NORAC®

TOPCON POSITIONING GROUP

NORAC UC7™ Technical Operation Manual

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Reorder P/N: UC7-BC-MN-TCH-MET Rev F

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The UC7™ Boom Height Control system will greatly improve your spraying height accuracy and protect the boom against damage in a wide variety of field conditions. 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.

⚠ Important

Under no circumstances should any service work be performed on the machinery while the UC7 Boom Height Control system is in automatic mode.

Always ensure that the UC7 Boom 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 UC7 system to manual mode.
- Turn the sprayer engine off.

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.

Every effort has been made to ensure the accuracy of this document at the time of publication. NORAC Systems assumes no responsibility for omissions and errors. Nor is any liability assumed for damages resulting from the use of information contained herein.

If you have any questions, feedback, or comments regarding the UC7™ Boom Height Control system, please contact us.

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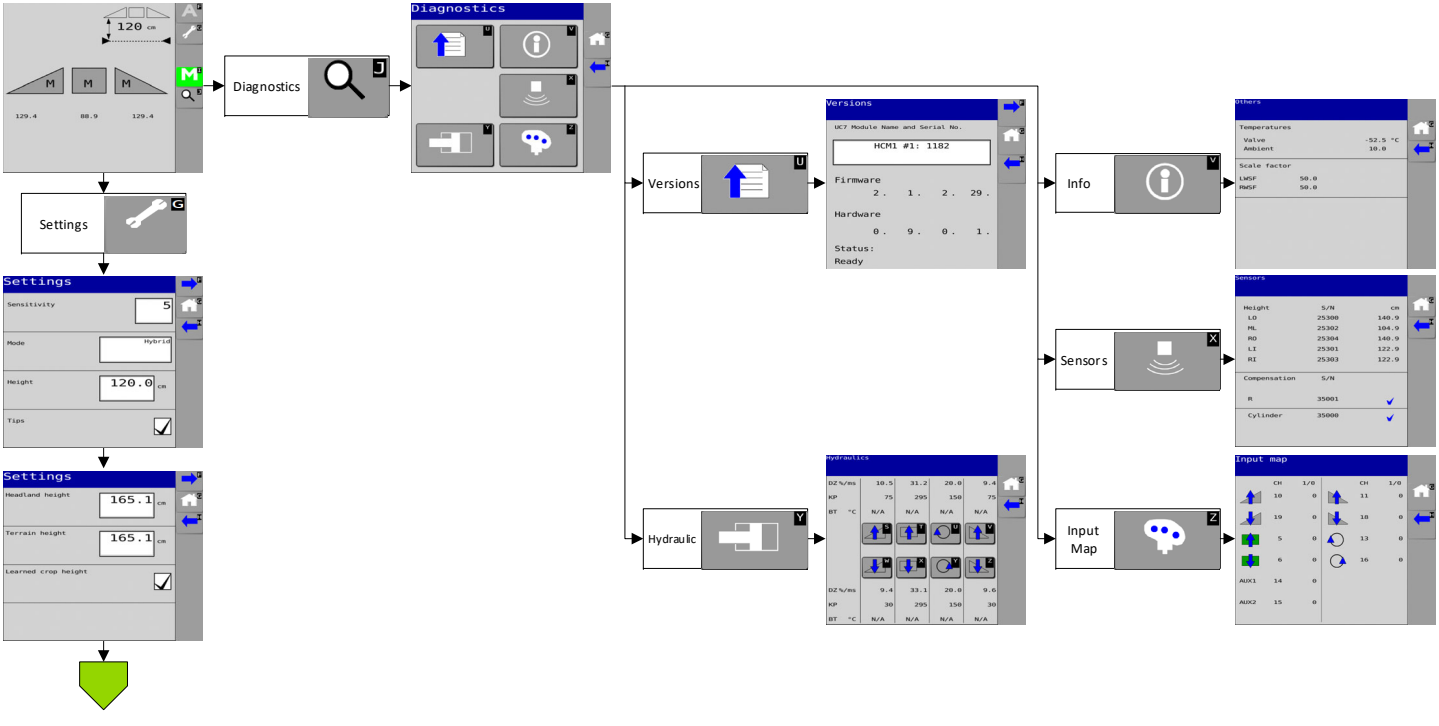
Table 1: System Specifications

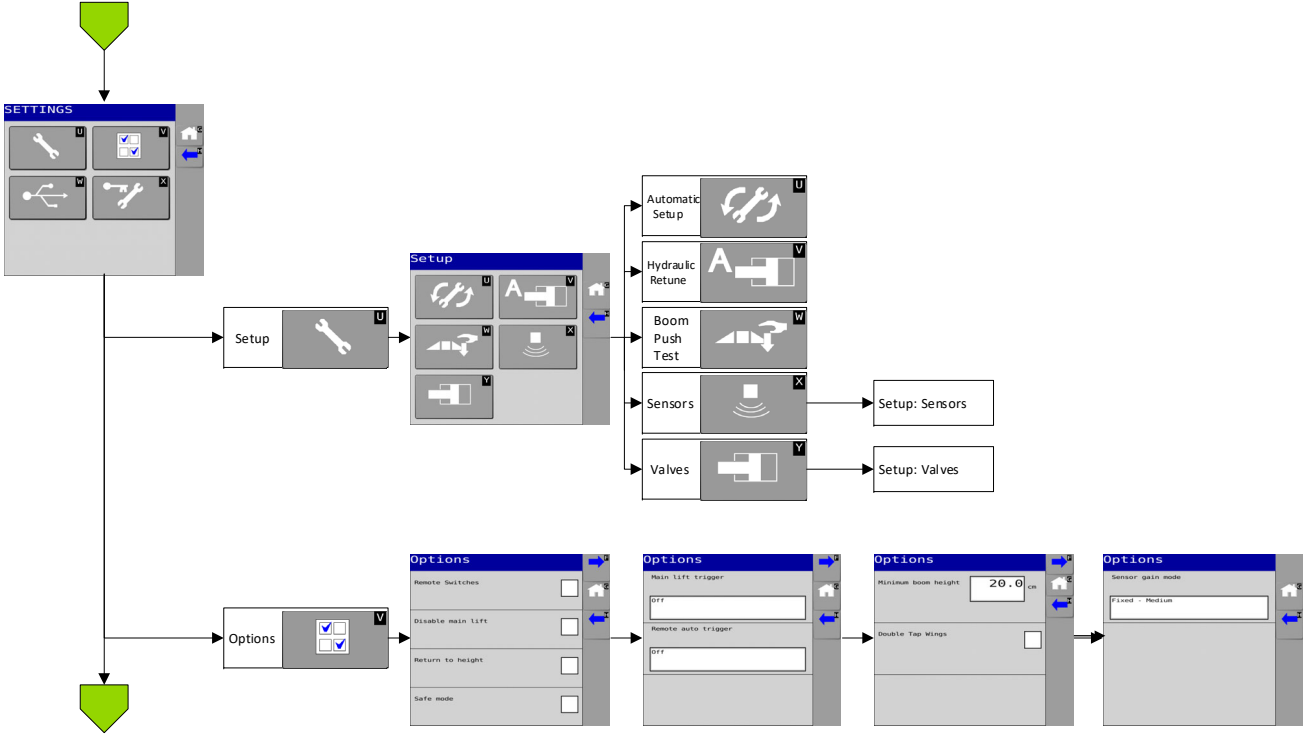
Supply Voltage (rated)	12VDC
Supply Current (rated)	10A
Hydraulic Pressure (maximum)	3300 psi
Baud Rate	250 kbps
Operating Temperature Range	0°C to 80°C

