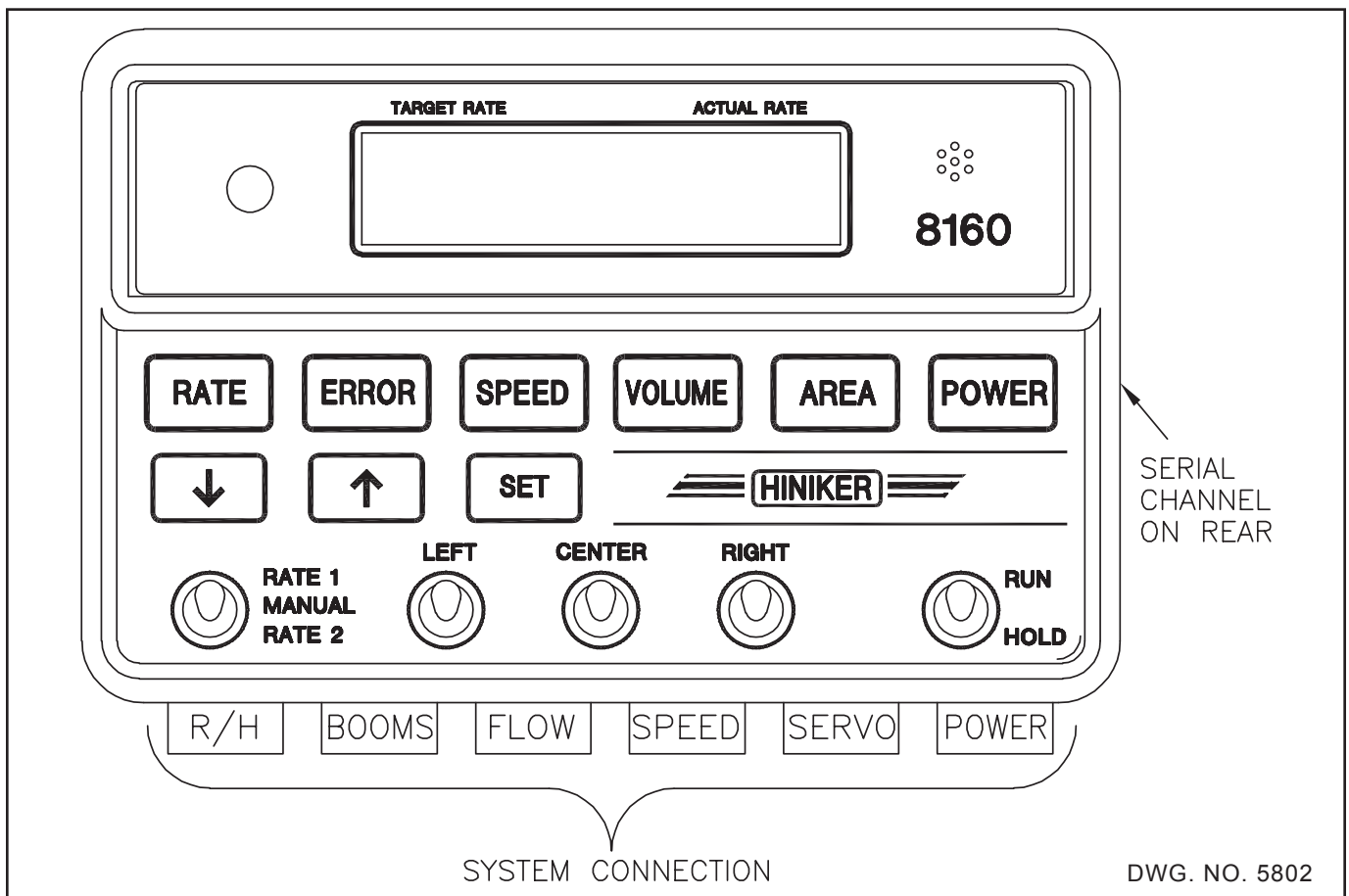
SYSTEM CONNECTIONS

POWER CONNECTOR

The Power cable connects to the battery to supply power to operate the system.

SPEED CONNECTOR

This is the Speed input. It connects to an appropriate Speed sensor.

FLOW CONNECTOR

This is the Flow input. It connects to the Flowmeter.

BOOM CONNECTOR

This is the connection for the Boom control valves. It has <u>all</u> the connections for connecting up to three motorized ball valves or solenoid valves. The connector also contains the connections for the Remote Run/ Hold.

SERVO CONNECTOR

This is the connection for the Motorized Control Valve (Servo Valve)

RUN / HOLD CONNECTOR

This is an alternate Run/Hold input connection. This input and the Run/Hold input in the Boom connector are electrically connected to the same input.

SERIAL CHANNEL CONNECTOR

This is a 9-pin Sub-D connector to connect to another device using RS-232 communications and the Hiniker Protocol or Generic Protocol for Variable Rate Applications. This connector is located on the back of the console.

OPERATION

OPERATING GUIDELINES

The purpose of this section is to provide some general guidelines and recommendations for operating the 8160 in the field.

The console must be configured for the mode (Spray or NH3) you are going to operate in before starting the application. Perform both the Set-up procedure and the Distance Calibration procedure before attempting to use this console. Failure to do this will result in faulty control and inaccurate Volume, Area, and Speed data.

When not applying chemical the console should be put into the Hold Mode. Move the Run/Hold switch on the console to the Hold position. This will shut off the Boom Valves and stop accumulating Volume and Area. This may also be accomplished by using a Remote Run/Hold switch. Using the Remote Run/Hold feature can reduce the number of operations the operator must perform when starting and stopping the application.

To apply chemical move the Run/Hold switch to the Run position as you reach the place in the field where you want to start the application. It is best to start moving before activating the Run Mode and to reach the operating speed as soon as possible. Return the Run/Hold switch to Hold at the end of the field. It is best not to slow down significantly before putting the console into Hold. This will prevent the Servo Valve from moving to far from its normal operating position. This reduces the time it takes to reach the proper application rate as you again start applying.

The Boom switches may be used to shut off Booms not required such as on end rows. The console will make the necessary corrections to insure proper application rates.

The 8160 console will allow you to determine what is going on with your system. The keyboard has five keys labeled RATE, ERROR, SPEED, VOLUME, AREA.

Pressing one of the five keys will display that selection. The top line of the display will always show the Target Rate along with either Actual Rate or % Error as selected by the operator. The bottom line will display SPEED, VOLUME, or AREA as selected by the operator. The operator is free to select whichever selection he desires, however, the following is a list of recommendations.

It is important to insure that the 8160 is controlling your sprayer properly. The RATE and ERROR keys will show this.

Pressing the RATE key will display the actual Volume per Area. Pressing the ERROR key will display the actual error between the Target and Actual application rates. This is displayed as a percentage.

The console must be in the Run Mode and be receiving Speed and Flow signals to display RATE or % ERROR. Although any calculated errors less than 10% are considered good The 8160 will control the servo valve until the error falls below ±1%. The warning light will flash when the error exceeds ±10%.

The 8160 will automatically adjust the flow whenever Rate 1 or Rate 2 is selected. Switching between Rate 1 and Rate 2 can be done at any time and as often as desired. The 8160 will change to the new application rate very quickly and maintain that rate very accurately.

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 at the lower Rate 1 and save chemicals.

When required putting the Rate switch in the center position (Manual) will turn the automatic control off. Pressure can then be adjusted manually.

Driving too slow will cause the servo valve to end stop (fully close). When this happens, your pressure gauge will show minimum PSI. The console can no longer maintain the selected application rate and will display LOW FLOW and stop controlling.

To prevent a "LOW FLOW" message as you slow down the 8160 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 OPTIONS Menu. This is only available for the Spray Mode. Keep in mind that you are OVERAPPLYING to maintain a spray pattern at very low speeds. Whenever the flow is reduced to the Minimum Flow level, the display will flash "MIN" 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. After slowing down the console does not control the servo valve but instead displays "LOW FLO", change the Rate switch to manual and press "⇧" key until you achieve operating flow. Increase your speed then select rate 1 or rate 2. The 8160 will again control your flow as you increase your speed. Keep in mind that you are OVERAPPLYING to maintain a spray pattern at very low speeds.

VARIABLE RATE

The 8160's Rate 1 can be changed "on the go" by using the Variable Rate feature. An external source must provide Application Rate information to the 8160 in real time.

The information must be provided through the RS232 port on the rear of the 8160 using either the Hiniker Protocol or the Generic Protocal. These protocols are listed in the appendix.

The external rate input will override the RATE 1 application rate data. The Rate Switch must be in the Rate 1 position.

The Rate 1 Application Rate that was programmed in during Set-Up is not changed. The console will use the variable Rate data until power is switched off. When the console is powered back on, the original Rate 1 data will be used.

Note: If you go into the Set-Up routine before powering down, the 8160 will save the current displayed Rate 1 data for Rate 1 when you exit Set Up.

The console will display the current Rate on the upper left of the display.

The 8160 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 will override the external rate input.

Turning the console off will reset the Variable Rate Data to the Rate 1 data that was originally programmed in.

Cables are available for connecting to most Precision Farming Systems. Refer to the Hiniker Parts Book for specific information. Refer to the Manual supplied with the Precision Farming equipment for programming their console for third party controllers.

The Hiniker Protocol requires a Null modem serial cable.

If using the Generic protocol, program the Precision Farming Console as if you were connecting to a Raven 440.

Do not divide the flow calibration number by 10 as instructed in some manuals. Use the calibration number listed on the Hiniker flowmeter.

For proper operation software version 3.0 or higher is required. If you have earlier versions the 8160 will need to have the software updated.

The software version is shown on the display each time the 8160 is powered up.

MENU

The 8160 is constructed to allow for maximum flexibility when changing between Spray and NH3 applications. The console will be configured individually for each application Set-up. The menu will allow you to easily access and change the configuration of each Set-up without effecting the other. All calibration information and user preference settings are stored separately for the Spray and NH3 configurations.
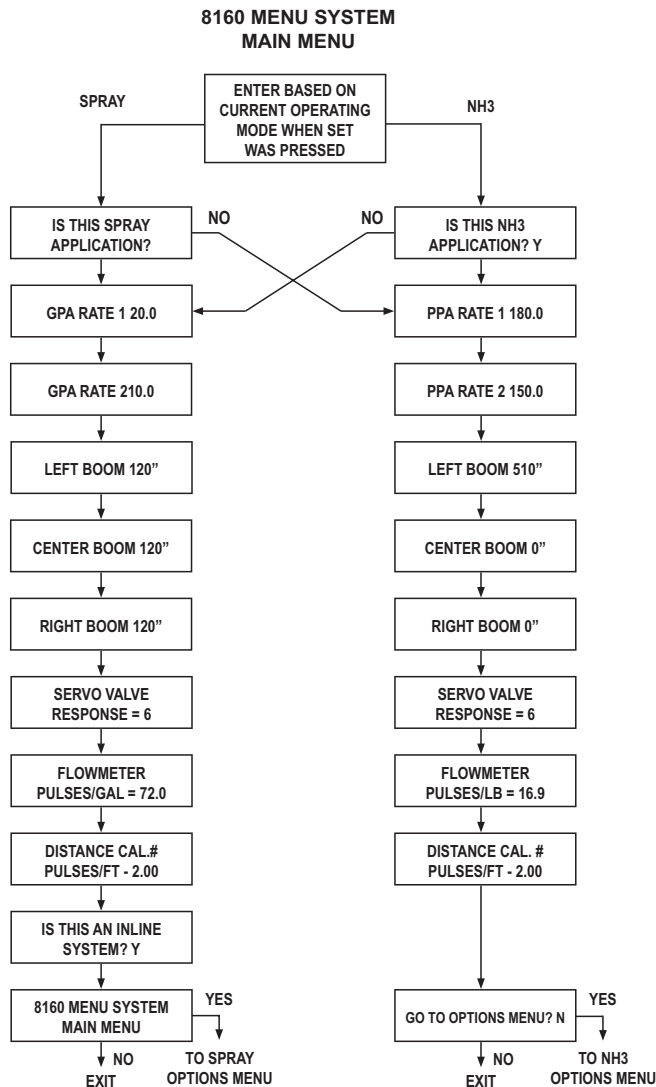
8160 MENU SYSTEM
MAIN MENU

To enter the Main Menu press and hold the SET key for 2 seconds.

Upon entering the main menu the current selected mode will be displayed, either Spray or NH3. To change to the other mode (Spray or NH3) press the ⇩ key to change the answer to NO then press SET.

Navigating the Menu

Three keys are used to navigate the menu. They are the SET, the ⇧ key and ⇩ key.

NOTE: Pressing any other key except SET, ⇧, ⇩, will provide a shortcut out of the menu system.

The ⇧ and ⇩ keys are used to change a Value or an Answer that is being displayed. The ⇧ key will increase a Value or change the answer to Yes (Y). The ⇩ key will decrease a Value or change the answer to No (N). These keys are also used to control the Servo Valve when in Manual.

The SET key is the same as the ENTER key on a computer keyboard and performs the same function. Pressing the SET key will cause the console to accept whatever is currently being displayed. This could be a Value, such as "LEFT BOOM 120", or the answer (Y or N) to a question such as "GO TO OPTIONS MENU? "N".

There are two types of menu items. The first are items that require a "Value". Examples are "GPA RATE 1 20.0" or "FLOWMETER PULSES/GAL = 72.0" Use the ⇧ and ⇩ keys to change the "Value" then press the SET key to accept these changes and proceed to the next menu item.

The second type of menu items are those that require an "answer" to a question. An example would be "IS THIS SPRAY APPLICATION? Y". Use the ⇧ key to answer "Y" (YES) or the ⇩ key to answer "N" (NO) then press the SET key to accept these changes and proceed to the next menu item. Which menu item will be displayed next is based on your answer to the question. In the example above, if the answer were changed to "N", then the next item displayed would be "PPA RATE 1 180.0" on the NH3 menu. If it was answered "Y" the next item would be "GPA RATE 1 20.0" in the Spray menu.

To navigate the menu, change the "Value" or the "answer" to the question, then press SET. The new "Value" will be saved and you will advance to the next menu item based on your answer.

NOTE: The default answers to the menu items are set to allow you to press SET repeatedly without changing any values or jumping to other menus or routines. This is to prevent unintentional changes and to allow for speedy access to each item.

SELECTING OPERATING MODES

There are two separate modes for the 8160, the Spray mode, and the NH3 mode. All calibration numbers, all settings, and the Area and Volume totals are stored separately for each mode. As an example, if you perform the Distance Calibration while in the Spray mode you would need to perform the Distance Calibration again after switching to the NH3 mode.

HOW TO SELECT AND CHANGE OPERATING MODES	
DISPLAY	COMMENTS and ACTIONS
	Press and hold SET key for Two seconds to enter Set-Up
IS THIS A SPRAY APPLICATION? Y Or IS THIS AN NH3 APPLICATION? Y	The Display will always show the current operating mode and "Y' as the default answer. Pressing SET will allow access to the menu for the current mode. To change Operating Modes and access it's Set-up Menu, press the ⇓ key to change the answer to "N" then press SET.
	Pressing any key except SET, ⇑, or ⇓ will provide a shortcut out of Setup and return you to the current operating mode. For instructions on setting up an application see Spray Mode Set-up or NH3 Mode Set-Up.

SPRAY MODE SET-UP

This section is for Sprayer Set-Up only. Refer to the NH3 Set-Up section for Anhydrous Ammonia applications.

To enter the Main Menu press and hold the SET key for 2 seconds.

Upon entering the main menu the current selected mode will be displayed, either Spray or NH3. If the NH3 mode is displayed then press the ⇩ key to change the answer to NO then press SET. This will take you to the Spray Menu.

SPRAY MODE SET-UP	
DISPLAY *	**COMMENTS and ACTIONS**
	To select the operating mode see "HOW TO SELECT AND CHANGE OPER-ATING MODES" See NH3 MODE SET-UP for NH3 applications.
GPA RATE 1 20.0	Press the ⇧ and ⇩ keys to adjust the value for Rate 1 then press SET.
GPA RATE 2 10.0	Press the ⇧ and ⇩ keys to adjust the value for Rate 2 then press SET.
LEFT BOOM 120"	Press the ⇧ and ⇩ keys to adjust the width, in inches, for the Left Boom Section, then press SET
CENTER BOOM 120"	Press the ⇧ and ⇩ keys to adjust the width, in inches, for the Center Boom Section, then press SET.
RIGHT BOOM 120"	Press the ⇧ and ⇩ keys to adjust the width, in inches, for the Right Boom Section, then press SET.
SERVO VALVE RESPONSE= 6	Press the ⇧ and ⇩ keys to adjust the Valve Response, then press SET. The higher the number the faster the response.
FLOWMETER PULSES/GAL = 72.0	Press the ⇧ and ⇩ keys to adjust the Flowmeter Calibration number, then press SET.
DISTANCE CAL. # PULSES/FT= 2.00	You may enter the Calibration number manually here or perform the "Distance Calibration Procedure" later to have it calculated automatically. To enter it manually press the ⇧ and ⇩ keys to adjust the Distance Calibration number, then press SET. To continue without changing the Calibration number just press SET.
IS THIS AN INLINE SYSTEM? Y	If this is an In-line System press the ⇧ key to change the answer to "Y", then press SET. For a By-pass System press the ⇩ key to change the answer to "N", then press SET.
GO TO OPTIONS MENU? N	The OPTIONS MENU contains optional features and Settings such as Distance Calibration, Remote Run/Hold control, and Minimum flow control. See "OPTIONS MENU" for further information. To go to the OPTIONS MENU press the ⇧ key to change the answer to "Y", then press SET. To exit the Spray Mode menu now press SET.

* Note: Display values shown are factory default values. Values shown will be the current settings.

NH3 MODE SET-UP

This section is for NH3 Set-Up only. Refer to the Spray Set-Up section for Spray applications. To enter the Main Menu press and hold the SET key for 2 seconds.

Upon entering the main menu the current selected mode will be displayed, either Spray or NH3. If the Spray mode is displayed then press the ⇩ key to change the answer to NO then press SET. This will take you to the NH3 Menu.

NH3 MODE SET-UP	
DISPLAY *	**COMMENTS and ACTIONS**
	To select the operating mode see "HOW TO SELECT AND CHANGE OPERATING MODES" See SPRAY MODE SET-UP for Spray applications.
PPA RATE 1 180.0	Press the ⇧ and ⇩ keys to adjust the value for Rate 1 then press SET. This is pounds of actual N per Acre.
PPA RATE 2 150.0	Press the ⇧ and ⇩ keys to adjust the value for Rate 2 then press SET. This is pounds of actual N per Acre.
LEFT BOOM 510"	Press the ⇧ and ⇩ keys to adjust the width, in inches, for the Left BoomSection, then press SET. If using only one boom enter the entire Boom Width here.
CENTER BOOM 0"	Press the ⇧ and ⇩ keys to adjust the width, in inches, for the Center Boom Section, then press SET. If using only one boom leave at "0" and turn center boom switch off.
RIGHT BOOM 0"	Press the ⇧ and ⇩ keys to adjust the width, in inches, for the Center Boom Section, then press SET. If using only one boom leave at "0" and turn center boom switch off.
SERVO VALVE RESPONSE= 6	Press the ⇧ and ⇩ keys to adjust the Valve Response, then press SET. The higher the number the faster the response.
FLOWMETER PULSES/LB = 16.9	Press the ⇧ and ⇩ keys to adjust the Flowmeter Calibration number, then press SET.
DISTANCE CAL. # PULSES/FT= 2.00	You may enter the Calibration number manually here or perform the "Distance Calibration Procedure" later to have it calculated automatically. To enter it manually press the ⇧ and ⇩ keys to adjust the Distance Calibration number, then press SET. To continue without changing the Calibration number just press SET.
GO TO OPTIONS MENU? N	The OPTIONS MENU contains optional Features and Settings such as Distance Calibration, Remote Run/Hold control, and Minimum flow control. See "OPTIONS MENU" for further information. To go to the OPTIONS MENU press the ⇧ key to change the answer to "Y". Then press SET. To exit the Spray Mode menu now press SET.

* Note: Display values shown are factory default values. Values shown will be the current settings.

OPTIONS MENUS

There are two "Options" menus. They are identical except that the Minimum Flow Feature is not available for NH3 applications. The settings for each of these option menus are stored separately for each operating mode (Spray or NH3). Changing a setting while in one operating mode has no effect on the settings in the other mode.

The Options menu is located at the end of the Main menu for each operating mode.

