

PinPoint™ III

ENVELOP

Spray Application

Operator Manual



Thank you for your business!

At CapstanAG, our goal is to redefine the way people do their chemical application. Our PWM control systems have been setting the bar for maximum productivity for more than 20 years. Our focus on performance, support, and education have dramatically changed the landscape of agricultural chemical application.

CapstanAG specializes in creating proprietary systems for the agricultural industry, primarily focusing on chemical and fertilizer applications. Our inventive process involves research, engineering, design, and lab and field testing.

Service Contact Information

If a problem occurs with your 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 CapstanAG.

System Purchased: _____
Dealer: _____
Contact: _____
Phone: _____
Address: _____
City, State/Province, Zip: _____

Factory Service/Repairs

CapstanAG

4225 S.W. Kirklawn Ave. | Topeka, KS 66609

Hours: 8:00 a.m. to 4:30 p.m. CST

Toll-free number: (855) 628-7722 | Fax: (785) 232-7799

CapstanAG.com | CapstanAG.ca

prodsupport@capstanag.com

Contents

Chapter 1: Safety	7
Signal Words	8
Safety Signs	8
Pressurized Fluid Lines	9
Personal Protective Equipment	9
Battery Safety	9
Chemical Safety	9
Emergency Safety	9
 Chapter 2: Warranty	 11
Limited Warranty.....	12
What does the Limited Warranty cover?	12
What is the period of coverage?	13
How do you get service?	13
How does state law relate to this Limited Warranty?	13
 Chapter 3: Introduction.....	 15
This Manual	16
System Identification	16
Virtual Terminal Display	17
How to Find the Software Version Information.....	17
Using the CapstanAG App with PinPoint III.....	18
Establishing Bluetooth Connection	19
Tip Check	20
Pressure Control	21
Software Update	22
 Chapter 4: Installation.....	 23
Prepare for Installation and Setup	24
Tip Selection and Capacities	24
Nozzle Valve Types and Component Identification (Spitfire Valve)	25
7-Watt—15 Series Coil Assembly Components	25
12-Watt Coil Components	26
Nozzle Valve Types and Component Identification (Legacy Valve).....	27
7-Watt—15 Series Coil Assembly Components.....	27

12-Watt—24 Series Coil Assembly Components	28
Assemble the Nozzle Valves	29
Move the Spray Tube Mount (Nozzle Valve Interference).....	30
Install the Gateway Hub	30
Gateway Hub Identification	31
Install the VCMs	32
Install the VCM Extension Harnesses.....	33
Install the Pressure Sensor (Optional).....	34
Install the Pressure Sensor Adapter Harness	34
Install the Battery Harness	35
Install the Circuit Breaker	35

Chapter 5: Initial System Setup..... 37

Factory Reset Procedure.....	38
Initial Setup of the Configuration Settings	38
VCM (Geometry) Setup Procedure	39
Initial Setup of System Settings.....	40
Change the Boom and Nozzle Settings	40
Change a Profile Name.....	41
Change the Pressure Settings	41
Change the Flow Settings	42
Change the Navigation Settings	42
Compass Calibration Procedure	46
Initial VT System Setup Procedure.....	46
System Dry Tests.....	47
Boom Shutoff Dry Test	47
Key Fob Boom Shutoff Dry Test.....	48
System Wet Tests.....	49
Key Fob Boom Shutoff Wet Test	51
Change the Units of Measure.....	52

Chapter 6: Operation..... 53

Main System Screen	54
Softkey Descriptions	55
Operate the System.....	55
Settings Menu Information.....	56
Boom/Nozzle Settings Menu Descriptions	56

Pressure Settings Menu Descriptions	57
Flow Settings Menu Descriptions	60
Maps Settings Menu Descriptions	63
Navigation Settings Menu Descriptions	63
Initial Setup Settings Descriptions	65
US Measurement Nozzle Speed Ranges	68
Blended Pulse™ Droplet Classification Table—US Measurements.....	72
Nozzle Speed Ranges.....	74
Metric Nozzle Speed Ranges	74

Chapter 7: Maintenance81

Service the System.....	82
Jump Start, Weld On, or Charge the Machine	82
Inspect the System	82
Clean the System	82
Storage of the System	82
Winterize for Storage	82
Recommended Guidelines for Maintenance/Service	83
Baseline Evaluation Process	83
Strainers and Screens	83
Nozzle Valves	84
Clean the Nozzle Valve(s).....	85
Plunger Seal Inspection	89

Chapter 8: Troubleshooting.....91

Troubleshooting Charts	92
Interchange Components	111
Coil Assembly Test	111
Circuit Breaker Test	112
System Load Capacity Test	113
Circuit Breaker Test	114
Boom Shutoff Signal Test	115
Pressure Sensor Signal Test	116
Power to Pressure Sensor Input Test	117
Technical Bulletin.....	118
Spray Skips from Poor Pulse Blending	118
To Prevent Skipping	119

Chapter 9: Schematics.....	121
VCM Connector Pinout.....	122
Hub Connector Pin Identification	123
System Layout.....	126
 Index	 129

Chapter 1: Safety

Topics:

- [Signal Words](#)
- [Safety Signs](#)
- [Pressurized Fluid Lines](#)
- [Personal Protective Equipment](#)
- [Battery Safety](#)
- [Chemical Safety](#)
- [Emergency Safety](#)

Signal Words



DANGER: Indicates an imminent hazard which, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations, typically for aircraft components that, for functional purposes, cannot be guarded.



WARNING: Indicates a potential hazard which, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.



CAUTION: Indicates a potential hazard which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT: This is used to draw attention to specific information that is necessary for the operation, setup, or service of the system.

Note: This is used for additional information that can help understand or operate the system.

Safety Signs



Figure 1: Safety Sign Example

The HCS aligned its provisions with the United Nations' Globally Harmonized System (GHS) Classification and Labeling of Chemicals in 2012. This is a GHS safety label example for a chemical hazard.

These labels and safety messages warn all personnel about hazardous chemicals or potentially unsafe chemical conditions that may exist while working around agricultural application equipment.

CapstanAG add-on application systems for OEM and retrofit agricultural application equipment (booms and toolbars) may contain HCS pictographs and GHS safety labels and safety signal word messages.

Pressurized Fluid Lines

Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when too much heat is present.

Personal Protective Equipment

Wear close-fitting clothing and the correct personal protective equipment (PPE) for the job. Refer to the specific chemical manufacturer documentation or other information for correct PPE.

Battery Safety

Use the procedure in the appropriate agricultural equipment manual for connecting, disconnecting, and jump-starting the machine's battery.

Keep sparks and flames away from the battery. Battery gas can explode and cause serious injury. Do not smoke in the battery charging area.

Remove jewelry, which might make electrical contact and create sparks.

Chemical Safety

Chemicals used in agricultural applications can be harmful to your health and/or the environment if not used correctly. Always follow all label directions for effective, safe, and legal use of agricultural chemicals.

Emergency Safety

Fire extinguishing systems must meet the applicable OSHA requirements, and all users of portable/ fixed fire suppression equipment must know the types, limitations, and proper uses of this equipment; including hazards involved with incipient stage firefighting.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

Know the location of fire extinguishers and first aid kits and how to use them.

Examine the fire extinguisher and service the fire extinguisher regularly.

Follow the recommendations on the instructions plate.

Very small fires can be put out (extinguished) with a fire extinguisher. Use an appropriate method to extinguish a fire (water for paper fires, and chemical extinguishers for electrical or chemical fires).

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Chapter 2: Warranty

Topics:

- [Limited Warranty](#)

Limited Warranty

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, 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 CapstanAG product can be performed by any company, we recommend that you use only authorized CapstanAG 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 or 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.

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.

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 #, customer's name, your address and phone number and description of problems or failure. If the component(s) are not returned to the shipping address below within the thirty (30) day period, no credit will be issued for the part. 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 am to 4:30 pm CST

Once the package is received by us, we have thirty (30) days to process the warranty claim. If the warranty claim is still open after thirty (30) days, the warranty will be accepted, and credit issued.

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.¹

¹ Rev. Date 11/02/2021

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Chapter 3: Introduction

Topics:

- [This Manual](#)
- [System Identification](#)
- [Virtual Terminal Display](#)
- [Using the CapstanAG App with PinPoint III](#)

This Manual

This manual includes operation, maintenance, and installation information for the system you purchased.

Make sure that all personnel have read this manual and that they thoroughly understand the safe and correct operation and maintenance procedures. Failure to do so could result in personal injury or equipment damage.

This manual should be considered a permanent part of your system and should remain with the system at all times and when you sell it.

Right and left sides of the system are determined by facing the direction of forward travel of the machine on which the system is installed.

The information, screenshots, and other illustrations were correct at the time of publication. Changes can occur without notice.

This manual contains important information on how to safely and correctly install, operate, and maintain CapstanAG products. These instructions will help keep personnel safe, reduce downtime, and increase the reliability and life of the equipment, its components, and related systems.

Review the safety information in the manual(s) from the Original Equipment Manufacturer (OEM).

Follow the instructions (in this manual) and in the OEM manual(s) for each step, to make sure that work conditions in and around the OEM equipment are safe.

It is important for all individuals working with chemicals to understand the potential risks, necessary safety precautions, and proper response in the event of accidental contact.

Review the OEM manual(s) for chemical safety information.

Read, understand, and review the procedures in this manual and OEM manual(s). Use the Safety Data Sheets (SDS) and the required Personal Protective Equipment (PPE) for hazardous chemicals.

Please keep this manual and all enclosed documentation in an accessible location known to all operators, installation, and maintenance personnel.

If you do not understand the CapstanAG equipment after reading this manual, please obtain the proper training before working with equipment, to make sure that your own safety, as well as your coworkers' safety, is maintained.

Do not attempt to operate any equipment or system until you completely understand why, when, and how it operates. If you are uncertain after studying this manual, please contact CapstanAG.

System Identification

Write the system name, serial number, and other information down in the Service Contact Information on the inside cover of this manual. Your dealer will use these numbers when you order parts. File a copy of the identification numbers in a secure place off the machine.

If you are not the original owner of this machine, it is in your interest to contact your local CapstanAG dealer to inform them of this unit's serial number. Providing this information will help CapstanAG notify you of any issues or product improvements.

Virtual Terminal Display

This system can be used with most touch-screen Virtual Terminal (VT) displays. The VT display interacts with the GPS and electronic control devices centralizing the ability to communicate, record, store, and show data.

Note: Each VT display is different, and the system screens may be different from what is shown in this manual.

How to Find the Software Version Information

The system must be installed and connected to the virtual terminal in the cab before you can find the CapstanAG icon on the display.

1. Select the CapstanAG icon on your virtual terminal (VT) display.

Note: Each VT display is different, and the system screens may be different from what is shown in this manual. Each VT display is different, and the system screens may be different from what is shown in this



2. Navigate:
3. The software version is displayed in the middle of the screen.
4. Make sure to write down the current information in the Service Contact Information on the inside cover of this manual.

Using the CapstanAG App with PinPoint III

The CapstanAG mobile app is available for iOS¹ or Android powered Smartphones and can be downloaded from Google Play Store or Apple App Store. Note that screen representations are shown for an Android powered device. The iOS interface appears slightly different, but functionality is unchanged.

The CapstanAG app can be used with the PinPoint III system for:

- Individual/sectional nozzle control (key fob mode only)
- Pressure control (key fob mode only)
- PinPoint III system firmware updates
- System diagnostics



Figure 2: CapstanAG App

From the CapstanAG app home screen, tap the PinPoint Icon to access PinPoint III features.

¹ iOS is Trademarked by Cisco Systems and Apple licenses iOS.

Establishing Bluetooth Connection

Verify Bluetooth on your phone is turned on. Connect the CapstanAG app to the PinPoint III system.

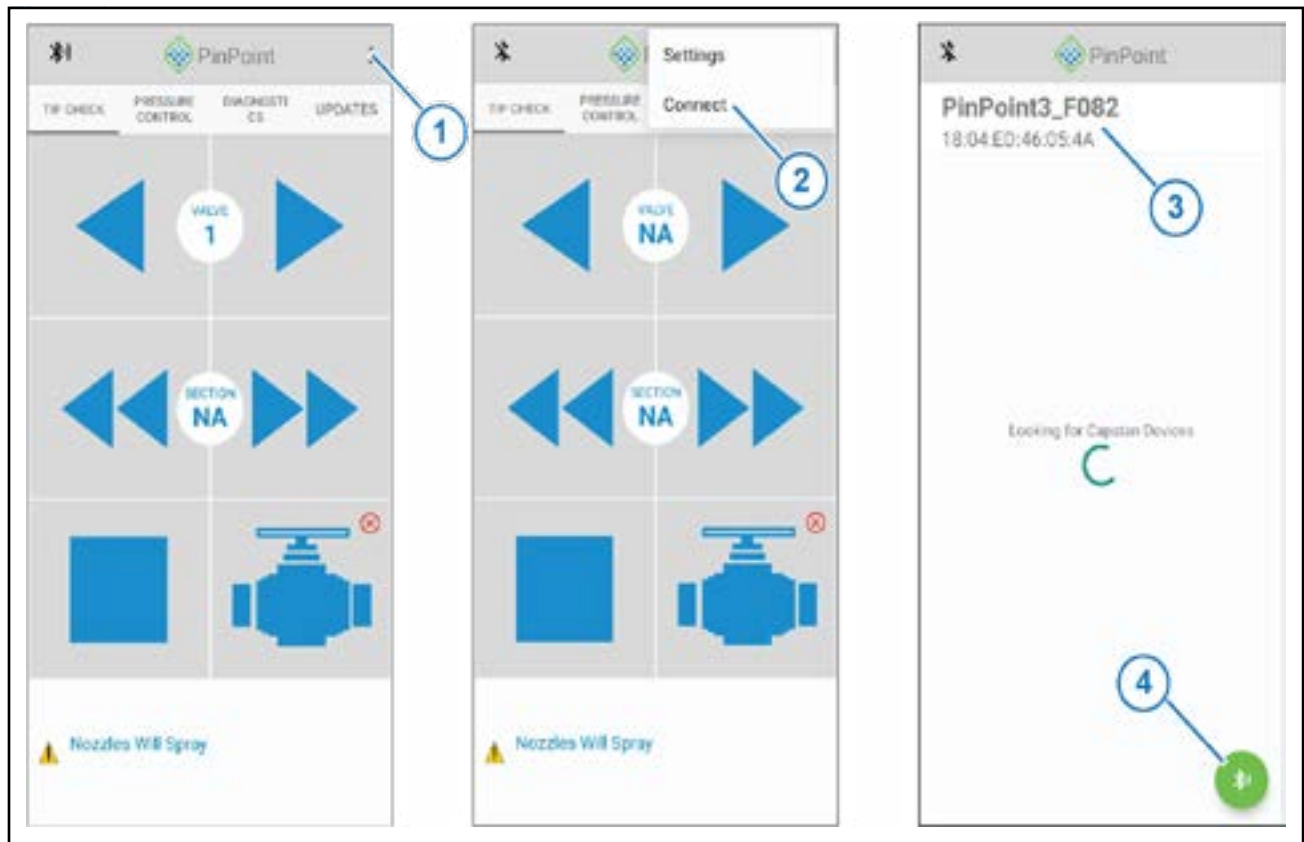


Figure 3: CapstanAG App Bluetooth Connection

1. Tap the menu icon (Figure 3, Item 1) at the upper right corner of the screen.
2. Tap Connect (Figure 3, Item 2).
3. Select the PinPoint III (Figure 3, Item 3) from the Capstan Devices list.

Note: Ensure no other Bluetooth devices are connected to your smart phone prior to establishing connection.

Note: If no Capstan device is found initially tap the Bluetooth icon (Figure 3, Item 4) to restart device search.

Tip Check

Once connected to the PinPoint III and the system is in key fob mode, tip checks can be performed. Refer to [Key Fob Boom Shutoff Dry Test](#), under Initial System Setup for more information on how to put the system in Key Fob Mode.

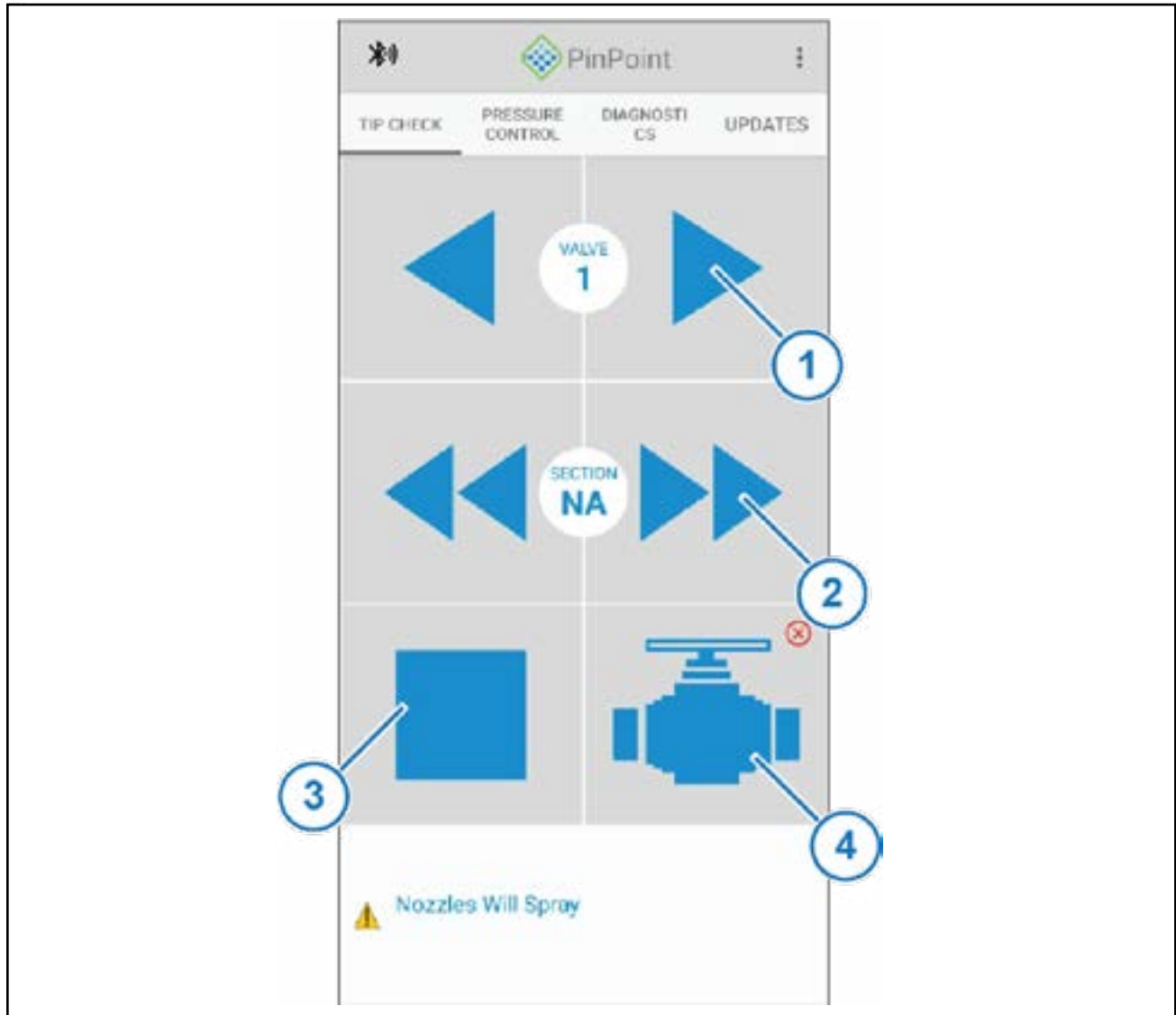


Figure 4: Tip Check

1. Tap the Tip Check icon in the menu ribbon.
2. Tap the single arrow icons (Figure 4, Item 1) to cycle each nozzle valve individually in sequence.
3. Tap the double arrow icons (Figure 4, Item 2) to cycle all nozzles in a section in sequence.
4. Tap the stop icon (Figure 4, Item 3) to stop the nozzles cycling.
5. The valve icon (Figure 4, Item 4) is used to control section valves.

Pressure Control



Figure 5: Pressure Control

1. Tap the Pressure Control icon in the menu ribbon.
2. The System PSI and Pump PWM (Figure 5, Item 1) display current system values.
3. The Target icon (Figure 5, Item 2) is used to toggle between set pressure points.
4. The Up and Down arrows (Figure 5, Item 3) are used to increase and decrease target pressure.
5. The Pump icon (Figure 5, Item 4) is used to toggle the pump on and off.

Software Update

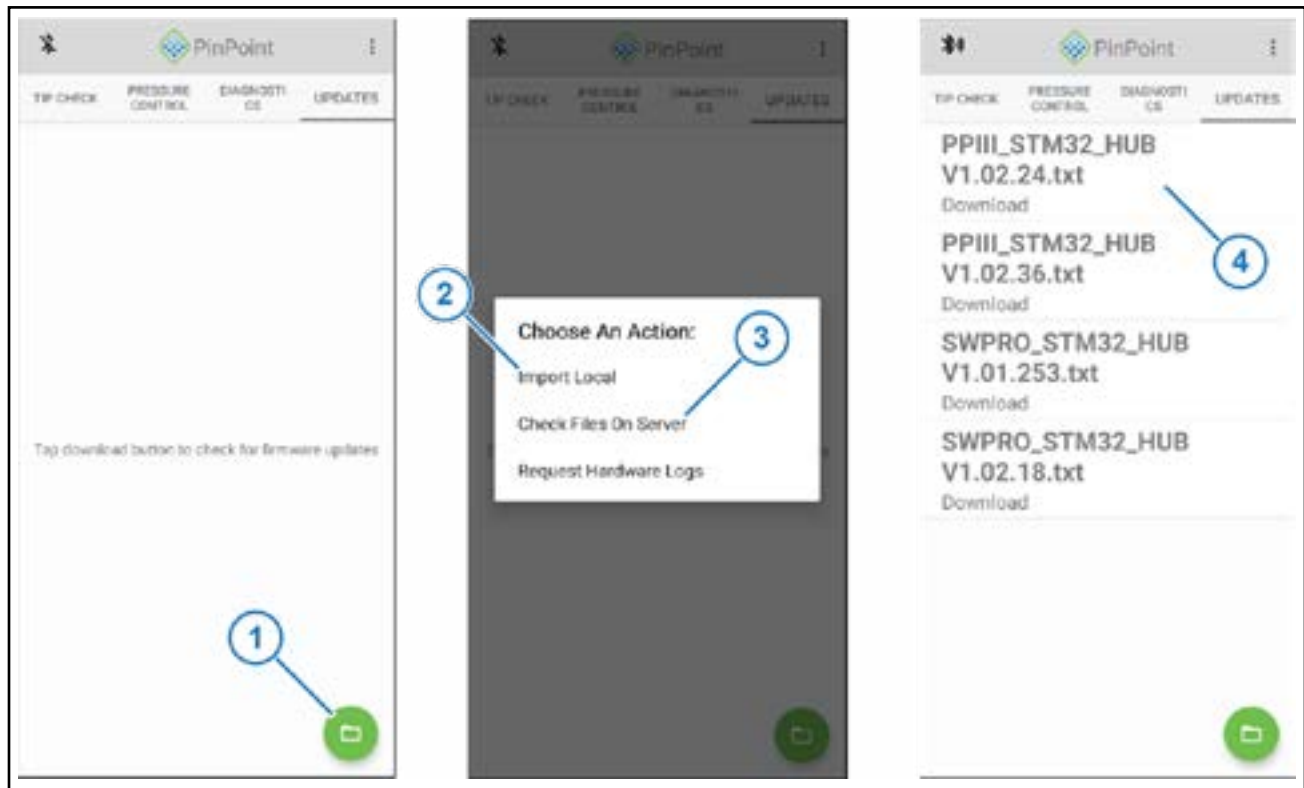


Figure 6: Software Update

1. Tap the Updates icon in the menu ribbon.
2. Tap the folder icon (Figure 6, Item 1).
3. If the software update file has been saved to your device tap the Import Local icon (Figure 6, Item 2).
4. If the update file is not on your device, tap the Check Files on Server icon (Figure 6, Item 3) to browse for files on the Capstan server.
5. Tap the desired software revision (Figure 6, Item 4) from the displayed list.
6. The selected software revision will now begin transferring to the PinPoint III Hub. The upload status is indicated by the blue status bar that appears on the app screen.

Note: If using an Apple device to perform a software update, do not allow the screen of your device to go to sleep or the file transfer could fail.

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Chapter 4: Installation

Topics:

- [Prepare for Installation and Setup](#)
- [Tip Selection and Capacities](#)
- [Nozzle Types and Component Identification](#)
- [Assemble the Nozzle Valves](#)
- [Install the Gateway Hub](#)
- [Install the VCMs](#)
- [Install the Pressure Sensor](#)
- [Install the Battery Harness](#)
- [Install the Circuit Breaker](#)

Prepare for Installation and Setup



CAUTION: Before installation, operation, or service to the system, read and understand the machine's operator manual and the system operator manual. Chemical residue may be present on/in the OEM equipment. Use the correct personal protective equipment.

IMPORTANT: Before installation, make sure that all parts are included in the shipping boxes, using the list of parts included in the order.

IMPORTANT: Do not attach the harnesses with cable ties until the dry test of the system is complete.

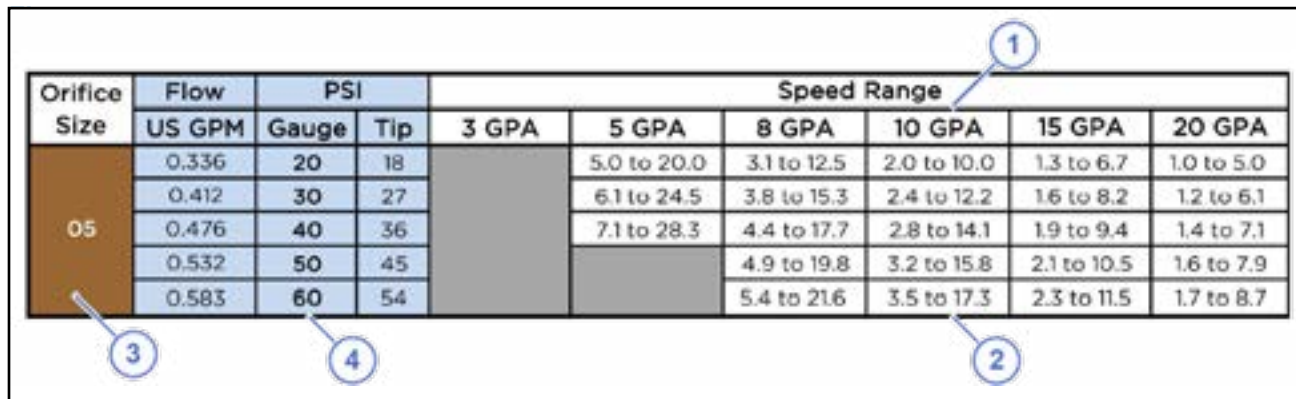
Check the general system layout at the back of this manual.

The VCMs are tagged and marked for the appropriate boom sections (1 to 10, etc.). Make sure that the VCMs are installed on the appropriate boom sections. Boom section 1 is the leftmost boom when at the back of the machine facing the front of the machine.

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

- Always follow the spray nozzle manufacturer guidelines.
- When routing nozzle harnesses and other wiring through the boom fold and swing joints, allow for boom joints to operate without damaging harnesses.
- Use the correct tip choices.

Tip Selection and Capacities



Orifice Size	Flow US GPM	PSI		Speed Range					
		Gauge	Tip	3 GPA	5 GPA	8 GPA	10 GPA	15 GPA	20 GPA
05	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
	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

Figure 7: Tip Selection Chart

When selecting the correct tips:

- Always use 110° spray angle tips and maintain the boom height of at least 24 in (61 cm). If 80° spray angle tips are used, maintain the boom height of at least 36 in (91 cm).
- The tip selection charts, in the operation section of this manual, describes the speed ranges that can be expected when operating with a rate controller at various rates and pressures.
- To use the chart, select the application rate (Figure 7, Item 1).
- Move down the column to the desired speed range (Figure 7, Item 2).
- Select a tip (Figure 7, Item 3) that provides the boom pressure you wish to spray (Figure 7, Item 4).

Nozzle Valve Types and Component Identification (Spitfire Valve)

7-Watt—15 Series Coil Assembly Components

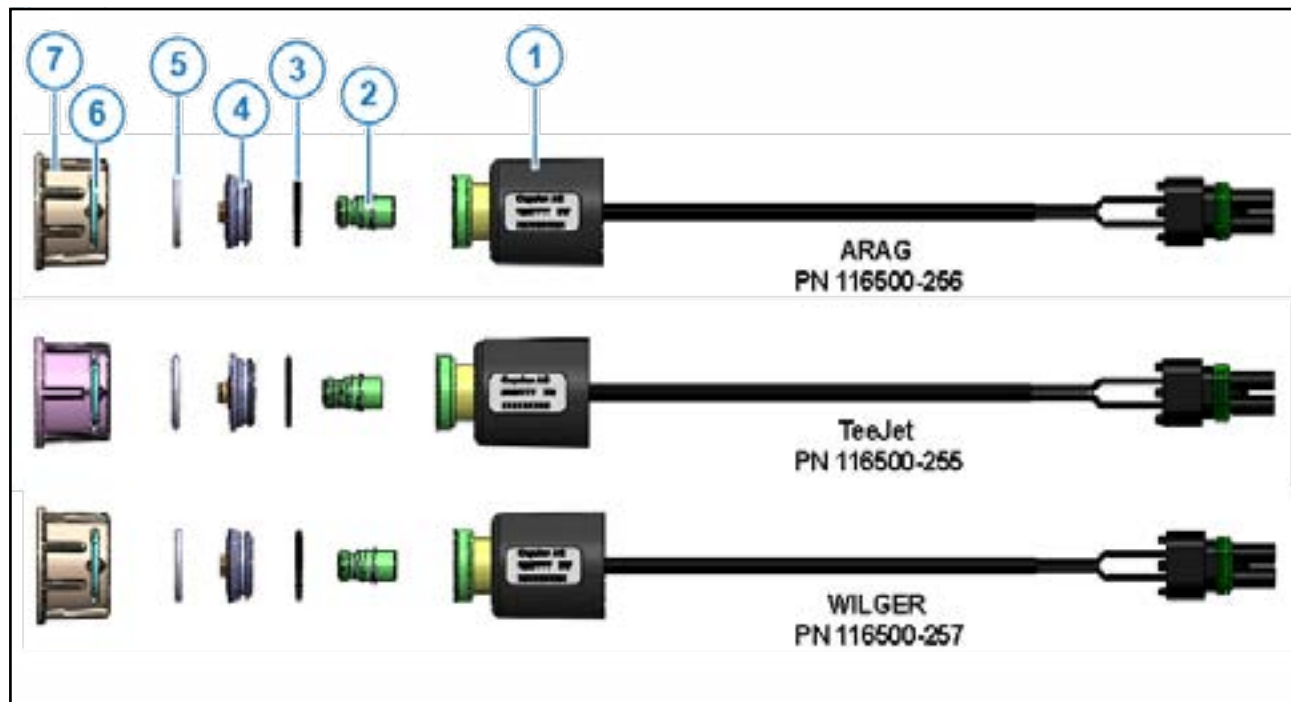


Figure 8: 7-Watt Coil Components

Refer to [Figure 8](#)

Item	Description	Arag Part Number	TeeJet Part Number	Wilger Part Number
1	Coil	116500-201	116500-201	116500-201
2	Plunger	716009-120	716009-120	716009-120
3	O-ring (Inner)	116500-221	116500-221	116500-221
4	Orifice Assembly (Identifiers)	116500-243 Mound: Black Tail: Black Shoulder on Tail: No	116500-244 Mound: Black Tail: SS Shoulder on Tail: Yes	116500-244 Mound: Black Tail: SS Shoulder on Tail: Yes
5	O-ring (Spoked)	116500-225	116500-225	116500-225
6	U-clip	116500-222	116500-222	116500-222
7	Fly Nut	116500-271	116500-272	116500-273
	Plug (not pictured)	116500-278	116500-277	116500-279

12-Watt Coil Components

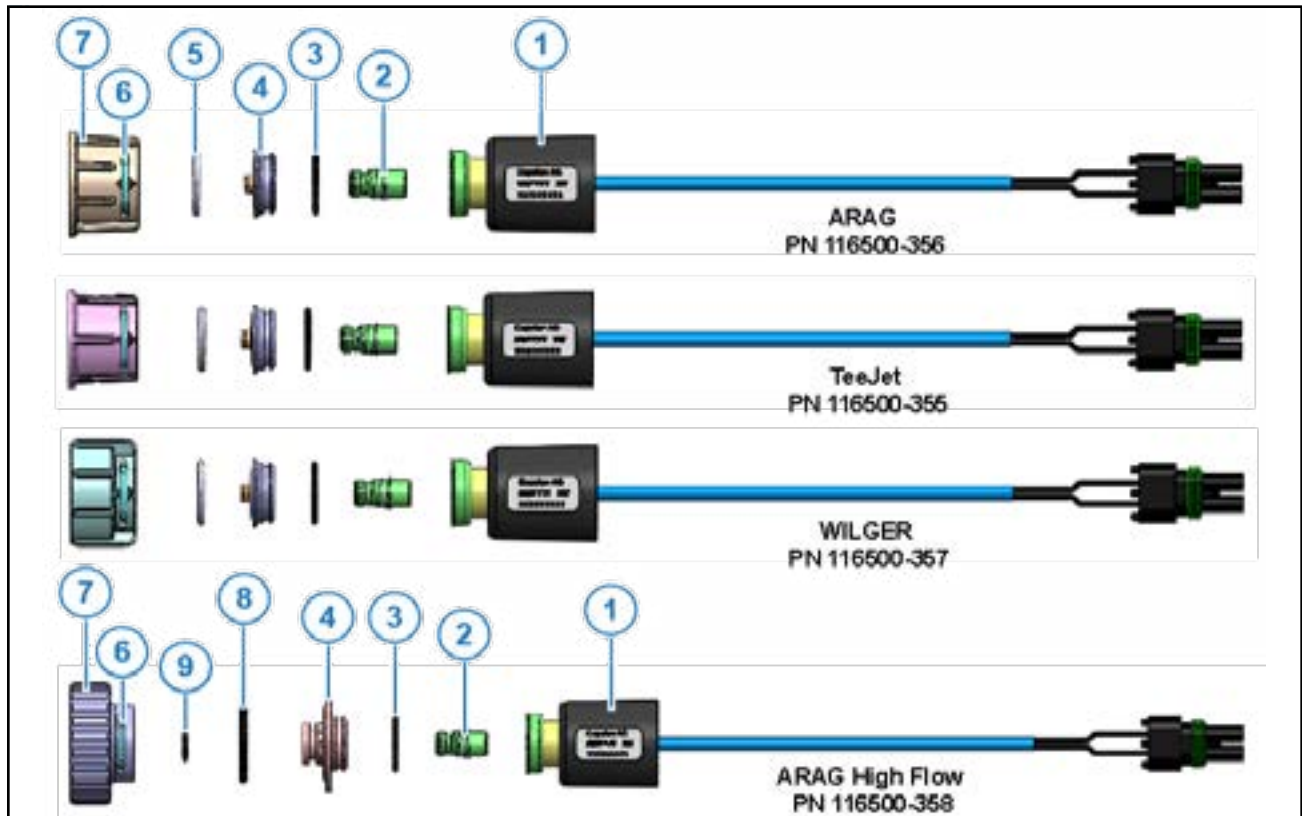


Figure 9: 12-Watt Coil Components

Refer to [Figure 9](#)

Item	Description	Arag Part Number	TeeJet Part Number	Wilger Part Number	Arag High Flow Part Number
1	Coil	116500-301	116500-301	116500-301	116500-301
2	Plunger	716009-120	716009-120	716009-120	716009-120
3	O-ring (Inner)	116500-221	116500-221	116500-221	116500-221
4	Orifice Assembly (Identifiers)	116500-245 Mound: SS Tail: Black Shoulder on Tail: No	116500-246 Mound: SS Tail: SS Shoulder on Tail: Yes	116500-246 Mound: SS Tail: SS Shoulder on Tail: Yes	116500-234 Mound: SS Tail: SS Shoulder on Tail: NA
5	O-ring (Spoked)	116500-225	116500-225	116500-225	NA
6	U-clip	116500-222	116500-222	116500-222	116500-222
7	Fly Nut	116500-271	116500-272	116500-273	116500-191
8	O-ring (outer)	NA	NA	NA	715022-215
9	O-ring (stem)	NA	NA	NA	715022-211
	Plug (not pictured)	116500-278	116500-277	116500-279	116500-276

Nozzle Valve Types and Component Identification (Legacy Valve)

