CONFIGURATION GUIDE

*Ag*GPS® EZ-Boom® 2010 System

Version 2.00
Revision A
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Trimble®

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Release notice

This is the August 2009 release (Revision A) of the *AgGPS EZ-Boom 2010 System Configuration Guide*.

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Configuring the System

In this chapter:

This document describes how to configure the *Ag*GPS® EZ-Boom® 2010 automated application control system from Trimble. The document contains descriptions and possible solutions to common configuration problems.

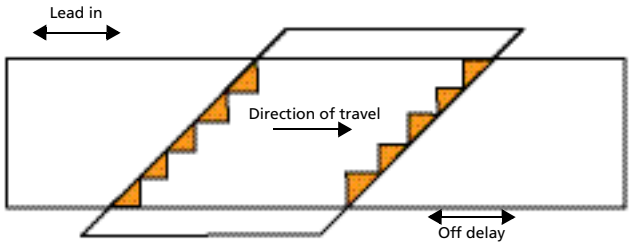
This document is intended for Trimble Distributors, Trimble Service Providers, Trimble Sales, and Trimble Employees.

Boom setup

Setting	Definition	How to use the setting
Fence Nozzles	Fence nozzles are spray sections at the far ends of the boom that point to the sides to cover any fence lines.	Enable or disable fence nozzle control. Options include: Left, Right, or both. On a 6-boom section sprayer with enabled fence row nozzles, from left to right: • Switch 1 controls the left fence nozzle (if enabled) • Switches 2-7 control the 6 standard boom sections • Switch 8 controls the right fence nozzle (if enabled) If there are 6 boom sections and neither fence nozzle is enabled, then the sections are controlled by the first 6 switches, starting with switch 1 on the left. ***Note –*** *Fence nozzles are always controlled manually through the hardware switches. To activate them, flip the section switch to the On position.*
Number of Sections	The number of sections that make up the spray boom.	For example, if you have five boom sections, select five sections in the controller. This will assign five switches. Do not include fence rows in the number of sections. If you enabled fence rows on a 5-boom section system, select 5 boom sections (not 7).
Section Widths	Enables you to define individual section widths. By default the swath width is divided equally by the number of sections.	The Section Widths of the boom sections default to a value calculated by dividing the Swath Width value by the Number of Sections value. If the boom has unequal boom widths, you can manually change this configuration to ensure optimal performance. This function will never allow a width to be more than the set boom width. When you change widths, change the sections in numerical order. If you try to change widths erratically, for example, from boom section 3 to 1 to 6, you are fighting this system. ***Note –*** *Before you change the Section Widths, make sure that you have the correct Implement Width in the system.*

Swath control setup

Setting	Definition	How to use the setting
Boom Control	Select manual or automatic boom control.	If you select manual boom control, you can control the spray boom sections with the switches on the EZ Boom controller. If you select automated boom control, the EZ-Boom controller switches the boom sections on and off. If you use automated boom control, you can still switch to manual with the EZ-Boom controller. You do not need to return to the *Configuration* menu. Do one of the following: **Automated Boom Control to Manual Rate Control** 1. While the vehicle is moving, switch from Rate 1 (or Rate 2) to manual. You can now control flow (gallons or liters/minute) instead of application rate (gal/ac or liters/ha). 2. Adjust the flow as required. The boom control will ***not*** be in manual mode. When you exit a boundary or enter a sprayed area, the boom sections will turn on and off when necessary to reduce overlap or skip. You will not be able to spray outside the boundary. **Manual Boom Control to Manual Rate Control** 1. While stationary, switch from Rate 1 (or Rate 2) to manual. You can now control flow by gallon/minute instead of by gallon/acre. 2. Adjust the flow as required. The boom control will be in manual mode. When you exit a boundary or enter a sprayed area, the boom section remains turned on, and you will be able to apply an application in areas that have already been sprayed. ***Note –*** *This setting is useful if the user runs out of application material and does not apply the correct amount in a specific area with a sprayed coverage area. If the boom control is set up for automated boom control, they will not be able to apply a second rate until they switch to manual boom control.*
Lead In / Start Overlap	You can use Lead In / Start Overlap in one of the following ways, which have different effects: • To compensate for the delay between activating spray and the spray actually beginning to be applied • To begin spraying before reaching the area to be sprayed to create deliberate overlap.	If you set the Lead In time to exactly the time that it takes for the spray to start after it is activated, the system will use your vehicle speed to anticipate when spray should begin to start at the correct point. It does not matter what speed you drive at, so this is not speed dependent. If you increase the Lead In time so the sprayer starts spraying before you enter an area (to create a buffer), then the extra distance covered is speed dependent. You cover more distance in 1 second at high speed than at low speed. Lead in is a time-based method of compensating for delay in flow control hardware or deliberate overlap and Start Overlap is a distance-based method.