The Options menu contains the following options and procedures:

1. Distance Calibration
2. Distance Measurement
3. Remote Run/Hold Enable
4. Horn Control
5. Minimum Flow Control (Spray Mode Only)
6. Protocol selection, Logging, and Field #.
7. Valve Profile selection
8. Speed Simulator
9. Test Inputs for Speed, Flow, and Run/Hold
10. Display Smoothing

OPTIONS MENU

ENTER FROM MAIN MENU

DO DISTANCE CALIBRATION? N — YES → PRESS SET TO START → DRIVE 500 FT → PRESS SET TO STOP >>> → PRESS SET TO EXIT CAL = X.XX

NO

DO DISTANCE MEASUREMENT? N — YES → PRESS SET TO START 0 FT → START DRIVING 0 FT → PRESS SET TO STOP XXX FT → PRESS SET TO EXIT XXX FT

NO

USING REMOTE RUN/HOLD? N

MINIMUM FLOW CONTROL = OFF (OFF, ON, SET, ADJ.) — SET → ADJ. & PRESS SET LIMIT= .0 GPM (ARROW KEYS ADJUST VALUE)

ADJ. → ADJ. & PRESS SET GPM LIMIT= .0 GPM (ARROW KEYS ADJUST VALUE)

ON/OFF

HORN IS ON TURN OFF? N — SPRAY MODE

SPRAY MODE ONLY

NH3 MODE

PROTOCOL = HINIKER (HINIKER - GENERIC) — GENERIC → LOGGING OFF (ON - OFF) — ON → FIELD # 0 (0 - 9999)

OFF

HINIKER

VALVE PROFILE = A (A = DEFAULT A - B)

SIMULATED SPEED = OFF? Y (OFF, 1 - 9 MPH)

TEST INPUTS? N — YES → TEST SPEED INPUT? N — YES → PRESS SET TO END 0

NO

NO

TEST FLOW INPUT? N — YES → PRESS SET TO END 0

NO

TEST RUN/HOLD INPUT? N — YES → PRESS SET TO END DISABLED 0

NO

DISPLAY TARGET RATE UNDER 1%? (1 - 10%)

EXIT

OPTIONS MENU	
DISPLAY *	**COMMENTS and ACTIONS**
GO TO OPTIONS MENU? N	The OPTIONS MENU is accessed through the main menu for each operating mode. Press SET repeatedly until the display at left is shown. Press the ⇧ key to change the answer to "Y" then press SET.
DO DISTANCE CALIBRATION? N	If you want to do Distance Calibration press the ⇧ key to change the answer to "Y" then press SET. Refer to the Distance Calibration procedure for instructions. To continue without doing this procedure press the ⇩ key to change the answer to "N". Then press SET.
DO DISTANCE MEASURMENT? N	If you want to do Distance Measurement press the ⇧ key to change the answer to "Y" then press SET. Refer to the Distance Measurement procedure for instructions. To continue without doing this procedure press the ⇩ key to change the answer to "N". Then press SET.
USING REMOTE RUN/HOLD? N	If Using the Remote Run/Hold option , press the ⇧ key to change the answer to "Y" then press SET. If not using the Remote Run/Hold option, it must be disabled, press the ⇩ key to change the answer to "N" then press SET.
HORN IS ON TURN OFF? N	The display will always show the current setting for the horn. Press the ⇧ key to change the answer to "Y" or press the ⇩ to change the answer to "N", then press SET.
MINIMUM FLOW CONTROL = OFF	**(SPRAY MODE ONLY)** Press the ⇧ and ⇩ keys to select either "ON", "SET", "ADJ", or "OFF" then press SET. Refer to the Minimum Flow procedure for instructions.
PROTOCOL = HINIKER	Select the "HINIKER" or "GENERIC" protocol using the ⇧ ⇩ keys. If selecting the "GENERIC" protocol you are prompted to turn "Logging ON or OFF" and enter a "FIELD" #".
VALVE PROFILE = A	Selected options are "A" or "B". "A" is our standard profile where "B" is more aggressive use the ⇧ ⇩ keys to select "A" or "B", "A" is default.
SIMULATED SPEED = OFF? Y	Selected options are "OFF, 1 ~ 9 MPH". Press the ⇧ and ⇩ keys to turn the Simulated Speed feature on and adjust the speed, then press SET. This feature must be turned off to do Distance Calibration.
TEST INPUTS? N	If you want to Test the Speed, Flow or Run/Hold inputs press the ⇧ key to change the answer to "Y" then press SET. Refer to the Test Inputs procedure for instructions.
DISPLAY TARGET RATE UNDER 1%?	Press the ⇧ and ⇩ keys to change the amount of smoothing for the display then press SET. The range is 1% to 10%. Selecting 1% (default) will always display the actual rate down to 1%. Selecting 10% will display the actual rate down to 10% then substitute the target rate below 10%. This has the effect of smoothing the display activity ONLY and has NO effect on the actual control. The controller will always try to control the application to less than 1-% error.

* Note: Display values shown are factory default values. Values shown will be the current settings.

SPEED SENSOR CALIBRATION

The purpose of this procedure is to match the console to the distance-measuring device you are using. This Distance Calibration procedure will allow you to easily calibrate the Speed Sensor.

In lieu of doing the Distance Calibration procedure a known PULSES/FT calibration number may be entered manually during Set-up. An example would be the 2.00 Pulses/Ft used with the HINIKER GPS Speed Sensor.

Both Spray and NH3 modes have their own PULSES/FT calibration number. That means you need do the Distance Calibration procedure for each mode. You may however enter the Calibration number manually while in Set-up for either mode.

The Distance Calibration Number is calculated by having you drive a predetermined distance, 500 feet in this case, while it counts the pulses from your speed sensor. It then divides the total pulses by the total feet (500). This is the Pulses/Ft calibration number used by the console to calculate Speed and Area.

This procedure works very well and provides an accurate calibration number in most cases. There are some things to consider when using certain types of Speed sensors. This is because the console starts counting pulses as soon as you press the SET key, any pulses generated, will be counted whether you are moving or not. The console will count ALL pulses between the PRESS TO START and the PRESS TO END key presses. The second thing to consider is that the Speed sensor must start sending pulses immediately when you start to drive. Any delay will cause the pulse count to be off.

RADAR:
Some radar may output pulses while the vehicle is sitting still. This is usually caused by vibration. To prevent this some models of radar prevent the outputting of pulses below a certain MPH. Both situations will cause inaccuracies when doing Distance Calibration.

To check for vibration do the following: Follow the procedure to do Distance Calibration. When the display shows "PRESS SET TO START" make sure the tractor is NOT moving then press SET. The display will show "DRIVE 500 FT" until it sees pulses. If this changes to "PRESS SET TO STOP" then you are receiving pulses, probably from vibration at the radar. If the display still shows "DRIVE 500 FT" then start driving, the display should change immediately to "PRESS SET TO STOP". If there is a delay you may be missing pulses.

To overcome these problems use the following procedure:

When the display shows "PRESS SET TO START" line up back of the start flag and start driving. Press the SET key as you pass the start flag. Drive at a constant speed then press SET as you pass the stop flag. Do not slow down until after you pass the flag.

GPS:
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.

DISTANCE CALIBRATION PROCEDURE	
DISPLAY *	**COMMENTS and ACTIONS**
	Measure 500 feet in your field and mark with start and stop flags.
DO DISTANCE CALIBRATION? N	The Distance Calibration routine is located in the Options menu for each operating mode. See " Options Menu" chart on how to access the Options menu items. To do Distance Calibration press the ⇧ key to change the answer to "Y", then press set.
PRESS SET TO START	Line up some convenient part of the tractor with the START flag. Press SET to start the measurement.
DRIVE 500 FT	Start driving in a straight line and a constant rate. This is displayed until the console starts seeing a signal from the speed sensor.
PRESS SET TO STOP > > >	When the same reference point on the tractor is lined up with the STOP flag press SET. Do not back up.
PRESS SET TO EXIT CAL. = 2.00	The new calculated Pulses/Ft Calibration number will be displayed and stored. If you want to use this same number for the other (Spray or NH3) mode then write it down and enter it manually during Set-up
DO DISTANCE CALIBRATION? N	Press SET to continue through the Options menu or change to "Y" and press SET to do Distance Calibration again.

* Note: Display values shown are factory default values. Values shown will be the current settings.

DISTANCE MEASURMENT

The Distance Measurement feature will allow you to use the 8160 to easily measure a distance.

The Area counter does not accumulate while measuring.

NOTE: Distance Calibration must be done before using the Distance Measurement feature. The maximum speed while measuring is 10 MPH.

DISTANCE MEASURMENT PROCEDURE	
DISPLAY *	**COMMENTS and ACTIONS**
DO DISTANCE MEASURMENT? N	The Distance Measurement routine is located in the Options menu for each operating mode. See "Options Menu" chart on how to access the Options menu items. To do Distance Measurement press the ⇧ key to change the answer to "Y" then press SET.
PRESS SET TO START 0 FT	Press SET to start the measurement. The Feet counter changes as you drive. Press ⇩ to clear feet to zero if needed.
PRESS SET TO STOP 13 FT *	Press SET to stop the measurement.
PRESS SET TO EXIT 13 FT *	Press SET to return to the Options menu.
DO DISTANCE MEASURMENT? N	Press SET to continue through the Options menu or change to "Y" and press SET to do Distance Measurement again.

* Note: Display values will vary depending on distance driven.

REMOTE RUN/HOLD

This option will reduce the number of controls the operator must use on end rows and turns. For maximum flexibility the Remote Run/Hold connector is available at the console and in the boom cable at the implement. Either connector may be used but not both at the same time.

⚠ **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 INJORY OR DEATH.**

The Remote Run/Hold switch is a normally closed switch. When the switch is pressed (opened) the console will remove power from the boom control valves causing them to shut off. The console will then go into the Hold mode.

A proximity sensor may be used for the Remote Run/Hold switch. When metal is present in front of the face of the sensor, the console will remove power from the boom control valves causing them to shut off. The console will then go into the Hold mode.

Before using the Remote Run/Hold feature it first must be enabled. The on/off control for the Remote Run/Hold is located in the Options menu. Press the ⇧ key to change the "USING REMOTE RUN/HOLD? N" question to "Y" then press SET. The default setting for the Remote Run/Hold feature is "off" for both Spray and NH3 modes.

With the Remote Run/Hold feature enabled the console will go into Hold when the switch is pressed. With the Remote Run/Hold disabled the consoles ignores the switch.

REMOTE RUN/HOLD	
DISPLAY	**COMMENTS and ACTIONS**
	The Remote Run/Hold control is located in the Options menu for each operating mode. See " Options Menu" chart on how to access the Options menu items.
USING REMOTE RUN/HOLD? N	If Using the Remote Run/Hold option , press the ⇧ key to change the answer to "Y" then press SET. If not using the Remote Run/Hold option, it must be disabled, press the ⇩ key to change the answer to "N" then press SET

HORN

The Horn control is located in the Options menu. Use the ⇧ and ⇩ keys to turn the horn on or off. If the horn is turned on it will sound when the application Rate Error is greater then 10%.

When turned off only the light will flash. The horn is also used as a key press indicator. This can not be turned off.

HORN CONTROL	
DISPLAY	**COMMENTS and ACTIONS**
	The Horn control routine is located in the Options menu for each operating mode. See " Options Menu" chart on how to access the Options menu items.
HORN IS ON TURN OFF? N	The display will always show the current setting for the horn. Press the ⇩ key to change the answer to "Y" or press the ⇧ to change the answer to "N", then press SET.

MINIMUM FLOW

This feature is used to set a limit on how low the console can reduce the flow during automatic operation. This will allow you to slow down to very slow speeds when necessary while keeping the pressure high enough to maintain a good spray pattern. You will be over applying to maintain a good spray pattern. As you speed up the controller will again control to the proper application rate. With this feature turned on the display will flash "MIN" when the console is limiting further reduction in flow.

The set minimum flow limit is automatically adjusted as booms are turned on and off. The Minimum Flow control procedure gives you four options. They are ON, OFF, SET, and ADJ. ON and OFF simply turn the limit on and off.

There are two ways to set the minimum flow limit. "SET" allows you to use the ⇧ and ⇩ keys to adjust the servo valve to adjust the pressure at the nozzles. The valve is adjusted for the lowest Pressure that will still provides for a good spray pattern. The display will show the current GPM limit. Pressing SET sets the limit.

"ADJ". (Adjust) allows you to use the ⇧ and ⇩ keys to adjust the displayed GPM setting for the limit directly. Adjust the value then press SET to set the limit. This is convenient when not wanting to spray any chemicals while setting.

When setting the GPM in this fashion the console assumes this GPM limit is for the entire boom width activated.

MINIMUM FLOW CONTROL	
DISPLAY	**COMMENTS and ACTIONS**
	The Minimum Flow routine is located in the Options menu for each operating mode. See " Options Menu" chart on how to access the Options menu items.
MINIMUM FLOW CONTROL = OFF	Press the ⇧ and ⇩ keys to change the control between ON, OFF, SET, or ADJ. If ON or OFF is selected then pressing SET will take you to the next item in the Options menu. If SET or ADJ. Is selected then pressing SET will take you to a routine for setting the Minimum Flow limit.
MINIMUM FLOW CONTROL = ADJ	Pressing SET when ADJ is being displayed will allow you to use the ⇧ and ⇩ keys to change the displayed GPM limit for the minimum flow.
ADJ. & PRESS SET GPM LIMIT = .0 GPM	Use the ⇧ and ⇩ keys to change the displayed GPM. Press SET when done to return to the Options menu where you can turn the feature on or off.
MINIMUM FLOW CONTROL = SET	Pressing SET when SET is being displayed will allow you to use the ⇧ and ⇩ keys to adjust the Servo valve.
ADJ. & PRESS SET LIMIT = .0 GPM	Use the ⇧ and ⇩ keys to adjust the Servo valve while watching the spray pattern or pressure gauge. The display will show the current GPM reading. Press SET after setting to return to the Options menu where you can turn the feature on or off.

SERIAL PROTOCOLS

There are two serial protocols available with the 8160. The "HINIKER" protocol is our original serial communication standard. The "GENERIC" protocol was developed to easily allow the 8160 to communicate to most mapping systems.

Refer to the Appendix for details on both communication protocols.

If the "GENERIC" protocol is selected the 8160 will prompt you to turn Logging "ON" or "OFF". Selecting "LOGGING = ON" will instruct the 8160 to start sending data to the serial port once per second. "LOGGING = OFF" turns this feature off. For most applications this is turned on.

With the "GENERIC" protocol selected the 8160 will now prompt you to enter a "FIELD #". You may enter 1 to 9999 using the ⇧ and ⇩ keys.

When using the 8160 with most mapping systems you should select the "GENERIC" protocol. From the mapping systems menu select *"RAVEN 440" as the serial controller. Follow the setup instructions for setting up a 440.

SERIAL PROTOCOL	
DISPLAY	**COMMENTS and ACTIONS**
	Serial protocol settings are listed in the Options menu for each operating mode. See "Options Menu" chart on how to access the Option Menu items.
PROTOCOL = HINIKER	Available selections are "HINIKER" and "GENERIC". If "GENERIC" is selected then the 8160 will prompt you for "LOGGING ON/OFF" and a "FIELD # "
LOGGING = OFF	Selecting "LOGGING = ON" will instruct the 8160 to start sending data to the serial port once per second. "LOGGING = OFF" turns this feature off
FIELD = 1	Available field identifier numbers are 1 to 9999

VALVE PROFILE

There are two Valve Profiles available with the 8160. They are called "A" and "B". "A" is our standard profile.

"B" has been modified to give a more linear response to change request so it tends to be more aggressive.

VALVE PROFILE	
DISPLAY	**COMMENTS and ACTIONS**
	Serial protocol settings are listed in the Options menu for each operating mode. See "Options Menu" chart on how to access the Option Menu items.
VALVE PROFILE = A	Available selections are "A" and "B". Press the ⇧ and ⇩ keys to select either "A", or "B" then press SET.

SPEED SIMULATOR

The 8160 has a built in speed simulator. It will allow you to set up you system without driving.

It can also be used as a temporary speed sensor replacement in the case of a malfunctioning speed sensor. It can be very helpful in troubleshooting control problems.

SPEED SIMULATOR	
DISPLAY	**COMMENTS and ACTIONS**
	The speed simulator routine is located. in the Options menu for each operating mode. See " Options Menu" chart on how to access the Options menu items.
SIMULATOR SPEED = OFF? Y	The available speeds are OFF and 1 through 9 MPH. Press the ⇧ and ⇩ keys to change to the required speed then press SET.

* Note: Display values shown are factory default values. Values shown will be current setting.

TEST INPUTS

The Test Input routine allows you to Test the Flow, Speed, and Run/Hold inputs of the console. After selecting the input to be tested the console will do the following for each pulse received. Flash the light, sound the horn, and display the number of pulses received.

The pulse count can be cleared to zero by pressing the ⇩ key. This allows you to easily troubleshoot the 8160 system. Refer to the Troubleshooting section for suggestions on its use.

TEST INPUT ROUTINE	
DISPLAY	**COMMENTS and ACTIONS**
TEST INPUTS? N	The Test Input routine is located in the Options menu for each operating mode. See " Options Menu" chart on how to access the Options menu items. To access the Test Input routine, press the ⇧ key to change the answer to "Y" then press SET.
TEST SPEED INPUT? N	To access the Test Speed Input routine, press the ⇧ key to change the answer to "Y" then press SET. To advance without testing press SET.
TEST FLOW INPUT? N	To access the Test Flow Input routine, press the ⇧ key to change the answer to "Y" then press SET. To advance without testing press SET
TEST RUN/HOLD INPUT? N	To access the Test Run/Hold Input routine, press the ⇧ key to change the answer to "Y" then press SET. To advance without testing press SET. If selected, the display will also show whether the Remote Run/Hold is enabled or disabled.
TEST INPUTS? N	Press SET to advance to next item in Options menu or to retest press the ⇧ key to change the answer to "Y" then press SET

DISPLAY SMOOTHING

The 8160 will always try to adjust the Actual Application Rate to within 1% of the Target Rate. To provide a smoothing effect on the display you can have the Target Rate displayed as the Actual Rate whenever the Actual Rate is within a set percentage of the target rate. This percentage can be set in the Options menu.

When the Question "DISPLAY TARGET RATE UNDER 1%?" is being displayed, use the ⇧ and ⇩ keys to adjust the %, then press SET. The range is 1% to 10%. The effect of setting the limit at 10% (for example) would be to display the "Actual Rate" when the error is greater than 10%; otherwise the "Target Rate" will be displayed.

DISPLAY SMOOTHING	
DISPLAY	**COMMENTS and ACTIONS**
	The Display smoothing routine is located in the Options menu for each operating mode. See " Options Menu" chart on how to access the Options menu items.
DISPLAY TARGET RATE UNDER 1%?	Press the ⇧ and ⇩ keys to change the amount of smoothing for the display then press SET. The range is 1% to 10%. Selecting 1% (default) will always display the actual rate down to 1%. Selecting 10% will display the actual rate down to 10% then substitute the target rate below 10%. This has the effect of smoothing the display activity ONLY and has NO effect on the actual control. The controller will always try to control the application to less then 1% error.

INSTALLATION - BASIC UNIT

CONSOLE MOUNTING

Select a convenient location to mount the control console.

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

There will be 6 cables connecting the console to the other parts of the system. They are listed in the table. The console location should allow easy routing of these cables.

