



UC5TM CAN BUS Spray Height Controller



Operator Manual
Ag Leader[®] Display

Printed in Canada

Copyright © 2010 by NORAC Systems International Inc.

Reorder P/N: UC5-BC-MANUAL-AL Rev E (UC5 Operator Manual – Ag Leader)

NOTICE: NORAC Systems International Inc. reserves the right to improve products and their specifications without notice and without the requirement to update products sold previously. Every effort has been made to ensure the accuracy of the information contained in this manual. The technical information in this manual was reviewed at the time of approval for publication.

Contents

1	INTRODUCTION	1
1.1	Warranty Registration	1
2	SAFETY PRECAUTIONS	2
3	TECHNICAL SPECIFICATIONS	3
4	SYSTEM DESCRIPTION	4
4.1	General UC5 System Layout	4
4.2	Height Sensors	5
4.3	Roll Sensors	5
4.4	Modules	5
5	OPERATION	6
5.1	Run Screen	6
5.2	Settings	9
5.3	Sprayer Switches	10
6	UNDERSTANDING THE UC5 SYSTEM	11
6.1	Boom Reaction Time	11
6.2	Ditches, Waterways and Outside Rounds	11
6.3	Driving Through Ditches and Over Terraces	11
6.4	Soil Mode and Crop Mode	12
6.5	Sensing Further Ahead of the Boom	13
6.6	Height Sensor Capabilities and Limitations	13
7	SETUP	14
7.1	Navigating to the UC5 Setup Menu	14
7.2	Automatic System Setup	16
7.3	Retune	21
7.4	Manual Setup	24
8	OPTIONAL KITS	38
8.1	Severe Terrain Kit	38
8.2	Enhanced Stability Kit	38
8.3	Roll Bias (Active Roll) Kit	39
9	OPTIONS MENU	40
9.1	Headland Assist Toggle	40
9.2	Headland Assist Trigger	40
9.3	Headland Assist Mode	41

9.4 Remote Switches	41
9.5 Severe Terrain Mode	42
9.6 High Oil Temp Alarm Toggle.....	42
9.7 Boom Geometry Test	42
9.8 Temperature Compensation Toggle	42
9.9 Slow Roll Reference.....	42
9.10 Manual Valve Drive	43
9.11 Double Tap Main	43
9.12 Double Tap Wings	43
10 MAINTENANCE	44
11 TROUBLESHOOTING.....	45
11.1 General Operation	45
11.2 Sensors.....	46
11.3 Modules	47
11.4 Hydraulics.....	48
11.5 Boom Stability	50
12 MENU STRUCTURE	51
13 STATEMENT OF LIMITED WARRANTY	52

I Introduction

Congratulations on your purchase of a NORAC UC5 Spray Height Control System. This system has an unmatched reputation within the industry for boom protection and spray height accuracy.

When properly used, the UC5 Spray Height Control System provides protection from boom damage as well as improving sprayer efficiency and chemical performance by ensuring correct chemical application.

To fully understand your new system and use it to its fullest capacity it is recommended that you read this manual. This manual provides a general overview, key features, operating instructions, assistance with system setup, regular maintenance recommendations and troubleshooting.

If you have any questions, feedback or comments regarding the NORAC UC5 Spray Height Control system, please contact any of the numbers below.

Phone:	1 800 667 3921	Canada (Toll Free)
	1 866 306 6722	United States (Toll Free)
	(+33) (0)4 26 47 04 42	Europe
	(+1) 306 664 6711	All other regions
E-mail:	service@norac.ca	
Web:	www.norac.ca	

The information in this manual applies to systems with Version 3.7.70 or newer firmware.

I.1 Warranty Registration

To activate the warranty, the product must be registered at the time of installation or delivery. Products can be registered online at www.norac.ca. Extended parts warranty can also be purchased when registering the product warranty. *Please note the extended parts warranty must be purchased within 30 days of equipment purchase.*

2 Safety Precautions

The UC5 Spray Height Control system will greatly improve your spraying height accuracy and protect the boom against damage in a wide variety of field conditions. However, under some circumstances performance may be limited. The operator of the sprayer must remain alert at all times and override the automatic control when necessary.

CAUTION

Under no circumstances should any service work be performed on the machinery while the UC5 Spray Height Control system is in the automatic mode.

Always ensure that the UC5 Spray Height Control system is powered down or in manual mode:

- Before leaving the operator's seat.
- While the machine is not moving.
- When transporting the machine.

Before working on any part of the booms:

- Set the UC5 system to manual mode.
- Turn the sprayer engine off.

Do not operate this system before:

- Reading and understanding the operator's manual.
- Thoroughly understanding the machine operation.

3 Technical Specifications



CAN ICES-3(A)/NMB-3(A)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

This Class A digital apparatus complies with Canadian ICES-003.

Pursuant to EMC Directive – Article 9, this product is not intended for residential use.

Table 1: System Specifications

Supply Voltage (rated)	12VDC
Supply Current (rated)	5A
Hydraulic Pressure (maximum)	3300 psi
Baud Rate	250 kbps
Clock Frequency (maximum)	96 MHz
Solenoid Valve PWM Frequency	300 Hz
Ultrasonic Sensor Transmit Frequency	50 kHz
Operating Temperature Range	0°C to 80°C

4 System Description

4.1 General UC5 System Layout

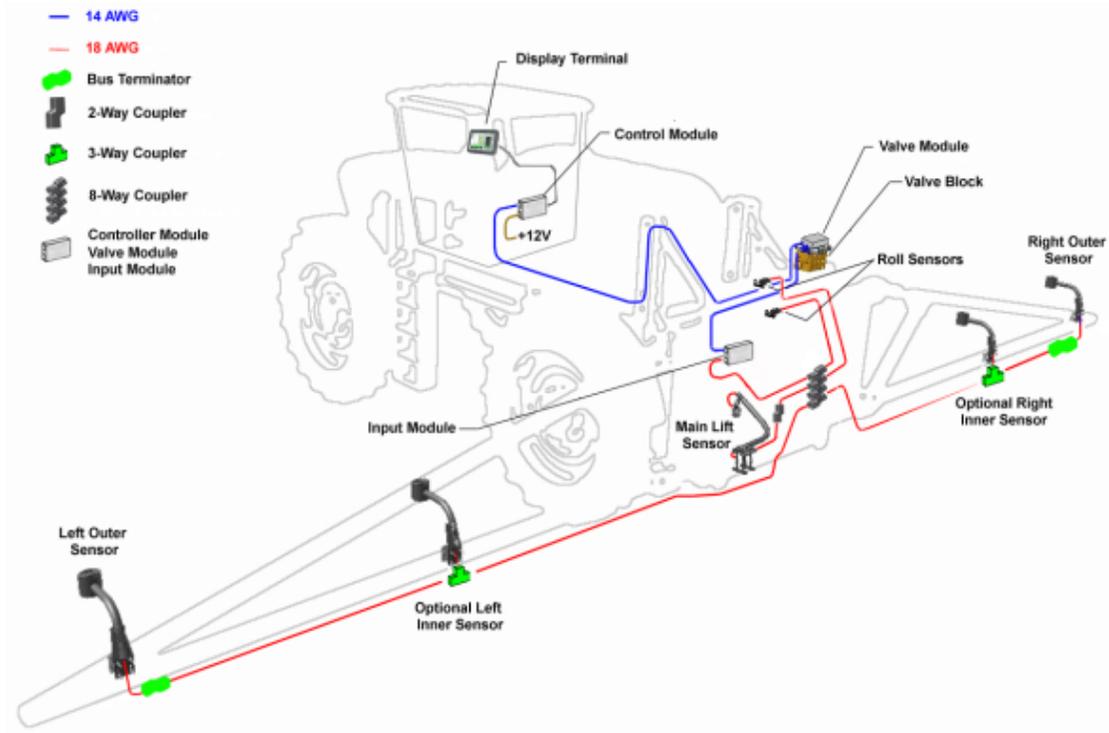


Figure 1: General UC5 System Layout (Self Propelled)

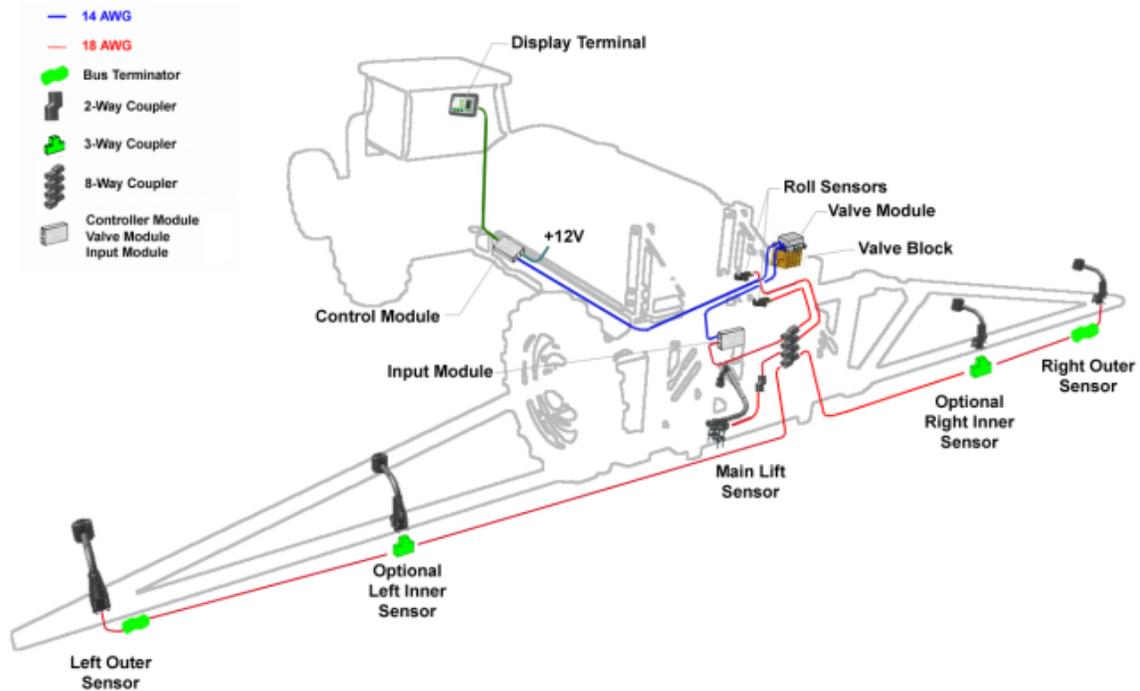


Figure 2: General UC5 System Layout (Pull Type)

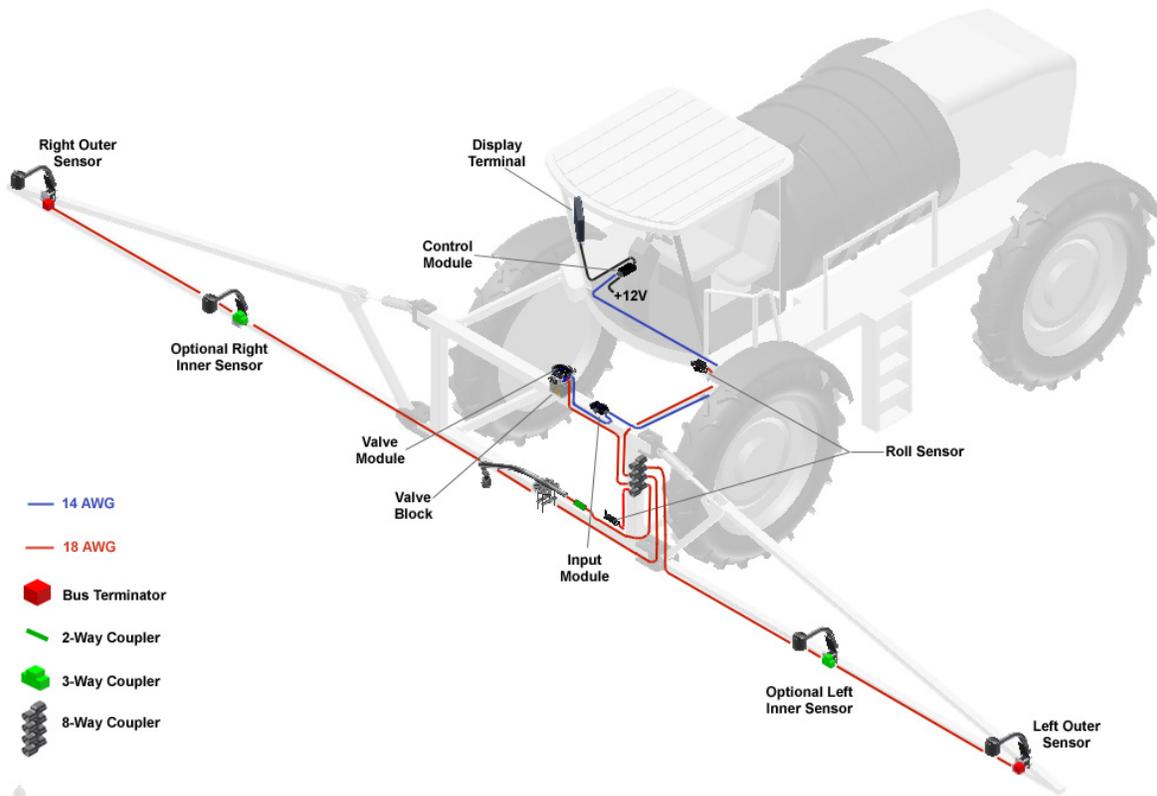


Figure 3: General UC5 System Layout (Front Mount)

4.2 Height Sensors

- Height sensors use an ultrasonic signal to measure distance to the ground or crop canopy.
- Normally there are three height sensors used. A sensor is mounted to the outer part of each boom tip, and another sensor is mounted to the center section.

4.3 Roll Sensors

- Roll sensors are important for measuring boom and sprayer roll dynamics.
- Two roll sensors are normally used for a UC5 Spray Height Control System.
- The mounting position of the roll sensors vary from sprayer to sprayer depending on boom geometry and suspension.

4.4 Modules

- Normally there are three modules included: a control module, an input module, and a valve module.
- Module status is indicated by a LED. Shortly after power-up, the module should present a green light, indicating the module is functioning and ready.

5 Operation

5.1 Run Screen

Once the system is correctly configured, it is very simple to use. The majority of functional settings and controls can be accessed on the main screen. An image of the boom, with the height of each boom section is displayed.

To change between automatic and manual, press the button in the lower right corner of the terminal. When the boom is blue, the UC5 system is in automatic. When the boom is black, the UC5 system is in manual.

When the UC5 Height Control System is in automatic, arrows will appear on the screen above or below the boom sections. These arrows indicate the UC5 system is making a correction to part of the boom in the displayed direction. Often times the correction will be very small and there may not be a noticeable change in boom position.

The height displayed on the boom is measured from the spray nozzles to the soil (soil mode) or crop canopy (crop mode). If there are five height sensors on the sprayer, the height displayed is the outer sensor height only. The main run screen is shown below for the Ag Leader® InSight™, INTEGRA™, EDGE™ and VERSA™ Displays.