Setting	Definition	How to use the setting
Off Delay / End Overlap	The Off Delay / End Overlap setting compensates for delays in flow control hardware stopping flow and / or allows deliberate overlap when entering an area that has already been applied.	Enter the actual time that the system takes to stop spraying after the boom valves are commanded to close: • A negative Off Delay turns off the boom valves before you get to the covered area. • A positive Off Delay turns off the boom valves after crossing into the covered area. The Off Delay time is not speed compensated. Off Delay is a time-based method of compensating for delay in flow control hardware or deliberate overlap and End Overlap is a distance-based method. **Example** A user travelling at 10 mph needs a higher Off Delay than a user travelling at 5 mph. The user travelling at 10 mph will cover 14.7 ft/sec, and the user travelling at 5 mph will cover 7.3 ft/sec. 

Setting	Definition	How to use the setting
Allowable Overlap	Controls the amount of boom section overlap before the section is automatically switched off.	The FieldManager™ display and EZ-Guide 500 lightbar have a slider bar that covers from Less Skip (99%) to Less Overlap (1%). • ***Less Skip***. If you set the slider towards this end of the scale, the system will turn off sections when they cover a larger percentage of any fully covered areas. As a result, you may get some double-coverage. Sections will turn on as soon as they move from a sprayed to an unsprayed area. • ***Less Overlap***. If you set the slider towards this end of the scale, the system turns off sections as soon as you reach any covered area. This may leave some skips. Sections will not turn on until the entire section has moved from a sprayed to an unsprayed area. Use this end of the scale when you want economy of product. ***Note –*** *The changes to the FieldManager display were made in version 3.20, and changes to the EZ-Guide 500 lightbar were made in version 2.00. Prior to version 3.2, the FieldManager display still had the Minimize Skip / Minimize Overlap settings.*
Minimize Skip / Minimize Overlap	Controls the amount of boom section overlap before the section is automatically switched off.	These settings are used on the EZ-Guide Plus lightbar: • ***Minimize Skip*** is where both end points of a section must be in covered area before the EZ-Boom system will switch off. • ***Minimize Overlap*** is where one end point only of a section must be in a covered area before the EZ-Boom system will switch off. The key to understanding these concepts is to always think in terms of "will the section be commanded ***off***". **Using the EZ-Guide® Plus lightbar** • If the boom section "straddles" the uncovered cell, both outer points will be in the covered area and it will be commanded OFF and not spray the skip area. • If the user sets Minimize Overlap and configures the swath/application to have overlap, the outer boom sections may never turn on. ***Note –*** *The changes to the FieldManager display were made in version 3.20, and changes to the EZ-Guide 500 lightbar were made in version 2.00. Prior to version 3.2, the FieldManager display still had the Minimize Skip / Minimize Overlap settings.*