7-Watt—15 Series Coil Assembly Components

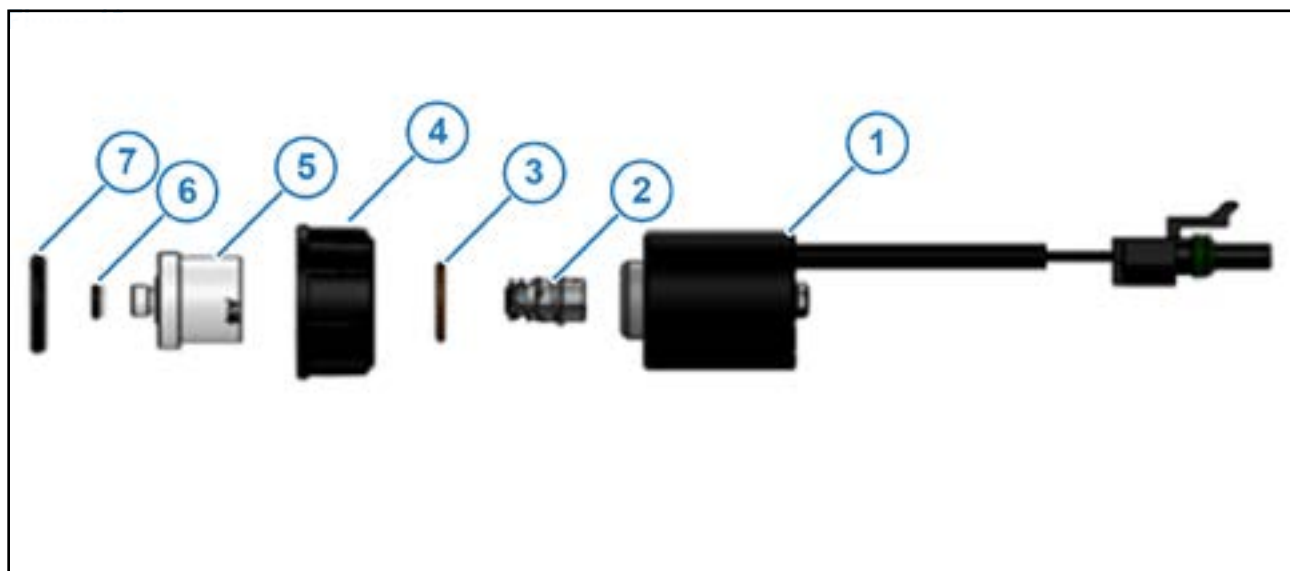


Figure 10: 7-Watt Coil Assembly

Table 1: 15 Series Coil Assembly Components

Refer to [Figure 10](#)

Item	Description	Arag High Flow (116290-211)	Arag (116290-111)	Tee Jet (116190-111)	Wilger (116390-111)
1	7-Watt Coil Assembly	116189-111	116189-111	116189-111	116189-111
2	Plunger Assembly	716009-111	716009-111	716009-111	716009-111
3	Inner Valve O-Ring	715022-204	715022-204	715022-204	715022-204
4	Fly Nut	717101-306	717101-006	717101-105	717101-007
5	Valve Body	116182-211	116182-111	116186-111	116188-111
6	Valve Body Stem O-ring	715022-211	715022-201	715022-200	715022-201
7	Nozzle Body Fly Nut O-ring	715022-215	715022-205	715022-202	715022-206

12-Watt—24 Series Coil Assembly Components

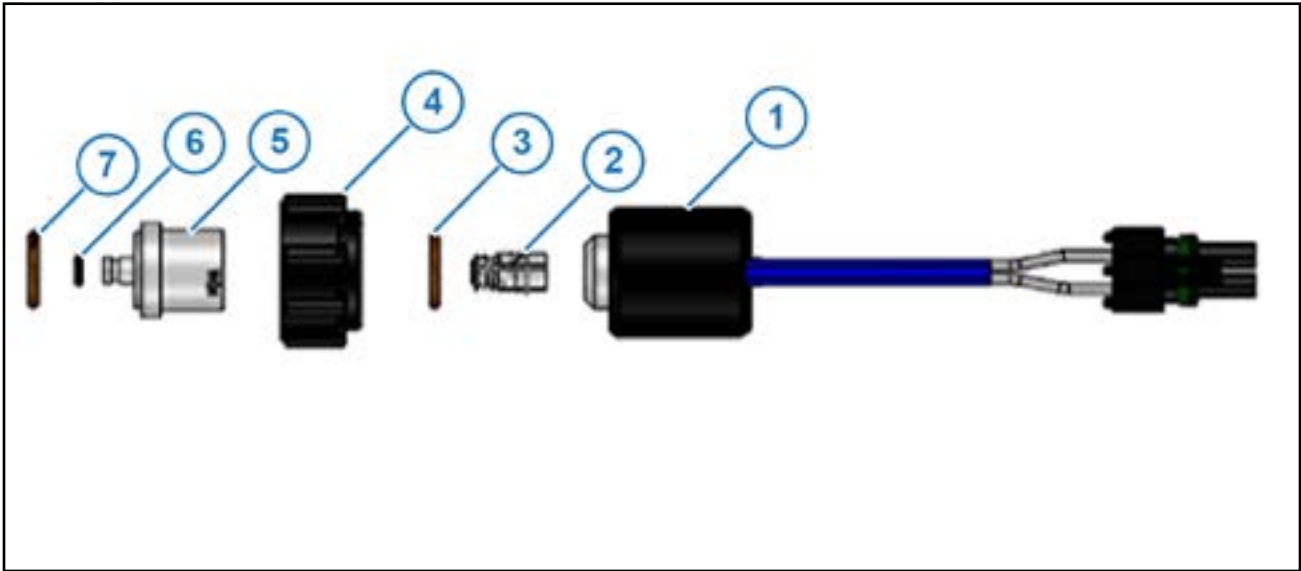


Figure 11: 12-Watt Valve Assembly

Table 2: 24 Series Coil Assembly Components

Refer to [Figure 11](#)

Item	Description	Arag High Flow (116290-211)	Arag (116290-111)	Tee Jet (116190-111)	Wilger (116390-111)
1	12-Watt Coil Assembly	625147-011	625147-011	625147-011	625147-011
2	Plunger Assembly	716009-111	716009-111	716009-111	716009-111
3	Inner Valve O-Ring	715022-204	715022-204	715022-204	715022-204
4	Fly Nut	717101-306	717101-006	717101-105	717101-007
5	Valve Body	116182-215	116182-150	116186-112	116188-112
6	Valve Body Stem O-ring	715022-211	715022-201	715022-200	715022-201
7	Nozzle Body Fly Nut O-ring	15022-215	715022-205	715022-202	715022-206

Assemble the Nozzle Valves

1. If necessary, remove the drip check valve and diaphragm cap from each nozzle body.

Note: Refer to Detail A for SpitFire Valves and Detail B for legacy valves.

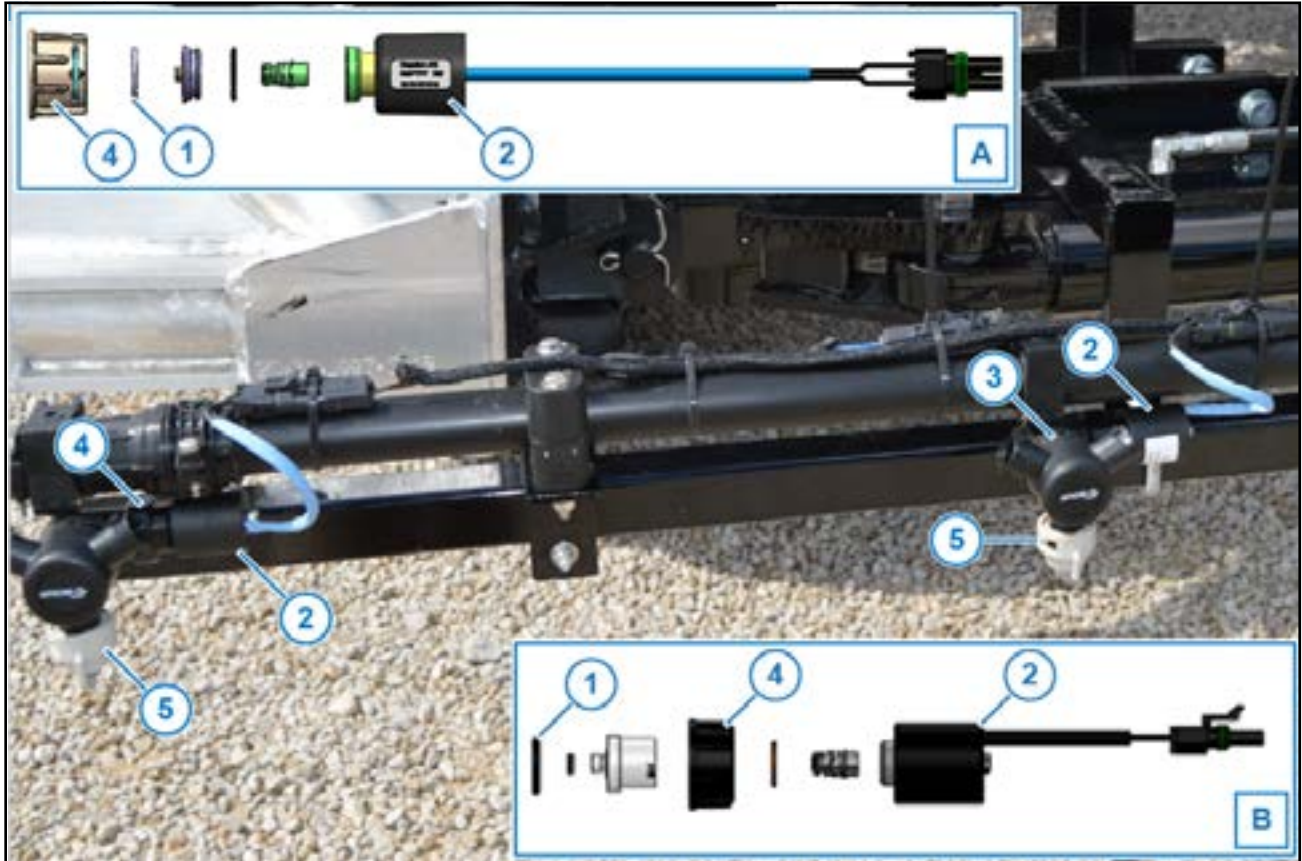


Figure 12: Nozzle Valve Assembly

2. Install the O-ring (Figure 12, Item 1) onto the nozzle valve assembly (Figure 12, Item 2).
3. Install the nozzle valve assembly onto the nozzle body (Figure 12, Item 3).
4. Tighten the fly nut (Figure 12, Item 4).

IMPORTANT: For Spitfire valves, the coil housing **MUST NOT** spin. Hold the coil stationary while tightening the flynut. If the coil is rotated while tightening the flynut, damage to the spoke O-ring will occur and cause the valve to leak.

For Legacy valves, it is normal for the coil housing to spin as the flynut is tightened.

The nozzle valves only need to be snug to prevent leakage.

5. Install and tighten the spray tip (Figure 12, Item 5).
6. Repeat Steps 1—5 for all nozzle valve assemblies.

Move the Spray Tube Mount (Nozzle Valve Interference)

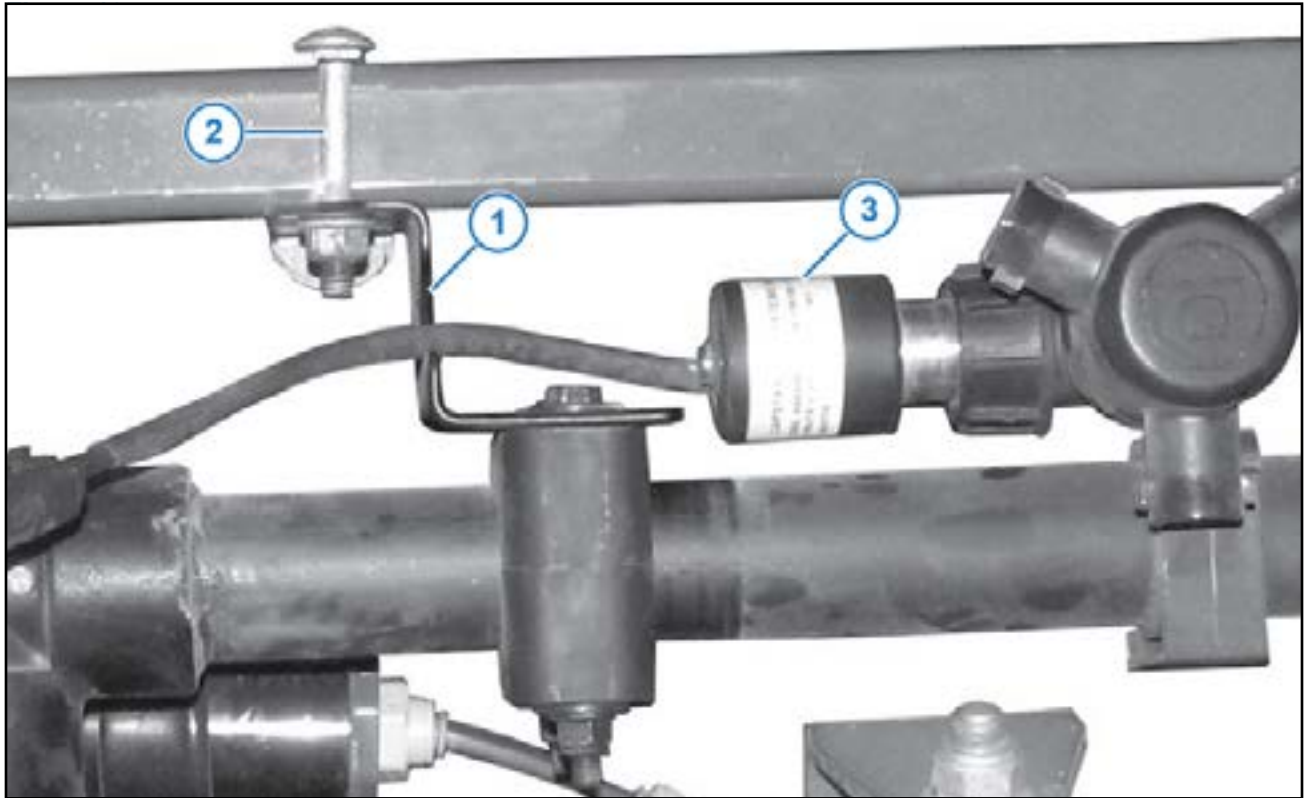


Figure 13: Spray Tube Mount/Nozzle Valve Interference

If a spray tube mount (Figure 13, Item 1) prevents nozzle valve installation:

1. Loosen the spray tube mount bolts (Figure 13, Item 2).
2. Slide the spray tube mount away from the nozzle valve assembly (Figure 13, Item 3) until the nozzle valve assembly can be properly installed.
3. Tighten the spray tube mount bolts.

Install the Gateway Hub

1. Locate an accessible location near the center of the boom mast.
2. Install the hub onto the boom mast with the supplied mounting bracket.

PinPoint III Hub Identification

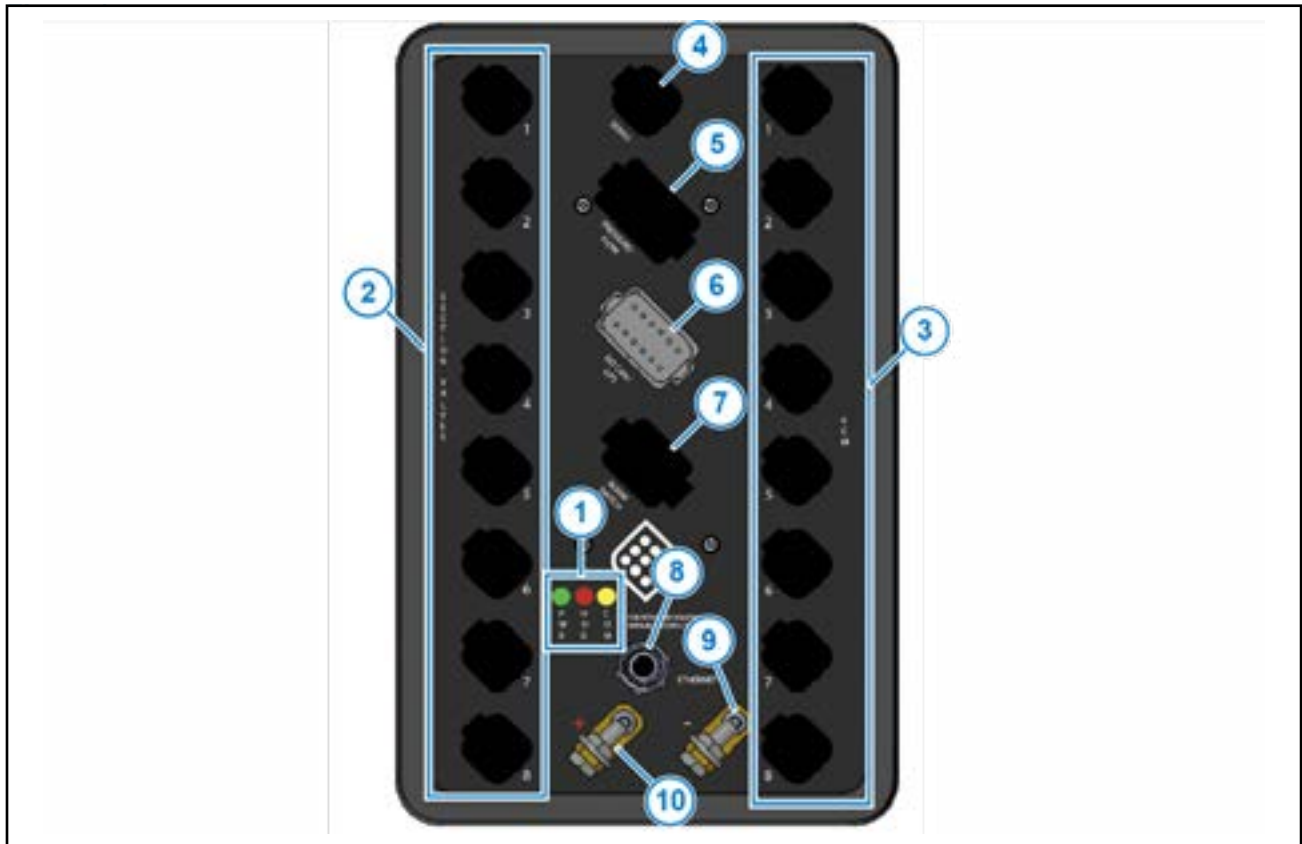


Figure 14: PinPoint III Hub Identification

Table 3: PinPoint III Hub Connections

Refer to [Figure 14](#)

Item	Name	Description
1	LEDs	Green—PWR: Power—On when there is key-switch power to the hub
		Red—HUB: Blinks when the main hub processor is running
		Yellow—COM: Blinks when the hub is communicating over CAN or Ethernet
2	SECTION VALVES	The Section Valve ports
3	VCM	The VCM ports
4	SERVO	The Servo port
5	PRESSURE/FLOW	The Pressure/Flow port
6	ISO CAN/GPS	The ISO CAN/GPS port
7	BOOM SWITCH	The Boom Switch port
8	ETHERNET	The Ethernet port is used to connect the hub to the CapMod
9	Ground Lug	Connect the ground wire to this lug
10	Power Lug	Connect the power wire to this lug

Install the VCMs



Figure 15: VCM Installation

1. Place each VCM (Figure 15, Item 1) adjacent to the first nozzle on the associated boom section. The VCMs are tagged and marked for the appropriate boom sections.
2. Make sure that each tagged VCM is installed on the correct boom section.
3. Route the harness (Figure 15, Item 2) along the booms.
4. Connect the harness connectors (Figure 15, Item 3) at the VCMs and the nozzle valves.
5. Install dust caps on any unused connectors.

Install the VCM Extension Harnesses

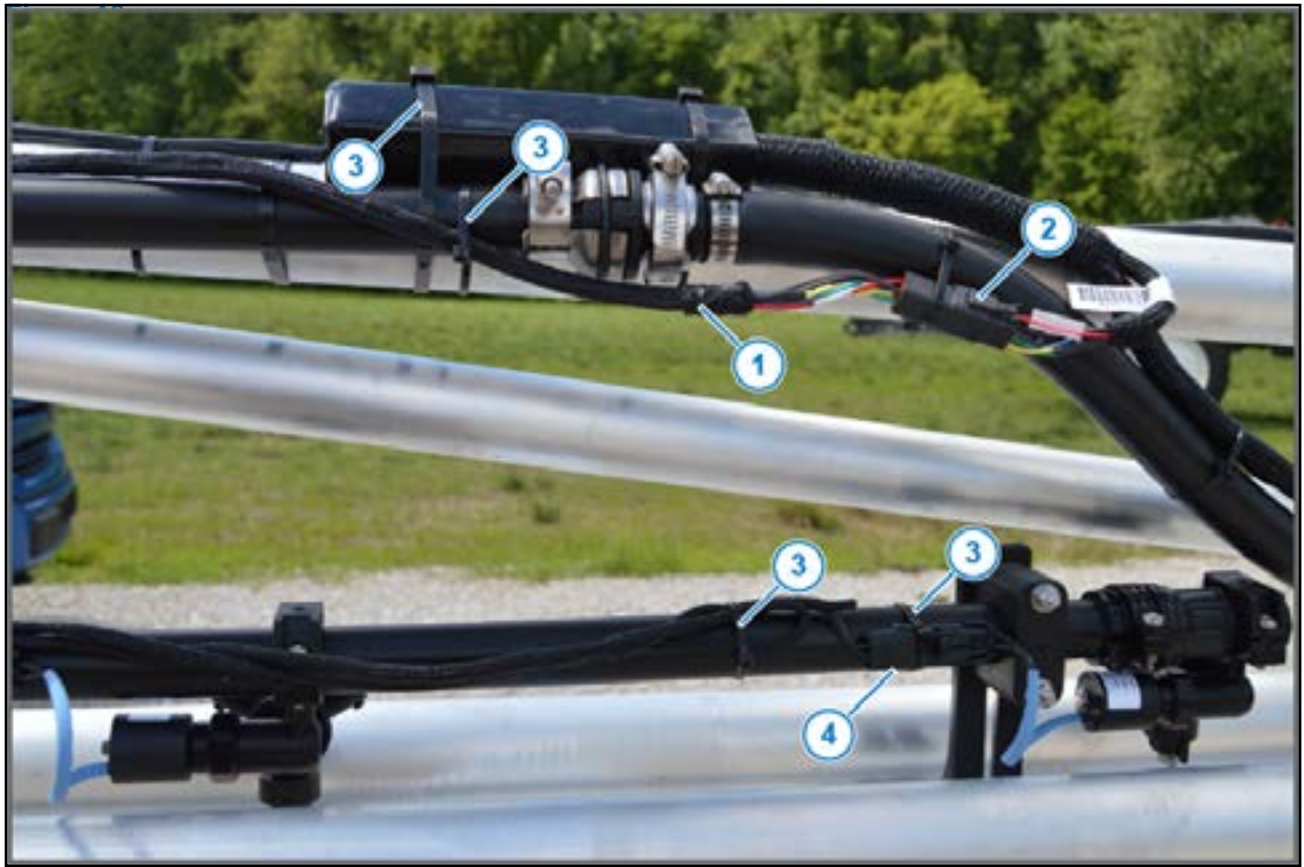


Figure 16: VCM Extension Harness

1. Connect each extension harness (Figure 16, Item 1) to the VCM 6-pin connector (Figure 16, Item 2).
2. Route the extension harnesses along the boom to the Gateway hub at the center of the machine.
Make sure that there is enough slack in the extension harnesses to raise and lower the booms and to avoid pinch points at the boom fold and pivot points.
3. Connect each extension harness to the correct connector on the Gateway hub (VCM Section 1, 2, etc.)
4. Use cable ties (Figure 16, Item 3) to attach the VCMs, harnesses, and nozzle connectors (Figure 16, Item 4) to the boom.

Install the Pressure Sensor (Optional)



Figure 17: Pressure Sensor

1. Remove the existing machine pressure sensor from the boom manifold.
2. Install the tee fitting and other hardware with Teflon tape.
3. Install the new pressure sensor with Teflon tape.
IMPORTANT: Do not over-tighten the pressure sensor when installing into plastic tee fittings.
4. Install the existing machine pressure sensor with Teflon tape.

Install the Pressure Sensor Adapter Harness

1. Route the pressure sensor adapter harness to the Gateway hub.
2. Connect the pressure sensor adapter harness to the harness that connects to the PRESSURE/FLOW port on the hub.

Install the Battery Harness

1. Route the battery harness connectors to the Gateway hub.
2. Connect the positive (+) red cable to the power (+) lug on the Gateway hub using the 1/4" hardware.
3. Connect the negative (-) black cable to the ground (-) lug on the Gateway hub using the 1/4" hardware.
4. Tighten the nuts on the power cables.
5. Install the rubber boots onto the terminals.
6. Route the battery harness from the hub over the boom mast and under the sprayer to the batteries.

IMPORTANT: Make sure that there is enough slack in the harness to raise and lower the boom mast.

Install the Circuit Breaker

1. Disconnect the battery power cables.
2. Cut a short length of wire from the battery harness positive (+) red cable. The length of the wire must reach from the circuit breaker mounting location to the battery positive (+) terminal.
3. Strip the insulation from each cut end of the wire.
4. Crimp the provided ring terminals to the end of each cable.

IMPORTANT: If the machine is so equipped, the system must be wired to the main power disconnect.

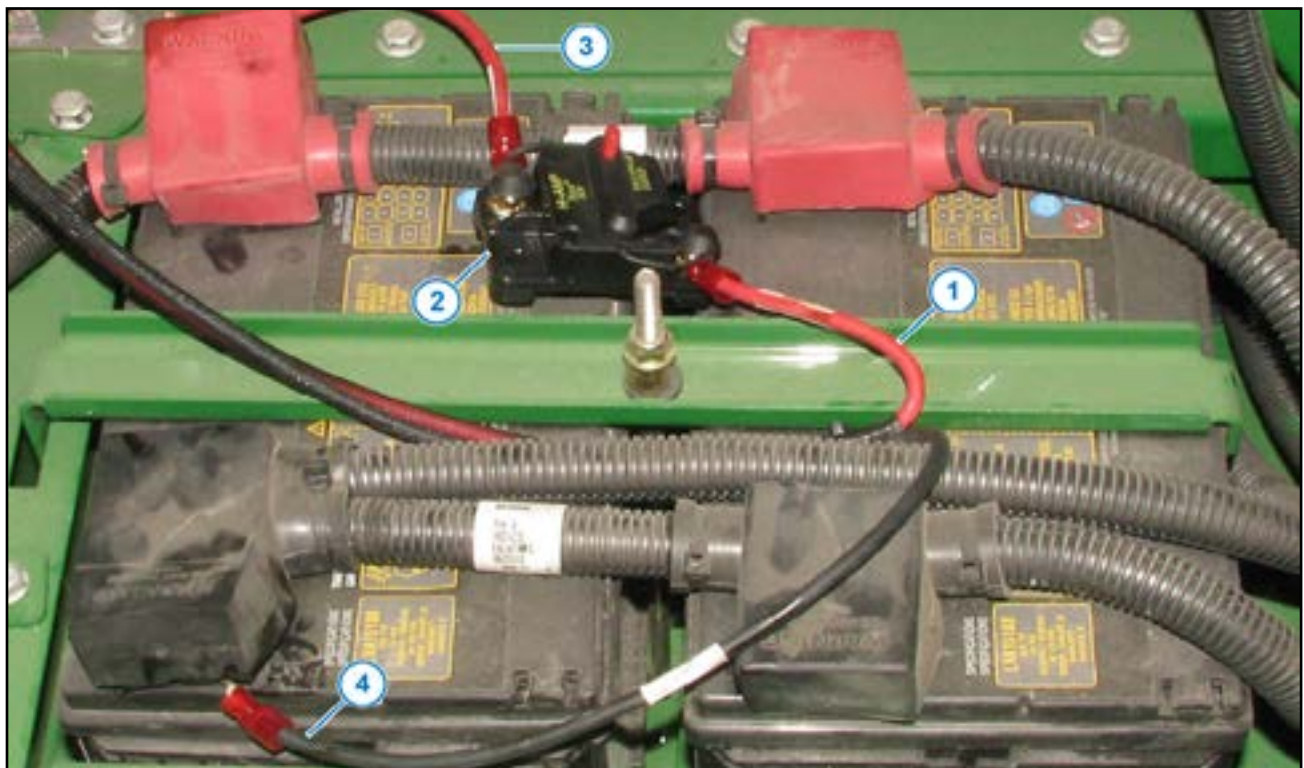


Figure 18: Circuit Breaker

5. Connect the positive (+) harness cable (Figure 18, Item 1) to the stud labeled **AUX** on the circuit breaker (Figure 18, Item 2).

Using the short length of cable from Step 2 (Figure 18, Item 3), connect one end to the stud labeled **BAT** on the circuit breaker. Connect the other end of the cable to the positive (+) battery terminal.

6. Connect the negative (-) black cable on the battery harness ([Figure 18](#), Item 4) to the battery ground terminal.

Chapter 5: Initial System Setup

Topics:

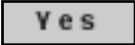
- [Factory Reset Procedure](#)
- [Initial Setup of the Configuration Settings](#)
- [VCM \(Geometry\) Setup Procedure](#)
- [Initial Setup of System Settings](#)
- [Initial VT System Setup Procedure](#)
- [System Dry Tests](#)
- [System Wet Tests](#)
- [Change the Units of Measure](#)

The first time your system is set up, these processes must be completed:

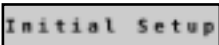
1. Initial Setup of the Boom Settings
2. VCM Setup Procedure
3. Initial Setup of the System Settings
4. Initial VT System Setup Procedure
5. System Dry Tests
6. System Wet Tests

Factory Reset Procedure

Important: Always save your profile settings and/or record all settings and location setup information before performing a factory reset.

Navigate:  >  >  >  > 

Initial Setup of the Configuration Settings

1. Navigate:  >  > 
2. Go through each menu item to make sure that each setting is correct for your machine and operating conditions.

For machine specific settings, refer to the PinPoint™ III Envelop website at www.capstanag.com/pinpoint-iii-envelop.

For setting definitions, refer to [Initial Setup Settings Descriptions](#).

VCM (Geometry) Setup Procedure - Legacy VCMs

1. Navigate:  > **Initial Setup** > **VCM Setup**

The hub detects which VCM port each VCM connector is installed.

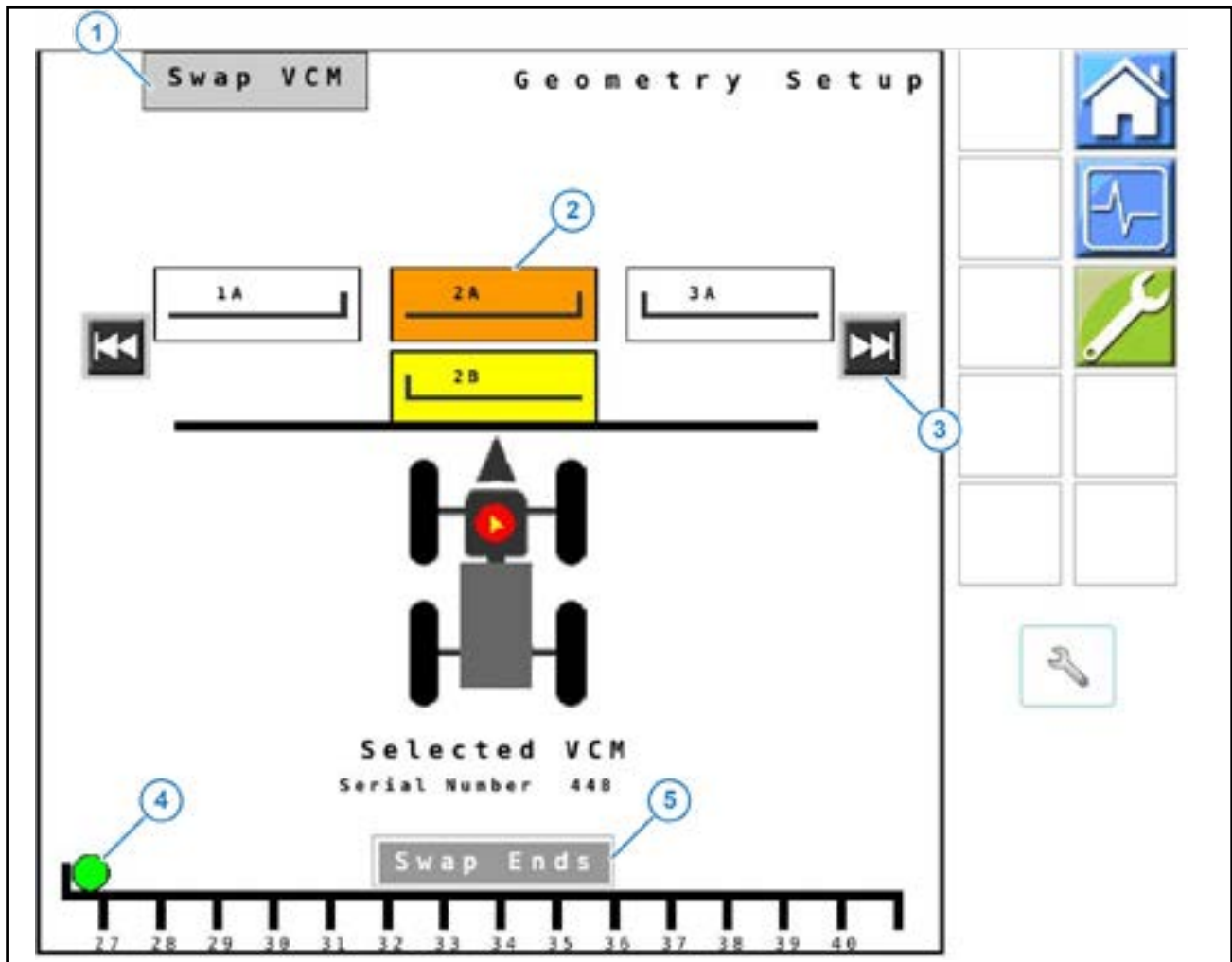


Figure 19: Geometry Setup - Legacy VCMs

2. If there are two VCMs on one section, you can change their positions. A Swap VCMs icon will show at the top of the screen (Figure 19, Item 1). To do this, tap one of the VCMs (will highlight yellow); tap the other VCM (will highlight orange); tap the Swap VCM button.
3. If the orientation on a VCM (Figure 19, Item 2) is incorrect, select Swap Ends (Figure 19, Item 5) to change which end the VCM (Figure 19, Item 4) is on.
4. Select  (Figure 19, Item 3) to go to the next VCMs in sequence.
5. Make sure that the number of nozzles controlled by each VCM matches what is on the boom.
6. Perform the [Key Fob Boom Shutoff Dry Test](#).

VCM (Geometry) Setup Procedure - Leap Start VCMs

1. Navigate:  > **Initial Setup** > **VCM Setup**

The hub detects which VCM port each VCM connector is installed.

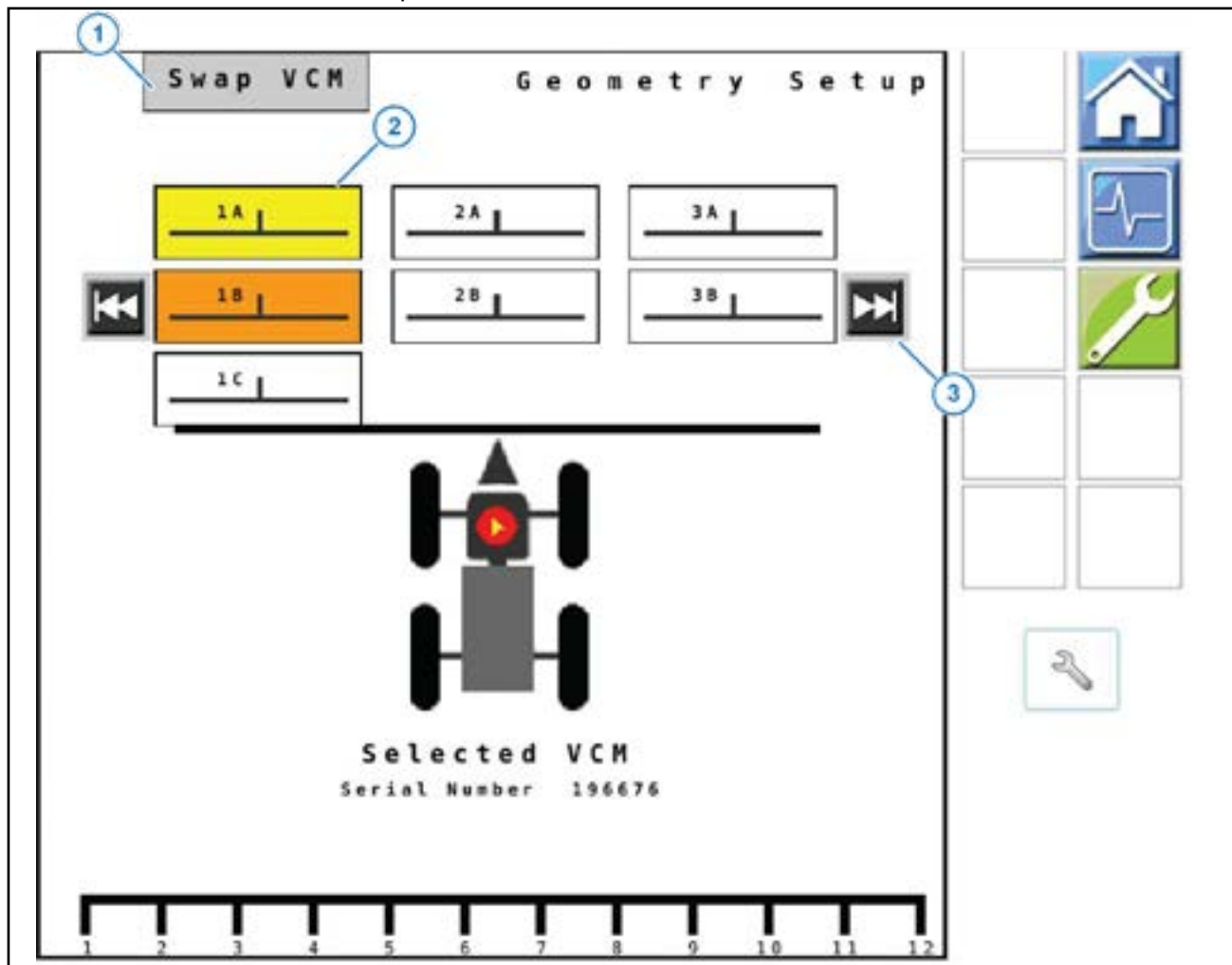


Figure 20: Geometry Setup - Leap Start VCMs

Leap Start VCMs are able to be "daisy-chained" on the boom, thereby minimizing harnessing running back to the PinPoint III or PinPoint III Lite hub. A maximum of three Leap Start VCMs are allowed per VCM Channel. These VCMs can accommodate up to 12 coils each.