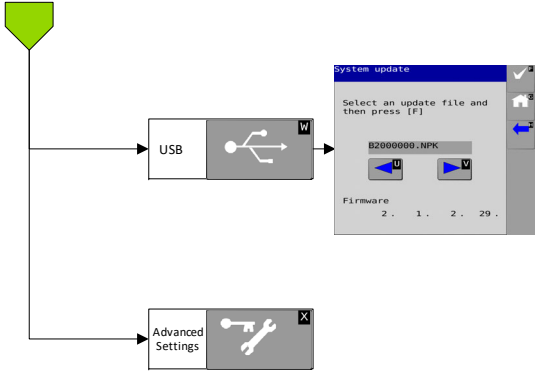
The 10A fuse on the power cable may be replaced by the operator if needed. The replacement fuse must be rated to blow in less than 120 seconds at 200% and be ANSI/UL248-14 or better.

Table 2: Replacement Fuse

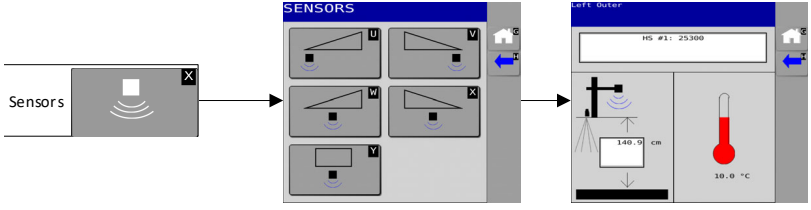
NORAC Part Number	106676
Manufacturer Part Number	Littelfuse – 0287010.PXCN


Diagnostics
Settings
Versions
Info
Sensors
Hydraulic
Input Map
Sensitivity
Mode
Height
Tips
Headland height
Terrain height
Learned crop height
Firmware
Hardware
Status:
Ready

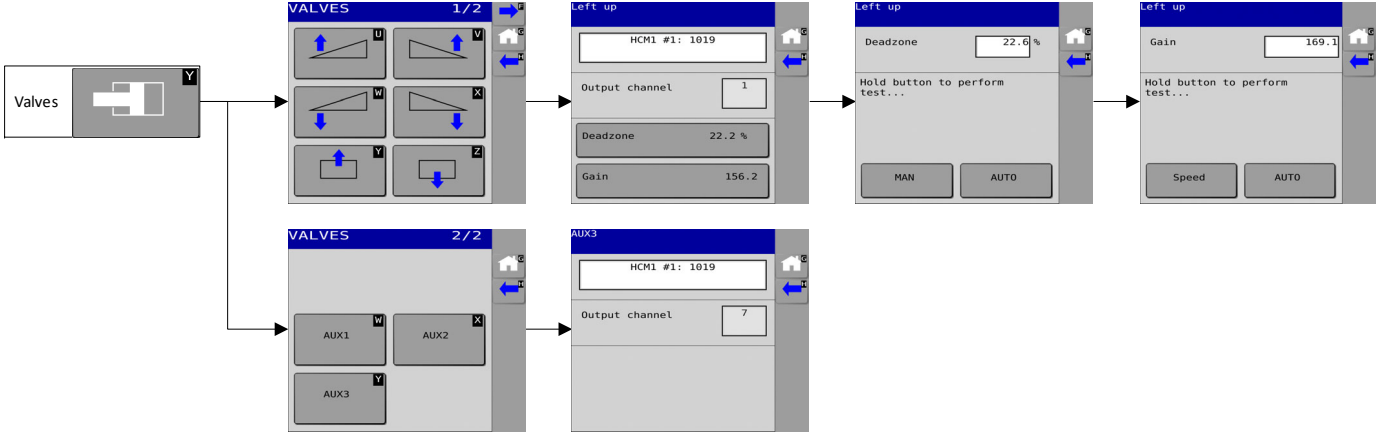

SETTINGS
Setup
Setup
Automatic Setup
Hydraulic Retune
Boom Push Test
Sensors
Valves
Setup: Sensors
Setup: Valves
Options
Options
Remote Switches
Disable main lift
Return to height
Safe mode
Options
Main lift trigger
Off
Remote auto trigger
Off
Options
Minimum boom height
20.0
cm
Double Tap Wings
Options
Sensor gain mode
Fixed - Medium


USB
W
System update
Select an update file and
then press [F]
B2000000.NPK
U
V
Firmware
2 . 1 . 2 . 29 .
Advanced
Settings
X

3.1 Setup: Sensors



3.2 Setup: Valves



4 Icon Descriptions

The following tables illustrate and describe the icons used in the display. These icons may look different depending on the type of display.