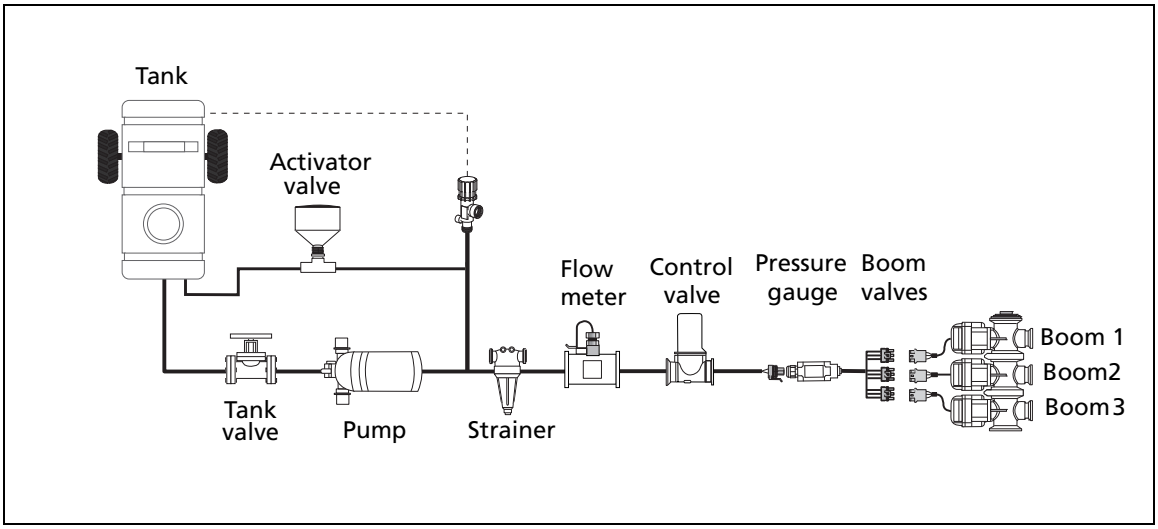
Application setup

Setting	Definition	How to use the setting
Rate Control	Enables or disables application rate control.	Set the Rate Control to: • *On*. This enables the EZ-Boom system to control the rate response and boom switching. When you select On, the EZ-Boom system takes over all rate control functions from the third-party controller. The EZ-Boom system controls the boom valves, flow meter, and control valve. You can also view readouts from two sets of pressure sensors. • *Off*. This allows the EZ-Boom system to control the boom switching while leaving the third-party console to control the application rate. When you select Off, you must connect a T-harness directly from the third-party console to the EZ-Boom system. The EZ-Boom system monitors only the signal line leading to the boom valves: The third-party display controls the flow meter and control valve.
Target Rate 1 Target Rate 2	Preset application rates that you can select from the EZ-Boom console switch.	If you define preset rates in the configuration, you can change between these rates while working, without having to manually increment the rate. **Example** • Set Target Rate 1 to 10.0 gallon/acre and use this for normal spraying conditions, such as short and thinned-out weeds in a specific area. • Set Target Rate 2 to 14.0 gallon/acre and use this when you have tall and thick weeds in a specific area that may require you to spray more chemicals to achieve adequate burn down.
Allowable Error	When the error between target flow and actual flow is less than this amount the flow control valve will not be adjusted. Allowable error is set in units of percent.	To achieve a lower error percentage, the value must be lower than the default setting. If you set a value that is much lower, the valve will work harder to achieve the required rate and this could cause oscillations. To reduce the oscillation or an increase in the actual rate, increase the allowable error, or adjust the servo/pump settings in the control valve setup menu. See also Control valve setup, page 10.
Minimum Flow	Measured in gallons/min. The control valve stops closing when the actual flow falls below the minimum flow setting; this flow is scaled for the active swath width. Set the minimum flow for the minimum flow with a full swath.	When you apply a given target rate at a selected speed, the EZ-Boom system controls the rate until you lower your speed (for example, at obstacles or a turn-about point). The sequence works at a lower speed when a lower flow/volume is applied to a specific area. When you reach this point and the actual flow is at the minimum flow setting, the EZ-Boom system recognizes this and maintains the value that you set. ***Note –*** *Minimum Flow is used as a safety feature. All sprayers currently on the market need a quantity of flow that maintains the flow from the body nozzles on the boom sections. When this pressure is met, the check valves in the body nozzles lock and stop fluid from coming out of the nozzle itself. To ensure that this does not occur, add a Minimum Flow value to the setup.*

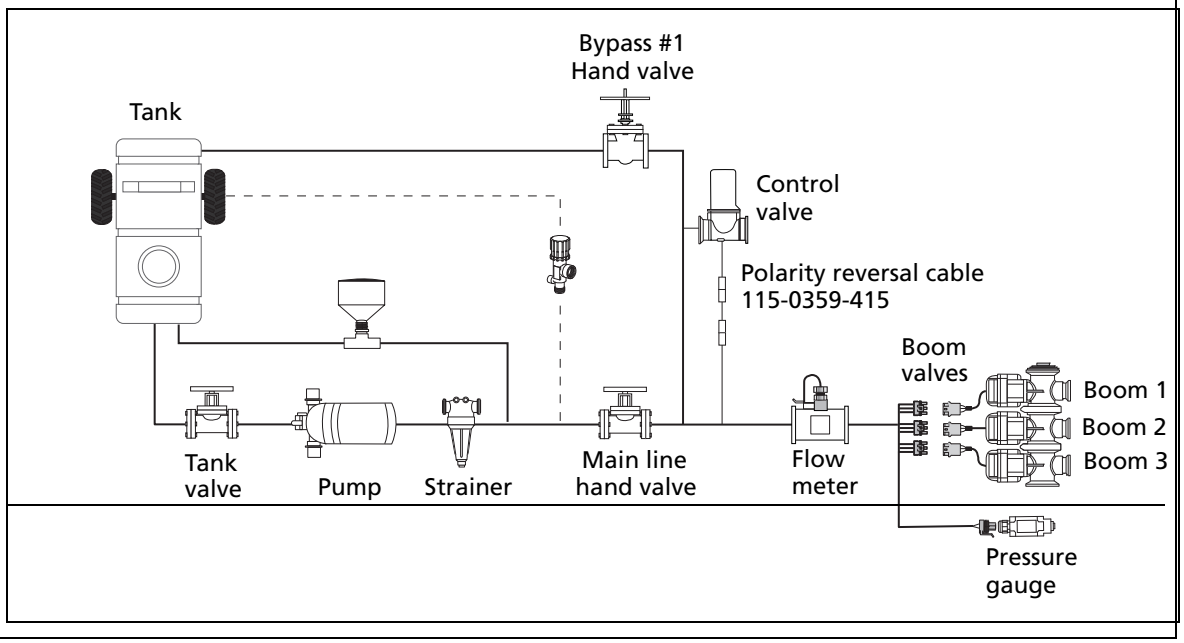
Setting	Definition	How to use the setting
Rate Increment	The amount by which the current application rate (Rate 1 or Rate 2) increases or decreases each time you press the Rate Adjustment (increase/decrease) switch.	Pick a rate increment step size suited for the application. The actual rate increment adjustment is done using the console +/- switch during operation. **Example** If Rate 1 = 10.0 gallon/acre, and the rate increment = 1.0 gallon/acre, press the switch up once to increase Rate 1 = 11.0 gallon/acre. ***Note –*** *If you use the pre-selected target rates (Rate 1 or Rate 2), toggle the switch every time that you want to increase or decrease the rate. When the system is in manual mode, you can hold the switch in the upward position—the application will continue to increase automatically. Release the switch when you reach the required rate.*
Flow Control Delay	This setting delays adjustments to the control valve when going from zero to non-zero flow. The setting is measured in seconds.	If the system is either very slow or very fast in reaching its target rate, you can adjust the Flow Control Delay (higher or lower, in seconds) to keep the flow control valve constant until the system stabilizes. This may prevent a situation where the flow rate starts oscillating due to premature adjustments on initial startup.
Off When Stopped	Controls whether the EZ-Boom system turns the sections off when the speed goes to zero or the vehicle stops.	Use primarily for planter row control (Tru-count clutches) to enable the clutches to remain engaged and planting when the vehicle stops and helps prevent skips when stopping and starting while planting. ***Note –*** *For planter row shutoff control, set off-when-stopped to No to prevent skips when stopping and starting.*