1. If there is more than one Leap Start VCM on a section, you can change their positions. A Swap VCMs icon will show at the top of the screen (Figure 20, Item 1). To do this, tap one of the VCMs (Figure 20, Item 2) will highlight yellow); tap another VCM on the same channel (will highlight orange); tap the Swap VCM button.
2. Select  (Figure 20, Item 3) to go to the next VCMs in sequence.
3. Make sure that the number of nozzles controlled by each VCM matches what is on the boom.
4. Perform the [Key Fob Boom Shutoff Dry Test](#).

Initial Setup of System Settings

Change the Boom and Nozzle Settings

1. Navigate:  > **Boom/Nozzle** > **Nozzle Bounds**
2. Change any of the values as needed.
For machine specific settings, refer to PinPoint™ III Envelop website at www.capstanag.com/pinpoint-iii-envelop.
For setting definitions, refer to [Boom/Nozzle Settings Menu Descriptions](#).

3. Navigate:  > **Boom/Nozzle** > **Nozzle Setup**

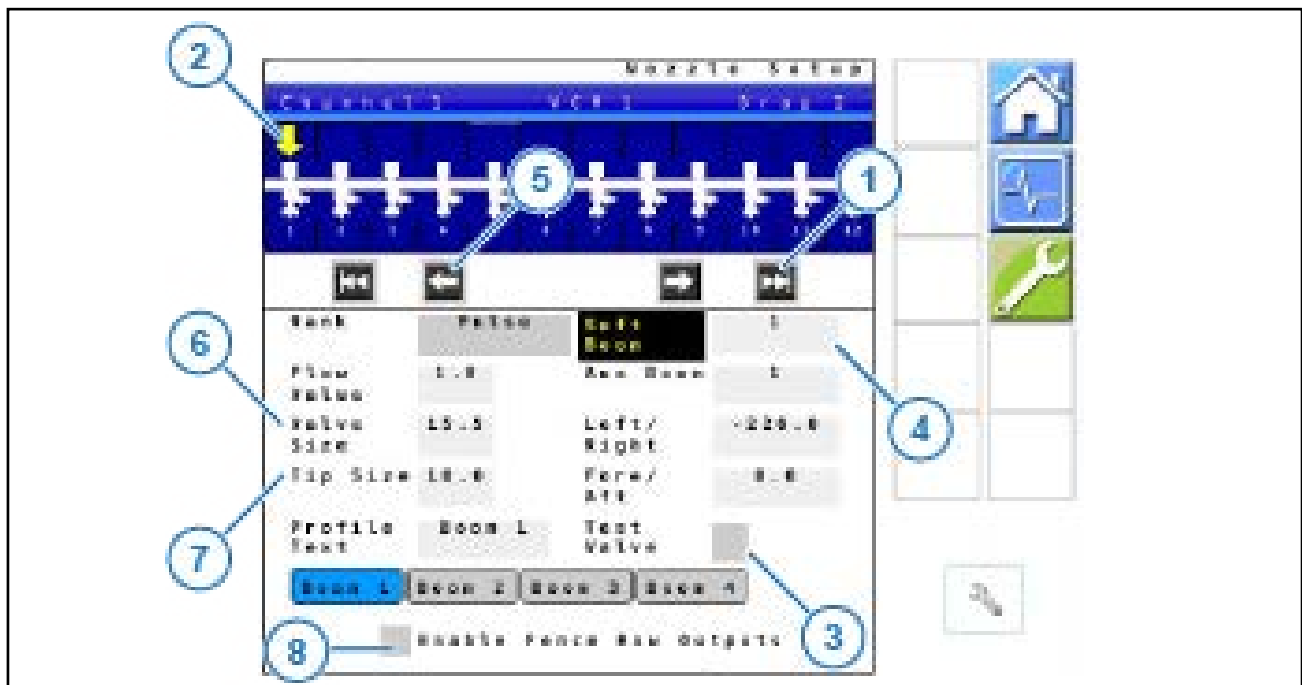


Figure 21: Nozzle Setup Screen

4. On the Nozzle Setup screen, select  (Figure 21, Item 1) to go to the next set of 12 nozzles in sequence.
5. Make sure that the yellow arrow (Figure 21, Item 2) is highlighting the correct nozzle.
6. To make sure that the correct valve is highlighted, select the box next to (Figure 21, Item 3) Test Valve. With an X in the box, the valve will pulse. Remove the X to stop the valve.
7. Select the box (Figure 21, Item 4) next to **Soft Boom** to change the boom layout as desired. Refer to your machine's Integration instructions for exact soft boom configurations.
8. Select  to go to the previous set of 12 nozzles in sequence.
9. If necessary, change the valve size (Figure 21, Item 6) or tip size (Figure 21, Item 7).
10. To enable Fence Row Outputs, tap checkbox (Figure 21, Item 8). See Hub Connector Identification on [Page 123](#) for output pin designations.

11. Select the box next to the text and enter the desired value.

If the value will be the same for all valves or tips, select **Yes** on the dialog that appears to change all nozzles.

From this screen, you can also change the profile names.

Change a Profile Name & Nozzle Setup Explanations

1. Navigate:  > **Boom/Nozzle** > **Nozzle Setup**
2. At the bottom of the screen, select the desired Profile name (Figure 21, Item 1).

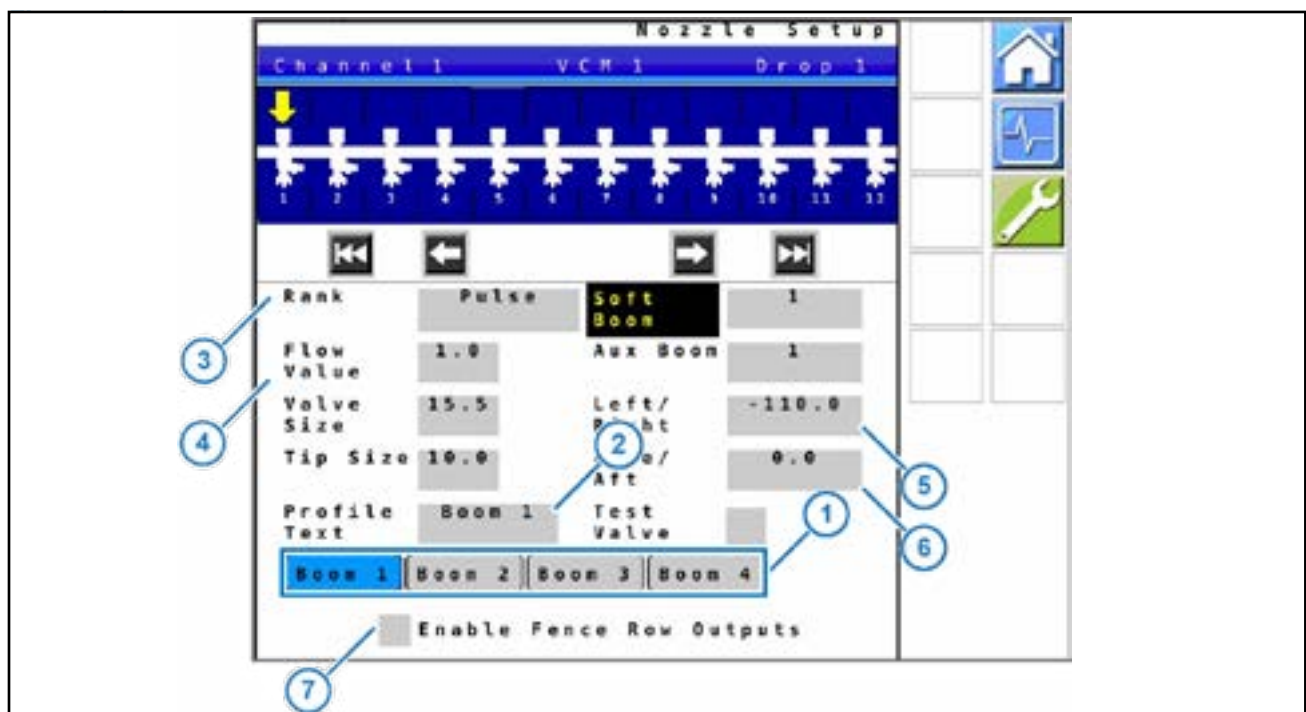


Figure 22: Profile Names on Nozzle Setup Screen

3. Select the box (Figure 22, Item 2) next to **Profile Text**.
4. Enter the desired profile name.
The profile name is limited to six characters.
5. The updated profile name will show on the name screen.
- Note:** To use modified profiles, **Custom** must be selected on the home screen.
6. The **Nozzle Rank** (Figure 22, Item 3) can be changed from the default **Pulse** setting to accommodate different operational requirements. Nozzles must be selected individually using the arrows to change their respective behavior. See Table 4 on Page 43 for Rank explanations.
7. The **Flow Value** (Figure 22, Item 4) adjusts the amount of flow from that nozzle to increase/decrease volume applied.
8. The **Left/Right** (Figure 22, Item 4) number indicates the selected nozzle's location left or right from the center of the boom. Nozzles to the left of center are negative values while nozzles to the right of center are positive values.

9. The **Fore/Aft** (Figure 22, Item 6) number indicates the nozzle location from the primary spray boom. This is typically left as the default 0 value. However, front-mounted boom sprayers may utilize this for rear boom application.
10. The **Enable Fence Row Outputs Checkbox** (Figure 22, Item 7) is used to enable 12V fence row outputs on Pin 6 of the VCM ports 6 & 8. These are controlled by on-screen switches located on the Home screen.

Table 4: Nozzle Rank Explanations

Nozzle Rank	Function
Pulse	Default mode of operation. Nozzles will function normally.
ON	The selected nozzles will be held open at 100% Duty Cycle.
OFF - TC Visible	The selected nozzles will be held closed but the location and nozzle width will be visible to the Task Controller. Will result in "candy striping" on application map.
OFF	The selected nozzles will be held closed but the location and nozzle width will be ignored by the Task Controller. This will increase the width of adjacent nozzles to accomodate gap left by the OFF nozzles so overall boom width is not affected.
Fence Row ON	Only to be used on Left and/or Right-most nozzles attached to a VCM Only . This setting will not affect the overall boom width detected by the Task Controller.
TC Fence Row	Only to be used on Left and/or Right-most nozzles attached to a VCM Only . This setting will allow the Task Controller to take the fence row nozzles into account for overall boom width.
Boost	Feature in development to allow stacked nozzle bodies for high flow applications.

Change the Pressure Settings

1. Navigate:  > 
2. Select each menu item and go through each screen with additional menu items to make sure that each setting is correct for your machine and operating conditions.

For machine specific settings, refer to the integration instruction that came with the system or the PinPoint™ III Envelop website at www.capstanag.com/pinpoint-iii-envelop.

For setting definitions, refer to [Pressure Settings Menu Descriptions](#).

Change the Flow Settings

1. Record flowmeter pulses/10 gal or pulses/10 liters information from the flowmeter tag. The information will be used during the initial system setup.

2. Navigate:  > 

3. Enter flowmeter cal number in the Meter 1 Calibration field.

Note: If the machine is equipped with a remote fill station, record flowmeter calibration number from corresponding flowmeter and enter into Meter 2 Calibration field.

For setting definitions, refer to [Flow Settings Menu Descriptions](#).

Change the Navigation Settings

1. Navigate:  >  > 
2. Select the correct **Machine Steering** ([Figure 23](#), Item 1) option for your machine:
 - 2 Wheel
 - 4 Wheel
 - Articulated

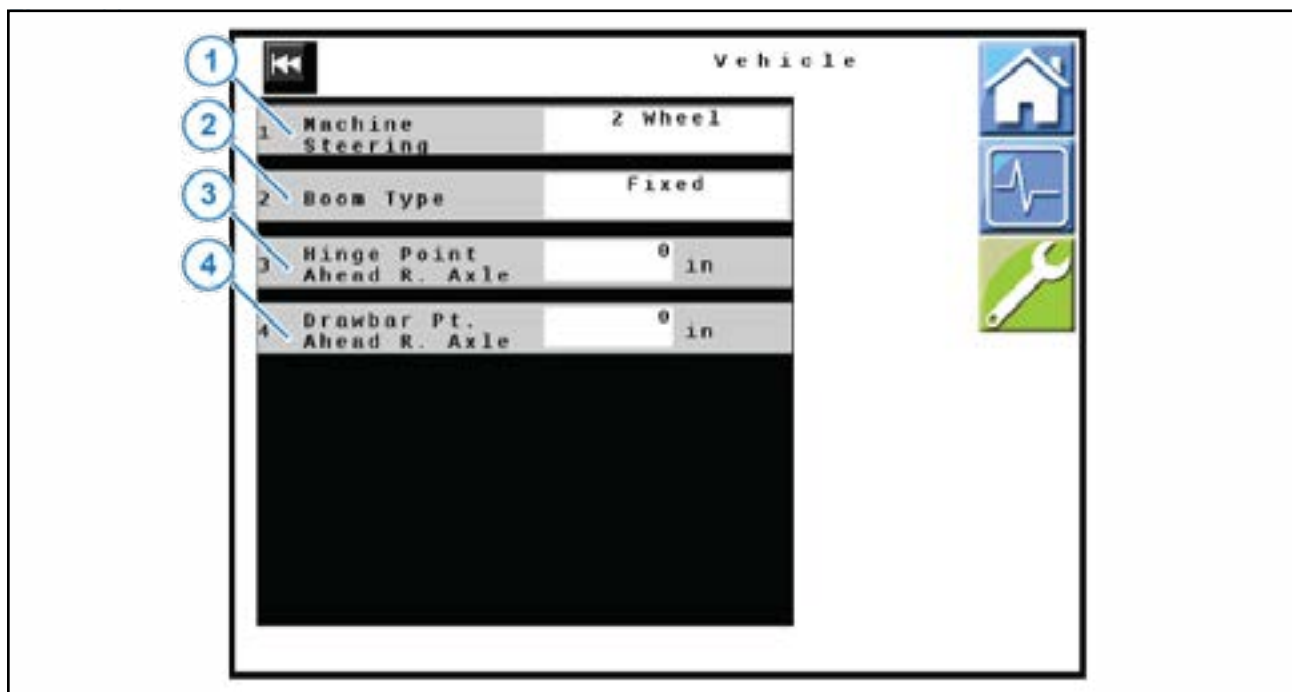


Figure 23: Vehicle Settings

3. Select correct **Boom Type** (Figure 23, Item 2) option for your machine:

- Fixed
- Pull

Note: If using a fixed boom sprayer, the **Hinge Point Ahead Rear Axle** and the **Drawbar Point Ahead Rear Axle** values will be left at zero. If using a Pull Type sprayer, refer to Figure 24 for measurement instructions. For setting definitions navigate: **Navigation Settings > Menu Descriptions**.

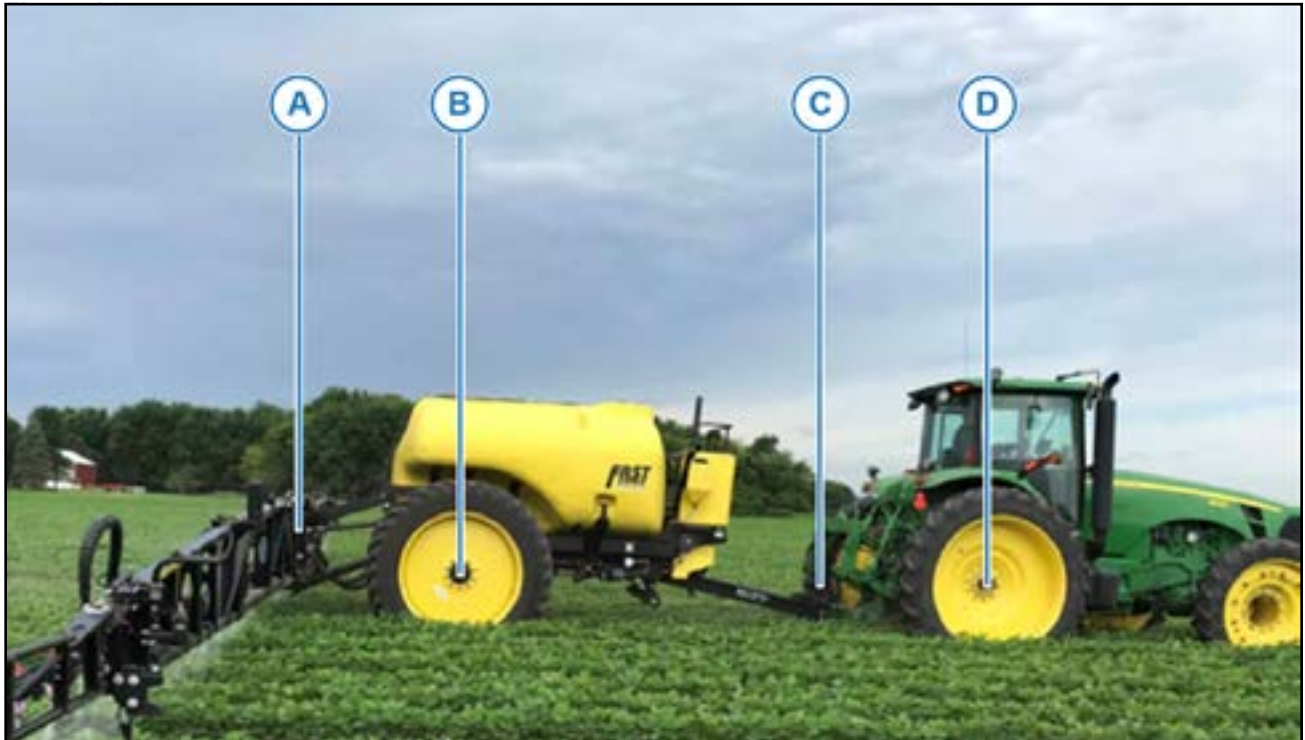


Figure 24: Navigation Setting Measurements

4. For Pull Type sprayers only, use a tape measure to take and record the following measurements:

- Drawbar Pt. Ahead R. Axle (D–C)
- Boom Ahead Rear Axle (D–A)
- Trail Axle Ahead R. Axle (D–B)

5. Enter the correct **Drawbar Pt. Ahead R. Axle** measurement (Figure 23, Item 4) on the **Vehicle** screen as a (-) negative value. The remaining values will be entered on the **Implement** screen.

6. For all machines, use a tape measure to take and record the following measurements:

- Boom Ahead Rear Axle (if not already recorded)
- GPS Ahead of Rear Axle
- GPS Right of Center
- GPS Height from Ground

7. Navigate: > **Navigation** > **Implement**



Figure 25: Implement Settings

8. Select the box (Figure 25, Item 1) next to Boom Ahead Rear Axle (Figure 25, Item 2).
9. Enter the correct value.

If the boom is behind the rear axle, the value will be (-) negative.

10. Select the box (Figure 25, Item 3) next to Trail Ahead Rear Axle (Figure 25, Item 4).
11. Enter the correct value.

For Pull Type sprayers, this value will be (-) negative, for all other machines, this value will be left at zero.

12. Navigate:  > 

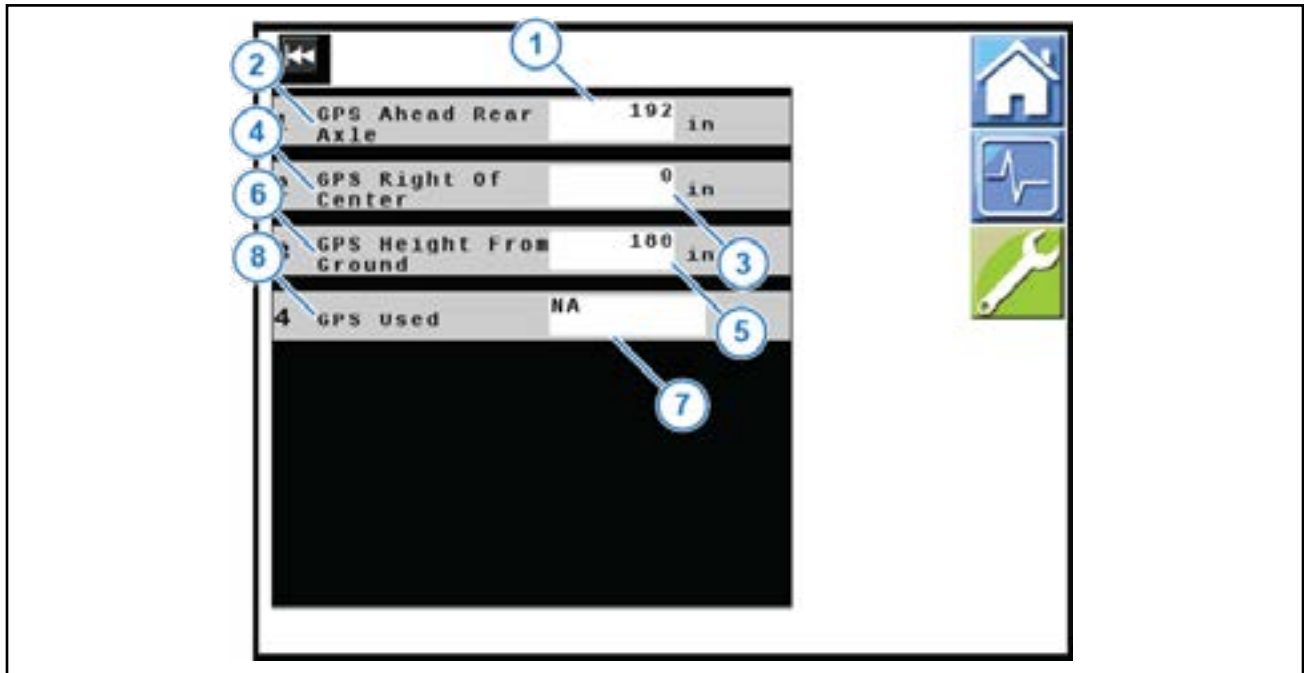


Figure 26: GPS Settings

13. Select the box (Figure 26, Item 1) next to GPS Ahead Rear Axle (Figure 26, Item 2).
14. Enter the correct value.
15. Select the box (Figure 26, Item 3) next to GPS Right of Center (Figure 26, Item 4).
16. Enter the correct value.
17. Select the box (Figure 26, Item 5) next to GPS Height From Ground (Figure 26, Item 6).
18. Enter the correct value.
19. Select the box (Figure 26, Item 7) next to GPS Used (Figure 26, Item 8).
20. Select the type of GPS from the list of available options.

Not all of the options may show on your system. Only the types available for your system will show on your list.

If you have serial GPS, select NMEA0183

If you have CAN GPS, available types include—in preference order:

- a. J1939
- b. ISO 11783
- c. NMEA2000

Compass Calibration Procedure

1. Navigate:  >  > 

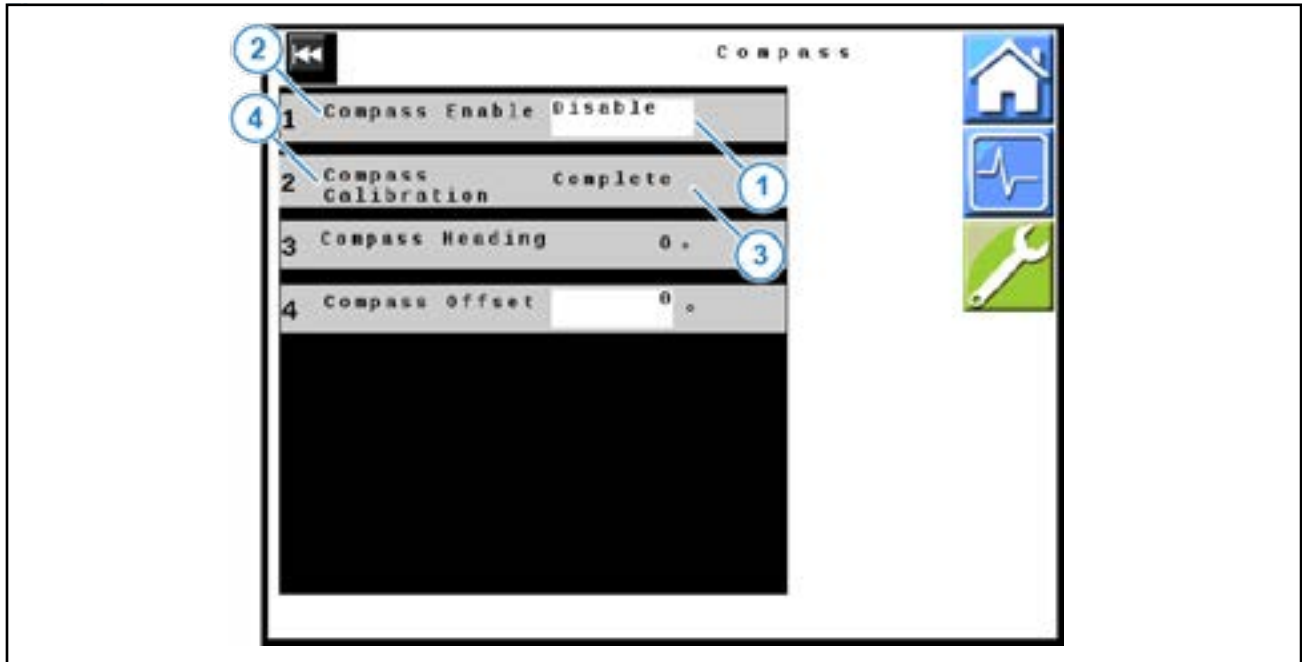


Figure 27: Compass Screen

2. Select the box (Figure 27, Item 1) next to Compass Enable (Figure 27, Item 2).
3. Select Enable.
4. Select the box (Figure 27, Item 3) next to Compass Calibration (Figure 27, Item 4).
5. Follow the prompts on the VT screen to complete the compass calibration.
6. Set compass to **Disable** after calibration is complete.

Initial VT System Setup Procedure

1. Refer to your specific VT manual(s) for system display setup information.
2. Visit www.capstanag.com/pinpoint-iii-envelop for machine specific CapstanAG setup information.

System Dry Tests

Follow these procedures to make sure that the soft boom and nozzle valves are operating correctly.

Boom Shutoff Dry Test

1. Make sure that the engine is off and the key is on.

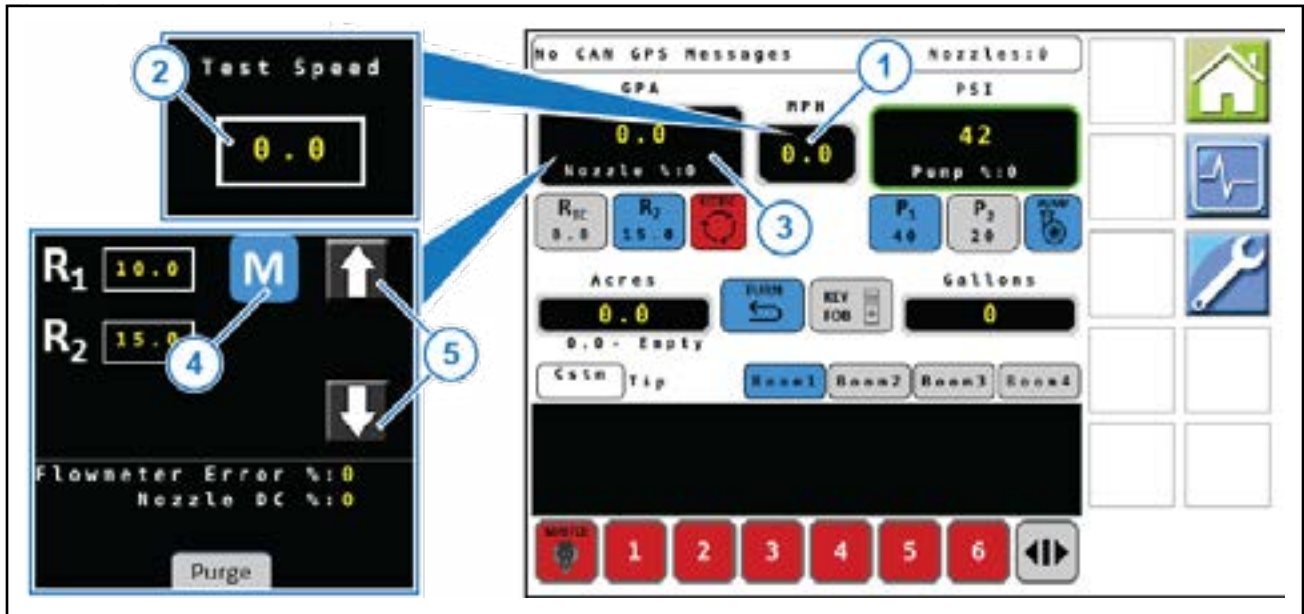


Figure 28: Boom Shutoff Dry Test

2. Select the speed box (Figure 28, Item 1).
3. Set a test speed (Figure 28, Item 2).
4. Select the rate box (Figure 28, Item 3).
5. Select M (Figure 28, Item 4) and then use the arrow icons (Figure 28, Item 5) to change the rate.
6. Turn on all boom switches.
7. Turn on the master switch.
All nozzles valves should start clicking.
8. Turn off all of the boom sections.
9. Turn on boom section 1.
10. Make sure the nozzle valves for the correct boom section are clicking.
11. Turn off boom section 1.
12. Repeat steps 9—11 for each boom section.
13. Turn off the master switch.

Key Fob Boom Shutoff Dry Test

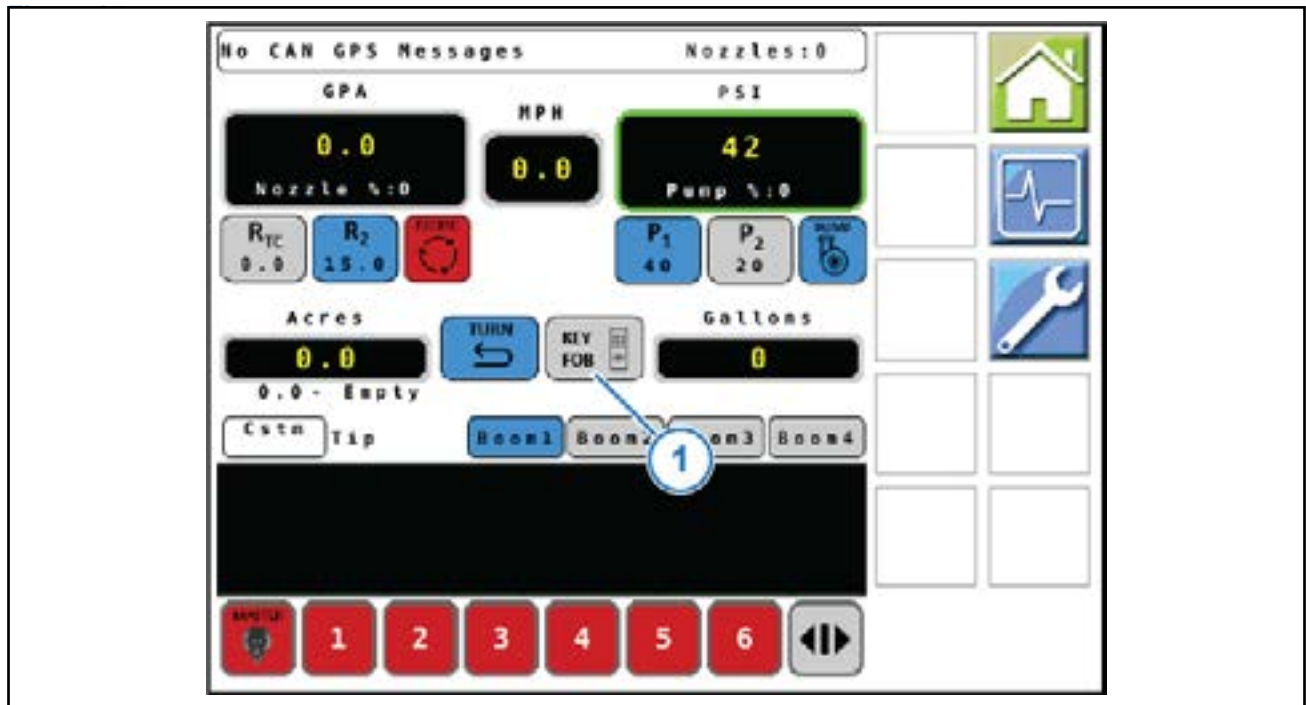


Figure 29: Run Screen

1. To initiate the key fob boom shutoff dry test, select the **KEY FOB** icon (Figure 29, Item 1).

Note: The CapstanAG Mobile App can be used with the system in key fob mode for this test procedure.



Figure 30: Key Fob

2. Press the top/bottom buttons (Figure 30, Item 1) on the key fob to turn on/off each boom section. Make sure that each boom section is operating (clicking) in the correct order.
3. Press the right/left buttons (Figure 30, Item 2) on the key fob to turn on/off each individual nozzle valve. Make sure that each nozzle valve is operating (clicking) in the correct order.
4. Press the center button (Figure 30, Item 3) on the key fob to turn off the whole boom.
5. On the VT screen, select the box (Figure 30, Item 3) next to Key Fob (Figure 29, Item 4) until OFF shows.

System Wet Tests

Follow these procedures to make sure that the soft boom and nozzle valves are operating correctly.

Boom Shutoff Wet Test

1. Fill the sprayer with approximately 400 gallons of water.
2. Make sure that the VT display and rate controller are off.
3. Start the machine engine and set to idle speed.
4. Turn on the VT display and rate controller.

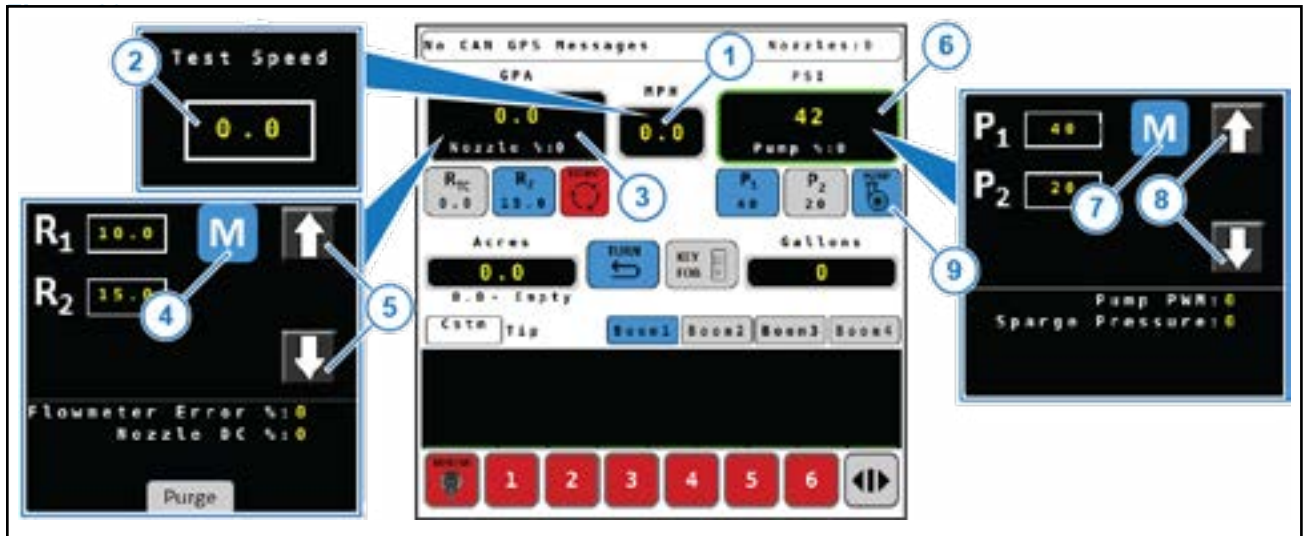


Figure 31: Boom Shutoff Wet Test

5. Select the speed box (Figure 31, Item 1).
6. Set a test speed (Figure 31, Item 2).
7. Select the rate box (Figure 31, Item 3).
8. Select M (Figure 31, Item 4) and then use the arrow icons (Figure 31, Item 5) to change the rate.
9. Select the pressure icon (Figure 30, Item 6).
10. Select M (Figure 31, Item 7) and then use the arrow icons (Figure 31, Item 8) to change the pressure.
11. Select the Pump icon (Figure 31, Item 9) to turn on pump.
12. Make sure that the system is controlling the pressure.
13. Turn on all of the boom switches.
14. All of the nozzle valves on the boom should start to spray.
15. Turn off all of the boom sections.
16. Turn on boom section 1.
The nozzle valves on boom section 1 should start to spray.
17. Repeat Step 16 for each boom section and make sure that each boom section operates in the correct order.

