

T3RRA



3 | Dealer Installation & Commissioning

October 2026



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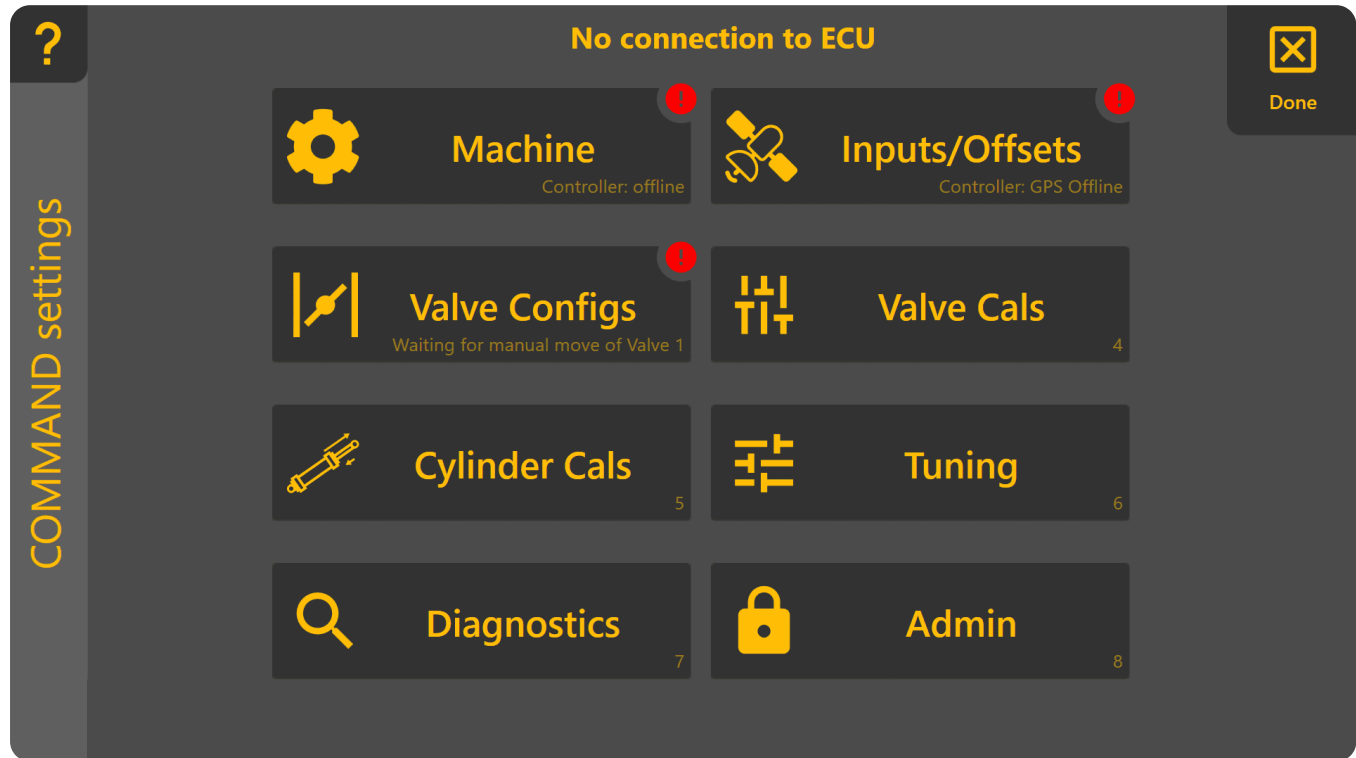
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3.1 | Connecting to the COMMAND ECU

To access **COMMAND** ECU settings from the Apply View, press "**More**" at the right side of the screen, then "**COMMAND Settings**". The **COMMAND** Settings Overview page shows each page related to operation of the ECU.



The Machine page is used to setup the connection between **Level** **COMMAND** software and the **COMMAND** ECU in addition to selecting the machine profile being used. To get to this page, first go to the **COMMAND Settings** page and click the top left '**Machine**' button.



ECU Serial Connection

Begin by connecting to the **COMMAND** ECU using the Comms tab. Select the correct COM port from the list OR

Click the '**Scan ports**' button to search for **COMMAND** data among all serial ports present. If the ECU is detected successfully, click **Connect**.

?

Machine

Serial (COM) Port: COM4

Port Connection Status: Connected

ECU Connection Status: Not Connected

ECU Authentication Status: Failed

Tractor CAN Baud Rate: 250kbps

SVC CAN Baud Rate: 250kbps

Back

Scan ports

Profile

Comms



Unable to connect/authenticate to the COMMAND ECU.
Confirm ECU power and harnessing

Port scan results

Found COMMAND.
Port: COM3, baud rate: 115200

Connect

Clear

Connection Failure

If **Level COMMAND** fails to connect to the ECU over the chosen COM port, a warning will be displayed. Verify power and communication connections before retrying.

Successful Connection



Unable to connect/authenticate to the COMMAND ECU.
Confirm ECU power and harnessing

Once connected to the ECU successfully, **Level COMMAND** will:

- Establish communication with the ECU
- Read stored parameters
- Load the current machine configuration

Once connected, Continue to **3.2 | Selecting A Machine Profile**.

Serial (COM) Port: COM3

Port Connection Status: Connected

ECU Connection Status: Connected

ECU Authentication Status: Success

3.2 | Checking for Software & Firmware Updates

-  Before proceeding with machine configuration and calibration, ensure both the **Level COMMAND** application and the **COMMAND** ECU are updated to the latest available versions.

Recommended Procedure

1. Connect to the **COMMAND** ECU successfully as performed in section 3.1.
2. Press **Back** to return to the COMMAND Settings Overview page, then press **Done** to return to the Apply View.
3. Check for available **Level COMMAND** software updates by pressing **More > Update/Changelog > Download Updates**:
4. Allow the updates to complete and restart **Level COMMAND** if prompted.
5. Return to the Apply View.
6. Check for available **COMMAND** ECU firmware updates by pressing **More > COMMAND Settings > Admin > Update to Latest**.
7. Allow any updates to install completely.
8. Restart the ECU by turning off the machine and restarting.



Software and firmware updates may include:

- Feature improvements
- Bug fixes

ECU Firmware

Version: v0.3.23 

Available: v0.3.24 



- GNSS compatibility updates
- Calibration improvements
- Stability enhancements

After updating:

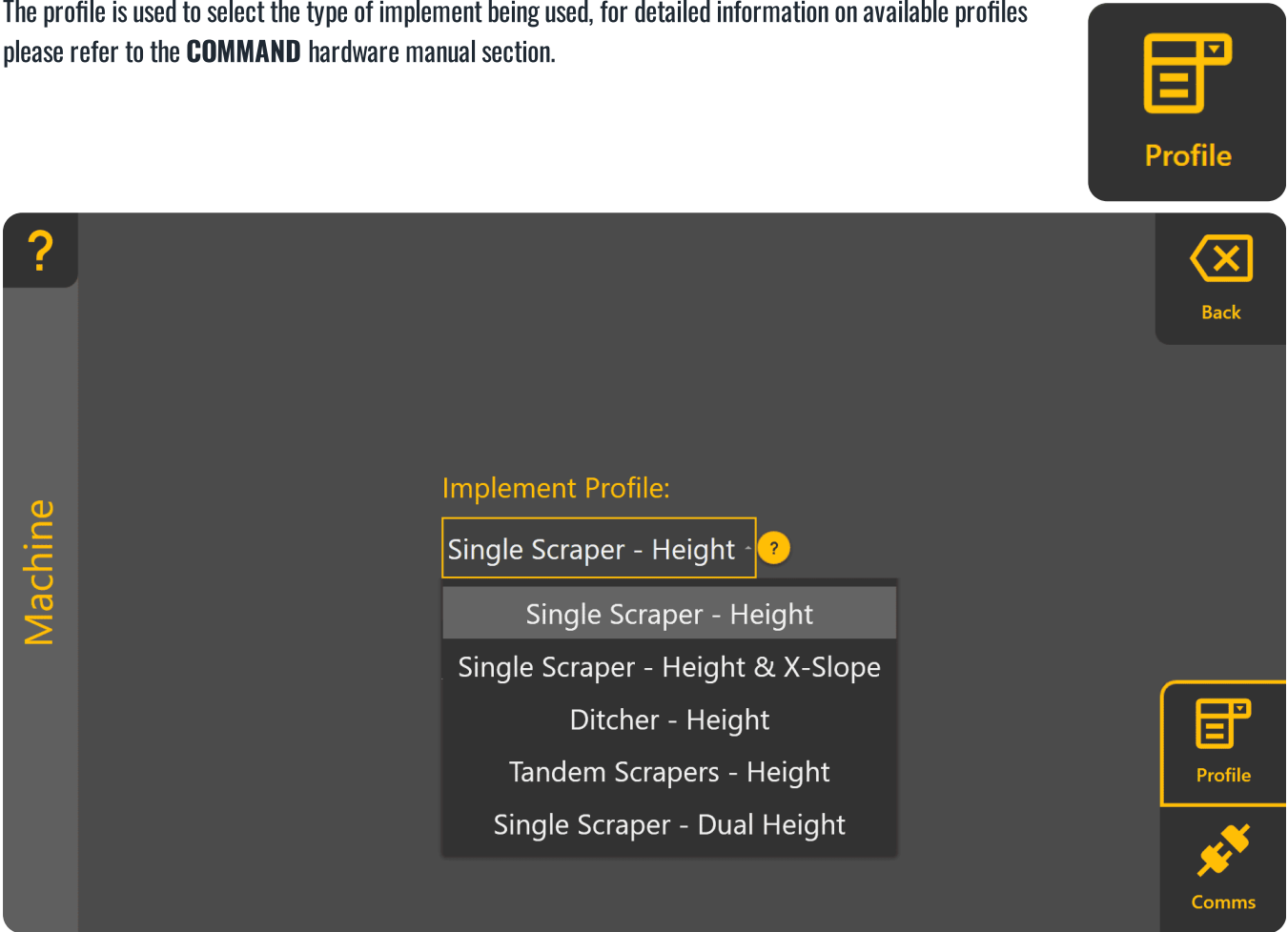
- Verify communication with the ECU
- Ensure no active faults or warnings are present at machine-level.

Continue to **3.3 | Selecting A Machine Profile**.

3.3 | Selecting A Machine Profile

Profile

The profile is used to select the type of implement being used, for detailed information on available profiles please refer to the **COMMAND** hardware manual section.