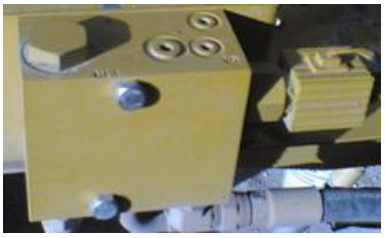
Control valve setup

Setting	Definition	How to use the setting
None (No Control Valve menu)	If Rate Control is Off, the EZ-Boom system sends commands only to the boom control; it does not look for a rate response from the flow meter, or send a signal out to the control valve.	Use this function only if the customer wants to use the EZ-Boom system for boom control. This allows the third-party controller to control the flow rate but not the boom control.
Inline Servo	Used to achieve rate control. If selected, the EZ-Boom system actuates a butterfly or ball valve in the solution hose that controls the product flow to the booms. • When the valve opens, the flow increases. • When the valve closes, the flow decreases.	Find the control valve and verify that it is located on the same line that the flow meter is on. If the control valve and flow meter are on the same line, you have an inline servo setup. Use this on: • The majority of pull-type sprayers • Case IH units that are AIM Command systems

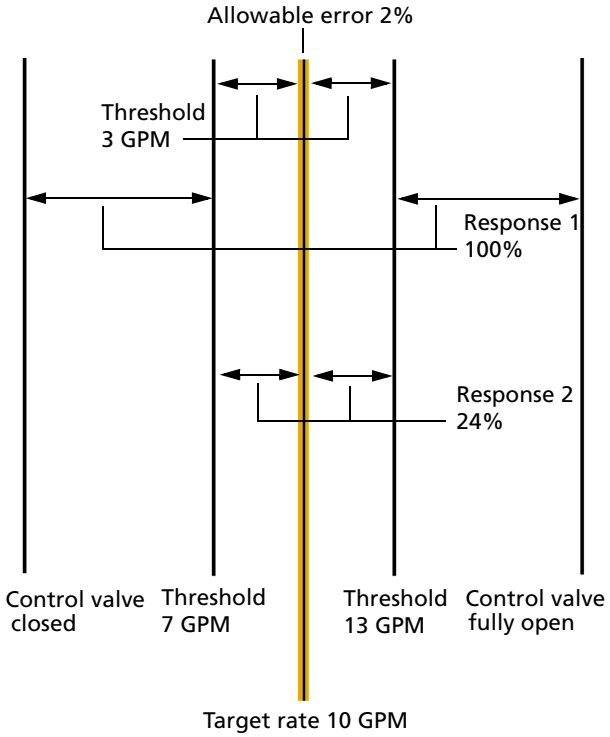


Setting	Definition	How to use the setting
Bypass Servo	Used to achieve rate control. If selected, the EZ-Boom system actuates a butterfly or ball valve in the return line to the solution tank. • When the valve opens, the flow to the boom valves decreases and this increases the flow through the return line back to the solution tank. • When the valve closes, the flow to the boom valves increases and this decreases the return to the solution tank.	Find the control valve and verify that it is located on a return line going back to the solution tank. The control valve and flow meter will not be in line with each other; they will each will be on a separate line. The control valve goes to the solution tank and the flow meter goes to the boom sections.