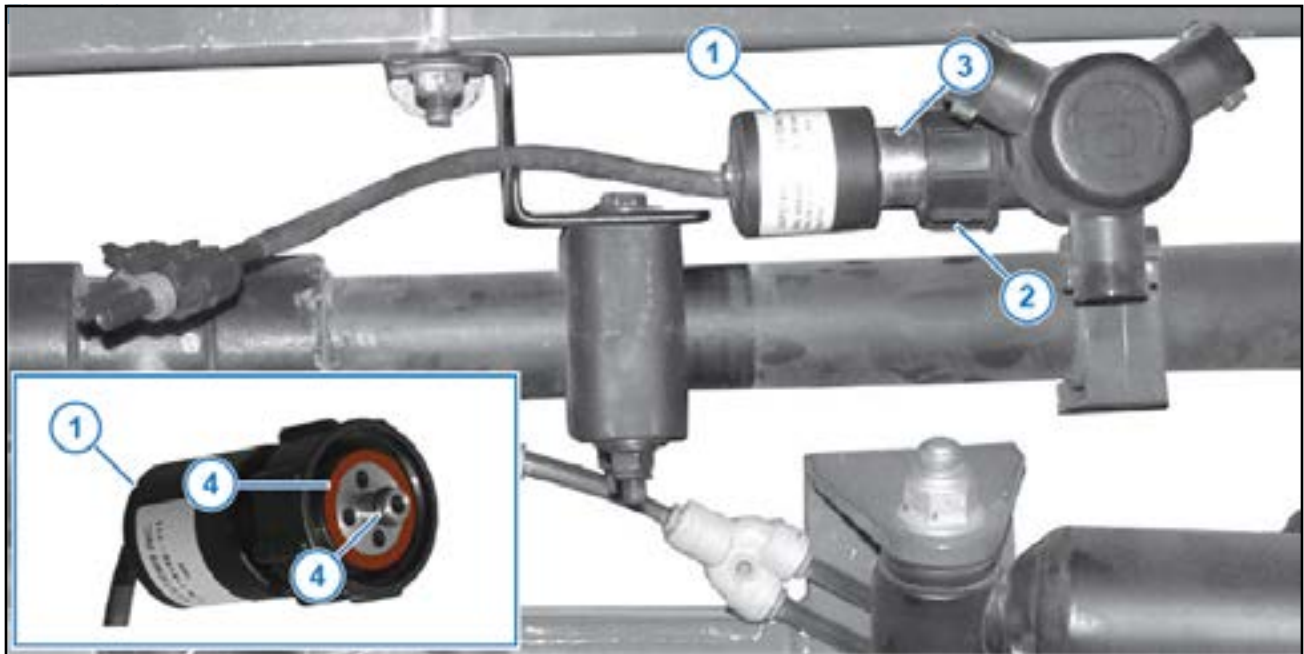


Figure 32: Nozzle Valve Leaks

If a leaking valve body is found, check the following:

18. If the coil housing (Figure 32, Item 1) spins, tighten the fly nut (Figure 32, Item 2) until the coil housing does not spin.
19. If the coil housing does not spin, remove the nozzle valve (Figure 32, Item 3).
20. Inspect the O-rings (Figure 32, Item 4). If an O-ring is damaged, replace the O-ring.
If the O-rings appear to be okay, install the existing nozzle valve.

Key Fob Boom Shutoff Wet Test

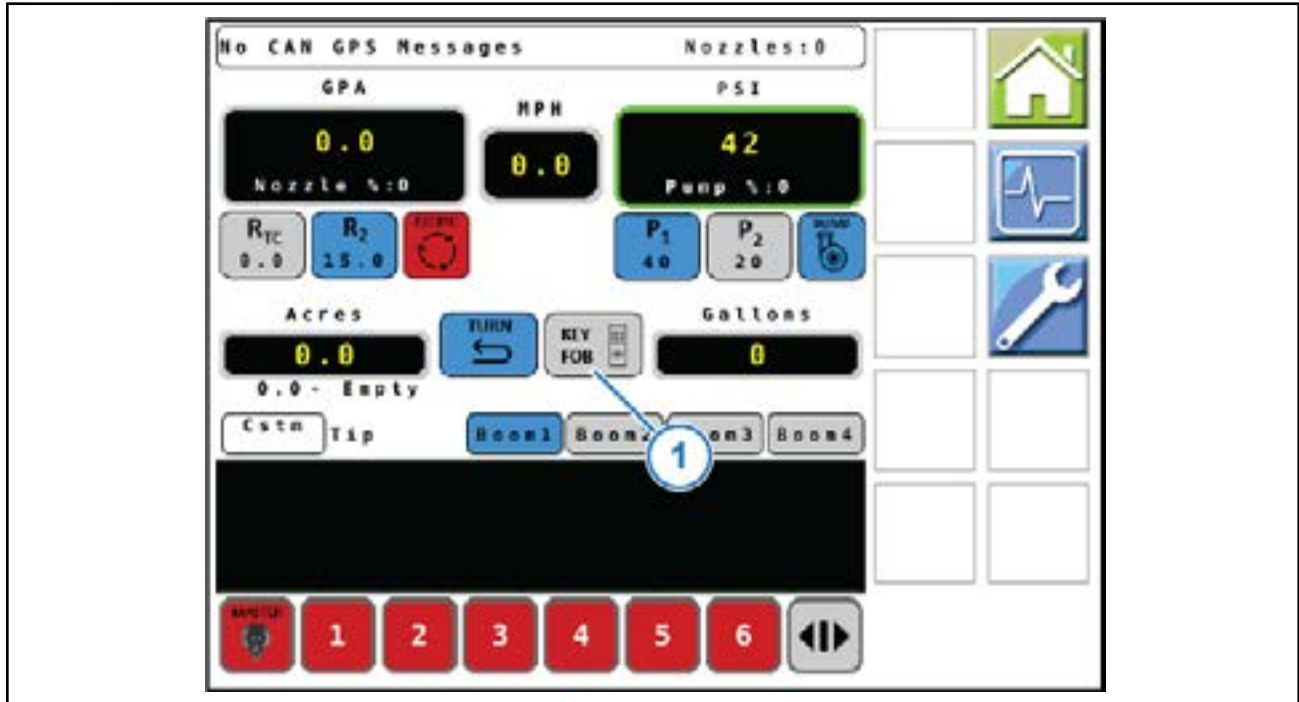


Figure 33: Key Fob Mode

1. After performing the boom shutoff wet test, initiate the key fob boom shutoff wet test, by selecting the **KEY FOB** icon (Figure 33, Item 1)
2. Turn on all of the boom section switches and the master switch.

Note: The CapstanAG Mobile App is available for iOS¹ and Android and is in both stores. You can use the app as a key fob for this test procedure.



Figure 34: Key Fob

3. Press the top/bottom buttons (Figure 34, Item 1) on the key fob to turn on/off each boom section. Make sure that each boom section is spraying in the correct order.

¹ iOS is Trademarked by Cisco Systems and Apple licenses iOS.

4. Press the right/left buttons (Figure 33, Item 2) on the key fob to turn on/off each individual nozzle valve.
Make sure that each nozzle valve is spraying in the correct order.
5. Press the center button (Figure 33, Item 3) on the key fob to turn off the whole boom.
6. Deselect the **KEY FOB** icon (Figure 32, Item 1).

Change the Units of Measure

Note: This setting is set by the virtual terminal. Refer to the VT manual for more information.

External Fill Station Monitor Setup

The PinPoint III has the ability to transmit a separate VT to another external display at up to two locations to control the sprayer during filling operations.

Note: This functionality will not work with OEM supplied fill station monitors. Suggested monitors to use with this function are:

- TopCon Opus
- Reichardt SMART 700

IMPORTANT: Ensure the correct **Fill Flowmeter calibration number** has been entered during the initial setup. If not, this number can be found at **Wrench > Flow > Flowmeter Setup > Meter 2 Calibration**.

Enter Tank Volume Information

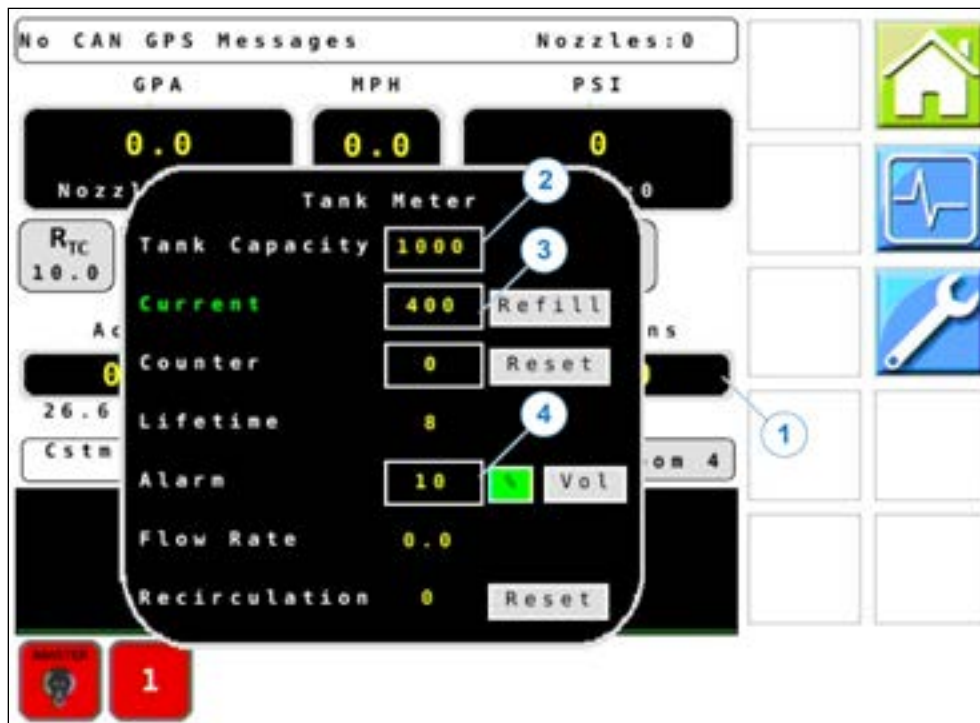


Figure 35: Tank Meter Popup

1. Tap the Gallons text area displaying the current tank volume (Figure 35, Item 1).
2. Enter the correct Tank Capacity (Figure 35, Item 2).
3. Enter the Current tank volume if applicable (Figure 35, Item 3).
4. Enter the Alarm threshold to alert for the tank percentage or volume specified (Figure 35, Item 4).

Enable Fill Station Monitors



Figure 36: Configuration Menu - Page 4

1. Navigate:  > **Initial Setup** > **Configuration** > Page 4.
2. Change Fill Station 1 menu item to appropriate monitor ([Figure 36](#), Item 1).
3. This will transmit the Fill Station object pool to the selected monitor.
4. Change Fill Station 2 menu item to appropriate monitor if attached ([Figure 36](#), Item 2).

Fill Station VT Overview

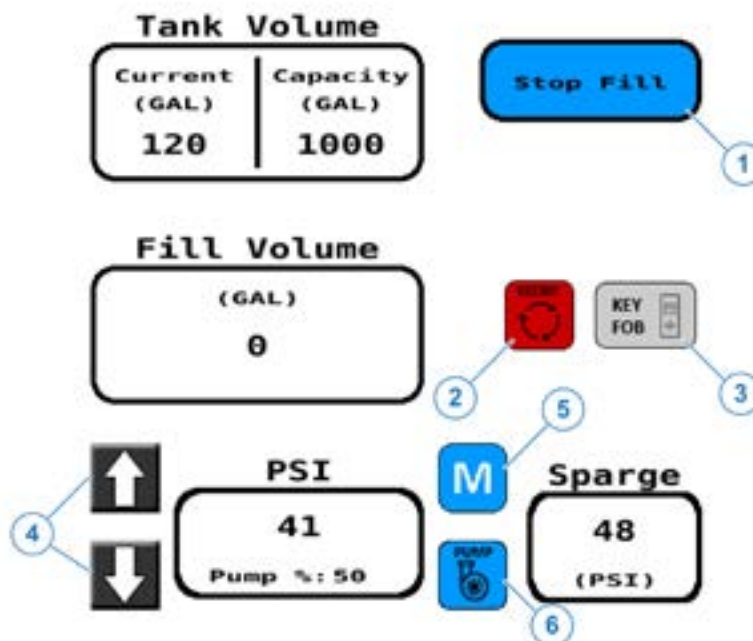


Figure 37: Fill Station Monitor Buttons

1. The Start/Stop Fill Button (Figure 37, Item 1) begins/ends the fill process. Tapping this button will automatically enable/disable the pump and place the sprayer into Manual pressure control.
- **Note:** The Pump % will automatically control to the Fill Station PWM setpoint. This setting can be changed on the PinPoint III Main VT at: **Wrench > Pressure > Pump Setup > Page 2 > Fill Station PWM**.
2. Boom Recirculation (Figure 37, Item 2) can be toggled here if equipped.
3. Key Fob mode (Figure 37, Item 3) can be toggled here as needed.
4. The Pump PWM % can be manually adjusted using the up/down arrows (Figure 37, Item 4).
5. If desired, the pump can be taken out of Manual Mode by tapping the Manual button (Figure 37, Item 5) to control to the pressure setpoint last selected on the PinPoint III VT Home screen.
6. The Pump can be enabled/disabled manually by tapping the Pump button (Figure 37, Item 6).

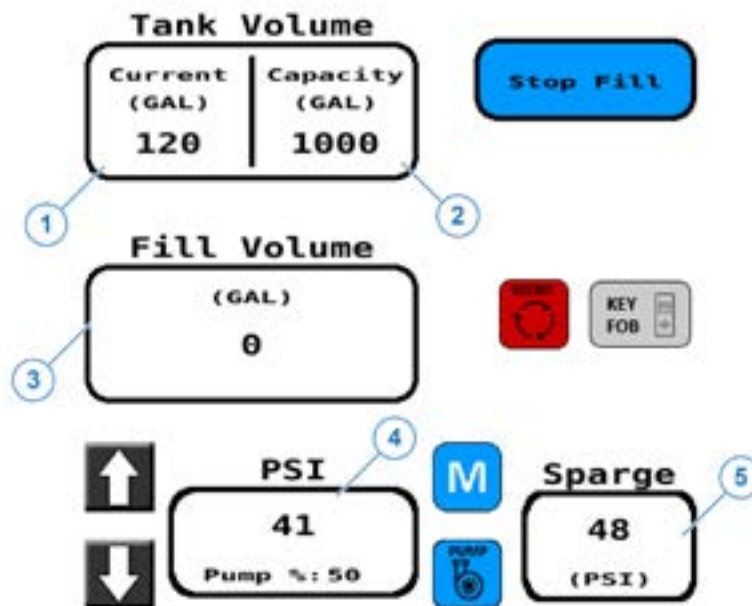


Figure 38: Fill Station Monitor Text Areas

1. The Current tank capacity is displayed under Tank Volume Current (Figure 38, Item 1). This volume will automatically be transferred to/from the PinPoint III VT.
2. The Total tank Capacity is displayed under Capacity (Figure 38, Item 2). This volume will automatically be transferred to/from the PinPoint III VT.
3. The Fill Volume text area (Figure 38, Item 3) displays the volume of liquid transferred to the sprayer as counted by the Fill Flowmeter.
4. The Boom Pressure is displayed under the PSI text area (Figure 38, Item 4).
5. The Sparge Pressure is displayed under the Sparge text area (Figure 38, Item 5).

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Chapter 6: Operation

Topics:

- [Main System Screen](#)
- [Operate the System](#)
- [Settings Menu Information](#)
- [Machine Specific Information](#)
- [Nozzle Speed Ranges](#)

Main System Screen

The main system screen is the main user interface for the control of the system.

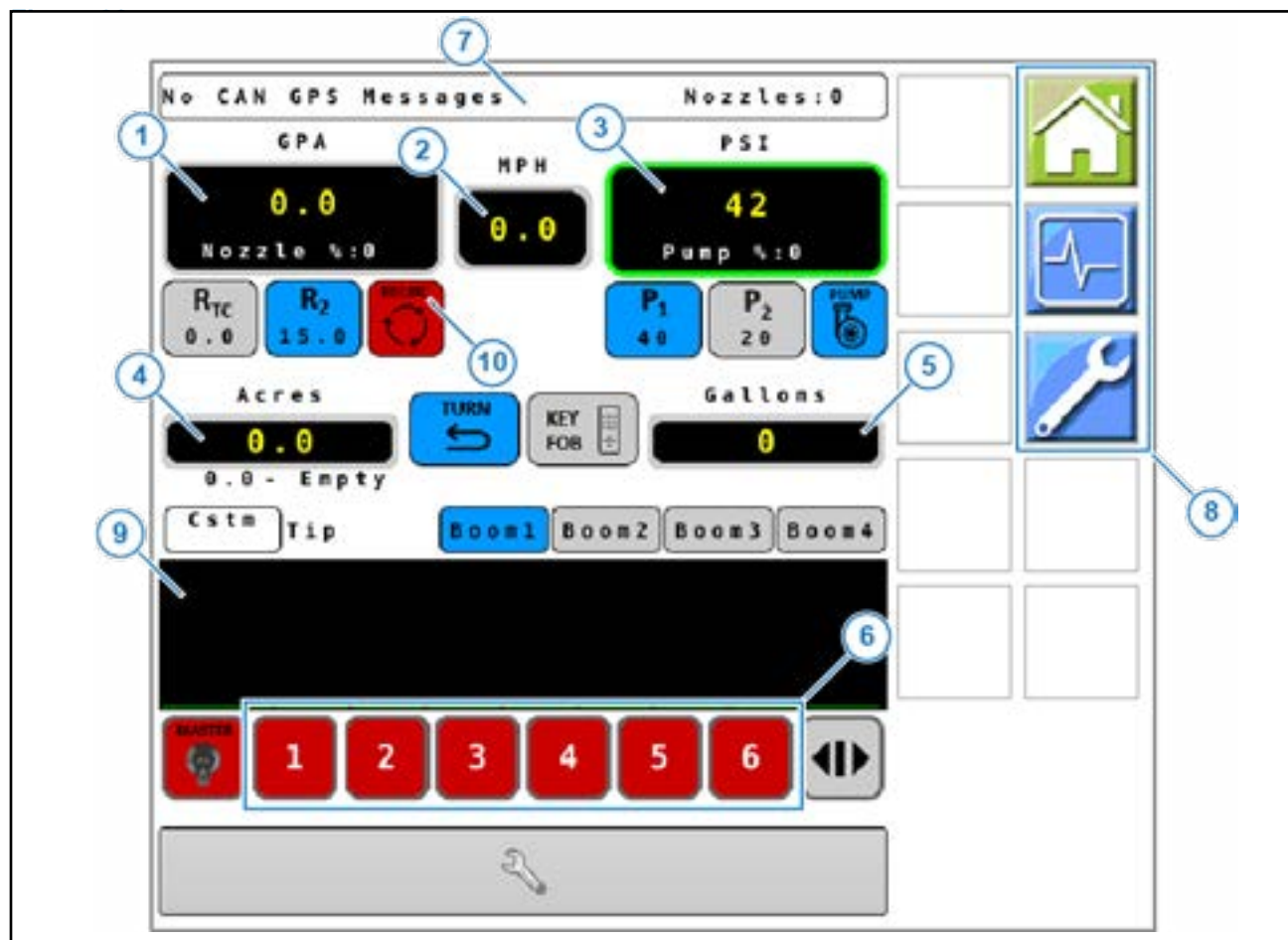


Figure 39: Main System Screen

Table 5: Main System Screen Identification

Refer to [Figure 39](#)

Item	Name	Description	Action
1	Rate	Actual application rate is displayed	Select for additional rate information
2	Speed	Actual speed is displayed	Select to change to test speed
3	Pressure	Actual pressure is displayed	Select for additional pressure information
4	Area	Counter for area covered	Select to see additional area counters
5	Volume	Counter for volume of fluid sprayed	Select to see additional volume counters
6	Profiles	Individual profile Soft Keys	Select one of the customizable profiles
7	Message Area	Displays system status, fault codes, and number of nozzles currently on	Shows any system fault messages in this area. For more information refer to Troubleshooting Charts .

Item	Name	Description	Action
8	Softkeys	Alternate menu soft keys	Select to navigate to other screens. For more information, refer to Softkey Descriptions .
9	Section Duty Cycle	Shows average duty cycle of nozzles on in each section	Rises and falls with each section's respective duty cycle. Sections will change color depending on condition: Green - Normal Condition; Yellow - Required rate exceeds capabilities; Red - Fault Condition
10	Boom Recirculation	Boom Recirculation Soft Key	Controls/displays status of boom recirculation

Softkey Descriptions

Icon		Description
		Select this softkey icon to open the Settings screen. The background of the icon is green when you are on the Settings screen.
		Select this softkey icon to navigate to the main Home screen The background of the icon is green when you are on the Home screen.
		Select this softkey icon to navigate to the Diagnostics screen. The background of the icon is green when you are on the Diagnostics screen.

Operate the System

1. Set up the VT display to operate.
Refer to the VT manual for more information.
2. Once the VT display is set up and the CapstanAG system is shown on the display, select the desired profile from the bottom of the screen.
3. Start operation.

Settings Menu Information

Boom/Nozzle Settings Menu Descriptions

Table 6: Nozzle Bounds

Line	Line Title	
	Description	
1	PWM Minimum %	
	This is the minimum pulse duty cycle for the nozzle valves. This value must not be lower than the Nozzle Pulse Frequency.	
2	PWM Maximum %	
	This is the limit of the maximum nozzle duty cycle.	
3	Nozzle Pulse Frequency	
	CapstanAG systems run at 10 pulses per second pulse frequency. CapstanAG does not recommend pulse frequencies slower than 10Hz in sprayer applications.	
4	Low Press Shutoff	
	When enabled, this setting causes the solenoid valves to shut off, like diaphragm drip checks at this value. When the low pressure shutoff value is 8 PSI, a message will show when the pressure goes below 8 PSI. At this point, nozzle valves will close. Nozzle valves will open, and the message will clear when the pressure increases to at least 12 PSI.	
5	Valve Type	
	Solenoid valve type that the system uses for flow detection.	
	7W	7-watt Coil
	12W	12-watt Coil
6	Valve Diagnostics	
	If the system is not using nozzles that use the CapstanAG nozzle diagnostics properly, the nozzle diagnostics can be disabled here. CapstanAG uses this feature on demonstration units and development units where lights are substituted for valves or reset to Coil Only. Coil Only disables the plunger movement detection without disabling short or open data.	
7	Zero Speed Spray	
	This feature allows the system to apply product when the machine is not moving. Select On to allow the system to spray when the machine is not moving. Select Off to make sure that the system will not spray when the machine is stopped.	
8	Zero Speed Handoff	
	This feature is to be used in conjunction with Zero Speed Spray. The speed entered here will allow the system to spray at a corresponding duty cycle to apply until the speed entered is exceeded.	
9	Tree Sense	
	This feature is only to be used in Orchard applications. Enabling this feature will add a button to the Home screen to change the section switch input source to On Screen instead of external sensor inputs.	

Table 7: Nozzle Setup

Nozzle Setup	
This screen is used to change nozzle information and to set the profile icons. For more information, refer to Change the Boom and Nozzle Settings .	

Table 8: Recirculation

Line	Line Title	
	Description	
1	Recirculation	
	If the system has a recirculation system select the desired operation mode and an icon will show on the run screen. Disable this feature if there is not a recirculation system on the machine. The pump must be enabled prior to enabling recirculation from the Home screen.	
	Manual	In Manual mode, select the recirculation icon to turn the system on and off.
	Auto	In Auto mode, select the recirculation icon to start the system the first time. After the initial start, the machine will operate the recirculation system when all of the nozzles are off.
2	Auto Delay 30s	In Auto Delay 30s, select the recirculation icon to start the system the first time. After the initial start, the machine will operate the recirculation system as needed and will wait 30 seconds after you stopped spraying to turn the system back on. This is the recommended operation mode if your machine has a recirculation system.
	Recirculation Valve	
3	Select the default state of the recirculation valve	
3	Cycle Boom Valves	
	Enable this feature if the system has boom section valves and a recirculation system. For all other systems, this feature is set to Disable.	
	Sequentially	Cycles Boom section valves one at a time down the boom.
	Simultaneously	Cycles boom section valves all at once.
4	Flush Quantity	
	For machines equipped with boom recirculation, a value can be entered here that will flush the boom with the specified volume. The boom flush sequence will begin once recirculation is turned on from the home screen. This flush quantity can be observed from the Gallons pop-up next to Recirculation. Note: once the recirculation volume reaches the quantity entered, recirculation will shut off automatically. If no volume is entered, the recirculation will count up indefinitely or until reset)	

Pressure Settings Menu Descriptions

Table 9: Pump Setup

Line	Line Title	
	Description	
1	Servo Type	
	Select the correct servo type for your machine.	
2	Servo Minimum	
	The servo minimum value is the minimum duty cycle that the pump will be driven. It is important that this value corresponds with the minimum duty cycle used by the rate controller.	

Line	Line Title	
	Description	
3	Servo Maximum	
	The servo maximum value is the maximum duty cycle that the pump will be driven. It is important that this value corresponds with the maximum duty cycle used by the rate controller.	
4	Servo Man Speed	
	The servo manual speed controls how fast the pressure changes in manual mode. If the valve operates too slowly in manual mode, increase this value. If the valve operates too quickly in manual mode, decrease this value.	
5	Pump Seal Shutdown	
	When the sensor falls below the pump seal shutdown value, the pump shuts off to prevent the pump from operating dry and causing pump seal failure.	
6	Pump Pulses/Rev	
	On sprayers that are equipped with a pump speed sensor, use this feature to limit the maximum pump speed to the selected pump pulses per revolution (RPM).	
7	Pump Max. Speed	
	The pump maximum speed is used on sprayers that are equipped with a pump speed sensor. When the pump speed limit is enabled, it will limit the maximum pump speed to the selected RPM.	
8	Rx Method	
	Minimum	The target pressure corresponds to the minimum prescription pressure for the boom.
	Maximum	The target pressure corresponds to the maximum prescription pressure for the boom.
	Average	This is the default setting. The target pressure corresponds to the average prescription pressure of the boom.
9	Min Pressure	
	If a minimum pressure is set, the system will not go below this value.	
10	Max Pressure	
	If a maximum pressure is set, the system will not exceed this value.	
11	Max Flow	
	If a maximum flow is set, the system will not exceed this flow.	
12	Pump Start-up Status	
	Set to Off: pump will always be off when the machine is started and must be started from the VT display. Set to Last: pump will begin in the same mode as it was when the machine was turned off.	
13	Conventional Standby	
	When Fluid Control Mode is set to Conventional, the system will reduce pump pressure at or below this set point when the master switch is turned off. This is done to minimize machine plumbing failures caused by high pressure spikes when the master switch is disabled.	
14	Fill Station PWM	
	Sets fill station pump PWM percentage when pump control is taken at the remote fill station	

Table 10: Sensor Setup

Line	Line Title
	Description
1	Sensor 1 Minimum
	The minimum voltage for sensor 1
2	Sensor 1 Maximum
	The maximum voltage for sensor 1
3	Sensor 1 Minimum
	The minimum pressure for sensor 1
4	Sensor 1 Maximum
	The maximum pressure for sensor 1
5	Sensor 1 Offset
	It is common to have 1 to 5 VDC sensors and 0.5 to 5 VDC sensors. The sensor offset is used when the sensor does not match a gauge. Entering an offset value will scale the sensor up or down. The sensor offset allowable range is $\pm 1-9$.
6	Sensor 2 Minimum
	The minimum voltage for sensor 2
7	Sensor 2 Maximum
	The maximum voltage for sensor 2
8	Sensor 2 Minimum
	The minimum pressure for sensor 2
9	Sensor 2 Maximum
	The maximum pressure for sensor 2
10	Sensor 2 Offset
	It is common to have 1 to 5 VDC sensors and 0.5 to 5 VDC sensors. The sensor offset is used when the sensor does not match a gauge. Entering an offset value will scale the sensor up or down. The sensor offset allowable range is $\pm 1-9$.

Table 11: Control Tuning (Pressure)

Line	Line Title
	Description
1	System Gain
	The system gain or Gain K scales all of the pressure gain values together. Most of the gain adjustments should be made to system gain. The higher the number, the more sensitive the control system.
2	Gain P
	The Gain P or proportional gain causes the control system to respond faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish, system use a higher number.

Line	Line Title
	Description
3	Gain I
	The Gain I or integral gain causes the control system to accelerate faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Integral gain is generally set at 1/10th of the proportional gain.
4	Gain D
	The Gain D or differential gain causes the control system to accumulate errors faster when errors are small. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Differential gain is rarely used and is generally set at 1/10th of the integral gain or zero.
5	Deadband
	The deadband pressure is used to tune out instability by providing a pressure zone that is considered satisfactory, thus requiring no action by the control system. The higher the number, the less sensitive the control system. To stabilize an oscillating system, use a higher number. To speed up a sluggish system, use a lower number. Range 0 to 100.
6	Run/Hold Delay
	Run/Hold Delay stops control when there is no flow. It will restart control once nozzles are on and the set delay time has elapsed.
7	Rate Sync
	Rate Sync changes the nozzle duty cycle based on the vehicle speed obtained from the GPS receiver.

Flow Settings Menu Descriptions

Table 12: Flowmeter

Line	Line Title
	Description
1	Flowmeter Setup
	Flowmeter Setup menu
2	Control Tuning
	Control Tuning menu
3	Rate Alarm Set point
	Enter a value to enable an audiovisual alarm to be triggered if the actual rate deviates from the specified rate by the set percentage.
4	Unexpected Flow Deadband
	The Unexpected Flow feature is used to monitor the machine's primary flowmeter when the master switch is off to indicate a recirculation valve malfunction. In some cases, the flowmeter will still read flow due to machine vibration or other factors. The Unexpected Flow Deadband is used to eliminate false alarms within 0–10 Hz. To decide where to set this deadband, observe the flowmeter frequency on the diagnostics page when the boom is off. Setting to 0 Hz disables the feature.

Table 13: Flowmeter Setup

Line	Line Title	
	Description	
1	Meter 1 Type	
	Type of flowmeter used on your machine.	
	Transparent	The flow signal from the flowmeter will be used without any adjustment at flows above the “set flowmeter” minimum.
	Correction	(Default setting) At flows above the minimum, the signal from the flowmeter is used, but adjusted with calculations for turn compensation and individual nozzle shutoff. At flows below the “set flowmeter” minimum, the value is calculated.
	Calculation	All flow is calculated, the flowmeter is not used.
2	Meter 1 Minimum	
	The flowmeter minimum value is the minimum flow at which the flowmeter is accurate.	
3	Meter 1 Calibration	
	The calibration value must match the tag on the flowmeter or a catch test.	
4	Meter 1 Error Limit	
	The flowmeter error limit ranges from Disabled to 50%. Flow % higher than the chosen % will cause a fault message and an alarm.	
5	Specific Gravity 1	
	Specific gravity refers to the density or weight per gallon as compared to water (Water = 8.35 lb./gal.). For water-based products, use 1.00. For liquid fertilizer, use 1.2 for 10 lb/gal product, etc. Specific gravity is used to calculate flow.	
6	Meter 2 Type	
	Type of fill or second flowmeter used on your machine.	
	Transparent	The flow signal from the flowmeter will be used without any adjustment at flows above the “set flowmeter” minimum.
	Correction	At flows above the minimum, the signal from the flowmeter is used, but adjusted with calculations for turn compensation and individual nozzle shutoff. At flows below the “set flowmeter” minimum, the value is calculated.
	Calculation	All flow is calculated, the flowmeter is not used.
	Flow Signal Out	Flow signal out is used to send a signal to an external rate controller.
7	Meter 2 Minimum	
	The flowmeter minimum value is the minimum flow at which the flowmeter is accurate.	
8	Meter 2 Calibration	
	The calibration value must match the tag on the flowmeter or a catch test.	
9	Meter 2 Error Limit	
	The flowmeter error limit ranges from Disabled to 50%. Flow % higher than the chosen % will cause a fault message and an alarm.	

Line	Line Title	
	Description	
10	Specific Gravity 2	
	Specific gravity refers to the density or weight per gallon as compared to water (Water = 8.35 lb./gal.). For water-based products, use 1.00. For liquid fertilizer, use 1.2 for 10 lb/gal product, etc. Specific gravity is used to calculate flow.	
11	JD-R Low Flow Mode	
	Only applicable to John Deere R Series sprayers in SharpShooter™ mode. Flow and pressure control are modified due to the low flow control.	
12	Preset Rate Average	
	Absolute	The target rate will be adjusted up or down to adjust for increased or decreased flows at individual nozzles.
	Average	The target rate will remain the same regardless of increased or decreased flows at individual nozzles. Flow added to nozzles will be taken from the rest of the boom.
13	Flowmeter Sense Resistor	
	In most cases, set to Pull Up; however, some flowmeter manufacturers require this setting to be Pull Down.	
14	Tank Sensor Calibration	
	Only used by specific European sprayers.	

Table 14: Control Tuning (Flow)

Line	Line Title	
	Description	
1	System Gain	
	The system gain or Gain K scales all of the pressure gain values together. Most of the gain adjustments should be made to system gain. The higher the number, the more sensitive the control system.	
2	Gain P	
	The Gain P or proportional gain causes the control system to respond faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system use a higher number.	
3	Gain I	
	The Gain I or integral gain causes the control system to accelerate faster when the errors are greater. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Integral gain is generally set at 1/10th of the proportional gain.	
4	Gain D	
	The Gain D or differential gain causes the control system to accumulate errors faster when errors are small. The higher the number, the more sensitive the control system. To stabilize an oscillating system, use a lower number. To speed up a sluggish system, use a higher number. Differential gain is rarely used and is generally set at 1/10th of the integral gain or zero.	

Line	Line Title
	Description
5	Deadband
	The deadband flow is used to tune out instability by providing a flow zone that is considered satisfactory, thus requiring no action by the control system. The higher the number, the less sensitive the control system. To stabilize an oscillating system, use a higher number. To speed up a sluggish system, use a lower number. Range 0 to 100.
6	Nozzle PWM Cycle Time
	The nozzle PWM cycle time value only affects in-line or bypass valve servo types. The nozzle PWM cycle time (4.0 seconds) is the time it takes for the pulsing nozzles to modulate from minimum to maximum duty cycle. To speed up a sluggish system reaction time, enter a lower number. To slow down the reaction time of an oscillating system, enter a higher number.

Navigation Settings Menu Descriptions

Table 15: Vehicle

Line	Line Title
	Description
1	Machine Steering
	The type of steering of your machine
2	Boom Type
	Type of boom on your machine
3	Hinge Point Ahead of R. Axle
	Measure and record the distance from the hinge point to the rear axle. A positive number indicates that the boom is ahead of the rear axle. A negative number indicates the hinge point is behind the rear axle. Only used for articulated machines.
4	Drawbar Pt. Ahead of R. Axle
	Measure and record the distance from the hitch pin on the drawbar to the rear axle. A positive number indicates that the boom is ahead of the rear axle. A negative number indicates the drawbar is behind the rear axle. Only used for trailers.

Table 16: Implement

Line	Line Title
	Description
1	Boom Ahead Rear Axle
	Measure and record the distance the boom is from the rear axle. A positive number indicates that the boom is ahead of the rear axle. A negative number indicates that the boom is behind the rear axle.
2	Trail Axle Ahead R. Axle
	Measure and record the distance the trailer axle is from the trailer rear axle. A negative number indicates that the trail axle is behind the rear axle. Only used for trailers.
3	Trail Hitch Ahead R. Axle
	Measure and record the distance of the trailer hitch on the rear of the first trailer from the rear axle of the trailer. A negative number indicates that the trail hitch is behind the rear axle. Only used for double trailers.

Line	Line Title
	Description
4	Trail 2 Axle Ahead R. Axle
	Measure and record the distance the trail 2 axle is from the rear axle of the tractor. A negative number indicates that the trail 2 axle is behind the rear axle. Only used for double trailers.
5	Sensor to Boom
	Only to be used in Orchard applications. Measure the distance from tree detection sensors to spray nozzles. This feature enables a delay from when a sensor triggers a section and the nozzles in that section spray.

Table 17: ISO Look Ahead

Line	Line Title
	Description
1	ON Look Ahead Time
	The time prior to entering a not applied area that a nozzle will turn on.
2	OFF Look Ahead Time
	The time prior to entering an applied area that a nozzle will turn off.
3	Sensor On Overlap
	Used to adjust the turn on distance after sensor detection. To turn on earlier, enter a negative number. To turn on later, enter a positive number.
4	Sensor Off Overlap
	Used to adjust the turn off distance after sensor detection cutoff. To turn off earlier, enter a negative number. To turn off later, enter a positive number.

Table 19: GPS

Line	Line Title
	Description
1	GPS Ahead Read Axle
	Measure and record the distance from the GPS to the rear axle.
2	GPS Right of Center
	Measure and record the distance from the GPS to the center of the machine.
3	GPS Height from Ground
	Measure and record the distance from GPS to the ground.
4	GPS Used
	The type of GPS the machine and system are using.

Table 18: Compass

Line	Line Title
	Description
1	Compass Enable
	Must have GPS signal to calibrate the compass.