After selecting the appropriate machine profile, enter a **Blade Width** in the field shown - a red exclamation mark icon indicates that the blade width has not been set yet.

?

Machine

Implement Profile:

Single Scraper - Height ?

Blade Width 0 m ? !



Blade width is required for control and for functions such as as-applied data.

Back

Profile

Comms

?

Machine

Implement Profile:

Single Scraper - Height ?

Blade Width 5 m ?

Back

Profile

Comms

Press "**Back**" to return to the COMMAND Settings Overview and continue to **3.4 | Configuring GNSS**.

3.4 | Configuring GNSS

The Inputs/Offsets page is used for selection of input sensors, such as GNSS receivers for height control or Inertial Measurement Units (IMU) for terrain compensation and Tilt / X-slope control.



GNSS Input Configuration

Pre-configuration

Before configuring **Level COMMAND** for use with receivers such as StarFire, ensure that the following settings have been checked and enabled/disabled as follows within the relevant system (e.g. Greenstar display for StarFire receivers):

Shared Signal - OFF/Disabled

Shared Signal functionality allows two StarFire Receivers to share correctional signals in dual-receiver applications, providing the benefits of the higher signal level.

This setting should be set to OFF/Disabled for usage with **Level COMMAND**.

RTK-X - OFF/Disabled

John Deere RTK-X is a backup correction feature for StarFire™ receivers that maintains high-accuracy guidance for up to 14 days if the primary radio or mobile RTK signal is lost.

This setting should be set to OFF/Disabled for usage with **Level COMMAND**.

Inputs

All **COMMAND** machine profiles have at least one height control function intended for use with a GNSS receiver for vertical position feedback.



?

Back

⚠ The controller isn't receiving any GPS data. Try checking the GPS connections and cables.

Inputs/Offsets

Inputs

Input Type:

NMEA 0183 (Serial)

Baud Rate:

115200

Fix Type:

GPS Offline

Sensor Offsets

☑ Enable sensor offset calculations

?

Offset

1.Sensor Height:

?

0m

2.Fore/Aft Distance:

?

0m

3.Lateral Distance:

?

0m

↕ Height

↻ X-Slope

Tap on the dropdown box below **Input Type** to view the different GNSS input options currently available.

This dropdown will update with any StarFire or NMEA 2000 receivers currently connected, which are then displayed with either "SF" or "N2K" followed by the receiver serial number.

Verify that each function ("Height" if using a single receiver, "Height 1" & "Height 2" if using tandem or dual receivers) has a Fix Type of RTK before proceeding.

⚠ **Fix Type MUST be RTK for accurate automatic control operation** - lower accuracy fix types such as GPS only, Differential or Float RTK are not appropriate for accurate implement position control. Poor GNSS quality will affect machine positioning and automatic control performance.

StarFire Example:

Inputs

Input Type:

NMEA 0183 (Serial)
NMEA 0183 (Serial)
SF S/N:552681

Fix Type: GPS Offline

Sensor Offsets

☒ Enable sensor offset calculations ?

	Offset
1.Sensor Height ?	0m
2.Fore/Aft Distance ?	0m
3.Lateral Distance ?	0m

NMEA 2000 Example:

Inputs

Input Type:

NMEA 0183 (Serial)
NMEA 0183 (Serial)
N2K SN:298733

Fix Type: GPS Offline

Sensor Offsets

☒ Enable sensor offset calculations ?

	Offset
1.Sensor Height ?	0m
2.Fore/Aft Distance ?	0m
3.Lateral Distance ?	0m

i Once the GNSS receiver has been selected, **Fix Type** should change from GPS Offline to another status to indicate the current GPS quality. If GPS Offline is still shown, the receiver may still be initialising.

Sensor Offsets

If using a GNSS receiver with **Level COMMAND** that is not capable of IMU-based terrain compensation, sensor offset calculations can be enabled.

Blade Width - Enter the height of the GNSS receiver's measurement point above the cutting edge of the blade.

Positive = Above the cutting edge

Negative = Below the cutting edge

Fore/Aft Distance - Enter the distance forward or backward from the cutting edge of the blade to the GNSS receiver centre point.

Positive = Behind the cutting edge

Negative = In front of the cutting edge

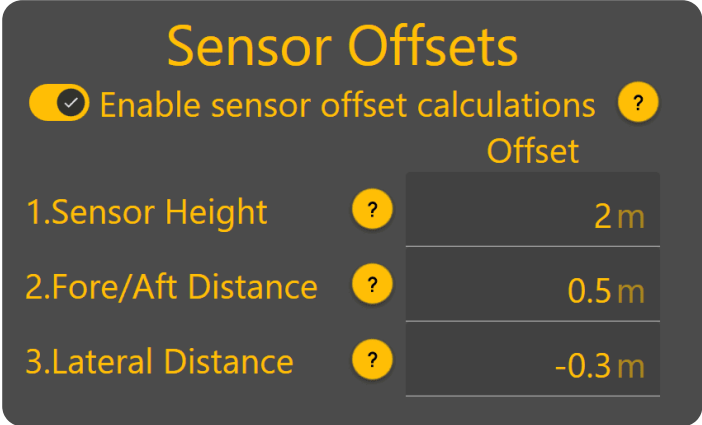
Lateral Distance Enter the distance between the GNSS receiver centre point to the middle of the cutting edge of the blade.

Positive = To the right side of the middle as if standing behind the scraper

Negative = To the left side of the middle as if standing behind the scraper

Sensor Offsets Example:

In the example screenshot below, the GNSS receiver has been mounted:



	Offset
1.Sensor Height	2m
2.Fore/Aft Distance	0.5m
3.Lateral Distance	-0.3m

- 2 metres above the blade cutting edge
- 0.5 metres behind the blade (away from the tractor)
- 0.3 metres to the left of the middle of the blade (looking toward the rear of the scraper)

✔ Inputs / Offsets setup is now complete for profiles with only a height control function.

⚠ If using Height & X-Slope, Tandem receiver or dual receiver profiles, continue on to set up the second control function's inputs/offsets.

Verifying GNSS Status & Health

GPS Thresholds

GPS Thresholds define the minimum GNSS performance requirements expected by **Level COMMAND**. These thresholds are used to determine when GNSS warnings should be generated and whether GNSS data quality is suitable for accurate automatic control.

The default values supplied by T3RRA have been selected to provide reliable operation in most environments and should not normally require adjustment. Only modify these values if directed by T3RRA Support or if site-specific conditions require alternative settings.

To access GPS Thresholds:

1. Return to the main **Level COMMAND** screen.

2. Press **More** on the right-hand side of the display.
3. Select **GPS Thresholds**.



The **GPS Thresholds** screen allows the following values to be configured:

Idle Timeout

The maximum allowable period of time that GNSS data can stop being received before a warning is generated.

RTK Timeout

The maximum acceptable age of RTK correction data. If corrections exceed this age, GNSS accuracy may no longer be suitable for automatic control.

Max VDOP

The maximum allowable Vertical Dilution of Precision (VDOP).

Lower VDOP values generally indicate better vertical positioning accuracy. A value below 2 is recommended for normal operation.

Min Satellites

The minimum number of satellites required before a warning is generated.

Note that some receivers only report a maximum of 12 satellites even when additional satellites from multiple constellations are being used. This behaviour can be normal and depends on the receiver manufacturer.

Live Values

The Live Values panel displays the current GNSS values being compared against the configured thresholds.

During commissioning, verify that:

- GNSS data is updating continuously.
- RTK correction age remains within limits.
- VDOP remains within the configured threshold.
- Satellite count satisfies the minimum requirement.

Live Values - Blade 1	
Idle Time	0 s
RTK Age	0 s
VDOP	1.8
Satellites	10

The Live Values panel provides a convenient method of confirming GNSS health during commissioning. For continuous monitoring during operation, GNSS information can also be displayed using the Widget Interface.

- ✓ Once GNSS receiver selection, sensor offsets and GPS Threshold verification have been completed, GNSS configuration is complete.

To get back to **COMMAND** Inputs set up, return to the **Level COMMAND** main page and press "**More**" at the right side of the screen > **COMMAND Settings** > **Inputs/Offsets**.

To set up a secondary receiver for Height 2, i.e. Tandem implements or implements with dual receiver follow the process above for **Height 2** as well.

X-Slope Input Configuration

Some **COMMAND** machine profiles have a Tilt / X-slope control function intended for use with an IMU for blade tilt / x-slope angle feedback. Tap on the **Input Type** dropdown box to view currently connected IMU sensors, and select the desired input sensor.



?

Inputs

Input Type:

IMU Status: Disconnected

Demo Mode

Back

Sensor Offsets

✓

Enable sensor offset calculations ?

	Actual	Offset
1.Fore/Aft Angle ?	0.00° 	0°
2.Roll Angle ?	0.00° 	0°
3.Yaw Angle ?		0°

↕

Height

↻

X-Slope

Once selected, **IMU Status** will change to Connected. Additionally, the **Actual** values for **Fore/Aft Angle** and **Roll Angle** below **Sensor Offsets** will begin updating with the current angle of the selected IMU sensor.

?

Inputs/Offsets

Demo Mode

Back

Inputs

Input Type:
TARS S/N:1514667

IMU Status: Connected

Sensor Offsets

Enable sensor offset calculations

	Actual	Offset
1.Fore/Aft Angle	0.32°	0°
2.Roll Angle	0.48°	0°
3.Yaw Angle		0°

Height

X-Slope

Accounting for IMU Mounting with Offsets

In cases where the IMU sensor has not been mounted on the blade at a perfect 0 degree pitch and/or roll angle, the save offset buttons can be used to set the **Fore/Aft Angle** and **Roll Angle** offsets to the current angle reading. Before doing so, use equipment such as a spirit level, or a known level surface to ensure the blade is completely level. Once done, press the **Save** icons to set each of the two offset values to the current angles.



- Offsets are saved in the **COMMAND** ECU and only need to be changed if the position of the IMU sensor has changed, or if fitting the IMU to a different implement.

?