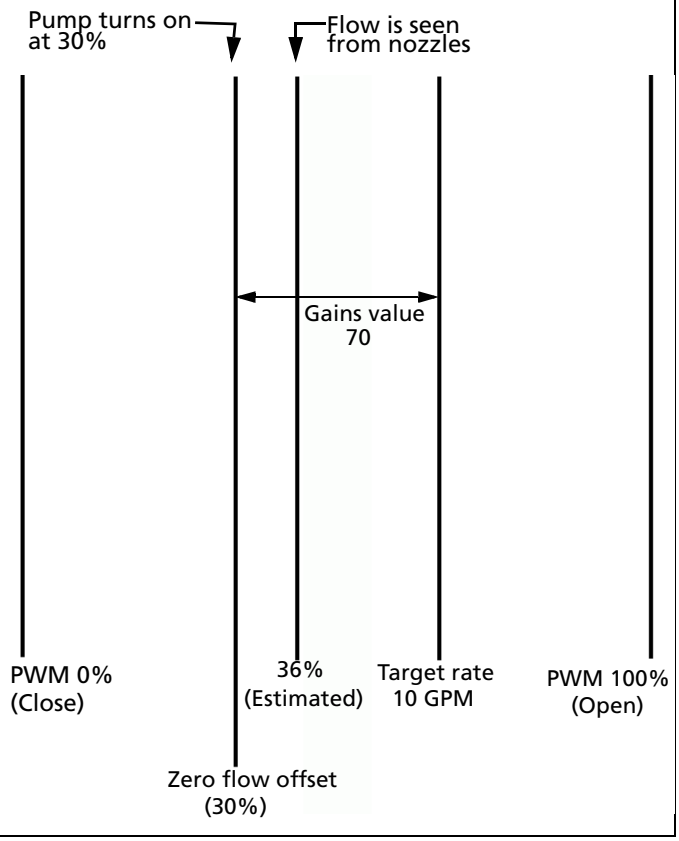
Setting	Definition	How to use the setting
Pump Servo	Used to achieve rate control. If selected, the EZ-Boom system sends changes to the solution pump to adjust product rate. The Pump Servo setting controls an electric motor which actuates a hydraulic valve. As the valve actuates, it adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly.	Find a valve that has an electric motor on top of a hydraulic manifold. The hydraulic manifold has lines coming into it from the priority pump on the sprayer. The output lines are connected to a pump (for example, a centrifugal pump) that is in-line with the flow meter. 
PWM (standard)	Used to achieve rate control. The EZ-Boom system sends speed changes to the solution pump. The PWM pump setting controls an electric solenoid valve which adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. PWM standard only changes the duty cycle of the signal line through the continuous power and leaves the common ground alone.	Find a valve that has a single electric solenoid attached to a hydraulic manifold. The hydraulic manifold has lines coming into it from the priority pump on the sprayer. The output lines are connected to a pump (for example, a centrifugal pump) that is in-line with the flow meter. PWM pumps have two wires going to the solenoid—one line is continuous power and the other is common ground.  The solenoid moves by the duty cycle of what is fed by the controller. On a standard PWM, the duty cycle changes on the continuous power side and not the common ground. This results in more or less hydraulic fluid fed to the pump, which causes the pump to turn slower or faster. When the pump spins faster, the boom can apply more flow.
PWM (grounded)	Used to achieve rate control. The EZ-Boom system sends speed changes to the solution pump. The PWM pump setting controls an electric solenoid valve which adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. PWM grounded only changes the duty cycle of the signal line through the common ground and leaves the continuous power alone.	Find a valve that has a single electric solenoid attached to a hydraulic manifold. The hydraulic manifold has lines coming into it from the priority pump on the sprayer. The output lines are connected to a pump (for example, a centrifugal pump) that is in-line with the flow meter. PWM pumps have two wires going to the solenoid—one line is continuous power and the other is common ground.  The solenoid moves by the duty cycle of what is fed by the controller. On a grounded (or sinking) PWM, the duty cycle changes on the common ground side and not the continuous power. This results in more or less hydraulic fluid fed to the pump, which causes the pump to turn slower or faster. When the pump spins faster, the boom can apply more flow.

Inline servo, bypass servo, pump servo setup

Setting	Definition	Process description
Valve Response 1	Controls the response time of the valve when the actual rate is outside the response threshold. A larger number makes the valve respond more quickly; a lower number makes the valve respond less quickly.	If you select a target rate of 10.0 gallon/acre and a threshold setting of 3, which shows an indication of a (+) or (-) point on each side of the target rate, you have a boundary at 7.0 gallon/acre and at 13.0 gallon/acre in relation to the target rate. Response 1 drives the control valve at 100% speed from either the closed or full open. Response 1 will run like this until it reaches the threshold: Once it is within the 3 (+) or (-) of the target rate, Response 1 drops off and Response 2 becomes active. Response 2 then runs at 24% of its speed capacity until it reaches the actual rate of 10.0 gallon/acre (the target rate). Once the valve is within the 2% allowable margin of error, it stops moving. When the flow ventures out of the 2% allowable margin of error, the valve then uses Response 2 at 24% to respond directly back to the target rate (10.0 gallon/acre). The control valve will work like this until there is no longer a rate response from the flow meter. The following diagram shows how the servo settings work: 
Valve Response 2	Controls the response time of the valve when the actual rate is inside the response threshold. A larger number makes the valve respond more quickly, while a lower number makes the valve respond less quickly. To reduce the likelihood of an overshoot when adjusting the flow rate, lower the Response 2 value.	
Valve Threshold	This setting affects the amount above or below target flow at which the control valve uses Response 1 (Fast) or Response 2 (Slow). Valve threshold is measured in gallons per minute (GPM.	
Close on Zero Flow	When enabled, this setting closes the control valve when target flow is zero.	