Line	Line Title
	Description
2	Compass Calibration
	Follow the on screen instructions for calibration.
3	Compass Heading
	The compass heading should approximately line up with the direction that the machine is facing
4	Compass Offset
	This value is used after calibrating the 3-dimensional compass to correlate the chassis with the hub.

Table 20: Gyro

Line	Line Title
	Description
1	Gyro
	The gyro is used to aid turn compensation. It can be disabled if it is malfunctioning.
2	Contour
	Turn compensation has a deadband to prevent slight turns from affecting application. Enable contour if you are spraying contours and would like to disable the deadband.
3	Initialize Accelerometer
	Recalibrates the hub's internal accelerometer in its current position.

Initial Setup Settings Descriptions

Table 21: Configuration

Line	Line Title
	Description
1	Task Controller Mode
	Select the rate control mode for your system:
	External Rate Rate and sections are controlled by an external rate controller.
	Internal Rate The PinPoint III™ system controls rate, sections are externally controlled.
2	ISO The task controller supplies the target rate and section control up to individual nozzle control. The PinPoint III system controls the rate.
	Fluid Control Mode
	Select the fluid control mode for your system:
	Synchro External Rate mode: the rate controller controls the nozzles and the PinPoint III™ system controls the pump to a target pressure. Internal Rate or ISO mode: the PinPoint III system controls the nozzles and the pump.
	No Pulse Mode The PinPoint III valves are used for on/off functions. Rate is controlled by pressure.
	Conventional Used without VCMs or pulsing valves. PinPoint III serves as the rate controller. The rate is controlled by pressure.

Line	Line Title	
	Description	
3	Product Mode	
	Single	One product is applied.
	Boost	One product is applied with two valves at each location.
	Dual	Two products are applied.
4	Master Switch Source	
	ISO/None	There is no master switch connected to the CapstanAG system. The master switch input is taken from the CAN.
	External	The master switch is wired to the hub.
	On-Screen	The master switch is shown on the VT display.
5	Boom Switch Source	
	ISO/None	There is no boom switch connected to the system. Use this setting for CAN boom switches.
	External	The boom switches are wired to the PinPoint III hub.
	On Screen	The boom sections are controlled by the on screen boom switches.
	Capstan Subnet	The boom sections are controlled by an external Capstan Boom Signal Transmitter.
6	Master Switch Input	
	This setting allows for different polarity switches.	
7	VT Update Rate	
	VT Update rate can be lowered for a virtual terminal (VT) that cannot handle enough data.	
8	Display Smoothing	
	Actual rate and pressure are shown as on target if within 10%.	
9	Nozzle Spacing	
	The default nozzle spacing is provided by the VCMs. This setting overrides any default set elsewhere.	
10	Total Number of Nozzles	
	Displays the current number of nozzles detected by the PinPoint III.	
11	Maximum TC Sections	
	This setting limits the maximum number of Task Controller (TC) sections. The actual number of sections is automatically configured by the task controller and the system. This number will typically match the total number of nozzles on the machine.	
12	Manufacturer	
	Enables manufacturer specific settings and layouts.	
13	Selected VT	
	If multiple virtual terminals (VT) are present, select the desired VT.	
14	Selected TC	
	If multiple task controllers (TC) are present, select the desired TC.	

Line	Line Title	
	Description	
15	Aux Boom Configuration	
	Some machines have pre-configured auxiliary booms. If a configuration matches your machine, select it here.	
16	Software Restart	
	Restarts the PinPoint™ system.	
17	Machine Configuration	
	Configurations can be saved and retrieved.	
18	Fill Station	
	Only to be used with specific sprayer models.	
19	Language	
	Sets language of the PinPoint III VT. English is currently the only supported language.	
20	Units (Pressure)	
	Toggles the default pressure units in the PinPoint III VT	
21	Turf Rate	
	The rate and coverage area are calculated based on Gallons per 1000 square feet.	
22	Flow Mode	
	This feature is only used on toolbars, planters, and air seeders for flow detection at each row.	
	Tattler	To be used with Tattler Sense modules and valve bodies.
	Flow Check	To be used with Row Splitter Manifolds and Flow Check modules.
23	Spot Spray	
	This feature is used only on machines equipped with a Camera Spot-Spray system.	
24	Rate Mode	
	Enables Half Rate or Rate and a Half Mode. Used in conjunction with Tattler Mode. This feature reduces/increases overall TC width depending upon requirement.	
25	Fill Station 1	
	Used with Capstan Fill Station monitor primary fill station display.	
26	Fill Station 2	
	Used with Capstan Fill Station monitor secondary fill station display.	
27	Bluetooth ID	
	Changes the broadcast name of the PinPoint III Hub to the CapstanAG App.	
28	Factory Reset	
	Resets the hub back to factory defaults. NOTE: Format SD Card option is recommended when updating software.	

Table 22: VCM Setup

VCM Setup
Use this screen to edit VCM order/orientation. For more information, refer to VCM (Geometry) Setup Procedure

US Measurement Nozzle Speed Ranges

Nozzle Spacing—15 in

Tip Size	Gauge (PSI)	3 GPA				5 GPA				8 GPA				10 GPA				12 GPA				15 GPA				20 GPA			
		Min	-	Max		Min	-	Max		Min	-	Max		Min	-	Max		Min	-	Max		Min	-	Max		Min	-	Max	
0.1 GPM #1	20	2	5	7	9	1	3	4	6	1	2	3	3	1	1	2	3	1	1	2	2	0	1	1	2	0	1	1	1
	30	3	6	9	11	2	3	5	7	1	2	3	4	1	2	3	3	1	1	2	3	1	1	2	2	0	1	1	2
	40	3	7	10	13	2	4	6	8	1	2	4	5	1	2	3	4	1	2	2	3	1	1	2	3	0	1	1	2
	50	4	7	11	15	2	4	7	9	1	3	4	6	1	2	3	4	1	2	3	4	1	1	2	3	1	1	2	2
	60	4	8	12	16	2	5	7	10	2	3	5	6	1	2	4	5	1	2	3	4	1	2	2	3	1	1	2	2
0.15 GPM #1.5	20	4	9	13	17	3	5	8	10	2	3	5	7	1	3	4	5	1	2	3	4	1	2	3	3	1	1	2	3
	30	3	6	9	11	2	3	5	7	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	3	1	1	2	3
	40	5	10	15	20	3	6	9	12	2	4	6	7	1	3	4	6	1	2	4	5	1	2	3	4	1	1	2	3
	50	6	11	17	22	3	7	10	13	2	4	6	8	2	3	5	7	1	3	4	6	1	2	3	4	1	2	2	3
	60	6	12	18	24	4	7	11	14	2	5	7	9	2	4	5	7	2	3	5	6	1	2	4	5	1	2	3	4
0.2 GPM #2	20	5	9	14	19	3	6	8	11	2	3	5	7	1	3	4	6	1	2	3	5	1	2	3	4	1	1	2	3
	30	6	11	17	23	3	7	10	14	2	4	6	9	2	3	5	7	1	3	4	6	1	2	3	5	1	2	3	3
	40	7	13	20	26	4	8	12	16	2	5	7	10	2	4	6	8	2	3	5	7	1	3	4	5	1	2	3	4
	50	7	15	22	29	4	9	13	18	3	5	8	11	2	4	7	9	2	4	5	7	1	3	4	6	1	2	3	4
	60					5	10	14	19	3	6	9	12	2	5	7	10	2	4	6	8	2	3	5	6	1	2	4	5
0.25 GPM #2.5	20					5	10	16	21	3	6	10	13	3	5	8	10	2	4	6	9	2	3	5	7	1	3	4	5
	30	6	12	17	23	3	7	10	14	2	4	6	9	2	3	5	7	1	3	4	6	1	2	3	5	1	2	3	3
	40	7	14	21	28	4	8	13	17	3	5	8	11	2	4	6	8	2	4	5	7	1	3	4	6	1	2	3	4
	50					5	10	15	20	3	6	9	12	2	5	7	10	2	4	6	8	2	3	5	7	1	2	4	5
	60					5	11	16	22	3	7	10	14	3	5	8	11	2	5	7	9	2	4	5	7	1	3	4	5
0.3 GPM #3	20					6	12	18	24	4	7	11	15	3	6	9	12	2	5	7	10	2	4	6	8	1	3	4	6
	30					6	13	19	26	4	8	12	16	3	6	10	13	3	5	8	11	2	4	6	9	1	3	4	6
	40																												
	50																												
	60																												
0.4 GPM #4	20																												
	30																												
	40																												
	50																												
	60																												
0.5 GPM #5	20																												
	30																												
	40																												
	50																												
	60																												

Figure 40: Speed Range (MPH) - 15" Nozzle Spacing

Tip Size	Gauge (PSI)	3 GPA				5 GPA				8 GPA				10 GPA				12 GPA				15 GPA				20 GPA			
		Min	-	Max		Min	-	Max		Min	-	Max		Min	-	Max		Min	-	Max		Min	-	Max		Min	-	Max	
		25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
0.4 GPM #6	20									5	10	15	20	4	8	12	16	3	7	10	13	3	5	8	10	2	4	6	8
	30									6	12	18	24	5	10	14	19	4	8	12	16	3	6	10	13	2	5	7	10
	40									7	14	21	28	6	11	17	22	5	9	14	18	4	7	11	15	3	6	8	11
	50													6	12	19	25	5	10	15	21	4	8	12	17	3	6	9	12
	60													7	14	20	27	6	11	17	23	5	9	14	18	3	7	10	14
	70													7	15	22	29	6	12	18	24	5	10	15	20	4	7	11	15
0.8 GPM #8	20									6	12	19	25	5	10	15	20	4	8	12	17	3	7	10	13	2	5	7	10
	30									8	15	23	30	6	12	18	24	5	10	15	20	4	8	12	16	3	6	9	12
	40													7	14	21	28	6	12	18	23	5	9	14	19	4	7	11	14
	50																	7	13	20	26	5	10	16	21	4	8	12	16
	60																	7	14	22	29	6	11	17	23	4	9	13	17
	70																					6	12	19	25	5	9	14	19
1.0 GPM #10	20									7	15	22	29	6	12	18	24	5	10	15	20	4	8	12	16	3	6	9	12
	30													7	14	22	29	6	12	18	24	5	10	14	19	4	7	11	14
	40																	7	14	21	28	6	11	17	22	4	8	12	17
	50																					6	12	19	25	5	9	14	19
	60																					7	14	20	27	5	10	15	20
	70																					7	15	22	29	6	11	17	22
1.2 GPM #12	20																	6	11	17	22	4	9	13	18	3	7	10	13
	30																	7	14	20	27	5	11	16	22	4	8	12	16
	40																					6	13	19	25	5	9	14	19
	50																					7	14	21	28	5	11	16	21
	60																									6	12	17	23
	70																									6	12	19	25
1.25 GPM #12.5	20																												
	30																	7	14	21	28	6	11	17	22	4	8	13	17
	40																					6	13	19	26	5	10	14	19
	50																					7	14	22	29	5	11	16	22
	60																									6	12	18	24
	70																									6	13	19	25
1.5 GPM #15	20																												
	30																									6	12	18	25
	40																									7	14	21	28
	50																												
	60																												
	70																												

Figure 41: Speed Range (MPH) - 15" Nozzle Spacing (cont'd)

Nozzle Spacing - 20 in

Tip Size	Gauge (PSI)	3 GPA				5 GPA				8 GPA				10 GPA				12 GPA				15 GPA				20 GPA			
		Min - Max				Min - Max				Min - Max				Min - Max				Min - Max				Min - Max				Min - Max			
		25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
0.1 GPM #1	20	2	3	5	7	1	2	3	4	1	1	2	3	1	1	2	2	0	1	1	2	0	1	1	1	0	1	1	1
	30	2	4	6	9	1	3	4	5	1	2	2	3	1	1	2	3	1	1	2	2	0	1	1	2	0	1	1	1
	40	2	5	7	10	1	3	4	6	1	2	3	4	1	1	2	3	1	1	2	2	0	1	1	2	0	1	1	1
	50	3	6	8	11	2	3	5	7	1	2	3	4	1	2	2	3	1	1	2	3	1	1	2	2	0	1	1	2
	60	3	6	9	12	2	4	5	7	1	2	3	5	1	2	3	4	1	2	2	3	1	1	2	2	0	1	1	2
	70	3	7	10	13	2	4	6	8	1	2	4	5	1	2	3	4	1	2	2	3	1	1	2	3	0	1	1	2
0.15 GPM #1.5	20	3	5	8	10	2	3	5	6	1	2	3	4	1	2	2	3	1	1	2	3	1	1	2	2	0	1	1	2
	30	3	6	10	13	2	4	6	8	1	2	4	5	1	2	3	4	1	2	2	3	1	1	2	3	0	1	1	2
	40	4	7	11	15	2	4	7	9	1	3	4	6	1	2	3	4	1	2	3	4	1	1	2	3	1	1	2	2
	50	4	8	12	17	2	5	7	10	2	3	5	6	1	2	4	5	1	2	3	4	1	2	2	3	1	1	2	2
	60	5	9	14	18	3	5	8	11	2	3	5	7	1	3	4	5	1	2	3	5	1	2	3	4	1	1	2	3
	70	5	10	15	20	3	6	9	12	2	4	5	7	1	3	4	6	1	2	4	5	1	2	3	4	1	1	2	3
0.2 GPM #2	20	3	7	10	14	2	4	6	8	1	3	4	5	1	2	3	4	1	2	3	3	1	1	2	3	1	1	2	2
	30	4	9	13	17	3	5	8	10	2	3	5	6	1	3	4	5	1	2	3	4	1	2	3	3	1	1	2	3
	40	5	10	15	20	3	6	9	12	2	4	6	7	1	3	4	6	1	2	4	5	1	2	3	4	1	1	2	3
	50	5	11	16	22	3	7	10	13	2	4	6	8	2	3	5	7	1	3	4	5	1	2	3	4	1	2	2	3
	60	6	12	18	24	4	7	11	14	2	5	7	9	2	4	5	7	2	3	5	6	1	2	4	5	1	2	3	4
	70	6	13	19	26	4	8	12	16	2	5	7	10	2	4	6	8	2	3	5	6	1	3	4	5	1	2	3	4
0.25 GPM #2.5	20	4	9	13	17	3	5	8	10	2	3	5	6	1	3	4	5	1	2	3	4	1	2	3	3	1	1	2	3
	30	5	11	16	21	3	6	10	13	2	4	6	8	2	3	5	6	1	3	4	5	1	2	3	4	1	2	2	3
	40	6	12	18	24	4	7	11	15	2	5	7	9	2	4	5	7	2	3	5	6	1	2	4	5	1	2	3	4
	50	7	14	20	27	4	8	12	16	3	5	8	10	2	4	6	8	2	3	5	7	1	3	4	5	1	2	3	4
	60	7	15	22	30	4	9	13	18	3	6	8	11	2	4	7	9	2	4	6	7	1	3	4	6	1	2	3	4
	70					5	10	15	19	3	6	9	12	2	5	7	10	2	4	6	8	2	3	5	6	1	2	4	5
0.3 GPM #3	20	5	10	15	21	3	6	9	12	2	4	6	8	2	3	5	6	1	3	4	5	1	2	3	4	1	2	2	3
	30	6	13	19	25	4	8	11	15	2	5	7	9	2	4	6	8	2	3	5	6	1	3	4	5	1	2	3	4
	40	7	15	22	29	4	9	13	17	3	5	8	11	2	4	7	9	2	4	5	7	1	3	4	6	1	2	3	4
	50					5	10	15	20	3	6	9	12	2	5	7	10	2	4	6	8	2	3	5	7	1	2	4	5
	60					5	11	16	21	3	7	10	13	3	5	8	11	2	4	7	9	2	4	5	7	1	3	4	5
	70					6	12	17	23	4	7	11	14	3	6	9	12	2	5	7	10	2	4	6	8	1	3	4	6
0.4 GPM #4	20	7	14	20	27	4	8	12	16	3	5	8	10	2	4	6	8	2	3	5	7	1	3	4	5	1	2	3	4
	30					5	10	15	20	3	6	9	12	2	5	7	10	2	4	6	8	2	3	5	7	1	2	4	5
	40					6	12	17	23	4	7	11	14	3	6	9	12	2	5	7	10	2	4	6	8	1	3	4	6
	50					6	13	19	26	4	8	12	16	3	6	10	13	3	5	8	11	2	4	6	9	2	3	5	6
	60					7	14	21	28	4	9	13	18	4	7	11	14	3	6	9	12	2	5	7	9	2	4	5	7
	70					8	15	23	30	5	10	14	19	4	8	11	15	3	6	10	13	3	5	8	10	2	4	6	8
0.5 GPM #5	20					5	10	15	20	3	6	9	12	2	5	7	10	2	4	6	8	2	3	5	7	1	2	4	5
	30					6	12	18	24	4	8	11	15	3	6	9	12	3	5	8	10	2	4	6	8	2	3	5	6
	40					7	14	21	28	4	9	13	18	4	7	11	14	3	6	9	12	2	5	7	9	2	4	5	7
	50					5	10	15	20	4	8	12	16	3	7	10	13	3	7	10	13	3	5	8	11	2	4	6	8
	60					5	11	16	22	4	9	13	17	4	9	13	17	4	7	11	14	3	6	9	12	2	4	6	9
	70					6	12	18	23	5	9	14	19	5	9	14	19	4	8	12	16	3	6	9	12	2	5	7	9

Figure 42: Speed Range (MPH) - 20" Nozzle Spacing

Tip Size	Gauge (PSI)	3 GPA				5 GPA				8 GPA				10 GPA				12 GPA				15 GPA				20 GPA			
		Min - Max				Min - Max				Min - Max				Min - Max				Min - Max				Min - Max				Min - Max			
		25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
0.6 GPM #6	20					6	12	18	24	4	7	11	15	3	6	9	12	2	5	7	10	2	4	6	8	1	3	4	6
	30					7	14	22	29	4	9	13	18	4	7	11	14	3	6	9	12	2	5	7	10	2	4	5	7
	40									5	10	16	21	4	8	12	17	3	7	10	14	3	6	8	11	2	4	6	8
	50									6	12	17	23	5	9	14	19	4	8	12	15	3	6	9	12	2	5	7	9
	60									6	13	19	25	5	10	15	20	4	8	13	17	3	7	10	14	3	5	8	10
	70									7	14	21	27	5	11	16	22	5	9	14	18	4	7	11	15	3	5	8	11
0.8 GPM #8	20					7	15	22	30	5	9	14	19	4	7	11	15	3	6	9	12	2	5	7	10	2	4	6	7
	30									6	11	17	23	5	9	14	18	4	8	11	15	3	6	9	12	2	5	7	9
	40									7	13	20	26	5	11	16	21	4	9	13	18	4	7	11	14	3	5	8	11
	50									7	15	22	30	6	12	18	24	5	10	15	20	4	8	12	16	3	6	9	12
	60													6	13	19	25	5	11	16	22	4	9	13	17	3	6	10	13
	70									7	14	21	28	7	14	21	28	6	12	17	23	5	9	14	19	3	7	10	14
1.0 GPM #10	20									6	11	17	22	4	9	13	18	4	7	11	15	3	6	9	12	2	4	7	9
	30									7	14	20	27	5	11	16	22	5	9	14	18	4	7	11	14	3	5	8	11
	40													6	12	19	25	5	10	16	21	4	8	12	17	3	6	9	12
	50													7	14	21	28	6	12	17	23	5	9	14	19	3	7	10	14
	60																	6	13	19	25	5	10	15	20	4	8	11	15
	70													7	14	21	28	7	14	21	28	6	11	17	22	4	8	12	17
1.2 GPM #12	20									6	12	19	25	5	10	15	20	4	8	12	17	3	7	10	13	2	5	7	10
	30													6	12	18	24	5	10	15	20	4	8	12	16	3	6	9	12
	40													7	14	21	28	6	12	18	23	5	9	14	19	4	7	11	14
	50																	7	13	20	26	5	11	16	21	4	8	12	16
	60																	7	14	22	29	6	12	17	23	4	9	13	17
	70																					6	12	19	25	5	9	14	19
1.25 GPM #12.5	20																												
	30																												
	40									8	16	23	31	6	13	19	25	5	10	16	21	4	8	13	17	3	6	9	13
	50													7	14	22	29	6	12	18	24	5	10	14	19	4	7	11	14
	60																	7	13	20	27	5	11	16	22	4	8	12	16
	70																	7	15	22	29	6	12	18	24	4	9	13	18
1.5 GPM #15	20																												
	30																												
	40													7	14	21	28	6	12	17	23	5	9	14	18	3	7	10	14
	50																	7	13	20	27	5	11	16	21	4	8	12	16
	60																	7	15	22	30	6	12	18	24	4	9	13	18
	70																					7	13	20	26	5	10	15	20

Figure 43: Speed Range (MPH) - 20" Nozzle Spacing (cont'd)

Blended Pulse™ Droplet Classification Table—US Measurements

Extremely Fine (EF)		Very Fine (VF)		Fine (F)		Medium (M)		Coarse (C)		Very Coarse (VC)		Extremely Coarse (EC)		Ultra Coarse (UC)	
<50		50 - 136		137-177		178-218		219-349		350-428		429-622		>622	

** Diska jets represent nozzles either not available or below the manufacturers operating specifications
*** Hypro and TeeJet droplet classifications below may not match manufacturers spec sheets. The chart below adjusts the droplet classification to be representative of the Actual Nozzle Pressure

Tip Size	Gauge PSI	Nozzle PSI	Wilger				Hypro						TeeJet							
			ER (110")	SR (110")	MR (110")	DR (110")	HF (140")	GRD (120")	LD (110")	VP (110")	TR (110")	F (110")	TTJ60 (110")	XR (110")	XRC (110")	DG (110")	TJ60 (110")	DGTJ60 (110")	TT (110")	TP (110")
0.1 GPM #1	20	20	F											F					C	
	30	30	F										F	F					M	F
	40	40	VF										F	F					M	F
	50	50	VF										F	F					M	F
	60	60	VF										VF	VF					F	VF
	70	70	VF																F	
0.15 GPM #1.5	20	20	F											F					C	
	30	30	F	M	C	VC							F	F		M		F	M	F
	40	40	F	M	C	C							F	F		F		F	M	F
	50	50	VF	M	C	C							F	F		F		F	M	F
	60	59	VF	M	C	C							F	F		F		F	F	F
	70	69	VF	F	M	C												F		
0.2 GPM #2	20	20	F					M	M	F	M		C	M	F				VC	
	30	30	F	C	C	XC		M	M	F	F	F	C	F	F	M	F	M	C	F
	40	39	F	M	C	VC		M	M	F	F	F	M	F	F	M	VF	M	M	F
	50	49	F	M	C	VC		M	M	F	F	F	M	F	F	M	VF	F	M	F
	60	59	F	M	C	C		M	M	F	F	F	M	F	F	M	VF	F	M	F
	70	69	VF	M	C	C		F	M	F	F		M					F		
0.25 GPM #2.5	20	19	M					M	M	M			VC	M	M				VC	
	30	29	M	C	VC	XC		M	M	F			C	M	F				C	
	40	39	M	C	C	VC		M	M	F			C	F	F				M	
	50	49	F	M	C	VC		M	M	F			M	F	F				M	
	60	58	F	M	C	VC		M	M	F			M	F	F				M	
	70	68	F	M	C	C		F	M	F			M						F	
0.3 GPM #3	20	19	M					M	C	M	M		VC	M	M				VC	
	30	29	M	C	VC	XC		M	C	F	M	F	C	M	F	C	F	M	C	F
	40	39	F	C	VC	XC		M	M	F	F	F	C	F	F	M	F	M	C	F
	50	48	F	C	C	VC		M	M	F	F	F	M	F	F	M	F	F	M	F
	60	58	F	C	C	VC		M	M	F	F	F	M	F	F	M	F	F	M	F
	70	67	F	C	C	VC		M	M	F	F		M						M	
0.4 GPM #4	20	19	C					C	C	M	M		VC	M	M				VC	
	30	28	C	C	VC	XC		C	C	M	M	M	C	M	M	C	F	C	C	M
	40	38	M	C	VC	XC		C	M	F	F	F	C	M	M	M	F	C	C	M
	50	47	M	C	VC	XC		M	M	F	F	F	M	F	F	M	F	C	M	F
	60	56	M	C	C	VC		M	M	F	F	F	M	F	F	M	F	M	M	F
	70	66	M	C	C	VC		M	M	F	F		M						M	
0.5 GPM #5	20	18	C					C	C	M	C		VC	M	M				VC	
	30	27	C	VC	XC	XC		C	C	M	M	M	C	M	M	C	M		VC	M
	40	36	M	C	XC	XC		C	C	F	F	F	C	M	M	C	M		C	M
	50	45	M	C	XC	XC		M	M	F	F	F	C	M	M	M	F		C	F
	60	54	M	C	VC	XC		M	M	F	F	F	C	F	F	M	F		C	F
	70	63	M	C	VC	XC		M	M	F	F		M						M	

Figure 44: Droplet Classification Table ASABE S-5572.1

		Extremely Fine (EF)	Very Fine (VF)	Fine (F)	Medium (M)	Coarse (C)	Very Coarse (VC)	Extremely Coarse (EC)	Ultra Coarse (UC)
		<50	50 - 136	137-177	178-218	219-349	350-428	429-622	>622

*** Blank cells represent nozzles either not available or below the manufacturer's operating specifications

*** Hygro and TeeJet droplet classifications below may not match manufacturer's spec sheets. The chart below adjusts the droplet classification to be representative of the Actual Nozzle Pressure.

Tip Size	Gauge PSI	Nozzle PSI	Wilger				Hygro						TeeJet							
			ER (110°)	SR (110°)	MR (110°)	DR (110°)	HF (140°)	GRD (120°)	LD (110°)	VP (110°)	TR (110°)	F (110°)	TTJ60 (110°)	XR (110°)	XRC (110°)	DG (110°)	TJ60 (110°)	DGTJ60 (110°)	TT (110°)	TP (110°)
0.6 GPM #6	20	17	C					VC	VC	M	C		VC	M	C				VC	
	30	26	C	XC	XC			C	C	M	C	M	C	M	M		M	C	VC	M
	40	35	C	VC	XC	XC		C	C	M	M	M	C	M	M		M	C	VC	M
	50	43	C	VC	XC	XC		C	C	M	M	M	C	M	M		F	C	VC	M
	60	52	C	C	XC	XC		C	C	F	M	F	C	M	M		F	C	C	M
	70	61	C	C	VC	XC		C	C	F	M		M						C	
0.8 GPM #8	20	16	C					VC	VC	C	C		VC	C	C				VC	
	30	24	C	XC	XC		VC	VC	VC	C	C		VC	C	C		M	C	VC	C
	40	32	C	XC	XC	XC	UC	C	C	M	C	M	VC	M	C		M	C	VC	C
	50	39	C	VC	XC	XC	UC	C	C	M	M	M	C	M	M		M	C	C	M
	60	47	C	VC	XC	XC	UC	C	C	M	M	M	C	M	M		M	C	C	M
	70	55	C	VC	XC	XC	XC	C	C	M	M		C						C	
1.0 GPM #10	20	14	VC																	
	30	21	VC				UC			C	VC		XC	C	C		M		UC	
	40	28	C	XC	XC	UC	UC			C	C	M	XC	C	C		M		XC	
	50	35	C	XC	XC	UC	UC			M	M	M	VC	C	C		M		XC	
	60	42	C	VC	XC	UC	UC			M	M	M	VC	M	M		M		VC	
	70	49	C	VC	XC	XC	UC			M	M		VC						VC	
1.2 GPM #12	20	12																	UC	
	30	18																	UC	
	40	24																	XC	
	50	30																	VC	
	60	36																	VC	
	70	42																	VC	
1.25 GPM #12.5	20	12	XC																	
	30	18	XC																	
	40	24	VC	XC	UC															
	50	30	VC	XC	UC	UC														
	60	36	VC	XC	XC	UC														
	70	42	C	VC	XC	XC														
1.5 GPM #15	20	10	XC																	
	30	15	XC				UC			VC	VC				VC					
	40	21	XC				UC			VC	VC				VC					
	50	26	VC	XC	UC		UC			VC	VC	C			VC					
	60	31	VC	XC	XC	UC	UC			VC	VC	C			VC					
	70	36	VC	XC	XC	UC	UC			C	C									

Figure 45: Droplet Classification Table ASABE S-5572.1 (cont'd)

Nozzle Speed Ranges

Metric Nozzle Speed Ranges

Nozzle Spacing—38 cm

Tip Size	Gauge (kPa)	30 l/hr				50 l/hr				60 l/hr				70 l/hr				80 l/hr				100 l/hr				120 l/hr			
		Min - Max				Min - Max				Min - Max				Min - Max				Min - Max				Min - Max				Min - Max			
		25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
0.1 GPM #1	138	4	7	11	14	2	4	6	8	2	4	5	7	2	3	5	6	1	3	4	5	1	2	3	4	1	2	3	4
	207	4	9	13	17	3	5	8	10	2	4	6	9	2	4	6	7	2	3	5	6	1	3	4	5	1	2	3	4
	276	5	10	15	20	3	6	9	12	2	5	7	10	2	4	6	9	2	4	6	7	1	3	4	6	1	2	4	5
	345	6	11	17	22	3	7	10	13	3	6	8	11	2	5	7	10	2	4	6	8	2	3	5	7	1	3	4	6
	414	6	12	18	24	4	7	11	15	3	6	9	12	3	5	8	10	2	5	7	9	2	4	5	7	2	3	5	6
0.15 GPM #1.5	483	7	13	20	26	4	8	12	16	3	7	10	13	3	6	8	11	2	5	7	10	2	4	6	8	2	3	5	7
	138	5	11	16	21	3	6	9	13	3	5	8	11	2	5	7	9	2	4	6	8	2	3	5	6	1	3	4	5
	207	6	13	19	26	4	8	12	16	3	6	10	13	3	6	8	11	2	5	7	10	2	4	6	8	2	3	5	6
	276	7	15	22	30	4	9	13	18	4	7	11	15	3	6	10	13	3	6	8	11	2	4	7	9	2	4	6	7
	345	8	17	25	33	5	10	15	20	4	8	12	17	4	7	11	14	3	6	9	12	2	5	7	10	2	4	6	8
0.2 GPM #2	414	9	18	27	36	5	11	16	22	5	9	14	18	4	8	12	16	3	7	10	14	3	5	8	11	2	5	7	9
	483	10	20	30	39	6	12	18	24	5	10	15	20	4	8	13	17	4	7	11	15	3	6	9	12	2	5	7	10
	138	7	14	21	28	4	8	13	17	3	7	10	14	3	6	9	12	3	5	8	10	2	4	6	8	2	3	5	7
	207	9	17	26	34	5	10	15	21	4	9	13	17	4	7	11	15	3	6	10	13	3	5	8	10	2	4	6	9
	276	10	20	30	40	6	12	18	24	5	10	15	20	4	8	13	17	4	7	11	15	3	6	9	12	2	5	7	10
0.25 GPM #2.5	345	11	22	33	44	7	13	20	27	6	11	17	22	5	9	14	19	4	8	12	17	3	7	10	13	3	6	8	11
	414	12	24	36	48	7	15	22	29	6	12	18	24	5	10	16	21	5	9	14	18	4	7	11	15	3	6	9	12
	483					8	16	24	31	7	13	20	26	6	11	17	22	5	10	15	20	4	8	12	16	3	7	10	13
	138	9	17	26	35	5	10	16	21	4	9	13	17	4	7	11	15	3	7	10	13	3	5	8	10	2	4	7	9
	207	11	21	32	43	6	13	19	26	5	11	16	21	5	9	14	18	4	8	12	16	3	6	10	13	3	5	8	11
0.3 GPM #3	276					7	15	22	30	6	12	18	25	5	11	16	21	5	9	14	18	4	7	11	15	3	6	9	12
	345					8	16	25	33	7	14	21	27	6	12	18	24	5	10	15	21	4	8	12	16	3	7	10	14
	414					9	18	27	36	8	15	23	30	6	13	19	26	6	11	17	23	5	9	14	18	4	8	11	15
	483					10	20	29	39	8	16	24	33	7	14	21	28	6	12	18	24	5	10	15	20	4	8	12	16
	138	10	21	31	41	6	12	19	25	5	10	16	21	4	9	13	18	4	8	12	16	3	6	9	12	3	5	8	10
0.4 GPM #4	207					8	15	23	30	6	13	19	25	5	11	16	22	5	10	14	19	4	8	11	15	3	6	10	13
	276					9	18	26	35	7	15	22	29	6	13	19	25	6	11	17	22	4	9	13	18	4	7	11	15
	345					10	20	30	39	8	16	25	33	7	14	21	28	6	12	18	25	5	10	15	20	4	8	12	16
	414					11	22	32	43	9	18	27	36	8	15	23	31	7	13	20	27	5	11	16	22	4	9	13	18
	483					12	23	35	47	10	19	29	39	8	17	25	33	7	15	22	29	6	12	17	23	5	10	15	19
0.5 GPM #5	138					8	16	25	33	7	14	20	27	6	12	18	23	5	10	15	20	4	8	12	16	3	7	10	14
	207					10	20	30	40	8	17	25	33	7	14	21	29	6	13	19	25	5	10	15	20	4	8	13	17
	276					12	23	35	46	10	19	29	39	8	17	25	33	7	14	22	29	6	12	17	23	5	10	14	19
	345									11	22	32	43	9	18	28	37	8	16	24	32	6	13	19	26	5	11	16	22
	414									12	24	35	47	10	20	30	41	9	18	27	35	7	14	21	28	6	12	18	24
0.5 GPM #5	483													11	23	34	45	10	19	29	38	8	15	23	31	6	13	19	25
	138					10	20	30	40	8	17	25	34	7	14	22	29	6	13	19	25	5	10	15	20	4	8	13	17
	207									10	21	31	41	9	18	26	35	8	15	23	31	6	12	18	25	5	10	15	21
	276									12	24	36	47	10	20	30	41	9	18	27	36	7	14	21	28	6	12	18	24
	345													11	23	34	45	10	20	30	40	8	16	24	32	7	13	20	26
0.5 GPM #5	414													11	22	33	44	9	17	26	35	7	13	20	27	6	11	16	22
	483													12	24	35	47	10	19	28	38	8	15	23	31	7	13	20	26

Figure 46: Speed Range (KPH) 38cm Nozzle Spacing

Tip Size	Geuge (kPa)	30 l/ha				50 l/ha				60 l/ha				70 l/ha				80 l/ha				100 l/ha				120 l/ha			
		Min - Max				Min - Max				Min - Max				Min - Max				Min - Max				Min - Max				Min - Max			
		25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
0.6 GPM #6	138									10	20	30	39	8	17	25	34	7	15	22	30	6	12	18	24	5	10	15	20
	207									12	24	36	48	10	21	31	41	9	18	27	36	7	14	22	29	6	12	18	24
	276													12	24	36	48	10	21	31	42	8	17	25	33	7	14	21	28
	345																	12	23	35	47	9	19	28	37	8	16	23	31
	414																					10	20	31	41	9	17	26	34
	483																						11	22	33	44	9	18	28
0.8 GPM #8	138													11	21	32	43	9	19	28	38	8	15	23	30	6	13	19	25
	207																	11	23	34	46	9	18	28	37	8	15	23	31
	276																					11	21	32	42	9	18	27	35
	345																					12	24	36	48	10	20	30	40
	414																									11	22	33	43
	483																										12	23	35
1.0 GPM #10	138																	11	22	33	44	9	18	27	36	7	15	22	30
	207																					11	22	33	43	9	18	27	36
	276																									10	21	31	42
	345																									12	23	35	47
	414																												
	483																												
1.2 GPM #12	138																					10	20	30	40	8	17	25	33
	207																									10	20	31	41
	276																									12	24	35	47
	345																												
	414																												
	483																												
1.25 GPM #12.5	138																												
	207																												
	276																												
	345																												
	414																												
	483																												
1.5 GPM #15	138																												
	207																												
	276																												
	345																												
	414																												
	483																												

Figure 47: Speed Range (KPH) 38cm Nozzle Spacing (cont'd)