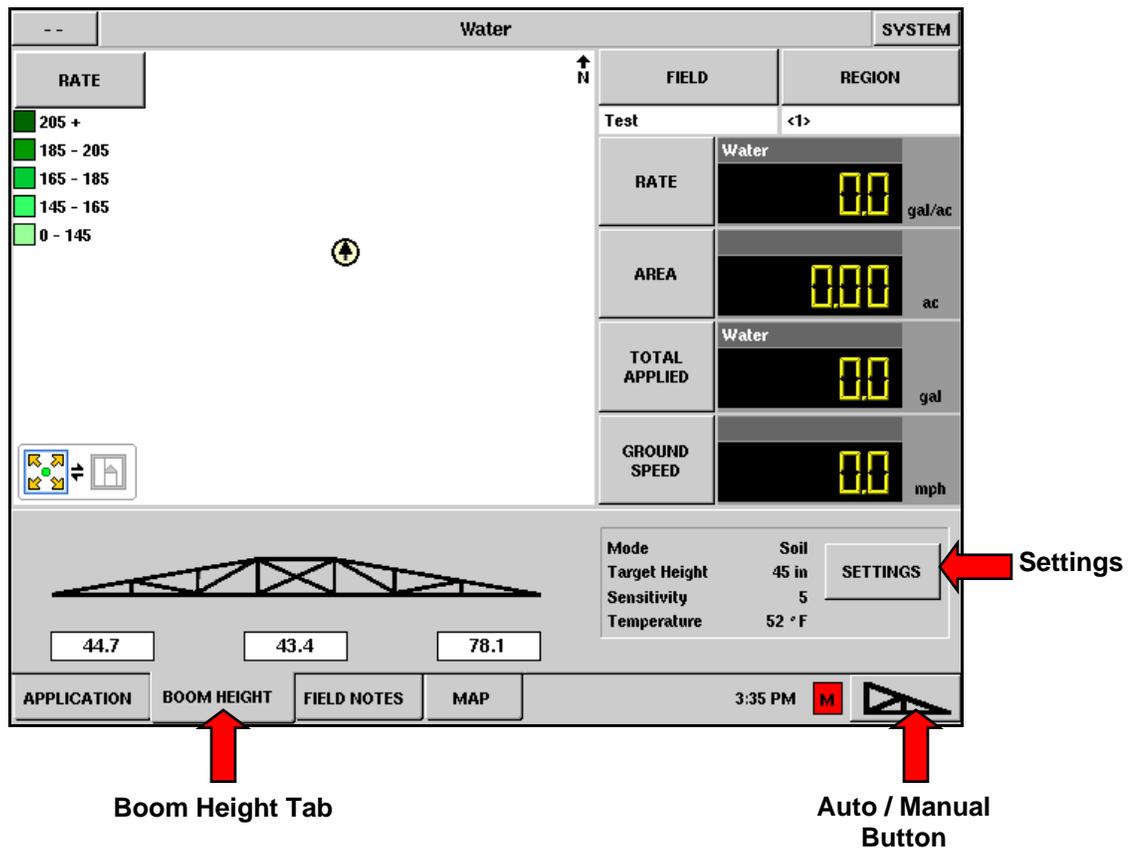


Figure 4: InSight™ Main Run-Screen

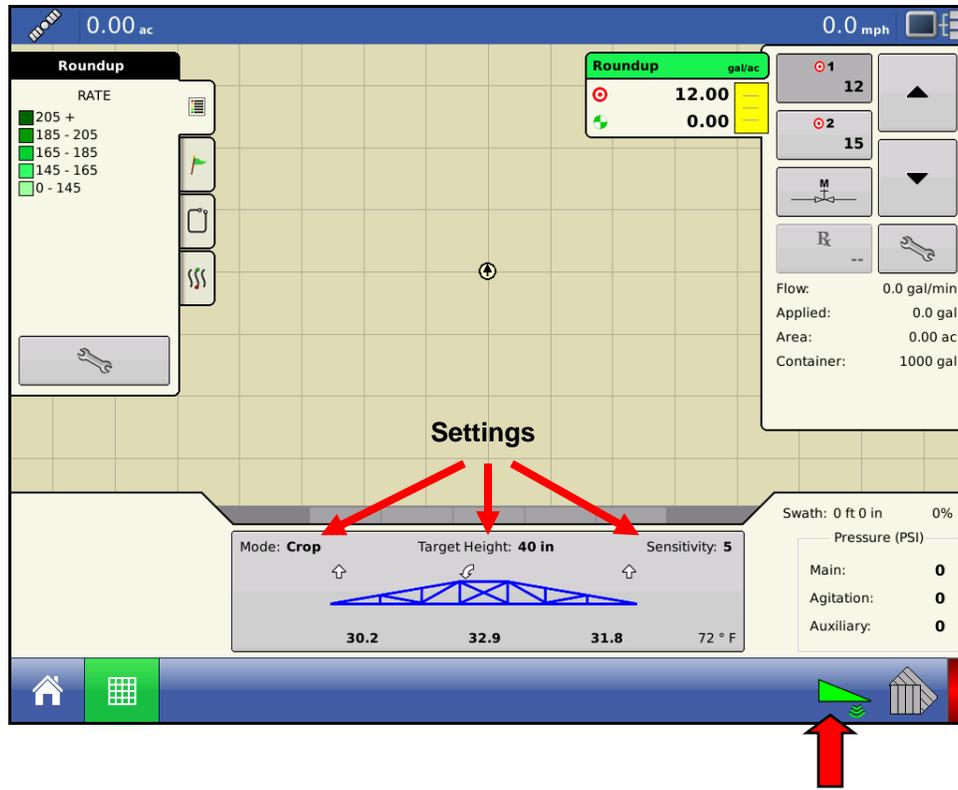


Figure 5: INTEGRA™ Main Run-Screen
Auto / Manual Button

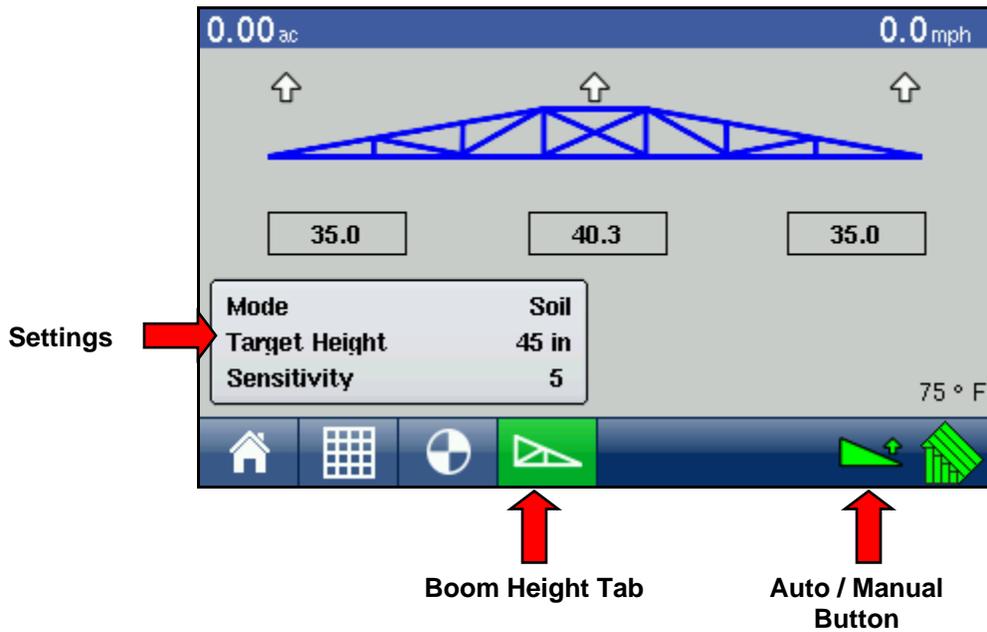


Figure 6: EDGE™ Main Run-Screen

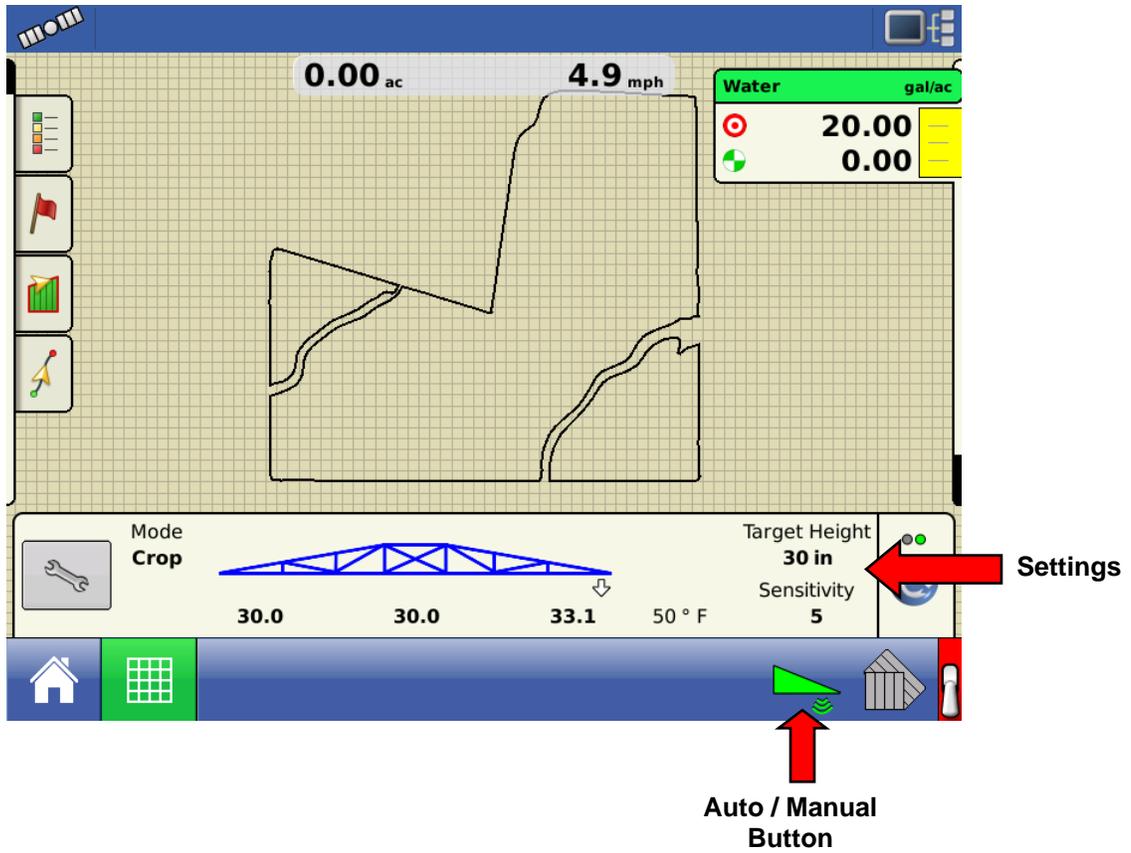


Figure 7: VERSA™ Main Run-Screen

5.2 Settings

The NORAC UC5 settings are displayed on the main run screen. To change these settings on the Integra or VERSA, press on the boom image to display the boom height control options screen as shown in **Figure 8**. To change the settings on the InSight and EDGE, click the settings button.

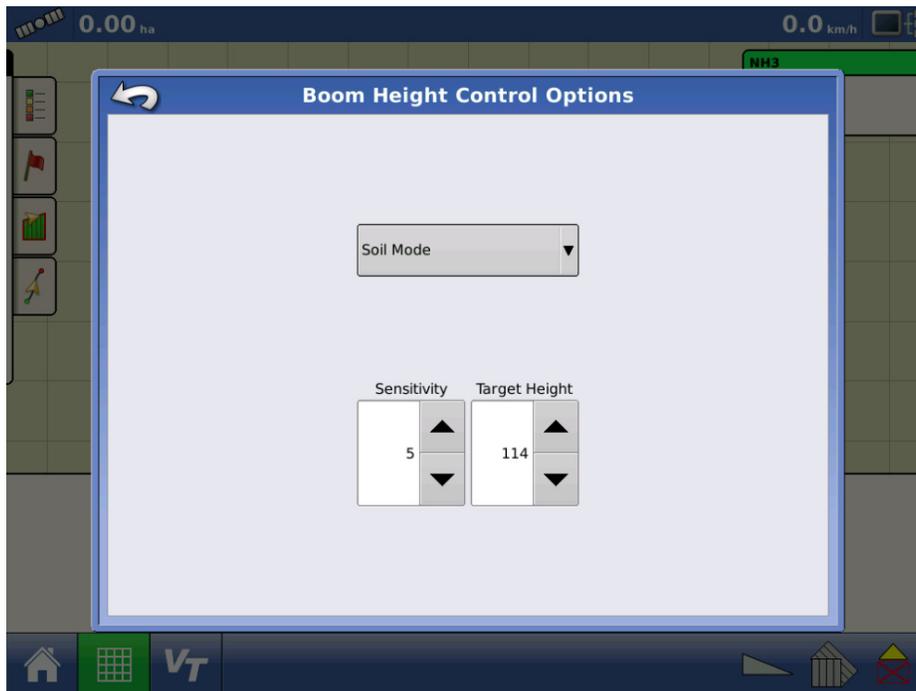


Figure 8: Boom Height Control Settings Screen (Integra™ Display)

Soil / Crop Mode:

The top drop down box allows the system to be changed from soil mode to crop mode. Soil mode allows the sensors to read a height from the spray nozzles to the ground, whereas crop mode will read the height from the spray nozzles to the top of the crop canopy. For more information on crop and soil mode refer to **Section 6.4**.

Sensitivity:

The sensitivity can be adjusted from 1 to 10, with 5 being the default setting. A lower number will reduce the system sensitivity. Higher settings will speed up the response and also create a greater demand on the hydraulics.

Target Height:

The target height is the height you would like the boom to be set at when spraying. When operating in soil mode, the target height is measured from the spray nozzles to the soil. In crop mode the target height is measured from the crop canopy to the spray nozzles.

5.3 Sprayer Switches

When a sprayer switch is pressed, an arrow will be displayed on the screen showing which function is being activated. For example, if the left up switch is pressed then an arrow will be shown above the left boom pointing up.

Tilt Switches:

While in automatic, if either left or right tilt switches are pressed, the corresponding boom section will go into manual mode. This is useful when spraying near ditches or fences where you would like to manually control one of the booms while leaving the other boom in automatic mode. To return all boom sections to automatic, press the auto / manual button. If the Double Tap Wings function is enabled, the tilt down switches can be used to resume Automatic Mode.

Main Lift Switch:

While in automatic, if the main lift up or down switch is momentarily pressed, the target height is incrementally adjusted up or down.

If Headland Assist (**Section 9.1**) is enabled with the trigger as the main lift switch, then the main lift switch will be used to control Headland Assist instead of the target height. The main lift up switch will activate Headland Assist. By pressing main lift down the system will return to automatic mode.

Pressing and holding the main lift switch will always put the system into manual. If the Double Tap Main function is enabled, the main lift down switch can be used to resume Automatic Mode.

** Some sprayer types may not have all the functionality listed above.*

6 Understanding the UC5 System

The UC5 Spray Height Control System will work well in most situations. As with any equipment, it is important that the operator remains alert at all times. There may be some situations and terrain where performance is limited and in these situations the operator must resume manual control of the booms. A discussion of settings and performance is given below to clarify these situations.

6.1 Boom Reaction Time

Sprayer hydraulics and boom suspension systems are the governing components to boom reaction time. The maximum hydraulic speed of the boom is determined by the sprayer manufacturer and is not diminished by the addition of the UC5 hydraulic system.

6.2 Ditches, Waterways and Outside Rounds

In many situations it is necessary to spray with one sensor reading over terrain that does not reflect the same situation of the rest of the boom. These situations may arise when spraying over ditches, waterways, or field edges. When spraying in these situations the operator must remain alert and override the height controller when necessary.

6.3 Driving Through Ditches and Over Terraces

Changes in terrain such as driving over terraces or through ditches are special performance situations. This type of terrain can cause the sprayer to pitch and roll significantly and when operating at high speeds this can cause rapid changes in boom tip height. Sprayer hydraulic systems are not capable of tip speeds high enough to correct for the boom tip error. There are two solutions to this problem.

- The first is for the operator to recognize these situations before they occur and manually raise the boom to a safe height.
- The second is to add the NORAC Roll Control option, if one is available for the specific sprayer. This will compensate for the sprayer roll and make the required corrections faster and smoother, allowing for increased boom protection and higher spraying speeds. For a description of the NORAC Roll Control, see **Section 8.3**.

6.4 Soil Mode and Crop Mode

Height sensors use “smart sensor” technology, which take measurements from both the top of the crop canopy and from the soil surface. This allows the user to select either “Crop” or “Soil” mode. In “Soil” mode the target height is measured from the soil to the sprayer nozzle. In “Crop” mode the target height is measured from the crop canopy to the sprayer nozzle.

Crop mode is usually used when operating in mature cereal grains, row crops or specialty crops. Soil mode is generally used to follow the ground through young crops, stubble or normal trash. Generally, if 60 percent of the ground is covered, crop mode should be used. Sometimes either mode may be used, depending on the crop.

- In row-crops, crop mode will work best with the sensor placed directly above a row. Soil mode will work best with the sensor placed between two rows.
- Crops in growing stages are relatively good targets for crop mode.
- Bearded crops are relatively poor targets for crop mode as they are a poor reflector of sound.
- Some crops will produce a more varying canopy than others. In these situations, the severe terrain option (**Section 8.1**) will provide more representative measurements when in crop mode and better performance.
- When mounting the main lift height sensor, ensure the sensor does not measure behind a wheel or tramline, when driving straight or turning. The crop behind a wheel will be flattened, resulting in inaccurate readings and poor crop mode performance.
- When operating in crop mode when the crop is lodged, or where there is no crop, the sensor will follow the target down and begin to track the soil. However, when the crop resumes, the sensor may be beneath the crop canopy, or the canopy might be within the blanking range of the sensor therefore preventing the sensor from making proper measurements. This situation may require the operator to manually raise the boom.