Inputs/Offsets

Inputs

Input Type:

TARS S/N:1514667

IMU Status: Connected

Sensor Offsets

☒ Enable sensor offset calculations

	Actual	Offset
1.Fore/Aft Angle	0.37°	0.381°
2.Roll Angle	0.42°	0.405°
3.Yaw Angle		0°

Height

X-Slope

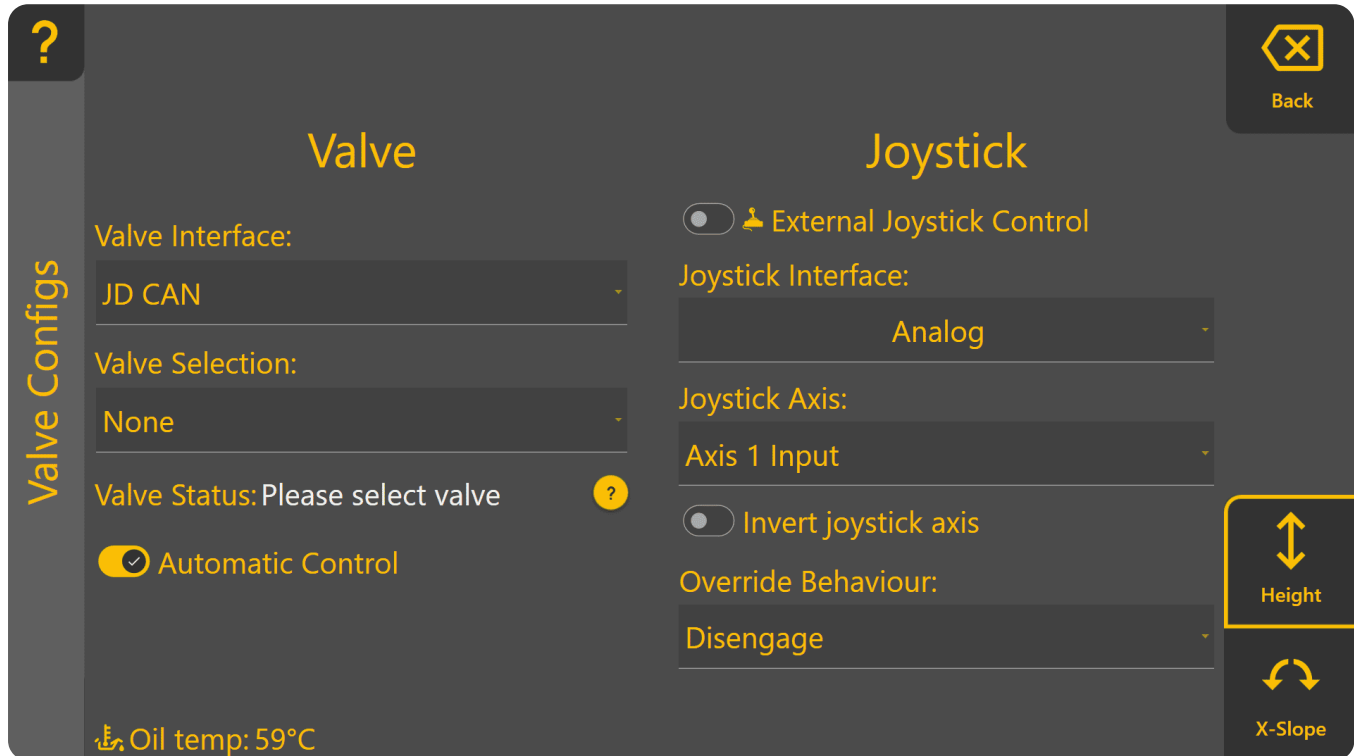
Demo Mode

Back

Press "**Back**" to return to the COMMAND Settings Overview and continue on to **3.5 | Setting Valve Configurations**.

3.5 | Configuring Valve Outputs

The **Valve Configs** page is used to set up the control output interface for each control function. Appropriate signals of that interface type are then generated when automatic or manually controlling the implement. External joystick inputs are also configured on this page when making use of an analog or J1939 CANBUS joystick.



Valve Configs

Waiting for manual move of Valve 1

Valve

Valve Interface: JD CAN

Valve Selection: None

Valve Status: Please select valve

☒ Automatic Control

Joystick

☐ External Joystick Control

Joystick Interface: Analog

Joystick Axis: Axis 1 Input

☐ Invert joystick axis

Override Behaviour: Disengage

Height

X-Slope

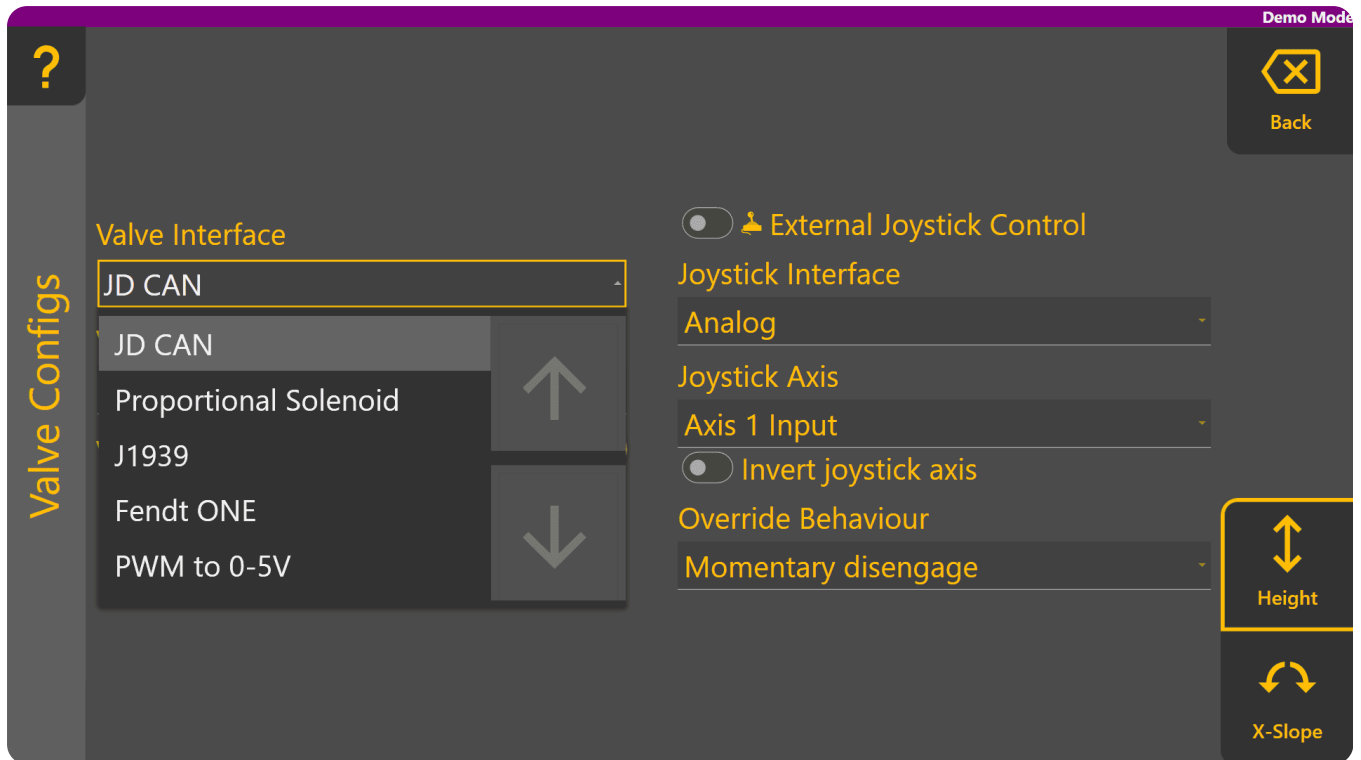
Oil temp: 59°C

At the bottom right corner of the screen, buttons will be shown if there are two available control functions. If using a Height control only machine profile, only the Height page is displayed.

Selecting the Valve Interface

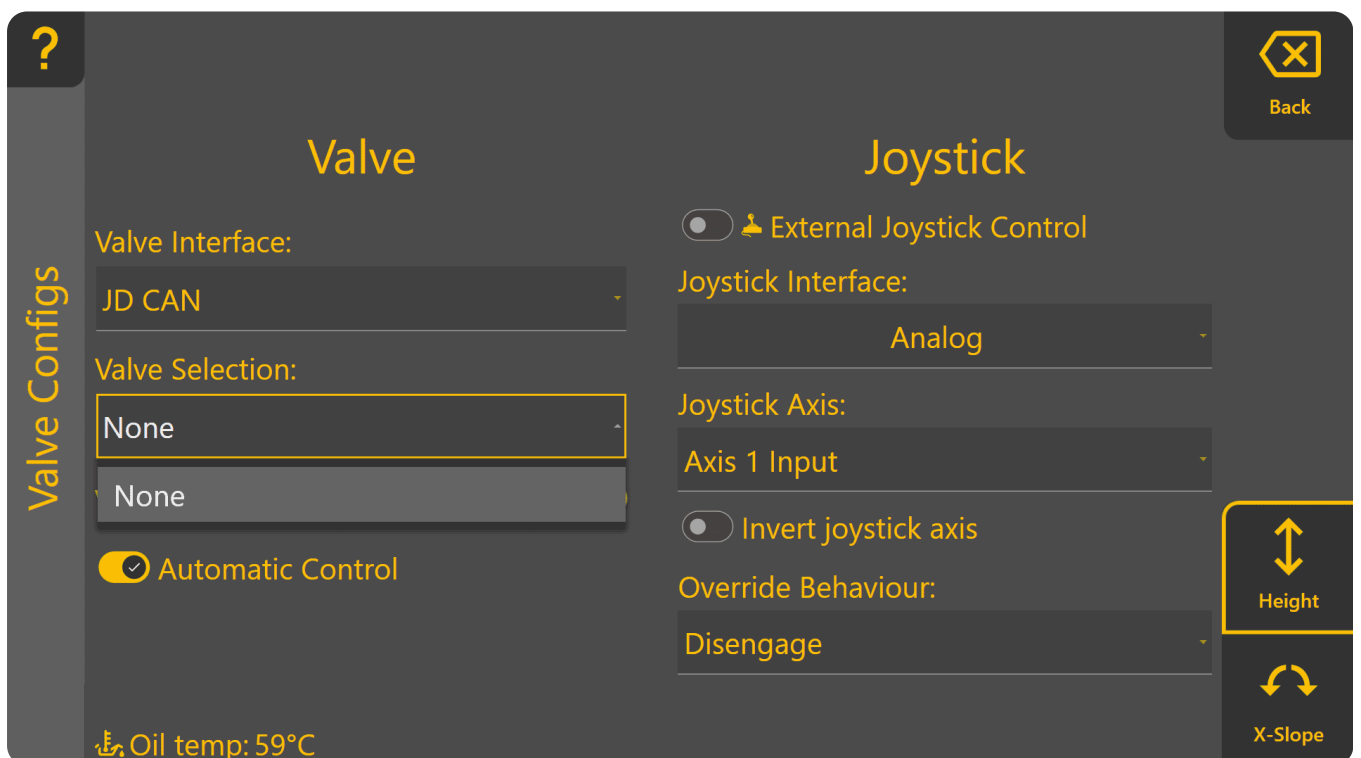
Select the appropriate **Valve Interface** for the tractor, machine or external valves being used for that function. To begin with, set the desired **Valve Interface** type for the Height control function.

