



SharpShooter[®] with Rate SyncTM

Product Manual

4225 SW Kirklawn Ave. Topeka, KS 66609 855-628-7722 www.CapstanAg.com

P/N 118156-002 Revised 10-14 © Capstan 2014

CONTENTS

INTRODUCTION	5
SAFETY	7 7 9 9
FIRE PREVENTION 1 Electrical 1 Welding 1 Fire Extinguishers 1	10 10 10 10
OPERATION 1 SharpShooter with Rate Sync (SSRS Display) 1 Menu Items 1 Operator Controls 2 Spraying Without the Sharpshooter with Rate Sync System 2 Tip Selection and Capacities 2 Blended Pulse Tip Chart 2 Technical Bulletin - July 11, 2001 (Revised April 12, 2006) 2	11 12 20 22 23 24 26
MAINTENANCE 2 Inspecting the Spray System 2 Cleaning The Spray System 2	29 29 29
PARTS IDENTIFICATION 3 SharpShooter with Rate Sync (SSRS Display) 3 Power Hub 3 Valve Driver 3 Pressure Sensor 3 Harness, Pressure Sensor 3 Harness, Pigtail (SSRS Display) 3 Extension Harness (SSRS Display) 3 Serial Extension Cable 3 Extension Harnesses (Boom) 3 Boom Shutoff Adapter 3 Y-Adapters 3 Nozzle Valve Assembly 3 Nozzle Alternator Harness 3 Power Harness 3 Circuit Breaker Kit (80A) 3 Power Hub Cover 3 Packard and Deutsch Plugs 3 SharpShooter with Rate Sync Product Manual 3	31 32 33 34 35 36 37 38

Power Disconnect Kit (Optional) Pressure Sensor Breakout Harness Installation Kit	38 38 39
SharpShooter with Rate Sync Parts List Base Kit Base Kit General Layout Example	40 41 42
SHARPSHOOTER WITH RATE SYNC SYSTEM	45 45
SHARPSHOOTER WITH RATE SYNC INSTALLATION OVERVIEW	46 46
SHARPSHOOTER WITH RATE SYNC INSTALLATION DETAIL	48 48
Harness Pigtail (SSRS Display)	48
Serial Extension	48 49
Pressure Sensor	49
Harness Pressure Sensor	50 50
Boom Shutoff Adapter	53
Harness Extension (SSRS Display)	54
Circuit Breaker	54 55
Power Disconnect Kit (Optional)	56
Special Installation Instructions	57 60
INSTALLATION SYSTEM TEST SharpShooter with Rate Sync (SSRS Display) Check	61 61
PRESSURE TUNING WITH PID PARAMETERS	63 63
SHARPSHOOTER WITH RATE SYNC TROUBLESHOOTING	65
Service - Recommended Guidelines	65
Baseline Service Checks	65 65
Fuses	66
Circuit Breaker	66
Nozzle Valve Servicing	66 68
Nozzle Valve Parts identification	69
Wet Tests	69
Symptom Troubleshooting Chart	71
Power Hub Pinout Identification	73
System Load Capacity Check	75
Valve Driver Voltage Check	75

Pressure Sensor Signal Test	5 7 3 1
Programming the SSRS Display	2
RATE CONTROLLER TROUBLESHOOTING83 Basic Rate Controller	3 3
VARRANTY POLICY	5
SERVICE CONTACT INFORMATION	7



APPLICATION SYSTEMS FOR PROFESSIONALS

INTRODUCTION

Congratulations! You are now part of the Capstan Ag Systems, Inc. precision application team, utilizing Blended Pulse[™] - a technology providing many features to assist in your spraying process!

Blended Pulse[™] technology is an innovative process utilizing Pulse Width Modulation to enhance your spraying experience. With Blended Pulse[™] you have a spray system with the ability to reduce drift potential, decrease waste, and lessen time spent in the field.

Your SharpShooter[®] with Rate Sync[™] system is designed to solve many of the spraying challenges experienced today. The features allow a more consistent application over wide speed ranges and frequent speed changes. Working with your rate controller, SharpShooter[®] with Rate Sync[™] automatically corrects rate and pressure, keeping you consistently on target. The SharpShooter[®] with Rate Sync[™] Display provides you with visual and audible indicators of your application. Audible alarms sound when application variables are inconsistent with your predetermined settings. With a range of menu settings allowing customized experiences in the field, you have the ability to enhance your application.

The Capstan team is excited to partner with you in your precision application operation. As an owner of a Capstan spray system, a network of experienced professionals are available in your region to provide informative technical support regarding your SharpShooter[®] with Rate Sync[™] spray system. To locate your nearest Capstan Dealer, Capstan Field Marketer or Field Technical Specialist please contact Capstan Ag Systems, Inc. at:

Capstan Ag Systems, Inc. 4225 SW Kirklawn Ave. Topeka, KS 66609 (785) 232-4477 - Headquarters (785) 232-7799 - Fax (855) 628-7722 - Toll-Free prodsupport@capstanag.com www.capstanag.com

NOTE: This document and the information provided are the property of Capstan Ag Systems, Inc. and may only be used as authorized by Capstan Ag Systems, Inc.



APPLICATION SYSTEMS FOR PROFESSIONALS

SAFETY

Safe Operation Is The Operator's Responsibility



This symbol with a warning statement means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.

- Make sure that all personnel have read this manual, and thoroughly understand safe and correct installation, operation and maintenance procedures.
- It is important for all individuals working with fertilizer to understand the potential risks, necessary safety precautions, and proper response in the event of accidental contact.

▲ DANGER

The signal word DANGER on the machine and in the manuals indicates a hazardous situation which, if not avoided, may result in death or serious injury.



The signal word CAUTION on the machine and in the manuals indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



The signal word WARNING on the machine and in the manuals indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.

IMPORTANT

This notice identifies procedures which should be followed to avoid damage to the machine.

SAFETY CONT.

Personal Safety

MPORTANT

Always wear proper protective equipment and use extreme caution when bleeding the sprayer system.

Working with sprayer equipment can be dangerous, so the proper hand and eye protection should be used at all times.

Sprayer lines may be pressurized. Relieve pressure before removing pressure sensor or pressure sensor lines.

Before removal or installation of nozzle valves, make sure that the pressure has been released from the sprayer lines.

Instructions are necessary before operating or servicing system. Read and understand the machine's Operator Manual and this Product Manual. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions may cause injury or death.

🚹 IMPORTANT

The spray tank and system should be emptied of chemical mixture and flushed with clean water before servicing the spray system or spray components. Clean the machine of all chemical residue before servicing.

- Use appropriate hand protection when hands are exposed to hazards such as: those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, and harmful temperature extremes.
- Installation should be performed by a person who is familiar with all local, state, and federal laws.

SAFETY CONT.

Health & Safety

- Sealant materials should be strictly applied in accordance with the manufacturer's instructions.
- Only an approved type of sealant, gasket or tape should be used.

Chemical Safety

- Always read the label before using chemicals. Follow the instructions from the chemical manufacturer on how to select, use and handle each chemical. Note protection information each time before opening the container.
- If written warnings cannot be understood by workers, verbal warnings should be given.
- Do not spill chemicals on skin or clothing. If chemicals are spilled, follow the instructions provided by the chemical manufacturer.
- The spray tank and system should be emptied of chemical mixture and flushed with clean water before servicing the spray system or spray components. Clean the machine of all chemical residue before servicing.
- Avoid inhaling chemicals. When directed to do so on the chemical label, wear protective clothing, face shield or goggles.
- Never smoke while spraying or handling chemicals.
- When spraying areas containing livestock or pets, cover food and water containers.
- If symptoms of illness occur during or shortly after spraying, immediately call a physician or go to a hospital.
- Follow the label's directions and advice to keep the residues on edible portions of plants within the limits permitted by law.

- Keep chemicals out of the reach of children, pets and unauthorized personnel. Store chemicals outside of the home, away from food and feed, and lock them in a secure area.
- Keep bystanders away from spray drift.
- Unless the manufacturer instructs otherwise, store chemicals in their original containers and keep the containers tightly closed. Read labels for hazards about chemical reactions with certain types of metals.
- Always dispose of empty containers according to the manufacturer's directions.

Use Safety Rules

- Read and follow instructions on the equipment and in the equipment's Operation & Maintenance Manual before operating.
- In addition to the design and configuration of equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence and proper training of personnel involved in the operation, transport, maintenance and storage of equipment.
- Make sure all the equipment controls are in the NEUTRAL position before operating the equipment.
- Operate the equipment according to the Operation & Maintenance Manual.
- DO NOT permit personnel to be in the work area when operating the equipment.
- DO NOT modify equipment.
- DO NOT make any adjustments or repairs on the equipment while the engine is running.
- Keep shields and guards in place. Replace if damaged.

FIRE PREVENTION



Electrical



Check all electrical wiring and connections for damage. Keep the battery terminals clean and tight. Repair or replace any damaged part or wires that are loose or frayed.

Battery gas can explode and cause serious injury. Use the procedure in the Operation & Maintenance Manual for connecting the battery and for jump starting. Do not jump start or charge a frozen or damaged battery. Keep any open flames or sparks away from batteries. Do not smoke in battery charging area.

Welding

Always clean the equipment, disconnect the battery, and all component wiring before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the equipment when welding.

Have good ventilation when welding or grinding painted parts. Wear dust mask when grinding painted parts. Toxic dust or gas can be produced.

Dust generated from repairing nonmetallic parts can be flammable or explosive. Repair such components in a well ventilated area away from open flames or sparks.

Fire Extinguishers



Know where fire extinguishers and first aid kits are located and how to use them. Inspect the fire extinguisher and service the fire extinguisher regularly. Obey the recommendations on the instructions plate.

OPERATION

Menu Button (enter/exit) Power Button Auto/Manual (on/off) **Button** (press for Auto) SharpSpooter' **Actual** Pressure Increase Readout **Button** 0 (toggle up) Manual (Effective Tip Manual Mode Size) Decrease <u>Button</u> 50 (toggle down) <u>Auto</u> (Target Pressure) Diagnostic Duty Cycle Readout Area Readout <u>Area</u>

SharpShooter with Rate Sync (SSRS Display)

Figure 1

The SSRS Display **[Figure 1]** has five buttons to navigate and control the system. A screen on the SSRS Display interface provides immediate information and easy access to the menu items.



Figure 2

Connections on the back of the SSRS Display [Figure 2] include the main connection port, a gps connection port and diagnostic connection port.

Power Button - Press the power button to turn on the SSRS Display. The system defaults to manual mode each time it is powered up.

With the SSRS Display turned OFF, the sprayer will only operate as a conventional rate controller. The Nozzle Solenoids work as an electric On/Off drip check and work with the boom section On/Off switches.

NOTE: Spraying in the OFF mode will require selecting different tips.

Menu Button - The menu button is used to enter and exit the menu list. Press menu button to enter the menu list pages, use the increase/decrease buttons to navigate the menu list highlighting the desired field. Press the menu button to enter desired selection. To exit menu structure, highlight the exit menu line and press the menu button.

Auto/Manual Button - Manual mode is the default mode at power up. Manual mode will pulse nozzle valves at the duty cycle percentage selected by the increase/decrease buttons. The Manual mode is used in the event that the SSRS Display fails to automatically control pressure. It is not necessary to change tips.

Manual Mode can also be used to close all nozzle valves. By toggling down to 10% duty cycle, then pressing decrease once more. This will close all solenoids and the diagnostic readout will show "OFF".

NOTE: In the Manual mode the increase/decrease buttons act like an electronic rotary nozzle body with an "infinite" number of tips that can be selected by the operator.

Automatic mode is the standard operating mode for the SharpShooter with Rate Sync system. In Auto mode the SSRS Display will automatically work to maintain an operator - set target pressure. It does this by pulsing the nozzle valves at a duty cycle percentage controlled by the target pressure. Activate the automatic pressure control by pressing the auto/manual button. The LED light behind auto/manual button will illuminate when auto mode is selected.

Increase/Decrease Buttons -

- 1. Manually select duty cycle percentage, or effective tips size in Manual mode, or
- 2. Set target pressure in Auto mode letting the SSRS Display determine the duty cycle, or in other terms, the "effective tip" size required.
- 3. Navigate up and down in menu structure.

Other Display Features

SharpShooter

0

al Mode

APSTAN

Display Screen - Is a real time readout of the SharpShooter with Rate Sync system operation.

Actual pressure, effective tip size, and duty cycle are displayed in the Manual mode. Actual pressure, target pressure and duty cycle appear in the AUTO mode. A diagnostics readout area appears in both modes.

3

1

SharpShooter

T

40

40

Hold

APSTAN

appear. 1. Pressor Sensor Error - Present when there is no pressure acting on the sensor. Could also be pressure above or below the limits of the pressure

2. Minimum Duty Cycle - Appears when the minimum duty cycle value is experienced.

The alarm readout will appear and the power button light will flash once per second when the following

- Maximum Duty Cycle Appears when the 3. maximum duty cycle value is experienced.
- 4. No GPS Will appear when the Rate Sync is functioning and no GPS values are being received by the SSRS Display. This error will not appear when Rate Sync is set to off.
- 5. No GPS VTG Shows that the SSRS Display is receiving some GPS signals but not the necessary VTG signal.
- 6. Low Pressure Shutoff When the Low Pressure Shutoff menu setting is 8 psi, this readout will appear when the psi drops below 8 psi. At this point the nozzle valves will close. Nozzle valves will open and the readout will clear when psi increases to at least 12 psi.

Menu Items

sensor.

The Menu button doubles as enter/exit through all menu items. To enter main menu press the menu button. To exit main menu scroll up/down with the arrow keys to highlight line 15 Exit Menu, then press menu button.

SnarpSnoote	er Ag	SharpSho	oter Ag
1 Backlight	4	12 Units	US (psi
2 Alarm Volume	3	13 Pressure Sensor !	Menu
3 Spray Tip Size	08	14 Diagnostics	
4 System Gain	9	15 Exit Menu	
5 P Gain	5.0		
6 I Gain	0.15		
7 Rate Sync	Auto		
8 Rate Sync Ave	0.1 sec		
9 Low Pressure Shutoff	8 psi		
10 Run/Hold Delay	3 sec		
11 Pressure Increment	5 psi		

Figure 4

Main menu screen, two pages, [Figure 4] shows all the menu items on left and the current value of each on right.

Figure 3

2

Indicator Lights and Sounds - The SSRS Display indicator lights are located behind the Power button and Auto/Manual button.

When the SSRS Display is powered on, the indicator light behind the power button (Item 1) [Figure 3] will appear constant. This signals a properly operating system.

The indicator light behind the Auto/Manual button (Item 2) will be off when in manual mode (also read out in center of screen). When Auto mode (Item 3) [Figure 3] is selected, the indicator light will turn on and screen readout will change to show target pressure.