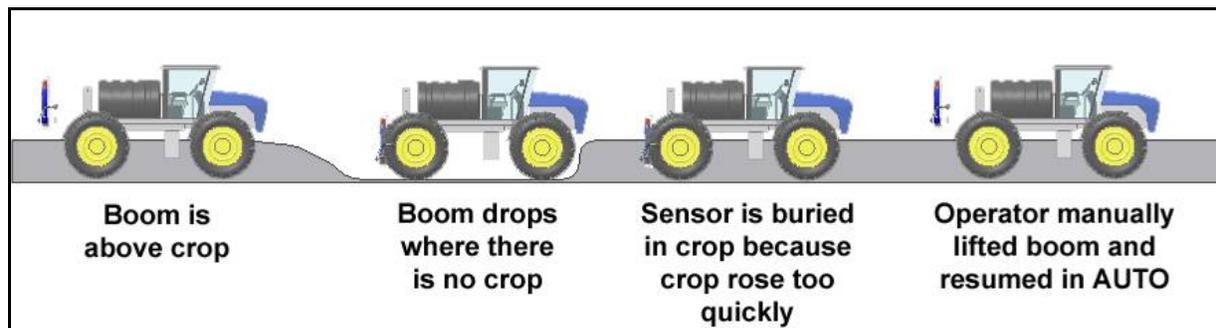


Figure 9: Area of No Crop When Operating in Crop Mode

6.5 Sensing Further Ahead of the Boom

A common misconception is moving the sensor further ahead of the boom will increase performance. Moving the sensor further ahead of the boom increases the distance between the nozzle and sensor. This puts the sensor at a different location within the field than the nozzles, which introduces a height error at the nozzles. In severe terrain this height error can bring the nozzles close to the ground as the sensor reads over the crest of the hill or down a ditch.

Similarly, aiming the sensors ahead (rather than pointing straight down) will reduce sensor performance by providing inaccurate height readings.

6.6 Height Sensor Capabilities and Limitations

The UC5 sensors are designed and built specifically for agricultural purposes. However, the ultrasonic transducer must be clean and dry for optimal performance. The foam disc fitted into the bottom of the sensor protects the transducer from dust. If the protective foams become wet from rain or drift from the spray nozzles the sensors may have trouble reading. Furthermore, if the transducer itself becomes wet, leave the UC5 system on, but in manual mode. The transducer's vibrations will clean itself of the water and after a few minutes it will begin to function again.

The height sensors will provide height readings from 22 to 300 cm (9 to 120 inches), under typical conditions.

In order to optimize sensor performance, the UC5 sensor has a minimum distance that it will read (also known as the blanking range). As a result, the UC5 sensor is designed to ignore targets closer than 8 inches (20cm) from the bottom of the sensor housing.

7 Setup

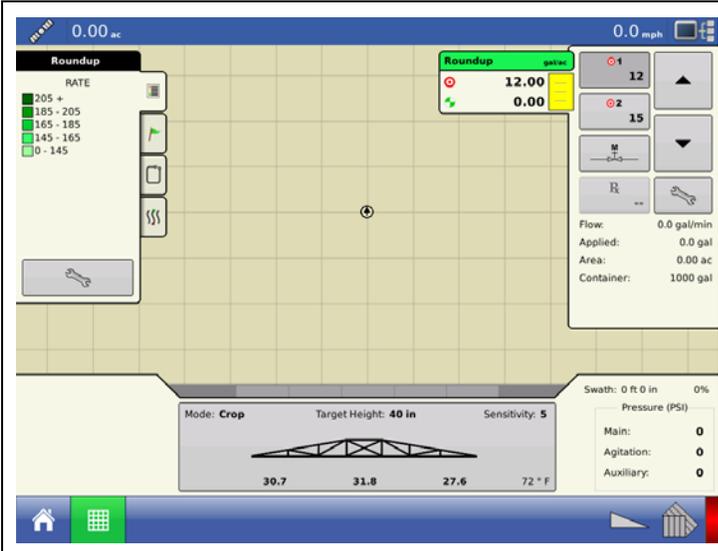
Once the UC5 Spray Height Control System has been installed, the Norac unlock code must be entered in the display. The Norac unlock code can be purchased from Ag Leader®. Before continuing, it is also recommended that any software updates for the Ag Leader® display and the Norac UC5 Spray Height Control system be downloaded from www.agleader.com and installed into the system.

After the Norac unlock code has been installed on the Ag Leader® display, the UC5 functionality must be tested and the software must be tuned for the sprayer. There are two methods to setup the UC5 system. The recommended way is to use the automatic system setup as shown in **Section 7.2**. The alternative method is to use manual setup, which is intended for expert users and troubleshooting.

* Some screens in this manual may appear different, depending on the type of display you have.

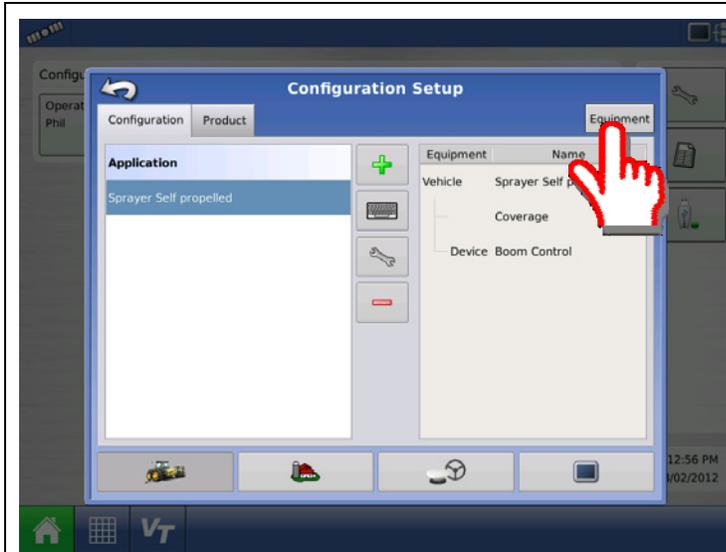
7.1 Navigating to the UC5 Setup Menu

To perform either the automatic or manual system setup, the user must navigate to the Norac UC5 setup menu.

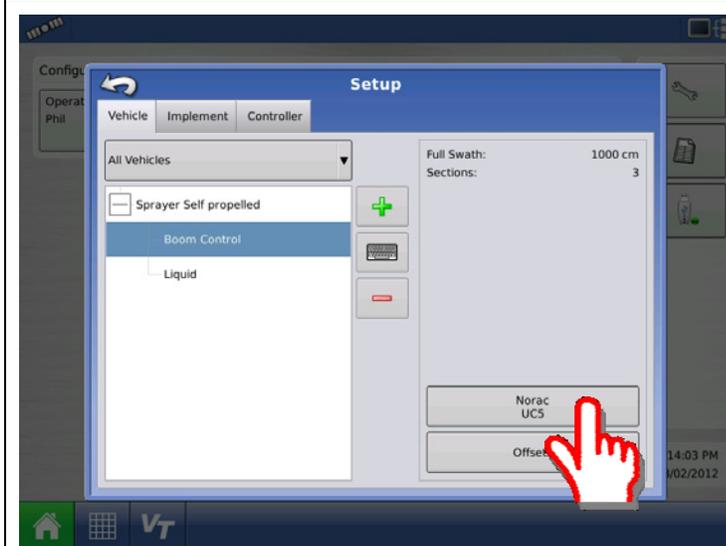


The screenshot shows the Ag Leader display interface. At the top, it displays '0.00 ac' and '0.0 mph'. The main area is a map with a grid. On the left, there's a 'Roundup' section with a 'RATE' legend showing four categories: 205+, 185-205, 165-185, and 0-145. A wrench icon is visible in the bottom left of the map area. On the right, there's a 'Roundup' control panel with a '12.00' rate display, a '0.00' rate display, and two buttons labeled '12' and '15'. Below this, there are buttons for 'M', 'R', and a wrench icon. Further down, it shows 'Flow: 0.0 gal/min', 'Applied: 0.0 gal', 'Area: 0.00 ac', and 'Container: 1000 gal'. At the bottom, there's a 'Swath: 0 ft 0 in 0%' display and a 'Pressure (PSI)' section with 'Main: 0', 'Agitation: 0', and 'Auxiliary: 0'. The bottom of the screen has a navigation bar with a home icon, a grid icon, and a right arrow.

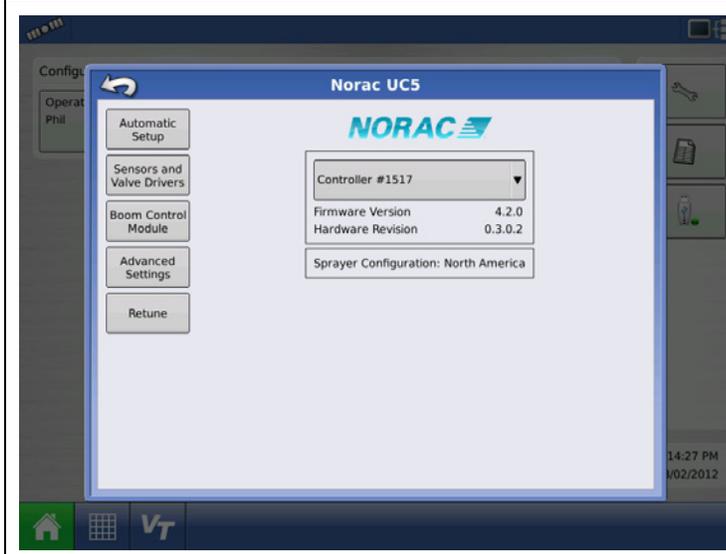
On the display, press the wrench to navigate to the Settings screens. The UC5 must be in manual to do this.



On the Setup page, click on the “Equipment” button.



Click on the Vehicle Tab and under the Vehicle Tab; highlight Boom Control on the list.
Select the “Norac UC5 Setup” button.



This is the Norac UC5 setup menu. The following sections will describe the features found within this menu.

7.2 Automatic System Setup

CAUTION

- All boom sections will move during the automatic install.
- People and equipment must be clear of sprayer boom.
- Ensure the booms have sufficient range to lift fully and are clear of any power lines.

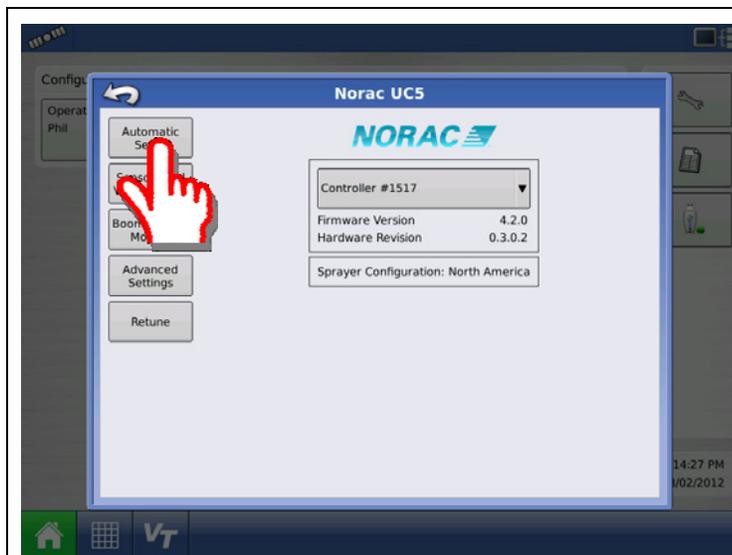
 All settings will be lost and the system will be inoperable until an automatic setup is completed.

Unfold the sprayer in a location that is relatively level and where the sensors are over bare soil or gravel. Do not conduct the system setup or retune procedures over standing crop or weeds/grass. Also, avoid concrete or asphalt surfaces.

Ensure the boom roll suspension system is functioning properly and smoothly. Friction on wear surfaces can be relieved using lubricants (grease, etc) or adjustment. Properly tuned suspension systems will optimize UC5 performance, especially on roll-bias (active roll) systems.

For best results, the hydraulic system should be under a normal load and at a normal working temperature.

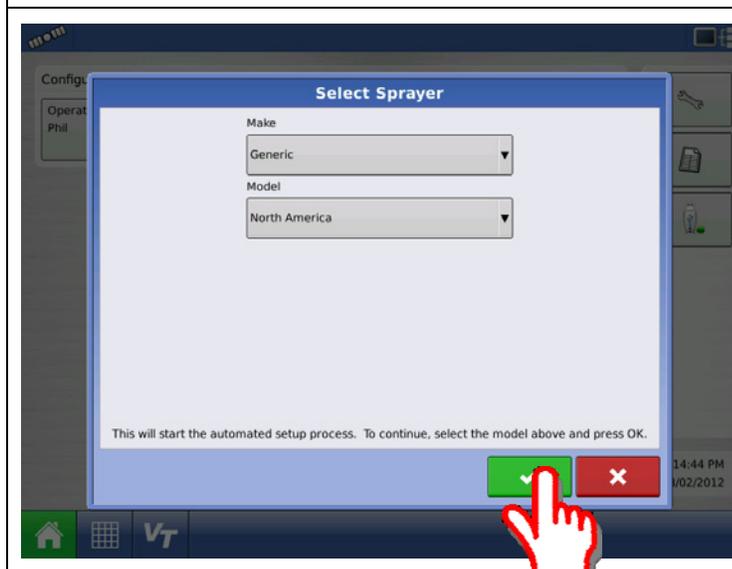
- Start the solution pump and run the sprayer's engine at a normal working RPM for the entire setup.
- Cycle all boom sections up and down manually for five minutes to warm the oil.
- For pull-type sprayers, ensure any hydraulic flow controls are adjusted for normal field operation.
- Changing the hydraulic flow controls after or during the system setup will affect the UC5 performance.



Navigate to the UC5 setup screen.

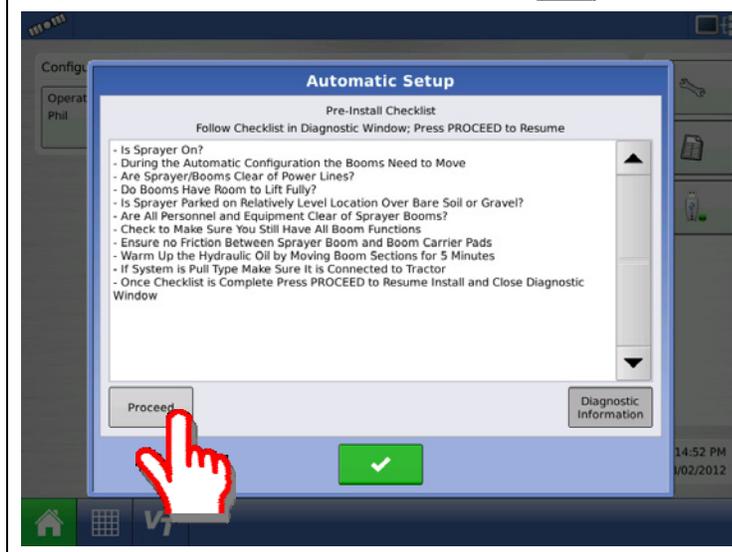
When the UC5 setup window is displayed, make sure the drop down box under the Norac logo is populated.

Select Automatic Setup.



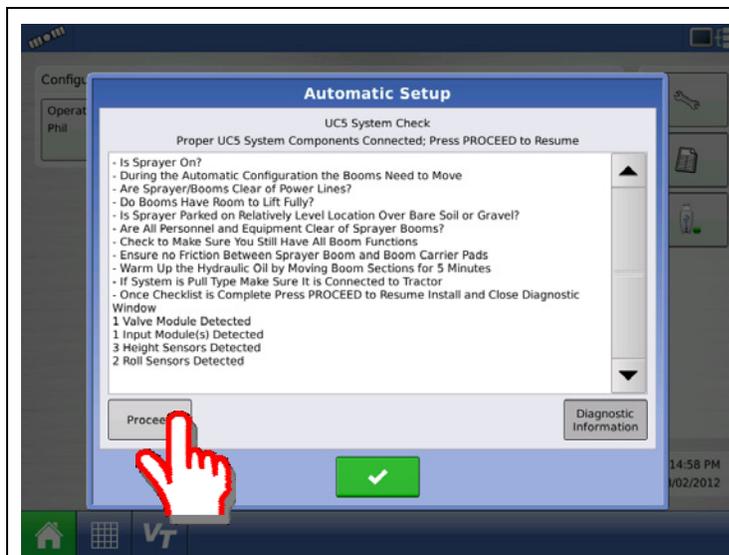
Select the sprayer make and model from the drop down boxes.

Then press the Check button.



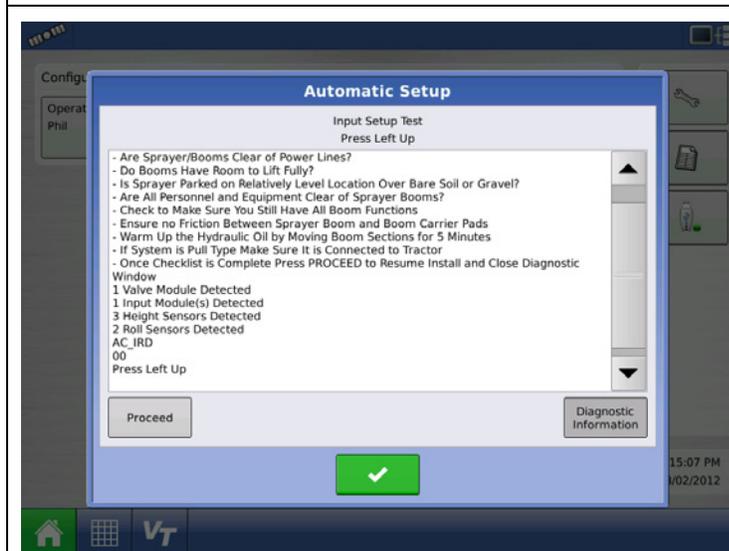
A list of precautions will be displayed on the terminal. It is very important that you read these precautions and follow them.