CABLE	CONNECTED TO
POWER	BATTERY
SERVO	SERVO VALVE
SPEED	SPEED SENSOR
FLOW	FLOWMETER
BOOM	BOOM VALVES/RUN/HOLD
RUN/HOLD	RUN/HOLD SWITCH

Install the "U" shaped mounting bracket as shown in DWG. 5935, using the hardware supplied.
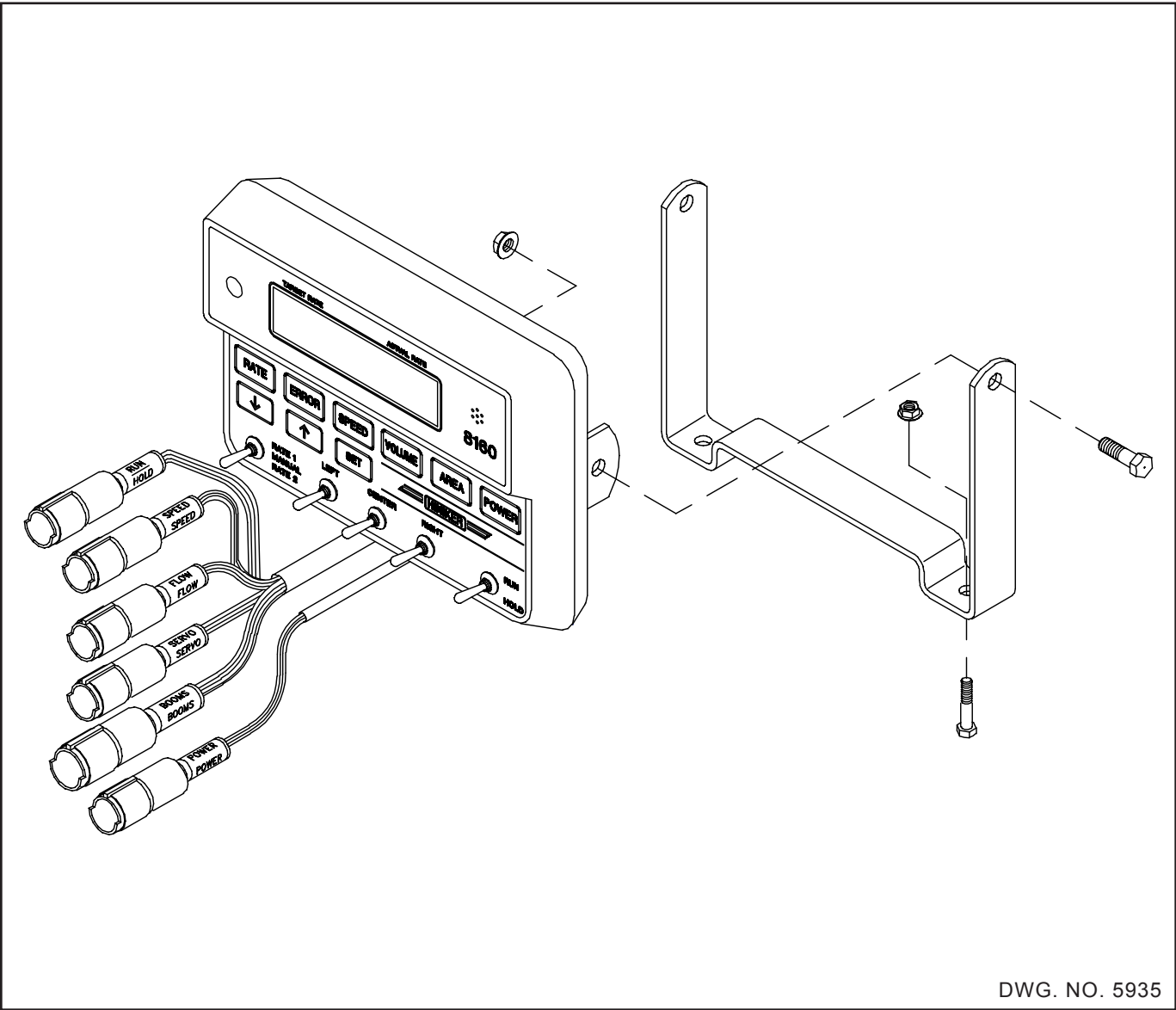
DWG. NO. 5935

8150 ADAPTER

An adapter (Part # 38815014) is available for using an 8160 to replace an 8100 or 8150 console without changing any of the wiring. All cables are the same except the BOOM Cable. To use your existing boom wiring, plug the 7-pin to 4-pin adapter into the 7-pin BOOM connection of the 8160, then connect to the 4-pin BOOM cable of the 8100/8150 wiring. The Run/Hold will work the same as it did with the 8100/8150.

POWER CABLE CONNECTION

The 15-foot 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 red and white leads with the 20 amp 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 console connector labeled power.

An adapter for in-cab connection to the convenience outlet is available, see parts breakdown.

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

IMPORTANT: Disconnect power cable from console when jump starting or charging the battery. Failure to do this may cause damage to the console.
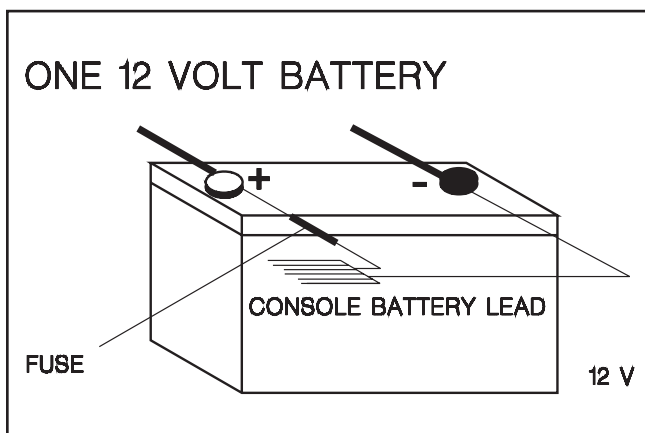
DWG. NO. 3446
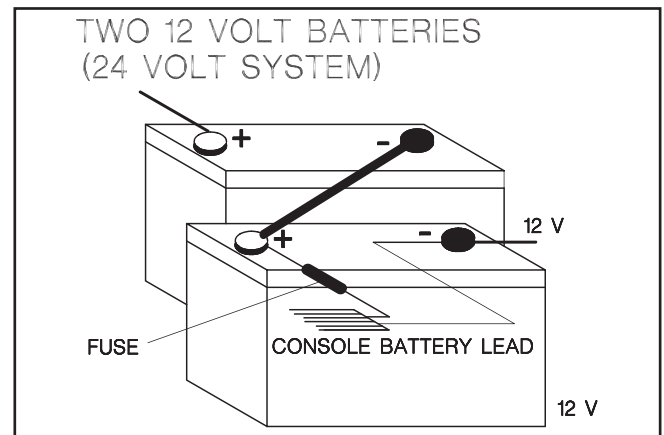
DWG. NO. 3445
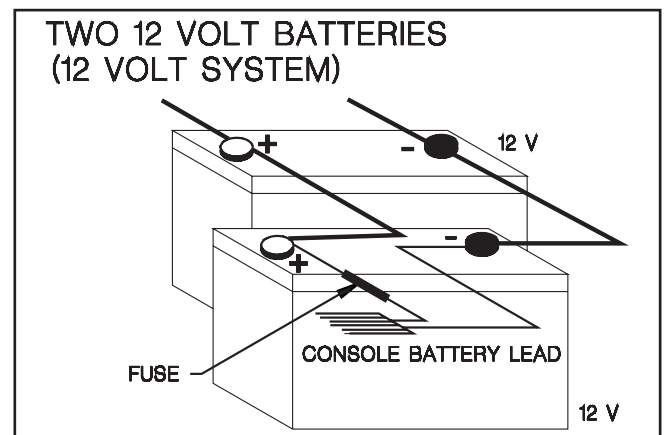
DWG. NO. 3443
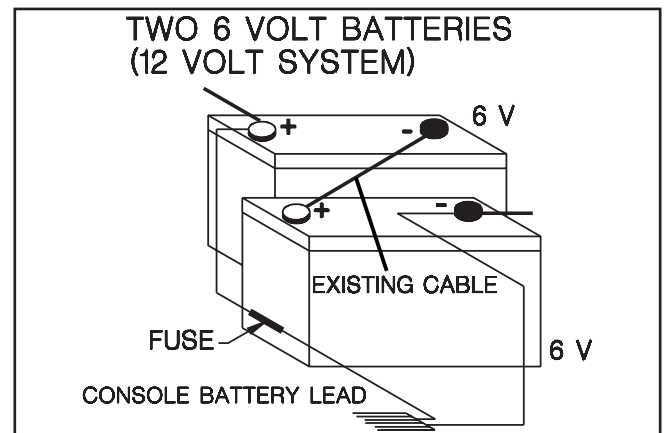
DWG. NO. 3444

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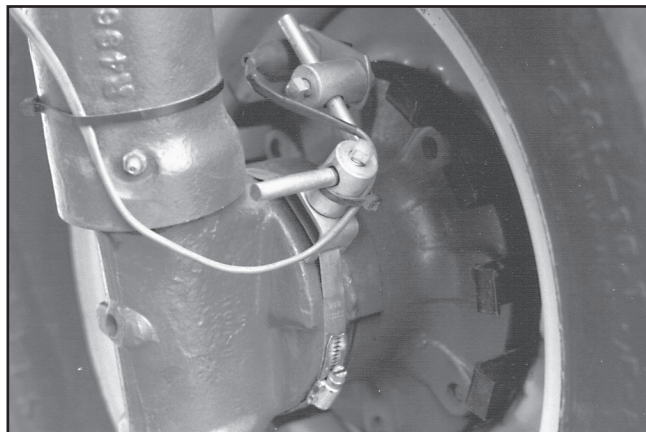
Refer to drawing 123. Place the hub disk onto the hub with the fingers facing as shown in Figure A.

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

FIGURE A

HUB DISC

FIGURE B

SET SCREW

SENSOR BRACKET

"L" ROD

WHIZ BOLT

SET SCREW

WHIZ BOLT

HOSE CLAMP

FIGURE D

CONSOLE

HUB SENSOR

10 FT CABLE   20 FT CABLE

FIGURE C

1/2 INCH OR MORE

DISC FINGER

1/4 INCH MAXIMUM AIR GAP

NYLON NUTS   SENSOR

SENSOR BRACKET

DWG. NO. 123

2 1/4   9 3/8 O.D.   7 11/16 I.D.   4 11/16

5-6 BOLT

2 1/4   11 1/4 O.D.   9 13/16 I.D.   6 5/8

8 BOLT

2 1/4   11 1/4 O.D.   9 13/16 I.D.   4

4 BOLT

1"   16 11/16 O.D.   14 3/4 I.D.   8 15/16

10 BOLT
(2 PIECES SHOWN)

1"   13 1/8 O.D.   10 7/8 I.D.   6 1/16

8 BOLT SPECIAL
(2 PIECES SHOWN)

DWG. NO. 5800

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 8160 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 8160 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).

TO CONSOLE
SPEED (DISTANCE) INPUT

363-008-003

RADAR

DWG. NO. 2750

TO CONSOLE
SPEED (DISTANCE) INPUT

363-008-006
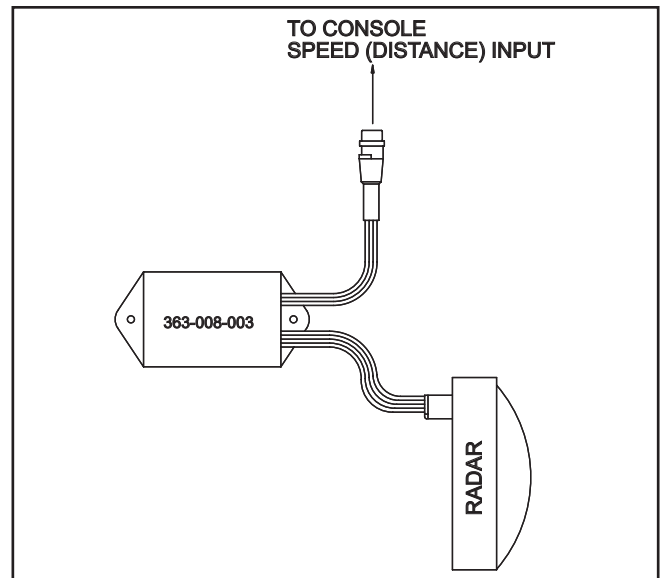
RADAR

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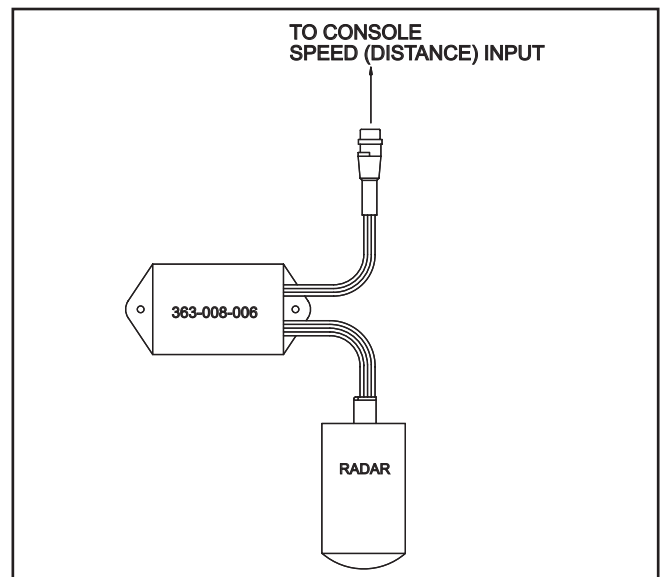
Adapters # 38828009 and # 38828010 are for interfacing to optional radar connections inside the cab. Only plug one of the Y-connectors to the optional radar connector. The other is used for expansion to another system.

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.

ADAPTIVE INTERFACE
360-208-001

#38828009
ADAPTER 2 PIN METRI-PACK

#38828010
ADAPTER 7 PIN AMPHENOL

#388-208-006
FORD ADAPTER

#388-208-002
PACKARD ADAPTER

#388-208-003
AMP C.P.C. ADAPTER

#388-208-004
CANNON SURESEAL ADAPTER

#388-208-005
UNIVERSAL SPLICE ADAPTER

#38828007
4 PIN DEUTSCH ADAPTER

#38828008
6 PIN DEUTSCH ADAPTER

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.

DWG. NO. 5222B

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 8160 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 8160 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.

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

DWG. NO. 1279
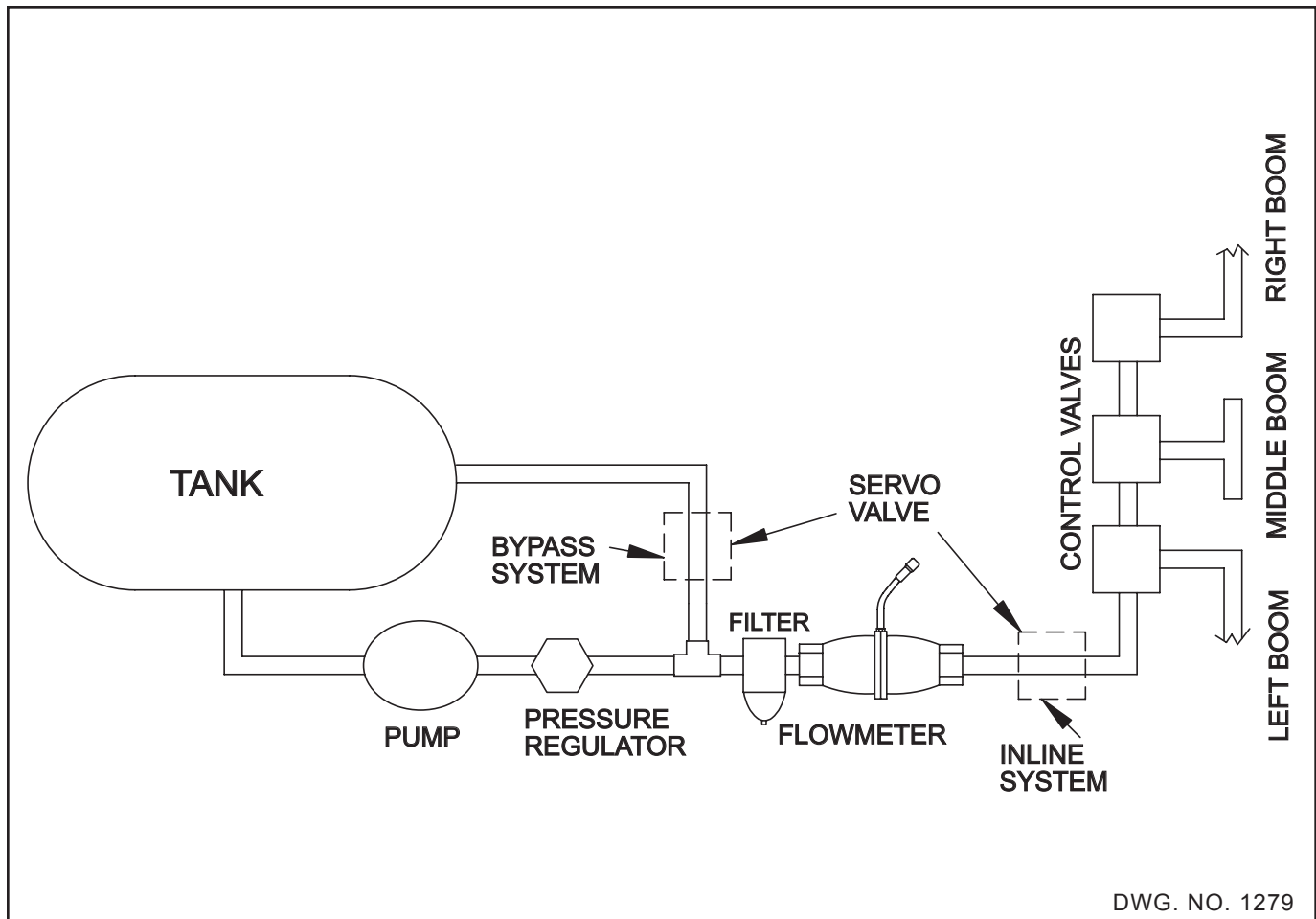
INLINE SYSTEMS

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 GAL-LONS PER MINUTE. THERE IS NO CONTROL-LING BELOW THIS RATE. FOR VERY LOW FLOW RATES A "BYPASS INSTALLATION" IS RECOMMENDED.

DWG. NO. 5799
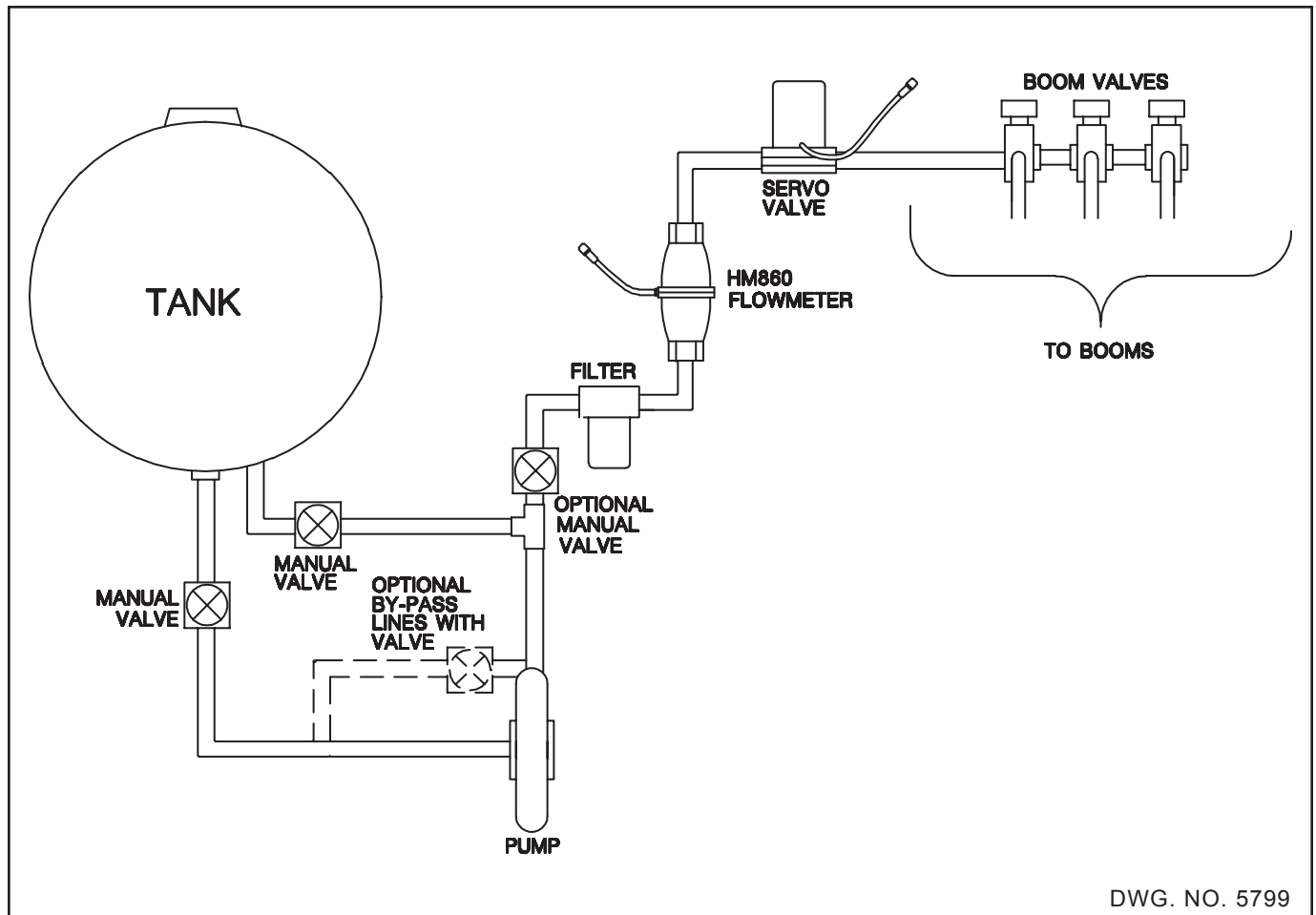
BYPASS SYSTEMS

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 by-pass 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.