Note – *Bypass and Inline values are similar and both setups help control the flow. Inline usually works with a smaller application and can control that better than a Bypass as this would be erratic over the application. However, Inline may not be suitable to control a higher flow and a Bypass would be more useful for servo control. For more information on servo control settings, see the AgGPS EZ-Boom 2010 System Getting Started Guide.*

PWM (Pulse Width Modulation) pump, PWM grounded setup

Setting	Definition	Process description
Close on Zero Flow	When enabled, this setting closes the control valve when target flow is zero.	Select a target rate (for example, 10.0 gallon/acre), and set the frequency for the FWM valve (for example, 122 Hz—the frequency required for reading the signal from the control by a Raven PWM). When you turn the pump on, the valve starts to react to the rate that it needs to achieve (10.0 gallon/acre). Because the zero flow offset was set to 30%, the valve automatically starts to increase to 36% instead of 0%. When it reaches 36%, flow is seen from the body nozzles on the boom. ***Note –*** *36% is not a set value and will be different on every sprayer model.* This enables you to increase the Zero Flow Offset to obtain a more direct response without requiring a delay in the pulse width modulated valve. The Gain value is used to speed up or slow down the responsiveness of the PWM in order to reach the target rate of 10.0 gallon/acre. The following diagram shows how the PWM settings work: 
Frequency	The frequency of the signal that controls the pulse width modulation valve. This value is specific to the type of valve being connected to.	
Gain	Controls the responsiveness of the PWM valve. The larger the PWM gain value, the more responsive the valve will be. The smaller the PWM gain value, the less responsive the valve is to reaching target.	
Zero Flow Offset	The shut-off point of the PWM valve	

Note – *When you select Zero Flow Offset, a certain speed or flow is required to achieve the required rate. For example, if the sprayer backs into a corner and can not achieve the required rate from here because there is either no speed or no flow, the user must switch the rate to manual and turn off the boom switches. This places pressure against the boom*

valves so that when the user drives away from the corner, the applicator will turn on the boom switches, opening the valves. This can be applied from a given stop. After the applicator has gained some speed, the user can then switch from manual to Rate 1 or 2 as required.

Tank setup

Setting	Definition	How to use the setting
Capacity	The volume the spray tank holds when full.	Adjust this setting before you adjust any other setting in this group. As the remaining settings are based on this setting, it must be accurate to ensure manageable values in the field.
Current Volume	The volume currently in the spray tank. As you continue to spray, the Current Volume decreases.	Use this setting to: • Adjust current volume in the tank. • Check how much fluid is still in the system. When you are spraying, the value decreases. The volume is based on the flow meter and how much fluid is going through the meter at a given time.
Low Limit	The volume at which you are alerted that the low limit is reached.	This setting alerts you when the tank is nearly empty. Make sure that you set the value high enough so that the system does not lose pressure or cause an intermittent flow issue. It is important to have good pressures while running the machine. If the lower limit is set too low, you may have erratic applications to the field. You must also consider whether the product foams—if the product foams, it will have less volume than shown on screen.
Refill Method	Enables you to either refill or partial refill the volume in the tank.	Select one of the following refill methods: • ***Refill*** – if you fill the tank to maximum capacity. • ***Partial Refill*** – if you add a specific amount to the tank when you refill it. The current volume is increased by the Partial Refill Quantity. ***Note –*** *If you select Partial Refill, the Partial Refill Quantity field appears on the Tank Setup Screen.*
Partial Refill Quantity	Changes the amount of volume incremented back into the tank, each time you do a Partial Refill Now.	Select a Partial Refill Quantity (ranging from 1 gallon upward). The quantity in the tank increases by this quantity every time that you select Partial Refill Now. **Example** If you set a Partial Refill Quantity of 100 gallons, the quantity in the tank will increase by 100 gallons if you press Partial Refill Now. If you have 225 gallons in the tank and then press Partial Refill Now twice, the tank volume increases from 225 gallons to 425 gallons.