-  Different **Valve Interface** selections display different **Valve Number** selections depending on how they work - for more information please see the section in the **COMMAND** manual.

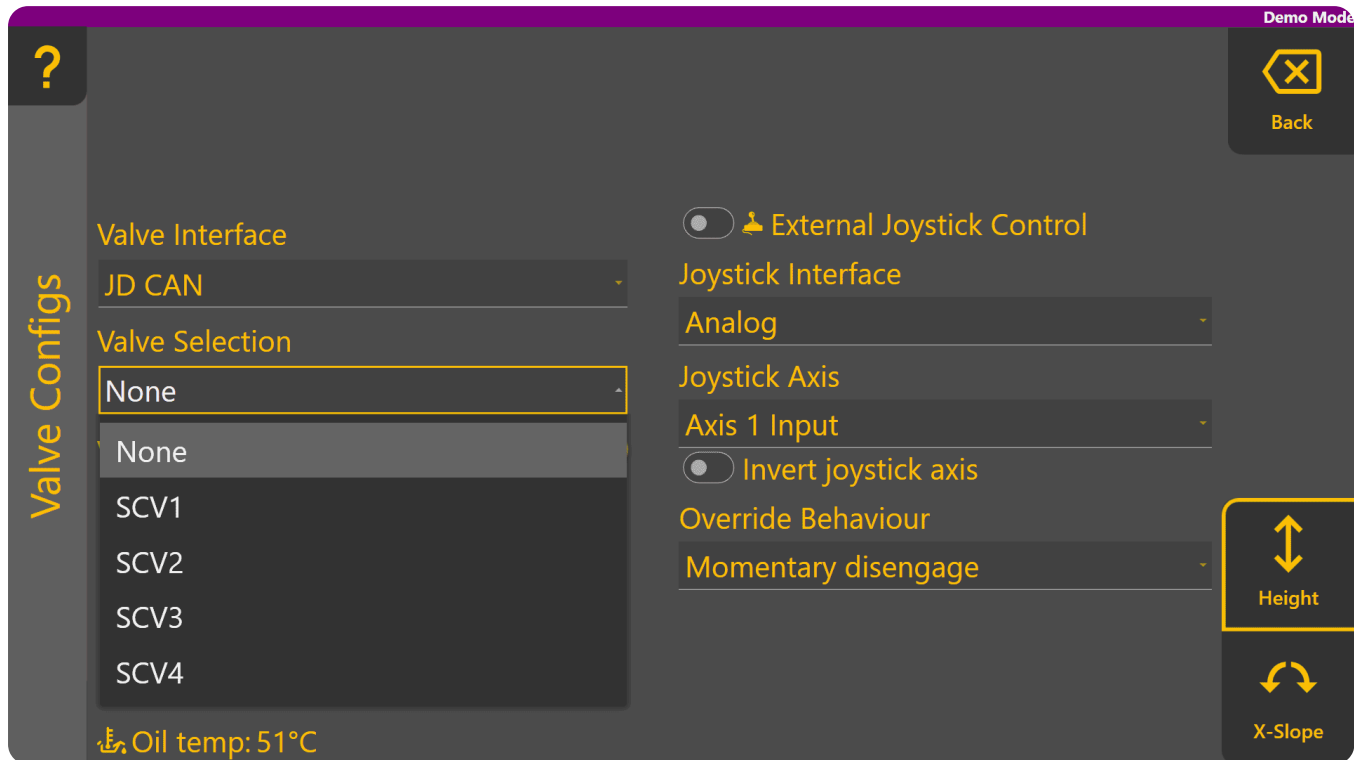


Selecting the Valve Number

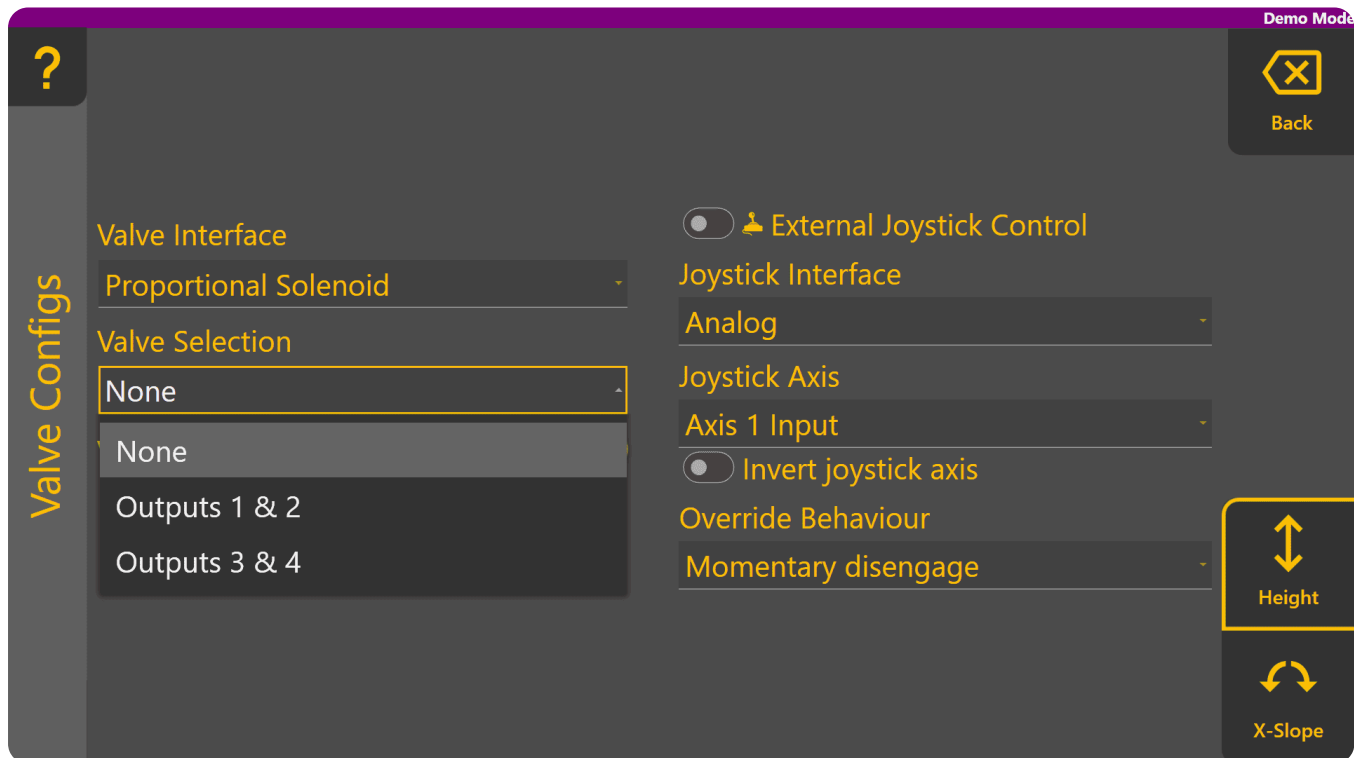
When selecting **Valve Interface** options like JD CAN, J1939 and Fendt ONE will only display valve numbers that have been detected on the ISOBUS or machine CANBUS. Below shows an example of the dropdown with the tractor switched off.



Once detected on the ISOBUS or machine CANBUS, any available SCV / Remote / Auxiliary valve selections will be displayed in the **Valve Selection** list as shown:



Analog valve interfaces such as Proportional Solenoid and PWM to 0-5V always display all available **Valve Selection** options. Valve signals for these selections generally rely on harnessing to connect the outputs of the **COMMAND** ECU to the proportional solenoid or laser system inputs.



Valve Status

Valve Status provides information on the current status of the selected **Valve Interface** and **Valve Selection**. The table below explains each of the different possible valve statuses that may appear:

Status	Description
Valve Unavailable	The selected valve is not available for use.
Waiting for Manual SCV Input	Move the SCV lever corresponding to the selected SCV - this must be done when using John Deere tractors.
Short to Ground	An overload has been detected and the resistance between the valve signal output pin and ground is near-zero, holding the output low.
Short to Batt	An overload has been detected and the valve signal output pin is being fed power from another source holding the output high.
Open Load	A connection or valve issue has been detected, and the resistance between valve signal output pin is too high, indicating a broken wire or valve solenoid/coil.
SCVs Locked	The SCVs must be unlocked using the console SCV padlock button.
System Not Armed	The COMMAND Arm/Engage switch must be armed or re-armed. If the Arm/Engage switch is currently Off: - Switch the Arm/Engage switch to the middle position. If the Arm/Engage switch is currently in the middle position: - Switch the Arm/Engage switch to the OFF position, and then back to the middle position.

Ready	The selected valve is currently not active and the ECU is ready for automatic control or manual control commands for that function.
-------	---

External Joystick Setup

Settings related to external joystick inputs for each function can also be found on this page. Enable external joystick control for each function using the toggle shown below. Once **External Joystick Control** has been enabled, the **COMMAND** ECU will begin using the selected **Joystick Interface** and **Joystick Axis** for manual implement control.

Selecting the Joystick Interface

  External Joystick Control

Select the appropriate **Joystick Interface** for the Height function, depending on the joystick being used:

- "Analog"
- If using a J1939 CANBUS based joystick, select "J1939"

- If using an analog voltage based joystick, select

Joystick Interface:

Analog

Analog

J1939

Selecting the Joystick Axis (Analog)

Next, select the appropriate **Joystick Axis**. For the Analog interface, Axis 1 is intended for the joystick Y-axis, Axis 2 is intended for the joystick X-axis and Axis 3 is intended for the joystick Z-axis if present.

Joystick Axis:

Axis 1 Input

Axis 1 Input

Axis 2 Input

Axis 3 Input

Selecting the Joystick Interface (J1939 / CAN)

For the J1939 interface, select the joystick axis to be used for the function, e.g. Y-axis for manual height control.