DWG. NO. 5803
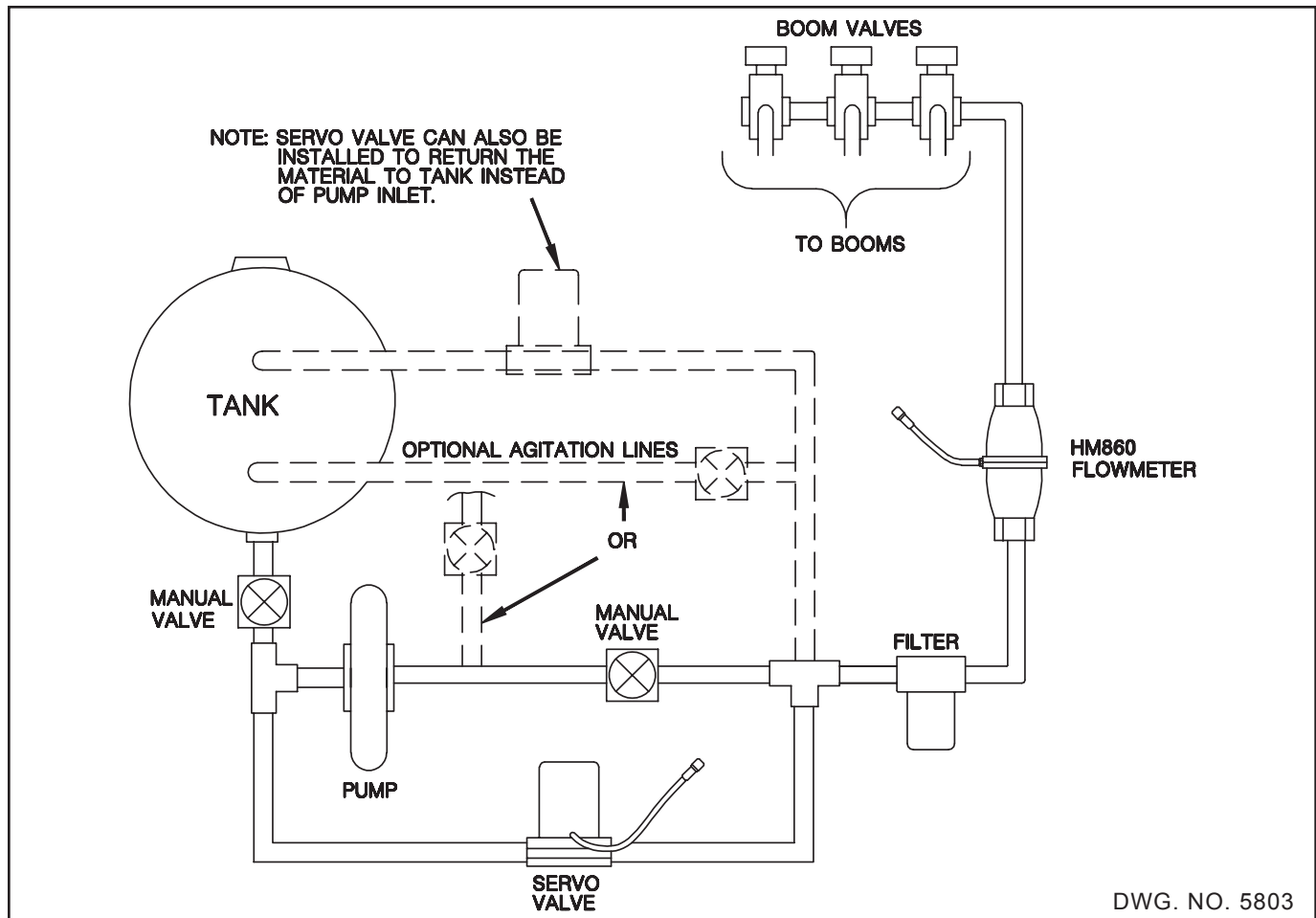
8160 TYPICAL WIRING — SPRAY APPLICATION
8160 CONSOLE

3 CONDUCTOR
BATTERY CABLE
15' 388-003-042

FUSE

12 V

BATTERY

2 CONDUCTOR
RUN/HOLD
EXTENSION CABLE
6' 38816012
10' 388-003-006
20' 38815018

3 CONDUCTOR
SPEED
EXTENSION CABLE
6' 38816011
10' 388-003-003
20' 388-003-020

7 CONDUCTOR
BOOM
EXTENSION CABLE
6' 38815026
10' 38815015
20' 38815016

3 CONDUCTOR
FLOWMETER
EXTENSION CABLE
6' 38816008
10' 388-003-004
20' 388-003-008

HM 860

3 CONDUCTOR
SERVO
EXTENSION CABLE
6' 38816009
10' 388-003-040
20' 388-003-041

2 CONDUCTOR
REMOTE RUN/HOLD
EXTENSION CABLE
6' 38816012
10' 388-003-006
20' 38815018

7 CONDUCTOR
BOOM HARNESS
BALL VALVES
38815017

3 PIECE
3-PIN MATING
CONNECTOR KIT
W/WIRES
36015006

3 CONDUCTOR
SPEED SENSOR
CABLE
12" 363-003-120
20' 363-003-020

SERVO
VALVE

(1) MATING CONN.
3 PIN WEATHER PACK
36028004

MOTORIZED
BALL VALVES

SOLENOID VALVES

HUB PLATE SPEED SENSOR
*NOTE: OTHER SPEED OPTIONS AVAILABLE

2 CONDUCTOR
REMOTE RUN/HOLD
CABLE
12" W/SWITCH 38815020
12" W/PROX SENSOR 38815019

REMOTE
RUN/HOLD

2 CONDUCTOR
REMOTE RUN/HOLD
CABLE
12" W/SWITCH 38815020
12" W/PROX SENSOR 38815019

DWG. NO. 5931

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."

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 Teflon pipe sealant tape on all pipe connections. Check all hoses and fittings for slag or contamination prior to assembly. Slag and pipe sealant (tape) are a major cause of flowmeter problems.

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 console receptacle labeled "Flow."
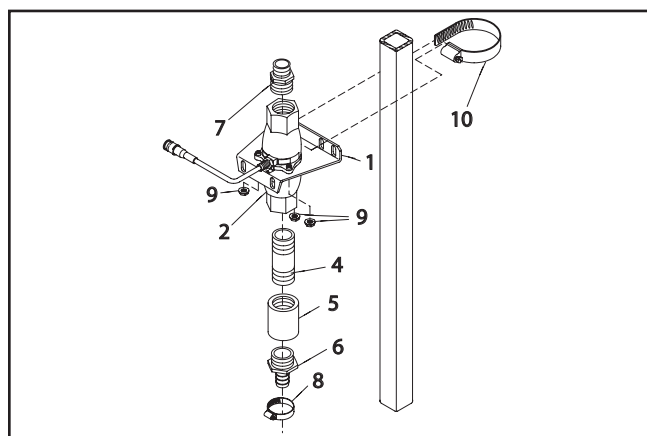
DWG. NO. 2729

SERVO VALVE:

The Servo Valve is a motorized Butterfly control valve that is used to control the flow in the system as directed by the console.

There are two kinds of servo valves, the 3-wire servo and the 2-wire servo valve. They both have the same 3-pin connector but the 2-wire only uses pins 2 and 3. The 3-wire valve uses the feedback from pin 1 to keep the valve in the proper quadrant (1/4 turn). The 2-wire does not have feedback to tell the console when it is full open or full closed. The switches on the valve will cause it to only operate from full closed to full open.

For use with the 8160 the valves are interchangeable.

The 2-wire valve is compatible with most precision farming systems; the 3-wire is not.

There are three valve sizes. The standard servo valve has a 1 inch female NPT on each end. A low flow 3/4 inch servo has a 3/4 inch female NPT on each end. A 1 1/4 inch high flow servo valve has 1 1/4 inch female NPT on one end and 1 1/4 inch male NPT on the other end. Select the proper size for your application.

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 towards the top so it will limit the accumulation of rain and dirt.

The servo valve is stainless steel. Maximum operating pressure is 400 PSI.

NOTE: USE TEFLON PIPE SEALANT TAPE ON ALL PIPE CONNECTIONS. CHECK ALL HOSES AND FITTINGS FOR SLAG OR CONTAMINATION PRIOR TO ASSEMBLY. SLAG AND PIPE SEALANT (TAPE) ARE A MAJOR CAUSE OF FLOWMETER PROBLEMS.

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 mounted in by-pass.

Reducing bushings may be used however, keep the bypass line as big in diameter as possible. Using a 1 inch line may severely limit the effective range of the servo valve.

If the Servo Valve is mounted in an existing by-pass 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.

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 8160 console. 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.
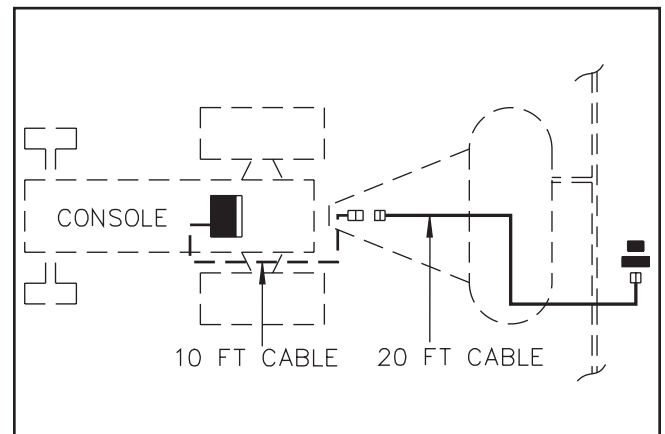
DWG. NO. 111

Boom Valve Connections

The "Ball Valve" Cable is for connecting to three three-wire ball valves. It has three 3-pin Weatherpack connectors for connecting to three motorized ball valves. It also contains the 2-pin connector for the Remote Run/Hold Switch or sensor.

Refer to drawing 5933 for proper connections. The control wire colors are Green (Left), Yellow (Center), and Blue (Right). Power is removed from these wires when the console is in the Hold Mode. The Black/White wires are the grounds, which are supplied through the console. The Red/White wires are connected directly to the battery through the console. The Red/White wires will always have 12 volts on them to allow the valves to close when the console is turned off.

The Weatherpack connectors will plug directly into 1AV-M valves from KZCO. Before making connections, check the wiring on your particular valve to see if it is wired the same. It may be necessary to re-pin or replace the connector for your type of motorized valve. The harness will work with all 3-wire valves that require 12 volts on the control wire to open the valve.

A boom valve pigtail kit is available for converting from the boom connector to individual wires. This allows for a custom connection to other type valves.

NOTE: if using a swath control system refer to the information on swath control in the appendix.

DWG. NO. 5933
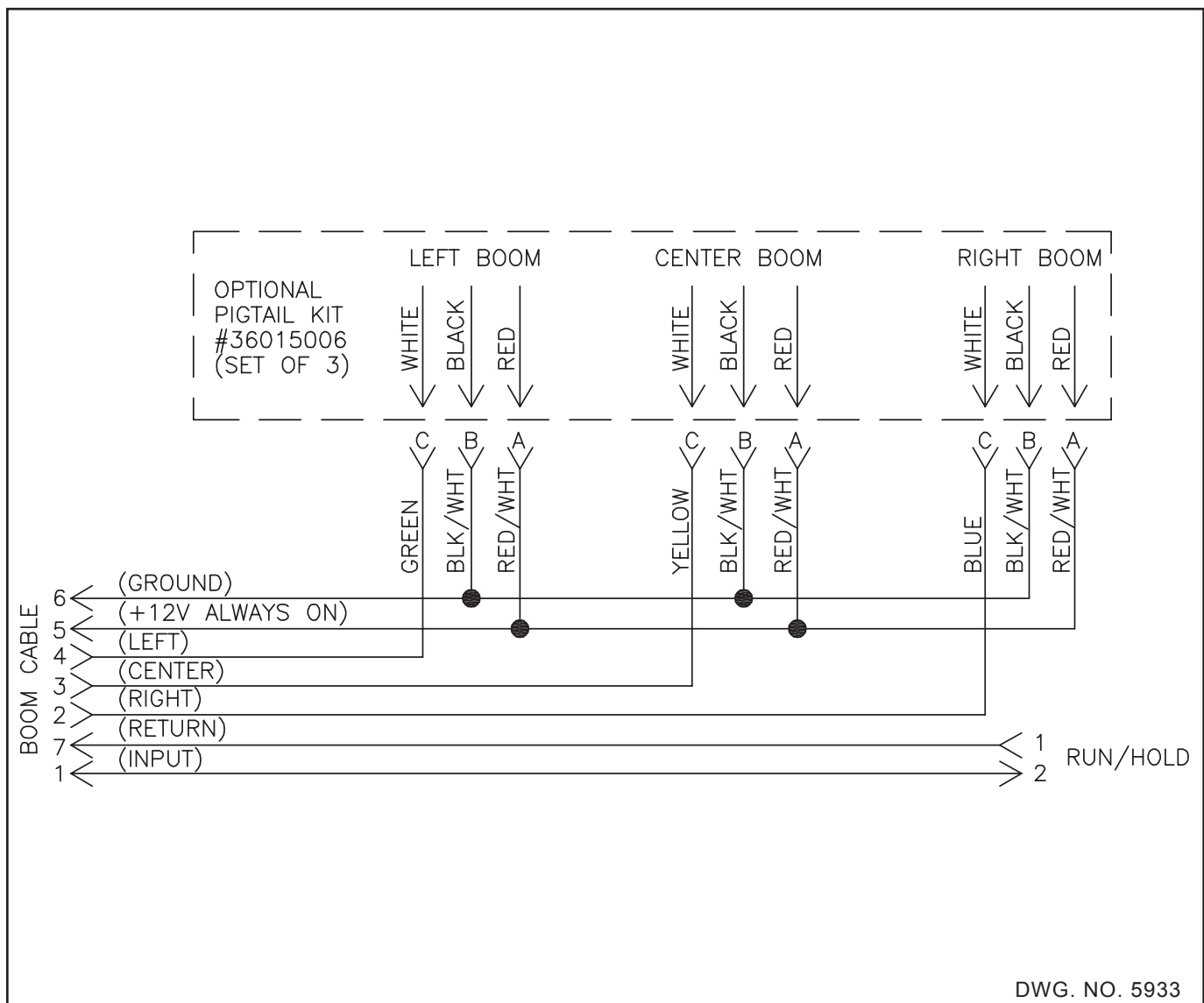
Remote Run/Hold

The remote Run/Hold is available at the console and at the end of the boom control cable. It consists of a 2-pin connector. Pin 1 is ground and pin 2 is the input.

A normally closed switch may be connected and positioned so that it will be activated when you want the console to go into Hold. Refer to drawing 5827 for a typical application.
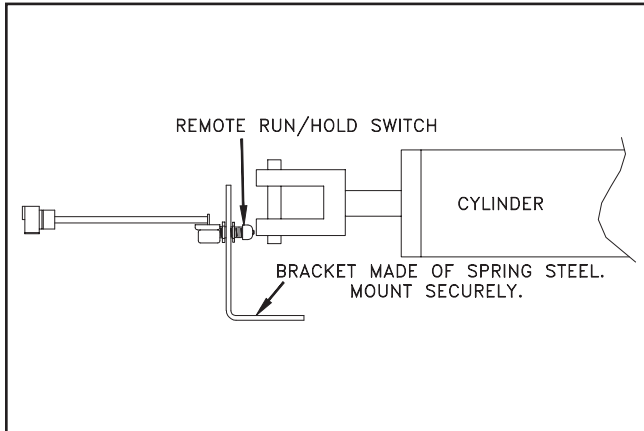
DWG. NO. 5827

A proximity sensor may be used instead of the switch. The console will go into Hold when metal is present near the face of the sensor.

Refer to drawing 5828 for proper installation dimensions.
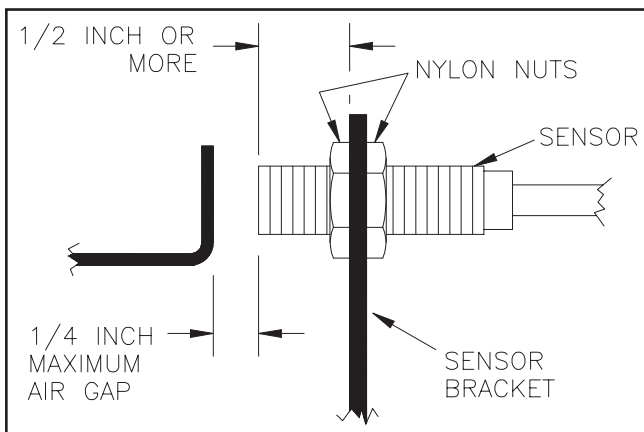
DWG. NO. 5828

Before using the Remote Run/Hold it first must be enabled. This is done during the Set-Up Procedure.

⚠ 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.

INSTALLATION - ANHYDROUS AMMONIA

INTRODUCTION

⚠ **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 number 360-000-246 Revision E or later for heat exchanger manufactured prior to 2007. These are painted gray. Or, refer to manual part number 39300035 for heat exchanger manufactured in 2007 or after. These are painted white.**

Refer to the proper "HINIKER ANHYDROUS AMMONIA MONITORING AND CONTROL SYSTEM MANUAL" for Installation of Anhydrous Ammonia systems. Refer to this manual for installing the Console, 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 console must be switched to Hold whenever the Anhydrous is turned off.

If not using the remote run/hold feature, it must be disabled during the NH3 set-up procedure. A normally closed switch or the proximity sensor may be used to activate the run/hold operation. Refer to drawing 5789 for connections.

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 activate the switch when turned OFF See drawing 2756 below. The run/hold switches is shown. A proximity sensor may also be used.
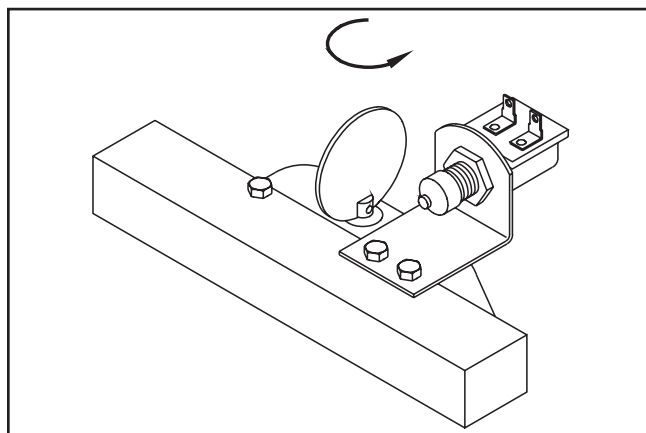
DWG. NO. 2756

8160 TYPICAL WIRING — NH3 APPLICATION

8160 CONSOLE

3 CONDUCTOR
BATTERY CABLE
15' 388-003-042

2 CONDUCTOR
RUN/HOLD
EXTENSION CABLE
6' 38816012
10' 388-003-006
20' 38815018

FUSE

12 V
BATTERY

3 CONDUCTOR
FLOWMETER
EXTENSION CABLE
6' 38816008
10' 388-003-004
20' 388-003-008

HM 860

3 CONDUCTOR
SPEED
EXTENSION CABLE
6' 38816011
10' 388-003-003
20' 388-003-020

3 CONDUCTOR
SERVO
EXTENSION CABLE
6' 38816009
10' 388-003-040
20' 388-003-041

3 CONDUCTOR
SPEED SENSOR
CABLE
12" 363-003-120
20' 363-003-020

SERVO
VALVE

HUB PLATE SPEED SENSOR
*NOTE: OTHER SPEED OPTIONS AVAILABLE

2 CONDUCTOR
REMOTE RUN/HOLD
CABLE
12" W/SWITCH 38815020
12" W/PROX SENSOR 38815019

REMOTE
RUN/HOLD

DWG. NO. 5789

TROUBLESHOOTING

Do not overlook the obvious. Check pump, solenoids, hoses, improper installation, etc.

The 8160 is easy to troubleshoot if you approach it in an organized manner. There are four primary parts. 1) The 8160 Console, 2) Speed Sensor, 3) Flowmeter, and 4) Servo Valve. Your main objective when troubleshooting is to isolate the problem and find out which of the four parts is defective.

The 8160 has been designed with internal protective circuitry. It protects the console 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 your Rate or % Error becomes erratic, one possible cause could be the servo valve is starting to require excessive current to operate. The console will begin to protect itself by limiting this current.

Extreme overheating of the console 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 Gallon 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 1 or RATE 2, then you can isolate the faulty sensor by testing other modes which depend upon only one of the sensors. Using the AREA or SPEED mode will test the speed sensor accuracy.