Once you have read the precautions, press the PROCEED button.

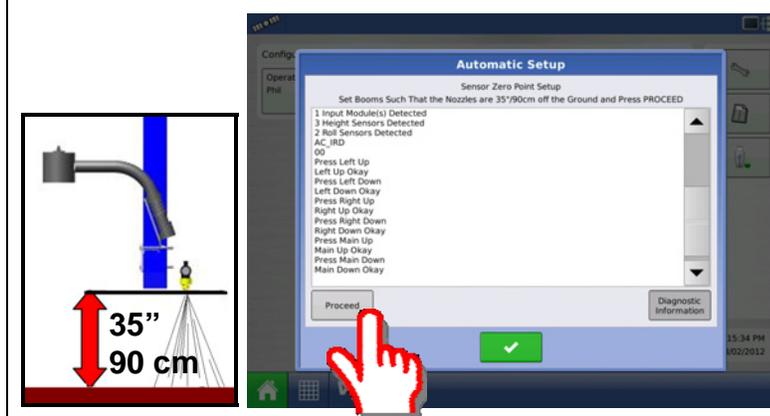
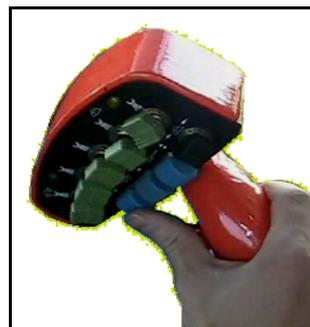


A list of connected modules will be displayed. Make sure the modules match your system modules.

If the list of modules matches the currently installed modules, press the PROCEED button.

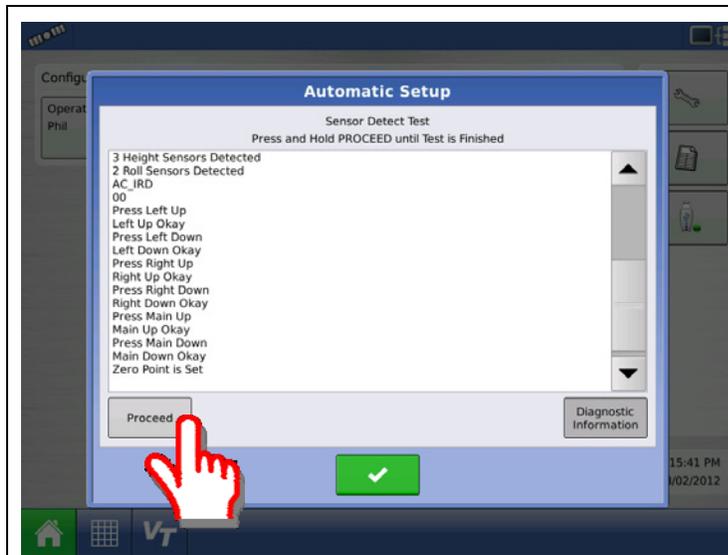


The system will instruct you to move boom functions using the sprayer controls. Move each boom as instructed on the terminal.



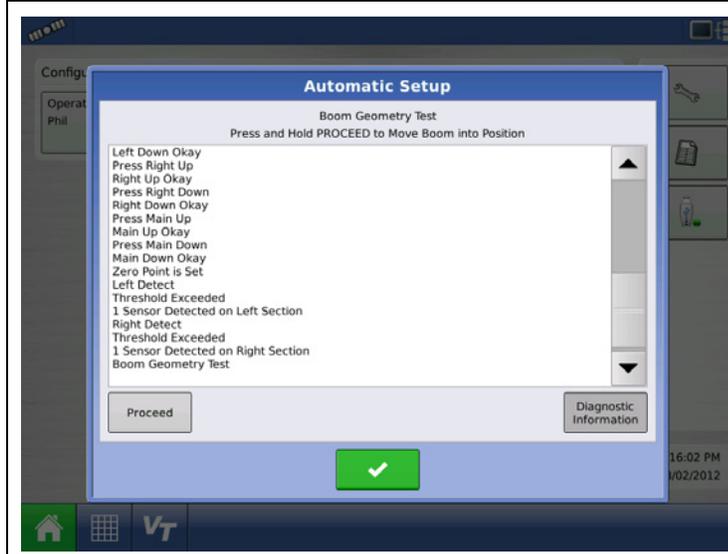
You will then be instructed to place the booms so the nozzles are 35" (90 cm) from the ground. Adjust the distance from the nozzle to the ground directly beneath. Ensure you are over bare, flat soil.

When the measured distance is 35" (90 cm) press PROCEED.



You will then be instructed to hold the PROCEED button. Continue holding while each boom section is moved during the “Sensor Detect Test”.

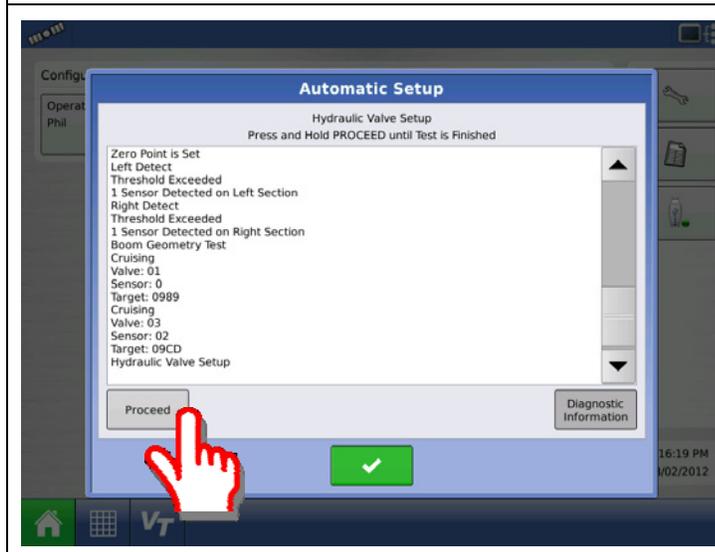
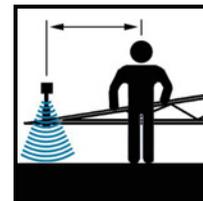
Then the terminal will display “Cruising”. When it is done the terminal will instruct you to release the PROCEED button. Do not move the booms at this time.



The terminal will then instruct you to exit the cab and pull the boom tip down towards the ground, and then release the boom.

Ensure you stay a minimum of 3 feet (1 m) away from any of the sensors.

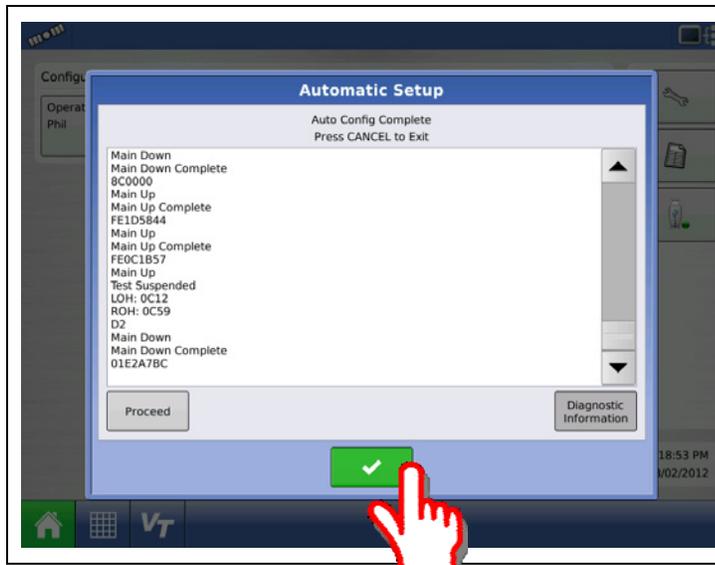
When finished, return to the cab.



Hold the PROCEED button and continue holding it until you are instructed to release it.

The system will now calibrate the hydraulics. All boom sections will move.

If you accidentally release the button, press and hold the PROCEED button to resume.



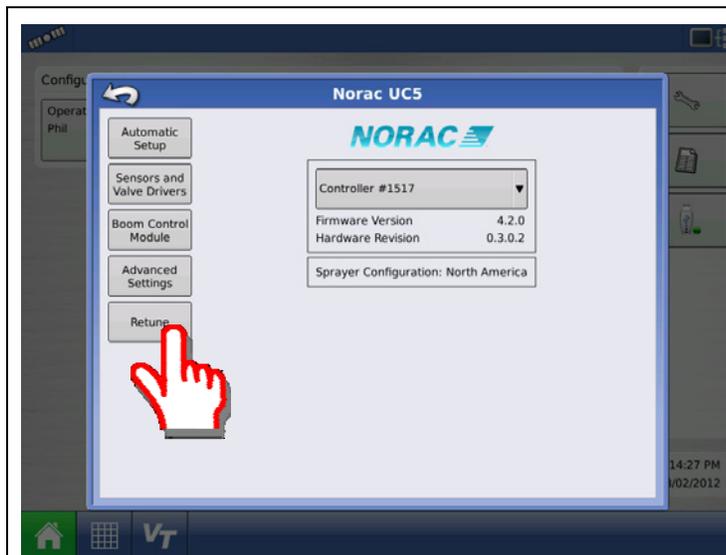
When the setup is finished the terminal will instruct you to press CANCEL to complete the automatic setup. On the Integra, press the green check button.

Your NORAC UC5 system is now configured and ready for operation.

7.3 Retune

On occasion it is necessary to recalibrate the NORAC UC5 Height Control System. You may want to perform a retune when:

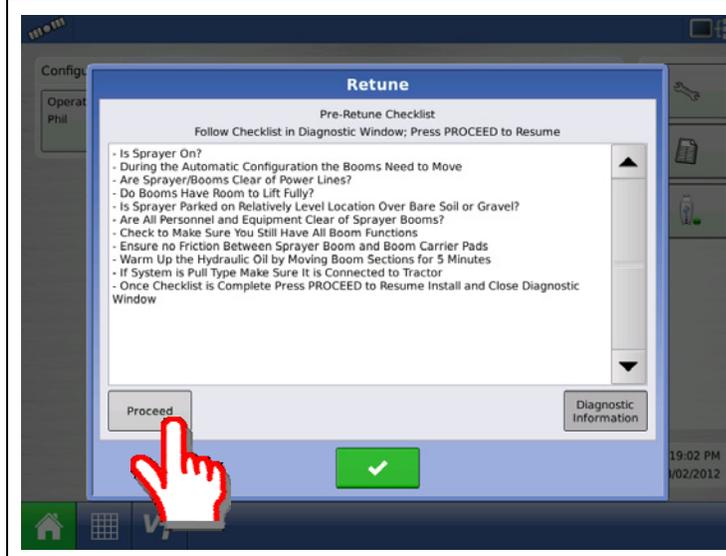
- A hydraulic solenoid has been changed.
- A hydraulic pump has been changed or adjusted.
- A different tractor has been connected to the sprayer.
- The tractor's hydraulic flow control has been adjusted.



Navigate to the UC5 setup screen.

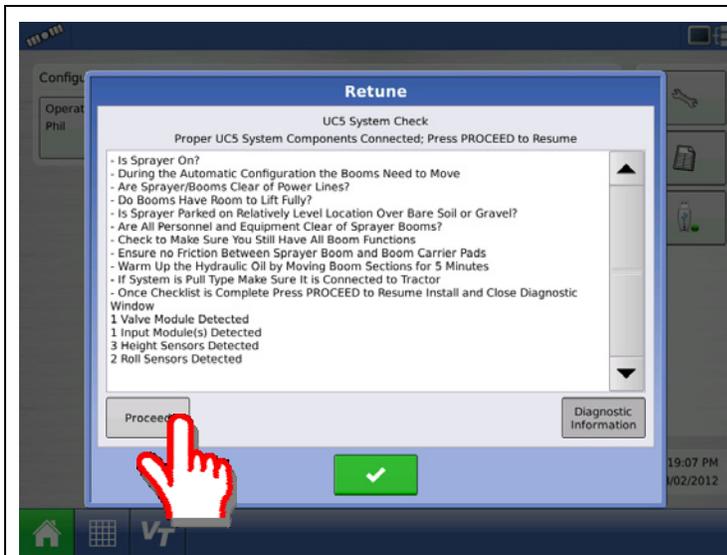
When the UC5 setup window is displayed, make sure the drop down box under the Norac logo is populated.

Select Retune.



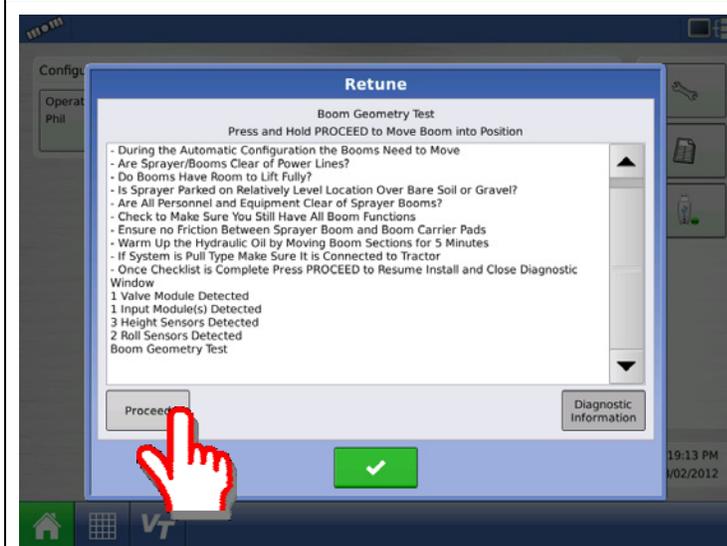
A list of precautions will be displayed on the terminal. It is very important that you read these precautions and follow them.

Once you have read the precautions, click the PROCEED button.



A list of connected modules will be displayed. Make sure the modules match your system modules.

If the list of modules matches the currently installed modules, press the PROCEED button.



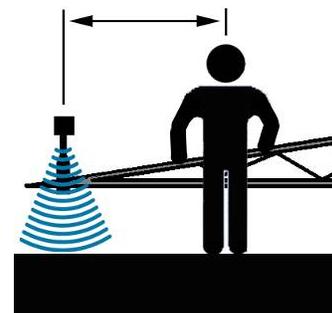
You will then be instructed to hold the PROCEED button. The terminal will display “Cruising”.

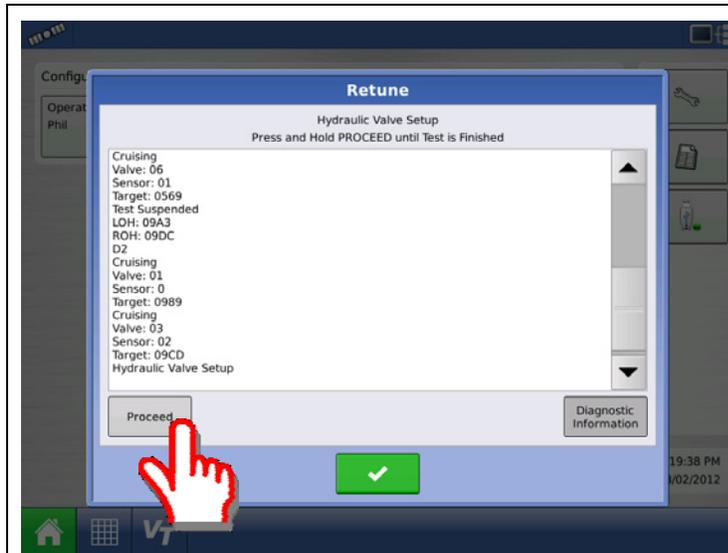
The terminal will then instruct you to exit the cab and pull the boom tip down towards the ground, and then release the boom.

If you wish to skip the boom geometry test, press the PROCEED button.



Ensure you stay a minimum of 3 feet (1 m) away from any of the sensors. When finished, return to the cab.