The SSRS Display includes audible and visual alarms. The audible alarms are an accessible menu item. Visual alarms include a readout area in the lower right hand portion of the screen and a flashing light behind the power button.

Menu Items Cont.

In each specific menu selection item screen, default value and current value are both listed on the left side of the screen. See **[Figure 5]** as an example.

Range of selection parameters is called out on the bottom of the screen and selection choices are located on the right.

To choose a new parameter in any menu, scroll up/ down with the arrow keys highlighting the desired selection, then press the menu button to exit that screen. Your selection will now be the value on the right side of the main menu screen. Reference [Figure 4].

Specific Menu Items -

Line 1 - Backlight



Figure 5

Backlight allows choices of LCD screen brightness and backlight behind the keypad for low light conditions **[Figure 5]**.

Range: 1 - 5 (Dimmest to Brightest)

When selections 1 and 2 are active (low ambient light conditions) the keypad buttons become back-lit.





Figure 6

Alarm volume menu offers personalization of the alarm function. One can choose to deactivate the alarm or a variety of volumes **[Figure 6]**.

Range: 1 - 5 (Quiet to Loudest)

Line 3 - Spray Tip Size



Figure 7

It is important to choose your Spray Tip Size in the SSRS Display menu for the Rate Sync to function properly **[Figure 7]**.

Range: 01 - 20

Line 4 - System Gain



Figure 8

System Gain is the first pressure control parameter in the SSRS Display menu system. System Gain changes the total response of system according to the same ratio between the individual P Gain and I Gain values. It is the first menu item to utilize when tuning the pressure control **[Figure 8]**.

Increasing the System Gain makes the SharpShooter with Rate Sync system react faster to pressure changes.

Decreasing System Gain makes the SharpShooter with Rate Sync system react slower to pressure changes.

Range: 1 – 14 (slow to fast)

Recommended Starting Value = 9

Line 5 - P Gain

P C	Gain	P Gain							
Default	Selection	Default	Selection						
5.0	8.5	5.0	5.0						
	8.0		4.5						
Current	7.5	Current	4.0						
	7.0		3.5						
5.0	6.5	5.0	3.0						
	6.0		2.5						
	5.5		2.0						
Range:	2.0 - 8.5	Range: 2.0 - 8.5							

Figure 9

P (Proportional) gain is the second pressure tuning parameter in the SSRS Display menu. Proportional gain determines the initial speed at which SSRS Display drives the duty cycle toward the target value. Stabilize an oscillating system by selecting a lower number. Speed up a sluggish system by selecting a higher number [**Figure 9**].

Range: 2.0 – 8.5 (slow to fast)

Recommended Starting Value = 5

Line 6 - I Gain



Figure 10

I (Integral) Gain, the third pressure tuning parameter in the SSRS Display, determines the acceleration driving duty cycle to the target value. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number [Figure 10].

Range: 0.05 – 0.35 (slow to fast)

Recommended Starting Value = 0.15

Line 7 - Rate Sync



Figure 11

Rate Sync uses real time speed change to determine the proper duty cycle for the appropriate nozzle. It is used to make the SharpShooter with Rate Sync system react faster to speed changes [Figure 11].

NOTE: A 10 Hz NMEA GPS connection is required for Rate Sync to operate properly.

Range: Off/Auto

Recommended Value = Auto

- Rate Sync auto allows the SharpShooter with Rate Sync system to correct the pressure quicker during speed changes based on GPS data and automatically calculates the max speed based on tip size.
- NOTE: Rate sync turned off disables speed change corrections. GPS connection is not needed with rate sync off.



Rate Sy	ync Ave
Default	Selection
0.1 sec	0.5 sec
	0.4 sec
Current	0.3 sec
0.1 sec	0.2 sec
0.1 sec	0.1 sec
Range:	0.1 - 0.5

Figure 12

Rate Sync Ave is the time parameter used in rate sync calculations. Default setting of 0.1 second is recommended, higher settings cause rate sync to react slower **[Figure 12]**.

Range: 0.1 - 0.5

Line 9 - Low Pressure Shutoff



Figure 13

Low Pressure Shutoff allows the SSRS Display to turn off the nozzle valves when the pressure decreases to below 8 psi. Thus this feature is intended to duplicate the effect of the nozzle drip checks found on sprayers. To alert the operator that the low pressure shutoff feature has been activated, Low psi shutoff will appear in the diagnostic readout area [Figure 13].

When the pressure rises above 12 psi again, the SSRS Display will pulse at 50% duty cycle for the start-up delay period and then will resume pressure control.

When set to the OFF position, the SSRS Display will maintain a minimum duty cycle percentage, equal to the pulse frequency, regardless of either low or zero pressure.

Range: Off/8 psi

Line 10 - Run/Hold Delay



Figure 14

Run/Hold Delay is the delay at start-up when SSRS Display begins at a preset value (50% duty cycle) allowing for the rate controller to stabilize before making larger pressure control changes [Figure 14].

In **AUTO** mode, whenever the boom or all sections are toggled off, the SSRS Display will store the duty cycle effective at that moment.

When the boom is turned on and the run / hold signal is returned, the SSRS Display will begin to control pressure by first resuming the pulsing at the previous duty cycle before the boom was shutoff.

The "Hold" readout will appear in the Diagnostics area, to alert the operator that the initialization delay has been activated. The start-up delay time is equal to the Run / Hold delay time.

This allows the flow control system to resume control and attain rate stability.

Once the delay period has elapsed, the SSRS Display will resume pressure control.

The diagnostic readout area will read Hold and count down the seconds to alert the operator that the run / hold delay has been activated. When Hold count down is finished, the SSRS Display will read Run in diagnostics area. At this Run point the SSRS Display is controlling pressure once again.

Range: 0 - 6

Line 11 - Pressure Increment



Figure 15

Pressure Increment allows the operator to choose pressure step increment per toggle of the increase/ decrease button [Figure 15] in the Auto mode.

Range: 1 - 10

Line 12 - Units



Figure 16

The Units Menu consists of three choices for the SSRS Display pressure units to be displayed in **[Figure 15]**.

Range: US, SI

Line 13 - Pressure Sensor Menu

2 Sensor volt min 0.5 volts 3 Sensor volt max 5.0 volts 4 Sensor pressure min 0 psi 5 Sensor pressure max 100 psi 5 Exit Sensor Menu		U psi
3 Sensor volt max 5.0 volt 4 Sensor pressure min 0 psi 5 Sensor pressure max 100 psi 5 Exit Sensor Menu	ensor volt min	0.5 volts
4 Sensor pressure min 0 psi 5 Sensor pressure max 100 psi 5 Exit Sensor Menu	ensor volt max	5.0 volts
5 Sensor pressure max 100 psi 5 Exit Sensor Menu	ensor pressure min	0 psi
Exit Sensor Menu	ensor pressure max	100 psi
	xit Sensor Menu	

Figure 17

PSI Sensor Menu consists of pressure sensor specific parameters. Entering Sensor psi offset and Sensor volt min allows one to select the appropriate equipment settings. Sensor volt max, sensor volt min and sensor psi max are readouts for diagnostic purposes [Figure 17].

Sensor PSI Offset



Figure 18

Manipulate this setting if a difference in pressure is noticed across separate pressure sensors, such as between the SSRS Display pressure reading and the rate controller pressure display from a secondary pressure sensor [Figure 18].

NOTE: The SharpShooter with Rate Sync system requires a greater quality pressure sensor relative to pressure sensors which just report a screen value. So in most cases the adjustment will be correcting the value to the least accurate.

Range: 10 to -10

Sensor Volt Min



Figure 19

Capstan psi sensors need no change from the default value of 0.5. Set appropriately if using a 1.0 - 5.0 volt psi sensor [Figure 19].

Range: 0.5 to - 1.0

Line 14 - Diagnostics

Hardware Version	1.0
2 Boot Version	0.0.35
3 Application Version	1.0.29
4 Hourmeter	0.0
5 System Voltage	13.3
6 GPS Baud Rate	19200
7 Pwm Frequency (Hz)	10.0
8 Exit Diagnostics	

Figure 20

Diagnostics menu is a readout for set parameters in the SharpShooter with Rate Sync system. These may be useful in troubleshooting and/or diagnostic purposes [Figure 20].

Application Systems for Professionals

OPERATION CONT.

Line 15 - Exit Menu



Figure 21

Use this line item to exit the main menu structure. Toggle the increase/decrease buttons highlighting the Exit Menu field, then press Menu button. This is necessary since the Menu button doubles as enter and exit functions [Figure 21].

Operator Controls

Manual flow control is made possible by using speed and pressure calibration techniques. When calculating actual nozzle flow, it is recommended to account for the pressure drop across the nozzle valve orifice. This is especially for the large size tips (12.5's, 15's) where nozzle valve pressure drop is significant. Reference SharpShooter tip selection guide to determine nozzle valve pressure drop for various tip sizes, see Blended Pulse Tip Selection Guides on pages 23 & 24.

Before applying any product to the crop or field, Capstan recommends a physical flow calibration.

Open / Close Valve - With the SSRS Display turned off the sprayer will only operate as a conventional rate controller. The Nozzle Solenoids work as an electric On/Off drip check and work with the boom section On/ Off switches.

NOTE: This allows the operator to disable the pulsing of the valves. Pulsing may not be desired for row banding, drop nozzles, special applications, maintenance, troubleshooting, or in the event of a system failure.



Figure 22

Indicator Lights - The SSRS Display indicator lights are located behind the Power button and Auto/Manual buttons.

When the SSRS Display is powered on, the indicator light behind the power button (Item 1) [Figure 22] will appear constant. This signals a properly operating system.

When the indicator light behind the Power Button begins flashing, it is signifying an alarm and the diagnostic readout area will read the cause.

The indicator light behind the Auto/Manual button will be off when in manual mode (also read out in center of screen). When Auto mode is selected, the indicator light (Item 2) **[Figure 22]** will turn on and the screen readout will change to show the target pressure.

Start-Up - In Auto mode, the SSRS Display will begin pulsing at 50% duty cycle and will remain constant until the start-up delay time has lapsed. This allows the flow control system to establish itself before the SSRS Display begins to control the pressure. The "Hold" readout will appear in the Diagnostics area to alert the operator that the initialization delay has been activated. The start-up delay time is equal to the Run / Hold delay time.

Low Pressure Shutoff - In Auto mode, the SSRS Display will turn off the nozzle valves when the pressure falls below 8 psi. This feature is intended to duplicate the effect of the nozzle drip checks found on sprayers. To alert the operator that the low pressure shutoff feature has been activated, the diagnostic readout area will show Low Pressure Shutoff. When the pressure rises above 12 psi again, the SSRS Display will pulse and resume pressure control.

The low pressure shutoff feature can be disabled through menu settings in the SSRS Display. When disabled, the SSRS Display will maintain a minimum duty cycle percentage, equal to the pulse frequency, regardless of either low or zero pressure.

NOTE: Disabling the low pressure shutoff feature is used for diagnostic purposes only.

Operator Controls Cont.

Run / Hold - In Auto mode, the SSRS Display will stop controlling pressure when the boom is turned off, therefore the hold signal is activated. When the boom is turned on and the run signal is activated, the SSRS Display will resume pulsing at the previous duty cycle before the boom was shutoff. This duty cycle will remain for a delay period set from Menu Run / Hold Delay choices. This allows the flow control system to resume control. Once the delay period has elapsed, the SSRS Display will resume pressure control. The diagnostic readout area will read Hold and count down the seconds (3.2.1) to alert the operator that the run / hold delay has been activated. When Hold count down is finished, the system will read Run in diagnostics area, and the SharpShooter with Rate Sync system is controlling pressure once again.

The run / hold feature can be changed in the menu structure of the SSRS Display. Default setting of 3 seconds can be changed in either direction. This modulation can cause the SSRS Display to spike / dip the pressure or cause control instability until the flow system catches up and pressure control resumes.

The run / hold delay value can be adjusted from 0 to 6 seconds through the menu settings.

Solving Problem 1: Excessive Spray Drift at High Rates and / or Speeds

Select the appropriate spray tip size, style and pressure for the application rate and maximum field speed and level to reach the desired spray drift control. For typical infield spraying, select the SSRS Display Auto mode and adjust the increase/decrease buttons to the desired spray pressure and droplet pattern. For on-the-go drift control, switch target pressure to the minimum pressure that the tip is rated for, (typically 25 psi). The SSRS Display will adjust the nozzle pulsing to the lower pressure to reduce drift while still maintaining the proper rate. Although the top end speed range might decrease slightly, the SharpShooter with Rate Sync system still maintains an impressive speed range at the lower set pressure. When the drift control is no longer necessary, simply switch the target pressure back to the higher pressure.

Solving Problem 2: Inconsistent Application over Wide Speed Ranges

Select the appropriate spray tip size, style and pressure to achieve a consistent application <u>up to</u> a maximum speed range of 8:1 or with frequent speed changes. Select the Auto mode on SSRS Display and adjust the target pressure to the desired spray pressure. When slowing down, the SSRS Display will adjust the nozzle pulsing to keep the operator pressure set-point constant. The same happens when speeding up. The SharpShooter with Rate Sync system will maintain the desired spray pressure up to an 8:1 speed range by adjusting the nozzle pulsing to maintain the constant pressure set by the operator.

Solving Problem 3: Limited Variable Rate Application Ranges

Typically, chemical rates vary within a 2:1 rate range. To achieve that range of application rate with a single tip, select the appropriate spray tip size, style and pressure for the coverage desired at the highest application rate and fastest speed. Select the SSRS Display Auto mode and then choose the desired target spray pressure. When changing rates, the SSRS Display will adjust the nozzle pulsing to permit the rate range of flow to change while still maintaining a constant spray pressure.

Spraying Without the Sharpshooter with Rate Sync System

SharpShooter with Rate Sync system has been designed with several features that allow the operator to continue spraying in the event of a SSRS or Rate Controller component failure.

When the SSRS Display will not automatically control pressure but still pulses:

- To operate in a Rate Controller mode, turn the SSRS Display to Manual mode. Different tips are NOT required. You can continue to use the tips selected for the SSRS Display Auto mode.
- In Manual mode, the nozzle valves will pulse at the selected duty cycle. The duty cycle percentage very closely approximates the actual flow through the nozzle. For instance, using a #8 sized tip and a 50% duty cycle will result in flow similar to a #4 size tip. The SSRS Display acts as an MANUAL TIP CHANGER to control pressure at the proper rate. Arrow up or down to find the effective tip size that results in the desired operating pressure.
- The Manual mode is typically used in the event of a SSRS pressure sensor failure. The Manual mode will allow the operator to adjust the pressure range in which the Rate Controller operates. This pressure range can be changed on-the-go for varying spray conditions.