TROUBLESHOOTING CHART							
	SELECTED MODE	SPEED MPH	VOLUME TOTAL GALLON	AREA TOTAL ACRE	RATE GAL/ACRE	GPA% ERROR	RATE 1 OR RATE 2
Sensor Used	SPEED SENSOR	X		X	X	X	X
	FLOWMETER		X		X	X	X
Calibration Numbers Used	SPEED	X		X	X	X	X
	PULSES/GALLON		X		X	X	X
	BOOM WIDTH			X	X	X	X
	VALVE RATE				X	X	X

CONSOLE - SYMPTOMS

A. Is completely dead.

    1, 2, 3, 4, and 6.

B. Displays "Default In Use" each time console is turned on.

    3 and 4.

C. Displays HOLD or switches will not operate Boom valves.

    2, 4, 5, 7, and 8.

D. Displays "LOW MPH."

    2, 4, 6, 9, and 10.

E. Displays "LOW FLOW."

    2, 4, 6, 11, and 12.

F. Displays "OVER."

    4, 10, 12 and 19.

G. Gallons per acre inaccurate.

    2, 4, 8, 9, 10, 11, and 12.

H. Gallons per acre fluctuates excessively or RATE 1 or RATE 2 will not control normally.

    2, 4, 6, 9, 11, 13, 14, 15, 16, 17, and 18.

I. Acres inaccurate or does not count.

    2, 4, 5, 7, 8, 9, and 10.

J. Total gallons inaccurate or does not count.

    2, 4, 5, 7, 11, and 12.

K. GPA% ERROR reading fluctuates plus or minus by more than 10%, or GPA% ERROR continually reads high or low by large percentage.

    2, 4, 6, 9, 11, 13, 14, 15, 16, 17, and 18.

L. Miles per hour inaccurate or reads 0.

    2, 4, 9, and 10.

POSSIBLE CAUSE

1. Battery voltage below 6 volts.

2. Bad cable.

3. Battery connections reversed or not connected directly to battery.

4. Defective console.

5. Remote RUN/HOLD question answered wrong.

6. Solenoid valve drawing too many amps.

7. Remote RUN/HOLD switch not functioning.

8. Boom width is not entered correctly, or boom switch is not turned on.

9. Speed sensor problem; see speed sensor troubleshooting.

10. Pulses/FT. calibration number not correctly entered.

11. Flowmeter problem; see flowmeter troubleshooting.

12. Flowmeter pulses per gallon not correctly entered.

13. Servo valve not functioning properly; see servo valve troubleshooting.

14. Valve rate adjusted too high or low.

15. Pump or pump hoses surging or sucking air.

16. Incorrect nozzle size, or driving too fast or too slow.

17. Target GPA is set beyond the range of your system.

18. During setup the "Inline System" question answered incorrectly.

19. Total gallons, or acres over 9999.

USING TEST INPUTS

The Test Input routine allows you to Test the Flow, Speed, and Run/Hold inputs of the console.

This routine gives you a convenient way of checking the cables and sensors along with the Flow, Speed, and Run/Hold inputs of the console. The routine is located in the Options menu. Refer to the TEST INPUT section on how to access each test routine. After selecting the input to be tested the console will do the following for each pulse received. Flash the light, sound the horn, and display the number of pulses received. The count may be cleared to zero by pressing the ⇩ key.

To test the sensors first activate the proper input to be tested then perform the necessary action to cause the sensor to output a signal. For Flow sensors start spraying or activate the sensor by passing a magnet over its face. For Speed sensors start driving or activate the sensor by passing a magnet over its face. For the Run/Hold sensor press the switch or pass a magnet over its face. The Run/Hold test routine will not cause the horn and light to stay on constantly while the switch is held activated. It will only give an indication (flash and beep) that the switch had been activated.

To locate the faulty component start testing at the sensor and work your way to the console. Use a good sensor or momentarily short pins one and two of the cable and check the console for an indication.

NOTE: If pin three (12 Volts) is accidentally shorted to pin one (Ground) the console will temporarily remove power from the Speed, Flow, and Servo connections to protect itself. To restore power shut off the console for a minute. Power should be available the next time the console is turned on.

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 servo cable.

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 console. Look for any cut, pinched, burned, or corroded wires which may be the source for the problem.

2. Check all connectors, including console connectors. Make sure all male pins are not bent, and are mating properly with the female socket. An indentation in the rubber next to the female socket is a good indication that the male pin is not aligned properly. Look for moisture, dirt, corrosion, etc., on the male pins or female 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 only has one female socket.

3. Check crimp connectors; the crimp connection in all connectors is where the wire is joined to the male pin or the female socket. Start by sliding the connector boot back to expose the wires (DWG. NO. 1290). 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.
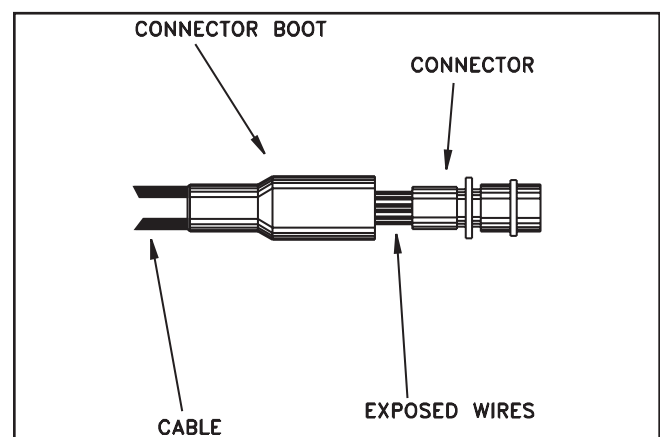
DWG. NO. 1290

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

CONSOLE/CABLE CONNECTORS

In the connector there are numbers stamped in the rubber next to each female socket and male pins. Each connector is listed on the next page. 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 connector is not twisted.

2 PIN CONNECTOR
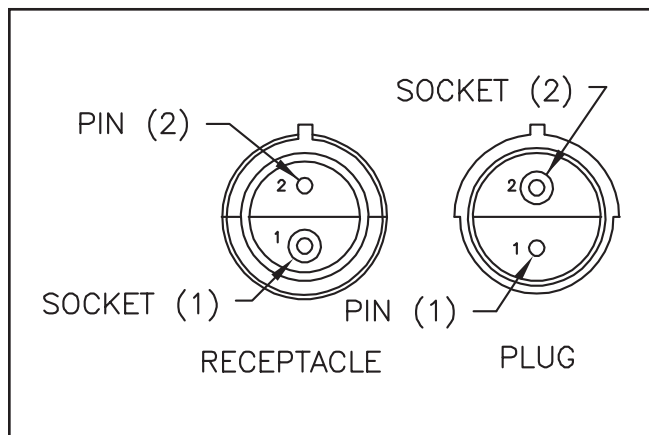
DWG. NO. 5823

3 PIN CONNECTOR
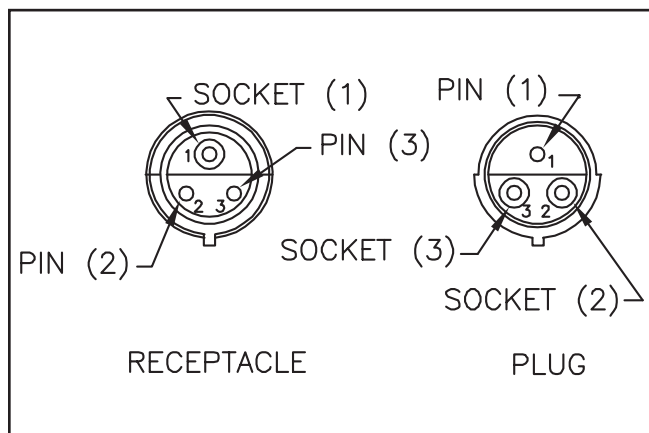
DWG. NO. 2763

7 PIN CONNECTOR
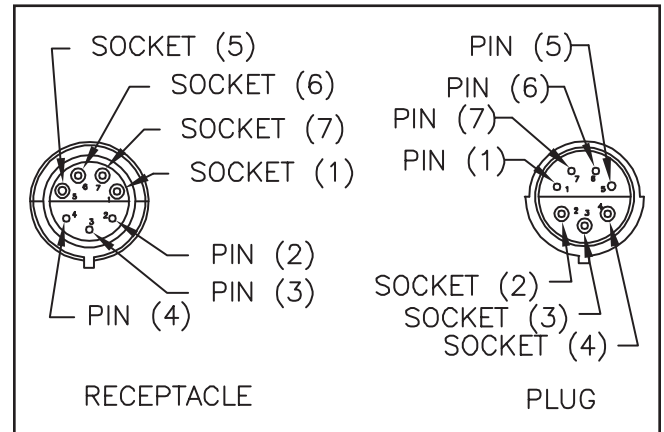
DWG. NO. 5837

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

SERVO VALVE CONNECTOR OR CABLE			
Pin or Socket Numbers	Console Cable Wire Color	Cable Wire Color	Description
1.	Tan	Black	Cam Switch, to sense if valve fully open or fully closed. Pin not used on 2-wire valve.
2.	Orange	White	Motor Terminal (-)
3.	Brown	Red	Motor Terminal (+)

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

BOOM VALVE CONNECTOR OR CABLE			
Pin or Socket Numbers	Console Cable Wire Color	Cable Wire Color	Description
1.	Pink	Orange	Run/Hold Input. Measures 5 Volts if Run/Hold Switch is disconnected.
2.	Blue	Blue	* Right Boom control 12 volt with switch on
3.	Yellow	Yellow	* Center Boom control 12 volt with switch on
4.	Green	Green	* Left Boom control 12 volt with switch on
5.	Red/Wht	Red	12 Volt (Always On) for Ball Valves
6.	Blk/Wht	Brown	Ground (high current)
7.	Black	Black	Run/Hold Return (ground)

RUN/HOLD CONNECTOR OR CABLE			
Pin or Socket Numbers	Console Cable Wire Color	Cable Wire Color	Description
1.	Black	Black	Run/Hold Return(Ground)
2.	Pink	Green	Run/Hold Input. Measures 5 Volts

7-PIN TO 4-PIN ADAPTER CABLE			
Pin or Socket Numbers	Console Cable Wire Color	Cable Wire Color	Description
1.	Pink	Pink	Run/Hold Input. Measures 12 Volts if Run/Hold Switch is disconnected.
2.	Blue	Blue	* Right Boom control 12 volt with switch on
3.	Yellow	Yellow	* Center Boom control 12 volt with switch on
4.	Green	Green	* Left Boom control 12 volt with switch on
5.	N/C		Not Used
6.	N/C		Not Used
7.	N/C		Not Used

* The console must be in the Run Mode for 12 volts to be supplied to the boom switches. Power is removed for the boom switches while in the Hold Mode.

HUB PLATE TYPE SPEED SENSOR TROUBLESHOOTING

The speed sensor is a very important component in the 8160 system. If the speed sensor is not functioning properly, it will have an adverse effect on the operation of the console. Rate per acre, miles per hour, acres, and percent error will all be inaccurate if the speed sensor is not functioning properly.

Make sure console is not in "HOLD". Check consoles speed calibration number and boom width. It is possible that the rolling circumference of the measuring wheel has changed due to a variation of field conditions or tire air pressure from the time it was originally calibrated.

Check the installation of the speed sensor. The sensor and bracket should be mounted very rigid. Sensor should be mounted through the holding bracket at least 1/2 inch. The sensor end should be no further away from the 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 8160 SPEED or RATE readout will fluctuate.

While traveling on a hard surface road at a constant speed the 8160's MPH should not vary by more than two tenths of a MPH. A loose wheel bearing could also cause fluctuating readouts.

If the speed sensor is still working intermittently, the sensor and cable should be thoroughly tested. Start by examining the sensor itself. Look for nicks, cuts, or scrapes on the sensor. If the sensor has been nicked hard or visibly worn on the end, it may need replacing.

The TEST SPEED input routine may be used to check for missing pulses or intermittent signals. Select the TEST SPEED routine under TEST INPUTS located in the OPTIONS menu. Drive forward slowly at a constant speed. The console will give an indication of each pulse received.

A speed simulator is built into the console. This can be used as an aid in troubleshooting or as a temporary speed signal replacement. This will allow you to continue with the application until the sensor or cable can be replaced.

The speed simulator is located in the options menu.

HM860 FLOWMETER

TROUBLESHOOTING

Make sure direction of flow (arrow on flowmeter) is correct.

Check flowmeter for debris slowing or stopping the turbine. For the flowmeter to measure accurately it must be kept very clean.

For application rates under 5 gallons per minute, the flowmeter should be mounted vertically with the flow going up.

Make sure the magnet on the turbine is positioned under the sensor.

Make sure the sensor is inserted fully into the meter.

Flowmeter operation may be affected by strong magnetic fields such as those created by motors and solenoid valves.

The TEST FLOW input routine may be used to check for missing pulses or intermittent signals. Select the TEST FLOW routine under TEST INPUTS located in the OPTIONS menu. Start spraying. The console will give an indication of each pulse received.

The HM860 flowmeter Sensor will output a pulse each time a pole on a magnet is passed over its face (sensors end).

To test, plug a known good sensor into the flow input or momentarily short pins one and two of the flow input.

Repeat the test working your way to the console until the faulty component is located.

NOTE: If pin three (12 Volts) is shorted to pin two (ground) the console will temporally remove power from the Speed, Flow and Servo connections to protect itself. To restore power shut off the console for a minute. Power should be available the next time the console is turned on.

MAINTENANCE

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.**

NOTE: Use Teflon pipe sealant tape on all pipe connections. Check all hoses and fittings for slag or contamination prior to assembly. Slag and pipe sealant (tape) are a major cause of flowmeter problems.

INLET
BUSHING
TURBINE
O RING
SENSOR
BEARING
OUTLET HOUSING
BUSHING
BEARING
DECAL
CALIBRATION
DWG. NO. 2767
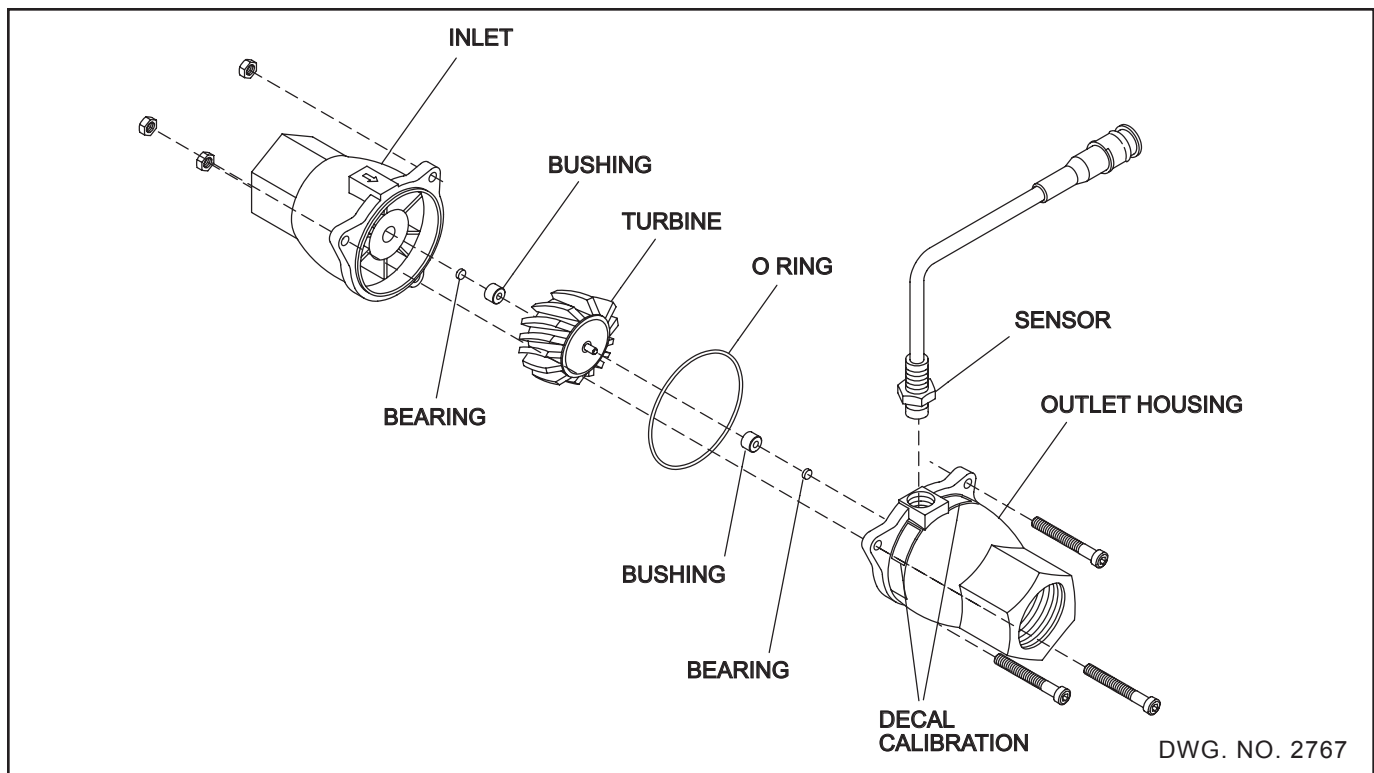
DISASSEMBLY

Refer to drawing 2767 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.

A. Go to the "Test Flow Input" test procedure. This routine is listed in the OPTIONS menu under Test Inputs. After answering yes (Y) to the "Test Flow" question press the SET key. The warning light will flash, the horn will beep, and the display will count for each pulse received from flow meter.

    Note: You can clear the count to zero by pressing the ⇓ key.

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, the 8160 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 and divide it by the amount of water pumped through the flowmeter into the calibrated tank. The result is the new PULSES/GALLON calibrate 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 SET-UP

SUPPLY TANK

PUMP

NO. 1 VALVE TO SET GPM

CALIBRATED TANK

FLOWMETER

NO. 2 ON/OFF BALL VAVLE

DWG. NO. 1280
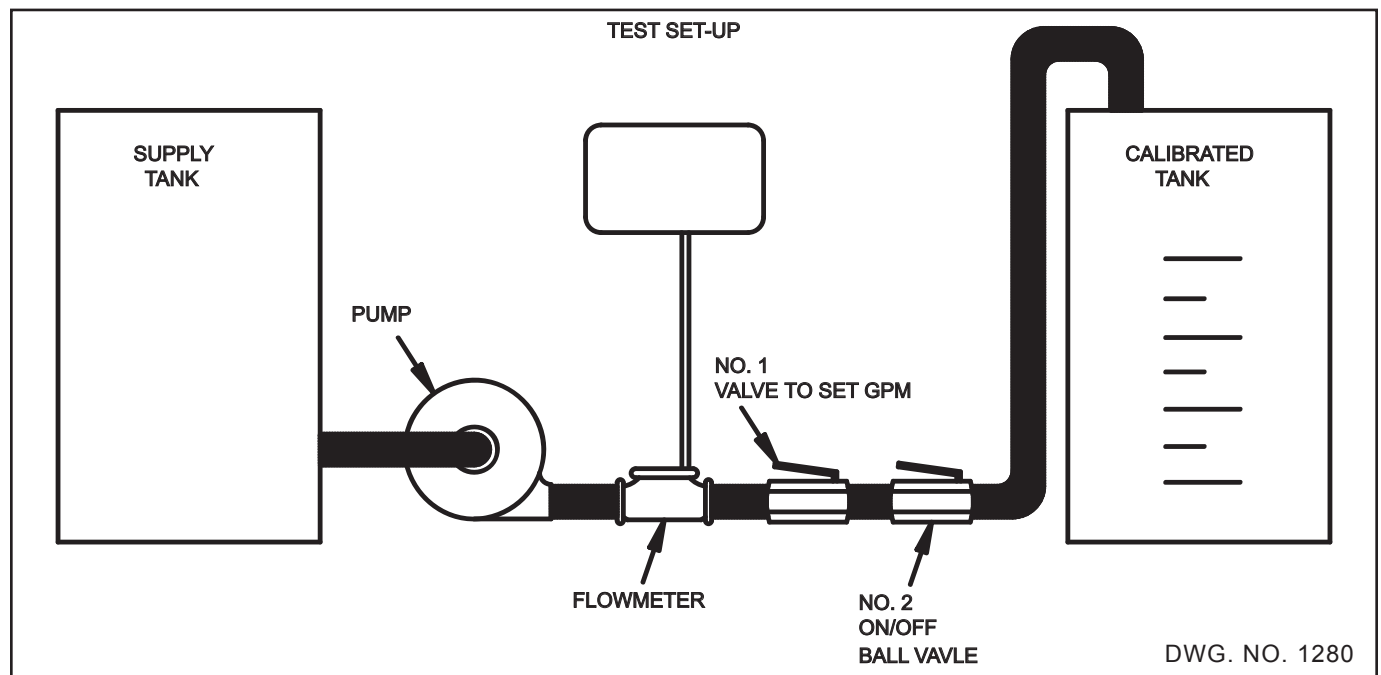
TEST SETUP

1. Set valve No. 1 for the GPM of the test. (Approximatly the same as application)

2. Stop flow with valve No. 2.

3. Select the "Test Flow Input Procedure".

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 above to determine the Pulse/Gallon.