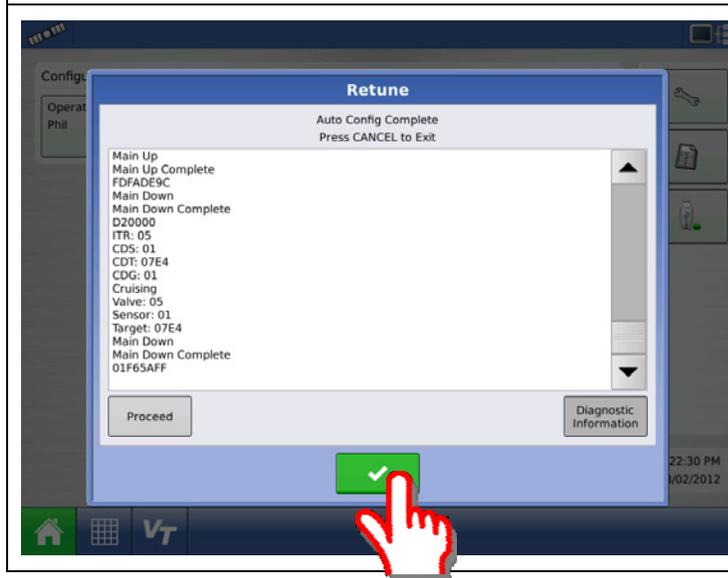




Hold the PROCEED button and continue holding it until you are instructed to release it.

The system will now calibrate the hydraulics. All boom sections will move.

If you accidentally release the button, press and hold the PROCEED button to resume.



When the Retune is finished the terminal will instruct you to press cancel to complete the Retune. On the Integra, press the green check button.

Your NORAC UC5 system is now configured and ready for operation.

7.4 Manual Setup

The UC5 Height Control system will not operate in automatic mode until the system has been configured. It is recommended that the automatic system setup be used, but if necessary a manual system setup may be used. The manual system setup involves setting up each sensor, valve output and remote switch input.

7.4.1 General Settings: Minimum Height Mode

Minimum height mode is normally used only for systems with five sensors (severe terrain kit). Since the five sensor system has two wing sensors that average the height, it is possible to have a boom tip close to the ground while still maintaining an acceptable average height. The minimum height defines the lowest height in which a single sensor on the wings is allowed to go.

The “relative” setting defines the number as the distance below the target height. The “absolute” setting defines the number as the distance above the ground.

7.4.2 Sensor Setup

Before beginning, it is necessary to know the serial number and location for each of the sensors. The sensor serial number is located on the bottom of the sensor housing, beside the foam disc.

It is recommended that you record the sensor location and serial number in **Figure 10**, because this information may be required during troubleshooting.

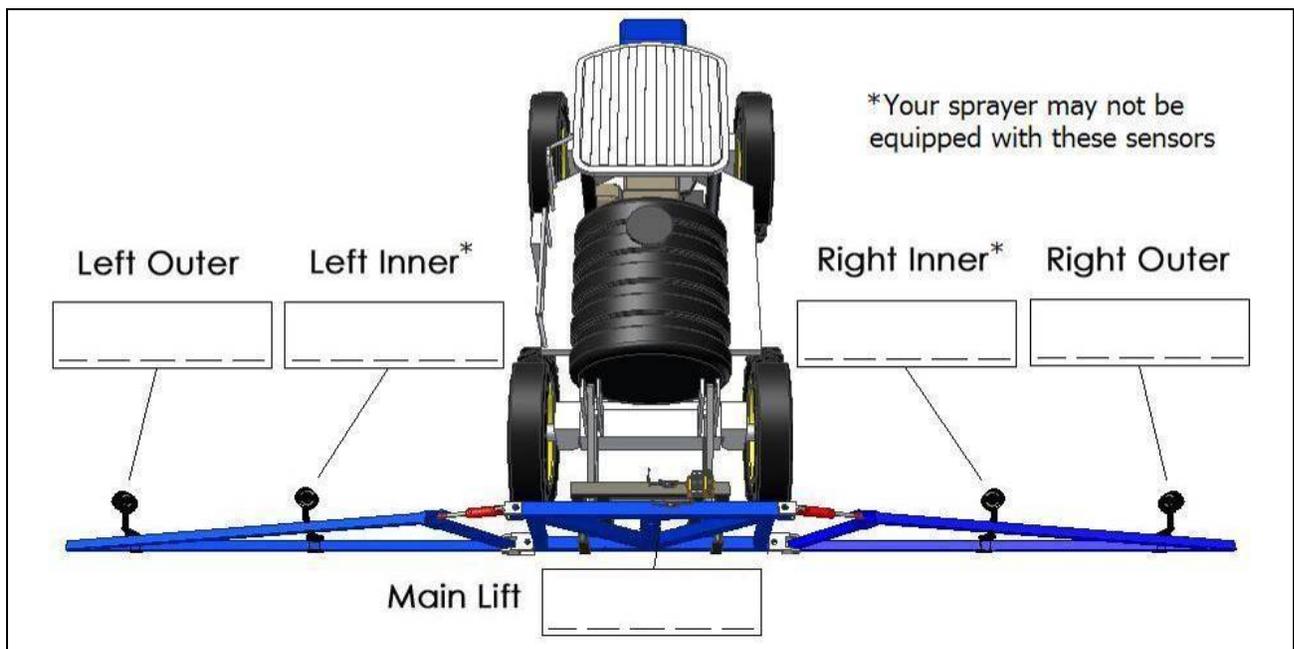
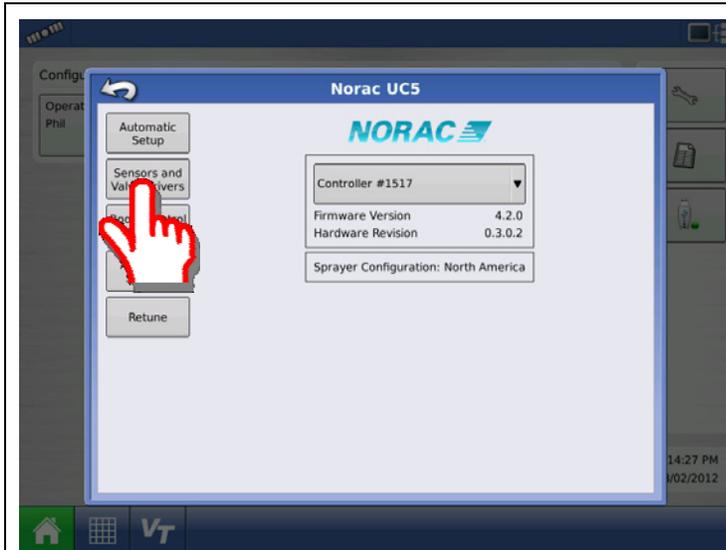


Figure 10: Sensor Serial Numbers and Positions

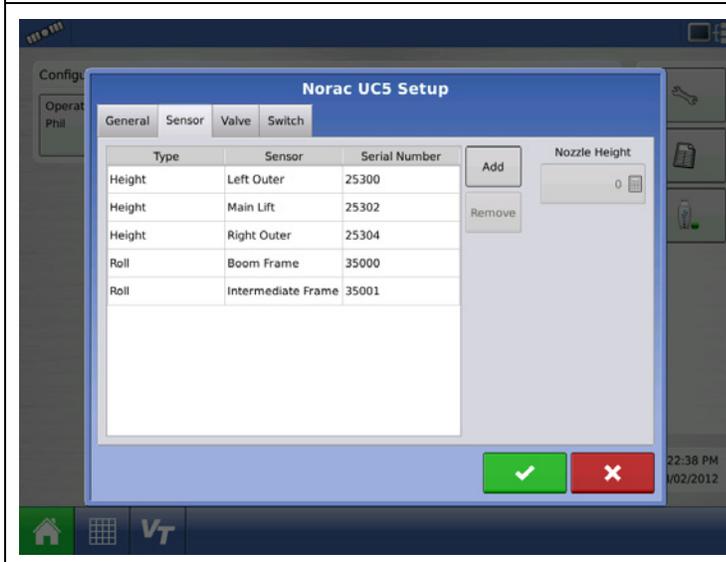
Once the sensor serial numbers and locations are known, the sensor setup can be performed using the following steps:



Navigate to the UC5 setup screen.

When the UC5 setup window is displayed, make sure the drop down box under the Norac logo is populated.

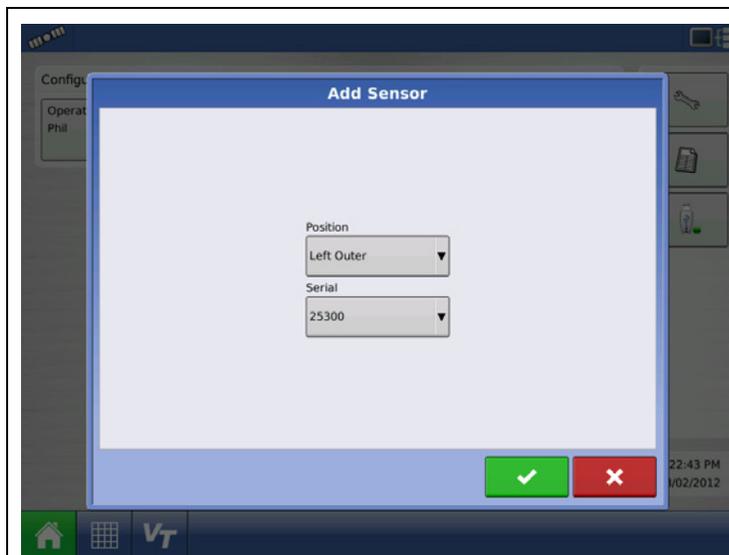
Select Sensors and Valve Drivers.



Select the Sensor tab.

This screen displays a list of currently configured sensors. If a sensor is not displayed in this screen, then it has not been setup.

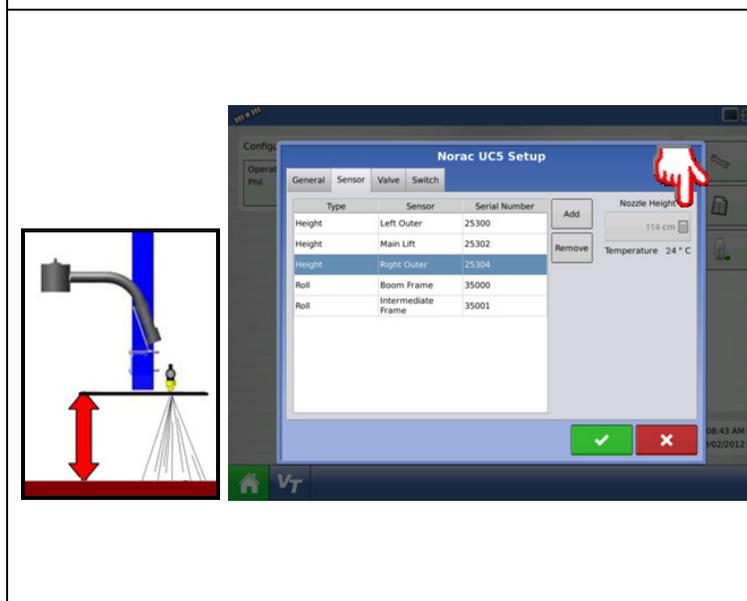
To setup a sensor, press the Add button.



Select the sensor position that you are configuring and select the appropriate serial number from the second drop down menus.

Select the check to confirm.

Continue this for each of the sensors, if necessary.



To set the sensor height, select the appropriate sensor. Measure from the ground to the bottom of the nearest sprayer nozzle tip.

Click on the keypad beside the nozzle height textbox and enter the measured number.

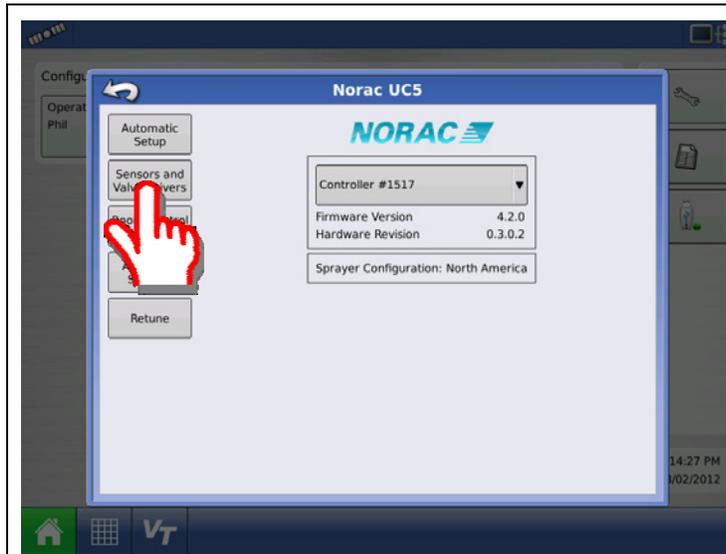
Repeat this to enter the correct height for each of the sensors.

When you change the roll sensor value the text changes from Nozzle Height to Measured Roll. This should be zero when the boom is level.

7.4.3 Valve Setup

Each valve must be setup and tuned correctly for optimum performance from the Norac UC5 Spray Height Controller. When setting up the valves, the sprayer booms must have room to move in their full range of motion. Make sure there are no obstructions, such as power lines, that the booms may come into contact with.

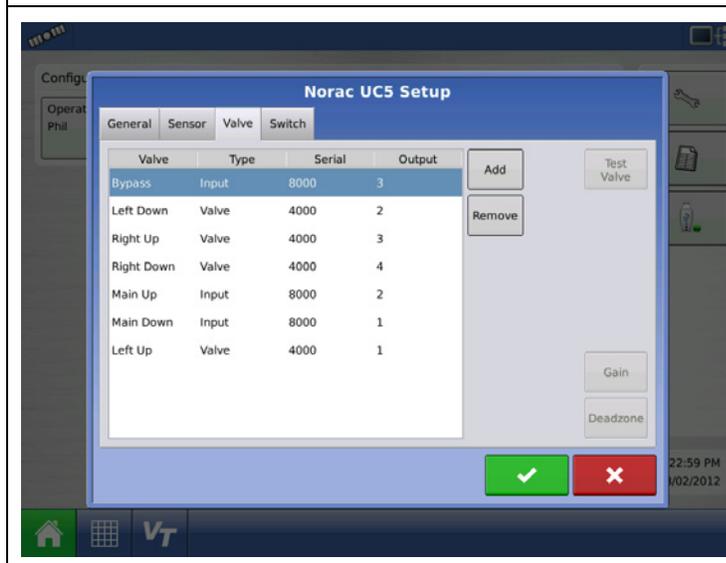
Before setting up the valves manually, it is recommended you attempt the automatic install. Starting the automatic install will load the default valve settings, which will make the manual valve setup much simpler. At any time the automatic install can be cancelled and the default settings are still stored.



Navigate to the UC5 setup screen.

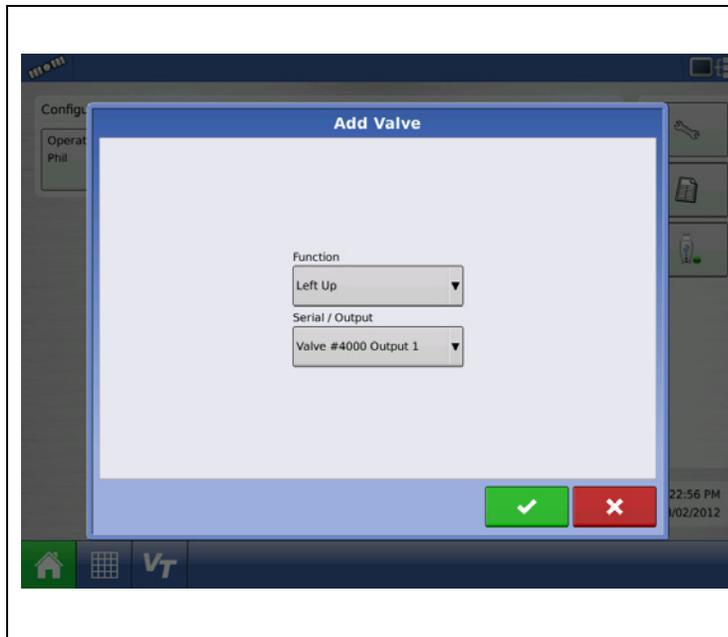
When the UC5 setup window is displayed, make sure the drop down box under the Norac logo is populated.

Select the Sensors and Valve Drivers button.



Select the Valve tab. This screen displays a list of currently configured valve functions. If a function is not displayed in this screen, then a valve has not been assigned for it.

To configure valve function, press the Add button.



Select the function that you are configuring and the appropriate driver (Serial/Output) from the drop-down menus.

There are two sources of drivers, the input module and valve module. You must choose the correct module and correct output for the valves to work correctly. A list with a default setup is shown in **Table 2** and **Table 3**.

Select the check to confirm.

Continue this for each of the sprayer functions if necessary.

Table 2 – Default Output Channels

Function	Module	Output Channel
Left Up (prop. valve)	Valve Module	1
Left Down (prop. valve)	Valve Module	2
Right Up (prop. valve)	Valve Module	3
Right Down (prop. valve)	Valve Module	4
Main Down (prop. valve)	Valve Module	5
Main Up (prop. valve)	Valve Module	6
Roll CCW (prop. valve)	Valve Module	7
Roll CW (prop. valve)	Valve Module	8
Main Down	Input Module	1
Main Up	Input Module	2
Aux 1 (Bypass)	Input Module	3
Aux 2	Input Module	4
Aux 3	Input Module	5
Aux 4	Input Module	6

In the case where the UC5 Input Module is driving the roll (slant) function, use the table below (**Table 3**) for the default output channels.