Table 3: Soft Key Icons

Icon	Name	Description
	Check	Confirms selection or completion of a step
	Error	Indicates when there is an error
	Next	Navigates to the next page
	Previous	Navigates to the previous page
	Home	This button always returns directly to the run screen
	Manual Mode (Active)	Indicates the system is in manual mode
	Manual Mode (Inactive)	Changes system to manual mode when the system is in automatic mode

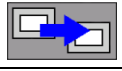
	Automatic Mode (Active)	Indicates the system is in automatic mode
	Automatic Mode (Inactive)	Changes system to automatic mode when the system is in manual mode
	Settings	Navigates to the settings screen
	Cancel	Cancels current selection or operation
	Setup Diagnostics	Navigates to the setup diagnostic screen
	Move to Next UT	Move the UC7™ screen to a different UT

Table 4: Button Icons

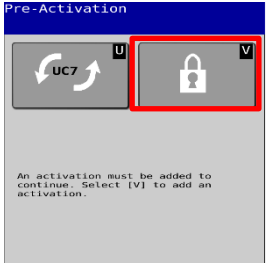
Icon	Name	Description
	Setup	Navigates to the automatic/manual setup screen
	Options	Navigates to the options screen
	USB	Navigates to the USB screen
	Advanced Settings	Navigates to the advanced settings
	Automatic Setup	Starts an automatic setup
	Retune	Starts a retune
	Boom Geometry Test	Starts a boom geometry (push) test
	Sensor Setup/ Diagnostics	Navigates to the manual sensor setup or sensor diagnostics screens
	Valve Setup/ Diagnostics	Navigates to the manual valve setup or hydraulic diagnostics screens
	Versions	Navigates to the UC7™ devices versions screen

	Information	Navigates to the information screen
	Manual Valve Drive	Navigates to the manual valve drive screen

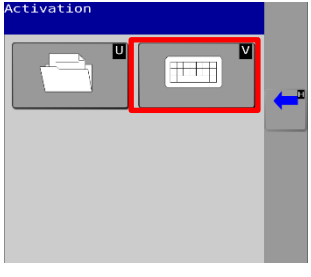
5 Activation Code

The NORAC UC7™ Boom Height Control systems require an activation code before they can be used. The activation code is included with the purchase of a complete kit. It can be found on the supplied USB Memory Stick, HCM1 packaging carton or inside the operator's manual. Each code is individually generated and will only work with the HCM1 that it was shipped with.

To enter the activation code, locate the activation code on the HCM1 packaging carton or inside the front cover of the operator's manual and follow the steps below.

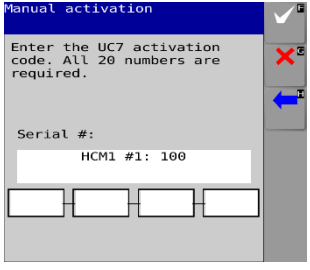


Power on the display terminal. The first screen should prompt for an activation code. Press the lock button (V).

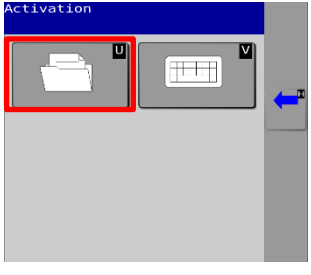


For Manual Entry

In the activation screen, select the keyboard button (V).



Enter the activation code provided for the specific make/model of sprayer. Select the check button (F).



For Loading from USB Memory Stick

Insert the USB stick into the HCM1 USB Port. (See Section 8 for details)

In the activation screen, select the folder button (U).

Choose the “ActCodes_H1 *****.txt” file.

Select the check button (F).

NOTE: *Some functions and features may not be available for all sprayer makes and models. Consult your sales representative or technical support with any questions or concerns.*

6.1 Initial Start Up

The first time the system is powered up it may need to upload information to the display and update the sensors to the latest version. It may take up to 5 minutes to appear on the display. Do not cycle power until the updates are complete. Subsequent startups will be significantly faster. On the initial startup and after confirming the legal disclaimer, a screen will appear informing the operator that an automatic setup must be performed. After confirming this screen, the automatic setup will begin. The automatic setup reminder at startup will also be shown each time a firmware update is performed.

6.2 Run Screen

Once the system is correctly configured, it is very simple to use. After confirming the legal disclaimer, the run screen will appear. For a universal terminal, select the UC7 icon from the display's start up screen. An image of the boom with the height of each boom section is displayed as shown in Figure 1.

When two or more universal terminals are connected on the display bus, the move to next UT button will appear on the soft key area of the run screen. This button allows the user to select the preferred terminal on which to display the UC7 screen. By pressing this button, the UC7 screen will move to next available terminal.

To change between automatic and manual mode, select the corresponding AUTO (A) or MANUAL (M) button. When the UC7 system is in manual mode, the height displayed under each boom section is measured from the spray nozzles to the soil (Soil Mode™) or crop canopy (Crop Mode™ or Hybrid Mode™). If there is more than one sensor on a boom section, the height reading displayed is for the outermost sensor (provided that the section is in use).

When the UC7™ system is in automatic mode, arrows will appear on the screen above or below the boom sections. These arrows indicate the UC7 system is making a correction to part of the boom in the displayed direction. Often the correction will be very small and there may not be a noticeable change in boom position.

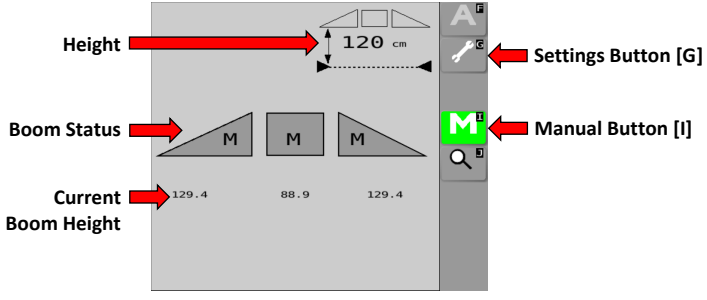


Figure 1: NORAC UC7 Run Screen – Manual Mode

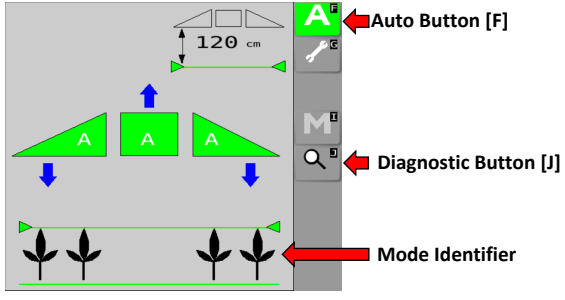


Figure 2: NORAC UC7 Run Screen – Automatic Mode

The height displayed under the boom in the upper right corner is the height that the system will automatically control the spray nozzles to. This is measured from the spray nozzles to the soil (Soil Mode™) or to the crop canopy (Crop Mode™ or Hybrid Mode™). The crop at the bottom of the screen identifies the mode the controller is in. If the green line is above the crop, the system is in Crop Mode. If the green line is below the crop, the system is in Soil Mode. If the green line is both above and below the crop, the system is in Hybrid Mode.