Joystick Axis:

Y (Forward / Aft)

Y (Forward / Aft)

X (Left / Right)

Z (Twist)

Swapping the Joystick Axis' Control Direction

☒ Invert joystick axis

If moving the joystick in a certain direction causes the wrong physical movement direction, the axis can be inverted using the **Invert Joystick Axis** toggle.

Selecting the Override Behaviour

Override Behaviour:

Disengage

Momentary disengage

Lastly, select the desired **Override Behaviour** for the function:

- "Disengage" will cause any joystick movement to disengage automatic control mode, requiring the operator to press the engage button again to resume automatic control.
- "Momentary Disengage" will cause any joystick movement to only momentarily disengage automatic control mode. Once the joystick is no longer being moved, **COMMAND** will resume controlling the implement automatically.

i Regardless of **Override Behaviour** selection, **COMMAND** will always prioritise joystick/manual control signals over automatic control signals to maintain full operator control of the implement.

Example Height Valve Configuration Page

Below shows an example of a configuration using PWM to 0-5V **Valve Interface**, using the **T3H-V001** valve adapter on Output 1, with **Automatic Control** enabled. **External Joystick Control** has also been enabled for use with a J1939 CANBUS joystick, with the Y-axis controlling the Height function and will momentarily disengage automatic control when the joystick is moved.

?

Back

Valve

Joystick

Valve Interface:

Analog Voltage (0-5V)

Valve Selection:

Output 1

Valve Status: Ready

Automatic Control

Oil temp: 59°C

External Joystick Control

Joystick Interface:

J1939

Joystick Axis:

Y (Forward / Aft)

Invert joystick axis

Override Behaviour:

Momentary disengage

Height

X-Slope

Example X-Slope Valve Configuration Page

Swapping over to the X-Slope function using the bottom right button, an example configuration shown below is set up to use PWM to 0-5V **Valve Interface**, using the T3H-V001 adapter on Output 2. X-Slope is enabled for automatic control, and also has External Joystick Control enabled for use with a J1939 CANBUS joystick on the X-axis, momentarily disengaging when the operator moves the joystick.

?

Back

Valve

Joystick

Valve Interface:

Analog Voltage (0-5V)

Valve Selection:

Output 2

Valve Status: Ready

Automatic Control

Oil temp: 59°C

External Joystick Control

Joystick Interface:

J1939

Joystick Axis:

X (Left / Right)

Invert joystick axis

Override Behaviour:

Momentary disengage

Height

X-Slope

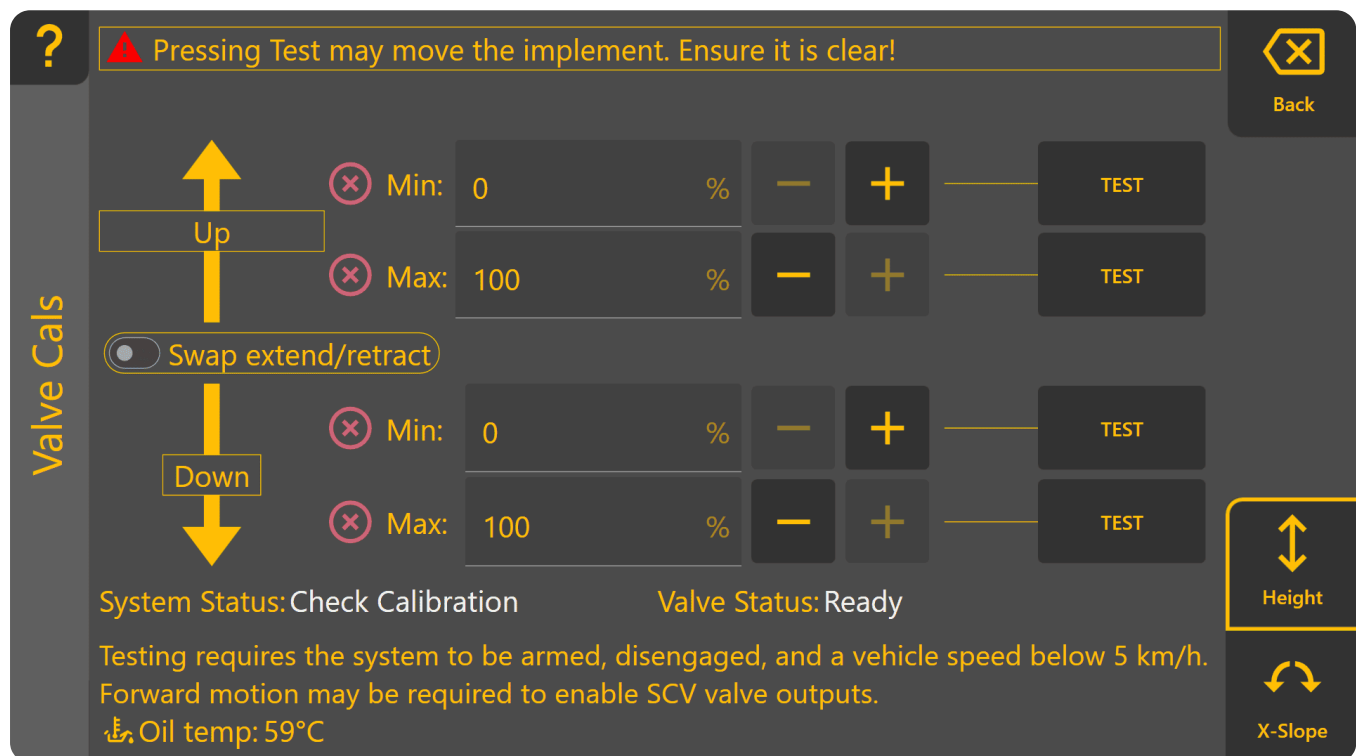
Press "**Back**" to return to the COMMAND Settings Overview page and continue on to **3.6 | Valve Threshold Calibration**.

3.6 | Valve Threshold Calibration

Valve Threshold Calibration establishes the minimum and maximum hydraulic outputs used by Automatic Control. Correct calibration ensures the implement can move smoothly for small corrections while still achieving full operating speed when required.

Access the **COMMAND** valve calibration page by going to: **More > COMMAND Settings > Valve Cals.**

- **Minimum Threshold (Min %)** determines the lowest output that reliably opens the hydraulic valve.
- **Maximum Threshold (Max %)** limits the highest output available to Automatic Control.



? ▲ Pressing Test may move the implement. Ensure it is clear! Back

Valve Cals

Up

Min: 0 % — + TEST

Max: 100 % — + TEST

☐ Swap extend/retract

Down

Min: 0 % — + TEST

Max: 100 % — + TEST

System Status: Check Calibration Valve Status: Ready

Testing requires the system to be armed, disengaged, and a vehicle speed below 5 km/h. Forward motion may be required to enable SCV valve outputs.

Oil temp: 59°C

Height

X-Slope

Calibration Procedure

- i The **COMMAND** ECU will not request movement of the implement unless the user has pressed one of the test buttons and is holding the engage button.

1. Select the function and direction to calibrate.
2. Press **TEST** and hold the machine **ENGAGE** button when instructed.
3. Increase **Min. %** until the implement begins moving consistently at a very slow speed, e.g. about 1 centimetre per second.
4. Adjust **Max. %** as required:
 - For proportional solenoids, limit output to approximately **1800 mA**.
 - Reduce further if lower maximum implement speed is desired.

5. Repeat for all active directions and functions.

Calibration Test Buttons

The "+", "-", and "TEST" buttons are used during the calibration process to incrementally increase or reduce a given threshold, which can then be tested using the process described in the next section.

Calibration Progress Icons



This icon indicates that a value has not been calibrated yet. All minimum and maximum values for all active functions must be calibrated before performing automatic control.



This icon indicates that a value has been calibrated. Once all min and max values display this icon, the function has been successfully calibrated.



Ticks next to Min or Max values mean that the test button was pressed, but **do not indicate a correctly calibrated function**.

Example for Completed Height Function

?

▲
Pressing Test may move the implement. Ensure it is clear!

X

Valve Cals

↑

Up

↓

Down

☒ Swap extend/retract

Min:	11	%	—	+	
					TEST
Max:	80	%	—	+	
					TEST

System Status: Ready to engage

Valve Status: Ready

Testing requires the system to be armed, disengaged, and a vehicle speed below 5 km/h. Forward motion may be required to enable SCV valve outputs.

Oil temp: 59°C

↕
Height

↻
X-Slope

Example for Completed X-Slope Function

?

▲ Pressing Test may move the implement. Ensure it is clear!

Back

Valve Cals

Left

Min: 14 %

Max: 100 %

Swap extend/retract

Right

Min: 12 %

Max: 100 %

TEST

TEST

TEST

TEST

System Status: Ready to engage

Valve Status: Ready

Testing requires the system to be armed, disengaged, and a vehicle speed below 5 km/h. Forward motion may be required to enable SCV valve outputs.

Oil temp: 59°C

Height

X-Slope

Verification

Verify that:

- Implement movement begins smoothly when Min % is tested.
- No excessive delay or valve chatter occurs.
- Full-speed movement is available when Max % is tested without hydraulic instability.
- All calibration indicators show as complete before commissioning proceeds.

Continue on to **3.7 | Cylinder Ratio Calibration**.

3.7 | Cylinder Ratio Calibration

Overview

Cylinder Ratio Calibration compensates for differences in implement movement speeds between opposing control directions. Hydraulic systems rarely move at identical speeds in both directions. Differences in cylinder geometry, implement weight, hydraulic flow characteristics, machine design and gravity can all influence the speed at which the implement moves.



For elevation control, the implement may raise more slowly than it lowers due to implement weight and hydraulic loading.

For cross-slope control, left and right tilt movements may also occur at slightly different rates due to cylinder geometry and hydraulic system characteristics.

Cylinder Ratio Calibration measures the time taken to move the implement through its full range of motion in each direction and automatically calculates a correction ratio used by Automatic Control.