Table 3 – Alternate Output Channels

Function	Module	Output Channel
Left Up (prop. valve)	Valve Module	1
Left Down (prop. valve)	Valve Module	2
Right Up (prop. valve)	Valve Module	3
Right Down (prop. valve)	Valve Module	4
Main Down (prop. valve)	Valve Module	5
Main Up (prop. valve)	Valve Module	6
Main Down	Input Module	1
Main Up	Input Module	2
Aux 1 (Bypass)	Input Module	3
Roll CW	Input Module	4
Roll CCW	Input Module	5
Aux 4	Input Module	6

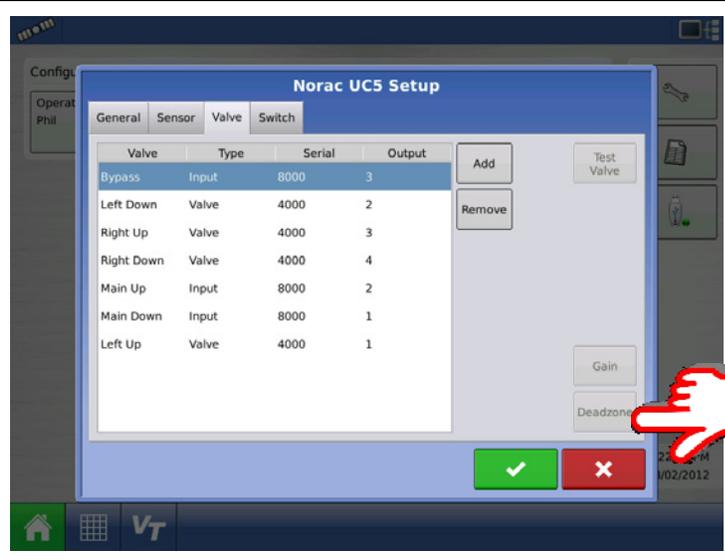
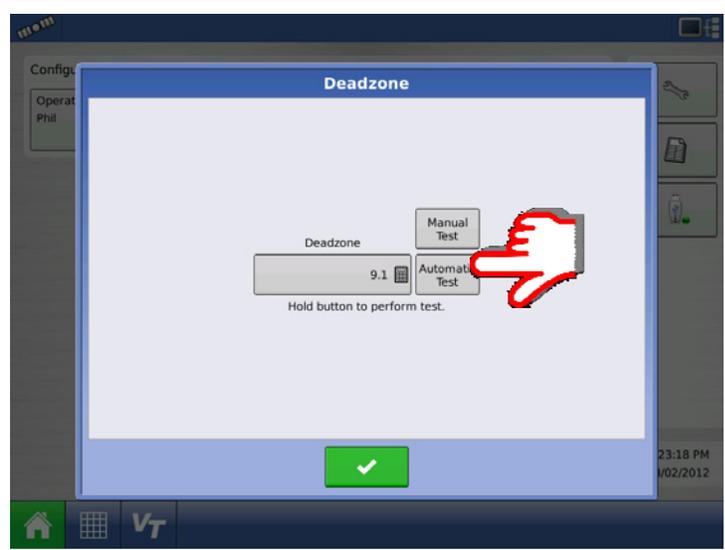
7.4.4 Valve Tuning

Each valve has two settings; a dead zone and gain setting. The dead zone relates to the smallest amount of movement the valve can produce. The gain relates to the maximum speed at which the valve can move the boom function.

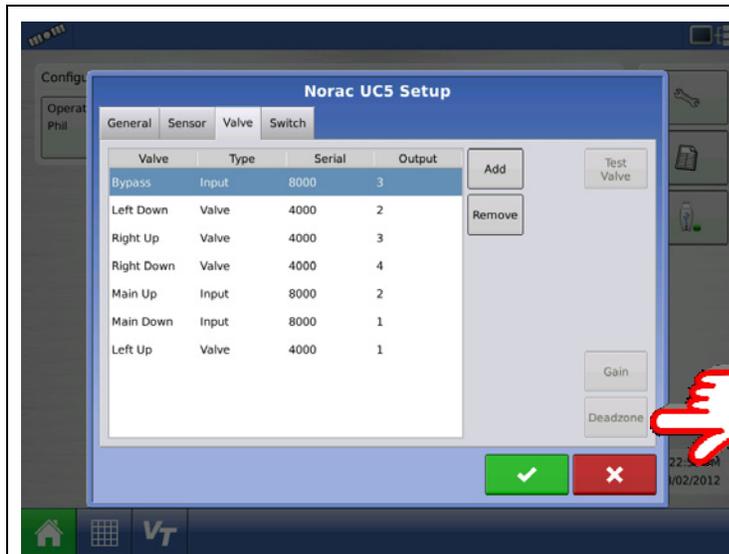
A dead zone and gain parameter exists for each valve. Each valve may be tuned:

- Automatically (as part of the automatic install or retune).
- Automatically (one valve at a time).
- Manually.

Automatic Dead Zone Calibration:

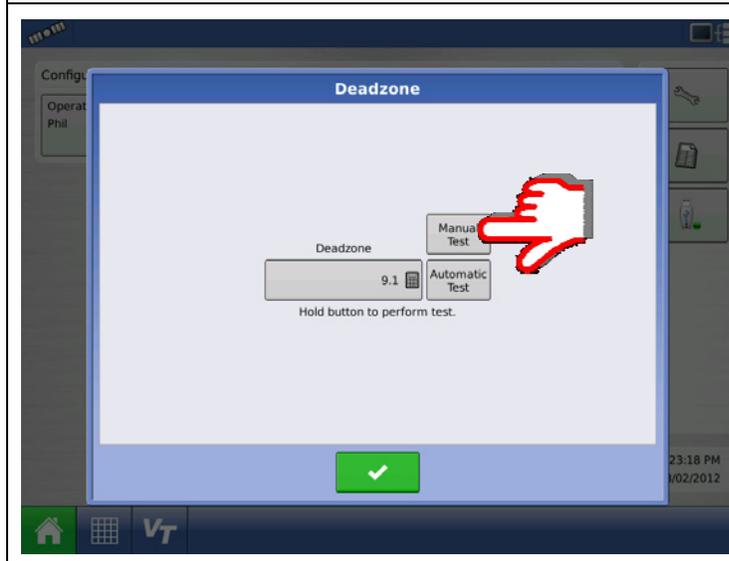
 <table border="1"><thead><tr><th>Valve</th><th>Type</th><th>Serial</th><th>Output</th></tr></thead><tbody><tr><td>Bypass</td><td>Input</td><td>8000</td><td>3</td></tr><tr><td>Left Down</td><td>Valve</td><td>4000</td><td>2</td></tr><tr><td>Right Up</td><td>Valve</td><td>4000</td><td>3</td></tr><tr><td>Right Down</td><td>Valve</td><td>4000</td><td>4</td></tr><tr><td>Main Up</td><td>Input</td><td>8000</td><td>2</td></tr><tr><td>Main Down</td><td>Input</td><td>8000</td><td>1</td></tr><tr><td>Left Up</td><td>Valve</td><td>4000</td><td>1</td></tr></tbody></table>	Valve	Type	Serial	Output	Bypass	Input	8000	3	Left Down	Valve	4000	2	Right Up	Valve	4000	3	Right Down	Valve	4000	4	Main Up	Input	8000	2	Main Down	Input	8000	1	Left Up	Valve	4000	1	<p>In the Valve tab, select the function that you wish to calibrate.</p> <p>Press the Deadzone button.</p>
Valve	Type	Serial	Output																														
Bypass	Input	8000	3																														
Left Down	Valve	4000	2																														
Right Up	Valve	4000	3																														
Right Down	Valve	4000	4																														
Main Up	Input	8000	2																														
Main Down	Input	8000	1																														
Left Up	Valve	4000	1																														
 <p>Deadzone: 9.1</p> <p>Manual Test</p> <p>Automatic Test</p> <p>Hold button to perform test.</p>	<p>Press and hold the Automatic Test button. Continue to hold it until the display says “Test Complete”.</p> <p>This will automatically calibrate the Deadzone value for that function.</p> <p>When the test is complete, press the check to save the setting.</p>																																

Manual Dead Zone Calibration:



In the Valve tab select the function that you wish to calibrate.

Press the Deadzone button.



Press and hold Manual Test.

Continue to hold it until the boom stops moving and the live reading of the distance travelled stabilizes.

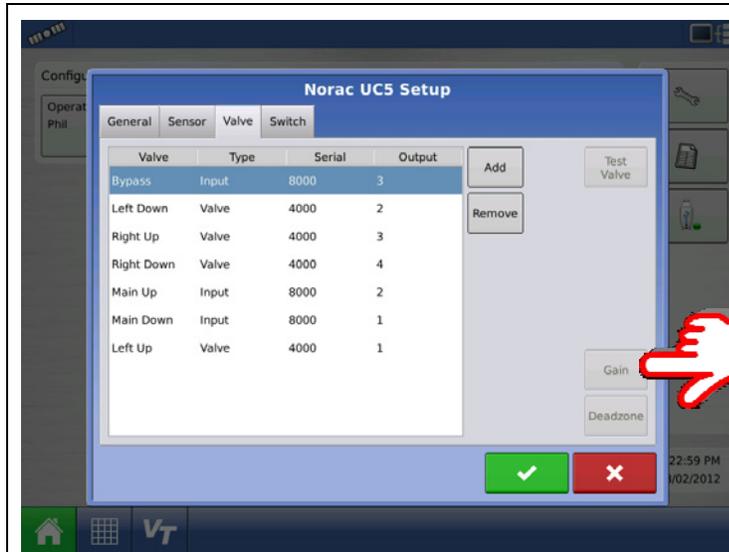
When properly tuned, the distance travelled should be 1-2 inches (2-5cm).

Adjust the deadzone value until the distance travelled is 1-2" (2-5cm).

When properly calibrated, press the check.

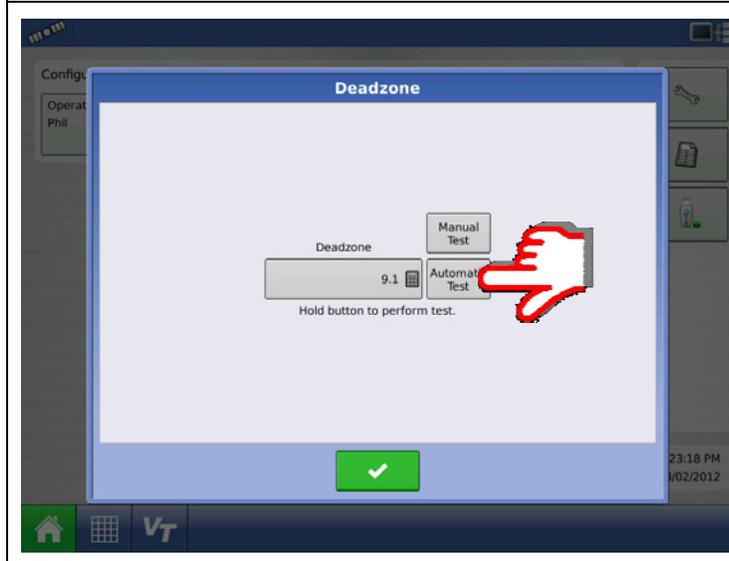
Automatic Gain Calibration:

Before tuning the gain setting, the dead zone for that function must be tuned. If the dead zone tuning has not been completed, follow the instructions for tuning a dead zone.



In the Valve tab, select the function that you wish to calibrate.

Press the Gain button.



Press and hold the Automatic Test button. Continue to hold it until the display says "Test Complete".

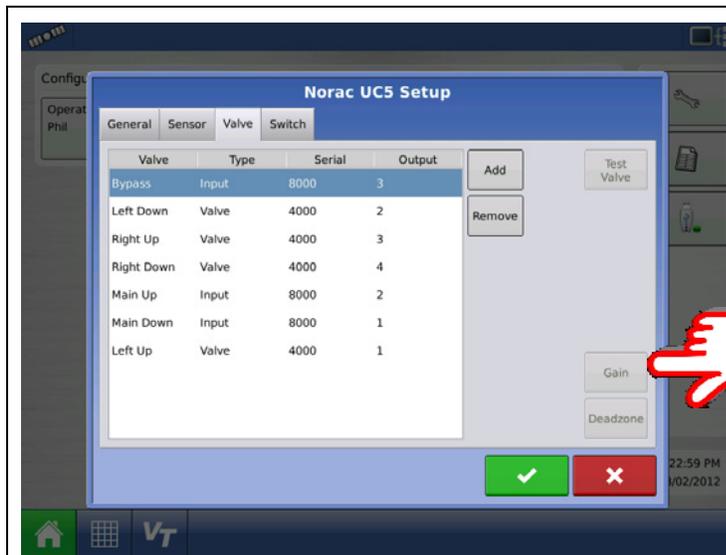
This will automatically calibrate the gain value for that function.

When the test is complete, press the check to save the setting.

Manual Gain Calibration:

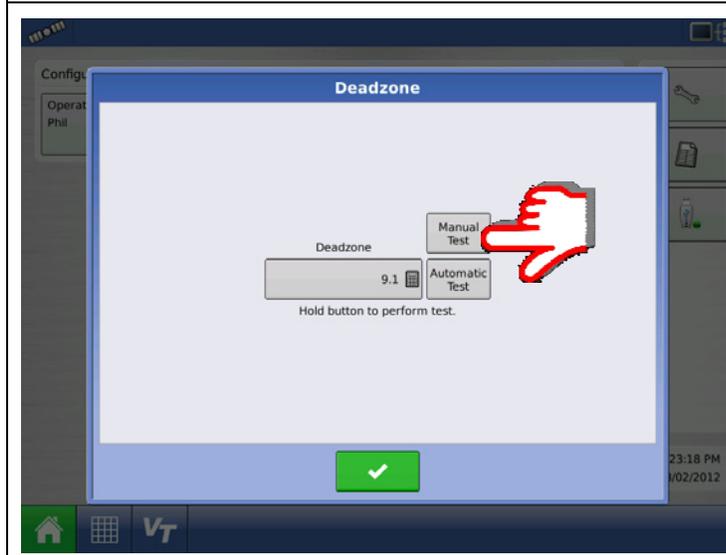
This test will drive the boom at full speed in the selected direction for one second. Make sure the boom has full range of movement and if driving the boom down, make sure it is not close to the ground. The purpose of this test is to determine the sprayer boom speeds. It is recommended that you perform each test three times and average your readings.

From the speed measurements taken, use **Table 4** to determine the appropriate gain values to use for each function. This test will provide approximate results for gain values. Proper gain values rely on more than just boom speed so it is highly recommended to use the automatic gain setup if possible.



In the Valve tab select the function that you wish to calibrate.

Press the Gain button.



Press and hold the Manual Test button. Continue to hold it until the boom stops moving and the live height reading stabilizes.

Displayed is the boom speed, in inches/second.

Use the following tables to determine the appropriate gain values.

Press the check button to accept the setting.

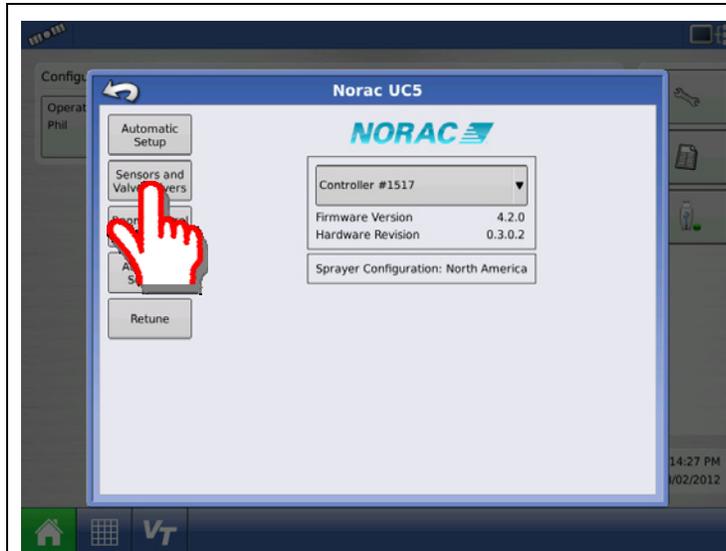
Table 4 – Gain Settings

Function	Boom Speed (inch / sec)	Up Gain	Down Gain
Tilt	1 - 5	Too Slow	Too Slow
Tilt	5 - 15	225 - 175	100 - 70
Tilt	15 - 25	175 - 150	70 - 50
Tilt	25 - 40	150 - 100	50 - 30
Tilt	40 - 70	100 - 50	30 - 15
Tilt	70 +	50 - 1	15 - 1
<hr/>			
Main (on / off)	1 - 5	300 - 225	300 - 225
Main (on / off)	5 - 10	225 - 150	225 - 150
Main (on / off)	10 - 15	150 - 90	150 - 90
Main (on / off)	15 - 20	90 - 45	90 - 45
<hr/>			
Main (proportional)	1 - 5	250 - 225	250 - 225
Main (proportional)	5 - 10	225 - 200	225 - 200
Main (proportional)	10 - 15	200 - 180	200 - 180
Main (proportional)	15 - 20	180 - 160	180 - 160
<hr/>			
Roll (proportional)	1 - 3	900 - 850	900 - 850
Roll (proportional)	3 - 6	850 - 800	850 - 800
Roll (proportional)	6 - 9	800 - 750	800 - 750
Roll (proportional)	9 - 15	750 - 700	750 - 700
Roll (proportional)	15 - 20	700 - 650	700 - 650
<hr/>			
Roll (on / off)	1 - 5	300 - 225	300 - 225
Roll (on / off)	5 - 10	225 - 150	225 - 150
Roll (on / off)	10 - 15	150 - 90	150 - 90
Roll (on / off)	15 - 20	90 - 45	90 - 45

7.4.5 Remote Switch Setup

Remote switches allow manual override of the UC5 system. Depending on the input, this may cause a complete override or a partial override of UC5 automatic control. Each of the UC5 functions requires a manual override.