6.3 Sprayer Manual Boom Switches

When a manual switch is pressed, an arrow will be displayed on the screen showing which function is being activated.

While in automatic mode, if either left or right tilt switches are pressed, the corresponding boom section will go into manual mode. If the main lift switch is held while in automatic mode, the entire system will go into manual mode. To return all boom sections to automatic mode, press the auto button.

6.4 Settings

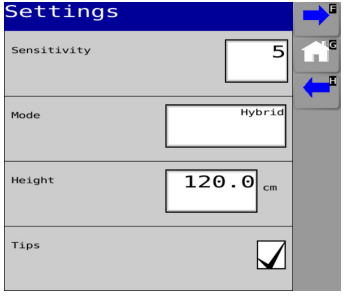


Figure 3: First Settings Screen

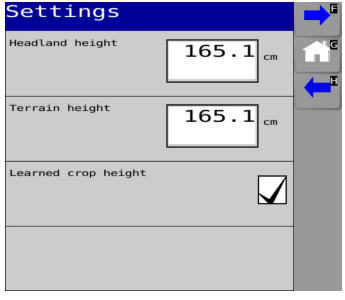


Figure 4: Second Settings Screen

Sensitivity:

The sensitivity setting can be adjusted from 1 to 10, with 5 being the default setting. The recommended setting is from 5 – 8. A lower setting (1 - 4) is conservative and will reduce the system sensitivity. A higher setting (9 – 10) is aggressive and will increase the system sensitivity.

Mode:

The mode setting allows the system to be changed between Soil Mode™, Crop Mode™ and Hybrid Mode™. Soil Mode allows the sensors to read a height from the spray nozzles to the ground. Soil Mode is intended for use when there is no crop or light crop cover. Crop Mode will read the height from the spray nozzles to the top of the crop canopy. Crop Mode is intended for use when there is thick crop cover. Hybrid Mode uses a combination of the crop and soil readings. Hybrid Mode is intended for use in all types of crop cover.

Height:

The height setting is the height that the operator would like the boom to be automatically controlled to when spraying. The height setting is the distance from the sprayer nozzles to the soil in Soil Mode and from the sprayer nozzles to the top of crop in Crop Mode or Hybrid Mode.

Tips, On/Off:

Some sprayers have the ability to fold in the boom tips and spray with only the inner sections of the boom. If the sprayer has this ability and is equipped with a five sensor system, the check box should be unchecked when spraying with the tips folded in (tips off). The tips option will not be shown for three sensor systems.

When the tips check box is unchecked (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.

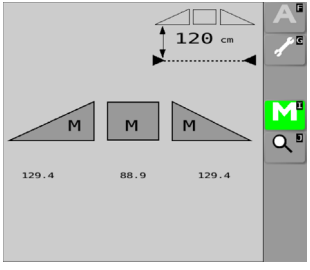
The check box is defaulted to be checked (tips on) and will return to be checked anytime the power is cycled.

Learned and Expected Crop Height:

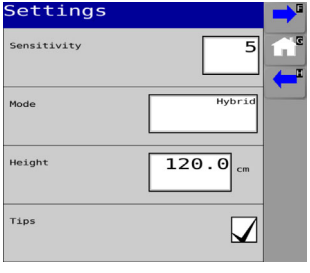
Hybrid Mode uses crop height in addition to the soil and crop readings. When learned crop height is enabled, the system continuously learns the crop height based on height sensor readings. Learned crop height is the recommended setting. Expected crop height is enabled when the learned crop height check box unchecked, and the crop height must then be entered manually.

7.1 Navigating to the UC7™ Setup Menu

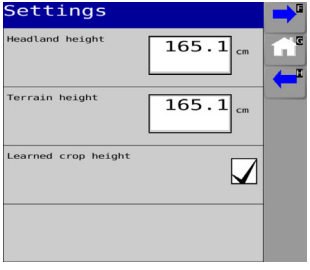
To perform the automatic system setup, the user must navigate to the setup screen. The system must be in manual mode to perform setups. If this is the initial startup, the automatic setup will begin after the legal disclaimer screen.



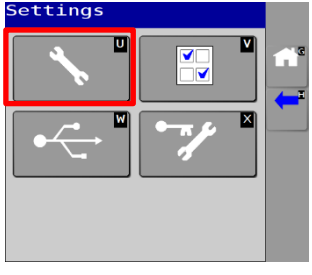
When the system is in manual mode, select the settings [G] button.



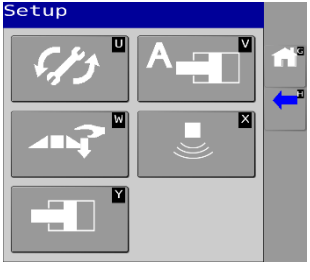
Select the next [F] button.



Select the next [F] button.



Select the setup [U] button.



The setup screen will be displayed.

7.2 Automatic System Setup

In some situations, it is necessary to reconfigure the entire NORAC UC7™ Boom Height Control system. When the automatic setup button is pressed from the setup screen, the system will go through the complete automatic setup. Follow the screen prompts to complete the automatic setup. An automatic setup should be performed when:

- Troubleshooting diagnostics have led to a new automatic setup being required.
  - Previous data will be erased when an automatic setup is started. It is therefore critical that troubleshooting is done before an automatic setup is started.
- A new NORAC UC7™ Boom Height Control has been installed.
- The HCM1 controller has been updated.
- The HCM1 controller, position sensor, roll sensor, or an OEM integrated ECU has been replaced. Replacing a height sensor does not require an automatic setup.

Warning

- *All boom sections will move during the automatic setup.*
- *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.*

Unfold the sprayer in a location that is relatively level and where the sensors are over bare soil or gravel. Do not conduct the setup over standing crop, weeds or grass. Also, avoid concrete or asphalt surfaces. Follow the screen prompts to complete the setup.