Nozzle Spacing - 50 cm

Tip Size	Gauge (kPa)	30 l/ha				50 l/ha				60 l/ha				70 l/ha				80 l/ha				100 l/ha				120 l/ha			
		Min		Max		Min		Max		Min		Max		Min		Max		Min		Max		Min		Max		Min		Max	
		25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
0.1 GPM #1	138	3	5	8	11	2	3	5	6	1	3	4	5	1	2	3	5	1	2	3	4	1	2	2	3	1	1	2	3
	207	3	7	10	13	2	4	6	8	2	3	5	7	1	3	4	6	1	2	4	5	1	2	3	4	1	2	2	3
	276	4	8	11	15	2	5	7	9	2	4	6	8	2	3	5	6	1	3	4	6	1	2	3	5	1	2	3	4
	345	4	8	13	17	3	5	8	10	2	4	6	8	2	4	5	7	2	3	5	6	1	3	4	5	1	2	3	4
	414	5	9	14	19	3	6	8	11	2	5	7	9	2	4	6	8	2	3	5	7	1	3	4	6	1	2	3	5
	483	5	10	15	20	3	6	9	12	2	5	7	10	2	4	6	9	2	4	6	7	1	3	4	6	1	2	4	5
0.15 GPM #1.5	138	4	8	12	16	2	5	7	10	2	4	6	8	2	3	5	7	1	3	4	6	1	2	4	5	1	2	3	4
	207	5	10	15	20	3	6	9	12	2	5	7	10	2	4	6	8	2	4	6	7	1	3	4	6	1	2	4	5
	276	6	11	17	23	3	7	10	14	3	6	8	11	2	5	7	10	2	4	6	8	2	3	5	7	1	3	4	6
	345	6	13	19	25	4	8	11	15	3	6	9	13	3	5	8	11	2	5	7	9	2	4	6	8	2	3	5	6
	414	7	14	21	28	4	8	12	17	3	7	10	14	3	6	9	12	3	5	8	10	2	4	6	8	2	3	5	7
	483	7	15	22	30	4	9	13	18	4	7	11	15	3	6	10	13	3	6	8	11	2	4	7	9	2	4	6	7
0.2 GPM #2	138	5	11	16	21	3	6	10	13	3	5	8	11	2	5	7	9	2	4	6	8	2	3	5	6	1	3	4	5
	207	7	13	20	26	4	8	12	16	3	7	10	13	3	6	8	11	2	5	7	10	2	4	6	8	2	3	5	7
	276	8	15	23	30	5	9	14	18	4	8	11	15	3	6	10	13	3	6	8	11	2	5	7	9	2	4	6	8
	345	8	17	25	34	5	10	15	20	4	8	13	17	4	7	11	14	3	6	9	13	3	5	8	10	2	4	6	8
	414	9	18	28	37	6	11	17	22	5	9	14	18	4	8	12	16	3	7	10	14	3	6	8	11	2	5	7	9
	483	10	20	30	40	6	12	18	24	5	10	15	20	4	9	13	17	4	7	11	15	3	6	9	12	2	5	7	10
0.25 GPM #2.5	138	7	13	20	26	4	8	12	16	3	7	10	13	3	6	8	11	2	5	7	10	2	4	6	8	2	3	5	7
	207	8	16	24	32	5	10	15	19	4	8	12	16	3	7	10	14	3	6	9	12	2	5	7	10	2	4	6	8
	276	9	19	28	37	6	11	17	22	5	9	14	19	4	8	12	16	4	7	11	14	3	6	8	11	2	5	7	9
	345	10	21	31	42	6	13	19	25	5	10	16	21	4	9	13	18	4	8	12	16	3	6	9	13	3	5	8	10
	414	11	23	34	46	7	14	21	27	6	11	17	23	5	10	15	20	4	9	13	17	3	7	10	14	3	6	9	11
	483					7	15	22	30	6	12	19	25	5	11	16	21	5	9	14	19	4	7	11	15	3	6	9	12
0.3 GPM #3	138	8	16	24	32	5	9	14	19	4	8	12	16	3	7	10	14	3	6	9	12	2	5	7	9	2	4	6	8
	207	10	19	29	39	6	12	17	23	5	10	14	19	4	8	12	17	4	7	11	14	3	6	9	12	2	5	7	10
	276	11	22	33	45	7	13	20	27	6	11	17	22	5	10	14	19	4	8	13	17	3	7	10	13	3	6	8	11
	345					7	15	22	30	6	12	19	25	5	11	16	21	5	9	14	19	4	7	11	15	3	6	9	12
	414					8	16	25	33	7	14	20	27	6	12	18	23	5	10	15	20	4	8	12	16	3	7	10	14
	483					9	18	27	35	7	15	22	29	6	13	19	25	6	11	17	22	4	9	13	18	4	7	11	15
0.4 GPM #4	138	10	21	31	41	6	12	19	25	5	10	16	21	4	9	13	18	4	8	12	16	3	6	9	12	3	5	8	10
	207					8	15	23	30	6	13	19	25	5	11	16	22	5	10	14	19	4	8	11	15	3	6	10	13
	276					9	18	26	35	7	15	22	29	6	13	19	25	5	11	16	22	4	9	13	18	4	7	11	15
	345					10	20	30	39	8	16	25	33	7	14	21	28	6	12	18	25	5	10	15	20	4	8	12	16
	414					11	22	32	43	9	18	27	36	8	15	23	31	7	13	20	27	5	11	16	22	4	9	13	18
	483					12	23	35	47	10	19	29	39	8	17	25	33	7	15	22	29	6	12	17	23	5	10	15	19
0.5 GPM #5	138					8	15	23	31	6	13	19	25	5	11	16	22	5	10	14	19	4	8	11	15	3	6	10	13
	207					9	19	28	37	8	16	23	31	7	13	20	27	6	12	18	23	5	9	14	19	4	8	12	16
	276					11	22	32	43	9	18	27	36	8	15	23	31	7	14	20	27	5	11	16	22	5	9	14	18
	345					12	24	36	48	10	20	30	40	9	17	26	35	8	15	23	30	6	12	18	24	5	10	15	20
	414									11	22	33	44	9	19	28	38	8	17	25	33	7	13	20	26	6	11	17	22
	483									12	24	35	48	10	20	31	41	9	18	27	36	7	14	21	29	6	12	18	24

Figure 48: Speed Range (KPH) 50cm Nozzle Spacing

Tip Size	Gauge (kPa)	30 l/ha				50 l/ha				60 l/ha				70 l/ha				80 l/ha				100 l/ha				120 l/ha			
		Min		Max		Min		Max		Min		Max		Min		Max		Min		Max		Min		Max		Min		Max	
		25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
0.6 GPM #4	138					9	18	27	36	7	15	22	30	6	13	19	26	6	13	17	22	4	9	13	18	4	7	11	15
	207					11	22	33	44	9	18	28	37	8	16	24	31	7	14	21	28	6	11	17	22	5	9	14	18
	276									11	21	32	42	9	18	27	36	8	16	24	32	6	13	19	25	5	11	16	21
	345									12	24	36	47	10	20	30	41	9	18	27	36	7	14	21	28	6	12	18	24
	414													11	22	33	44	10	19	29	39	8	16	23	31	6	13	19	26
	483													12	24	36	48	11	21	32	42	8	17	25	34	7	14	21	28
0.8 GPM #8	138					11	23	34	45	10	19	29	38	8	16	24	33	7	14	21	29	6	11	17	23	5	10	14	19
	207									12	23	35	47	10	20	30	40	9	17	26	35	7	14	21	28	6	12	17	23
	276													12	23	35	46	10	20	30	40	8	16	24	32	7	13	20	27
	345																	11	23	34	45	9	18	27	36	8	15	23	30
	414																					10	20	30	40	8	16	25	33
	483																					11	21	32	43	9	18	27	36
1.0 GPM #10	138									11	22	34	45	10	19	29	39	8	17	25	34	7	13	20	27	6	11	17	22
	207													12	24	35	47	10	21	31	41	8	17	25	33	7	14	21	28
	276																	12	24	36	48	10	19	29	38	8	16	24	32
	345																					11	21	32	43	9	18	27	36
	414																					12	23	35	47	10	19	29	39
	483																									11	21	32	42
1.2 GPM #12	138													11	22	33	44	10	19	29	38	8	15	23	30	6	13	19	25
	207																	12	23	35	47	9	19	28	37	8	16	23	31
	276																					11	22	32	43	9	18	27	36
	345																					12	24	36	48	10	20	30	40
	414																									11	22	33	44
	483																									12	24	36	48
1.25 GPM #12.5	138																												
	207																												
	276																												
	345																												
	414																												
	483																												
1.5 GPM #15	138																												
	207																												
	276																												
	345																												
	414																												
	483																												

Figure 49: Speed Range (KPH) 50cm Nozzle Spacing (cont'd)

Blended Pulse™ Droplet Classification Table—Metric

		Extremely Fine (EF)	Very Fine (VF)	Fine (F)	Medium (M)	Coarse (C)	Very Coarse (VC)	Extremely Coarse (EC)	Ultra Coarse (UC)
		<50	50 - 136	137-177	178-218	219-349	350-428	429-622	>622

--- Blank cells represent nozzles either not available or below the manufacturer's operating specifications
--- Hydro and TeeJet droplet classifications below may not match manufacturer's spec sheets. The chart below adjusts the droplet classification to be representative of the Actual Nozzle Pressure

Tip Size	Gauge (kPa)	Nozzle (kPa)	Wilger				Hydro						TeeJet							
			ER (110°)	SR (110°)	MR (110°)	DR (110°)	HF (140°)	GRD (120°)	LD (110°)	VP (110°)	TR (110°)	F (110°)	TT160 (110°)	XR (110°)	XRC (110°)	DG (110°)	TJ60 (110°)	DGTJ60 (110°)	TT (110°)	TP (110°)
0.1 GPM #1	138	137	F											F					C	
	207	206	F									F		F					M	F
	276	275	VF									F		F					M	F
	345	343	VF									F		F					M	F
	414	412	VF									VF		VF					F	VF
	483	481	VF																F	
0.15 GPM #1.5	138	137	F											F					C	
	207	206	F	M	C	VC						F		F		M		F	M	F
	276	273	F	M	C	C						F		F		F		F	M	F
	345	342	VF	M	C	C						F		F		F		F	M	F
	414	410	VF	M	C	C						F		F		F		F	F	F
	483	478	VF	F	M	C													F	
0.2 GPM #2	138	136	F					M	M	F	M		C	M	F				VC	
	207	203	F	C	C	XC		M	M	F	F	F	C	F	F	M	F	M	C	F
	276	271	F	M	C	VC		M	M	F	F	F	M	F	F	M	VF	M	M	F
	345	339	F	M	C	VC		M	M	F	F	F	M	F	F	M	VF	F	M	F
	414	407	F	M	C	C		M	M	F	F	F	M	F	F	M	VF	F	M	F
	483	475	VF	M	C	C		F	M	F	F		M						F	
0.25 GPM #2.5	138	134	M					M	M	M			VC	M	M				VC	
	207	202	M	C	VC	XC		M	M	F			C	M	F				C	
	276	269	M	C	C	VC		M	M	F			C	F	F				M	
	345	336	F	M	C	VC		M	M	F			M	F	F				M	
	414	403	F	M	C	VC		M	M	F			M	F	F				M	
	483	470	F	M	C	C		F	M	F			M						F	
0.3 GPM #3	138	133	M					M	C	M	M		VC	M	M				VC	
	207	199	M	C	VC	XC		M	C	F	M	F	C	M	F	C	F	M	C	F
	276	256	F	C	VC	XC		M	M	F	F	F	C	F	F	M	F	M	C	F
	345	332	F	C	C	VC		M	M	F	F	F	M	F	F	M	F	F	M	F
	414	399	F	C	C	VC		M	M	F	F	F	M	F	F	M	F	F	M	F
	483	465	F	C	C	VC		M	M	F	F		M						M	
0.4 GPM #4	138	129	C					C	C	M	M		VC	M	M				VC	
	207	194	C	C	VC	XC		C	C	M	M	M	C	M	M	C	F	C	C	M
	276	259	M	C	VC	XC		C	M	F	F	F	C	M	M	M	F	C	C	M
	345	323	M	C	VC	XC		M	M	F	F	F	M	F	F	M	F	C	M	F
	414	388	M	C	C	VC		M	M	F	F	F	M	F	F	M	F	M	M	F
	483	452	M	C	C	VC		M	M	F	F		M						M	
0.5 GPM #5	138	125	C					C	C	M	C		VC	M	M				VC	
	207	187	C	VC	XC	XC		C	C	M	M	M	C	M	M	C	M		VC	M
	276	250	M	C	XC	XC		C	C	F	F	F	C	M	M	C	M		C	M
	345	312	M	C	XC	XC		M	M	F	F	F	C	M	M	M	F		C	F
	414	375	M	C	VC	XC		M	M	F	F	F	C	F	F	M	F		C	F
	483	437	M	C	VC	XC		M	M	F	F		M						M	

Figure 50: Droplet Classification Table ASABE S-5572.1

Extremely Fine (EF)		Very Fine (VF)		Fine (F)		Medium (M)		Coarse (C)		Very Coarse (VC)		Extremely Coarse (EC)		Ultra Coarse (UC)	
<50		50 - 136		137-177		178-218		219-349		350-428		429-622		>622	

*** Blank cells represent nozzles either not available or below the manufacturer's operating specifications

*** Hypro and TeeJet droplet classifications below may not match manufacturer's spec sheets. The chart below adjusts the droplet classification to be representative of the Actual Nozzle Pressure

Tip Size	Gauge (kPa)	Nozzle (kPa)	Wilger				Hypro						TeeJet							
			ER (110")	SR (110")	MR (110")	DR (110")	HF (140")	GRD (120")	LD (110")	VP (110")	TR (110")	F (110")	TTJ60 (110")	XR (110")	XRC (110")	DG (110")	TJ60 (110")	DGTJ60 (110")	TT (110")	TP (110")
0.6 GPM #6	138	120	C					VC	VC	M	C		VC	M	C				VC	
	207	180	C	XC	XC			C	C	M	C	M	C	M	M		M	C	VC	M
	276	240	C	VC	XC	XC		C	C	M	M	M	C	M	M		M	C	VC	M
	345	300	C	VC	XC	XC		C	C	M	M	M	C	M	M		F	C	VC	M
	414	360	C	C	XC	XC		C	C	F	M	F	C	M	M		F	C	C	M
	483	420	C	C	VC	XC		C	C	F	M		M						C	
0.8 GPM #8	138	109	C					VC	VC	C	C		VC	C	C				VC	
	207	163	C	XC	XC		VC	VC	VC	C	C		VC	C	C		M	C	VC	C
	276	218	C	XC	XC	XC	UC	C	C	M	C	M	VC	M	C		M	C	VC	C
	345	272	C	VC	XC	XC	UC	C	C	M	M	M	C	M	M		M	C	C	M
	414	327	C	VC	XC	XC	UC	C	C	M	M	M	C	M	M		M	C	C	M
	483	381	C	VC	XC	XC	XC	C	C	M	M		C						C	
1.0 GPM #10	138	97	VC																	
	207	146	VC				UC			C	VC		XC	C	C		M		UC	
	276	195	C	XC	XC	UC	UC			C	C	M	XC	C	C		M		XC	
	345	243	C	XC	XC	UC	UC			M	M	M	VC	C	C		M		XC	
	414	292	C	VC	XC	UC	UC			M	M	M	VC	M	M		M		VC	
	483	341	C	VC	XC	XC	UC			M	M		VC						VC	
1.2 GPM #12	138	83																		
	207	124																	UC	
	276	135																	UC	
	345	207																	XC	
	414	248																	VC	
	483	290																	VC	
1.25 GPM #12.5	138	84	XC																	
	207	125	XC																	
	276	167	VC	XC	UC															
	345	209	VC	XC	UC	UC														
	414	251	VC	XC	XC	UC														
	483	292	C	VC	XC	XC														
1.5 GPM #15	138	71	XC																	
	207	107	XC				UC			VC	VC				VC					
	276	142	XC				UC			VC	VC				VC					
	345	178	VC	XC	UC		UC			VC	VC	C			VC					
	414	214	VC	XC	XC	UC	UC			VC	VC	C			VC					
	483	249	VC	XC	XC	UC	UC			C	C									

Figure 51: Droplet Classification Table ASABE S-5572.1 (cont'd)

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Chapter 7: Maintenance

Topics:

- [Service the System](#)
- [Inspect the System](#)
- [Clean the System](#)
- [Storage of the System](#)
- [Recommended Guidelines for Maintenance/Service](#)
- [Baseline Evaluation Process](#)
- [Strainers and Screens](#)
- [Nozzle Valves](#)

Service the System



CAUTION: Before operation or service to the system, read and understand the machine's operator manual and the system operator manual. Chemical residue may be present on/in the OEM equipment. Use the correct personal protective equipment.

Before servicing the system or plumbing components, release the pressure and empty any product from the system and liquid delivery lines.

Jump Start, Weld On, or Charge the Machine

If jump starting the machine, make sure that you trip the circuit breaker to prevent damage.

If charging the machine's batteries or welding on the machine, trip the circuit breaker.

Inspect the System

- Inspect the hoses for cuts, nicks, or abrasions before each use. Immediately replace any damaged hoses.
- Make sure that the strainers are clean.
- Make sure that all hoses and wiring are secure.
- Check for loose hoses, mounting hardware, and other components. Tighten if necessary.
- Check for damaged or missing decals. Replace if necessary.

Clean the System

- Thoroughly clean the system after each use.
- Avoid high-pressure spray when cleaning the system components.

Storage of the System

Thoroughly clean the implement and the system before any long storage.

Winterize for Storage

Do not use fertilizer to winterize! The use of fertilizer to winterize will cause internal damage to the nozzle valves.

Note: Improper winterizing will result in damage to the internal components of the nozzle valves.

Thoroughly clean the system before winter storage. Flush the system with clean water.

Winterize the system with RV antifreeze for winter storage. Proper winterizing of the machine with a CapstanAG system installed on it is essential. Make sure that the lines are completely full of antifreeze at 100% strength and that the nozzle valves are purged until 100% antifreeze is seen at all nozzle valves.

Recommended Guidelines for Maintenance/Service

When servicing a system, it is recommended to do these:

- Do the baseline service checks and verify the original setup values in this manual.
- Identify individual performance problems. Evaluate possible causes and corrections for performance issues.
- Troubleshoot individual components and replace, if needed.

IMPORTANT: The primary service tool will be a voltmeter that can measure voltage and resistance (ohms).

Baseline Evaluation Process

1. Make sure that the voltage readings are correct.
2. Visually check of all wire connections, harnesses, and connectors. Make sure that there are no loose, broken, or damaged parts.
3. Make sure that the correct tip size is used for the application.
4. Compare the current settings with those recorded in the manual during setup.
5. Make sure that the liquid product plumbing and the strainer(s) are clean.
6. Perform a like component swap test to see if the failure follows the component.
7. Repair or replace any damaged components.
8. Perform the system tests.
9. Review the system testing information in this manual.

Strainers and Screens

IMPORTANT: Clean the strainers on a regular basis.

Check the mesh size of the strainers and replace the screens if they are too coarse. 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. An 80-mesh screen is required to prevent nozzles from plugging. When selecting a strainer, do not rely on the color coding. Check with the strainer manufacturer to be sure and select the 80-mesh strainer.

Plugged strainers will cause a reduction in system operating pressure.

When replacing the mesh screen on a Tee-jet Strainers:

1. Install and set the mesh screen in the strainer head.
2. Install the strainer cap.

IMPORTANT: Failure to do this will likely result in a damaged mesh screen and overall strainer failure.

Nozzle Valves

Plugged nozzle valves can be classified into two categories:

- Plunger blockage
- Plunger stuck

Plunger blockage 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 in place. Symptoms of a blocked or stuck plunger are:

- Constant application
- Leaking when the nozzle is shut off
- No application

Note: Pinched or split O-rings will also cause nozzles to drip when shutoff.

Note: Operating a plugged nozzle valve for extended periods of time may result in a nozzle valve coil failure. Immediately clean any plugged nozzle valves.

Note: Before removing the nozzle valves, make sure that the pressure has been released from the boom tubes.

If plugged nozzles are a frequent problem in a particular boom section, examine the boom filter screens for plugged or damaged screens.

CapstanAG recommends using an 80-mesh screen to prevent the nozzles from plugging.

Check the mesh size of the strainers and replace strainers if they are too coarse.

Clean the Nozzle Valve(s)



WARNING: Chemical residues may be present in the agricultural equipment. Always use proper personal equipment to avoid personal injury.

1. Release pressure from the system before servicing.
2. Clean the system before installation or service of the fittings, hoses, valves, or nozzles.

Legacy Valve Service Procedure

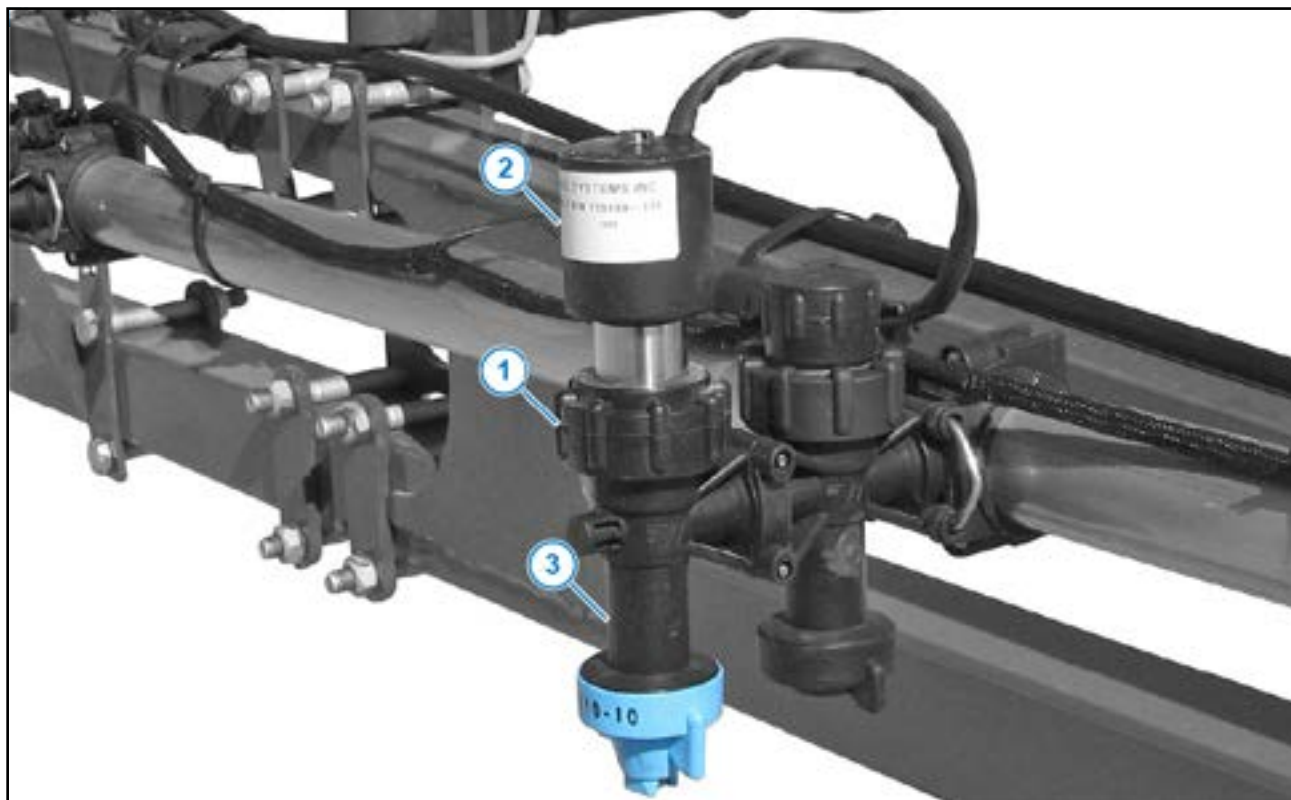


Figure 52: Nozzle Valve Disassembly

1. Unscrew the fly nut (Figure 52, Item 1) counter-clockwise to remove the nozzle valve assembly (Figure 52, Item 2) from the nozzle body (Figure 52, Item 3).

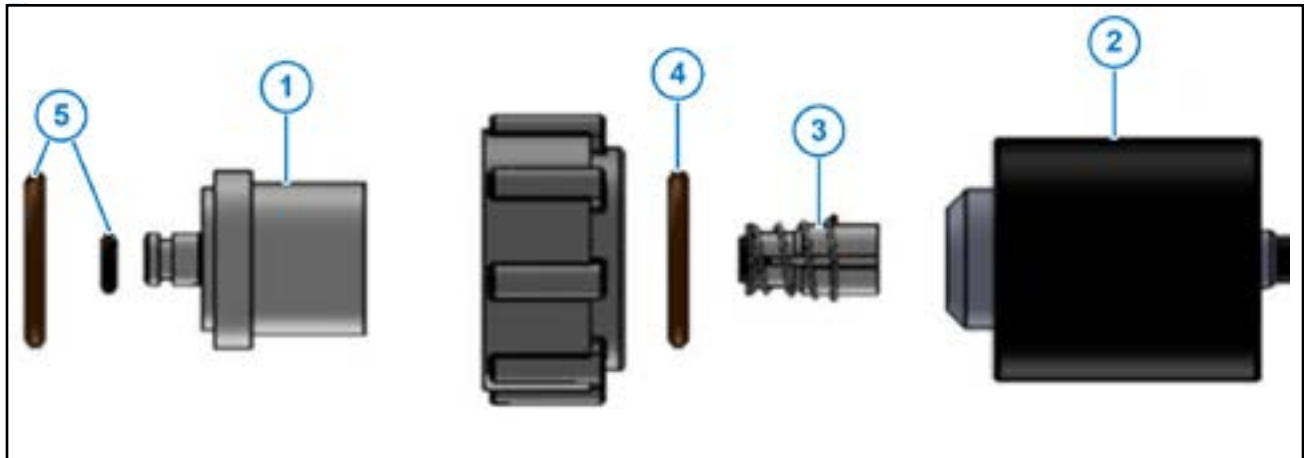


Figure 53: Nozzle Valve

2. Use pliers or other appropriate tool to hold the valve body (Figure 53, Item 1) so that the assembly coil harness faces the ground.
3. Rotate the coil (Figure 53, Item 2) counter-clockwise to remove the coil from the valve body.
4. Remove the plunger (Figure 53, Item 3) from the coil.
5. Inspect the O-ring (Figure 53, Item 4) on the coil.
6. Inspect the O-rings (Figure 53, Item 5) on the valve body.
7. Wash the nozzle valve components to remove any debris.
8. Inspect the plunger for wear or damage.
9. If there is wear or damage to the plunger, replace the plunger.
10. Inspect the valve body.
Make sure that the orifice is not plugged with debris, worn, or damaged.
11. If there is wear or damage to the orifice, replace the valve body.
12. Wash the nozzle body components to remove any debris.

IMPORTANT: Do not use brake cleaner. Brake cleaner can damage the seal.

IMPORTANT: During installation, apply 40 in-lbs (4.52 Nm) of torque to the coil when it threads into the valve body to properly seat the O-ring.

Spitfire Valve Service Procedure

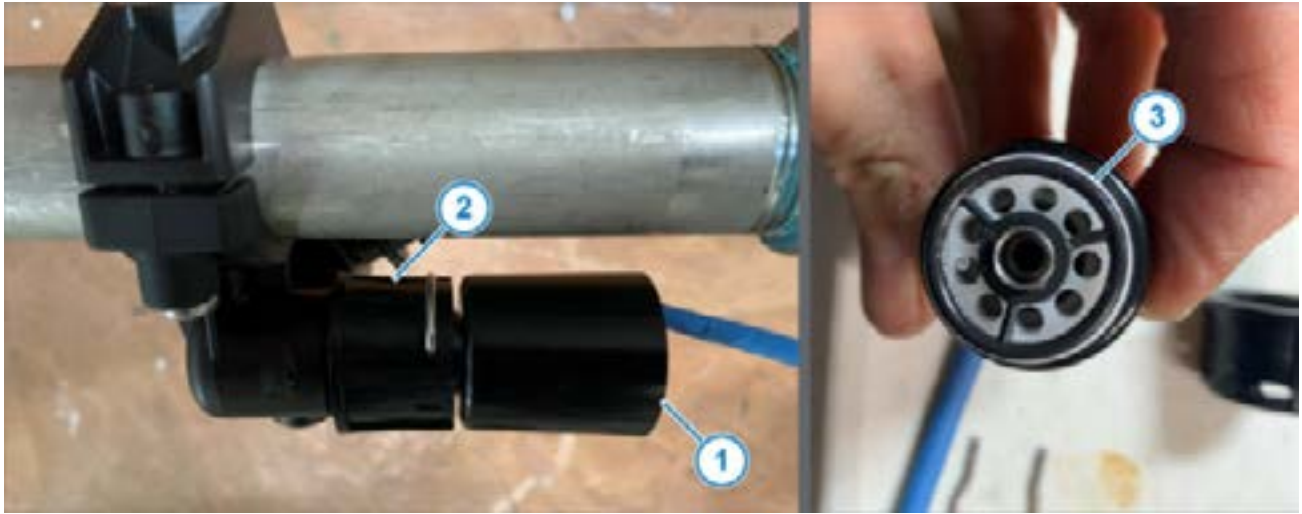


Figure 54: Flynut

Hold the coil (Figure 54, Item 1) stationary while tightening or loosening the flynut (Figure 54, Item 2). If the coil is rotated while tightening or loosening the flynut, damage to the spoke O-ring (Figure 54, Item 3) can occur and cause the valve to leak.



Figure 55: Retaining Clip

To service the valve components, remove the retaining clip (Figure 55, Item 1). Use the retaining clip to remove the orifice insert (Figure 55, Item 2) to service the plunger (Figure 55, Item 3).

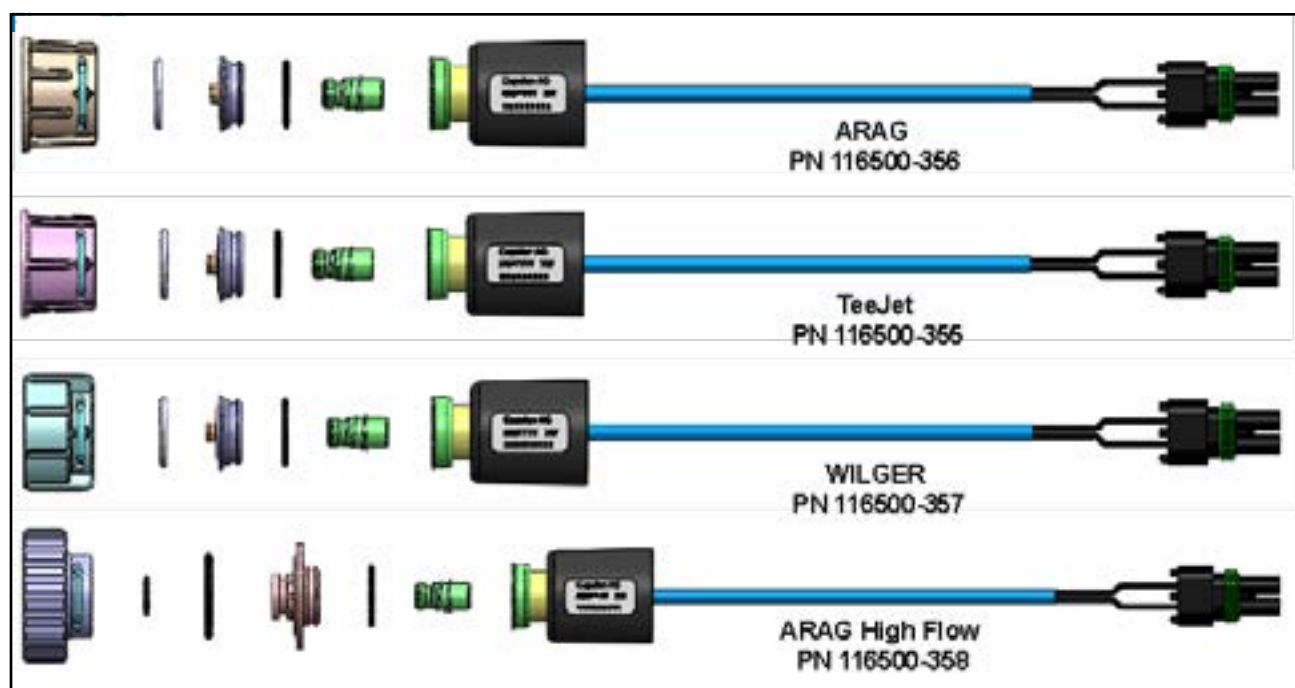


Figure 56: Spitfire Valve

Refer to [Figure 56](#) for disassembly of the Spitfire valve.

Plunger Seal Inspection



Figure 57: Plunger Assembly

After extended use, the plunger seal will wear a groove (Figure 57, Item 1) 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 system.

The result is erratic pulsing, often described as “flickering.” The system will operate normally at lower pressures until replacement parts can be installed. High operating pressures and abrasive chemicals will accelerate the wear of the plunger seal material.

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Chapter 8: Troubleshooting

Topics:

- [Troubleshooting Charts](#)
- [Interchange Components](#)
- [Coil Assembly Test](#)
- [Circuit Breaker Test](#)
- [System Load Capacity Test](#)
- [VCM Voltage Test](#)
- [Boom Shutoff Signal Test](#)
- [Pressure Sensor Signal Test](#)
- [Power to the Pressure Sensor Input Test](#)
- [Technical Bulletin](#)

Troubleshooting Charts

Table 23: System Fault Codes

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 1: Reset	Brown out reset	The system has reset after a low voltage event.	Make sure that the system has at least 12 V. Note: At 10 V to 10.5 V the reset will occur.
			Check the power connections for reliable supply.
Fault 2: Reset	Watchdog reset	The processor got stuck in a task.	Continue operation. If problem persists, do a Factory Reset.
Fault 4: Memory Fault	Internal FLASH write Fault	The hub did not write correctly to the FLASH memory	Upload software to hub.
			Contact CapstanAG to repair or replace the hub.
Fault 7: Memory Fault	EEPROM read Fault	The hub did not read correctly from EEPROM memory	If the system does not operate correctly, first perform a Factory Reset.
			Upload software to hub.
			Contact CapstanAG to repair or replace the hub.
Fault 8: Memory Fault	EEPROM write Fault	The hub did not write correctly to EEPROM memory	If the system does not operate correctly, first perform a Factory Reset.
			Upload software to hub.
			Contact CapstanAG to repair or replace the hub.
Fault 9: Internal Communication Fault	Processor to processor communication with VCM Port 1	The main hub processor and VCM 1 port connector on the hub have stopped communicating.	If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub.

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 10: Internal Communication Fault	Processor to processor communication with VCM Port 2	The main hub processor and VCM 2 port connector on the hub have stopped communicating.	If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub.
Fault 11: Internal Communication Fault	Processor to processor communication with VCM Port 3	The main hub processor and VCM 3 port connector on the hub have stopped communicating.	If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub.
Fault 12: Internal Communication Fault	Processor to processor communication with VCM Port 4	The main hub processor and VCM 4 port connector on the hub have stopped communicating.	If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub.
Fault 13: Internal Communication Fault	Processor to processor communication with VCM Port 5	The main hub processor and VCM 5 port connector on the hub have stopped communicating.	If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub.

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 14: Internal Communication Fault	Processor to processor communication with VCM Port 6	The main hub processor and VCM 6 port connector on the hub have stopped communicating.	If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub.
Fault 15: Internal Communication Fault	Processor to processor communication with VCM Port 7	The main hub processor and VCM 7 port connector on the hub have stopped communicating.	If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub.
Fault 16: Internal Communication Fault	Processor to processor communication with VCM Port 8	The main hub processor and VCM 8 port connector on the hub have stopped communicating.	If there are any unused VCM ports on the hub, remove the VCM harness from the stopped port and all subsequent ports. Skipping the stopped port, install the harnesses to remaining ports in the same order. If all of the VCM ports are in use, contact CapstanAG to repair or replace the hub.
Fault 25: No CAN Communications	No CAN communications	ISOBUS CAN is disconnected or damaged	Do a check of the connections for the ISOBUS CAN—ISO CAN GPS connector on hub and the harnesses on the machine.
			Do a check for proper termination on the ISOBUS CAN.
Fault 26: No CAN GPS Messages	No CAN GPS Messages	After CAN GPS is selected, the system is not receiving CAN GPS Messages. Note: Options are only visible on the display if the system detects that they are available.	Verify the GPS source and change if necessary.

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 27: No CAN Lat/Lon Message	No CAN Lat/ Lon Message	After CAN GPS is selected the system is not receiving CAN latitude and longitude GPS Messages. Note: Options are only visible on the display if the system detects that they are available.	Verify GPS source is transmitting Lat/Lon.
			Verify the GPS source and change if necessary.
Fault 28: No CAN Course Over Ground/Speed Over Ground Message	No CAN Course Over Ground/Speed Over Ground Message	After CAN GPS is selected the system is not receiving CAN bearing and speed GPS Messages. Note: Options are only visible on the display if the system detects that they are available.	Verify GPS source is transmitting bearing and speed.
			Verify the GPS source and change if necessary.
Fault 29: No CAN VT Reception	No CAN Communications With The VT	ISOBUS CAN Fault	Check the connections for the ISOBUS CAN—ISO CAN GPS connector on hub and the harnesses on the machine.
			Check for proper termination on the ISOBUS CAN.
		No virtual terminal display connected	Connect the virtual terminal display.
Fault 30: No CAN TC Reception	No CAN Communications With The TC	ISOBUS CAN Fault	Check the connections for the ISOBUS CAN—ISO CAN GPS connector on hub and the harnesses on the machine.
			Check for proper termination on the ISOBUS CAN.
		Task Controller is not configured correctly	Machine Task Controller setup required.
		Task Controller is not enabled or not unlocked	Contact your machine dealer.