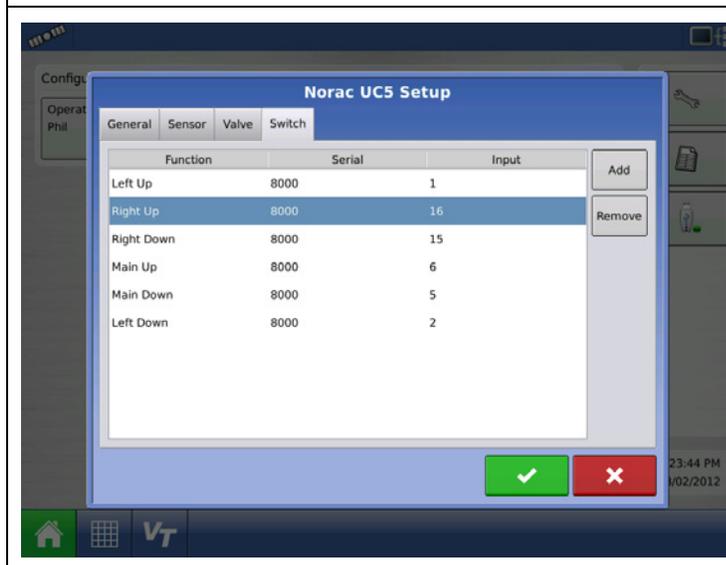
Before manually setting up the remote switches it is recommended that you attempt an automatic setup. By starting an automatic setup the default values will be set up for the remote switches.



Navigate to the UC5 setup screen.

From the UC5 setup window, make sure the drop down box under the Norac logo is populated.

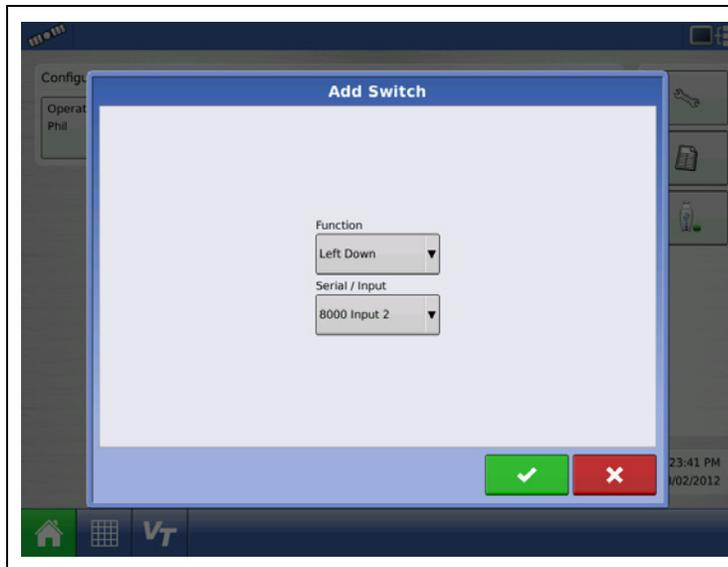
Press the Sensors and Valve Drivers button.



Select the Switch tab.

This screen displays a list of currently configured remote switches. If a function is not displayed in this screen, then a switch has not been setup for it.

To setup a function, press the Add button.



Select the function that you are setting up from the drop down menu, and then select the appropriate switch from the serial/output box.

A list with the default input channels is shown in **Table 5**.

Select Accept to set the settings.

Continue this for each of the sprayer functions, if necessary.

Table 5 – Default Input Channels

Function	Module	Input Channel
Left Up	Input Module	1
Left Down	Input Module	2
Aux 2	Input Module	3
Aux 1 (Bypass)	Input Module	4
Main Down	Input Module	5
Main Up	Input Module	6
Aux 3 (Rem Man)	Input Module	7
Aux 4 (Rem Auto)	Input Module	8
Roll CCW	Input Module	13
Roll CW	Input Module	14
Right Down	Input Module	15
Right Up	Input Module	16

In the case where the UC5 Input Module is driving the roll (slant) function, use the table below (**Table 6**) for the default input channels.

Table 6 – Alternate Input Channels

Function	Module	Input Channel
Left Up	Input Module	1
Left Down	Input Module	2
Roll CW	Input Module	3
Aux 1 (Bypass)	Input Module	4
Main Down	Input Module	5
Main Up	Input Module	6
Roll CCW	Input Module	7
Aux 4 (Rem Auto)	Input Module	8
Aux 3 (Rem Man)	Input Module	13
Aux 2	Input Module	14
Right Down	Input Module	15
Right Up	Input Module	16

8 Optional Kits

The kits shown below are optional add on kits for the UC5 Spray Height Control System. These kits will help improve the performance for certain situations described below.

8.1 Severe Terrain Kit

- Additional sensors may be added to improve boom protection and system performance.
- This is more suitable for larger booms and in severe terrain conditions.
- Improves performance in crop mode.

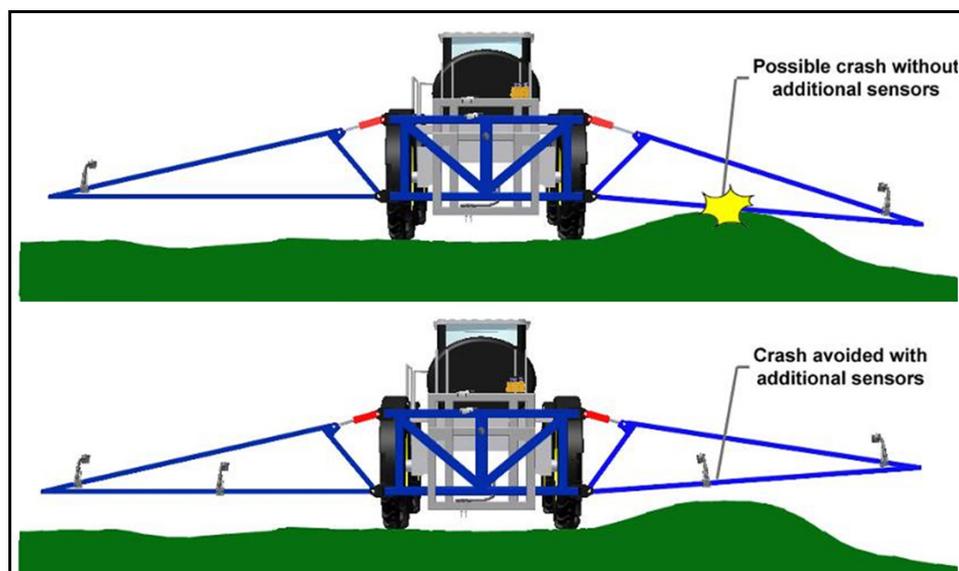


Figure 11: Example of Severe Terrain

8.2 Enhanced Stability Kit

- This kit is designed to provide enhanced boom stability for sprayers with booms that do not pivot freely. The symptom of a boom not pivoting freely is that the boom lift arms pivot when the boom tip is pushed down.
- The roll sensor included in this kit will provide an additional measurement of the sprayer dynamics to allow for greater stability of the boom.

8.3 Roll Bias (Active Roll) Kit

- Available on certain sprayer models (most sprayers with boom roll capability).
- Full boom roll is controlled actively together with wing tilt functions.
- Provides active isolation between the boom and sprayer, and increases reaction speed.
- This option improves spray height accuracy and provides unprecedented control.

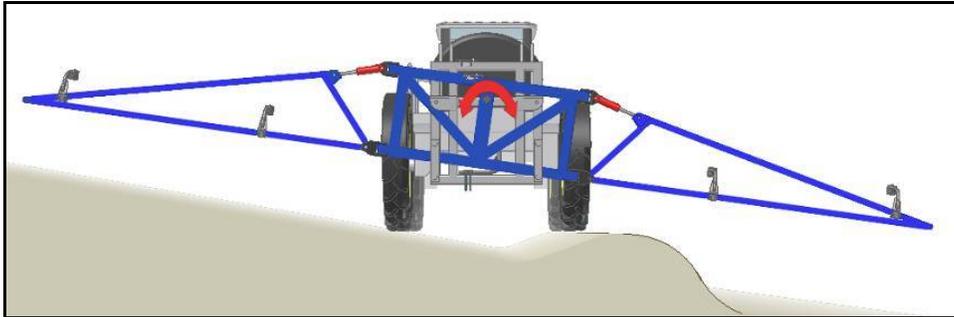


Figure 12: Roll Bias over a Terrace

9 Options Menu

Several options are available to configure your UC5 System to operate in different modes. The options menu is located in the Automatic Setup Menu. Navigate to the UC5 Setup Menu (**Section 7.1**) and choose Automatic Setup. Under the sprayer make drop down box choose “Options”. The sprayer model drop down box will now display a list of options. Each time you select an option it will toggle between the available selections. After the option is selected, press “OK” and the settings will be displayed in the diagnostics window.

9.1 Headland Assist Toggle

Selecting this option will toggle between enabling and disabling Headland Assist. By default, this feature is enabled for certain sprayer types. Headland Assist is used to raise the wings only or the entire boom at the end of the field for turning. This feature operates when the system is in automatic.

The headland mode height can be changed. While the boom is in headland mode, the operator can change the height by simply adjusting the target height.

9.2 Headland Assist Trigger

When the Headland Assist feature is enabled, a trigger type must be selected to activate it in the field. The trigger may be either the main lift up / down switch or the remote auto input line.

Main Lift Switch:

If the main lift switch is enabled as the trigger, the Headland Assist will be triggered when the operator presses the “main up” switch while in automatic. By pressing the “main down” switch the boom will return to automatic mode. When in manual the main lift switch will operate the normal main lift function.

If the main lift switch is enabled as the trigger, then the set point increment / decrement feature is disabled for the main lift switch.

Remote Auto:

Enabling remote auto as the trigger will allow a separate switch to trigger the Headland Assist. This switch must be a momentary type switch. Remote auto is an input line located on the UC5 input module. Refer to **Section 9.4** for the location of the remote switch inputs. If remote auto is enabled as the trigger then the remote switches will also be enabled.

While in manual, if the system voltage (+12 VDC) is momentarily applied to the remote auto line, the system will switch to automatic. While in automatic, each time the system voltage is momentarily applied to the remote auto line, the system will change between automatic and headland mode.

With Remote Auto selected as the trigger, the set point increment / decrement feature can still be used with the main lift switch to change the target height for headland mode and automatic.

9.3 Headland Assist Mode

The Headland Assist feature can operate in two different modes; main mode or wings only.

If the main mode is selected, when the Headland Assist is triggered the wings will temporarily be disabled and the main lift will raise to the predetermined Headland Assist height to allow the operator to turn around at the end of the field. When triggered again, the entire boom will return to automatic.

If the wings only mode is selected; when the Headland Assist is triggered only the wings will raise to the Headland Assist height. When triggered again, the entire boom will return to automatic.

9.4 Remote Switches

When remote switches are enabled, the UC5 can be put into automatic or manual using a remote switch connected to the remote auto and manual input lines. This feature can still be used in conjunction with the remote auto line as the trigger in headland mode. The remote auto and manual input lines are located on the UC5 Input Module.

To activate automatic, momentarily apply system voltage (+12 VDC) to the remote auto line. The voltage must always be applied after the display has been powered up. The UC5 will not go into automatic if voltage is applied to the remote auto input line before the system is powered up.

To activate manual, momentarily apply system voltage to the remote manual line. The remote manual function always has priority over the automatic function. The pin location of the input lines is different based on the sprayer configuration.

If the UC5 Input Module is driving the roll (slant) output:

The remote auto line is located on pin 6 and pin 7 (either pin may be used) on the black 12 pin side connector on the Input Module.

The remote manual line is located on pin 4 and pin 9 (either pin may be used) on the grey 12 pin side connector on the Input Module.

For all other applications:

The remote auto line is located on pin 6 and pin 7 (either pin may be used) on the black 12 pin side connector on the Input Module.

The remote manual line is located on pin 5 and pin 8 (either pin may be used) on the black 12 pin side connector on the Input Module.

9.5 Severe Terrain Mode

Some sprayers have the ability to fold in the boom tips and spray with only the inner sections of the boom. If your sprayer has this ability and is equipped with a five sensor system (severe terrain kit) then this feature may be used when spraying with the tips folded in.

By setting the “Tips Off” the two outer sensors on the wings will be disabled and only the inner wing sensors will be used to control the height. The Severe Terrain Mode is defaulted to “Tips On” and will return to “Tips On” anytime the power is cycled. When spraying with the full boom this feature should be set to “Tips On” to allow the outer sensors to operate again.

9.6 High Oil Temp Alarm Toggle

The High Oil Temperature Alarm is normally defaulted to on. Selecting this option will toggle between enabling and disabling the alarm. When enabled, an error message will appear if the Norac valve block reaches a temperature of 95° C. It will appear once and will not repeat until power has been cycled.

This alarm is for informational purposes only, to indicate when there is a major oil heating issue with the machine. This alarm does not reflect the warranty of any components. Actual maximum oil temperature is determined by the fluid used in the system and should be recommended by the sprayer manufacturer.

9.7 Boom Geometry Test

Select this option if you would like to redo the boom geometry test. After selecting this option, the display will prompt you to exit the cab and manually push either boom tip down 1 – 3 feet (30 – 90 cm) for a moment and then let go.

Do not walk near the sensors when approaching the boom. Stay at least 3 feet from the sensor to not induce a measurement error.

9.8 Temperature Compensation Toggle

This feature is normally enabled to provide compensation to the UC5 system as the hydraulic oil changes temperature. Disabling this feature may only be useful for troubleshooting purposes.

9.9 Slow Roll Reference

The Slow Roll Reference option is set by sprayer type. It may be useful to enable this feature for high pendulum style booms (with roll/slant) where the boom does not follow the chassis on side hills. When this feature is enabled the UC5 system will adjust the roll (slant) on side hills to bring the center section of the boom parallel to the chassis.

You may want this feature disabled for situations where the sprayer is driving in an extended rut and you would like the roll (slant) to follow the ground as opposed to the chassis.

9.10 Manual Valve Drive

Manual Valve Drive is normally defaulted off for most sprayer types. When enabled, this feature will drive the corresponding valve when a switch input is detected. This feature only needs to be enabled if the hardware installation requires it to be enabled. Please contact Norac for assistance if you need to enable Manual Valve Drive.

9.11 Double Tap Main

When this option is enabled (checked), the system can be put into Automatic Mode by tapping the main lift down switch twice. When this feature is enabled, the Setpoint Bump feature is automatically disabled. Holding any of the up or down switches will still put the system into Manual Mode. It is possible to have both the Double Tap Main and the Double Tap Wings features enabled at the same time.

9.12 Double Tap Wings

When this option is enabled (checked), the system can be put into Automatic Mode by tapping either the left down switch or the right down switch twice. Holding any of the up or down switches will still put the system into Manual Mode.

10 Maintenance

The UC5 Height Control System requires very little maintenance, but there are a few procedures that will ensure the system continues to work correctly for many years.

Before each day:

- It is highly recommended that the sprayer friction pads are greased. This will ensure the boom is pivoting separately from the sprayer. It is very important to keep the friction pads greased on active roll systems. It may be necessary to grease the friction pads multiple times throughout each day.
- Ensure the UC5 sensor breakaway brackets are functioning correctly.
- Ensure that there is a clean, dry foam disc inserted in each sensor. The foam disc must be pushed inside the sensor housing so that it lays flat.
- Inspect the foam disc insert in each sensor. If it is clogged with dust or other debris, clean it. When the foam is removed from the sensor, it can be blown out with an air compressor. If necessary, replace the foam. The UC5™ system must always be operated with the foam disc insert in each height sensor.