SERVO BUTTERFLY VALVES

The servo valve does the actual controlling or adjusting of the flow mate. 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 8160 can still be used as a monitor by putting the RATE 1, RATE 2 switch in the MANUAL (center) position.

Make sure your cables are connected properly.

Check setup question "Inline system?" If the question was answered yes, then 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 or the input of the pump. In this case, the "⇧" key should CLOSE the valve to increase flow to the boom.

Check the valve response number. If the 8160 does not adjust the flow fast enough for speed changes, increase this number.

If the 8160 GPA readout fluctuates excessively, decrease this number.

The 8160 console applies a discontinuous positive voltage level (short pulses of voltage) to the gear motor. This causes the servo gear motor to run "jerky." With a voltmeter, check between cable connector pins 2 and 3 on the servo cable. You should get a readout of 1 to 8 volts when the RATE 1/MAN/RATE 2 switch is in the center (manual) position and the "⇧" or "⇩" key is depressed. If there is no voltage during this test, refer to Cable and Connector troubleshooting or the console could be defective. If there is voltage, and the motor does not turn the butterfly the motor may be burned out. There may be some-thing binding the butterfly or the set screws on the switch cam may be loose.

2- WIRE SERVO

The 2-wire servo valve only uses 2 and 3 on the servo cable. Unlike the 3-wire servo valve pin 1 is not used.

The 8160 discontinuous positive Voltage level to either pin 2 or 3 to operate the valve. The 8160 can vary the discontinuity times to vary the valve speed.

There are two switches that will keep the valve in one quadrant (1/4 turn of the valve).

There is no feedback (pin 1) to the 8160 to let it know if it is full open or full closed.

If the 8160 tries to increase the flow after the 2-wire servo has reached the full open position, the motor will stop, the 8160's %Error will increase, and the Rate reading will decrease.

NOTE: The following assumes the 8160 is setup for an "Inline System".

Normal operation is in the quadrant where the top switch is normally pressed and the bottom switch is normally released.

To see if the gear motor and position switches are functioning properly put the RATE 1/ MAN/ RATE 2 switch in the center (manual) position and press and hold the "⇧" key. This should drive the valve fully open. When the cam turns far enough to <u>deactivate</u> the <u>top</u> position switch, the servo gear motor should stop and the valve should be full open. If the valve does not stop when the switch is <u>deactivated</u>, the valve is in need of repair and should be repaired or replaced.

Now press and hold the "⇩" key. This should drive the valve fully closed. When the cam turns far enough to <u>activate</u> the <u>bottom</u> position switch, the servo gear motor should stop and the valve should be full closed. If the valve does not stop when the bottom switch is <u>activated</u>, the valve is in need of repair and should be repaired or replaced.

NOTE: If the valve has been dissembled or the motor has had power applied directly to its terminals, the valve may not be in the proper quadrant. Press and hold the "⇧" key until it stops rotating (less then 1 revolution). It should now operate as explained in the previous paragraph.

2-WIRE SERVO DIAGRAM

+ ON WHITE WIRE CLOSES VALVE
SW2 CHANGES TO NO WHEN FULLY CLOSED

CONDITION	SW1	SW2	REMARKS
FULL OPEN	NC	NC	CLOSE ONLY SW1,2 RELEASED
OPERATING	NO	NC	OPEN/CLOSE SW1 PRESSED SW2 RELEASED
FULL CLOSED	NO	NO	OPEN ONLY SW1,2 PRESSED

+ ON RED WIRE OPENS VALVE
SW1 CHANGES TO NO WHEN FULLY OPEN

DWG. NO. 6652
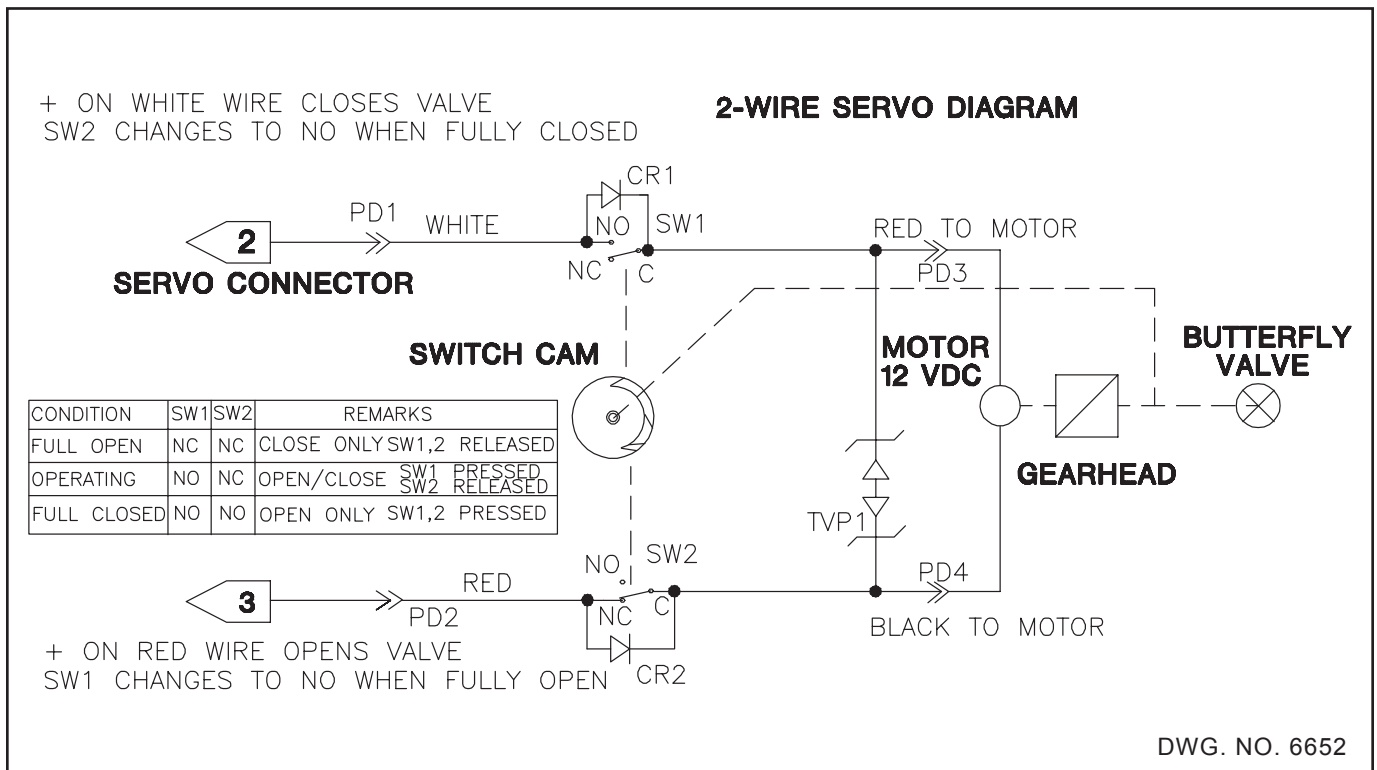
TESTING MOTOR

To check the Motor, first disconnect the valve from the 8160, and then apply 10 to 12 volts to the terminals on top of the motor (any polarity). The motor should drive as long as you apply voltage to it. Reverse polarity, and the motor should drive the opposite direction. Normal current is less than 1/2 amp. Anything drawing up to 1 amp may need replacing. Replace any motor drawing more than 1 amp current.

NOTE: To test in both directions, reverse leads to motor.

NOTE: Failure to disconnect the servo valve from the 8160 prior to applying voltage directly to the motor may cause permanent failure of the 8160 console.
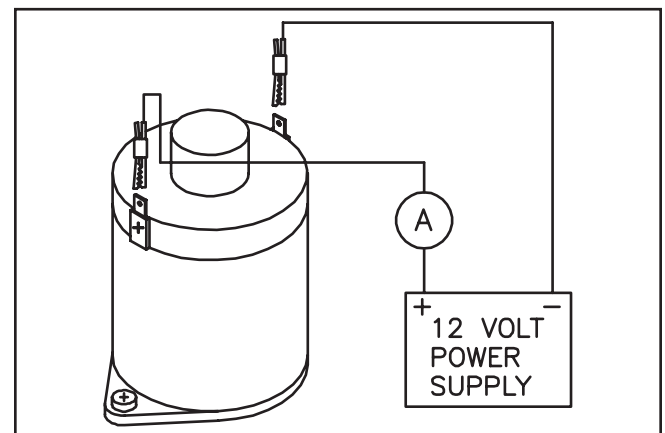
FIGURE 1   DWG. NO. 2030

A = Ampmeter

3-Wire Valve

To see if the gear 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 "⇧" or "⇩" key. This should drive the valve in one direction. When the switch cam turns far enough to activate the position switch, the servo gear motor should stop its positive direction of travel and oscillate back and forth. 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 "⇧" and "⇩" key. If the valve only responds to one of the keys, refer to "Testing Motor". If the motor turns both directions and only one direction with the console or wiring, the console should be repaired.

The servo diagram indicates how the valve operates. At least one motor drive input (connector pins 2 or 3) is always negative. The diodes steer this negative level to the position switch. The output voltage level of the position switch is determined by which quadrant the butterfly disc is in.

This quadrant information enables the servo controller to determine the required motor drive polarity. The 8160 applies a discontinuous positive voltage level to either pin 2 or 3 to operate the valve. The 8160 can vary the discontinuity times to vary the valve speed.

DWG. NO. 2768B
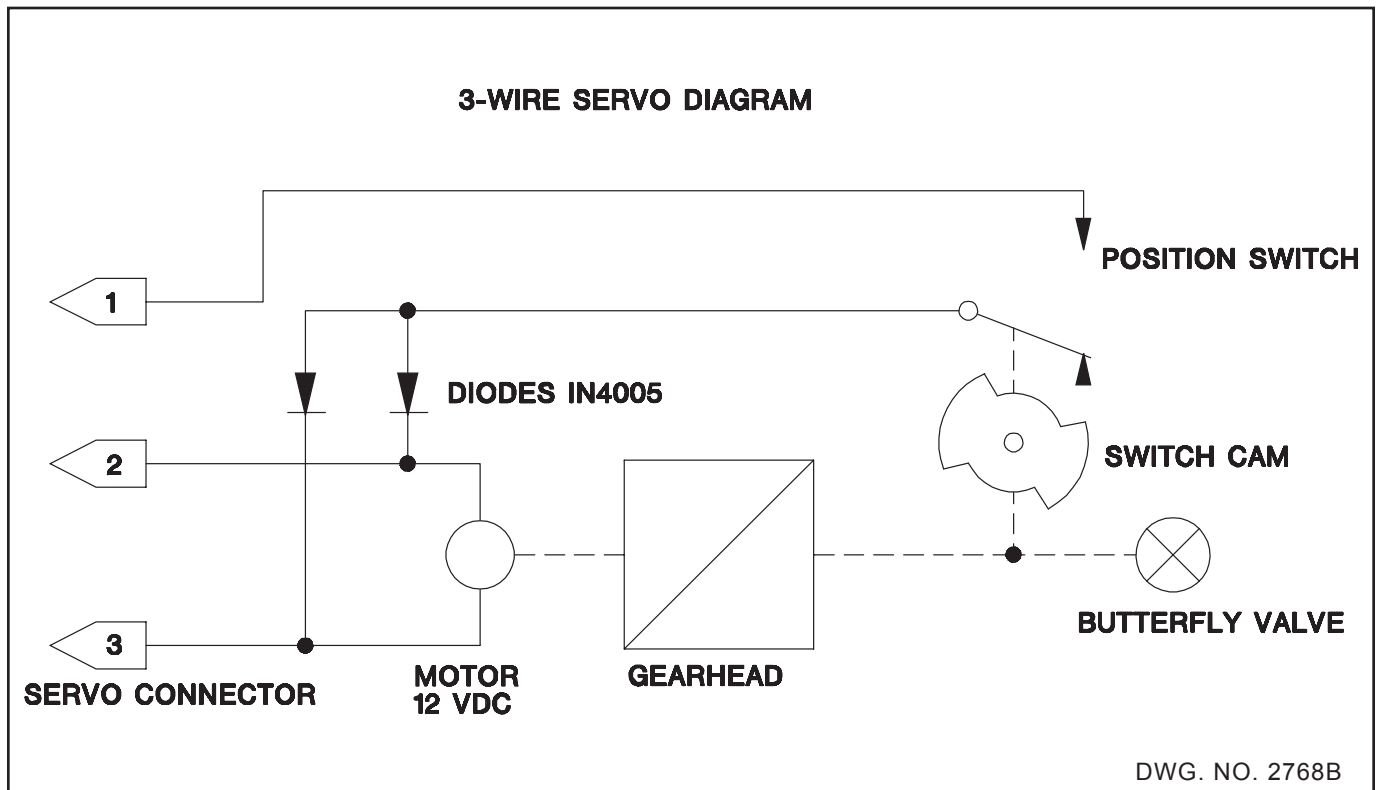
Remote Run/Hold

⚠ **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.**

Before using the Remote Run/Hold feature it first must be enabled. The on/off control for the Remote Run/Hold is located in the Options menu. Press the ⇧ key to change the "USING REMOTE RUN/HOLD? N" question to "Y" then press SET. The default setting for the Remote Run/Hold feature is "off" for both Spray and NH3 modes.

With the Remote Run/Hold feature enabled the console will go into Hold when the switch is pressed. With the Remote Run/Hold disabled the console ignores the switch.

The Remote Run/Hold is available at the console and at the end of the boom control cable. Only one of these connections should be used at a time. It consists of a 2-pin connector. Pin 1 is ground and pin 2 is the input.

If a normally closed switch is connected it must be positioned so that it will be activated when you want the console to go into Hold. Refer to drawing 5827 for a typical application.

If a proximity sensor is being used instead of the switch then the console will go into Hold when metal is present near the face of the sensor.

Refer to drawing 5828 for proper installation dimensions. These dimensions must be adhered to or the sensor will not work properly.

The 8160 has a routine that will help you locate the faulty component. This routine is listed in the OPTIONS menu under Test Inputs. After answering yes (Y) to the "Test R/H" question press the SET key. The warning light will flash, the horn will beep, and the display will count for each R/H pulse received. The count may be cleared by pressing the ⇩ key.

NOTE:. The Run/Hold test routine will not cause the horn and light to stay on constantly while the

switch is activated. It will only give an indication (flash and beep) that the switch had been activated.

The display will show whether you have the Remote Run/Hold disabled or not. If it is disabled then this is probably the problem. The console ignores the Remote RUN/HOLD if it has been disabled. It can be enabled during the Set-up procedure.

The Proximity Sensor will output a pulse each time ferrous metal is passed over its face (sensors end). The Switch will output a pulse each time it is momentarily pressed.

To test the console, plug a known good sensor into the Run/Hold input at the console or momentarily short pins one and two of the Run/Hold input.

If the console counts properly, plug a good sensor into the sensor connection. Each time it has a magnet passed across its face or the switch is momentarily pressed it should count one. Repeat the test working your way to the console until the faulty component is located.
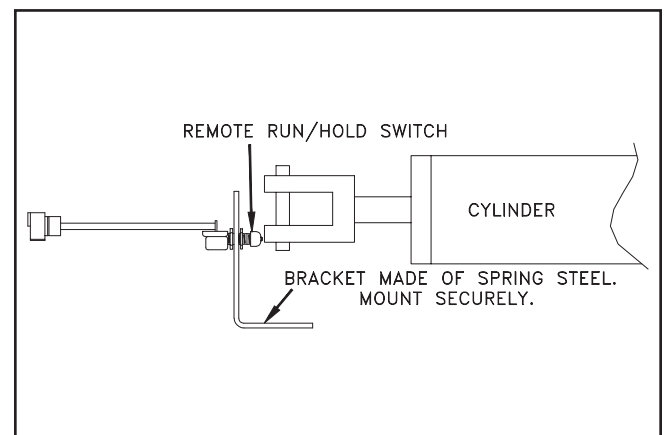
DWG. NO. 5827
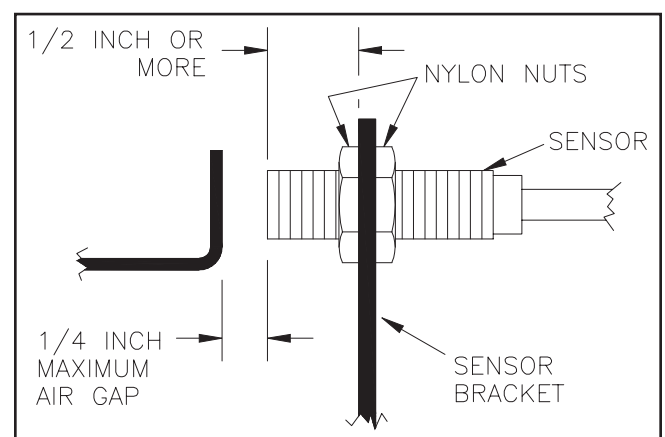
DWG. NO. 5828

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 PROTOCOLS

There are two serial protocols available with the 8160. The "HINIKER" protocol is our original serial communication standard. The "GENERIC" protocol was developed to easily allow the 8160 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 over write 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 8160 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 Snap Shot 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 8160 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 8160 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 8160 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 8160 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 8160 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 8160 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 8160 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 8160 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 8160 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 8160 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 8160 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 8160 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.

8160 CONSOLE OUTPUT STRINGS

All console output strings begin with $R035J

C1 Calibration String (C1)
The C1 calibration string contains boom switch status, boom width, and speed calibration number information.

Format:
$R035J,C1,<switch_byte_1>,<switch_byte_2>,<boom_1_cal>,<boom_2_cal>,<boom_3_cal,<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 through 3 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.
Left Boom = Boom1, Center Boom = Boom2, and Right Boom = Boom3.

Format:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	But 2	Bit 1	Bit 0
1	0	0	0	0	B3	B2	B1

<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:
$R035J,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:
$R035J,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:
$ R 0 3 5 J , D 1 , < t o t a l _ a r e a > , < f i e l d _ 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 8160

D2 Data String (D2)
The D2 data string contains total volume and field volume information.

Format:
$ R 0 3 5 J , D 2 , < t o t a l _ v o l u m e > , < f i e l d _ 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 8160.

D3 Data String (D3)
The D3 data string contains tank volume and distance information.
Format:
$R035J,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:
$R035J,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:
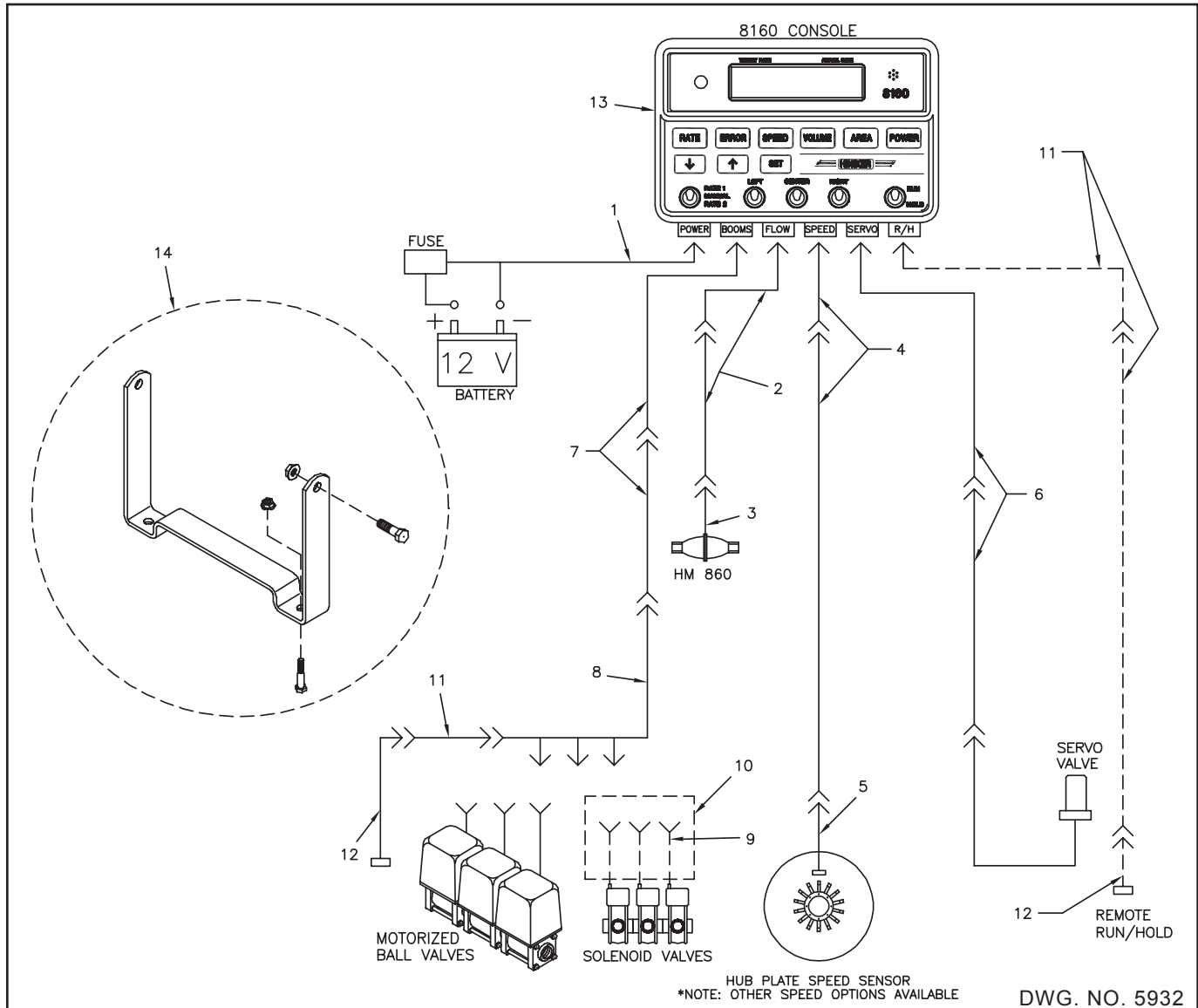$R035J,TD,<hr:min>,<month/day/year>,<field_reference><CR><LF>

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.