When the SSRS Display does not automatically control pressure and does not pulse:

 Turn the SSRS Display OFF to operate in a Rate Controller mode. Different tips will be required to spray properly. With the SSRS Display turned "Off" or removed, the Valve Drivers will continue to open or close the nozzle valves with the boom section on / off switches. The spray rate controller will continue to function normally. This feature will allow the operator to continue spraying until time allows to repair / replace the SSRS Display in the event of a failure.

When the Rate Controller or flow meter fails, and the SharpShooter with Rate Sync continues to pulse:

- The operator can spray according to traditional Speed and Pressure techniques by using a nozzle chart. Put the rate controller in manual mode and the SSRS Display in Manual mode. Change the duty cycle percentage with the Up/Down arrows to meet the flow requirement from the speed and pressure calculation.
- Before applying any product in this scenario, Capstan recommends a physical flow calibration.

Interchangeable Components

• The SharpShooter with Rate Sync uses multiple Valve Drivers, Nozzle Valves, and Extension Harnesses. To assist in troubleshooting, identical components can be swapped. It is recommended that the operator carry spare nozzle valves in critical situations.

Tip Selection and Capacities

It is important to adhere to the following rules:

- 1. Always use 110° spray angle tips, and maintain the boom height at 24" or greater. If 80° spray angle tips are used, maintain the boom height at 36" or greater.
- 2. Never use Air Induction (AI) spray tips.

Strainers - Most sprayers are built with strainers to filter debris from the spray. At least an 80-mesh screen is required to prevent nozzles from plugging.



Figure 23

Check the mesh size of the strainers **[Figure 23]** and replace the screens if they are too coarse.

NOTE: Use 80-mesh or finer strainer screens.



The filter manufacturer is specified only on the strainer housing. Only a color code identifies the strainer mesh size which is not consistent between filter suppliers.

Blended Pulse Tip Chart

PULSE TIP SELECTION GUIDE: ENDED **SPEED RANGE (ENGLISH)**



Use wide-angle tips (110 degrees) and appropriate Always verify actual spray rates before applying chemicals on the field.

boom heights to provide 100% nozzle overlap.

Stay within the recommended speed ranges to prevent skips and inconsistent spray patterns.

Actual speed range depends on machine design and limitations.

the droplet classification. DO NOT USE AI TIPS. published data. Capstan Ag does not guarantee the accuracy of the tip manufacturer data nor Chart data is based on tip manufacturer's

Operator is responsible for the understanding and proper use of this chart.

tip manufacturer and governmental requirements. Operator is responsible to follow chemical labels,

Orifica	Flow		12	-		Speed Ra	ngo mph		
Size	US gpm	Gauge	Tip	3 GPA	5 GPA	8 GPA	10 GPA	15 GPA	20 GPA
	0.208	20	19	5.2 to 20.6	3.1 to 12.4	1.9 to 7.7	1.2 to 6.2	0.8 to 4.1	0.6 to 3.4
	0.255	30	29	6.3 to 25.3	3.8 to 15.2	2.4 to 9.5	1.5 to 7.6	1.0 to 5.1	0.8 to 3.8
03	0.295	40	39	7.3 to 29.2	4.4 to 17.5	2.7 to 10.9	1.7 to 8.7	1.2 to 5.8	0.9 to 4.4
	0.329	50	48		4.9 to 19.6	3.1 to 12.2	2.0 to 9.8	1.3 to 6.5	1.0 to 4.9
	0.361	60	58		5.4 to 21.4	3.3 to 13.4	2.1 to 10.7	1.4 to 7.1	1.1 to 5.4
	0.274	20	19	6.8 to 27.1	4.1 to 16.3	2.5 to 10.2	1.6 to 8.1	1.1 to 5.4	0.8 to 4.4
	0.335	30	28		5.0 to 19.9	3.1 to 12.5	2.0 to 10.0	1.3 to 6.6	1.0 to 5.0
04	0.387	40	38		5.8 to 23.0	3.6 to 14.4	2.3 to 11.5	1.5 to 7.7	1.2 to 5.8
	0.433	50	47		6.4 to 25.7	4.0 to 16.1	2.6 to 12.9	1.7 to 8.6	1.3 to 6.4
	0.474	60	56		7.0 to 28.2	4.4 to 17.6	2.8 to 14.1	1.9 to 9.4	1.4 to 7.0
	0.336	20	18		5.0 to 20.0	3.1 to 12.5	2.0 to 10.0	1.3 to 6.7	1.0 to 5.0
	0.412	30	27		6.1 to 24.5	3.8 to 15.3	2.4 to 12.2	1.6 to 8.2	1.2 to 6.1
05	0.476	40	36		7.1 to 28.3	4.4 to 17.7	2.8 to 14.1	1.9 to 9.4	1.4 to 7.1
	0.532	50	45			4.9 to 19.8	3.2 to 15.8	2.1 to 10.5	1.6 to 7.9
	0.583	60	54			5.4 to 21.6	3.5 to 17.3	2.3 to 11.5	1.7 to 8.7
	0.396	20	17		5.9 to 23.5	3.7 to 14.7	2.4 to 11.8	1.6 to 7.8	1.2 to 5.9
	0.485	30	26		7.2 to 28.8	4.5 to 18.0	2.9 to 14.4	1.9 to 9.6	1.4 to 7.2
06	0.560	40	35			5.2 to 20.8	3.3 to 16.6	2.2 to 11.1	1.7 to 8.3
	0.626	50	43			5.8 to 23.2	3.7 to 18.6	2.5 to 12.4	1.9 to 9.3
	0.685	60	52			6.4 to 25.4	4.1 to 20.4	2.7 to 13.6	2.0 to 10.
	0.503	20	16			4.7 to 18.7	3.0 to 14.9	2.0 to 10.0	1.5 to 7.5
	0.616	30	24			5.7 to 22.9	3.7 to 18.3	2.4 to 12.2	1.8 to 9.1
08	0.711	40	32			6.6 to 26.4	4.2 to 21.1	2.8 to 14.1	2.1 to 10.
	0.795	50	39	-		7.4 to 29.5	4.7 to 23.6	3.1 to 15.7	2.4 to 11.
	0.871	60	47				5.2 to 25.9	3.4 to 17.2	2.6 to 12.
	0.728	30	21			6.8 to 27.0	4.3 to 21.6	2.9 to 14.4	2.2 to 10.
10	0.840	40	28				5.0 to 25.0	3.3 to 16.6	2.5 to 12.
	0.939	50	35				5.6 to 27.9	3.7 to 18.6	2.8 to 14.
	1.029	60	42				6.1 to 30.6	4.1 to 20.4	3.1 to 15.
	0.843	30	18	e.			5.0 to 25.0	3.3 to 16.7	2.5 to 12.
12.5	0.973	40	24				5.8 to 28.9	3.9 to 19.3	2.9 to 14.
	1.088	50	30					4.3 to 21.5	3.2 to 16.
	1.192	60	36					4.7 to 23.6	3.5 to 17.
	0.933	30	15				5.5 to 27.7	3.7 to 18.5	2.8 to 13.
15	1.078	40	21				5	4.3 to 21.3	3.2 to 16.
10	1.205	50	26					4.8 to 23.9	3.6 to 17.
	1.320	60	31					5.2 to 26.1	3.9 to 19.

Blended Pulse Tip Chart Cont.

BLENDED PULSE TIP CHART (ENGLISH)

							Tip) Inf	fo			ger ilger net			le www.te	eJet eiet.com			ww	Hy w.hypro	pro pumps.o	:om	
						Or	ifice	P	SI	ER	SR	MR	DR	XR/XRC	TJ	TT/2XTT	TTJ60	TR	F	VP	ADI	GRD	LD
						s	ize	Gage	Tip	110	110	110	110	110 M	110	110 VC	110 VC	<u>110</u> м	110	110 M	110	120	110
								20	19	<u> </u>	č					ve	•••				Ŭ	Ŭ	
			0			0)3	30	29	F	м	С	vc	м	F	С	С	м	м	м	м	С	С
tior	F 235	M 340	C -40	7C -500	ပ္ပန္တ			40	38	F	м	С	vc	м	F	С	С	F	F	F	м	С	м
fica	135	1 235	340	400	× *			50	47	F	м	MR	vc	F	F	м	С	F	F	F	м	С	м
assi								60	56	F	м	MR	С	F	F	м	с	F	F	F	м	м	м
t								20	40	м	с			м		vc	vc	м		м		с	С
ple	F 35	1 235	1 340	400	200 200		1	20	19	F	м	vc	хс	м	F	С	С	м	м	м	vc	с	С
Dre	∨ <1] 135-	1 235-	340.	V 400			30	28	F	м	C	VC	м	F	c	c	F	м	м	c	C	м
								40	38	<u> </u>													
			e	de				50	47		IVI	C	vc	IVI	F	۰ د	د د	-	IVI	IVI	ر د	U.	
ion	0	e	icid	bici				60	56	F	м	MR	vc	м	F	С	С	F	F	F	С	С	м
Act	cide	icid	lerb	Her	izeı			20	18	М	VC			м		VC	vc	С		С		С	С
e of	ıngi	sect	ct H	ntic	ertil	0)5	30	27	F	С	хс	хс	м		vc	с	м	м	м		с	С
lod	Fu	Ins	nta	ema	F	()		40	36	F	м	vc	хс	м		С	с	F	м	м		с	С
			ပိ	Syst				50	45	F	м	vc	хс	м		С	с	F	м	м		С	С
								50	45	F	м	с	VC	м		с	с	F	м	м		с	м
							-	60	54		xc					XC	xc	~				NC	
								20	17	IVI	XC			U U	IVI	XC	×C	ر د				VC	C .
						06	6	30	26	М	vc	хс	хс	м	м	vc	vc	С	м	С		С	С
)6)	40	35	М	С	vc	хс	м	м	С	С	м	м	М		С	С
						н		50	44	М	С	vc	хс	м	м	С	С	М	м	М		С	С
								60	52	F	м	vc	vc	м	м	С	С	м	м	м		с	С
						Г		20	16	С	хс			с	м	хс		С		С		хс	vc
							2	20	10	м	vc	хс	хс	с	м	vc		с	с	с		vc	с
								30	24	м	VC	xc	xc	c	м	VC		м	c	м		С	с
101	101	_						40	32			Xo	×0										
	6	יאי	DC'	ТΔ	N			50	39	M	C	vc	xc	м	м	C		M	C	M		C	C
SINCE	1893 A	G SY	ISTE	MS. I				60	47	М	С	vc	хс	м	М	С		М	С	М		С	С
APPLIC	ATION	SYSTEM	IS FOR F	ROFES	SIONALS	1	0	30	21	С	хс	хс	хс		С			С	С	С			
-						1	10)	40	28	м	vc	хс	хс		м			м	с	С			
W	ww.C	Capsta	nAg.o	com				50	35	м	vc	vc	хс		м			м	с	м			
Mark	eting	@Caj	pstan/	Ag.co	m				40	м	vc	vc	хс		м			м	с	м			
42	25 SV	N Kir	klawr	n Ave		11	2 5	00	42	VC	хс	хс	хс										
	Topel	ka, K	S 666	09				40	24	VC	VC	YC.	VC										
Tol	l-Free	e (855	628	-7722	2			50	30	vu	vu	лС 	AC .										
		(, 0					60	36	VC	VC	xc	XC										
						1	5	40	21	VC	XC	хс	xc					С	С	С			
						e	(5)	50	26	VC	xc	хс	хс					С	С	С			
								60	31	VC	хс	хс	хс					м	С	м			

Technical Bulletin - July 11, 2001 (Revised April 12, 2006)

Spray Skips from Poor Pulse Blending

NOTE: For: SharpShooter[®] and PinPoint[®] Blended Pulse Spray Systems. (For additional information contact your Capstan Ag dealer.

Capstan's field engineers have received many questions about blended pulse spraying, and its potential for causing skips in the field. In rare instances, skipping has been documented in the field. This technical bulletin is intended to explain pulse blending, and the techniques used to provide optimum spray coverage and to prevent skipping.

What is blended pulse spraying? Each nozzle in a blended pulse spray system emits 10 spray pulses per second. Adjacent nozzles have alternate timing. The alternating pulses, the overlapping spray patterns and the natural dispersing of droplets, blend together to provide consistent coverage of the target.

What makes the pulses blend? Below is an illustration of what a blended pulse spray pattern might look like if it were sprayed upon a flat surface. This spray pattern is similar to a #8 size flat fan spray tip (with a 110° fan angle) that is spraying 5 gpa at 15 mph with a 50 psi boom pressure. The nozzles are 20" apart. Each tip is rotated 12.5° to prevent pattern interference between nozzles. The minimum boom height is 21" above the spray target.



In this example, each nozzle sprays 1/3 of the time, but adjacent nozzles alternate and overlap to fill in areas between the nozzles. As the sprayer increases speed, rate, or boom height, the pulses become wider, this provides additional overlap, better pulse blending, and increased spray coverage.

As the sprayer decreases speed or rate, skips may begin to appear. For this example, a smaller tip size would be recommended if slower speeds are desired.

Pattern width and natural droplet dispersion are not shown in the diagram. These factors help to smooth out the pulses and fill in skips. The amount of droplet dispersion depends on the style of tip being used. For example, low-drift tips typically emit large droplets and provide minimal droplet dispersion.

Technical Bulletin - July 11, 2001 (Revised April 12, 2006) Cont.

What causes skipping? Below is the same illustration from the previous page except that 80° fan angle tips are used rather than 110° tips. In this case, the 21" boom height doesn't provide adequate nozzle overlap and skips can be seen. Tips emitting small droplets, with plenty of droplet dispersion, will fill in large skips. Large droplet tips may not fill in the skips, and this may result in poor coverage. The skips appear as diagonal lines in the direction of travel. The angle of the diagonal depends upon the speed of the sprayer.



To Prevent Skipping:

- 1. Use wide-angle spray tips and appropriate boom heights to provide 150% nozzle overlap.
 - For 80° tips, use 36" or greater boom height.
 - For 110° tips, use 21" or greater boom height.
 - Use pressures which fully develop the intended fan angle.
- 2. Avoid pulse duty cycles below 33%.
 - Use appropriately sized spray tips for the desired speed, rate, and pressure ranges.
 - Avoid speeds in the lower 1/3 of the speed range.
 - Avoid rates in the lower 1/3 of the rate range.
- Use additional caution when using drift control tips or drift control additives which increase droplet size and reduce droplet dispersion. Carefully observe the boom height, duty cycle, and tip selection recommendations to ensure adequate spray coverage.
- 4. Always read and follow chemical label instructions! Agronomic and environmental factors significantly affect efficiency of the chemicals, and will magnify the adverse effects of poor coverage. Carefully observe boom height, duty cycle and tip selection recommendations for hot and dry field conditions, large / mature weed pressures, etc.
- 5. Always apply blended pulse broad cast sprays using a 10hz.