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 UC7™ performance.

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 trailed 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 UC7 performance.

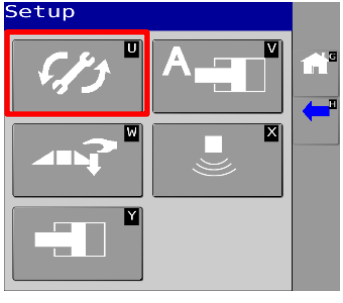


Figure 5: Automatic Setup Button

NORAC UC7™ Boom Height Control systems are designed to perform on a large variety of sprayers. Some sprayers have a special profile that has been created for a certain model or configuration. Before completing an automatic setup, check if there is a sprayer specific profile by following the steps below. If there is no profile that matches the configuration, select the generic profile that best matches. Each generic profile has a base starting point and will learn the required settings.

7.2.1 Tailored Profiles

Make:

Select the drop-down box to choose the make that best matches the machine. The make may also be referred to as the brand.

Model:

Select the model. The model is commonly marked with a decal on the side of the machine.

Submodel:

Select the submodel. The submodel generally includes distinguishing options such as: boom width, performance level, and optional addons.

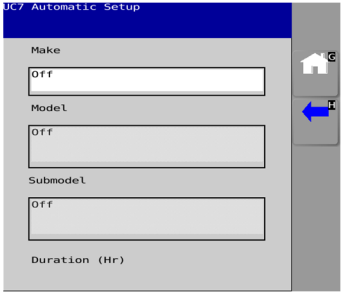


Figure 6: Profile Selection

7.2.2 Generic Profiles

A generic profile is used if there is not a machine specific profile available for the machine.

Make:

Select the drop-down box to choose Generic.

Model:

Select the performance level that has been purchased. There are also some model options for unique configurations for machines that are not typical wet boom sprayers.

Submodel:

Select the submodel. The submodel needs to be matched with the hardware configuration. Some examples of the different possible hardware options are below.

Table 5: Submodel Examples

Hardware Configuration	Submodel Description
12 pin Inputs	Sensing switch inputs from the sprayer are detected through the 12 pin connector on the HCM1.
4 pin Inputs	Sensing switch inputs from the sprayer are detected through the 4 pin connector on the HCM1.
Directional Valves	Machines that use directional valves and cannot drive up and down functions at the same time.
Proportional Main Lift	Machines where a proportional valve block was added.

7.3 Hydraulic Retune

On occasion, it is necessary to recalibrate the hydraulics of the NORAC UC7™ Boom Height Control system. When the retune button is pressed from the setup screen, the system will go through only the hydraulic tuning portion of the automatic setup. Follow the screen prompts to complete the retune. A retune should be performed when:

- A hydraulic solenoid has been changed.
- A hydraulic pump has been changed or adjusted.
- A different tractor is being used.

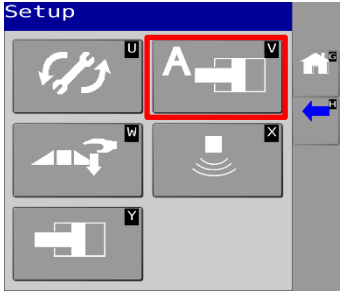


Figure 7: Retune Button

7.4 Options Menu

NOTE: *Some functions and features may not be available for all sprayer makes and models. Consult your sales representative or technical support with any questions or concerns.*

Navigate to the UC7™ settings menu (Section 7.1) and choose options [V] as shown in Figure 8. The first screen of the options menu is shown in Figure 9.

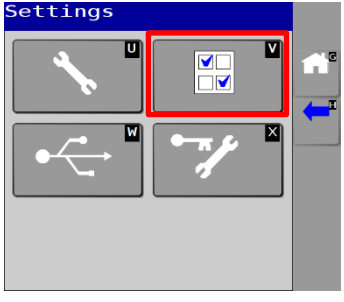


Figure 8: Selecting Options Menu

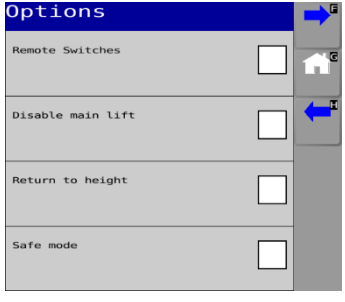


Figure 9: First Options Screen

7.4.1 Remote Switches

When remote switches are enabled, the UC7 system can be put into automatic or manual mode using external switches. For more information on setting up remote switches, refer to www.solutions.norac.ca (Section 9).

7.4.2 Disable Main Lift

The main lift disable option can be used to turn off the main lift output. The main lift sensor will continue to output a height reading.

7.4.3 Return to Height

When this option is enabled, the main lift will move to the set height and remain there while the UC7 system is in automatic mode. After the initial main lift adjustments, no further adjustments are made to the center section.

7.4.4 Safe Mode

The safe mode option can be used to disable the Roll Control in Active Control systems. This option should remain unchecked unless advised otherwise by a technician.

7.4.5 Main Lift Trigger

If the main lift trigger is enabled, the feature selected will be engaged when the main up switch is pressed and disengaged when the main down switch is pressed while in automatic mode.

7.4.6 Remote Auto Trigger

Enabling the remote auto trigger will allow a separate switch to trigger another feature. This switch must be a momentary type switch. Remote auto is an input line located on the UC7™ module. If remote auto trigger is enabled, the remote switches will also be enabled.

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

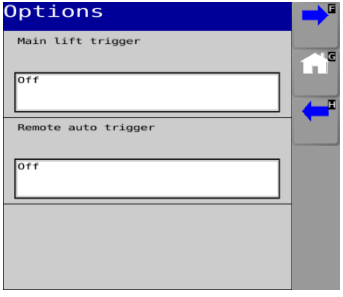


Figure 10: Second Options Screen

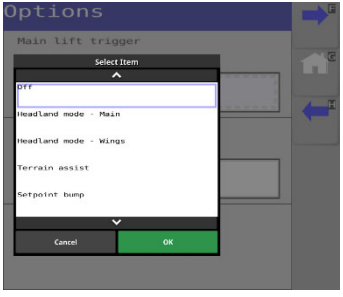


Figure 11: Main Lift Trigger Options

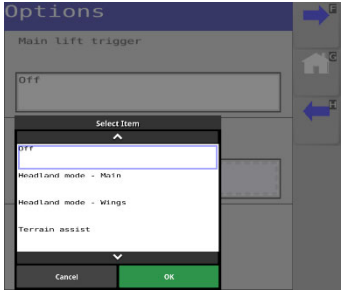


Figure 12: Remote Auto Trigger Options

7.4.7 Headland Assist™

Headland Assist is used to raise the wings only (Headland mode - Wings) or the entire boom (Headland mode - Main) at the end of the field for turning. This feature operates when the system is in automatic mode. The headland height can be adjusted on the second settings screen.