Calibration Procedure

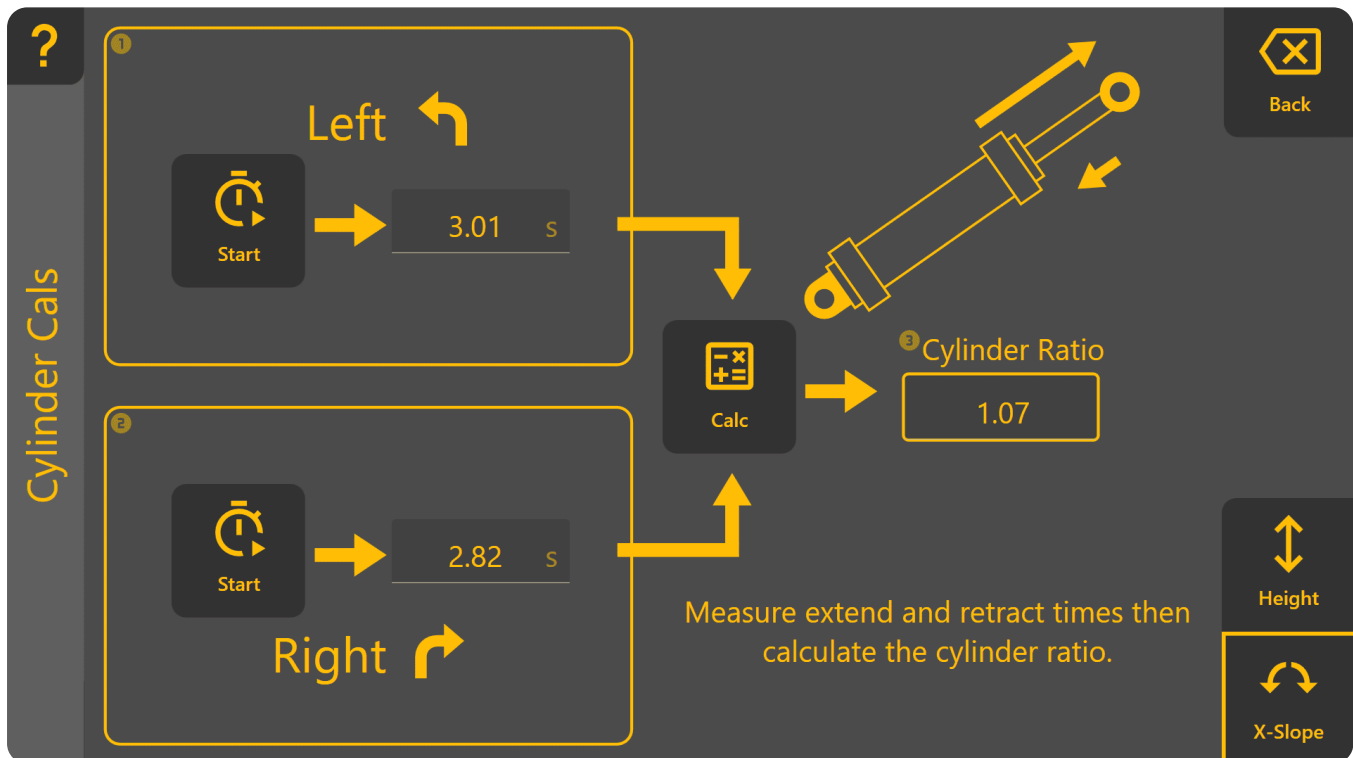
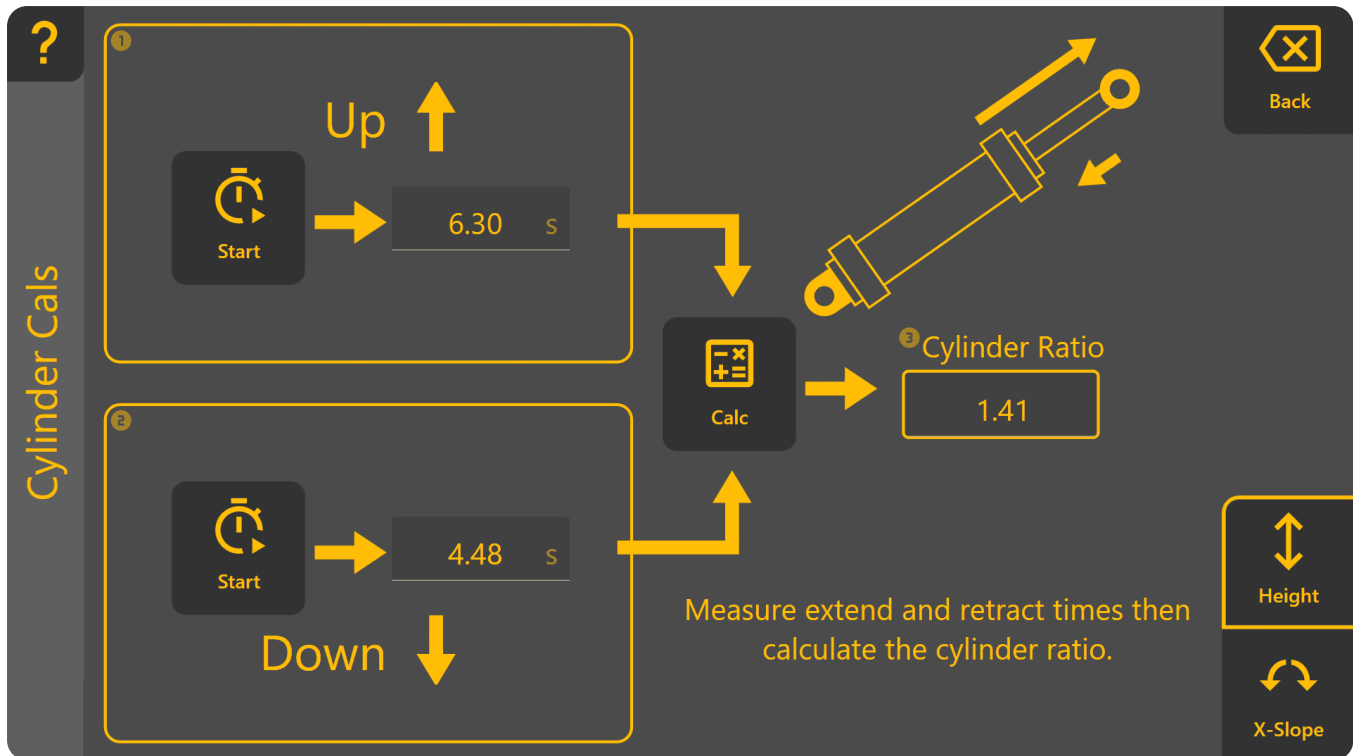
Elevation (Raise / Lower)

1. Position the implement at its lowest operating position.
2. Press **Start** in the **Up** section.
3. Immediately raise the implement at full manual control speed until maximum height is reached.
4. Press **Stop** when maximum height is reached.
5. Press **Start** in the **Down** section.
6. Immediately lower the implement at full manual control speed until minimum height is reached - do not make contact with the ground, stop the implement before it does.
7. Press **Stop** when minimum height is reached.
8. Press **Calc** to generate the Elevation Cylinder Ratio.



Cross-Slope (Left / Right)

1. Position the implement at one end of its available tilt range.
2. Press **Start Left** or **Start Right** as appropriate.
3. Immediately move the implement at full manual control speed until the opposite end of travel is reached.
4. Press **Stop** when the limit of travel is reached.
5. Repeat for the opposite direction.
6. Press **Calc** to generate the Cross-Slope Cylinder Ratio.



Verification

After calibration:

- Implement movements should respond consistently in both directions during Automatic Control.
- Neither direction should appear noticeably slower or more aggressive than the opposite direction.

- If hydraulic components, cylinders, valves or plumbing are modified, cylinder calibration should be repeated.

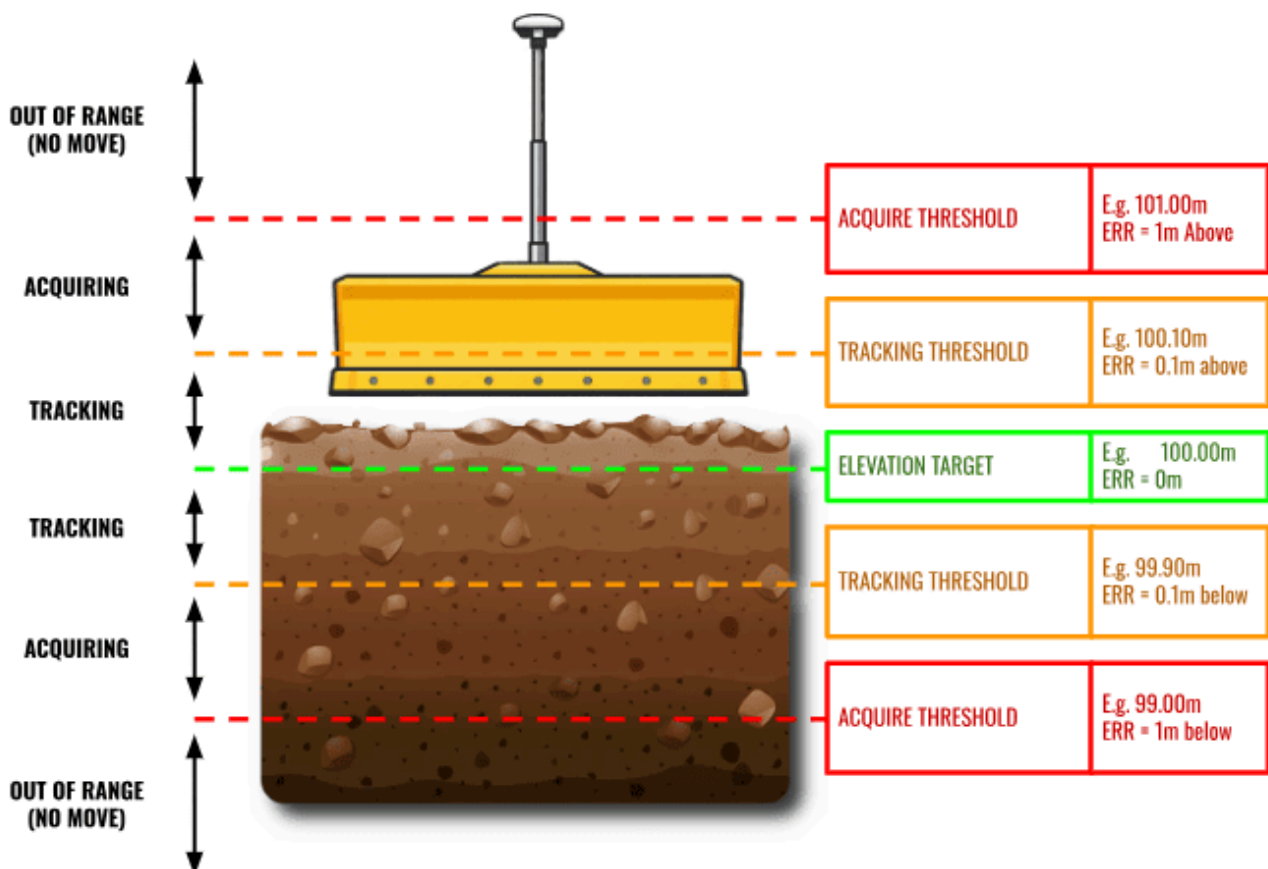
Continue to **3.8 | Tuning Automatic Implement Control**.