SharpShooter[®] with Rate SyncTM Product Manual

MAINTENANCE

Inspecting the Spray System

- Inspect spray system hoses for cuts, nicks or abrasions before each use. Replace any damaged hoses immediately.
- Make sure boom strainers are clean.
- Make sure all hoses and wiring is secure.
- Check for loose hoses, mounting hardware and components. Tighten if necessary.
- Before jump starting or welding on the sprayer, disconnect the SharpShooter with Rate Sync power wires from the battery or trip the 80A circuit breaker.
- Check for damaged or missing decals. Replace decals if damaged or missing.

Cleaning The Spray System

- Flush the spray system with clean water after each use.
- Avoid high pressure spray when cleaning the spray system components, valves and wiring connectors.

Storage

- Thoroughly clean the spray system before winter storage.
- Flush the spray system with clean water.
- Winter the spray system with RV antifreeze for winter storage.



SharpShooter[®] with Rate SyncTM Product Manual

PARTS IDENTIFICATION

SharpShooter with Rate Sync (SSRS Display)



Figure 24

The SSRS Display **[Figure 24]** is located in the sprayer's cab.

The SSRS Display contains a user interface screen and several keypad buttons.

- Power button
- Menu button
- Auto/Manual button
- Increase button
- Decrease button

Power Hub



Figure 25

The Power Hub **[Figure 25]** is usually located at the center of the boom mast near the Pressure Sensor.

The Power Hub is a junction block where the battery power is routed to the Valve Drivers. The Power Hub also routes Pressure Sensor signals and Valve Driver signals to the SSRS Display.

PARTS IDENTIFICATION CONT.

Valve Driver



Figure 26

The Valve Drivers (Item 1) **[Figure 26]** are usually located next to the first nozzle on the associated boom sections.

Each Valve Driver has two connectors. The male Deutsch 6-Pin connector (Item 2) connects to the boom extension harness. The 3-Pin shroud connector (Item 3) [Figure 26] connects to the boom section nozzle harness wiring.

NOTE: A maximum of 22 nozzle valves may be installed on a single boom section. Additional nozzle valves will result in a blown Valve Driver Extension Harness fuse.

Pressure Sensor



Figure 27

The Pressure Sensor **[Figure 27]** is usually located in the center of the boom near the boom section manifold. The Pressure Sensor must be installed at a location in the plumbing that will provide an accurate reading when all or only one boom section is turned on. A good location for the Pressure Sensor is near the sprayer's pressure gauge port.

PARTS IDENTIFICATION CONT.

Harness, Pressure Sensor



Figure 28

The 5' (3-Pin WP x 4-Pin DT) extension harness **[Figure 28]** is used to connect the Pressure Sensor to the Power Hub.

Harness, Pigtail (SSRS Display)



Figure 29

The 10' fused SSRS Display Pigtail harness (Item 1) **[Figure 29]** connects from the SSRS Display to the SSRS Display extension harness.

- NOTE: The 5A fused end (Item 2) [Figure 29] connects to the SSRS Display allowing for the other end to be routed outside the cab.
- NOTE: This allows for a simple disconnect when removing the boom from the sprayer.

Extension Harness (SSRS Display)



Figure 30

The SSRS Display extension harness **[Figure 30]** connects from the SSRS Display pigtail harness to the Power Hub.

- 20' (P/N 118200-030)
- 40' (P/N 118200-031) [Not Shown]

Serial Extension Cable



Figure 31

The serial extension cable DB9 x 15' [Figure 31] connects the SSRS Display to the GPS system.

PARTS IDENTIFICATION CONT.

Extension Harnesses (Boom)



Figure 32

The extension harness, Boom 1, 2, 3, 4, 5, etc. (Item 1) **[Figure 32]** connects to the appropriate Valve Drivers of each boom section and to the Power Hub.

NOTE: The boom extension harness contains a 15A fuse (Item 2) [Figure 32].

- 6-Pin x 10' (P/N 118650-010) [Not Shown]
- 6-Pin x 20' (P/N 118650-020)
- 6-Pin x 30' (P/N 118650-030) [Not Shown]
- 6-Pin x 40' (P/N 118650-040) [Not Shown]
- 6-Pin x 50' (P/N 118650-050) [Not Shown]
- 6-Pin x 60' (P/N 118650-060) [Not Shown]

Boom Shutoff Adapter





Several boom shutoff adapters [Figure 33] are available depending on the sprayer model and boom configuration.

The boom shutoff adapter intercepts signals from the machines boom section shutoff harness.

SharpShooter with Rate Sync uses this signal to turn on and off the nozzle valve assemblies. These assemblies are located on the boom section spray tubes. When the signal wire is powered up, 12V dc, the nozzle valves open. When the signal wire has no power, the nozzle valves close.

NOTE: For available boom section shutoff adapters see page 39.
Y-Adapters





The 3-Pin Y-adapter harness [Figure 34] is required when locating a Valve Driver on the center of a boom section. The 3-Pin Y-adapter harness allows nozzle harnesses to be routed in each direction on the boom section. See General Layout Example on page 42.



Figure 35

The 6-Pin Y-adapter harness **[Figure 35]** can be used to connect two Valve Drivers together on a boom section.

NOTE: A maximum of 22 nozzle valves may be installed on a single boom section. Additional nozzle valves may result in a blown Valve Driver Extension Harness fuse.

Nozzle Valve Assembly

Capstan offers several types of nozzle valve assemblies to accommodate the variety of nozzle bodies used on sprayers. It is important to have the correct nozzle valve assembly for the nozzle body.



Figure 36

The SharpShooter pulses the Nozzle Valve Assemblies [Figure 36] to maintain a constant boom and tip pressure.

- 1. TeeJet Nozzle Valve Assembly (P/N 116190-111)
- 2. Arag Nozzle Valve Assembly (P/N 116290-111)
- 3. Wilger Nozzle Valve Assembly (P/N 116390-111)
- 4. Arag High Flow Nozzle Valve Assembly (P/N 116290-211)
- NOTE: A maximum of 22 nozzle valves may be installed on a single boom section. Additional nozzle valves may result in a blown Valve Driver Extension Harness fuse.

Nozzle Harnesses



Figure 37

Nozzle Harness [Figure 37]

- Nozzle Harness, 8 x 20" (P/N 117501-005)
- Nozzle Harness, 4 x 20" (P/N 117501-006) [Not Shown]
- Nozzle Harness, 8 x 15" (P/N 117501-022) [Not Shown]
- Nozzle Harness, 4 x 15" (P/N 117501-023) [Not Shown]
- NOTE: When installing the nozzle harnesses along the booms, remember that the nozzle harness pigtails (connector's wires) are color coded.

One nozzle harness pigtail will contain a White and Black wire, while the adjacent nozzle harness pigtail (connector) will contain a Green and Black wire.

- NOTE: The nozzle harness pigtails (connectors) must alternate along the boom, "White" / "Green" wire alternation.
- NOTE: Every other nozzle must pulse together to create pulse blending. The White wire creates an odd pulse. The Green wire creates an even pulse.





The 1 x 20" nozzle harness **[Figure 38]** (if required) is used to connect to one nozzle valve on a boom section. See General Layout Example on page 42.

Nozzle Alternator Harness



Figure 39

A Nozzle Alternator Harness **[Figure 39]** is required when the nozzle harness "White" / "Green" wire alternation cannot be maintained.

If required, the nozzle alternator harness is installed between the Valve Driver and nozzle valve harness. See General Layout Example on page 42.

Power Harness



Figure 40

A 40' Power Harness (Item 1) supplied with electrical terminals (Item 2) **[Figure 40]** connects from the Power Hub to the 80A circuit breaker battery.

Circuit Breaker Kit (80A)



Figure 41

The circuit breaker kit is installed for circuit protection in the power circuit, which provides power to the SharpShooter with Rate Sync system.

This 80A Circuit Breaker is equipped with automatic and manual trip features as well as a manual reset button (Item 1) [Figure 41].

Power Hub Cover





The Power Hub Cover **[Figure 42]** protects the Power Hub.

Packard and Deutsch Plugs



Figure 43

Packard plugs [Figure 43] are used to weather proof any unused connectors.

- 1. WP Plug 2-Pin Tower (116200-045)
- 2. WP Plug 3-Pin Tower (116200-046)
- 3. DT Plug 6-Pin Male (706530-348)

SharpShooter with Rate Sync Product Manual



Figure 44

The SharpShooter with Rate Sync Product Manual **[Figure 44]** is supplied to aid the owner/operator in safety, operation, maintenance and troubleshooting of the SharpShooter with Rate Sync system.

Power Disconnect Kit (Optional)



Figure 45

A Power Disconnect kit **[Figure 45]** is available for trailer sprayers or for sprayer applications where disconnecting of the battery power wires is desired.

Pressure Sensor Breakout Harness



Figure 46

The Pressure Sensor Breakout Harness [Figure 46] is a service tool used to evaluate the Pressure Sensor.

Installation Kit

The Installation Kit 118703-002 is included in the Base Kit. (See Base Kit on page 41).

	INSTALLATION KIT 118703-002				
ITEM	PART NO.	DESCRIPTION	QTY.		
Not Shown	118156-002	Owners Manual, SS w/Rate Sync	1		
Not Shown	709301-803	Screw, 10-24 x 1/2"	4		
Not Shown	118603-111	Ball Mount Ram w/U-Bolts	1		
Not Shown	713501-905	Nut, Hex 3/8-16	4		
Not Shown	713501-405	Bolt, Flanged 3/8-16 x 4" GR8	4		
Not Shown	118640-031	Bracket, Power Hub Mount	2		
7A	118604-006	Circuit Breaker Kit, 80A (See page 40)	1		
Not Shown	120100-010	Installation Kit, Cable Ties	1		
Not Shown	716008-310	Tee, 3/8 FTP, SS	1		
Not Shown	716008-314	Tee, 1/4 FTP, SS	1		
Not Shown	716008-312	Nipple, 3/8 MPT x 3/8 MPT, SS	1		
Not Shown	716008-315	Nipple, 1/4 MPT x 1/4 MPT, SS	1		
Not Shown	716008-316	Bushing, 3/4 MPT x 1/4 FTP, SS	1		
Not Shown	716008-311	Bushing, 3/8 MPT x 1/4 FTP, SS	1		
Not Shown	708000-051	Tape Teflon	1		
Not Shown	620185-001	Pressure Break-Out Harness 3 Pin	0 - 1		

Parts as Required

ITEM	PART NO.	DESCRIPTION	QTY.
Not Shown	118605-001	Power Disconnect Kit (Optional)	0 - 1
		BOOM SHUT OFF ADAPTERS	
	118606-200	S/O Adapter SSRS RoGator 60/80 5 Section	
	118606-001	Harness, Shutoff Pigtail, SSRS, 6 Pin Shroud, DT	
	118606-002	Harness, Shutoff, SSRS, Case SPX, DT	
	118606-100	Harness, Shutoff, SSRS, Apache, DT	
	118606-200	Harness, Shutoff, SSRS, RoGator, SS, 90 &100', 5 Section, DT	
	118606-201	Harness, Shutoff, SSRS, RoGator, SS/C, 120', 7 Section, DT	
	118606-202	Harness, Shutoff, SSRS, RoGator 90 ft and 100 ft x 5 Sections, DT	
	118606-300	Harness, Shutoff, SSRS, 2009 JD x 7 Section, DT	
	118606-301	Harness, Shutoff, SSRS, JD 4940 11 Section, DT	
	118606-302	Harness, Shutoff, SSRS, JD 4930 Ground Switched, DT	
	118606-303	Harness, Shutoff, SSRS, John Deere 4720, DT	
	118606-304	Harness, Shutoff, SSRS JD, R Series, 7 Section	
	118606-305	Harness, Shutoff, SSRS, JD, R Series, 9 Section	
	118606-306	Harness, Shutoff SSRS, JD, R Series, 11 Section	
	118606-307	Harness, Shutoff, SSRS, JD, R Series, SSRS-SS	
	118606-400	Harness, Shutoff, SSRS, NH Guardian, DT	
	118606-401	Harness, Shutoff, SSRS, New Holland, 120 ft, DT	

SharpShooter with Rate Sync Parts List



Base Kit

The Base Kit 118703-003 is the starting point for all SharpShooter's with Rate Sync systems. The base kit includes all components shared by every machine.

		BASE KIT 118703-003			
ITEM	PART NO.	DESCRIPTION	QTY.		
1	118550-002	SharpShooter with Rate Sync Display, (SSRS Display)	1		
2	118600-012	Power Hub	1		
3	116301-001	Pressure Sensor Assembly, 100 psi	1		
4	118200-035	Harness, Pressure Sensor Adapter	1		
5	118676-001	Power Harness, 40'	1		
6	118200-033	Harness Pigtail, (SSRS Display) 10'	1		
Not Shown	120140-016	Serial Extension, DB9 x 15'	1		
Not Shown	118640-107	Power Hub Cover, Assembly	1		
7	118703-002	Installation Kit, SSRS Display (See Installation Kit on page 39)	1		

Parts as Required

ITEM	PART NO.	DESCRIPTION	QTY.
8	118200-030	Extension Harness, (SSRS Display) 20'	0 - 1
	118200-031	Extension Harness, (SSRS Display) 40'	0 - 1
9	As Req.	Harness, Boom Shutoff Adapter (See Parts as Required on page 39)	1
10	118400-004	Valve Driver Assembly	As Req.
11	117501-005	8 x 20" Nozzle Harness	As Req.
	117501-022	8 x 15" Nozzle Harness	As Req.
	117501-006	4 x 20" Nozzle Harness	As Req.
	117501-023	4 x 15" Nozzle Harness	As Req.
	116200-040	1 x 20" Nozzle Harness	As Req.
12	116190-111	TeeJet Nozzle Valve Assembly	0 - 84
	116290-111	Arag Nozzle Valve Assembly	0 - 84
	116390-111	Wilger Nozzle Valve Assembly	0 - 84
	116290-211	Arag High Flow Nozzle Valve Assembly	0 - 84
13	118650-010	Harness Extension (Boom) 6 cond x 10'	As Req.
	118650-020	Harness Extension (Boom) 6 cond x 20'	As Req.
	118650-030	Harness Extension (Boom) 6 cond x 30'	As Req.
	118650-040	Harness Extension (Boom) 6 cond x 40'	As Req.
	118650-050	Harness Extension (Boom) 6 cond x 50'	As Req.
	118650-060	Harness Extension (Boom) 6 cond x 60'	As Req.
14	116200-045	WP Plug 2-Pin Tower	As Req.
15	116200-046	WP Plug 3-Pin Tower	As Req.
Not Shown	706530-348	DT Plug 6-Pin Male Deutsch	As Req.
Not Shown	N/A	DT Plug 6-Pin Female Deutsch	As Req.
Not Shown	116200-032	Y-Adapter 3-Pin	As Req.
Not Shown	118640-032	Y-Adapter 6-Pin	As Req.
Not Shown	116200-013	Nozzle Alternator Harness	As Req.