Setting	Definition	How to use the setting
Partial Refill Now	Adjusts incrementally to the current volume by the amount in the Partial Refill Quantity value.	When you spray a field and then refill the tank by only a few gallons instead of to capacity, you can reset the amount that shows in the tank. **Example** If you have 225 gallons in a tank, and need an additional 300 gallon to finish the field, you can fill the sprayer up to 525 gallons. When you have filled the sprayer, select Partial Refill Now. If the default Partial Refill Quantity is set to 100 gallons, press Partial Refill Now three times to increase the volume from 225 gallons to 525 gallons.
Refill Tank Now	Changes the amount of the volume currently being viewed back to the full capacity that is set in the capacity screen on the display.	When you spray a field and the tank is empty, you can refill the tank to capacity. If you do this, you will have to change the nearly empty tank value to the capacity setting of the tank. If the tank capacity is 1000 gallons, you can refill the tank when it is nearly empty (for example, 50 gallons remaining), and then press Refill Tank Now. This will change the 50 gallons showing on screen to 1000 gallons as this is the tank capacity.

Pressure calibration

Setting	Definition	How to use the setting
Calibrate Pressure Sensor 1 Calibrate Pressure Sensor 2	Enables or disables a pressure sensor reading on the run screen of the: • EZ-Guide® Plus lightbar • EZ-Guide 500 lightbar • FieldManager™ display	If the user has a pressure transducer installed and wants to have a pressure sensor show on the display, do the following: 1. Enable Pressure Sensor 1 or Pressure Sensor 2. 2. Set the correct Slope value, see the pressure sensor owner's manual. 3. Check the pressure gauge reading and then set the Set Point value. If there is not a gauge, insert a gauge in-line with the pressure sensor. 4. Select **Calibrate Now**. 5. Return to the *Pressure Calibration* menu. If the pressure reading is not correct on the manual pressure gauge, re-run the wizard to change values as required. If the user does not have a pressure transducer installed and wants to have a pressure sensor show on the display, they must do the following: 1. Install a pressure transducer. 2. Cable it to the EZ-Boom 2010 controller or check to see if there is signal, power, and ground coming back into the controller.

Setting	Definition	How to use the setting	
		Pressure sensor pinouts for the EZ-Boom controller Pressure Sensor 1: Power is a +12 V source	
			Secondary connector (14-pin connector)
		Ground	9
		Power	8
		Signal	10
		Pressure Sensor 2: Power is a +12 V source	
			Secondary connector (14-pin connector)
		Ground	5
		Power	4
		Signal	6
		Note – *To receive or enable Pressure Sensor 1 and 2 to work simultaneously, you must have firmware version 1.01 or later installed on the EZ-Boom controller. Pressure Sensor 1 can be labeled at boom/pump pressure. Pressure Sensor 2 was added for spare/return pressure.*	
Slope	The relationship between pressure and the output of the sensor, measured in mV/PSI or mV/kPa	This is a set value determined by the manufacturer of the pressure sensor. If the value is not correct, the pressure readout will either be inaccurate or not give a dynamic readout, that is, the readout will be stationary and will not fluctuate with the pressures shown on the display.	
Set Point	The actual pressure at the time of calibration.	If your sprayer has a pressure gauge fitted, use it to determine the Set Point. If the sprayer does not have a pressure gauge on the machine, add a pressure gauge in-line to the pressure sensor. This allows you to verify that the slope is set correctly/accurately in an electronically versus a manual readout.	

Flow calibration

Setting	Definition	How to use the setting
Flow Meter Calibration	The calibration number from the flowmeter measured in pluses/gallon or pulses/liter.	You must enter the Flow Meter Calibration value when you set up the EZ-Boom system to work with flow control. It is not required if you are only using boom control. The number is on the flow meter. If you cannot see the number, contact the manufacturer of the meter. ***Note –*** *If you are using a Raven flow meter, enter the calibration number exactly as it is written on the tag. For other flow meter brands, add a zero to the number when you enter it, for example, if the number is 75, enter it as 750.*
Target Rate	The target application rate to be used for the flow calibration sequence.	You can use the default setting to make sure that the unit works correctly. However, Trimble recommends that you change the value to the targeted rate. If you do this, the rate will stabilize and perform slightly better by reaching the target rate.
Speed	The target ground speed to be used for the flow control calibration. For example, 12 mph.	You can use the default setting to make sure that the unit works correctly. However, Trimble recommends that you set the value to the speed that the user will be traveling while applying the expected rate. If you do this, the rate will stabilize and perform slightly better while traveling at the expected speed (miles per hour).
Total Nozzles	The total number of nozzles on the spray boom, excluding the fence row section nozzles.	Advise the user to select the correct number of boom section nozzles used for spraying. Make sure that they do not include the fence row nozzles.
Calibration Steps	A flow calibration improves the performance when using the EZ-Boom 2010 controller.	Trimble recommends this procedure. 1. Make sure that the EZ-Boom system is configured and that the spray rig is connected. 2. Enter the Flow Meter Calibration shown on the flow meter. 3. Enter the Target Rate (the expected application rate). 4. Enter the Speed (the expected driving speed). 5. Enter the Total Nozzles—include the boom section nozzles only. 6. Select **Calibrate Now**. 7. Turn the pump on and open the boom valves. 8. Check that the system is at normal operating pressure and that all nozzles are functioning correctly—nozzles and screens should not be plugged or defective. 9. Take a timed sample from at least three nozzles—check that they are distributing the correct gal/min or oz/min during this time. 10. Average the timed samples that you recorded—for example, if you have three samples, add the gal/min or oz/min readings and then divide the total by 3. 11. Check that the current rate is reaching the target rate that you are trying to achieve. 12. Check that the calculated flow is consistent with the average flow, see Step 10.