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 32: No RS-232 GPS Communications	No RS-232 GPS	No GPS messages are being received	Cycle the GPS power
			Check the GPS antenna connections and fuses
		GPS messages are being received but are empty	Wait for the GPS antenna to acquire satellites
		Faulty GPS antenna	Replace the GPS antenna
		Faulty GPS receiver	Replace the GPS receiver
		Incorrect GPS settings	Wait 10 seconds while the GPS verifies itself. Change GPS receiver settings to: • Baud Rate: 19200 to 115200 • GGA: 10 Hz or more • VTG: 10 Hz or more • ZDA: 1 Hz or more
Fault 33: No RS-232 GGA Message	No RS-232 GGA Message	Incorrect GPS settings	Change the GGA message rate to at least 10 Hz on the GPS receiver
Fault 34: No RS-232 VTG Message	No RS-232 VTG Message	Incorrect GPS settings	Change the VTG message rate to at least 10 Hz on the GPS receiver
Fault 36: No Ethernet Communications	No Ethernet Communications	No Ethernet communication with the CapMod	Check the harnessing between the Ethernet port on the hub and the CapMod Ethernet port.
			Contact CapstanAG to repair or replace the hub or CapMod.
Fault 38: Internal Communication Fault	Accelerometer initialization error	Communication problem with the Inertial Measurement Unit in the hub.	Contact CapstanAG to repair or replace the hub.
			Disable the compass and gyro on the display.
Fault 39: Internal Communication Fault	Accelerometer read error	Communication problem with the Inertial Measurement Unit in the hub.	Contact CapstanAG to repair or replace the hub.
			Disable the compass and gyro on the display.
Fault 40: Internal Communication Fault	Compass initialization error	Communication problem with the Inertial Measurement Unit in the hub.	Contact CapstanAG to repair or replace the hub.
			Disable the compass and gyro on the display.
Fault 41: Internal Communication Fault	Compass read error	Communication problem with the Inertial Measurement Unit in the hub.	Contact CapstanAG to repair or replace the hub.
			Disable the compass and gyro on the display.
Fault 42: Internal Communication Fault	Gyroscope initialization error	Communication problem with the Inertial Measurement Unit in the hub.	Contact CapstanAG to repair or replace the hub.
			Disable the compass and gyro on the display.

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 43: Internal Communication Fault	Gyroscope gyro read error	Communication problem with the Inertial Measurement Unit in the hub.	Contact CapstanAG to repair or replace the hub.
			Disable the compass and gyro on the display.
Fault 44: Drop 1 Power Short	Power shorted to ground on drop 1	Damaged harness	Inspect the harness, repair or replace as necessary
Fault 45: Drop 2 Power Short	Power shorted to ground on drop 2	Damaged harness	Inspect the harness, repair or replace as necessary
Fault 46: Drop 3 Power Short	Power shorted to ground on drop 3	Damaged harness	Inspect the harness, repair or replace as necessary
Fault 47: Drop 4 Power Short	Power shorted to ground on drop 4	Damaged harness	Inspect the harness, repair or replace as necessary
Fault 48: Drop 5 Power Short	Power shorted to ground on drop 5	Damaged harness	Inspect the harness, repair or replace as necessary
Fault 49: Drop 6 Power Short	Power shorted to ground on drop 6	Damaged harness	Inspect the harness, repair or replace as necessary
Fault 50: Drop 7 Power Short	Power shorted to ground on drop 7	Damaged harness	Inspect the harness, repair or replace as necessary
Fault 51: Drop 8 Power Short	Power shorted to ground on drop 8	Damaged harness	Inspect the harness, repair or replace as necessary
Fault 52: VCM drop 1 controller version error	VCM drop 1 controller version does not match the Hub application	The VCM drop version was updated with the latest Hub update and needs to be boot-loaded.	Perform a factory reset or software reset to trigger VCM drop bootloader
Fault 53: VCM drop 2 controller version error	VCM drop 2 controller version does not match the Hub application	The VCM drop version was updated with the latest Hub update and needs to be boot-loaded.	Perform a factory reset or software reset to trigger VCM drop bootloader
Fault 54: VCM drop 3 controller version error	VCM drop 3 controller version does not match the Hub application	The VCM drop version was updated with the latest Hub update and needs to be boot-loaded.	Perform a factory reset or software reset to trigger VCM drop bootloader
Fault 55: VCM drop 4 controller version error	VCM drop 4 controller version does not match the Hub application	The VCM drop version was updated with the latest Hub update and needs to be boot-loaded.	Perform a factory reset or software reset to trigger VCM drop bootloader
Fault 56: VCM drop 5 controller version error	VCM drop 5 controller version does not match the Hub application	The VCM drop version was updated with the latest Hub update and needs to be boot-loaded.	Perform a factory reset or software reset to trigger VCM drop bootloader

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 57: VCM drop 6 controller version error	VCM drop 6 controller version does not match the Hub application	The VCM drop version was updated with the latest Hub update and needs to be boot-loaded.	Perform a factory reset or software reset to trigger VCM drop bootloader
Fault 58: VCM drop 7 controller version error	VCM drop 7 controller version does not match the Hub application	The VCM drop version was updated with the latest Hub update and needs to be boot-loaded.	Perform a factory reset or software reset to trigger VCM drop bootloader
Fault 59: VCM drop 8 controller version error	VCM drop 8 controller version does not match the Hub application	The VCM drop version was updated with the latest Hub update and needs to be boot-loaded.	Perform a factory reset or software reset to trigger VCM drop bootloader
Fault 60: Drop 1 CAN Failure *	CAN Failure on drop 1	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
Fault 61: Drop 2 CAN Failure *	CAN Failure on drop 2	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
Fault 62: Drop 3 CAN Failure *	CAN Failure on drop 3	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
Fault 63: Drop 4 CAN Failure *	CAN Failure on drop 4	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
Fault 64: Drop 5 CAN Failure *	CAN Failure on drop 5	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
Fault 65: Drop 6 CAN Failure *	CAN Failure on drop 6	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.

*** Faults 60-67 could also indicate that no valves are detected by the VCM. Check valve harness for correct pinout as shown on [Page 129](#). If correct, inspect VCM and other associated harnessing.**

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 66: Drop 7 CAN Failure *	CAN Failure on drop 7	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
Fault 67: Drop 8 CAN Failure *	CAN Failure on drop 8	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
Fault 68: VCM drop 1 Firmware update failure	A firmware update failed on VCM drop 1	Process failure	Perform a software reset from the System Menu.
		Poor harness connection	Inspect the harness connections on VCM Drop 1.
Fault 69: VCM drop 2 Firmware update failure	A firmware update failed on VCM drop 2	Process failure	Perform a software reset from the System Menu.
		Poor harness connection	Inspect the harness connections on VCM Drop 2.
Fault 70: VCM drop 3 Firmware update failure	A firmware update failed on VCM drop 3	Process failure	Perform a software reset from the System Menu.
		Poor harness connection	Inspect the harness connections on VCM Drop 3.
Fault 71: VCM drop 4 Firmware update failure	A firmware update failed on VCM drop 4	Process failure	Perform a software reset from the System Menu.
		Poor harness connection	Inspect the harness connections on VCM Drop 4.
Fault 72: VCM drop 5 Firmware update failure	A firmware update failed on VCM drop 5	Process failure	Perform a software reset from the System Menu.
		Poor harness connection	Inspect the harness connections on VCM Drop 5.
Fault 73: VCM drop 6 Firmware update failure	A firmware update failed on VCM drop 6	Process failure	Perform a software reset from the System Menu.
		Poor harness connection	Inspect the harness connections on VCM Drop 6.
Fault 74: VCM drop 7 Firmware update failure	A firmware update failed on VCM drop 7	Process failure	Perform a software reset from the System Menu.
		Poor harness connection	Inspect the harness connections on VCM Drop 7.
Fault 75: VCM drop 8 Firmware update failure	A firmware update failed on VCM drop 8	Process failure	Perform a software reset from the System Menu.
		Poor harness connection	Inspect the harness connections on VCM Drop 8.

*** Faults 60-67 could also indicate that no valves are detected by the VCM. Check valve harness for correct pinout as shown on [Page 129](#). If correct, inspect VCM and other associated harnessing.**

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 76: Section 1 Valve Short Circuit	Section 1 Valve Short Circuit	Damaged harness	Check the connections to section 1 valve and section 9 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 1
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 77: Section 2 Valve Short Circuit	Section 2 Valve Short Circuit	Damaged harness	Check the connections to section 2 valve and section 10 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 2
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 78: Section 3 Valve Short Circuit	Section 3 Valve Short Circuit	Damaged harness	Check the connections to section 3 valve and section 11 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 3
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 79: Section 4 Valve Short Circuit	Section 4 Valve Short Circuit	Damaged harness	Check the connections to section 4 valve and section 12 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 4
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 80: Section 5 Valve Short Circuit	Section 5 Valve Short Circuit	Damaged harness	Check the connections to section 5 valve and section 13 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 5
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 81: Section 6 Valve Short Circuit	Section 6 Valve Short Circuit	Damaged harness	Check the connections to section 6 valve and section 14 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 6
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 82: Section 7 Valve Short Circuit	Section 7 Valve Short Circuit	Damaged harness	Check the connections to section 7 valve and section 15 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 7
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 83: Section 8 Valve Short Circuit	Section 8 Valve Short Circuit	Damaged harness	Check the connections to section 8 valve and section 16 valve. Inspect pin 3 (blue wire) on harnesses of VCM drop 8
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 84: Section 1 Valve Open Circuit	Section 1 Valve Open Circuit	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 85: Section 2 Valve Open Circuit	Section 2 Valve Open Circuit	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 86: Section 3 Valve Open Circuit	Section 3 Valve Open Circuit	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 87: Section 4 Valve Open Circuit	Section 4 Valve Open Circuit	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 88: Section 5 Valve Open Circuit	Section 5 Valve Open Circuit	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 89: Section 6 Valve Open Circuit	Section 6 Valve Open Circuit	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 90: Section 7 Valve Open Circuit	Section 7 Valve Open Circuit	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 91: Section 8 Valve Open Circuit	Section 8 Valve Open Circuit	Damaged harness	Inspect the harnesses and connections, repair or replace as necessary
		Internal hub problem	Contact CapstanAG to repair or replace the hub.
		Servo valve failure	Repair or replace the servo valve
Fault 92: Section 1 Low Pressure	Section 1 Low Pressure	If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 93: Section 2 Low Pressure	Section 2 Low Pressure	If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 94: Section 3 Low Pressure	Section 3 Low Pressure	If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 95: Section 4 Low Pressure	Section 4 Low Pressure	If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 96: Section 5 Low Pressure	Section 5 Low Pressure	If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 97: Section 6 Low Pressure	Section 6 Low Pressure	If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 98: Section 7 Low Pressure	Section 7 Low Pressure	If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 99: Section 8 Low Pressure	Section 8 Low Pressure	If you are using sectional pressure sensors, this means the section is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 100: Section 1 High Pressure	Section 1 High Pressure	If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 101: Section 2 High Pressure	Section 2 High Pressure	If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 102: Section 3 High Pressure	Section 3 High Pressure	If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 103: Section 4 High Pressure	Section 4 High Pressure	If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 104: Section 5 High Pressure	Section 5 High Pressure	If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 105: Section 6 High Pressure	Section 6 High Pressure	If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 106: Section 7 High Pressure	Section 7 High Pressure	If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 107: Section 8 High Pressure	Section 8 High Pressure	If you are using sectional pressure sensors, this means the section is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 108: Servo Valve Short Circuit	Servo Short Circuit	Damaged harness	Repair or replace the harness
		Damaged valve	Repair or replace the valve
Fault 109: Servo Valve Open Circuit	Servo Open Circuit	Damaged harness	Repair or replace the harness
		Damaged valve	Repair or replace the valve
		Connectors are not connected	Check the connections
Fault 110: Flowmeter Short Circuit	Flowmeter Short Circuit	Damaged harness	Repair or replace the harness
		Damaged flowmeter	Repair or replace the flowmeter
Fault 111: Flowmeter Open Circuit	Flowmeter Open Circuit	Damaged harness	Repair or replace the harness
		Damaged flowmeter	Repair or replace the flowmeter
		Connectors are not connected	Check the connections
Fault 112: System 1 Low Pressure	System 1 Low Pressure	The system is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 113: System 1 High Pressure	System 1 High Pressure	The system is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 114: System 2 Low Pressure	System 2 Low Pressure	The system is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 115: System 2 High Pressure	System 2 High Pressure	The system is above the maximum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 116: VCM Memory	VCM Memory	Settings in the VCM do not match settings in the Hub.	Cycle the power to the system
			Perform a factory reset
			Upload software to the hub

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 117: Boom Profile Mismatch	Nozzle Memory	The boom profile in memory doesn't match the attached hardware.	Cycle the power to the system
			Perform a factory reset
			Upload software to the hub
Fault 118: Nozzle Count Error	Nozzle Count Error	The number of attached nozzle valves doesn't match the value in memory	Cycle the power to the system
			Perform a factory reset
			Verify all valves are functional
Fault 119: System Memory	System Memory	The hub did not read the menu settings correctly from memory.	Cycle the power to the system
			Perform a factory reset
			Contact CapstanAG to repair or replace the hub.
Fault 120: Pump Seal	Pump Seal	System pressure dropped below the minimum for 8 seconds.	Fill the tank and then restart the pump. To restart the pump: Go to the main screen CapstanAG operating screen: Select System>>On/off icon next to Pump is system status window
Fault 121: Control Duty Cycle Zero	Control Duty Cycle	Pump control is off because external rate controller is off. (Only used in External Task Control Mode with Synchro fluid control)	Check the rate controller settings and change as necessary.
Fault 122: Low Pressure	Low Pressure	The system is below the minimum voltage for the pressure sensor.	Inspect the pressure sensor, harnesses, and connections, repair or replace as necessary.
Fault 123: Flow Percentage	Flow percentage exceeds the maximum value set in the system menu	Flowmeter calibration number is incorrect	Check the flowmeter calibration.
		Damaged flowmeter	Repair or replace the flowmeter as necessary.
		Wrong tip size on display	Change the value on the display
		Wrong valve size on display	Change the value on the display
		Boom leak	Inspect the booms and repair any damage
		Section valve not operating	Inspect the section valves and repair/replace as necessary
		Plugged strainers	Clean or replace the strainers
		Lodged plungers	Clean or replace the strainers
Fault 125: Low Flow Rate Sync	Low Flow Rate Sync	This is used only for John Deere and is information only.	
Fault 126: Pump Speed	Pump Speed	On a system with a pump speed sensor, the system has exceeded the maximum allowable pump speed.	Fill the tank
			Reduce the pressure or flow

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 127: Plug Strainer	Plug Strainer	Strainer is clogged	Clean or replace the strainers
Fault 128: Low Tank Volume	Low Tank Volume	The tank volume is low	Fill the tank
Fault 129: Float Switch	Float Switch	The float switch indicated that the tank is empty or there is vapor in the lines.	Fill the tank
Fault 130: Float Switch 2	Float Switch 2	The float switch indicated that the tank is empty or there is vapor in the lines.	Fill the tank
Fault 131: Pressure Transducer Short Circuit	Pressure Transducer Short Circuit	Pressure sensor power shorted to ground	Inspect pressure sensor wiring Inspect PSI/Flow Connection at hub Inspect Pressure Sensor Connection Replace Pressure Sensor
Fault 132: Rate Above Setpoint	Rate Above Setpoint	Actual rate is greater than target rate	Check flowmeter calibration Verify Tip/Valve size Adjust Rate Alarm Setpoint % in Flowmeter menu
Fault 133: Rate Below Setpoint	Rate Below Setpoint	Actual rate is less than target rate	Check flowmeter calibration Verify Tip/Valve size Adjust Rate Alarm Setpoint % in Flowmeter menu
Fault 134: Unexpected Flow	Unexpected Flow	Flow detected at main product flowmeter when boom is OFF	Check product recirculation valve for lodged condition If recirculation valve is satisfactory, increase Unexpected Flow Deadband in the Flowmeter menu
Fault 135: Drop Count Mismatch	Drop Count Mismatch	The number of valves attached to VCMs is different than last detected	Check valve connections Check VCM Setup Page and compare to boom for missing nozzles

Table 24: Valve Fault Codes

Fault Code: Message	Fault	Cause(s)	Correction(s)
Fault 500: Valve Lodged Open	Valve Lodged Open	Debris in the valve	Clean the valve
Fault 501: Valve Lodged Closed	Valve Lodged Closed	Debris in the valve	Clean the valve
Fault 502: Coil Circuit Open	Coil Circuit Open	Coil wire is pinched, cut, broken, or disconnected	Check the coil connection and resistance: • 7-watt coils resistance — 21 ohms to 23.5 ohms • 12-watt coils resistance — 10 ohms to 11.5 ohms
Fault 503: Coil Circuit Short	Coil Circuit Short	Internal coil short: Coil wire is pinched, cut, or broken	Check the coil connection and resistance: • 7-watt coils resistance — 21 ohms to 23.5 ohms • 12-watt coils resistance — 10 ohms to 11.5 ohms
Fault 504: Extra Coil	Extra Coil	A valve has been sensed on a VCM after the system was setup.	If you do have an extra valve, perform a factory reset to correctly set up the system.
			If you do not have additional valve(s), there is a VCM problem and you must repair or replace the VCM.

Table 25: System Operation Errors

Issue	Cause(s)	Correction(s)
Under application	Tips are too small	Find and install tips that are the correct size
	Plugged tips	Clean or replace the tips
	Plugged filter(s)	Clean or replace the filter(s)
	Filter(s) not correctly installed	Correctly install filter(s)
	Plugged, kinked, or collapsed hoses	Check all hoses and replace as needed
	Pump is not turned on	Refer to the sprayer manual for instructions to start the pump
	Outrunning sprayer liquid system capability	Slow down
		Run at optimum pressure per nozzle speed range charts
	Incorrect rate settings	Check and adjust the rate settings
	Incorrect calibration settings	Refer to the rate controller and/or system manuals for instructions
	Faulty radar	Replace the radar
	Poor GPS satellite signal	Make sure that the GPS is working correctly
	Faulty rate controller switch(es)	Locate and replace the faulty switch(es)
	Servo valve not working correctly	Inspect the Servo valve and replace as necessary
	Flowmeter calibration value is incorrect	Check the flowmeter calibration
	Faulty flowmeter	Repair or replace the flowmeter
Over application	Tips are too large	Install tips of the correct size
	Worn tips	Replace the tips
	Speed too slow	Increase speed
	Incorrect rate settings	Check the rate settings and adjust as necessary
	Incorrect calibration settings	Refer to the rate controller and/or system manuals for instructions
	Servo valve not working correctly	Inspect the Servo valve and replace as necessary
	Flowmeter calibration value is incorrect	Check the flowmeter calibration
	Faulty flowmeter	Repair or replace the flowmeter

Issue	Cause(s)	Correction(s)
Rate instability	Low voltage to the rate controller	Test the voltage and repair as needed
	Faulty flowmeter	Repair or replace the flowmeter
	Faulty speed sensor reading	Inspect the radar and replace as needed
	Collapsed suction hose	Replace the suction hose
	Inlet plugged	Inspect the inlet and clean as necessary
	Incorrect valve calibration settings	Check the valve calibration settings and adjust as necessary. Refer to the rate controller manual
	Incorrect system gain	Check of the system gain and adjust as needed
	The system run/hold parameter is too short	Incrementally adjust up the system run/hold parameter to decrease the instability
	Air in the spray boom	Bleed air from the system
	Faulty rate controller	Replace the rate controller
Pressure instability	Faulty rate controller	Replace the rate controller
	Worn or sticky poppet(s)	Inspect the poppet(s) and replace as necessary
	Incorrect system gain setting	Check the system gain setting and adjust as needed
	Faulty pressure sensor	Replace the pressure sensor
Single nozzle valve drips when shut off	Plunger is lodged with debris	Clean the nozzle valve
	Plunger is worn	Replace the plunger
	O-ring is pinched or broken	Replace the O-ring
Single nozzle valve sprays erratically	Plunger is worn	Replace the plunger
Single nozzle valve will not shut off	Plunger is lodged with debris	Clean the nozzle valve
	O-ring is pinched or broken	Replace the O-ring
Section will not spray	Faulty VCM	Repair or replace the VCM
	Damaged VCM extension harness	Repair or replace the VCM extension harness
	Rate controller is not activating the section	Make sure that the section signal is getting to the hub.
		Repair or replace the rate controller components.
Skips at the edges of a field	Overlap distance is set too low	Increase the overlap distance to at least 40"
	Incorrect GPS antenna location	Check the measurements to the GPS antenna location
	The display overlap settings are incorrect	Set the look ahead time and overlap distance to prevent skips
	Incorrect ball valve settings	Make sure that the ball valves are turning on soon enough or turning off late enough

Table 26: Rate Controller Errors

Issue	Cause(s)	Correction(s)
Under application	Tips are too small	Install tips of the correct size
		Check the low rates with a Wilger Quick Calibrator (or similar) or with a catch time test at each nozzle: - Oz/min per nozzle = GPA x Test Speed (mph) x Nozzle Spacing (inches) / (5940 x 128) - Oz/min per nozzle = G/1000 ft² x Test Speed (mph) x Nozzle Spacing (inches) / (136 x 128)
	Plugged filters	Inspect the filters and replace as needed
		Make sure that the filters are installed correctly
	Plugged lines	Make sure that the lines are clean and do not have any kinks
	Shutoff valve is partially closed	Make sure that each shutoff valve is fully open
	Control Valve Type: Use A, B, C, or D as it applies to your Machine	A. Pressure set too low on the flow by-pass lines - Make sure that the settings on each pressure controlled by-pass valve are correct B. In-line Servo flow control valve is stuck - Make sure that the Servo flow control valve is operating correctly C. Servo signal wire polarity is switched - Make sure that the valve opens with a rate increase - Make sure that the valve closes with a rate decrease D. Top PWM valve is set too low - Adjust the rate controller PWM valve to the desired setting
	Electric Servo Valve pump control is stuck	Make sure that the electric Servo pump control is operating correctly
	PWM spool is stuck	Change the rate to observe whether the rate change is slow, limited, or does not change at all. Replace as needed
	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

Issue	Cause(s)	Correction(s)
Under Application	Worn flowmeter	Remove the rate smoothing feature
		Put the rate controller in manual mode at a test speed Note: Putting the rate controller in manual mode will lock the Servo valve position unless the valve position is changed manually. If the rate becomes stable: • Worn Servo Valve • Worn PWM Valve If the rate remains unstable, the issue is usually the flowmeter signal instability. Manually increase the rate. The rate and pressure should increase. If the rate does not increase: • Worn Servo Valve • Worn PWM Valve Manually decrease the rate. The rate and pressure should decrease. If the rate does not decrease: • Worn Servo Valve • Worn PWM Valve
Over Application	Worn tips or tips that are too big	Install tips of the correct size Check the low rates with a Wilger Quick Calibrator (or similar) or with a catch time test at each nozzle: • $\text{Oz/min per nozzle} = \text{GPA} \times \text{Test Speed (mph)} \times \text{Nozzle Spacing (inches)} / (5940 \times 128)$ • $\text{Oz/min per nozzle} = \text{G}/1000 \text{ ft}^2 \times \text{Test Speed (mph)} \times \text{Nozzle Spacing (inches)} / (136 \times 128)$
	Incorrect speed calibration value	Adjust the speed calibration setting
Rate Instability	Check the rate controller calibration values	Check the valve type and change if necessary
		Check the valve calibration. Refer to the rate controller information for the cal number for the specific valve type
	Worn or sticking Servo valve	Inspect the Servo valve and replace as needed
	Worn of sticking PWM valve	Inspect the PWM valve and replace as needed
	Flowmeter signal instability	Make sure that the flowmeter signal is correct
	Plugged, kinked, or collapsed hoses	Inspect all hoses and replace as needed

Issue	Cause(s)	Correction(s)
Rate Instability	Controller pressure instability	Isolate the display from the rate controller and then put the system in manual mode at 50%
		Inspect the rate controller pressure sensor and replace as needed
		Make sure that the rate controller calibration values are correct

Interchange Components

The system includes a number of usages of the same part in multiple locations:

- Nozzle Valves
- Extension Harnesses
- VCMs

When troubleshooting failed components, it can be helpful to replace the failed part with a working part at 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, and other troubleshooting means may be followed.

Note: Use caution when failed parts are interchanged with a part that is operating correctly; in rare cases, the failed component may cause other components to fail at the new location.

Coil Assembly Test

Use a voltmeter to measure the ohms of resistance across pins A and B on the coil connector.

Note: Correct resistance is:

- 7-watt coils resistance — 21 ohms to 23.5 ohms
- 12-watt coils resistance — 10 ohms to 11.5 ohms

If resistance value is incorrect:

- Clean the connector terminals and retest
- Replace the coil assembly

Coil assembly failures are often the result of two factors:

- Extended valve use with a plugged nozzle
- Extended use in corrosive environments

CapstanAG recommends cleaning any plugged valve assemblies immediately. Additionally, rinse the inside of the booms, and wash the outside of the coil assemblies with clean water as often as practical.

Circuit Breaker Test



Figure 58: Circuit Breaker

The circuit breaker has a manual trip button (Figure 58, Item 1) and a manual reset lever (Figure 58, Item 2). A tripped circuit breaker is an indicator of a short or overload condition.

Do not reset the circuit breaker without looking into the cause of the tripped circuit breaker.

Note: The circuit breaker is usually located near the battery or in the battery compartment. The 60A or 80A circuit breaker is equipped with a manual trip. To reset the breaker, rotate the tripped lever back into the reset position.

IMPORTANT: When disconnecting the battery terminals, remove the negative (-) cable first, then remove the positive (+) cable. When connecting cables, connect the positive (+) cable first, then connect the negative (-) cable.

System Load Capacity Test

1. Start the machine engine.
2. Turn on all the boom sections.
3. Turn on all electrical loads, including the air conditioning, foam marker monitors, etc.
4. Observe the voltage readout on the correct settings screen in the display.

The 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, inspect the nozzle valves for worn plunger seals.

If low voltage is observed, inspect:

- Battery terminals, clean as necessary
- Battery condition
- Alternator condition
- Electrical connections

Circuit Breaker Test

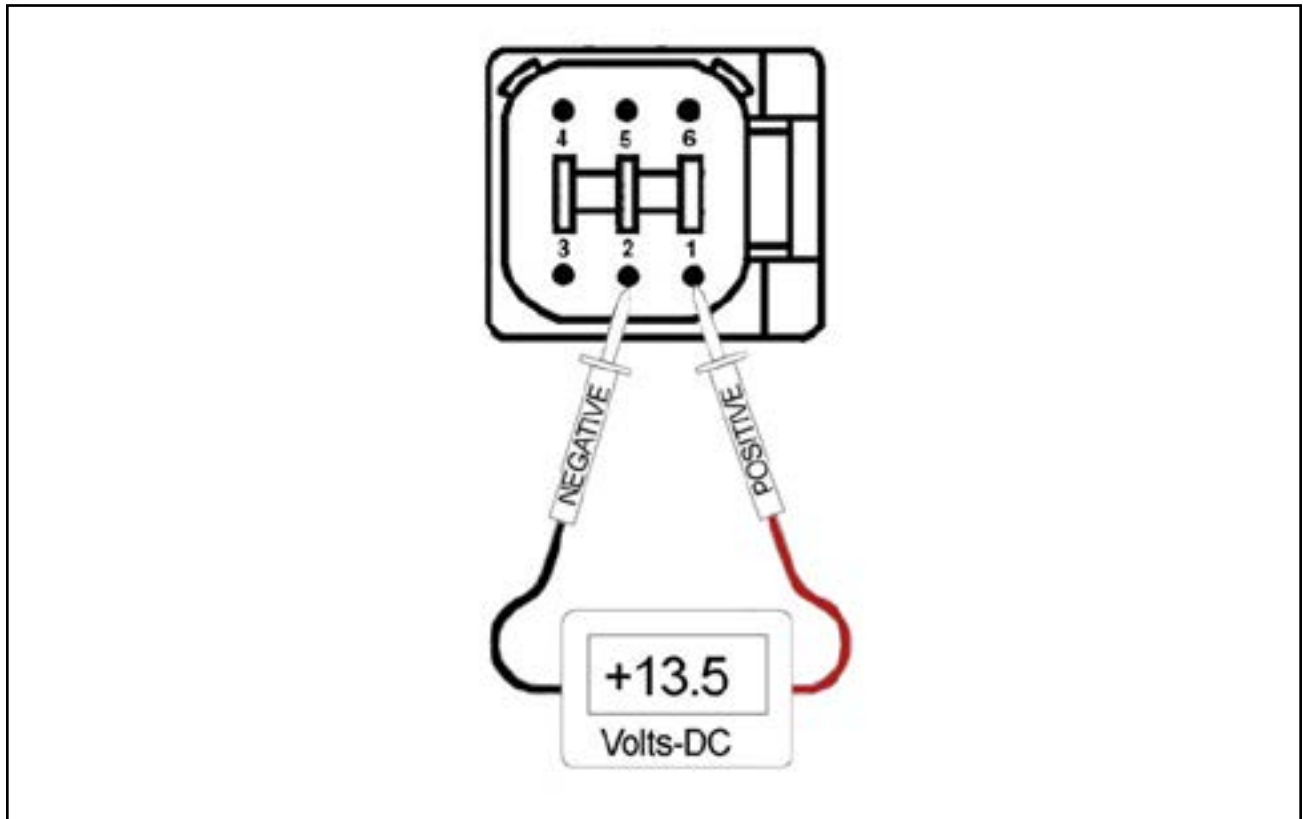


Figure 59: VCM Voltage Test Setup

Disconnect the VCM extension harness (6-pin Deutsch connector) at each boom section VCM.

- With the engine of the machine running, use a voltmeter to observe that there is a 13.5 VDC between pin 1 and pin 2.
- With the engine of the machine running, use a voltmeter to observe that there is a 13.5 VDC between pin 2 and pin 6.

Make sure that the polarity is accurate by looking at the positive voltage when the red (positive) probe is connected to pin 1, and the black (negative) probe is connected to pin 2.

If there is no voltage present between pin 2 and pin 6:

- Turn on the key.
- Make sure there are no short circuit alarms on the VT.
- Check the voltage at the hub.
- Inspect the circuit breaker at the machine battery.
- Inspect the PinPoint™ battery harness connections.

VCMs require constant power on pin 1 and key switched power on pin 6.

Boom Shutoff Signal Test

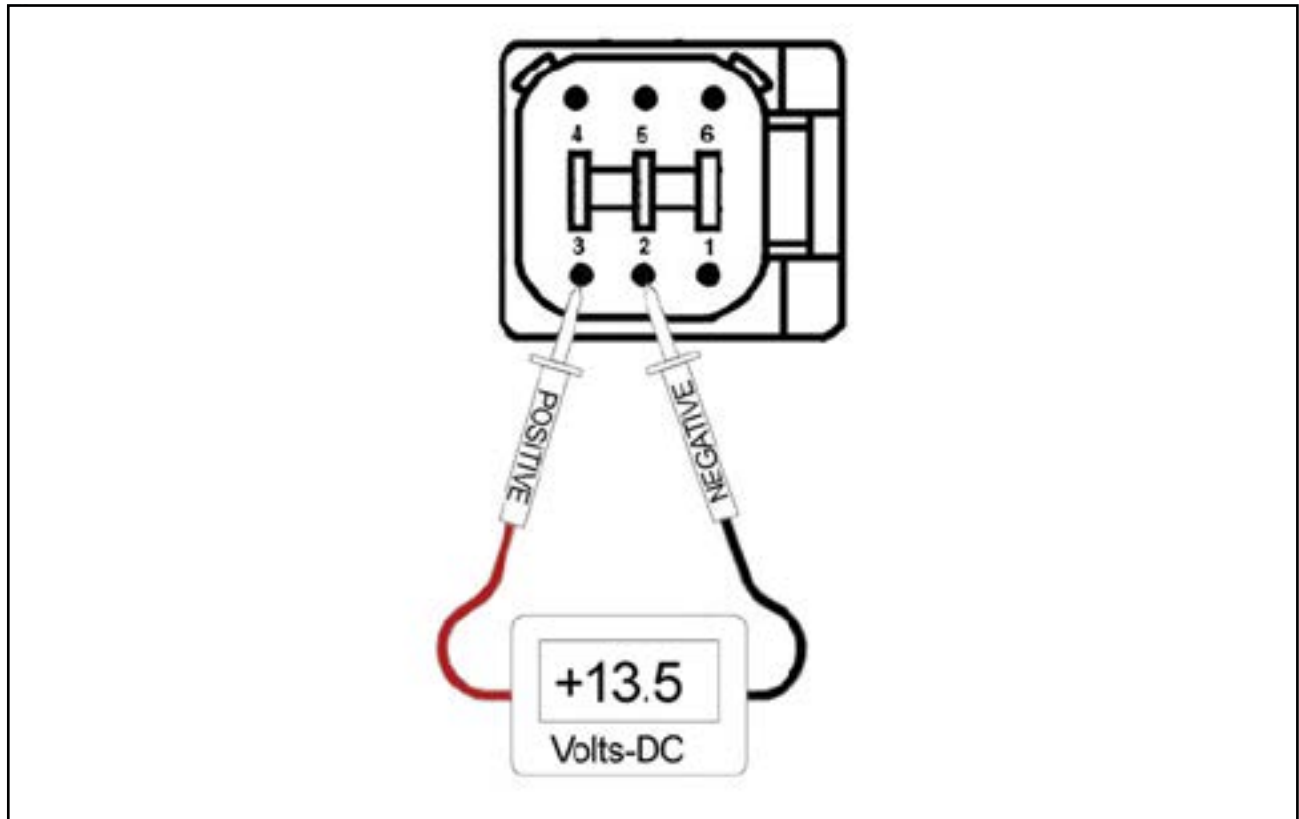


Figure 60: Boom Shutoff Signal Test Setup

Disconnect the VCM extension harness (6-pin Deutsch connector) from the VCM.

Turn on the boom section shutoff switch for the VCM being tested.

- With the engine of the machine running, use a voltmeter to observe that there is a 13.5 VDC between pin 2 and pin 3.
- With the engine of the machine off, there is a 12.0 VDC between pin 2 and pin 3. Make sure that the polarity is accurate by looking at the positive voltage when the red (positive) probe is connected to pin 3, and the black (negative) probe is connected to pin 2.

If there is no voltage present:

- Check the boom shutoff switches
- Check the voltage at the hub
- Inspect the circuit breaker at the machine battery
- Inspect the PinPoint™ battery harness connections

For a VCM to spray, there must be 12V on pin 1 (constant power), pin 3 (boom signal), and pin 6 (key switched power).

Pressure Sensor Signal Test

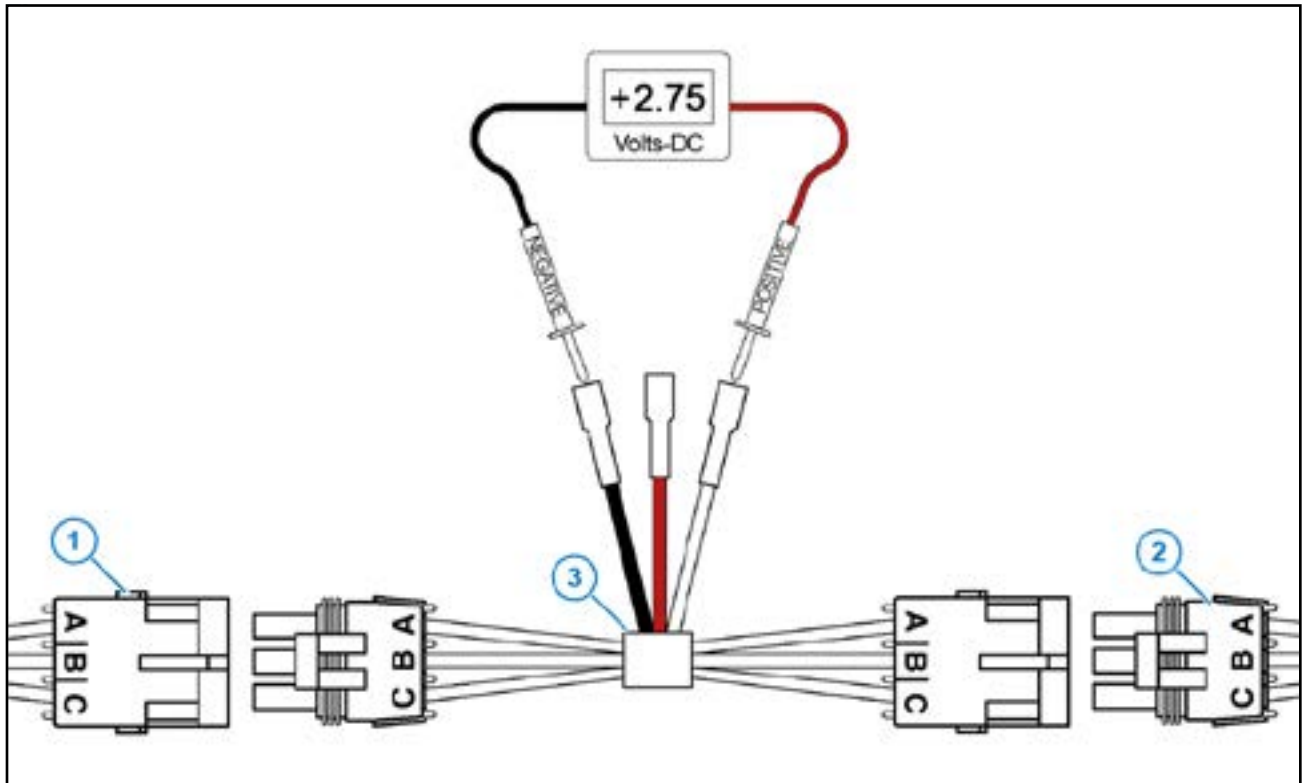


Figure 61: Pressure Sensor Signal Test Setup

Disconnect the pressure sensor (Figure 61, Item 1) from the pressure sensor harness (Figure 61, Item 2). Connect one end of the pressure sensor breakout harness diagnostic tool (Figure 61, Item 3) into the pressure sensor shroud connector. Connect the other end into the pressure sensor harness tower connector.