PARTS BREAKDOWN

8160 CONSOLE

FUSE

12 V
BATTERY

HM 860

MOTORIZED
BALL VALVES

SOLENOID VALVES

HUB PLATE SPEED SENSOR
*NOTE: OTHER SPEED OPTIONS AVAILABLE

SERVO
VALVE

REMOTE
RUN/HOLD

DWG. NO. 5932

REF. NO.	PART NUMBER	DESCRIPTION	QTY.	REF. NO.	PART NUMBER	DESCRIPTION	QTY.
1	388-003-042	15 Ft. 3 conductor Battery cable with fuse	1	10	36015006	3-pin mating connector w/ wires Kit of 3	A/R
	38815023	6 Ft. 3 conductor Battery cable w/ Amp convenience plug for in-cab connection	1	11	38816012	6 Ft. 2 conductor Run/Hold extension cable	A/R
					388-003-006	10 Ft. 2 conductor Run/Hold extension cable	A/R
2	38816008	6 Ft. 3 conductor Flowmeter extension cable	A/R		38815018	20 Ft. 2 conductor Run/Hold extension cable	A/R
	388-003-004	10 Ft. 3 conductor Flowmeter extension cable	A/R	12	38815020	N/C Switch w/ 12 Inch 2-pin plug	1
	388-003-008	20 Ft. 3 conductor Flowmeter extension cable	A/R		383-101-007	N/C Switch only	1
3	363-004-010	HM860 Flowmeter Sensor	1		38815019	Proximity Sensor w/ 12 Inch 2 -pin plug	1
4	38816011	6 Ft. 3 conductor Speed extension cable	A/R	13	36015005	8160 console only	1
	388-003-003	10 Ft. 3 conductor Speed extension cable	A/R		8169	8160 Console, Manual, and 7 to 4-pin boom adapter. Replaces Spray Commander, 8100 or 8150 console. Use existing wiring	1
	388-003-020	20 Ft. 3 conductor Speed extension cable	A/R				
5	363-003-020	Speed Sensor w/ 20 Ft. 3 conductor cable	1				
	363-003-120	Speed Sensor w/ 12 Inch 3 conductor cable	1		38815014	(Not Shown) 7-pin to 4-pin Boom cable adapter. Required when using Spray Commander, 8100 or 8150	1
6	38816009	6 Ft. 3 conductor Servo extension cable	A/R				
	388-003-040	10 Ft. 3 conductor Servo extension cable	A/R				
	388-003-041	20 Ft. 3 conductor Servo extension cable	A/R		393-002-089	(Not Shown) Cable Decal Kit: 4 each; Speed, Flow, Boom, Run/Hold, Servo 2 each; Power, 1 each; Bat (-), Left, Center, Right	A/R
7	38815026	6 Ft. 7 conductor Boom extension cable	A/R				
	38815015	10 Ft. 7 conductor Boom extension cable	A/R				
	38815016	20 Ft. 7 conductor Boom extension cable	A/R				
8	38815017	7 conductor Boom harness w/ connectors	1	14	363-006-007	Console Mounting Bag	1
9	36028004	3-pin mating connector only (single)	A/R				

SWATH CONTROL

The 8160 controller can be used with external devices such as light bars that use swath control to turn each boom section valve on and off.

If connected as shown below the 8160 will perform the application control while the swath control will be in control of the boom sections.

The 8160 considers a boom valve "on" if it has 12 volts applied to the control wire.

Connect the control valve wiring (Power, Ground, and Control) as instructed in the Swath Controller Manual. Connect the 3 control wires from the 8160 Boom cable to the valves along with the control lines from the swath control unit. The remaining wires from the boom cable will not be connected.

For the 8160 to work, all boom switches on the 8160 must be in the off position. When connected in this way the 8160 senses the state (On/Off) of each boom section valve.

If all section valves are off, the Hiniker console will be in Hold. The 8160 will operate as if it were controlling the boom section valves.

Any Remote Run/Hold should be accomplished through the swath control device. The 8160 will go into Hold when sensing that all booms are off. A Remote Run/Hold connected directly to the Hiniker console will not turn the section valves off when the console goes into Hold. The same holds true when putting the Run/Hold switch on the 8160 into the Hold position. Leave the Run/Hold switch on the Hiniker console in the Run position and the boom switches off.

DWG. NO. 6655
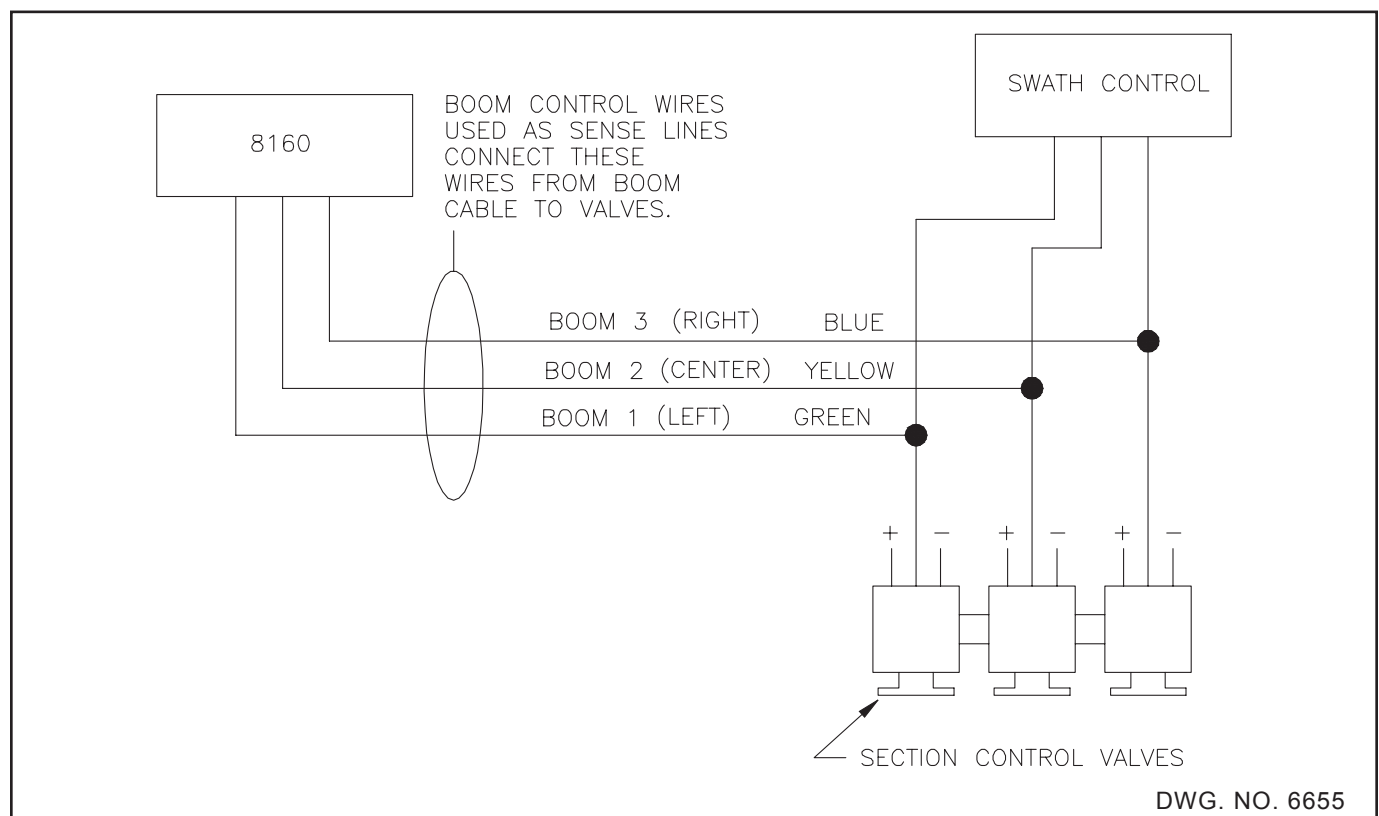
GENERAL INFORMATION

HOW TO MAKE CHEMICAL APPLICATION PRECISE AND COST EFFECTIVE

Proper chemical application is crucial. Applied uniformly and at the correct rate, you can count on excellent weed control without damage to the crop. Applied incorrectly and at an uncontrolled rate, you can count on added chemical expense, potential crop damage and greater weed competition.

OVER APPLICATION

In a typical situation, over application can be as much as 30%. With the cost of chemicals increasing constantly each year, it's getting even more expensive to over apply.

UNDER APPLICATION

Here too, the application rate can be off as much as 30%. Poor weed control results and yields are cut substantially. Tests have proven that a single extra weed every 128 feet in a row of grain sorghum, for instance, can reduce yields by 5%.

To help increase your application efficiency and assure maximum results, the Hiniker Company has published the following guidelines and special instructions.

WHAT DETERMINES GALLONS PER ACRE?

SIZE OF NOZZLE TIPS AFFECT G.P.A.
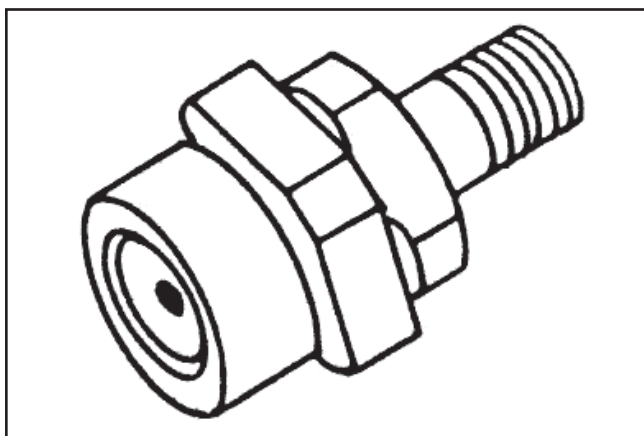
A 20 gallon per acre nozzle allows .3 gallons per minute at 40 pounds pressure.

A 40 gallon per acre nozzle allows .6 gallons per minute at 40 pounds pressure.

NOZZLE SPACING AFFECTS G.P.A.
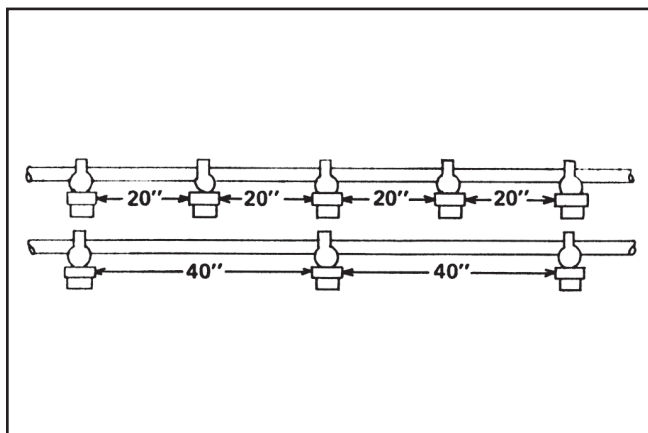
20 GPA nozzles spaced 20 inches apart will apply 20 gallons per acre. Spaced 40 inches apart, 10 gallons per acre.

PRESSURE AFFECTS G.P.A.
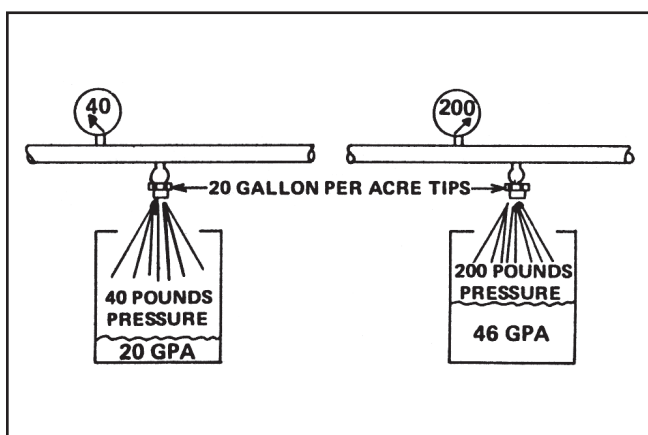
When you increase pressure, you increase nozzle output. Double nozzle output increases pressure four times. Too much pressure also causes drifting.

TRACTOR SPEED AFFECTS G.P.A.

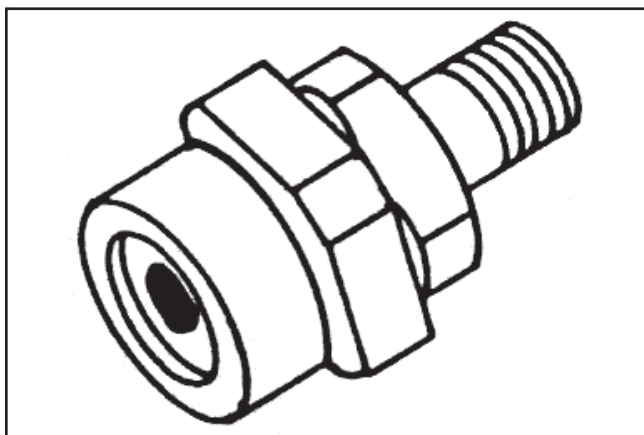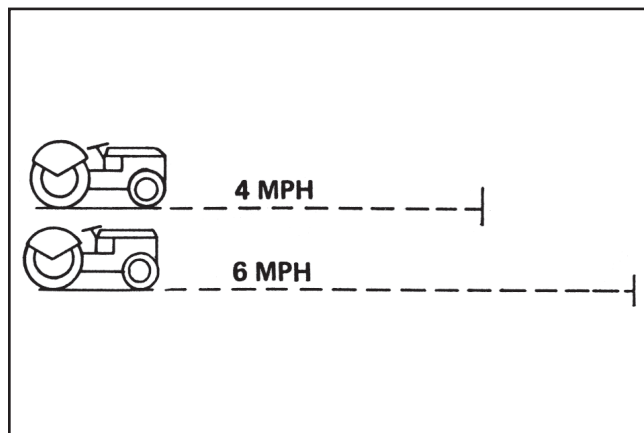If you are using 30 Gallon, Per Acre Tips and traveling 4 miles per hour, you are applying 30 gallons per acre. If you increase your speed to 6 miles per hour, using the same nozzle, you will apply 20 gallons per acre.

NOZZLE TYPE

The first step in setting up a sprayer is to select the proper nozzle type. Be sure to check nozzle type, spray angle, and boom height as described below.
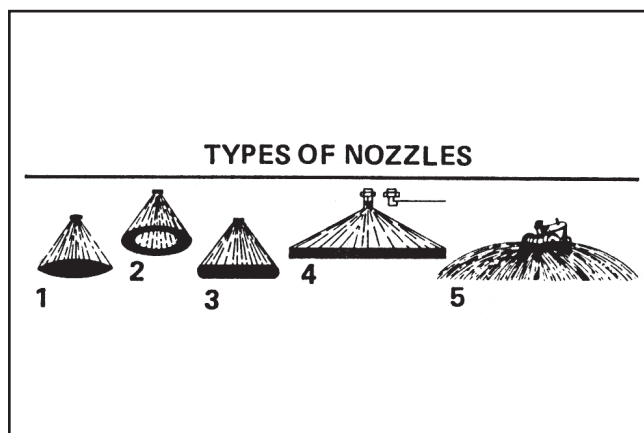
There are many types of nozzles. Select the type and size best suited for the work to be done. Popular types used are:

1. FLAT FAN nozzles have a tapered edge pattern so a slight overlapping gives uniform coverage. Spray tips should be rotated approximately 12 degrees so that patterns are slightly offset. They are used primarily for broadcast spraying of herbicides and insecticides.

2. HOLLOW CONE nozzle pattern is also slightly overlapped for uniform coverage. Misalignment is impossible. Used for broadcasting of herbicides or insecticides. Gives excellent plant coverage with drops.

3. EVEN SPRAYS give an even pattern that does not taper at the ends. They are used only for pre-emergence brand spraying. Do not use on a boom, the overlap would cause double dosage.

4. FLOODING nozzles provide an extra wide, flat spray pattern and are usually spaced every 40 inches along the boom. There is less drifting because the droplets are larger and the boom can be carried closer to the ground. Because their output is double that of fan nozzles, they do not plug easily. They are slightly less accurate.

5. JET or BOOMLESS nozzles provide wide coverage (up to 50 feet from a single nozzle). They are used in large fields where drifting is not a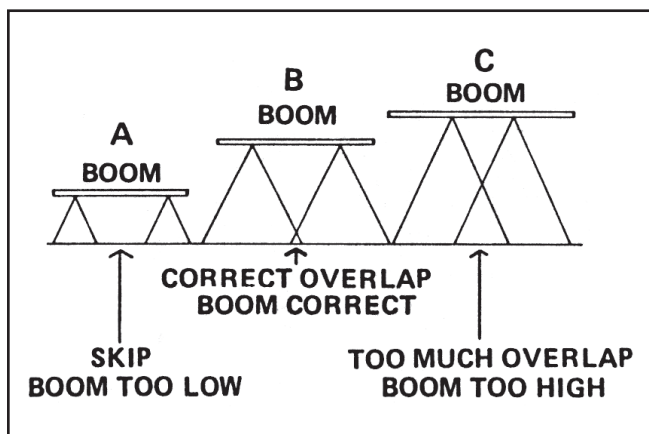 problem or for fence rows, roadsides, or where there are many obstacles a boom would hit. The pattern is easily affected by wind conditions.

BOOM HEIGHT IS IMPORTANT

Proper boom height is important. Too much or too little spray overlap causes skips or heavy dosage. Refer to nozzle output charts for proper spraying height.