3.8 | Tuning Automatic Implement Control

The purpose of tuning is to achieve stable, accurate Automatic Control that follows the design surface smoothly without excessive lag or oscillation. The Tuning page provides the controls and feedback required to optimise control performance. To find the tuning page from the Apply View, press **More > COMMAND Settings > Tuning**.

Tracking and Acquisition Behaviour

Once Automatic Control is engaged, the **COMMAND** ECU adjusts its control strategy according to the current error between the implement and the design surface.



Automatic Control transitions between Acquisition, Tracking and Out-of-Range regions according to the current error between the implement and the design surface.

- ✓ The default **Tracking Threshold** and **Acquire Threshold** values are suitable for almost all applications and should not normally require adjustment. Modification of these parameters is generally not recommended.

Three operating regions are used:

Tracking Region (e.g. < 10cm Error)

The Tracking Region is the area immediately surrounding the design surface. This region provides the highest grading accuracy and is where the implement should spend most of its operating time.

When the current error is within the configured **Tracking Threshold**, **COMMAND** continuously adjusts hydraulic output using its tracking control algorithm to accurately maintain the implement on grade.

By default, the tracking threshold is 10cm for height functions, and 10 degrees for x-slope functions. Within the Tracking Region, hydraulic output is continuously adjusted between the calibrated minimum and maximum valve thresholds according to the current control error.

Acquisition Region (e.g. > 10cm but < 1m Error)

The Acquisition Region exists between the **Tracking Threshold** and **Acquire Threshold**.

When the implement is outside the Tracking Region but remains within the **Acquire Threshold**, **COMMAND** prioritises returning the implement to the Tracking Region as quickly as possible.

During acquisition, the ECU commands hydraulic output at the calibrated **Max %** threshold until the implement re-enters the Tracking Region. Once inside the Tracking Region, control automatically transitions back to normal tracking.

Out of Range (e.g. > 1m Error)

If the current error exceeds the configured **Acquire Threshold**, the implement is considered too far from the design surface for Automatic Control to operate safely or effectively.

In this condition, **COMMAND** does not command hydraulic movement. This prevents large or unexpected hydraulic movements when the implement is significantly displaced from the design surface. The operator should manually reposition the implement closer to the design surface before Automatic Control resumes operation.

Before Tuning

Before tuning, verify the following diagnostic indicators report normal operating status:

- **COMMAND** ECU Status
- Input Status
- Valve Status
- Automatic Control Diagnostics

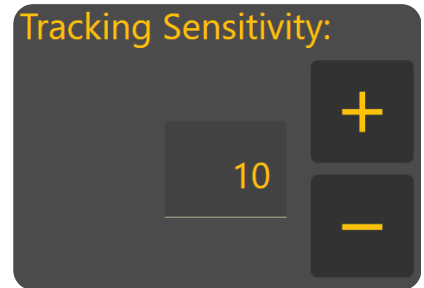
ECU Status: Ready to engage
Input Status: No Error
Valve Status: Ready
Automatic Control: Enabled

Any active faults or invalid status conditions should be corrected before tuning begins.

Tuning Procedure

Tuning should always be performed under normal working conditions using the same machine speed, hydraulic flow settings and operating practices that will be used during production work.

Level COMMAND currently provides a single tuning parameter called **Tracking Sensitivity**. The objective is to achieve stable control while maintaining accurate tracking of the target surface.

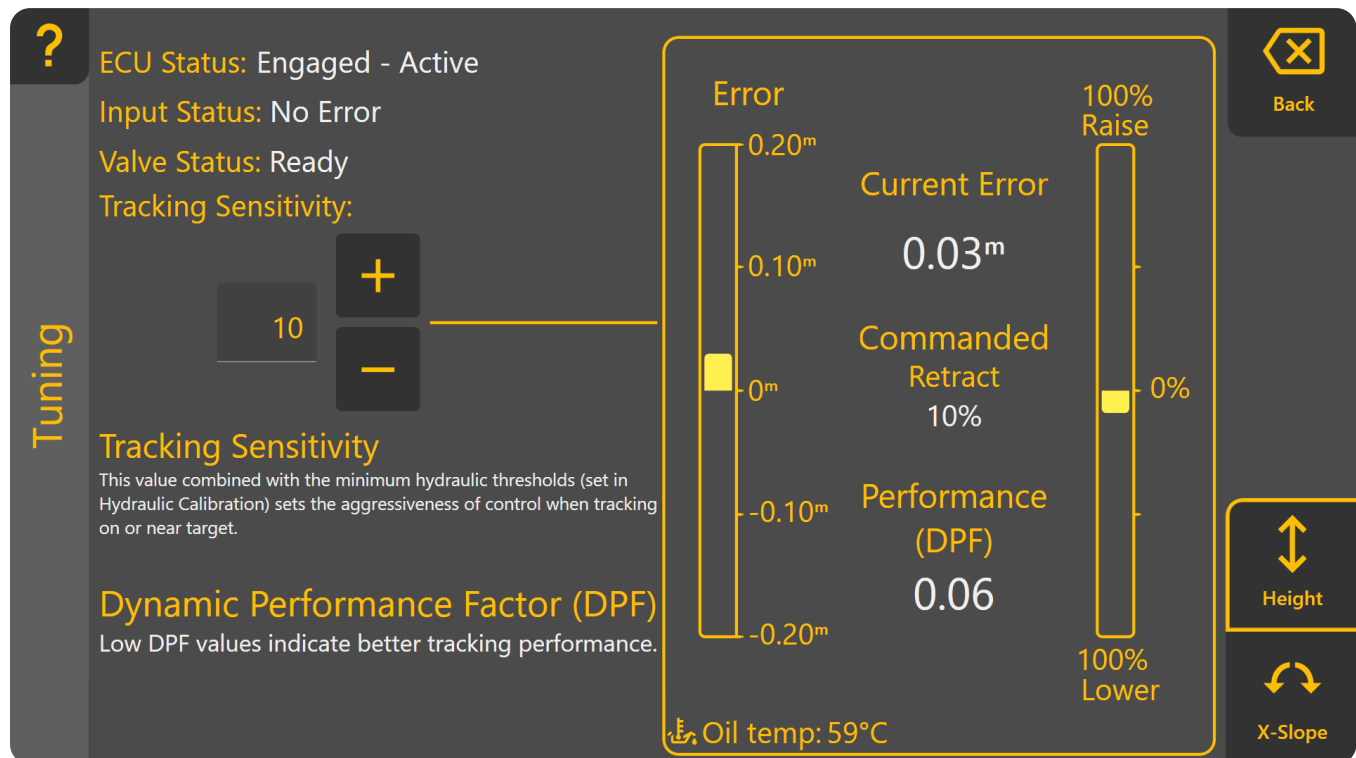


1. Load a suitable project or design surface.
2. Engage Automatic Control.
3. Perform several passes under normal operating conditions.
4. Observe implement behaviour and control performance.
5. Adjust **Tracking Sensitivity** as required.
6. Repeat until the implement follows the target smoothly without excessive lag or oscillation.

During normal grading, the implement should enter the Acquisition Region only briefly before returning to the Tracking Region, where it should remain for most of the grading operation. If the implement spends excessive time acquiring, overshoots repeatedly or oscillates around the target surface, further tuning may be required.

Adjustment	Typical Effect
Increase Tracking Sensitivity	Faster response, more aggressive control, increased risk of overshoot or oscillation.
Decrease Tracking Sensitivity	Slower response, smoother control, increased risk of lag and persistent tracking error.

Understanding Tuning Feedback



Current Error

Current Error displays the difference between the actual implement position and the target position. Large or persistent error indicates the implement is struggling to follow the target surface accurately.

Commanded Output %

Commanded % displays the control effort being requested by Automatic Control. This value can help identify whether the controller is responding aggressively enough to changing conditions.

Dynamic Performance Factor (DPF)

Dynamic Performance Factor (DPF) is a rolling performance metric used to indicate how closely the implement is following the target surface. A **DPF** value of **0** represents perfect control performance. Lower **DPF** values indicate better control performance.

As tracking error, overshoot, oscillation and other control deviations increase, the **DPF** value will also increase. **DPF** is calculated using approximately five seconds of Automatic Control performance data and is only updated while Automatic Control is engaged.

DPF should be used as a comparative tuning aid rather than an absolute performance target.

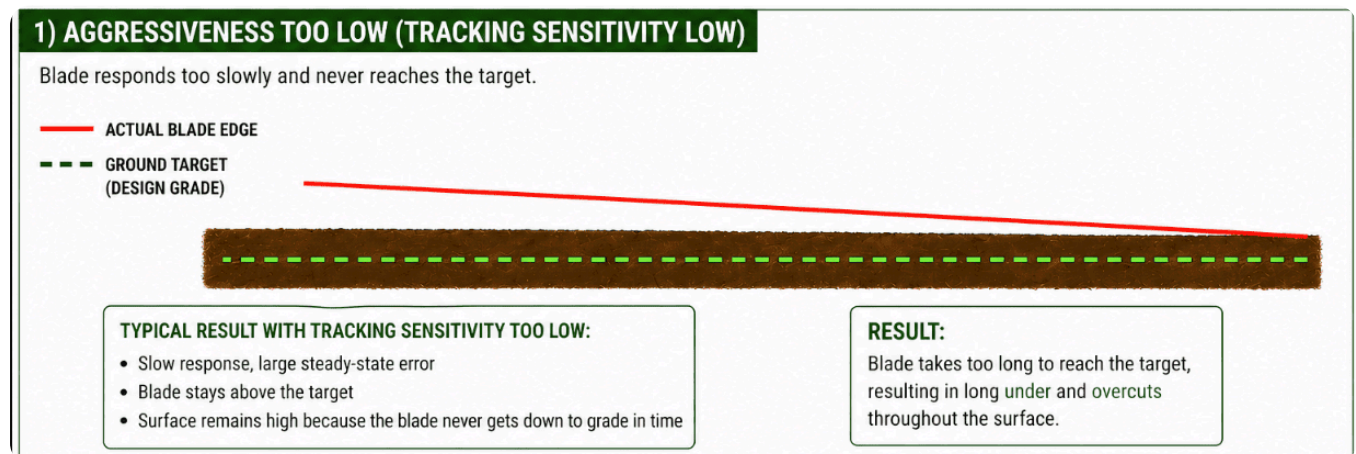
Common Tuning Symptoms

-  Correct **valve calibration**—particularly the **Min %** thresholds—is essential before tuning begins. Incorrect **Min %** calibration can produce symptoms similar to incorrect **Tracking Sensitivity** and cannot be corrected through tuning alone.