General Layout Example

SharpShooter[®] with Rate SyncTM

Note: Only Boom Sections 1 and 3 Parts Identification Shown.







SharpShooter[®] with Rate SyncTM Product Manual

SHARPSHOOTER WITH RATE SYNC SYSTEM

SharpShooter with Rate Sync Kit





The SharpShooter with Rate Sync kit ships in 4 or 5 boxes [Figure 47] that contain the following marked boxes:

- Cab & Power Hub (Box 1 of 5)
- Boom Sections (Box 2 and/or 3 of 5)
- Valves (Box 4 of 5)
- Cover Assembly (Box 5 of 5)

NOTE: Your SharpShooter with Rate Sync system is assembled, tested and shipped according to your machine's boom configurations. Make sure that the boom section boxes are installed on the appropriate boom sections (1 thru 10 etc).



Figure 48

Boom Section boxes [Figure 48] are marked for each boom section.

Boom Section contents may contain:

- Valve Drivers
- Nozzle Valve Harnesses
- Extension Harnesses
- Nozzle Alternator Harnesses (if required)
- Y-Adapters (if required)
- Nozzle Valve Assemblies
- Plugs

NOTE: Nozzle alternator adapters and Y-adapters (if required) are also pre-assembled to the Boom Section components and wiring.

SHARPSHOOTER WITH RATE SYNC INSTALLATION OVERVIEW

Working with sprayer equipment can be dangerous, so the proper hand and eye protection should be used at all times.

Before installation of the SharpShooter with Rate Sync system components, make sure the machine / sprayer is clean. Flush the spray system with water and make sure that the pressure is released from the sprayer system. Unfold and lower the sprayer booms.

- NOTE: The following are eleven basic steps for installing the SharpShooter with Rate Sync system. If additional installation information is required, refer to pages 48 thru 59.
- NOTE: For general reference of SharpShooter with Rate Sync system components and wiring, see General Layout Example on page 42.

SharpShooter with Rate Sync Installation Overview Steps 1 - 11

- 1. <u>SHARPSHOOTER WITH RATE SYNC (SSRS</u> <u>DISPLAY</u>) - Install the SSRS Display inside the cab with the Ram mounting bracket and hardware provided.
- 2. <u>HARNESS, SSRS PIGTAIL</u> Connect the SSRS Pigtail harness fused end to the SSRS Display and route the opposite end out the cab.
- NOTE: Install the SSRS Display within reach of the operator.
- SERIAL EXTENSION DB9 x 15' Connect the serial extension to the SSRS Display and to the GPS system.
- 4. **<u>POWER HUB</u>** Install the Power Hub on the boom mast, and secure it with the mounting hardware kit.
- NOTE: Due to the extension harness lengths, locate the Power Hub as close to center as possible.

- <u>PRESSURE SENSOR</u> Install the Pressure Sensor into the machine's boom manifold with the fittings and sealant tape supplied in kit.
- NOTE: The Capstan Pressure Sensor should sense pump pressure. If a check valve is located in the plumbing, be sure to place Capstan Pressure Sensor on pump side of check valve.
- HARNESS, PRESSURE SENSOR Connect the Pressure Sensor harness to the Pressure Sensor and to the Power Hub.
- NOTE: Your SharpShooter with Rate Sync system has been shipped according to your machine's boom configurations. Make sure that the individually marked Boom Section box components / harnesses are installed on the appropriate boom sections (1 thru 5 etc).
- 7. <u>BOOM SECTION BOX COMPONENTS</u> Install the individually marked Boom Section box components, nozzle valve harnesses, valve drivers, nozzle valves and boom extension harnesses, to the appropriate boom sections.
 - A. Nozzle Harnesses Route and secure nozzle harnesses along the boom sections.
 - B. Valve Drivers Install and secure the Valve Drivers on the boom near the first nozzle of each boom section.
 - C. Nozzle Valves Nozzle valves are installed in place of the check valve. Install one nozzle valve assembly per valve body.
 - D. Extension Harness (Boom) Install the extension harnesses from each boom section Valve Driver and connect them to the appropriate connector on the Power Hub.
- 8. **BOOM SHUTOFF ADAPTER** Install the Boom Shutoff Adapter between the machine's boom section manifold and the machine's boom section harness. Connect the Boom Shutoff Adapter to the Power Hub.
- NOTE: To prevent damage to the wiring harnesses, allow enough slack to raise and lower the booms and to operate the boom folds.

SHARPSHOOTER WITH RATE SYNC INSTALLATION OVERVIEW CONTD.

- HARNESS, EXTENSION, SSRS DISPLAY Install the SSRS Display extension harness to the Power Hub and route and connect it to the SSRS Pigtail harness from the cab.
- 10. <u>HARNESS, POWER</u> Install the Power harness to the Power Hub and route it to the machine's batteries. DO NOT connect to the batteries.
- NOTE: Before installing the circuit breaker and battery connections, make sure that all SharpShooter with Rate Sync component wiring and connections have been completed.
- 11. <u>CIRCUIT BREAKER</u> Install the Circuit Breaker near the machine's batteries. Route and attach the Power Harness leads to the circuit breaker and battery.
- NOTE: Once the SharpShooter with Rate Sync system installation is complete, the SSRS with Rate Sync system is ready for testing. See INSTALLATION SYSTEM TEST on page 61.

STEP 1

SharpShooter with Rate Sync (SSRS Display)



Figure 49

The Cab Component box [Figure 49] contains the following:

- 1. SSRS Display
- 2. Ram Mounting Bracket and Hardware
- 3. 9 pin Serial Cable

Choose a mounting location in the cab within reach and view of the operator. Use the mounting hardware supplied in the kit to mount the SSRS Display.

STEP 2

Harness Pigtail (SSRS Display)



Figure 50

Connect the SSRS Display Pigtail harness male Deutsch 8-Pin connector (Item 1) fused end to the SSRS Display. The opposite end male Deutsch 8-Pin connector (Item 2) **[Figure 50]** will route out of the cab.

STEP 3

Serial Extension



Figure 51

NOTE: SharpShooter with Rate Sync requires a GPS unit connected for the Rate Sync feature to function.

The GPS connection is achieved by attaching a GPS receiver signal to SSRS Display via a serial adapter cable (Item 1) to the right side port (Item 2) [Figure 51] located on the backside of the SSRS Display.

Connect the serial adapter cable opposite end (Item 3) to the machines GPS system.

SharpShooter with Rate Sync requires VTG messages and at a recommended rate of 10HZ to function properly.

STEP 4

Power Hub



Figure 52

The Power Hub (Item 1) **[Figure 52]** box contains the following:

- SharpShooter with Rate Sync Product Manual
- Power Hub
- Pressure Sensor
- Boom Shutoff Adapter
- Circuit Breaker
- Cable Tie Kit
- Plugs
- Extension 3 cond x 10'

Use the hardware mounting kit (Item 2) **[Figure 52]** to install the Power Hub on, or near, the center of the boom mast.

NOTE: Mount the Power Hub in either a horizontal or vertical position, so that water will not collect near the wires. Mounted horizontally will allow the power hub cover correct orientation.

STEP 5

Pressure Sensor



Sprayer lines may be pressurized. Relieve pressure before removing pressure sensor or pressure sensor lines.



Figure 53

NOTE: The Pressure Sensor should be installed in the plumbing in a location that will have an accurate reading when all or only one boom section is turned on.

NOTE: The Pressure Sensor shoud be installed vertically with the harness located at the top.

Install the Pressure Sensor **[Figure 53]** near the boom section manifold. The Pressure Sensor should be installed at a location in the plumbing that will provide an accurate reading when all or only one boom section is turned on. A good location for the Pressure Sensor is near the sprayer's pressure gauge port.

It is recommended that the Pressure Sensor **[Figure 53]** be installed near the existing Pressure Sensor or pressure gauge (in the main boom plumbing).

SharpShooter with Rate Sync Pressure Sensor has a male 1/4" pipe thread boss. Sometimes an unused boss is available on the sprayer. It is usually necessary to remove the pressure gauge / line and install a tee (supplied with kit).

A short nipple may be required to install the tee, and a reducer bushing may be required to facilitate 1/4" pipe threads.

Use Teflon[®] tape to prevent leakage.

NOTE: See Page 59 for installation of a Pressure Sensor onto a sprayer.

STEP 6

Harness Pressure Sensor



Figure 54

Connect the Pressure Sensor harness 3-Pin tower connector to the pressure sensor. Route the male Deutsch 4-Pin connector and connect it to the Power Hub.

STEP 7

Boom Section Box Components

- NOTE: Your SharpShooter with Rate Sync system has been shipped according to your machine's boom configurations. Make sure that the individually marked Boom Section box components / harnesses are installed on the appropriate boom sections (1 thru 5 etc).
- NOTE: Boom section box components, harness lengths and component quantities will vary according to each of your machine's boom section configurations.

Boom Section boxes contents may be as follows:

- Nozzle Valve Harnesses
- Valve Drivers
- Nozzle Valve Assemblies
- Extension Harnesses
- Alternator Harnesses (if required)
- Y-Adapters (if required)

Nozzle Harnesses

Route and secure nozzle harnesses along the boom sections.

When installing the nozzle harnesses along the booms, remember that the nozzle harness pigtails (connector wires) are color coded.

The nozzle harness pigtail (connectors) contains a White and Black wire, while the adjacent pigtail (connector) contains a Green and Black wire.



Figure 55

- NOTE: The nozzle harness pigtails (connectors) should alternate along the boom, "White" / "Green" wire alternation [Figure 55].
- NOTE: Every other nozzle should pulse together to create pulse blending White wire odd pulse Green wire even pulse.
- NOTE: The leading edge of the nozzle harness has a 3-Pin connector that connects to the Valve Driver.

Additional wire length is required when routing nozzle harnesses around boom fold hinges.

When routing nozzle harnesses around a boom fold, skip and cap two nozzle harness pigtails (connectors) around the boom fold. When connecting the nozzle harness pigtail to the next nozzle valve, allow enough slack in the harness for the operation of the boom fold and preserve the correct nozzle alternation.

NOTE: Install dust caps on all the unused connectors and secure the nozzle harness wiring with cable ties, allow enough slack to operate the boom fold.

STEP 7 CONT.

Boom Section Box Components Cont.

Valve Drivers



Figure 56

With cable ties, mount and secure the Valve Driver(s) (Item 1) **[Figure 56]** to the boom, near the first nozzle valve on each boom section. See General Layout Example on page 42.

NOTE: Mount the Valve Driver in a horizontal or vertical position, so that water will not collect near wires.

Connect the 3-Pin shroud connector (Item 2) [Figure 56] to the nozzle harness on each boom section.

Nozzle Valves



Before removal or installation of nozzle valves, make sure that the pressure has been released from the sprayer lines.

NOTE: While incorrect nozzle valves may screw onto the nozzle body, they will leak or pop off under pressure. It is important to have the correct nozzle valve for the nozzle body.



Figure 57

Remove and discard the drip check (Item 1) and the diaphragm (Item 2) [Figure 57] from the nozzle bodies.



Figure 58

Install the O-ring (Item 1) supplied with the kit. Install the nozzle valve assembly (Item 2) onto the nozzle body (Item 3). Rotate the nozzle valve assembly so that the wire (Item 4) is close to the boom. Tighten the flynut (Item 5) [Figure 58].

Install the spray tip (Item 6) [Figure 58].

- NOTE: If the coil housing spins, tighten the flynut until the coil housing does not spin. The nozzle valves only need to be snug to prevent leakage.
- NOTE: Install dust caps on any unused connectors.
- NOTE: Repeat [Figure 57] & [Figure 58] procedures for all nozzle valve assemblies.

STEP 7 CONT.

Boom Section Box Components Cont.

Nozzle Valves Cont.

- NOTE: When ordering the SharpShooter with Rate Sync kit, the nozzle valve assembly threaded cap is unique to different brands of nozzle bodies. Be sure to have identified the nozzle body types being used on the sprayer.
- NOTE: If interference issues arise when installing nozzle valves onto the sprayer nozzle bodies, see Special Installation Instructions on page 57.

Nozzle Alternator Harness (If Required)



Figure 59

NOTE: A nozzle alternator harness [Figure 59] is required only when the nozzle harness "White" / "Green" wire alternation cannot be maintained between nozzle valves.

See General Layout Example on page 42.



3-Pin Y-Adapter Harness (If Required)

Figure 60

The 3-Pin Y-adapter harness [Figure 60] is required when locating a Valve Driver on the center of a boom section. The 3-Pin tower end (Item 1) will connect to the Valve Driver.

Each 3-Pin shroud end (Item 2) [Figure 60] connects to a nozzle harness and allows the nozzle harnesses to be routed in each direction on the boom section.



Figure 61

When connecting the 3-pin Y-adapter harness shroud ends to the nozzle harnesses, take note of the White wire (position C) (Item 1) and White wire (position B) (Item 2) [Figure 61].

The connector (Item 1) **[Figure 61]** White wire (position C) must connect to the nozzle harness on the first nozzle valve of the White alteration.

See General Layout Example on page 42.

STEP 7 CONT.

Boom Section Box Components Cont.

Boom Extension Harnesses



Figure 62

Connect the boom 1, 2, 3, etc. extension harness female Deutsch 6-Pin connector (Item 1) to the valve driver on each boom section. Route the male Deutsch 6-Pin connector (Item 2) **[Figure 62]** fused end along the boom and connect it to the appropriate connector on the Power Hub. Repeat for each boom section.

NOTE: To prevent damage to the wiring harnesses, allow enough slack to raise and lower the booms and to operate the boom folds.

STEP 8

Boom Shutoff Adapter



Figure 63

Install the Boom Shutoff Adapter between the machine's boom section manifold and the machine's boom section harness. Connect the Boom Shutoff Adapter male Deutsch 12-Pin connector (Item 1) [Figure 63] to the Power Hub.

STEP 9

Harness Extension (SSRS Display)

NOTE: To prevent damage to the wiring harnesses, allow enough slack to raise and lower the booms and to operate the boom folds.



Figure 64

Install the SSRS Display extension harness male Deutsch 8-Pin connector (Item 1) to the Power Hub. Route and connect the female Deutsch 8-Pin connector (Item 2) **[Figure 64]** to the SSRS Display Pigtail harness from the cab.