If the headland mode is set to main, when Headland Assist is triggered, the main lift will raise to the predetermined headland height. When triggered again, the entire boom will return to automatic mode.

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

7.4.8 Terrain Assist™

When Terrain Assist is enabled, tapping the trigger up will activate Terrain Assist. When activated, both wing sections will raise as quickly as possible to the Terrain Assist height and will continue to control at this height automatically. The terrain assist height can be changed while the boom is in terrain assist mode by adjusting the terrain height in the second settings screen. Pressing the trigger down momentarily will return the system to regular automatic operation. Note the Setpoint Bump™ and Headland Assist cannot be active for the main lift while the Terrain Assist feature is enabled.

7.4.9 Setpoint Bump

When this option is enabled, the main lift sprayer switch is used to increase/decrease the height by a small increment while running in automatic mode.

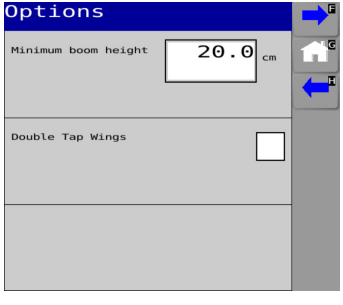


Figure 13: Third Options Screen

7.4.10 Minimum Boom Height

The minimum boom height indicates the lowest mechanical height the boom could achieve. This feature allows the operator to set a minimum height that will not be exceeded by the automatic control system.

7.4.11 Double Tap Wings

When this option is enabled, the system can be put into automatic mode by tapping either the left down switch or the right down switch twice provided that at least one boom section is already in automatic mode. Holding any of the up or down switches will still put the system into manual mode.

7.4.12 Sensor Gain Mode

The default operating mode for the sensor's gain is "Fixed – Medium" and for most users this should not be changed. If the sensor gain mode is changed a power cycle is required.

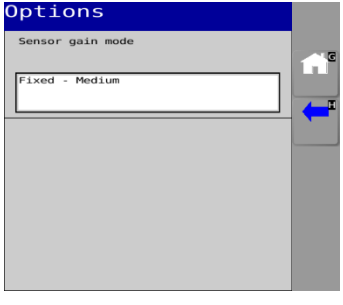


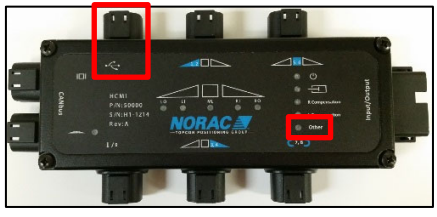
Figure 14: Fourth Options Screen

Table 6: Sensor Gain Mode

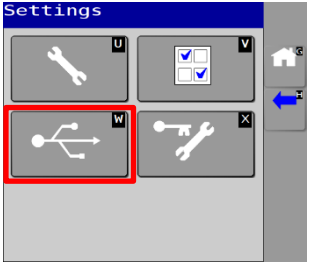
Sensor Gain Mode	Description
Conventional	This mode is used in situations where non-standard sensor mounting or other factors prevent the fixed modes from functioning as designed.
Fixed – Medium	This is the default mode. It works well in a large majority of situations.
Fixed – High	This option is used if the sensors have difficulty tracking the crop height in Hybrid Mode.

NOTE: If the HCM1 software is downgraded to a version prior to 3.4, this setting must be changed to Conventional before the software is changed.

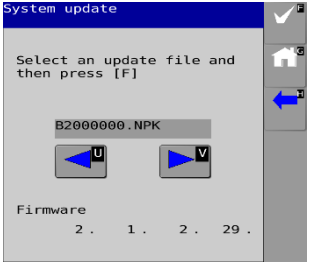
To update the firmware of the UC7™ Boom Height Control system, follow the steps below:



Insert a USB drive loaded with the *XXXXXX.npk* update file into the USB connector on the HCM1. The LED marked Other will be solid green when the USB is recognized.



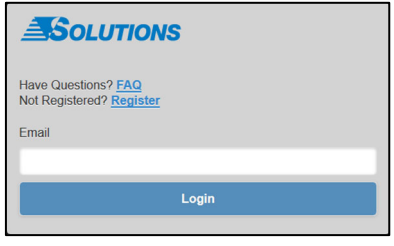
Navigate to the settings menu (Section 7.1), select the USB [W] button.

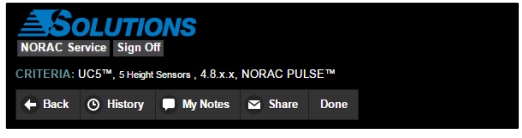


Select the update file to use. Press the [F] button. Wait while the system updates. Turn the machine off and on when the update is complete. If the sensors need to be updated, the system will take longer than normal to load onto the display. Complete one additional power cycle after the system loads onto the display. An automatic setup will need to be performed each time a firmware update is completed.