Tracking Sensitivity Too Low

- Implement responds slowly
- **Current Error** remains visible for extended periods
- Blade struggles to reach target grade
- **DPF** remains elevated due to persistent tracking error

Recommended Adjustment > Increase **Tracking Sensitivity**.

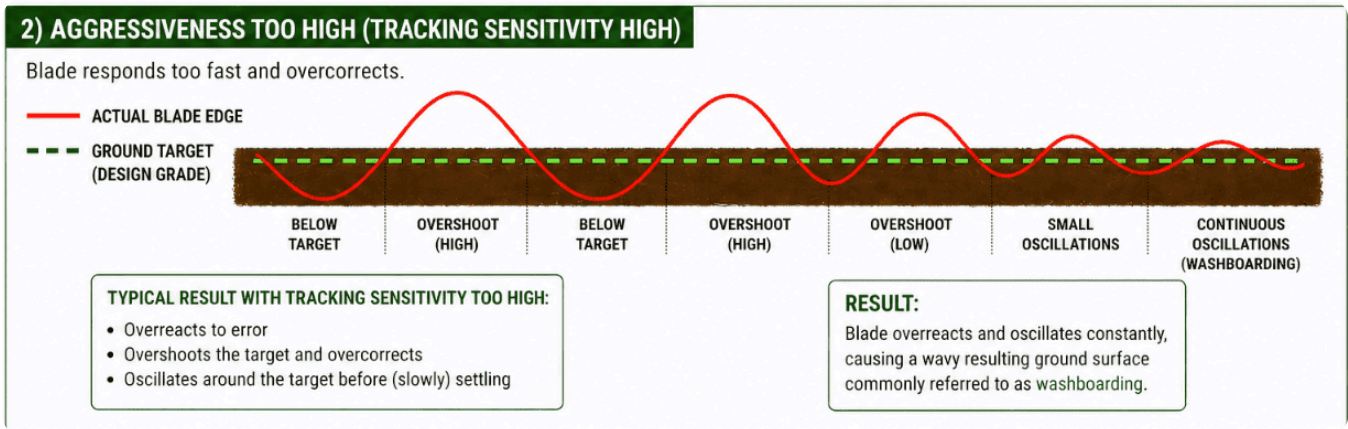


Tracking Sensitivity Too High

- Implement reacts aggressively
- Blade overshoots the target surface
- Oscillation develops
- **DPF** increases due to instability and overcorrection

Reduce **Tracking Sensitivity**.

Recommended Adjustment > Reduce **Tracking Sensitivity**.



Once Automatic Control is performing at an acceptable level, continue on to **3.9 | Validating System Operation**.

3.9 | Validating System Operation

Status Validation Checks

Item	Expected Result
ECU Status	Connected and operating normally
GNSS Status	Fixed RTK solution
Position Accuracy	Within expected limits
Inertial Sensors	Reporting valid data
Valve Outputs	Available and responding
Machine Configuration	Correct implement selected
Active Faults	None present

If any item fails, correct the issue before proceeding.

Manual Hydraulic Validation

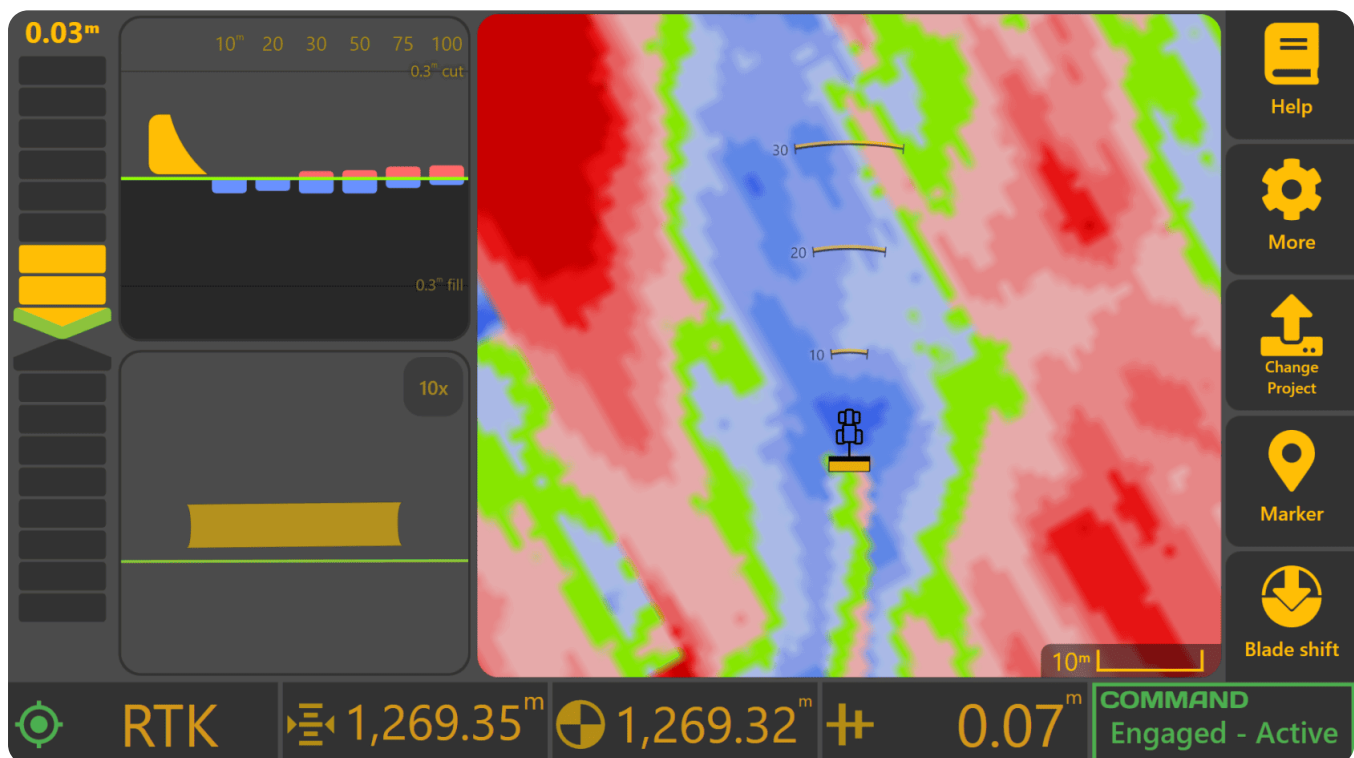
Verify manual hydraulic operation is as expected before engaging automatic control.

1. Raise and lower the implement using manual controls.
2. Confirm smooth movement.
3. Confirm correct movement direction.
4. Confirm full travel can be achieved.
5. Verify no unexpected hydraulic behaviour occurs.

Expected Result:

- Implement responds immediately.
- Movement direction matches commanded direction (Up/Down/Left/Right).
- No instability or oscillation is present.

Automatic Control Engagement Validation



Verify Automatic Control can engage and operate correctly:

1. Position the machine in a safe operating area.
2. Load a valid design surface.
3. Satisfy all engagement requirements.
4. Engage Automatic Control.

Expected Result:

- Automatic Control engages successfully.
- No engagement warnings are generated.
- Control outputs become active.

Automatic Control Response Validation

Verify control outputs produce the expected machine response when Automatic Control is active.

1. Engage Automatic Control on the previously loaded design surface.
2. Observe implement movement.

Expected Result:

- Implement moves toward the design surface.
- Movement direction is correct.
- Correction occurs without hesitation.
- No excessive overshoot occurs.

Grade Tracking Validation

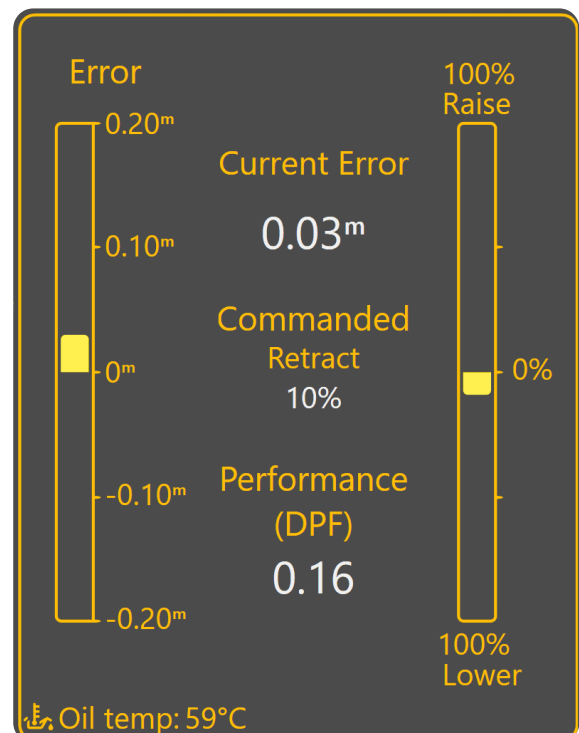
Operate the machine under normal working conditions. Navigate to **More > COMMAND Settings > Tuning**.

Observe:

- Current Error
- Commanded Output %
- Dynamic Performance Factor (DPF)

Expected Result:

- Current Error remains stable and controlled.
- Commanded Output % changes smoothly.
- DPF remains low and consistent.
- Automatic Control maintains the design surface without oscillation.



Commissioning Acceptance Checklist

Validation Item	Pass
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Validation Item	Pass
ECU communicating successfully	☐
GNSS selected and stable with RTK Fix	☐
X-Slope sensor angle values updating correctly	☐
Hydraulic outputs verified	☐
Cylinder calibration completed	☐
Automatic Control engages correctly	☐
Control direction verified	☐
Tracking Sensitivity tuned	☐
Grade tracking validated	☐
Automatic Control performance acceptable	☐
No active faults present	☐



Once all validation checks have been completed successfully and Automatic Control performance has been verified, the machine is ready for operator training and production use.

Dealer installation and commissioning is now complete. Continue to **Section 4 | Operator Quick Start** for guidance on day-to-day operation of **Level COMMAND**.