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

Use a voltmeter to observe that there is 2.75 VDC between the black and white wires on the pressure sensor breakout harness.

Using the rate controller, adjust the pressure to 100 psi. The voltmeter should read 5.0 VDC.

If accurate voltage is not present:

- Verify the accuracy of the pressure gauge on the sprayer.
- Check the power to the pressure sensor.
- Use the serial diagnostics to check the pressure sensor calibration.
- Replace the pressure sensor.

Power to Pressure Sensor Input Test

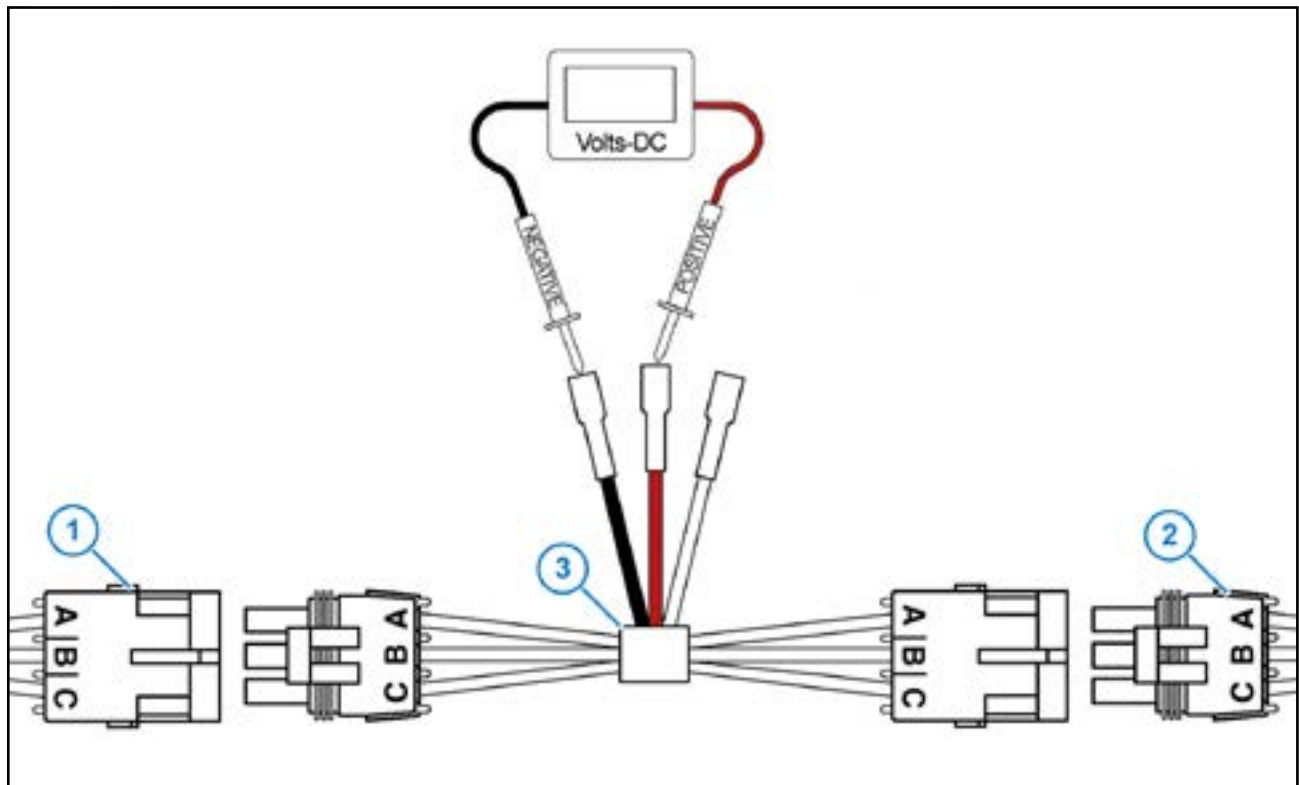


Figure 62: Power to Pressure Sensor Input Test Setup

Disconnect the pressure sensor (Figure 62, Item 1) from the pressure sensor harness (Figure 62, Item 2). Connect one end of the pressure sensor breakout harness diagnostic tool (Figure 62, Item 3) into the pressure sensor shroud connector. Connect the other end into the pressure sensor harness tower connector.

Use a voltmeter to observe that there is 13.5 VDC between the red and black wire on the pressure sensor breakout harness with the engine running or 12.0 VDC without the engine running.

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

If no voltage is present:

- Inspect the circuit breaker at the machine battery
- Inspect the PinPoint™ battery harness connections
- Inspect the battery condition
- Inspect the alternator condition

Technical Bulletin

This technical bulletin was originally produced July 11, 2001. The latest revision to this bulletin was made November 1, 2017.

Spray Skips from Poor Pulse Blending

Over the years, CapstanAG 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 in apart. Each tip is rotated 12.5° to prevent pattern interference between nozzles. The minimum boom height is 21 in above the spray target.

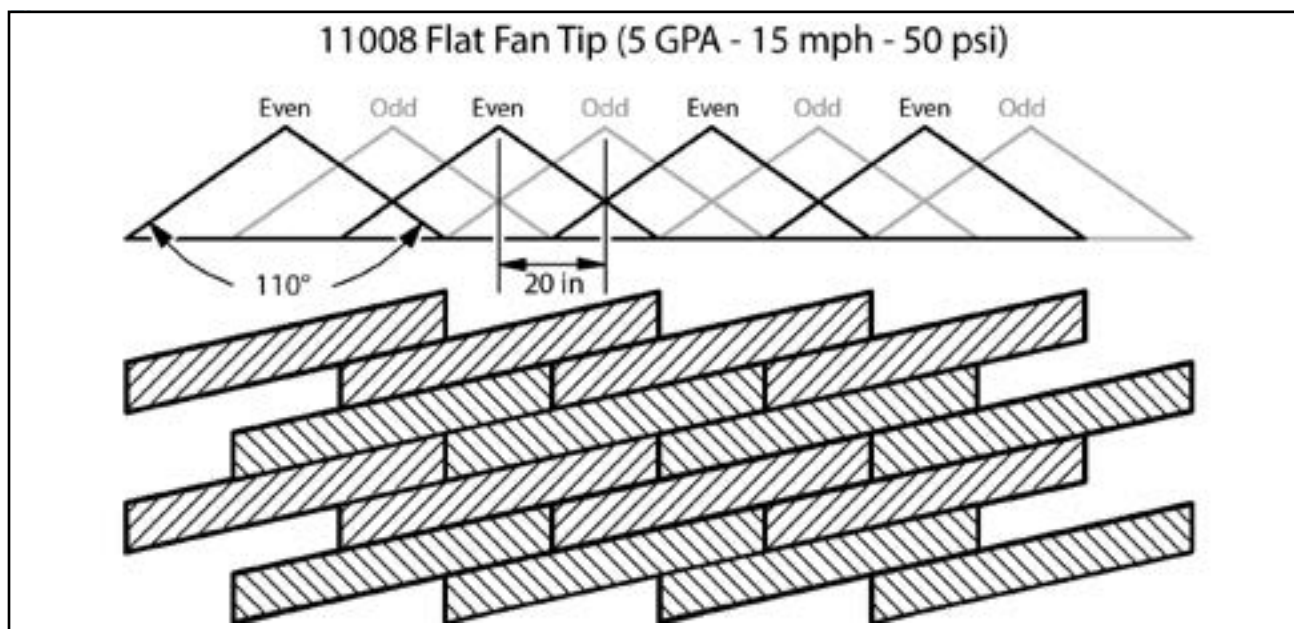


Figure 63: 11008 Flat Fan Tip

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 upon the style of tip being used. For example, low-drift tips typically emit large droplets and provide minimal droplet dispersion.

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 in boom height does not 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.

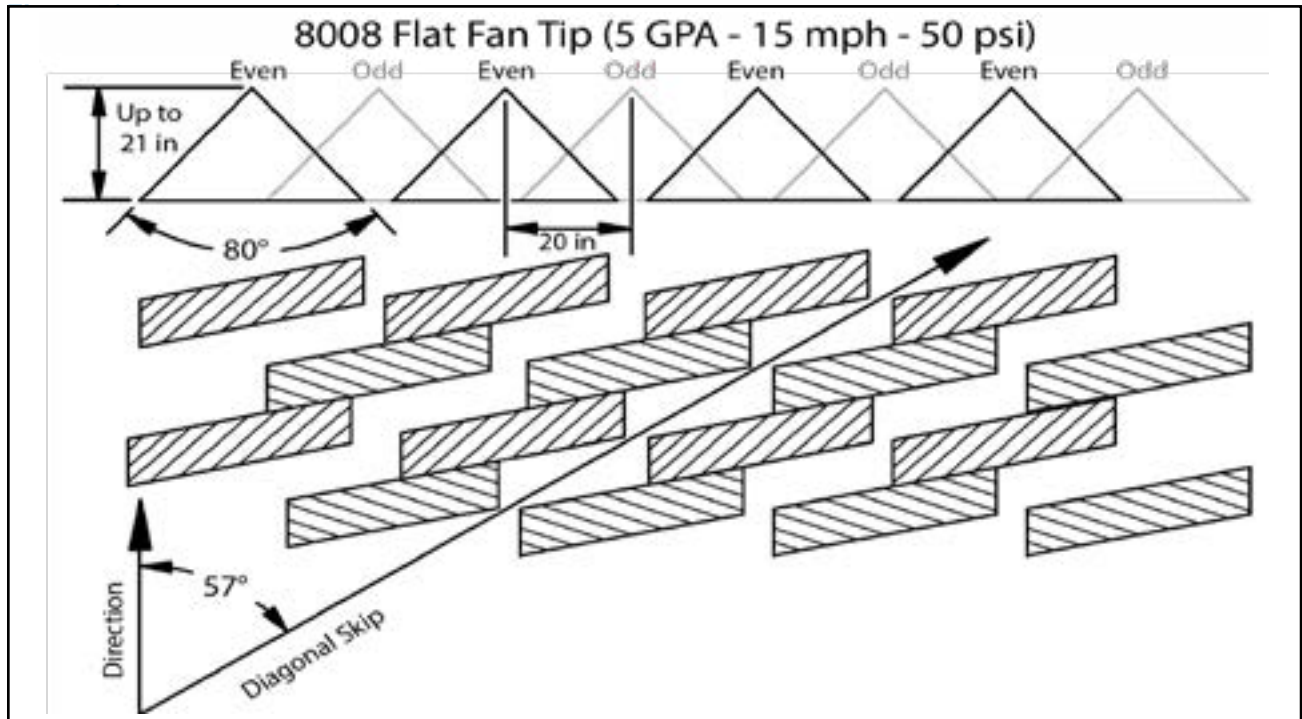


Figure 64: 8008 Flat Fan Tip

To Prevent Skipping

1. Use wide-angle spray tips and appropriate boom heights to provide 150% nozzle overlap.
 - For 80° tips, use 36 in or greater boom height.
 - For 110° tips, use 24 in 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.
3. Use additional caution when using drift control tips or drift control additives which increase droplet size and reduce droplet dispersion. Follow the boom height, duty cycle, and tip selection recommendations to make sure that there is 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. Follow boom height, duty cycle, and tip selection recommendations for hot and dry field conditions, large/mature weed pressures, etc.
5. Always apply Blended Pulse™ broadcast sprays using a 10 Hz or greater pulse frequency. The CapstanAG master module and display allow the pulse frequency to be reduced for non-sprayer applications, when uniform coverage is not required.

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Chapter 9: Schematics

Topics:

- [VCM Connector Pinout](#)
- [Hub Connector Pin Identification](#)
- [System Layout](#)

Hub Connector Pin Identification

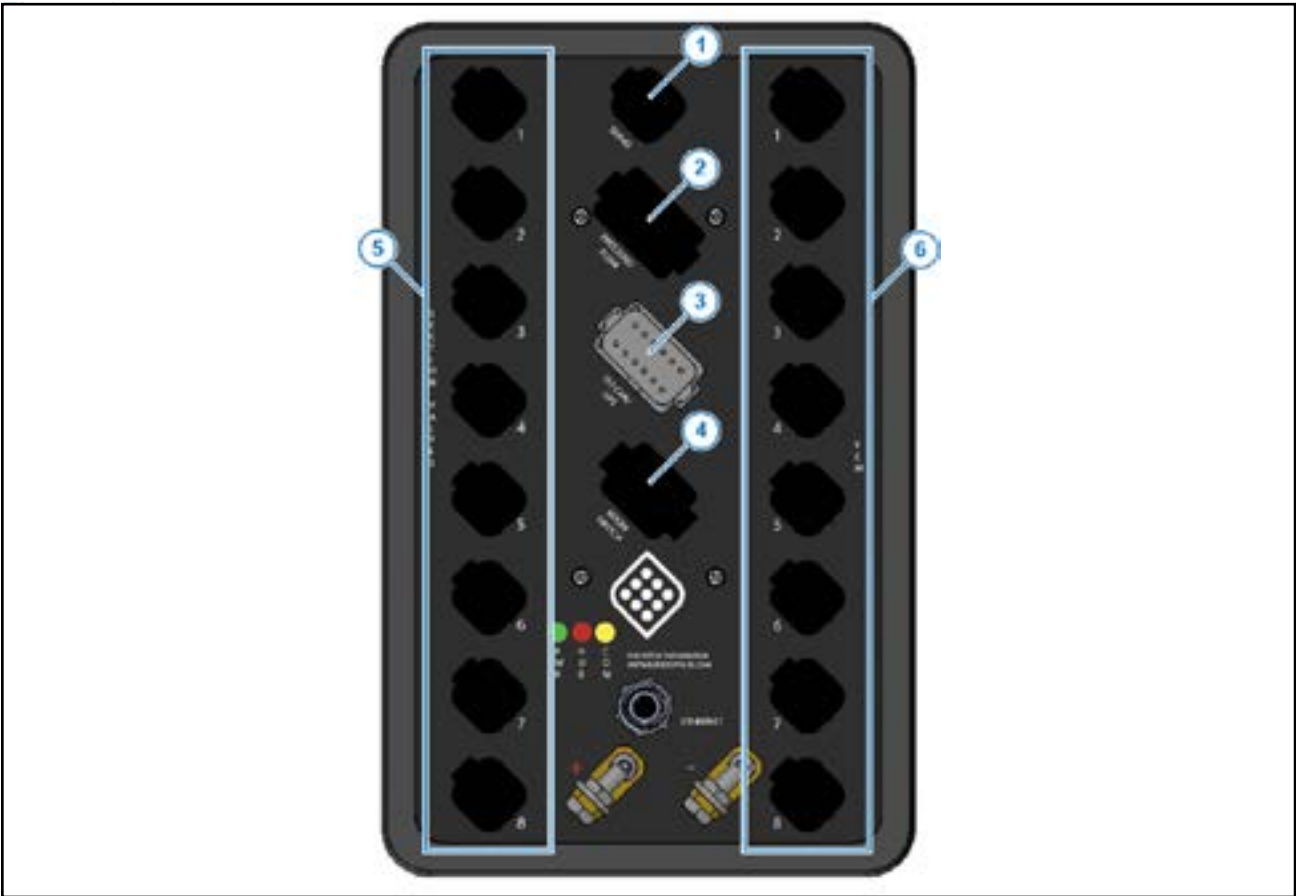


Figure 65: Gateway Hub

Table 27: Servo Port (Figure 65, Item 1) Pinout

Pin	Description	Pin	Description
1	Servo In INC (+)	4	Servo 2 Out Ground (-)
2	Servo Out INC (+)	5	Servo Out DEC (-)
3	Servo 2 Out Power (+)	6	Servo In DEC (-)

Table 28: Pressure/Flow Port (Figure 65, Item 2) Pinout

Pin	Description	Pin	Description
1	Flowmeter Power	7	Pressure Sensor Ground
2	Flowmeter Signal	8	Sparge Pressure Signal
3	Flowmeter Ground	9	Pressure Sensor Power
4	Pressure Sensor Power	10	Fill Flowmeter Ground
5	Boom Pressure Signal	11	Fill Flowmeter Signal
6	Pressure Sensor Ground	12	Fill Flowmeter Power

Table 29: ISO CAN/GPS Port (Figure 65, Item 3) Pinout

Pin	Description		Pin	Description
1	ISO CAN High		7	Sensor Power
2	ISO CAN Low		8	Analog In
3	Key Switched Power		9	Digital In 2
4	RS232 TX		10	Digital In 1
5	RS232 RX		11	Ground
6	Ground		12	Boom Master Switch In

Table 30: Boom Switch Port (Figure 65, Item 4) Pinout

Pin	Description		Pin	Description
1	Section 1 In		5	Section 5 In
2	Section 2 In		6	Section 6 In
3	Section 3 In		7	Section 7 In
4	Section 4 In		8	Section 8 In

Table 31: Section Valve Ports (Figure 65, Item 5) Pinout

Section Valve 1				
Pin	Description		Pin	Description
1	Section 1 Signal		4	Section Pressure
2	Ground		5	Section Ground
3	Section Power		6	Section 9 Signal

Table 32: Section Valve Ports (Figure 65, Item 5) Pinout

Section Valve 2				
Pin	Description		Pin	Description
1	Section 2 Signal		4	Section Pressure
2	Ground		5	Section Ground
3	Section Power		6	Section 10 Signal

Table 33: Section Valve Ports (Figure 65, Item 5) Pinout

Section Valve 3				
Pin	Description		Pin	Description
1	Section 3 Signal		4	Section Pressure
2	Ground		5	Section Ground
3	Section Power		6	Section 11 Signal

Table 34: Section Valve Ports (Figure 65, Item 5) Pinout

Section Valve 4					
Pin	Description		Pin	Description	
1	Section 4 Signal		4	Section Pressure	
2	Ground		5	Section Ground	
3	Section Power		6	Section 12 Signal	

Table 35: Section Valve Ports (Figure 65, Item 5) Pinout

Section Valve 5					
Pin	Description		Pin	Description	
1	Section 5 Signal		4	Section Pressure	
2	Ground		5	Section Ground	
3	Section Power		6	Section 13 Signal	

Table 36: Section Valve Ports (Figure 65, Item 5) Pinout

Section Valve 6					
Pin	Description		Pin	Description	
1	Section 6 Signal		4	Section Pressure	
2	Ground		5	Section Ground	
3	Section Power		6	Left Fence Row Signal	

Table 37: Section Valve Ports (Figure 65, Item 5) Pinout

Section Valve 7					
Pin	Description		Pin	Description	
1	Section 7 Signal		4	Section Pressure	
2	Ground		5	Section Ground	
3	Section Power		6	Recirculation Signal	

Table 38: Section Valve Ports (Figure 65, Item 5) Pinout

Section Valve 8					
Pin	Description		Pin	Description	
1	Section 8 Signal		4	Section Pressure	
2	Ground		5	Section Ground	
3	Section Power		6	Right Fence Row Signal	

System Layout (Legacy A14 VCMs)

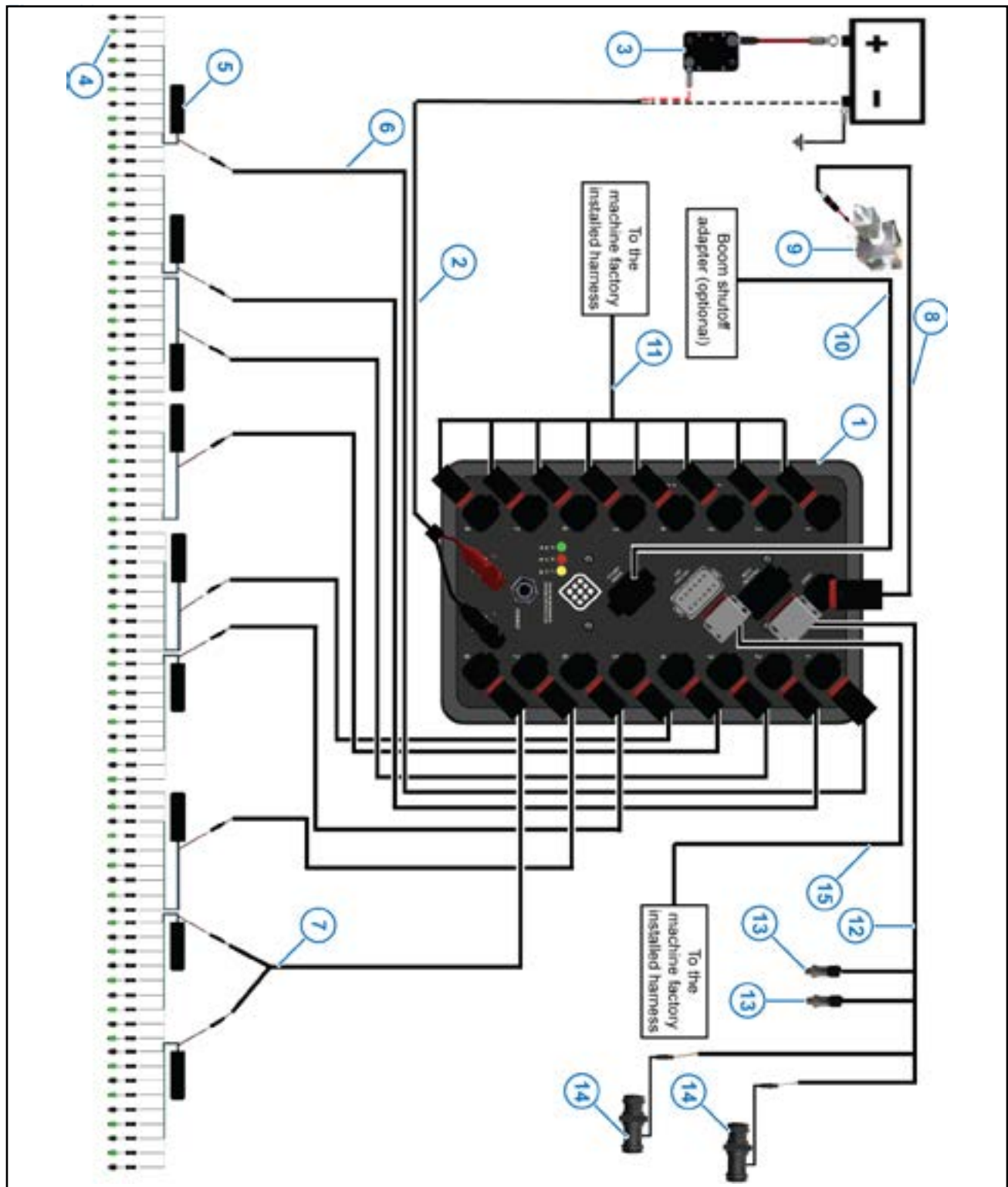


Figure 66: System Layout

Table 39: System Layout Diagram Components

Item	Description
1	Gateway Hub
2	Power Harness
3	Circuit Breaker Kit (Optional)
4	Valve Assembly
5	VCM
6	Extension Harness
7	Y-adaptor Harness
8	Harness to Connect to the Servo Port
9	PWM or Servo Valve
10	Harness to Connect to the Boom Switch Port
11	Shutoff Harness
12	Harness to Connect to the Pressure/Flow Port
13	Pressure Sensor
14	Flowmeter
15	Harness to Connect to the ISO CAN/GPS Port

VCM Connector Pinout

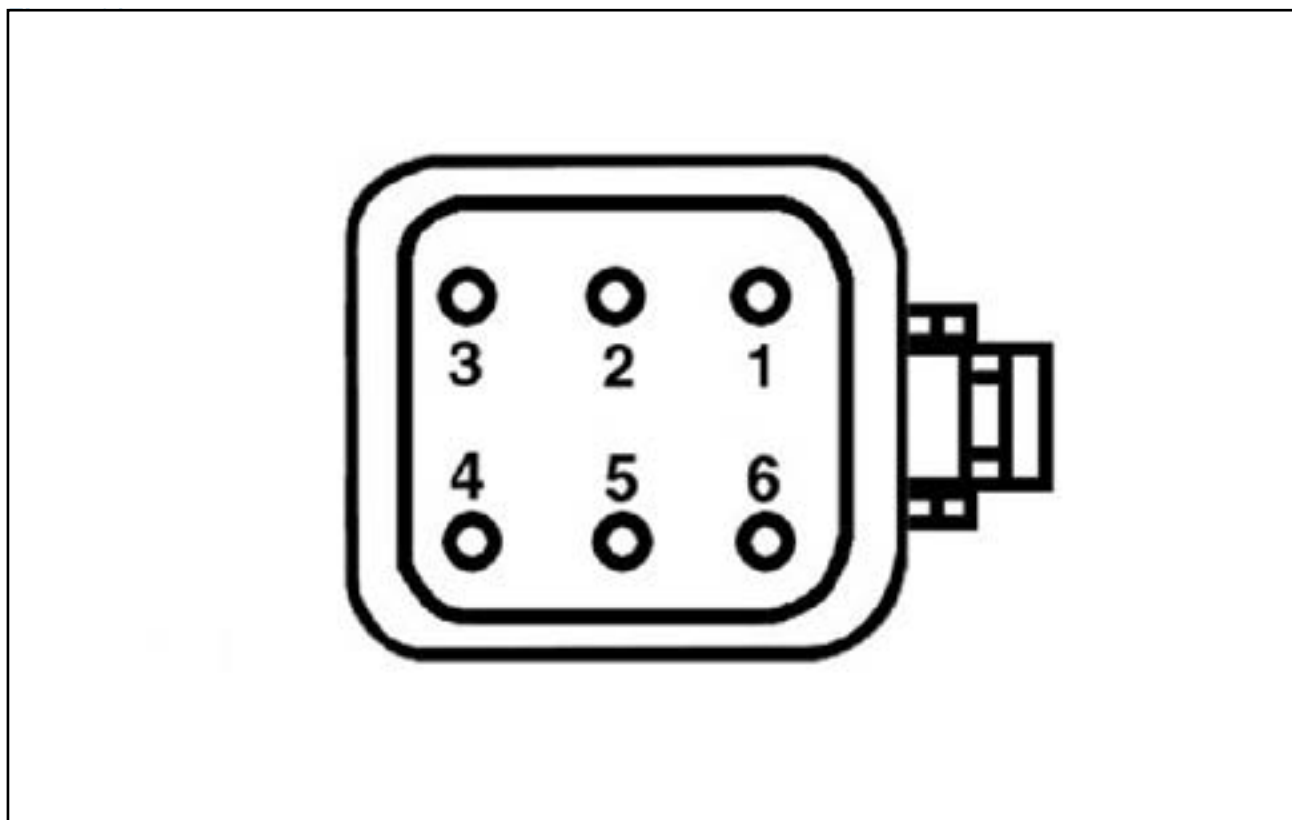


Figure 67: VCM Connector

Table 40: VCM Connector Pinout

Pin	Description	Wire Color	Pin	Description	Wire Color
1	Power	Red	4	CAN High	Yellow
2	Ground	Black	5	CAN Low	Green
3	Boom Switch Signal	Blue	6	Key Switched Power	Brown

Leap Start VCM Identification

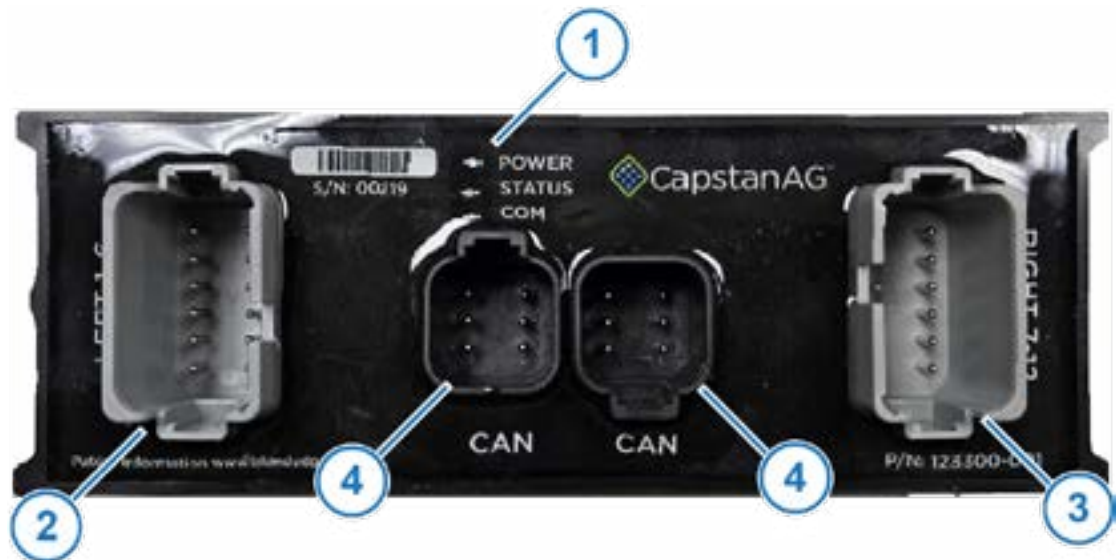


Figure 68: Leap Start VCM

Item	Description
1	VCM Status Lights
2	Valve Harness Connector for Valves 1-6
3	Valve Harness Connector for Valves 7-12
4	CAN/Power Connections

Table 41: Leap Start VCM Identification

Pin	Wire Color	Description	
		Left 1-6	Right 7-12
1	Red	Valve 6 Power	Valve 7 Power
2	Black	Valve 5 Power	Valve 8 Power
3	Blue	Valve 4 Power	Valve 9 Power
4	Yellow	Valve 3 Power	Valve 10 Power
5	Green	Valve 2 Power	Valve 11 Power
6	Brown	Valve 1 Power	Valve 12 Power
7	Brown/White	Valve 1 Return	Valve 12 Return
8	Green/White	Valve 2 Return	Valve 11 Return
9	Yellow/White	Valve 3 Return	Valve 10 Return
10	Blue/White	Valve 4 Return	Valve 9 Return
11	Black/White	Valve 5 Return	Valve 8 Return
12	Red/White	Valve 6 Return	Valve 7 Return

Table 42: Leap Start VCM Valve Connection Pinout

System Layout (Leap Start VCMs)

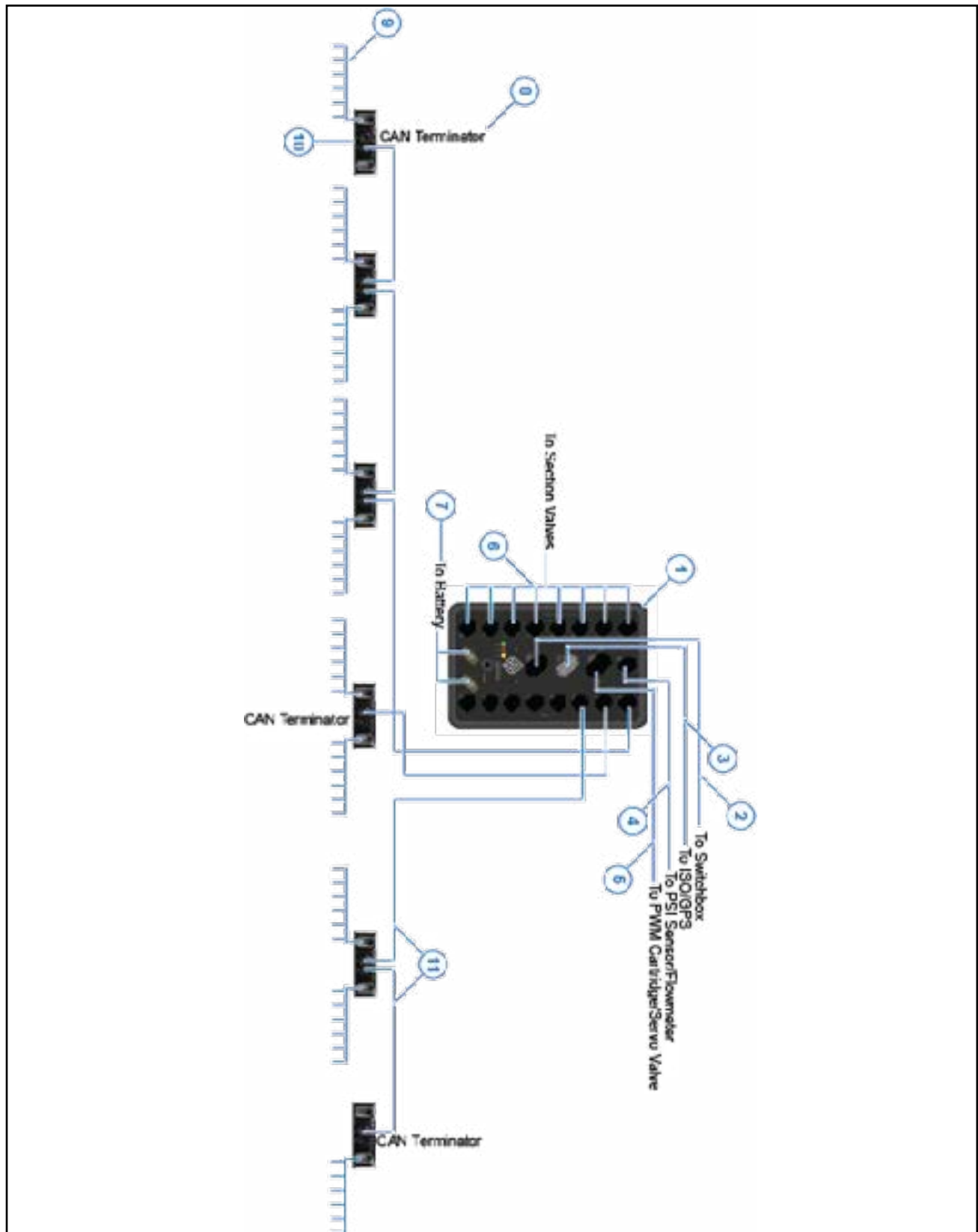


Table 43: System Layout Diagram Components with Leap Start VCMs

Item	Description
1	PinPoint III Hub
2	Harness to Switchbox (Optional)
3	Harness to ISOCAN/GPS Connections
4	Harness to Pressure Sensor/Flowmeter
5	Harness to Pump PWM Cartridge/Servo Valve
6	Harness to Section Valves
7	Harness to Battery
8	Leap Start VCM CAN Terminator
9	Leap Start VCM Valve Harness
10	Leap Start VCM
11	CAN Extension Harness

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Index

#

15 Series Coil Assembly Components 25, 27
24 Series Coil Assembly Components 28

A

Assemble the Nozzle Valves 29

B

Baseline Evaluation Process 83
Battery Safety 9
Blended Pulse™ Droplet Classification Table—Metric 78
Blended Pulse™ Droplet Classification Table—US Measurements 72
Boom/Nozzle Settings Menu Descriptions 56
Boom Shutoff Dry Test 47
Boom Shutoff Signal Test 115

C

CapstanAG App 18
Change a Profile Name 41
Change the Boom and Nozzle Settings 40
Change the Flow Settings 42
Change the Navigation Settings 42
Change the Pressure Settings 41
Change the Units of Measure 52
Chemical Safety 9
Circuit Breaker Test 112, 114
Clean the Nozzle Valve(s) 85
Clean the System 82
Coil Assembly Test 111
Compass Calibration Procedure 46
Configuration Settings 38

E

Emergency Safety 9
Establishing Bluetooth Connection 19

F

Factory Reset Procedure 38
Flow Settings Menu Descriptions 60

G

Gateway Hub Identification 31

H

Hub Connector Pin Identification 123

I

Initial Setup 38
Initial Setup Settings Descriptions 65
Inspect the System 82
Install the Battery Harness 35
Install the Circuit Breaker 35
Install the Gateway Hub 30
Install the Pressure Sensor 34
Install the Pressure Sensor Adapter Harness 34
Install the VCM Extension Harnesses 33
Install the VCMs 32
Interchange Components 111

J

Jump Start, Weld On, or Charge the Machine 82

K

Key Fob Boom Shutoff Dry Test 48
Key Fob Boom Shutoff Wet Test 51

L

Legacy Valve 27
Legacy Valve Service Procedure 85
Limited Warranty 12

M

Main System Screen 54
Maps Settings Menu Descriptions 62
Metric Nozzle Speed Ranges 74
Move the Spray Tube Mount 30

N

Navigation Settings Menu Descriptions 63
Nozzle Speed Ranges 74
Nozzle Valve Types and Component Identification 25, 27
Nozzle Valve Interference 30
Nozzle Valves 84

O

Operate the System 55

P

Personal Protective Equipment 9
Plunger Seal Inspection 89
Power to Pressure Sensor Input Test 117

Prepare for Installation and Setup 24
Pressure Control 21
Pressure Sensor Signal Test 116
Pressure Settings Menu Descriptions 57
Pressurized Fluid Lines 9
Prevent Skipping 119

R

Recommended Guidelines for Maintenance/Service
83

S

Safety Signs 8
Service the System 82
Settings Menu 56
Signal Words 8
Softkey Descriptions 55
Software Update 22
Software Version Information 17
Spitfire Valve 25
Spitfire Valve Service Procedure 87
Spray Skips from Poor Pulse Blending 118
Storage of the System 82
Strainers and Screens 83
System Dry Tests 47
System Identification 16
System Layout 126
System Load Capacity Test 113
System Settings 40
System Wet Tests 49

T

Technical Bulletin 118
This Manual 16
Tip Check 20
Tip Selection and Capacities 24
Troubleshooting Charts 92

U

US Measurement Nozzle Speed Ranges 68

V

VCM Connector Pinout 122
VCM (Geometry) Setup Procedure 39
Virtual Terminal Display 17
VT System Setup Procedure 46

W

Winterize for Storage 82

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