SPRAY ANGLE

The spray angle of the nozzle determines the boom height. Flooding nozzles have a wide angle, from 115 to 147 degrees. Standard cone and fan nozzles, from 65 to 80 degrees. The wider the spray angle, the lower the boom can be carried.
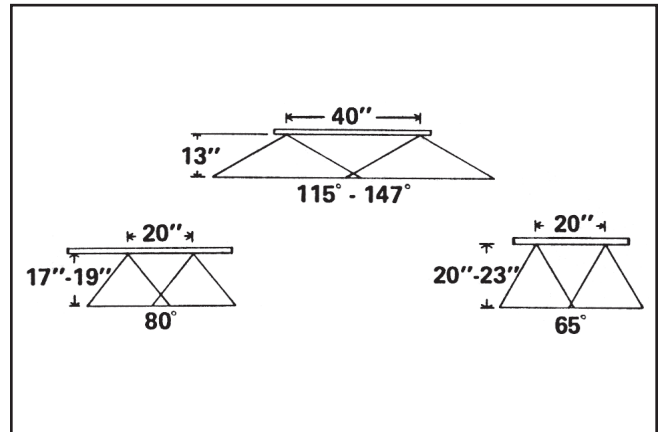
SPRAY COVERAGE INFORMATION

This table lists the theoretical coverage of spray patterns as calculated from the included spray angle and the distance from the nozzle orifice. These values are based on the assumption that the spray angle remains the same throughout the entire spray distance. In actual practice, the tabulated spray angle does not hold for long spray distances.
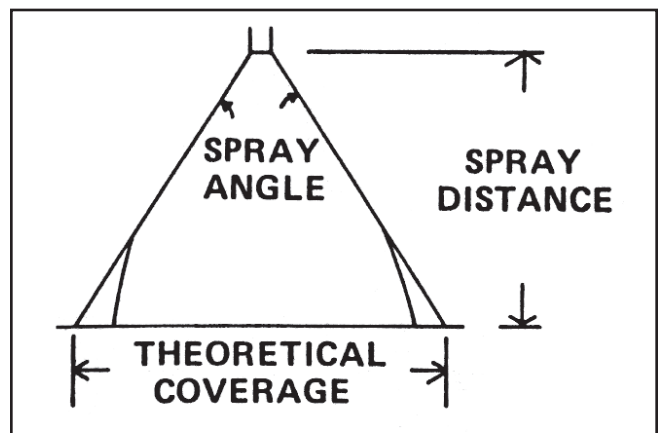
Included Spray Angle	THEORETICAL COVERAGE AT VARIOUS DISTANCES (IN INCHES) FROM NOZZLE ORIFICE											
	2"	4"	6"	8"	10"	12"	15"	18"	24"	30"	36"	48"
5°	0.2"	0.4"	0.5"	0.7"	0.9"	1.1"	1.3"	1.6"	2.1"	2.6"	3.1"	4.2"
10°	0.4"	0.7"	1.1"	1.4"	1.8"	2.1"	2.6"	3.1"	4.2"	5.2"	6.3"	8.4"
15°	0.5"	1.1"	1.6"	2.1"	2.6"	3.2"	3.9"	4.7"	6.3"	7.9"	9.5"	12.6"
20°	0.7"	1.4"	2.1"	2.8"	3.5"	4.2"	5.3"	6.4"	8.5"	10.6"	12.7"	16.9"
25°	0.9"	1.8"	2.7"	3.5"	4.4"	5.3"	6.6"	8.0"	10.6"	13.3"	15.9"	21.2"
30°	1.1"	2.1"	3.2"	4.3"	5.4"	6.4"	8.1"	9.7"	12.8"	16.1"	19.3"	25.7"
35°	1.3"	2.5"	3.8"	5.0"	6.3"	7.6"	9.5"	1 1 .3"	15.5"	18.9"	22.7"	30.3"
40°	1.5"	2.9"	4.4"	5.8"	7.3"	8.7"	10.9"	13.1"	17.5"	21.8"	26.2"	34.9"
45°	1.7"	3.3"	5.0"	6.6"	8.3"	9.9"	12.4"	14.9"	19.9"	24.8"	29.8"	39.7"
50°	1.9"	3.7"	5.6"	7.5"	9.3"	11.2"	14.0"	16.8"	22.4"	28.0"	33.6"	44.8"
55°	2.1"	4.2"	6.3"	8.3"	10.3"	12.5"	15.6"	18.7"	25.0"	31.2"	37.5"	50.0"
60°	2.3"	4.6"	6.9"	9.2"	11.5"	13.8"	17.3"	20.6"	27.7"	34.6"	41.6"	55.4"
65°	2.5"	5.1"	7.6"	10.2"	12.7"	15.3"	19.2"	22.9"	30.5"	38.2"	45.8"	61.2"
70°	2.8"	5.6"	8.4"	11.2"	14.0"	16.8"	21.0"	25.2"	33.6"	42.0"	50.4"	67.2"
75°	3.1"	6.1"	9.2"	12.3"	15.3"	18.4"	23.0"	27.6"	36.8"	46.0"	55.2"	73.6"
80°	3.4"	6.7"	10.1"	13.4"	16.8"	20.2"	25.2"	30.3"	40.3"	50.4"	60.4"	80.6"
85°	3.7"	7.3"	11.0"	14.7"	18.3"	22.0"	27.5"	33.0"	44.0"	55.0"	66.0"	88.0"
90°	4.0"	8.0"	12.0"	16.0"	20.0"	24.0"	30.0"	36.0"	48.0"	60.0"	72.0"	96.0"
95°	4.4"	8.7"	13.1"	17.5"	21.8"	26.2"	32.8"	39.3"	52.4"	65.5"	78.6"	105.0"
100°	4.8"	9.5"	14.3"	19.1"	23.8"	28.6"	35.8"	43.0"	57.2"	71.6"	85.9"	114.0"
110°	5.7"	11.4"	17.1"	22.8"	28.5"	34.3"	42.8"	51.4"	68.5"	85.6"	103.0"	
120°	6.9"	13.9"	20.8"	27.7"	34.6"	41.6"	52.0"	62.4"	83.2"	104.0"		
130°	8.6"	17.2"	25.7"	34.3"	42.9"	51.5"	64.4"	77.3"	103.0"			
140°	10.9"	21.9"	32.9"	43.8"	54.8"	65.7"	82.2"	98.6"				
150°	14.9"	29.8"	44.7"	59.6"	74.5"	89.5"	112.0"					
160°	22.7"	45.4"	68.0"	90.6"	113.0"							
170°	45.8"	91.6"										

NOZZLE SIZE SELECTION

After selecting the correct nozzle TYPE, the correct nozzle SIZE and operating PRESSURE must be selected.

The following equation assumes you already know the desired Gallons Per Acre. This information is always supplied with the chemical being applied. Follow the chemical manufacturers instructions carefully. Ground speed in MPH is also required. Most spraying is done in the 4-to-5 MPH range. The Operator's Manual for your sprayer should give you the manufacturer's recommendations. Nozzle spacing is also required. This can be obtained from your sprayer Operator's Manual. If you are setting up your own sprayer, the most common nozzle spacings are 20 inches or 40 inches.

To calculate nozzle SIZE, use the following formula:

$$\text{Gal. Per Minute (Per Nozzle)} = \frac{\text{Desired Gal./Acre} \times \text{MPH} \times \text{Noz. Sp.}}{5940}$$

Example: Suppose you want to spray 10 gallons per acre, with nozzles spaced 40 inches apart on the boom, while traveling at 5.2 miles per hour. Your formula would then look like this:

$$\text{GPM} = \frac{10 \times 5.2 \times 40}{5940} = .35$$

All nozzle tables or charts will give you gallons per minute (GPM) for several pressures. Using the correct table for the type of nozzle (flat, flood, etc.) that you selected, find the GPM closest to the desired nozzle PSI you would like to maintain. For example, a C-2 in the sample chart will provide .35 GPM at 30 PSI.

When selecting a nozzle size, chemical manufacturers normally recommend low pressure in the range of 20 - 40 PSI to prevent chemical drift, proper overlap and minimize wear. Nozzle manufacturers usually include recommended pressure ranges for their nozzles.

You should pick a nozzle size, in the middle of the pressure range, will allow some flexibility in changing application rates and ground speed. You may want to recalculate your GPM/per nozzle using your maximum MPH.

As shown in the table below, (for 40 inch nozzle spacing), a C-2 nozzle gives the most flexibility. When staying within the recommended 20 - 40 PSI nozzle pressure, you may adjust your application rate from 6.9 to 14.8 gallons per acre in the 4 - 6 MPH range. This enables you to tailor your application rate to field conditions without changing nozzles.

Instead of using a nozzle chart, the following formula can be used. For given nozzle size, nozzle spacing and ground speed the required pressure to apply a desired Gallons Per Acre can be found by solving:

Where:

$$\text{Pressure (PSI)} = \left[\frac{\text{GPA x Spacing x Speed}}{1878 \times \text{Size}} \right]^2$$

- GPA is desired Gallons Per Acre.

- SPACING is nozzle spacing in inches.

- SPEED is given in MPH.

- SIZE is nozzle size, given in GPM (Gallons Per Minute) at 10 PSI.

- [ ] 2 To find the "square," multiply the result (inside brackets) times itself.

1. To find the maximum required pressure, use the above formula with the maximum speed that will be used.

2. To find the minimum pressure, use the minimum desired speed in the above formula.

3. After calculating the min. - max. pressure required, consult the nozzle manual or chart to ensure that the nozzle can be used at those pressures.

Stainless Steel Tip No .	Nylon Tip No.	Liquid Pressure in p.s.i	Capacity in G.P.M.	GALLONS PER ACRE* BASED ON WATER - 40" NOZZLE SPACING						
				2 M.P.H	3 M.P.H	4 M.P.H.	5 M.P.H	6 M.P.H.	7.5 M.P.H.	10 M.P.H.
TKSS 1.5	C-1.5	10	.15	11.1	7.4	5.6	4.5	3.7	3.0	2.2
		20	.21	15.7	10.5	7.8	6.3	5.2	4.3	3.2
		30	.26	19.2	12.9	9.7	7.7	6.4	5.2	3.9
		40	.30	22.0	14.9	11.1	8.9	7.4	6.0	4.5
TKSS 2	C-2	10	.20	14.9	9.9	7.4	5.9	5.0	4.0	3.0
		20	.28	21.0	14.0	10.5	8.4	6.9	5.6	4.2
		30	.35	26.0	17.2	12.9	10.3	8.7	6.9	5.2
		40	.40	30.0	19.8	14.8	11.8	10.	7.9	5.9
TKSS 2.5	C-2.5	10	.25	18.5	12.4	9.3	7.4	6.2	5.0	3.7
		20	.35	26.0	17.2	12.9	10.3	8.7	6.9	5.2
		30	.43	32.0	21.	16.0	12.8	10.6	8.5	6.4
		40	.50	37.0	25.	18.5	14.9	12.4	9.9	7.4
TKSS 3	C-3	10	.30	22.0	14.9	11.1	8.9	7.4	5.9	4.5
		20	.42	32.0	21.0	15.7	12.6	10.4	8.4	6.3
		30	.52	38.0	26.0	19.3	15.4	12.9	10.3	7.7
		40	.60	45.0	30.0	22.0	17.8	14.9	11.8	8.9
TKSS 5	C-5	10	.50	37.0	25.0	18.5	14.9	12.4	9.9	7.4
		20	.71	53.0	36.0	27.0	21.0	17.8	14.2	10.7
		30	.87	65.0	44.0	33.0	26.0	21.5	17.4	13.1
		40	1.0	75.0	50.0	38.0	30.0	24.8	20.0	15.1
TKSS 10	C-7.5	10	.75	56.0	37.0	28.0	22.0	18.6	14.9	11.1
		20	1.1	82.0	55.0	41.0	33.0	27.2	22.0	16.3
		30	1.3	96.0	64.0	48.0	39.0	32.2	26.0	19.3
		40	1.5	111.0	74.0	56.0	45.0	37.1	30.0	22.0

NOTE: The MOST common problem is failure to select the correct nozzle size and failure to perform the "Initial Set-Up" procedure!!

Since all nozzle charts or tabulations are based on spraying water, which weighs 8.34 LBS per USA gallon, conversion factors must be used when spraying solutions which are heavier or lighter than water. Using conversion factors from the tables below, multiply by the catalog tabulator GPM and GPA rates - to arrive at the value for the solution to be sprayed.

WEIGHT OF SOLUTION	SPECIFIC GRAVITY	CONVERSION FACTORS
7.0 lbs. per gallon	.84	1.09
8.0 lbs. per gallon	.96	1.02
8.34 lbs. per gallon	1.00	1.00
9.0 lbs. per gallon	1.08	.96
10.0 lbs. per gallon	1.20	.91
11.0 lbs. per gallon	1.32	.87
12.0 lbs. per gallon	1.44	.83
14.0 lbs. per gallon	1.68	.77
16.0 lbs. per gallon	1.92	.72
18.0 lbs. per gallon	2.16	.68
20.0 lbs. per gallon	2.40	.65

To calculate gallons per minute, use this formula:

$$\frac{\text{Gal. Per Acre x MPH x Width (in feet)}}{495} = \text{Gal. Per Minute}$$

Divide the calculated GPM, by the conversion factor, to find the actual nozzle size required.

EXAMPLE: Using the previous example, the required size was .35 GPM. Assume you want to spray a fertilizer that weighs 10.0 LBS per gallon. As expected, a lower amount of this thicker, heavier material would go through a nozzle if the same pressure is used. To compensate, use the conversion factor in the table.

$$\frac{.35}{.91} = .38 \text{ GPM is the actual GPM required}$$

Again, refer to nozzle charts or tables to find the nozzle that is closest to .38 GPM at a given pressure. Use that SIZE and that PRESSURE.

NOTE: If this correction factor was not included, an additional error of 9% would be introduced.

BAND SPRAYING

The two key points for calibrating the 8160 for band spraying is: 1) the gallons per acre (Broadcast Rate) and 2) the total width of the actual ground being sprayed (sum of the individual band widths).

When band spraying, program the boom width to the total inches of each of the width of the bank per boom. For example, 4 rows with 15 inch wide bands would equal 60 inches. Suppose the chemical you are spraying has a recommended rate of say, 10 gallons per acre (Broadcast rate). No conversions are required; simply program your target RATE 1 or RATE 2 to 10 gallons per acre.

To recalculate the total ACRES, as might be the case if you used the 8160 for Band spraying and would like to know the total acres of the whole field, use the ratio procedure shown below.

Example:
Old Acres Sprayed - 300 inches
Old total boom width - 120 inches
New total boom width - 240 inches

$$1 \quad \frac{\text{Old Acres Sprayer (300)}}{\text{Old Boom Width (120)}} = \frac{\text{New Recalculated Acres}}{\text{240 New Boom Width}}$$

$$2 \quad \text{New Recalculated Acres} = \frac{\text{Old Acres Sprayed x New Boom Width}}{\text{Old Boom Width}}$$

$$3 \quad \text{New Recalculated Acres} = 600 = \frac{300 \times 240}{120}$$

BEFORE YOU GO INTO THE FIELD

Check all your equipment - make certain that all components are clean ... including the tank, pump, control valves, check valves, hoses, boom, strainers, nozzles, and spray tips.

⚠ **WARNING: Never use a metal object in cleaning nozzle orifices.**

Adjust the boom height to give proper spray overlaps. Check the flow rate from all nozzles using a master pressure gauge mounted in the boom close to the nozzles. (After the test, remove the master pressure gauge and plug the connection). While this nozzle flow test is being conducted, check the pressure reading on the rig pressure gauge to compare its reading to the pressure at the nozzles. The flow rates can be determined from the following flow charts. Remember, the catalog tabulations are based on pressure at the nozzles.

GPM	Seconds To Collect 1 Quart	GPM	Seconds To Collect 1 Quart
.05	300	.20	75
.06	250	.22	67
.07	214	.25	60
.08	188	.30	50
.09	167	.35	43
.10	150	.40	38
.11	136	.50	30
.12	125	.60	25
.13	115	.70	21
.14	107	.80	19
.15	100	.90	17
.17	88	1.0	15

IMPORTANT: Replace all worn tips and those with streaky or uneven patterns.

AFTER SPRAYING

Rinse and clean all the spraying equipment - including the spray tips, being careful not to use a metal probe in the orifice. This cleaning routine is especially important after spraying of wettable powders. Wash spray tips thoroughly with water or cleaning solution (appropriate for chemicals sprayed). Blow out orifice, clean and dry. If orifice remains clogged, clean it with a fine bristle (not wire) brush ... or with a toothpick. Do not damage the orifice. Water-rinse and dry tips before storing.

CHOICE AND CARE OF SPRAY EQUIPMENT

All the factors in today's spraying applications, including chemical costs, pollution and driftage control, point to the importance of choosing the proper spray equipment and maintaining it in an efficient operating order. Therefore, the original purchased equipment should be made of materials which resist corrosion and wear ... such as stainless steel spray tips. Since usage of spray nozzles usually brings about orifice clogging problems, erosion, etc., it is very important that the tips be cleaned after each operation, and tested before using again. Finally, even when using precision spray tips, it is necessary to control all the other factors in the spraying application - such as rig speed, spraying pressure, spray height, etc., in order to place the proper amount of chemicals in the proper areas. An electronic monitor such as the 8160 will make this task very easy. An established routing of proper maintenance will soon pay for itself.

⚠ **CAUTION: Agricultural chemicals can be dangerous. Improper selection or use can seriously injure persons, animals, plants, soil or other property. BE SAFE: Select the right chemicals for the job. Handle them with care. Follow the instructions on the container label and instructions from the equipment manufacturer.**

Glossary

8150 Adapter	7-pin to 4-pin adapter cable that allows the 8160 to be used with 8150 boom wiring
⇧ Key	This key is used to; 1) increase 2) scroll up and 3) answer "Yes" .
⇩ Key	This key is used to; 1) decrease 2) scroll down and 3) answer "No"
%Error	The difference between the target and actual application rate as a percentage
Acr	Acre
Acre	Area of 43,560 square feet
Actual Rate	The Rate that is being applied based on measurement
Anhydrous Ammonia	NH3 Fertilizer, 82% Nitrogen by weight
Application Rate	The amount volume required per area such as Gallons per Acre or Pounds per Acre
Area	Boom width X Distance traveled. Displayed as Acres
Area Key	Will display Total Acres counted since last cleared
Boom Valve	A valve used for boom section on/off control
Boom Width	Actual spray or application width
Bypass System	A system configuration where the Servo is in the return line to the pump or tank
Err	Error
Error Key	Will display % Error
Gal	Gallon
GPA	Gallons Per Acre
GPS	Global Positing System, a satellite system for navigation and speed.
Hiniker Protocol	The hardware and software Specification of the serial communication for Variable Rate Control
Hold Mode	Console is not controlling or accumulating Volume and Area. Boom Valves are off
InLine System	A system configuration where the Servo is in the line to the booms
MAN ERR	Stands for Manual error. % Error cannot be displayed while in Manual
Manual Mode	Console is not controlling but Volume and Area accumulating. Boom Valves are on. Valve is adjusted with ⇧ and ⇩ keys.
Menu	Organized listing of functions and features
Minimum Flow Rate	A minimum flow (GPM) set to insure proper spray pattern at slow speeds.
Mode Control	Feature that switches between Spray and NH3 Modes
Motorized ball valve	3-wire ball valve used for on/off control of boom sections
MPH	Miles Per Hour
NH3	Anhydrous Ammonia
NH3 Mode	Uses NH3 Menu where Volume is in Pounds of N and rate is in PPA
Power Key	Will turn console on and off.
PPA	Pounds Per Acre of actual N, not total weight of NH3
Rate Key	Will display selected application Rate
Remote Run/Hold	Connector locations to connect a Run/Hold Switch for automatically controlling the operating mode
Run/Hold Switch	A switch that controls the mode of operation of the console. Either on the console or remotely
Run Mode	Console is controlling and accumulating Volume and Area. Boom Valves are on. Also includes Manual operation.
Run Mode Suspended	Operation of console while in error condition such as "Low Speed " or "Low Flow". The console cannot control but the boom valves are on. Volume or Area may accumulate depending on error.

Servo Valve	A motorized butterfly valve for controlling flow
Set Key	This key is uses as an "Enter" key to select an item or procedure
Set-up	Calibration and setup procedure. Data is stored separately for the Spray and NH3 modes
Solenoid Valve	A 2-wire plunger type on/off valve for boom control
Speed Key	Will display speed in MPH
Spray Mode	Uses Spray Menu where Volume is in Gallons and Rate is in GPA
Target Rate	The application rate that you are trying to apply
Use Defaults	Erases all data and calibration numbers from memory and sets console back to factory default data
Variable Rate	The ability to change Application Rates on the go based on an application map.
Variable Rate Message	An application rate received from the serial port. It must conform to one of the Hiniker protocols.
Ver X.XX	Software Version Number displayed during power up.
Volume Key	Will display Total Volume in Gallons or Pounds of actual N counted since last cleared
VPA	Volume Per Area such as GPA

DEFAULT VALUES

DESCRIPTION	SPRAY	NH3	COMMENTS
Rate 1	20.0 GPA	180.0 PPA	PPA = Actual Pounds of 'N' Per Acre
Rate 2	10.0 GPA	150.0 PPA	PPA = Actual Pounds of 'N' Per Acre
Left Boom	120 In	510 In	
Center Boom	120 In	0 In	
Right Boom	120 In	0 In	
Servo Valve Response	6	6	Range Is 1 To 16
Flowmeter Cal. #	72.0 P/GAL	16.9 P/Lb	
Distance Cal. #	2.00 P/FT	2.00 P/FT	
Inline Sys.	Yes	Always Inline	Answer No For Bypass System
Remote Run/Hold	No	No	
Horn	On	On	
Minimum Flow	Off	Not Available	Off, On, Set, Adj.
Simulated Speed	Off	Off	Off, 1~9 MPH
Display Smoothing	1%	1%	1%~10%
Area Counter	0	0	
Volume Counter	0	0	
Mode	X		

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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