At the end of the season:

- Remove the height sensors from the sprayer and store inside. Record the sensor serial numbers in **Figure 10 (Section 7.4.2)** to ensure each height sensor is returned to its original location at the start of the next season.
- If necessary, contact your NORAC dealer to have the sensors recalibrated or repaired. A typical sensor can operate three to ten years without requiring attention.
- Replace the oil filter in the NORAC hydraulic manifold (PT# 104827) annually.

II Troubleshooting

II.1 General Operation

Boom does not appear to be level after system setup:

- The sensitivity setting may be too low. Check the sensor height readings from the run screen, if it differs from the target height then try turning up the sensitivity. The default tolerance for a sensitivity setting of 5 is ± 6 cm (2.5 inches).
- The sensor offset heights may be incorrect. Refer to **Section 7.4.1**.
- The Deadzone may be calibrated incorrectly. If the Deadzone is set too low the system cannot make small corrections. Recalibrate the Deadzones as described in **Section 7.4.4**.

The system will not go into automatic mode:

- Ensure the system has completed an automatic install. If you have started and not finished an automatic install, you will need to manually tune at least one hydraulic function (**Section 7.4.4**) before the system will allow you to go into automatic.
- Ensure the sensors are reporting less than 60 inches (152 cm). If the booms are above this height, the system will not go into automatic.

The system resets when a valve is turned on:

- Check the power supply. Ensure the sprayers power supply voltage is more than +12 VDC.
- This may also be caused by a damaged or defective power supply cable. Check the power cable for a good connection to the supply.

The system randomly switches between auto and manual mode:

- This may be caused by a damaged or defective interface cable. Ensure all cables are connected correctly. The connections should be tight and free of corrosion.
- There may be electrical noise on the sprayer's D.C. system. Add a power line filter or freewheeling diodes on one or more of the sprayer's solenoid valves.

11.2 Sensors

Height or roll sensor appears not to work (displays “NO COMM”):

- This may be caused by a damaged or defective CAN-bus cable. Ensure all cables are connected correctly. The connections should be tight and free of corrosion.
- If the cables check out ok the sensor may be damaged. Try swapping sensors to see if the problem follows the sensor.

Invalid height sensor measurement (displays “NO DATA”):

- It is normal to see this message occasionally. If you are seeing this message all the time the sensor may be having difficulty obtaining a proper reading. Ensure the sensor is not out of range. Check the sensor alignment. The sensor should point almost perpendicular to the ground and there should be no obstructions between the sensor and the ground.
- The protective foam shield may be contaminated. Inspect and clean the foam shield. If it is severely worn or dirty replace the foam shield.
- The sensor may have moisture in it. This can be common for sprayers which fold the wing tips up; therefore pointing the sensors into the air. If rain or moisture collects in the sensor, remove the protective foam disc and allow the water to drain out. If you leave the sensor running it will dry out on its own and start working again.
- The sensor transducer may be damaged. Remove the foam shield and check if you can hear the sensor ticking. If you cannot hear the ticking sound or if it is very faint then the transducer may be damaged and the sensor would need repairing.

11.3 Modules

The green LED on the module is flashing:

- Count the number of times that the LED flashes and refer to the following table for diagnostics. The LED will flash quickly followed by a three second delay, after which the flash pattern will be repeated. Display Bus errors are only valid on the Control Module.

Number of Flashes	Description
Solid (No Flash)	Everything is ok
1	No devices connected on the Display Bus
2	No devices connected on the NORAC Bus
3	Undefined
4	Undefined
5	CANbus warnings on Display Bus – the CANbus is still functioning; the LED will flash until the power is cycled.
6	CANbus warnings on NORAC Bus – the CANbus is still functioning; the LED will flash until the power is cycled.
7	CANbus errors on Display Bus – there have been too many CAN warnings, the CAN chip will restart itself
8	CANbus errors on NORAC Bus – there have been too many CAN warnings, the CAN chip will restart itself

The red LED on the module is lit or flashing:

- Refer to the following table for diagnostics.

Number of Flashes	Description
Solid (No Flash)	Module failure
1 per second	Module is programming

11.4 Hydraulics

- When diagnosing hydraulic problems you should first determine if the electrical system is ok. Check all cable connections and ensure they are tight and free of corrosion. Measure the electrical output at the valve to ensure there is voltage at the connection.
- Most valves will have an override pin. This is a small brass colored hole located at the end of each coil in the center. There will be one for each valve. By pushing in the pin you can manually activate the valve. There must be pressure at the block for the function to move.
- If your sprayer is equipped with a bypass valve it will need to be activated anytime a hydraulic function is required.

Boom(s) will not raise or lower:

- Ensure there is hydraulic oil being supplied at the Norac valve block and that there is pressure at the pressure port. The hydraulics will not work if the pressure and tank lines are reversed. If you have any quick couplers in the system they must be properly connected.
- Check the bypass valve (if equipped) for proper operation and cable connections to the UC5 system. The bypass valve must be configured correctly in the manual valve setup (**Section 7.4.3**).
- There may not be enough back pressure to activate the check valves in the Norac valve block. You can place orifices in the “A” lines going to tank in order to create sufficient back-pressure to activate the pilot-operated check valves in the Norac valve block.
- The raise and lower lines to the tilt cylinders may be reversed. Ensure the raise lines are connected to the “B” ports on the Norac valve block. The lower lines should be connected to the “A” ports.

The boom will raise when it should lower, or vise versa:

- Check the cable connections to the valve block and ensure they are not reversed.
- The raise and lower lines to the tilt cylinders may be reversed. Ensure the raise lines are connected to the “B” ports on the Norac valve block. The lower lines should be connected to the “A” ports.

The hydraulic oil is overheating:

- Using the UC5 system at higher sensitivities may create a greater demand on the sprayer’s hydraulics. Try lowering the sensitivity.
- Plumbing single acting systems as double acting with orifices in both “A” ports may reduce the heating. Contact Norac for more information.

The boom will creep up or down in manual mode:

- The raise and lower lines to the tilt cylinders may be reversed. Ensure the raise lines are connected to the “B” ports on the Norac valve block. The lower lines, if installed, should be connected to the “A” ports.
- This may be caused by a problem with the sprayer’s hydraulic system. Check the sprayer hydraulics. Check if the tilt cylinders are leaking and replace the seals if needed.
- There may be an internal problem with the Norac valve block. Some possible causes are; a sticky valve, worn valve, faulty check valves or a foreign object stuck in the valve block. If possible try removing any foreign objects in the valve. The valve block may need also repairing.
- There may not be enough back pressure to activate the check valves in the Norac valve block. You can place orifices in the “A” lines going to tank in order to create sufficient back-pressure to activate the pilot-operated check valves in the Norac valve block.

11.5 Boom Stability

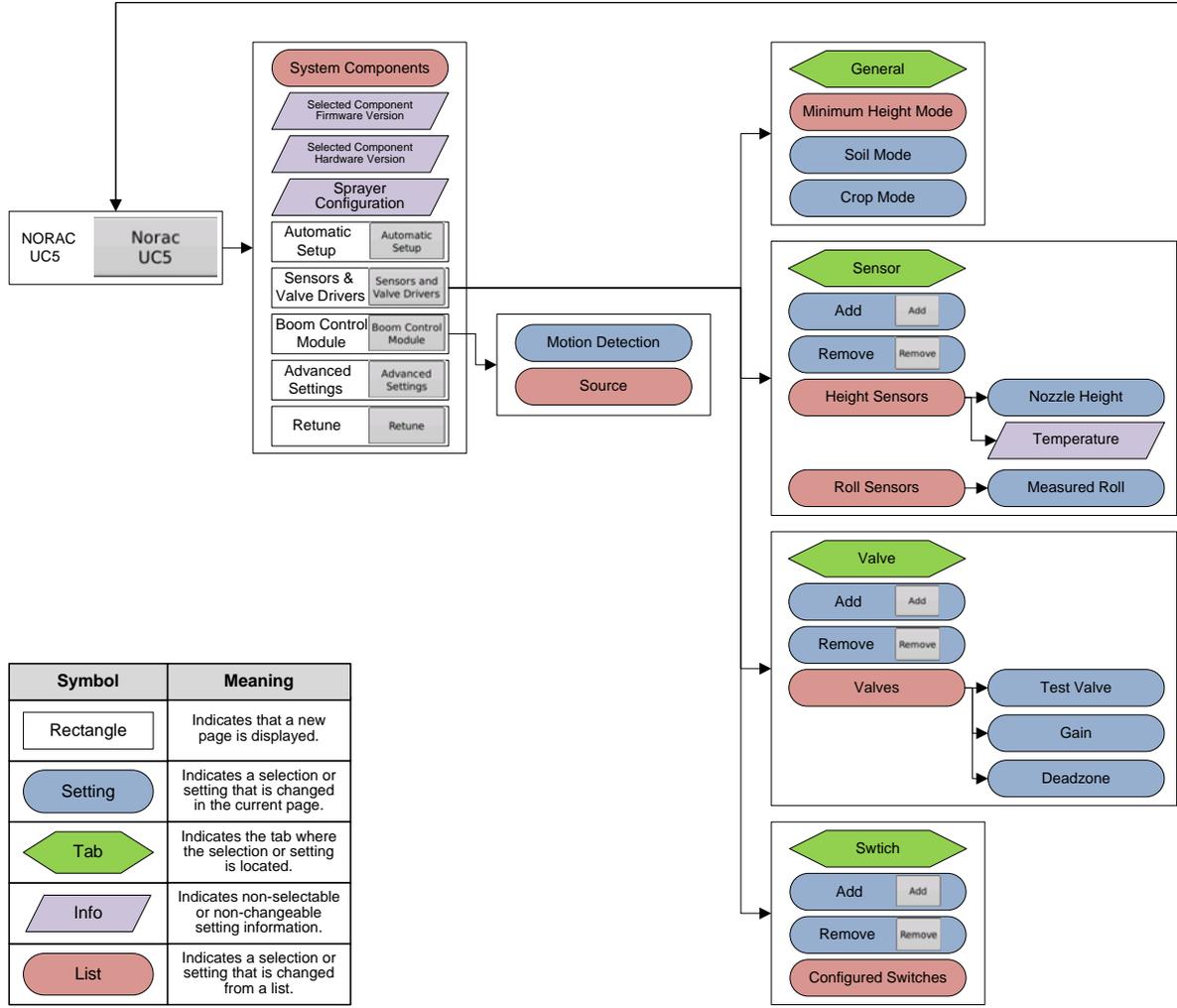
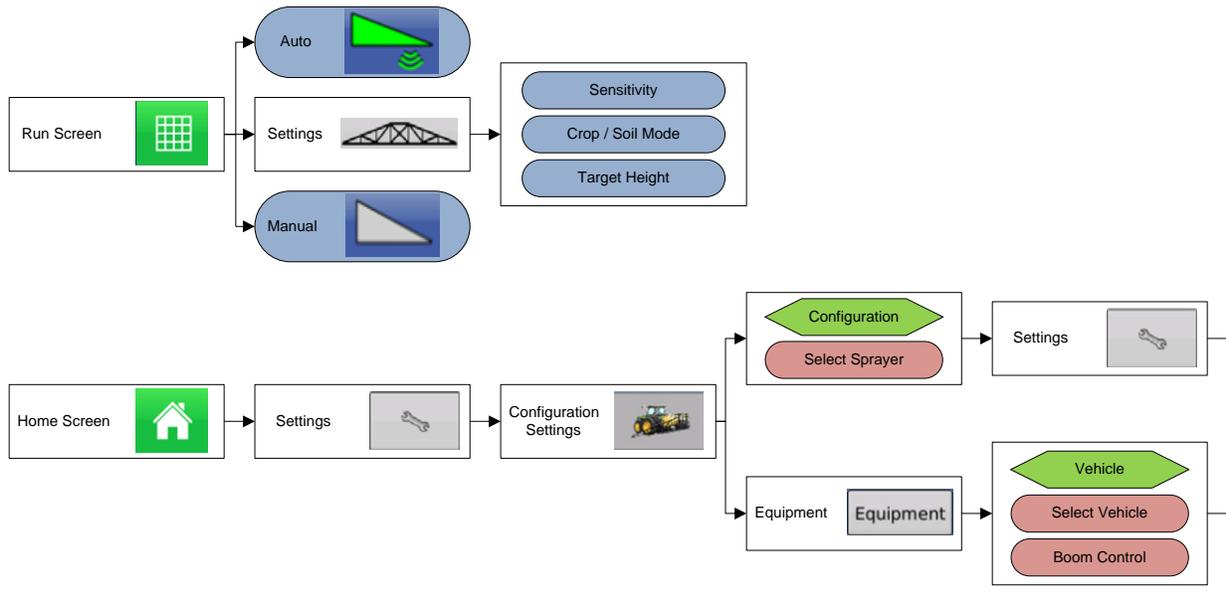
The boom is unstable in automatic mode:

- Ensure the sprayer's boom suspension is operating correctly and moving freely. If the suspension is sticking or too loose the boom will be unstable. If the boom is unstable in manual mode, the height control system will not make it more stable.
- If there are friction pads on the boom, ensure they are well greased. Check the boom damper shocks and replace them if they are worn. If there is substantial wear in the mast-style main lift the boom will be too loose. Install shims or adjust the mast-style lift if possible.
- Retune the system. If the hydraulic settings are not calibrated correctly the boom may be unstable. Perform a Retune and redo the Boom Geometry Test.
- Check the mounting of the roll sensors. They must be mounted for the type of boom suspension as shown in the installation manual.
- Ensure the height sensors are reading properly and consistently. The sensors must be aligned and mounted correctly. The sensor should point almost perpendicular to the ground and there should be no obstructions between the sensor and the ground.
- If your sprayer is equipped with accumulators on the tilt cylinders they should be charged to the manufacturers specifications. There should also be orifices installed between the accumulators and tilt cylinders.

The boom(s) move all the way to the top in crop mode:

- The sensors are likely reading off of the boom in crop mode. Ensure the sensors are aligned and mounted correctly. The sensor should point almost perpendicular to the ground and there should be no obstructions between the sensor and the ground.

12 Menu Structure



Symbol	Meaning
Rectangle	Indicates that a new page is displayed.
Setting	Indicates a selection or setting that is changed in the current page.
Tab	Indicates the tab where the selection or setting is located.
Info	Indicates non-selectable or non-changeable setting information.
List	Indicates a selection or setting that is changed from a list.

13 Statement of Limited Warranty

NORAC SYSTEMS INTERNATIONAL INC., also known as NORAC, warrants all equipment of its manufacture to be free of defects in material and workmanship for a period of one year. This warranty period is for a period of twelve months from the date the equipment is delivered by NORAC or its authorized dealer to the purchaser. Items include control systems and genuine replacement parts manufactured by NORAC. Auxiliary components not manufactured by NORAC or NORAC rebuilt parts are covered by a 90-day warranty.

NORAC will repair free of charge items returned within the warranty period to one of NORAC's authorized service centers. In countries where NORAC maintains authorized service centers, freight will be paid one way and returned by the same carrier unless instructed differently. The purchaser is responsible that the item is properly packaged for shipment. Shipping damage is not covered under this warranty.

NORAC or its authorized Service Center will repair or replace, at its option, any defective part or component at no cost to the purchaser during the Warranty period. If service in the field is required NORAC will authorize on-site repairs at no charge for parts and labor. Travel time, travel costs and per diem expenses to and from the place where repairs are made, will not be covered by this warranty.

For the nearest Service Center visit our website at www.norac.ca or call +1 306 664 6711 or e-mail service@norac.ca.

Any evidence of, negligent or abnormal use, alteration of serial numbers, or repairs attempted by other than NORAC authorized personnel or not using NORAC certified or recommended parts, automatically voids the warranty. Normal wear is not covered under this warranty.

NORAC will not warranty any complaints relating to inadequate installation (unless the installation was performed by NORAC), adjustments or calibration.

The forgoing states the entire liability of NORAC regarding the purchase and use of its equipment. The purchaser agrees that NORAC accepts no liability for any consequential loss or damage of any kind. The purchaser further agrees that the warranties contained herein are in lieu of all other warranties, expressed or implied, and, specifically NORAC disclaims any implied warranty regarding merchantability or fitness for a particular purpose. This paragraph is of no force or effect in those jurisdictions, where the limitations of the type noted herein are prohibited by law.

To ensure warranty coverage the customer must register within 30 days of their purchase by either sending in a registration form included with the equipment or online at www.norac.ca.

Canada

NORAC Systems International Inc.

Phone: (+1) 306 664 6711

Toll Free: 1 800 667 3921

Shipping Address:

3702 Kinnear Place

Saskatoon, SK

S7P 0A6

United States

NORAC, Inc.

Phone: (+1) 952 224 4142

Toll Free: 1 866 306 6722

Shipping Address:

6667 West Old Shakopee Road, Suite 111

Bloomington, MN

55438

Europe

NORAC Europe

Phone: (+33) (0)4 26 47 04 42

Shipping Address:

Rue de l'hermitage

01090 GUEREINS

France

www.norac.ca

NORAC 