NORAC Solutions is a free web application that works with any internet enabled device to help troubleshoot NORAC products. NORAC Solutions works offline if internet access is not available.

www.solutions.norac.ca

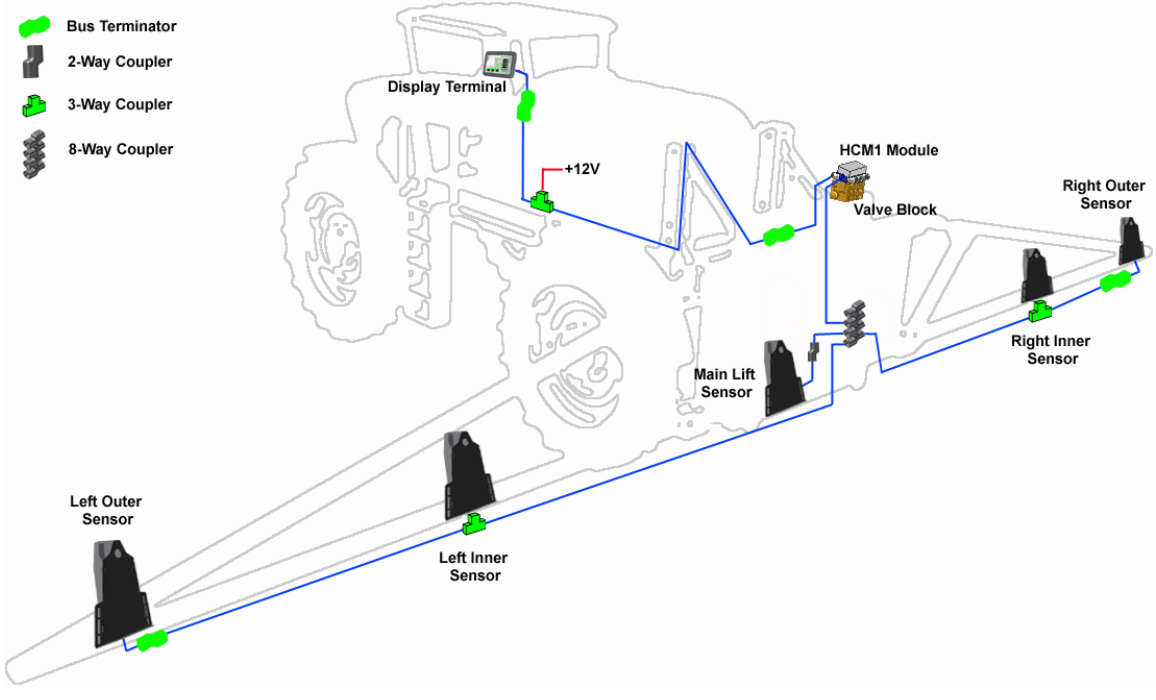




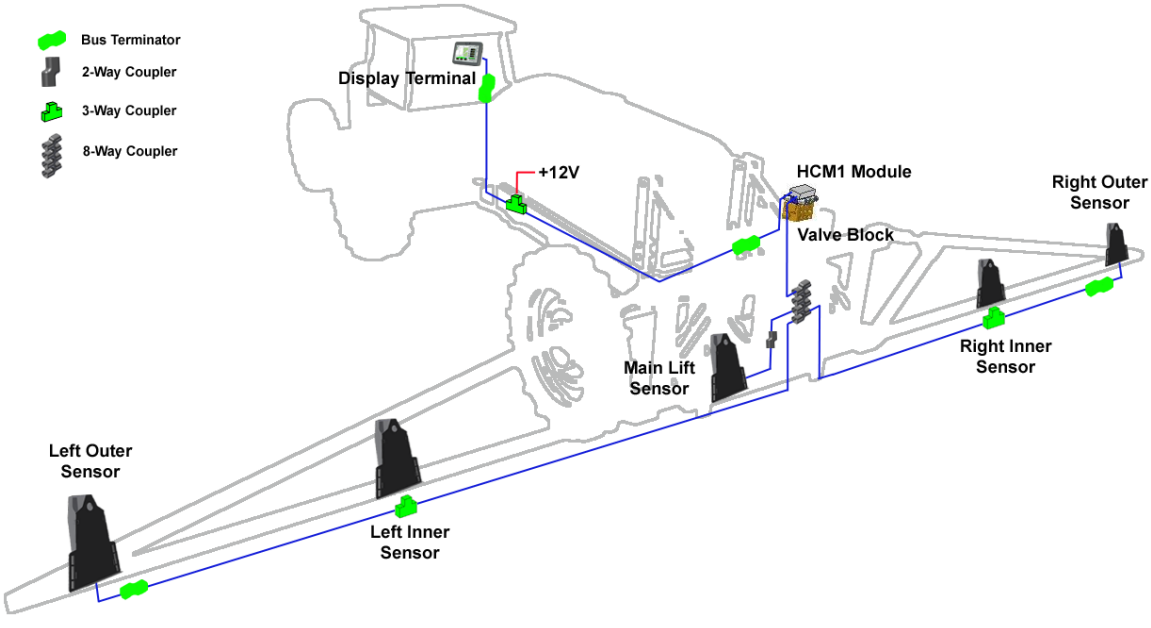
The help menu contains links to:

- A FAQ page.
- A video explaining how to use NORAC Solutions.
- Contact information for NORAC.
- A history of diagnostic sessions.

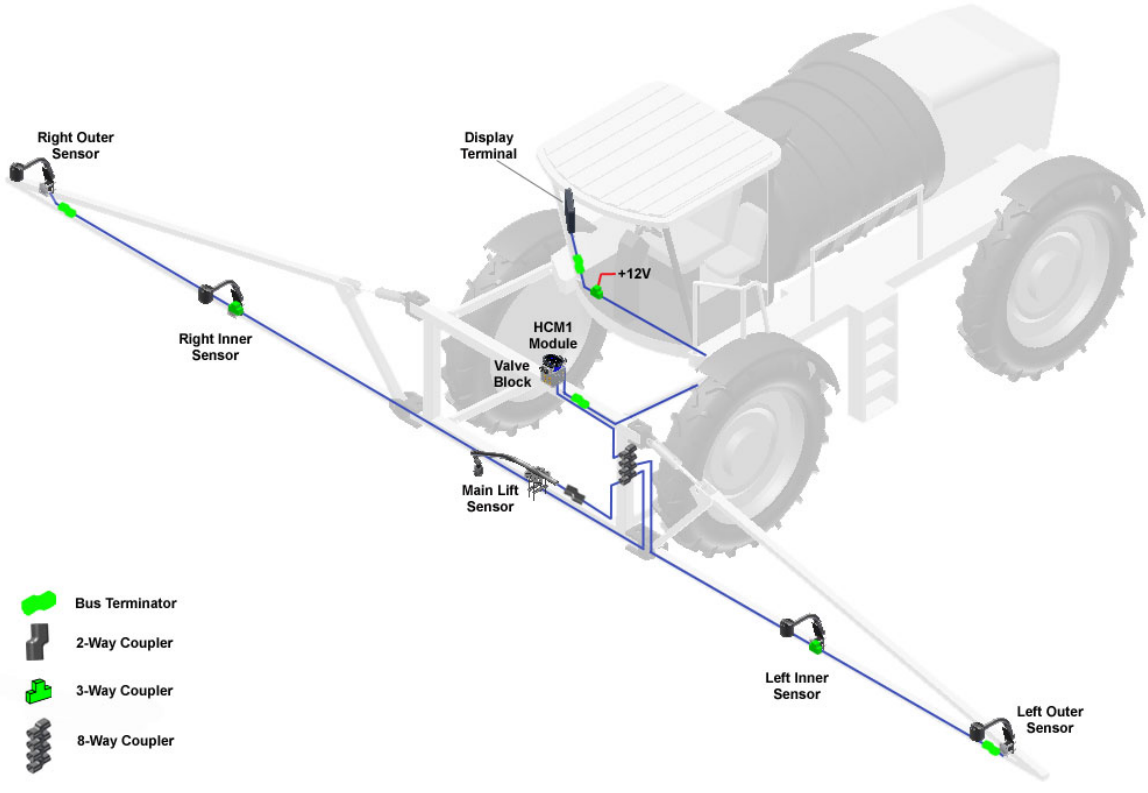
Typical Self-Propelled Sprayer Installation