NOTE: Route and secure the extension harness along existing wiring / plumbing. Secure excess wire with cable ties.

STEP 10

Harness Power



Figure 65

Connect the Power Harness Red wire terminal (Item 1) to the Power Hub 12V (+) terminal (Item 2) [Figure 65].

Connect the Power Harness Black wire terminal (Item 3) to the Power Hub ground (-) terminal (Item 4) **[Figure 65]**.

Route the Power Harness wire along existing wiring / plumbing until the wire reaches the machines batteries.

NOTE: To prevent damage to the power harness, allow enough slack to raise and lower the booms.

STEP 11

Circuit Breaker

NOTE: Before installing the circuit breaker and battery connections, make sure that all SharpShooter with Rate Sync component wiring and connections have been completed.



Figure 66

Cut a length of wire from the power harness Red (+) wire, enough length to reach from the circuit breaker to the battery (+) positive terminal. Strip the insulation from each cut. Crimp the ring terminals provided, to each wire end.

Connect the power harness Red (+) wire (Item 1) to the Circuit Breaker (Item 2). Then connect the Red wire (Item 3) **[Figure 66]** to the Circuit Breaker and battery (+) positive terminal.

Connect the power harness Black (-) wire (Item 4) [Figure 66] to the battery ground terminal.

NOTE: If the machine is equipped with a power disconnect, connect the Power Hub power harness Black (-) wire (Item 4) to the machines power disconnect ground terminal.

IMPORTANT

When disconnecting the battery terminals, remove the NEG (-) cable first, then remove the POS (+) cable. When connecting cables, connect the POS (+) cable first, then connect the NEG (-) cable.

NOTE: Once the SharpShooter with Rate Sync system installation is complete, the SharpShooter with Rate Sync system is ready for testing. See INSTALLATION SYSTEM TEST on page 61.

Power Disconnect Kit (Optional)

A power disconnect kit is available for trailer sprayers or for sprayer applications where disconnecting of the battery power wires is desired.



When disconnecting the battery terminals, remove the NEG (-) cable first, then remove the POS (+) cable. When connecting cables, connect the POS (+) cable first, then connect the NEG (-) cable.



Figure 67

NOTE: Disconnect the Power Hub Power Harness from the machine's batteries before installing the Power Disconnect.

Cut and strip the Power Harness wires at the desired disconnect location. Crimp the spacer bushing (Item 1) and terminal (Item 2) onto each wire. Insert the terminals into the housing, making sure that the positive (+) Red wire and negative (-) Black wire are in the correct housing (Item 3) [Figure 67] location.

NOTE: The Power Disconnect housing locations are marked with a (+) positive and (-) negative.

Reconnect the Power Hub Power Harness to the machines batteries.

Special Installation Instructions

Nozzle Valves



Before removal or installation of the nozzle valves, make sure that the pressure has been released from the sprayer lines.

NOTE: The special installation instructions show the interference issues that occur on some model sprayers.



Figure 68

If the knurls of the boom tube threaded caps (Item 1) interfere with the nozzle valve threaded cap (Item 2) **[Figure 68]**, slightly rotate the threaded cap until the nozzle valve assembly cap is free to rotate and tighten.

NOTE: Some boom tube supports may need to be adjusted for nozzle valve assembly clearance.



Figure 69

At the end of the inner boom structure, an additional section of boom can be added. A boom stop bolt (Item 1) **[Figure 69]** may interfere with the valve assembly installation.

In this case, the bolt was not required and removed. In addition, the boom liquid tube retainers were also loosened. The boom tube was moved slightly toward the inside of the machine in order to install the valve assembly.

Special Installation Instructions Cont.

Nozzle Valves Cont.



Figure 70

At two locations, the quick coupler boom tube fitting (Item 1) **[Figure 70]** interferes with the valve assembly installation.

Remove the clamp (Item 2) and quick coupler boom tube fitting (Item 1) [Figure 70].



Figure 71

Install the female coupler (Item 1) and a male threaded barb (Item 2) **[Figure 71]**.

Tighten the hose clamps (Item 3) [Figure 71].

Once the quick coupler boom tube fitting is removed (Item 1) **[Figure 70]** install glue and install the plastic female coupler (Item 1) **[Figure 71]**. The barb connector glues into the female coupler and the hose reinstalls with a band clamp.

Special Installation Instructions Cont.

Pressure Sensor

- NOTE: Instructions are shown for the Pressure Sensor installed onto a sprayer. Installation procedures for your sprayer may be slightly different.
- NOTE: The Pressure Sensor should be installed vertically, with the Pressure Sensor up.



Sprayer lines may be pressurized. Relieve pressure before removing pressure sensor or pressure sensor lines.





Remove the sprayer's Pressure Sensor line (Item 1) from the 1/4" x 90° plastic elbow fitting (Item 2) [Figure 72].

Remove the 1/4" x 90° plastic elbow fitting (Item 2) [Figure 72].



Figure 73

Install the 1/4" nipple (Item 1) wrapped with Teflon[®] tape and the 1/4" tee (Item 2) [Figure 73] that are supplied with kit.

Wrap and reinstall the $1/4" \times 90^{\circ}$ plastic elbow fitting (Item 3), then install the sprayer's pressure line (Item 4) **[Figure 73]** into the $1/4" \times 90^{\circ}$ plastic elbow fitting.

Wrap and install the Pressure Sensor (Item 5) [Figure 73] into the tee.

NOTE: The Pressure Sensor will connect to the Power Hub.

SharpShooter with Rate Sync Installation Tips

Although the installation is usually straightforward, the following are common installation oversights:

- 1. Never connect more than 22 nozzle valves to a Valve Driver.
- 2. When routing nozzle harnesses through the boom fold and swing joints, skip two nozzle harness pigtails. This allows for boom joints to operate without damaging harnesses, and maintains even / odd nozzle pairing.
- 3. Where side by side nozzle valves are pulsing together, install the nozzle alternator harnesses on Valve Drivers to maintain even / odd pulses.
- 4. Never use Air Induction (AI) spray tips.
- 5. Route wires to allow for raise / lower movement of the boom mast, boom fold and boom swing functions.
- 6. When wiring to boom section signals, a custom harness is needed for unsupported platforms.
- 7. Connect the nozzle wiring harnesses to alternate pulsing on side-by-side nozzles.
- 8. Use the correct tip choices.
- 9. The menu screens are used to check key software settings. If assistance is required, contact your SharpShooter with Rate Sync distributor.

INSTALLATION SYSTEM TEST

Fill the product tank with 100 gallons of clean water.

SharpShooter with Rate Sync (SSRS Display) Check

Power to the SSRS Display:



Figure 74

- 1. Connect the SSRS Display pigtail harness to the SSRS Display.
- 2. Power up the SSRS Display, it will default to Manual mode.
- 3. Observe that the SSRS Display screen reads Manual Mode and 50% duty cycle [Figure 74].
- NOTE: This confirms that power is being received by the SSRS Display.

Boom Section Display Check:

- 1. With the rate controller master switch Off, turn the rate controller ON.
- 2. Turn ON all rate controller boom section switches and the rate controller master switch.
- 3. Turn ON the SSRS Display, it will be in Manual Mode at 50% duty cycle.

NOTE: All solenoid valves on the boom should start clicking.

- 4. Turn OFF the rate controller boom switches.
- 5. Turn the rate controller boom section 1 switch ON.
- NOTE: The solenoid valves on boom section 1 should start clicking.
- 6. Repeat step 5 for each boom section.
- NOTE: If the solenoid valves on a different boom section click on instead, the shutoff adapter is not properly connected to the appropriate boom sections.

Manual Mode Check:

To confirm that the SSRS Display is functioning in Manual mode, perform the following steps.

- 1. Set a test speed and a rate value in the rate controller.
- 2. Turn ON the machines product pump.
- 3. Turn ON the boom, and allow the machine to spray water until rate and pressure values are achieved.
- 4. Place the SSRS Display in the Manual mode.
- 5. The SSRS Display will default to 50% duty cycle.

NOTE: The boom should be spraying and the solenoid valves on the boom should be pulsing.

- 6. Use the *decrease* button to select 20% duty cycle to observe an increase in pressure.
- 7. Use the *increase* button to select 80% duty cycle to observe a decrease in pressure.

INSTALLATION SYSTEM TEST CONT.

Auto Mode Check:

To confirm that the SSRS Display is operating in Auto mode, perform the following steps.

- NOTE: The rate controller may need to be adjusted to put SSRS Display in a practical control range. See the rate controller Operation Manual.
- 1. Select Auto mode and set the target pressure to 40 psi.
- 2. Observe that the SSRS Display adjusts the pulse duty cycle to achieve 40 psi.
- 3. Set the rate controller in manual mode.
- 4. Using the rate controller, decrease the rate until SSRS Display reaches minimum pulse duty cycle and displays minimum duty cycle in diagnostics area.
- 5. Using the rate controller, increase the rate until SSRS Display reaches maximum duty cycle (100% or open flow).

Static Systems Check:

- 1. Set the rate controller to 10 GPA.
- 2. Enter a test speed of 10 mph.
- 3. Turn ON the product pump.
- 4. Place the SSRS Display in the Auto mode.
- 5. Set target pressure to 40.
- NOTE: Let the rate and pressure stabilize at 10 GPA and 40 psi. Check that the speed is at 10 mph.

Pressure Control Test:

- 1. Set target pressure to 60.
- NOTE: Check to see if the pressure does climb to 60 psi. With the test speed still at 10 mph, the rate should settle back to the 10 GPA mark.
- 2. Set target pressure to 20.
- NOTE: Check to see if the pressure does drop to 20 psi. With the test speed still at 10 mph, the rate should settle back to the 10 GPA mark.
- 3. Return target pressure to 40.

Flow Control Test:

- 1. Start with a test speed set at 10 mph, a pressure of 40 psi, and a rate at 10 GPA.
- 2. On the rate controller, increase the rate to 15 GPA.
- NOTE: The rate controller should work to achieve the 15 GPA and the pressure should settle back to 40 psi.
- 3. On the rate controller, decrease the rate to 5 GPA.
- NOTE: The rate controller should work to achieve the 5 GPA and the pressure should settle back to 40 psi.

Speed Control Test:

- NOTE: If any of these installation tests fail, See PRESSURE TUNING WITH PID PARAMETERS on page 63.
- 1. Start with a test speed set at 10 mph, a pressure of 40 psi and the rate at 10 GPA.
- 2. Increase the test speed to 15 mph.
- NOTE: The rate controller should work to return to 10 GPA and the pressure should settle back to the 40 psi.
- 3. Decrease the test speed to 5 mph.

NOTE: The rate controller should work to return to 10 GPA and the pressure should settle back to the 40 psi.

If all tests are successful, machine is ready for use and the SharpShooter with Rate Sync system is now ready for field operation.

PRESSURE TUNING WITH PID PARAMETERS

SharpShooter with Rate Sync uses three control parameters to stabilize pressure in the control software algorithm.

<u>System Gain</u> - Changes the total gain of the system according to the same ratios of what the Proportional/ Integral gain establish.

This gain number is the one most often used to tune sluggish or oscillating systems. The greater the number, the more sensitive the control system. Stabilize an oscillating system by selecting a lower number. Speed up a sluggish system by selecting a higher number.

System gain recommended starting value = 9.

<u>**P Gain</u></u> - Proportional gain determines the speed that the SharpShooter with Rate Sync drives the duty cycle toward the target value.</u>**

Stabilize an oscillating system by selecting a lower number. Speed up a sluggish system by selecting a higher number.

P gain recommended starting value = 5.0.

<u>I</u> Gain - Integral gain determines the acceleration of duty cycle changes to the target value.

Stabilize an oscillating system by selecting a lower number. Speed up a sluggish system by selecting a higher number.

I Gain recommended starting value = 0.15.

SharpShooter with Rate Sync (SSRS Display) Data Logging Procedure

The tools required are:

- A computer.
- A nine pin pigtail (male pins) to USB serial cable purchased at a local electronics store.
- Capstan diagnostic software tool. See instructions below to acquire this software.

Capstan Diagnostic Software Tool

This software tool may be downloaded from the Capstan website at www.capstanag.com.

- Log in at the dealer log-in.
- Look for the Capstan Diagnostic Tool, and double click to download.
- Elect the "Save As" option to store at a desired location on your computer.
- When the save is complete, select the "Open Folder" option.
- In the folder, double click the Capstan Diagnostic file to "unzip" and save it as an icon on the computer's main screen.

Connect the serial cable into both the 9-pin pigtail on the SSRS Display and the USB port to the computer. You may need a USB to serial cable to connect to your computer.

Locate which computer communication port the USB cable is using, by viewing "Devices". Typically, you can use the "Control Panel" selection on your computer to view "Devices". From here, you should be able to see the computer COM port that the USB cable is using.

Click on the Capstan Diagnostic Tool and enter the proper COM port number from the drop-down menu. The Baud Rate should be set at 19200.

You are now able to run the programming diagnostics.

- NOTE: This data may be useful when assistance is required for diagnostic reasons.
- NOTE: Connect serial cable to SSRS Display left port as you are looking at the back of the display.



Service - Recommended Guidelines

NOTE: With the SharpShooter with Rate Sync system the primary service tool will be a simple multi-meter that can measure DC voltage and resistance (ohms).

When servicing a SharpShooter with Rate Sync and Rate Controller System, Capstan recommends the following three step troubleshooting process:

- 1. Perform **Baseline Service Check** and verify the original SSRS Display setup programming parameters. See PRESSURE TUNING WITH PID PARAMETERS on page 63.
- 2. Identify **Individual Performance** problems to determine possible causes and corrections for performance issues. See Symptom Troubleshooting Chart on page 71.
- Troubleshooting Components. See pages 65 thru 81.

Baseline Service Checks

- 1. Verify the voltage readings. See page 75 thru 81 for individual component testing.
- 2. Visually check all wire connections, harnesses and connectors for loose, broken, or damaged wires.
- 3. Tip selection check.
- 4. Check the Rate Controller Cal numbers, the operator can often accidently change these values.
- 5. Do a "Like Component Swap" to see if the failure follows the component. See Swapping Components on page 65.
- Hook up the computer with the Capstan diagnostic tool. See SharpShooter with Rate Sync (SSRS Display) Data Logging Procedure on page 63.
- 7. Perform wet tests. See Wet Tests on page 69 and 70.

Swapping Components



Figure 75

SharpShooter with Rate Sync systems are comprised of a number of components. Some of these components are used in multiples. Components with multiple uses are:

- Nozzle Valves (Item 1) [Figure 75].
- Valve Drivers (Item 2) [Figure 75].
- Extension Harnesses (Not Shown).