Setting	Definition	How to use the setting
Nozzle Selections	Select the correct nozzles to obtain optimal performance.	You must select nozzles carefully to ensure that they are in the correct range between PSI, gallons/minute, and spacing width. If you do not take these values into account, it is almost impossible to obtain the current targeted rate. To select the correct nozzles: 1. Check the gal/min that the grower wants to achieve. Use the following equation to determine gallon/minute from the requested gallon/acre value: $GPM = \frac{GPA x MPH x W}{5,940}$ Where: – GPM = gallons per minute – GPA = gallons per acre (application rate user wants to achieve) – MPH = miles per hour (speed at which user wants to drive) – W = application width (spacing width between nozzles in inches) 2. When you have determined the gallon/minute rate, use the following flow characteristic chart to select the correct nozzle to use for this application. For example, if the spacing is 30”, select a size from a specific nozzle manufacturer. The following table shows the nozzle categories.

Nozzle category	PSI	Capacity one nozzle in GPM	Capability one nozzle in oz/min	GPA 30°											
				3 MPH	3.5 MPH	4 MPH	4.5 MPH	5 MPH	5.5 MPH	6 MPH	6.5 MPH	7 MPH	7.5 MPH	8 MPH	8.5 MPH
Nozzle #1 95 degrees spray angle 0.15 GPM nozzle capacity	30 40 50 60	0.13 0.15 0.17 0.18	17 19 22 23	8.6 9.9 11.2 11.9	7.4 8.5 0.6 10.2	6.4 7.4 8.4 8.9	5.7 6.6 7.5 7.9	5.1 5.9 6.7 7.1	4.7 5.4 6.1 6.5	4.3 5.0 5.6 5.9	4.0 4.6 5.2 5.5	3.7 4.2 4.8 5.1	3.4 4.0 4.5 4.8	3.2 3.7 4.2 4.5	3. 0 3. 5 4. 0 4. 2
Nozzle #2 95 degrees spray angle 0.2 GPM nozzle capacity	30 40 50 60	0.17 0.20 0.22 0.24	22 26 28 31	11.2 13.2 14.5 15.8	9.6 11.3 12.4 13.6	8.4 9.9 10.9 11.9	7.5 8.8 9.7 10.6	6.7 7.9 8.7 9.5	6.1 7.2 7.9 8.6	5.6 6.6 7.3 7.9	5.2 6.1 6.7 7.3	4.8 5.7 6.2 6.8	4.5 5.3 5.8 6.3	4.2 5.0 5.4 5.9	4. 0 4. 7 5. 1 5. 6
Nozzle #3 95 degrees spray angle 0.3 GPM nozzle capacity	30 40 50 60	0.26 0.30 0.34 0.37	33 38 44 47	17.2 19.8 22.0 24.0	14.7 17.0 19.2 21.0	12.9 14.9 16.8 18.3	11.4 13.2 15.0 16.3	10.3 11.9 13.5 14.7	9.4 10.8 12.2 13.3	8.6 9.9 11.2 12.2	7.9 9.1 10.4 11.3	7.4 8.5 9.6 10.5	6.9 7.9 9.0 9.8	6.4 7.4 8.4 9.2	6. 1 7. 0 7. 9 8. 6
Nozzle #4 95 degrees spray angle 0.4 GPM nozzle capacity	30 40 50 60	0.35 0.40 0.45 0.49	45 51 58 63	23.0 26.0 30.0 32.0	19.8 23.0 26.0 28.0	17.3 19.8 22.0 24.0	15.4 17.6 19.8 22.0	13.9 15.8 17.8 19.4	12.6 14.4 16.2 17.6	11.6 13.2 14.9 16.2	10.7 12.2 13.7 14.9	9.9 11.3 12.7 13.9	9.2 10.6 11.9 12.9	8.7 9.9 11.1 12.1	8. 2 9. 3 10 .5 11 .4
Nozzle #5 95 degrees spray angle 0.5 gpm nozzle capacity	30 40 50 60	0.43 0.50 0.56 0.61	55 64 72 78	28.0 33.0 37.0 40.0	24.0 28.0 30.0 32.0	21.0 25.0 28.0 30.0	18.9 22.0 25.0 27.0	17.0 19.8 22.0 24.0	15.5 18.0 20.0 22.0	14.4 16.5 18.5 20.0	13.1 15.2 17.1 18.6	12.2 14.1 15.8 17.3	11.4 13.2 14.8 16.1	10.6 12.4 13.9 15.1	10 .0 11 .6 13 .0 14 .2