Typical Pull Type Sprayer Installation



Typical Front Mount Sprayer Installation



10.1 Sensor Maintenance

As part of the machine's operational check, ensure there is a clean and dry foam or mesh inserted into each sensor.

- Chemicals or compressed air should never be used to clean sensors.
- The sensor can be used if the foam is wet; however, a valid height reading may not be obtained until it is completely dry.
- It is recommended to have replacements foams available. Additional foams are available for purchase. See Table 7.
- Visit www.solutions.norac.ca for more detailed troubleshooting information.
- Examples of sensors with the different foam or mesh configurations:

Figure 15: Ultrasonic Sensor with Foam

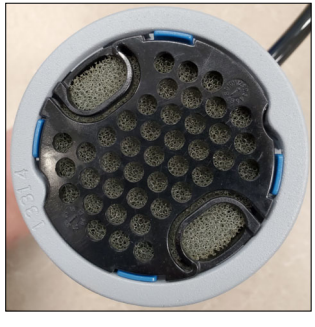


Figure 16: Ultrasonic Sensor with Retainer Clip

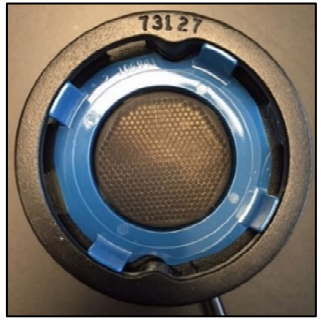


Figure 17: Ultrasonic Sensor with Mesh

10.1.1 Cleaning Ultrasonic Height Sensors

Foam with Velcro:

- Remove the foam disc from the sensor and wash it with clean water. Squeeze out water and allow the foam disc to dry or replace with a spare.
- If the transducer inside the sensor is also dirty, wipe it using a clean, damp cloth. Do not submerge or pressure-wash the sensor.
- Insert the foam into the sensor by pressing it firmly into place so that the foam is contacting the Velcro retainer.

Table 7: Replacement Foam Disc Package

Part Number	Name	Quantity
1045970-01	FOAM DISK PKG OF 2 ULTRASONIC SENSOR	1

Foam with Retainer Clip:

- Remove the foam retainer by squeezing the two finger holes together and gently pulling outward.

Figure 18: Sensor Foam Retainer Clip Removal

- Remove the foam disc from the retainer and wash it with clean water. Squeeze out water and allow the foam disc to dry or replace with a spare.
- If the transducer inside the sensor is also dirty, wipe it using a clean, damp cloth. Do not submerge or pressure-wash the sensor.
- Insert the foam into the retainer. Align the foam retainer notches with the vent holes of the sensor. Press down until the retaining clips engage with a click sound.

Table 8: Foam Retainer Upgrade Kit

Part Number	Name	Quantity
1047436-01	FOAM RETAINER W/FOAM	1

Mesh:

- It is recommended that sensors with mesh are upgraded to foam. See Table 9 for ordering information.

Table 9: Foam/Clip Upgrade Kit

Part Number	Name	Quantity
411613	SENSOR UPDATE KIT - FOAM/VELCRO	1

- To clean the mesh, wipe the mesh covering with a clean, damp cloth. If the mesh is heavily soiled and/or if the sensor is not reporting height readings, remove the blue clip holding the mesh in place. Wash the mesh with clean water using a clean cloth and allow it to dry. Avoid creasing or crumpling the mesh when cleaning. See Figure 19 and Figure 20 for examples of soiled and clean mesh. The soiling can best be seen when holding the mesh up to a light source.
- If the transducer inside the sensor is also dirty, wipe it using a clean, damp cloth. Do not submerge or pressure-wash the sensor.

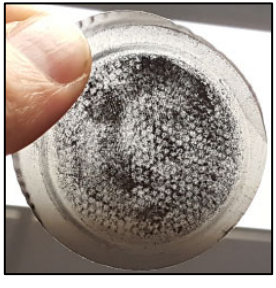


Figure 19: Soiled Mesh

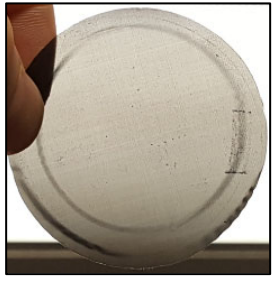


Figure 20: Clean Mesh

10.2 Sensor Mounting

- Mount the sensors into the sensor brackets.
- Torque the M8 nut to 108 in-lb (12Nm).
- Run the sensor cable through hole in the back of the bracket. Ensure the cable is clear of moving parts and will not be damaged during folding.

10.3 Mechanical Suspension Maintenance

The performance of a boom height control system is also dependent on the state of mechanical components. The condition of each of the machine's applicable suspension components should be checked on a regular basis.

- Springs and dampers are in good condition.
- Grease wear pads on the sprayer boom.
- Nothing is broken and/or binding.

- NORAC Solutions: http://solutions.norac.ca
- Service and Support: 888 979 9509
- Email: tasupportn@topcon.com
- Please have the following information available:
  - Product model: UC7™
  - Installation date
  - Sprayer make and model
  - Customer information: name and location
  - HCM1 Module serial number and firmware version