When troubleshooting failed components, it can be helpful to swap the failed part with a part that works from another location. If the problem follows the failed part to the new location, repair or replace the failed part.

If the problem does not follow the failed part, then the problem is likely elsewhere in the system. Other troubleshooting means may need to be followed.

NOTE: Use caution when swapping failed components, as in rare cases, the failed component may cause other components to fail.

Fuses

Fuses are located in two places within the SharpShooter with Rate Sync system.

FUSE LOCATION	RATING	ТҮРЕ	COLOR
SSRS Display Pigtail Harness	5A	ATO/ATC	Tan
Valve Driver Extension Harnesses	15A	ATO/ATC	Blue

Blown fuses are indicators of a short or overload condition. Never replace a fuse with a larger fuse. Larger fuses may result in costly component failures.

NOTE: A maximum of 22 nozzle valves may be installed on a single boom section. Additional nozzle valves will result in a blown Valve Driver Extension Harness fuse. Eleven valves must be installed on the even circuit and eleven must be installed on the odd circuit.

Circuit Breaker

A circuit breaker is located near the battery in the Power Hub power cable.

CIRCUIT BREAKER LOCATION	RATING	TYPE
Battery	80A	Auto or Manual Trip, Manual Reset

A tripped circuit breaker is an indicator of a short or overload condition.

Nozzle Valve Servicing

Be sure to FIRST check that the tips are not plugged.

Plugged nozzle valves can be classified in two categories:

- Plunger blockage debris keeping the plunger from seating against the outlet properly.
- Plunger stuck debris causing the plunger to be stuck.

Improper seating of the plunger results when larger debris catches between the orifice and plunger seal. This is the smallest flow passage within the nozzle valve.

Stuck plungers result when smaller debris collects around the barrel of the plunger and binds the plunger into place.

Symptoms of a blocked or stuck plunger are:

- Constant spray.
- Dripping when the nozzle is shut off.
- NOTE: Pinched or split O-rings will also cause nozzles to drip when shutoff.
- NOTE: Operating a plugged nozzle valve for extended periods may result in a nozzle valve coil failure. Clean any plugged nozzle valves immediately.
- NOTE: If plugged nozzles are a frequent problem in a particular boom section, inspect the machine's boom filter screens for plugged or damaged screens. An 80 mesh screen is recommended to prevent the nozzles from plugging. Check the mesh size of the strainers and replace them if they are too coarse.

Nozzle Valve Servicing Cont.

Nozzle Valve Cleaning



Before removal or installation of the nozzle valves, make sure that the pressure has been released from the sprayer lines.



Figure 76

Remove the O-ring (Item 1), O-ring (Item 2), valve body (Item 3), flynut (Item 4), plunger (Item 5) and O-ring (Item 6) from the coil (Item 7) **[Figure 76]**. See Nozzle Valve Parts Identification on page 68.

Inspect the plunger for wear or damage. Replace the plunger if worn or damaged. See Plunger Seal Inspection on page 67.

NOTE: Remove debris from the nozzle components by washing the components with clean water. Plunger Seal Inspection



Figure 77

After extended use, the soft plunger seal will wear a groove (Item 1) **[Figure 77]** where the seal impacts the hard orifice seat. Replace the plunger if worn or damaged.

As the groove deepens, the pressure capacity of the valve will decrease until the pressure capacity interferes with the operating pressure of the sprayer. The result is erratic pulsing, often described as "flickering".

The SharpShooter with Rate Sync system will operate normally at lower pressures until replacement parts can be acquired. High operating pressures and abrasive spray solutions will accelerate the wear of the plunger seal material.

Nozzle Valve Parts Identification



*Parts shown above are for reference purposes only.

Figure 78

ITEM NO.	DESCRIPTION	PART NO. WILGER	PART NO. TEEJET	PART NO. ARAG	PART NO. HIGH FLOW
1	O-Ring	715022-206	715022-202	715022-205	715022-215
2	O-Ring	715022-201	715022-200	715022-201	715022-211
3	Valve Body	115188-111	116186-111	116182-111	116182-211
4	Flynut	717101-007	717101-004	717101-006	717101-006
5	Plunger	716009-111	716009-111	716009-111	716009-111
6	O-Ring	715022-204	715022-204	715022-204	715022-204
7	Coil	116189-111	116189-111	116189-111	116189-111

🚹 IMPORTANT

Verify nozzle body make and model before ordering Capstan Nozzle Valve parts.

Nozzle Valve Diagnostics

Coil Failure

Coil failures are often the result of:

- Extended valve use with a plugged plunger.
- Extended use in liquid fertilizer overspray environments.

Capstan recommends cleaning any plugged nozzle valve immediately. Capstan also recommends rinsing the inside of the boom with clean water and washing the outside of the coils with clean water as often as practical.

NOTE: Capstan recommends washing the outside of the coils with clean water on a regular basis.

Disconnect the nozzle valve from the nozzle harness pigtail (connector) by unplugging the 2-pin Packard connector which is located on the spray boom.



Figure 79

Use a voltmeter (Item 1) **[Figure 79]** to measure 21 to 23.5 ohms of resistance across pins A and B on the nozzle valve connector.

If proper resistance is not found:

- Clean the connector terminals.
- Replace the coil.

Wet Tests

WET TEST #1

- With water in the tank, turn all of the components On.
- Set a test speed in the rate controller.
- Start with the rate controller in manual mode, this locks rate controller into a single rate, then place the SSRS Display in Manual mode at 50% duty cycle (locks a fixed orifice).

Using the SSRS Display arrow keys, increase/ decrease the duty cycle to verify the duty cycle operation. The pulsing at the nozzles should change.

Increase/decrease the rate to verify the rate controller servo valve operation. The rate should change.

WET TEST #2

- With water in the tank, place the rate controller in AUTOMATIC mode and the SSRS Display in the Auto mode.
- Set a test speed in the rate controller and then set the SSRS Display to 40 psi.
- Static spray test control:
 - Rate Change (with constant pressure and test speed)

Pressure Change (with constant rate and test speed)

Speed Change (with constant rate and constant pressure)

WET TEST #3 (Integration Checks)

- Isolate the Rate Control System from the SharpShooter with Rate Sync system by turning the SSRS Display to the Manual mode and then set the SSRS Display to 50% duty cycle.
- Place the rate controller in AUTOMATIC control mode.
- Set a test speed in the rate controller, and then set the SSRS Display to 40 psi.
- Using the SSRS Display arrow keys, increase/ decrease the duty cycle to verify pressure change. The rate controller should maintain the rate. If the problem is eliminated, the issue is with the SharpShooter with Rate Sync system. If the problem remains, the issue is likely with the rate controller.
- Increase/decrease the rate to verify the rate controller valve operation. If the rate does not change, the issue is with the rate controller.

Wet Tests Cont.

WET TEST #4 (Advanced Integration Checks)

- Auto Mode to Manual Mode Comparison, see Performance Evaluation for Pulsing.
- Valve Calibration and PID Parameter Tweaking.
- Run / Hold Time to check the timing of rate control changes (in the rate controller) to the pressure control response by the SharpShooter with Rate Sync system.
Symptom Troubleshooting Chart



Before operating or servicing system: Read and understand the machine's Operator Manual and this Product Manual. Follow the warnings and instructions in the manuals when making repairs, adjustments, or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death.

Use the following troubleshooting chart to locate and correct problems which most often occur with the SharpShooter with Rate Sync system.

PROBLEM	CAUSE	CORRECTION
Under application	Tips too small	Check for proper tip size
	Plugged tips	Clean or replace tips
	Plugged filter(s)	Clean or replace filter(s)
	Filter(s) not installed correctly	Check all filters for correct installation
	Plugged, kinked, or collapsed hoses	Check all hoses Replace as needed
	Pump not turned on	Turn pump on
	Outrunning sprayer liquid system capability	Slow Down
		Run at optimum pressure (not too low, not too high)
	Incorrect rate controller input settings	Check and adjust settings
	Incorrect calibration settings	Check and adjust settings
	Faulty radar	Replace radar
	Poor GPS satellite signal	Verify that the GPS is working correctly
	Faulty rate controller switch	Locate faulty switch(s) and replace
	Servo valve not working correctly	Check servo valve and replace if needed
Over application	Tips too large	Check for proper tip size
	Worn tips	Replace tips
	Speed too slow	Increase speed
	Incorrect rate settings	Check and adjust rate settings
	Incorrect calibration settings	Check and adjust settings
	Servo valve not working correctly	Check servo valve, and replace if needed
Rate instability	Low voltage to rate controller	Test voltage and repair as needed
	Faulty flow meter	Check flow meter and replace if needed
	Faulty pressure dampner on diaphragm pump(s)	Replace pressure dampner(s)
	Faulty speed sensor reading	Check radar and replace if needed
	Collapsed suction hose	Replace suction hose
	Inlet plugged	Check and clean inlet if needed
	Incorrect valve calibration settings	Check and adjust settings See the rate controller's manual

Symptom Troubleshooting Chart Cont.

PROBLEM	CAUSE	CORRECTION
Rate instability	Incorrect SSRS Display PID Parameters	Check SSRS Display PID Parameters and adjust as needed
	SSRS Display Run / Hold Parameter too short	Adjust SSRS Display Run / Hold Parameter
	Faulty rate controller	Replace rate controller
Pressure instability	Faulty rate controller	Replace rate controller
	Worn or sticky poppets	Check and replace poppets as needed
	Incorrect SSRS Display PID Parameters	Check SSRS Display PID Parameters and adjust as needed
	Faulty pressure sensor	Replace pressure sensor
Single nozzle valve drips when shutoff	Plunger is lodged with debris	Clean nozzle valve See Nozzle Valve Cleaning on page 67
	Plunger is worn	Replace plunger. See Plunger Seal Inspection on page 67
Single nozzle valve sprays erratically	Plunger is worn	Replace plunger See Plunger Seal Inspection on page 67
Single nozzle valve will not shut off	Plunger is lodged with debris	Clean nozzle valve See Nozzle Valve Cleaning on page 67
Section will not spray	Blown fuse on Valve Driver	Replace fuse on Valve Driver
	Faulty Valve Driver	Replace Valve Driver
SharpShooter Display not functioning properly	Low voltage at SSRS Display	Perform system voltage checks
Every other nozzle pulses	Faulty Valve Driver	Replace Valve Driver
	Faulty harness	Replace harness
No pulse - Auto mode (Manual mode: Pulses)	Incorrect pressure sensor input and output settings	Check and adjust settings
No Pulse - Auto mode (Manual mode: No Pulse)	Faulty SSRS Display	Replace SSRS Display

SharpShooter with Rate Sync (SSRS Display)

Connect the SSRS Display to the Power Hub, turn on the SSRS Display and place in Manual mode at 50% duty cycle.

Turn ON the boom and observe that the nozzles are pulsing at 50% duty cycle. Press the decrease button turning duty cycle to 20% and observe a decrease in flow and an increase in pressure.

Press the increase button, turning duty cycle to 80% and observe an increase in flow and a decrease in pressure. This confirms that the SSRS Display is functioning in Manual mode.

Switch the spray rate controller to MANUAL mode and the SSRS Display to the Auto mode. Then, decrease the flow until the SSRS Display reaches the minimum pulse duty cycle and begins to display minimum duty cycle in diagnostics area.

Use the spray rate controller to increase the flow until the SSRS Display reaches maximum duty cycle (100% or open flow) and begins to display maximum duty cycle in diagnostics area. This confirms that the SSRS Display is operating in Auto mode. If the SharpShooter with Rate Sync system is not operating properly:

- Check the circuit breaker near the battery and the fuse on the SSRS Display pigtail harness.
- Check gps setup.
- Use diagnostics to check functionality of pressure sensor, voltage, etc.
- Use serial diagnostics to check pressure sensor, voltage, etc.

Power Hub Pinout Identification



System Load Capacity Check

Disconnect the nozzle valve 2-pin connector that is located on the spray boom farthest from the battery.

Turn OFF the SharpShooter with Rate Sync Display, and then turn ON all boom sections.

Start the engine and turn ON all electrical loads' including air conditioning, foam markers, monitors, etc.





Figure 80

Use a voltmeter to observe the system voltage between pins A and B [Figure 80].

The SharpShooter with Rate Sync nozzle valves operate best at 12 vdc or higher. Using less than 12 vdc will result in reduced pressure capacity, this will often result in erratic nozzle pulsing, sometimes described as "flickering". Also, check nozzle valves for worn plunger seals. See Plunger Seal Inspection on page 67.

If low voltage is observed:

- Check and clean the battery terminals.
- Check the battery condition.
- Check the alternator condition.
- Check the condition of connections.

Valve Driver Voltage Check

Disconnect the Valve Driver from the extension harness by disconnecting the 6-pin Deutsch connector. The connection is generally located at each boom section.



Figure 81

Use a voltmeter to observe that there is 13.5 vdc between pins 1 and 2 with the engine running, or 12.0 vdc without the engine running **[Figure 81]**.

Be sure the polarity is accurate by observing the positive voltage when the red (positive) probe is connected to pin 1 and the black (negative) probe is connected to pin 2.

If no voltage is present:

- Check the 80A circuit breaker located at the battery.
- Check the Power Hub battery connections.
- Check the Power Hub Valve Driver extension connection.
- Check the condition of the battery.
- Check the condition of the alternator.

Pressure Sensor Signal Test

Disconnect the pressure sensor 3-pin connector from the Power Hub harness and then insert the Capstan pressure breakout harness diagnostic tool.

With the engine running and the pump turned on, use the spray rate controller to establish 50 psi on the pressure gauge.



Figure 82

Use a voltmeter to observe that there is 2.75 vdc between the Black and White wires on the pressure breakout harness [Figure 82].

Using the spray rate controller, adjust the pressure to 100 psi and observe 5.0 vdc on the voltmeter.

If accurate voltage is not present:

- Verify the accuracy of the sprayers pressure gauge.
- Check for power to the pressure sensor. See Pressure Sensor Input Power Check on page 77.
- Check the pressure sensor calibration using the serial diagnostics.
- Replace the pressure sensor.

Pressure Sensor Input Power Check

Disconnect the pressure sensor 3-pin connector from the Power Hub harness, and then insert the Capstan pressure breakout harness diagnostic tool.



Figure 83

Use a voltmeter to observe that there is 13.5 vdc between the Red and Black wires on the pressure breakout harness with the engine running, or 12.0 vdc without the engine running [Figure 83].

Be sure the polarity is accurate by observing that there is positive voltage when the Red (positive) probe is connected to Red pressure breakout harness wire and the Black (negative) probe is connected to Black pressure breakout harness wire.

If no voltage is present:

- Check the 80A circuit breaker located at the battery.
- Check the Power Hub battery connections.
- Check the condition of the battery.
- Check the condition of the alternator.

Pulse Circuit Test

SSRS Display Output Check

Disconnect the Valve Driver from the extension harness by disconnecting the 6-pin Deutsch connector. The connector is generally located at each boom section.

Place the SSRS Display in the Manual mode and then select 70% duty cycle with increase/decrease keys.



Figure 84

Use a voltmeter to observe that there is 10.00 vdc between pins 1 and 4 **[Figure 84]**.

Most voltmeters measure signal as 12 vdc 10hz square wave which is a low voltage. In addition, the signal is inverted, so the 70% duty cycle selected on SSRS Display will actually be a 30% duty signal at the Valve Driver. Measurements may vary depending on the voltmeter used. This tests the even pulse. Make the same measurement between pins 1 and 5. This tests the odd pulse.

If accurate voltage is not found:

- Check the Valve Driver extension connections.
- Check the SSRS Display extension connections.
- Check the SSRS Display serial diagnostics.

Valve Driver Output Check

Disconnect the nozzle valve 2-pin connector from the nozzle harness pigtail (connector) located on the spray boom.

Place the SSRS Display in the Manual mode and then select 70% duty cycle with increase/decrease keys. Turn ON the boom section, corresponding to the nozzle harness pigtail (connector) being tested.



Figure 85

Use a voltmeter to observe that there is 9.5 vdc between pins A and B [Figure 85].

Most voltmeters measure signal as 12 vdc 10hz square wave which is a low voltage. Measurements may vary depending on the voltmeter used. Note the color of the wire in position B as either White or Green.

Make the same measurement on an adjacent nozzle harness pigtail (connector). The wire color in position B should change from White to Green or from Green to White. If accurate voltage is not found:

- Check the nozzle harness extension connections.
- Check the Valve Driver extension connections.
- Check the SSRS Display extension connections.

Valve Driver Input Check

Disconnect the SSRS Display from the SSRS Pigtail harness by disconnecting the 8-pin Deutsch connector located on the SSRS Display.

Start the engine, turn ON the pump and boom, then use the spray rate controller to establish 40 psi on the pressure gauge. The boom should now be spraying.



Figure 86

Tap a jumper wire, several times per second, between pins 1 and 4 on the extension harness 8-pin Deutsch connector. Observe every even nozzle valve turn off as the jumper connects and turn on as the jumper disconnects [Figure 86].

Tap a jumper wire, several times per second, between pins 1 and 5 on the extension harness connector. Observe that every odd nozzle valve turn on as the jumper connects and turn off as the jumper disconnects [Figure 86].

Observe the nozzle pulsing on each boom section.

If the boom sprays, but does not pulse, when the jumper wire is tapped:

- Check the Power Hub SSRS Display extension connection.
- Check the Valve Driver extension connections.

Boom Shutoff and Run / Hold Signal Test

Run / Hold Signal

Disconnect the SSRS Display from the SSRS Pigtail harness by disconnecting the 8-pin Deutsch connector located on the SSRS Display.

Start the engine, then turn ON the pump and turn OFF the boom, then use the spray rate controller to establish 40 psi on the pressure gauge. The boom should NOT be spraying.



Figure 87

Turn ON boom section number one to observe that the nozzle valves on boom section number one turn on and spray fully open. Use a voltmeter to observe that there is 13.5 vdc between pins 1 and 6 with the engine running, or 12.0 vdc without the engine running [Figure 87].

Turn OFF boom section number one and then observe the spray and voltage disappear. Repeat the test for boom sections two thru six.

If no spray or voltage is observed:

- Check the boom shutoff adapter connections.
- Check the boom shutoff extension connections.
- Check the Valve Driver extension connections.

Valve Driver Shutoff Signal

Disconnect the Valve Driver from the extension harness by disconnecting the 6-pin Deutsch connector. The connector is generally located at each boom section.

Turn ON the boom shutoff switch that corresponds with the Valve Driver extension being tested.



Figure 88

Use a voltmeter to observe that there is 13.5 vdc between pins 2 and 3 with the engine running, or 12.0 vdc without the engine running [Figure 88].

Turn OFF the boom shutoff switch to observe the voltage disappear.

If no voltage is present:

- Check the boom shutoff adapter connections.
- Check the boom shutoff extension connections.
- Check the Power Hub Valve Driver extension connection.
- Check the boom shutoff switches.

Programming the SSRS Display

NOTE: This should be performed only by a qualified service technician.

Required Items:

- Capstan Can Commander
- Translator Box and USB Cable
- Programming Cable



Figure 89

Connect the programming cable to the SSRS Display auxiliary port (Item 1) and to Can 1 port of translator (Item 2) [Figure 89].

Programming:

- 1. Power up the SSRS Display
- 2. Plug in Translator and Programming Cable



Figure 90

- 3. *Open Capstan Can Commander [Figure 90]
 - Choose 'Software Upload' tab
 - Select 'SSQ/Cab Box' (SSRS Display)
 - Click 'Locate Network Devices' (hardware info appears)
 - Select 'Erase All Sectors'
 - Click Browse and choose code to upload
 - Click hardware info above, it will be highlighted in blue
 - Click 'Begin Upload' progress bar will appear (wait for 'programming complete')
 - Disconnect programming cable
 - Power Up SSRS Display

RATE CONTROLLER TROUBLESHOOTING

Basic Rate Controller

Symptom: Under Application

- 1. Tips too small
- Verify that all nozzle valves have correct tips, and are the correct size.
- Verify the low rates with a Wilger Quick Calibrator or with a catch / time test at each nozzle.

Oz / min per nozzle = GPA x Test Speed in mph x Nozzle Spacing in inches / (5940 x 128).

 $Oz / min per nozzle = G/1000 ft^2 x Test Speed in mph x Nozzle Spacing in inches / (136 x 128).$

- 2. Plugged filters
- Check the filters and replace any plugged or restricted filters.
- Verify that each filter is correctly installed.
- 3. Plugged lines
- Verify that each line is clear and free of kinks.
- 4. Shut-off valves partially closed
- Verify that each shut-off valve is fully open.
- 5. Pressure set too low on flow by-pass lines
- Verify settings on each pressure-controlled by-pass valve.
- 6. In-line servo flow control valve stuck
- Verify that the servo flow control valve is operating correctly.
- 7. Electric servo valve pump control stuck
- Verify that the electric servo pump control is operating correctly.
- 8. Servo signal wire polarity switched
- Verify that the valve opens with a rate increase.
- Verify that the valve closes with a rate decrease.
- 9. Top PWM value set too low

- Adjust the rate controller PWM valve to the desired setting.
- 10. PWM spool stuck
- Change the rate to observe whether the rate change is slow, limited or doesn't change at all. Replace as needed.
- 11. Worn flow meter
- Remove the rate smoothing feature.
- Place the rate controller in manual mode at a test speed.

NOTE: Placing the rate controller in manual mode will lock the servo valve position (unless manually changed).

If the rate becomes stable, then it is either a worn servo valve or PWM valve.

If the rate continues to be unstable, it is likely flow meter signal instability.

• Manually increase the rate.

The rate and pressure should increase.

If the rate does not increase, then it is either a worn servo valve or PWM valve.

Manually decrease the rate.

The rate and pressure should decrease.

If the rate does not decrease, then it is either a worn servo valve or PWM valve.

- 12. Worn pump
- Speed data error

Incorrect speed calibration number

Poor GPS satellite reception / number of satellites

• Spraying too fast which outruns the liquid system capability.

RATE CONTROLLER TROUBLESHOOTING CONT.

Basic Rate Controller Cont.

Symptom: Over Application

- 1. Worn tips or tips too large
- Verify that all nozzle locations have the correct size and type of tips.
- Verify the low rates with a Wilger Quick Calibrator or with a catch / time test at each nozzle.

Oz / min per nozzle = GPA x Test Speed in mph x Nozzle Spacing in inches / (5940 x 128).

 $Oz / min per nozzle = G/1000 ft^2 x Test Speed in mph x Nozzle Spacing in inches / (136 x 128).$

Incorrect speed calibration number

Adjust the speed calibration setting.

Symptom: Rate Instability

1. Check the rate controller calibration numbers

Valve Type - Standard, Fast, PWM, PWM Close, etc.

Valve Calibration - Refer to rate controller information to check the cal number for valve type.

- 2. Worn or sticking servo valve
- Check the servo valve and replace if needed.
- 3. Worn or sticking PWM valve
- Check the PWM valve and replace if needed.
- 4. Flow meter signal instability
- Verify the flow meter signal.
- 5. Hose integrity
- Check for plugged, kinked, or collapsed hoses. Replace as needed.
- 6. Controller Pressure Instability
- To isolate SSRS Display from rate controller, put the SSRS Display in Manual mode at 50%.

Faulty controller pressure sensor

Check the rate controller calibration numbers.

WARRANTY POLICY

LIMITED WARRANTY

A. What does the Limited Warranty cover?

The ultimate purchaser/user ("you"), by acceptance of seller Capstan Ag Systems, Inc.'s, ("our," "we," or "us") product, assume all risk and liability of the consequences of any use or misuse by you, your employees, or others.

All replacement components furnished under this warranty, but shipped before the failed component is returned for evaluation, will be invoiced in the usual manner and warranty adjustments will be made after the component claimed to be defective has been returned to and inspected and deemed defective by us at our factory.

Upon determining that a component has failed under warranty, the repaired component or replacement component, furnished under this warranty, will be shipped at our expense, to your location. We will credit you an amount equal to the incoming freight you paid. We shall not be responsible for installation costs. (You shall be responsible for all customs and brokerage fees for all international transactions.)

If the component does not prove to be defective, you shall be liable for all freight, inspection and handling costs. In no event will any claim for labor or incidental or consequential damages be allowed for removing or replacing a defective product. Warranty will be denied on any component which has been subject to misuse, abuse, accidents, or alterations, or to improper or negligent use, maintenance, storage or transportation and handling.

Our liability under this warranty, or for any loss or damage to the components whether the claim is based on contract or negligence, shall not in any case exceed the purchase price of the components and upon the expiration of the warranty period all such liability shall terminate. The foregoing shall constitute your exclusive remedy and our exclusive liability.

The terms of this warranty do not in any way extend to any product which was not manufactured by us or one of our affiliates.

While necessary maintenance or repairs on your Capstan Ag Systems, Inc. product can be performed by any company, we recommend that you use only authorized Capstan Ag Systems, Inc. dealers. Improper or incorrectly performed maintenance or repair voids this warranty.

The foregoing warranty is exclusive and is in lieu of all other warranties expressed or implied. We shall not be liable for any incidental or consequential damages resulting from any breach of warranty.

Your exclusive remedy for breach of warranty shall be repair or replacement of defective component(s): Provided, if the component(s) are incapable of being repaired or replaced, your exclusive remedy shall be credit issued, but such credit shall not exceed the purchase price of the components.

On any claim of any kind, including negligence, our liability for any loss or damage arising out of, or from the design, manufacture, sale, delivery, resale, installation, technical direction of installation, inspection, repair, operation of use of any products shall in no case exceed the purchase price allocable to the components.

In no event, whether as a result of breach of contract or warranty or alleged negligence, shall we be liable for incidental or consequential damages, including, but not limited to: personal injury, loss of profits or revenue, loss of use of equipment or any associated equipment, cost of capital, cost of substitute equipment, facilities or services, downtime costs, environmental damage, crop losses, or claims of customers of you for such damages.

B. What is the period of coverage?

We warrant to you, that our products are free from defects in material and workmanship in normal use and service for a period of one year from date of purchase.

C. How do you get service?

Our obligation under this warranty shall be limited to the repairing or replacing at our option, the component which our inspection discloses to be defective, free of charge, return freight paid by us, provided you: (i) Notify us of defect within thirty (30) days of failure; (ii) Return the defective component to us, freight prepaid; (iii) Complete the Owner Registration Form and returned it to us; and (iv) Establish that the product has been properly installed, maintained and operated in accordance with our instructions or instructions contained in our operations or maintenance manuals and within the limits of normal usage.

Any claim for breach of our warranty must be in writing addressed to us and must set forth the alleged defect in sufficient detail to permit its easy identification by us. All breach of warranty claims must be made within thirty (30) days after expiration of the warranty period which is applicable to the defective product. Any breach of warranty claim not timely made will not be honored by us and will be of no force and effect.

Any component that needs to be repaired or evaluated for warranty has to be authorized before return. Contact the factory (785-232-4477) to get a Return Materials Authorization (RMA #). This helps to track the part coming into the factory for repair or replacement.

Before returning any component to the factory, clean the component as well as possible to remove any dirt or chemical residue. Components received at the factory that are not clean, will be returned and warranty denied.

After receiving your RMA #, package the part, making sure to include the RMA #, your name, customer's name, your address and phone number and description of problems or failure. Then ship to:

Capstan Ag Systems, Inc. Attn: Warranty/Repair 4225 SW Kirklawn Ave. Topeka, KS 66609

Phone: (785) 232-4477 Fax: (785) 232-7799 Hours: 8 a.m. - 4:30 pm CST

D. How does state law relate to this Limited Warranty?

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

SERVICE CONTACT INFORMATION

If a problem arises with the SharpShooter with Rate Sync System that cannot be corrected with the information in this manual, please contact your dealer for service and technical assistance. If further assistance is needed, contact Capstan Ag Systems, Inc.

ealer:
ontact:
hone:
ddress:
tity / State / Zip:

FACTORY SERVICE / REPAIRS

Capstan Ag Systems, Inc. 4225 S.W. Kirklawn Ave. Topeka, KS 66609 Toll-free number: (855) 628-7722 Topeka Office Fax: (785) 232-7799 Hours: 8 a.m. to 4:30 p.m. CST

On-Line

www.CapstanAg.com

Headquarters

Capstan Ag Systems, Inc 4225 S.W. Kirklawn Ave. Topeka, KS 66609 Topeka Office Phone: (785) 232-4477 Topeka Office Fax: (785) 232-7799 prodsupport@CapstanAg.com

NOTE: This document and the information provided are the property of Capstan Ag Systems, Inc. and may only be used as authorized by Capstan Ag Systems, Inc.



APPLICATION SYSTEMS FOR PROFESSIONALS

APPLICATION SYSTEMS FOR PROFESSIONALS

Capstan Ag Systems Inc. 4225 SW Kirklawn Ave.

4225 SW Kirklawn Ave. Topeka, KS 66609

Toll-free Number: (855) 628-7722 Topeka Office Phone: (785) 232-4477 Topeka Office Fax: (785) 232-7799 Hours: 8 a.m. to 4:30 p.m. CST

www.CapstanAg.com E-mail: prodsupport@CapstanAg.com



P/N 118156-002 Revised 10-14 © Capstan 2014