NORAC
WEIGHING AND CONTROL SYSTEMS

UC4™ *Total Control*™

Automatic Boom Height Technical Manual

2007



Canada

NORAC Systems International Inc.

TOLL FREE: 1-800-667-3921
(306) 664-6711
SHIPPING ADDRESS:
3702 Kinnear Place
Saskatoon, SK
S7P 0A6

United States

NORAC, Inc.

TOLL FREE: 1-866-306-6722
(763) 786-3080
SHIPPING ADDRESS:
1290 Osborne Rd. NE, Suite F
Fridley, MN
55432-2892

For other service locations please view our website:

www.norac.ca

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1 INTRODUCTION

Congratulations on your purchase of the NORAC UC4 automated sprayer boom height control system. The system is manufactured with top quality components and is engineered using the latest technology to provide operating features and reliability unmatched for years to come.

When properly used, the UC4 system can provide protection from sprayer boom damage, improve sprayer efficiency, and ensure chemicals are applied correctly.

This manual is intended to be used in conjunction with the:

- **UC4 Total Control Quick Guide (UC4 Quick Guide)**
- **UC4 Total Control Automatic Boom Height System Installation Manual (UC4 Installation Manual)**

The manual provides a general description of the boom height control system, a section regarding system operation, and discussion related to understanding performance issues. Also provided are instructions for the use of the control panel, information regarding system setup, and a section about regular maintenance.

Please take the time to read the complete manual before attempting to use the system. Although the UC4 system has been designed for easy set up and use, a thorough understanding of the information provided will ensure that you receive the maximum benefit from the system.

If you have any questions or comments regarding the operation of the UC4 system, please contact NORAC at any of the numbers below. If you require service, phone us or visit our web site for the location of the NORAC Service center nearest to you.

Phone: **1-800-667-3921** **in Canada (Toll Free)**

1-866-306-6722 **in the United States (Toll Free)**

0-800-404-8389 **in the United Kingdom (Toll Free)**

1-306-664-6711 **all other regions**

E-mail: service@norac.ca

Web Site: www.norac.ca

2 CHECK YOUR SOFTWARE VERSION

The information in this manual applies to systems with **Version 5** UC4 control panel software. When the panel is turned on, the software version and revision will be displayed for a few seconds as described in **Section 5.1**. If your control panel does not display a version when it is turned on, your software is Version 1 (all revisions).

All UC4 control panels can have their software upgraded for a nominal fee. It is recommended that all panels with earlier software be updated to the current software version. Contact your local dealer or NORAC for more information.

3 OPERATOR SAFETY

⚠ DANGER ⚠

STEP 1: **Always ensure that the UC4 system is powered down or in MANUAL mode:**

- **before leaving the operator's seat**
- **while the machine is not moving**
- **or when transporting the machine**

STEP 2: **Under no circumstances should any service work be performed on the machinery while the UC4 system is in the AUTOMATIC mode.**

STEP 3: **Before working on any part of the booms:**

- **set the UC4 system to MANUAL mode**
- **turn the sprayer engine off**

STEP 4: **Do not operate this system before:**

- **reading and understanding this UC4 Technical Manual**
- **thoroughly understanding your machine operation**

STEP 5: **The UC4 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 UC4 system's automatic control when necessary. Refer to the warranty statement in Section 10 for more details.**

4 GENERAL SYSTEM DESCRIPTION

Figure 1 shows the general layout of the UC4 Boom Height Control system. The function of each of the major system components is described in this section.

NOTE: Some kits may not include all of the components shown.

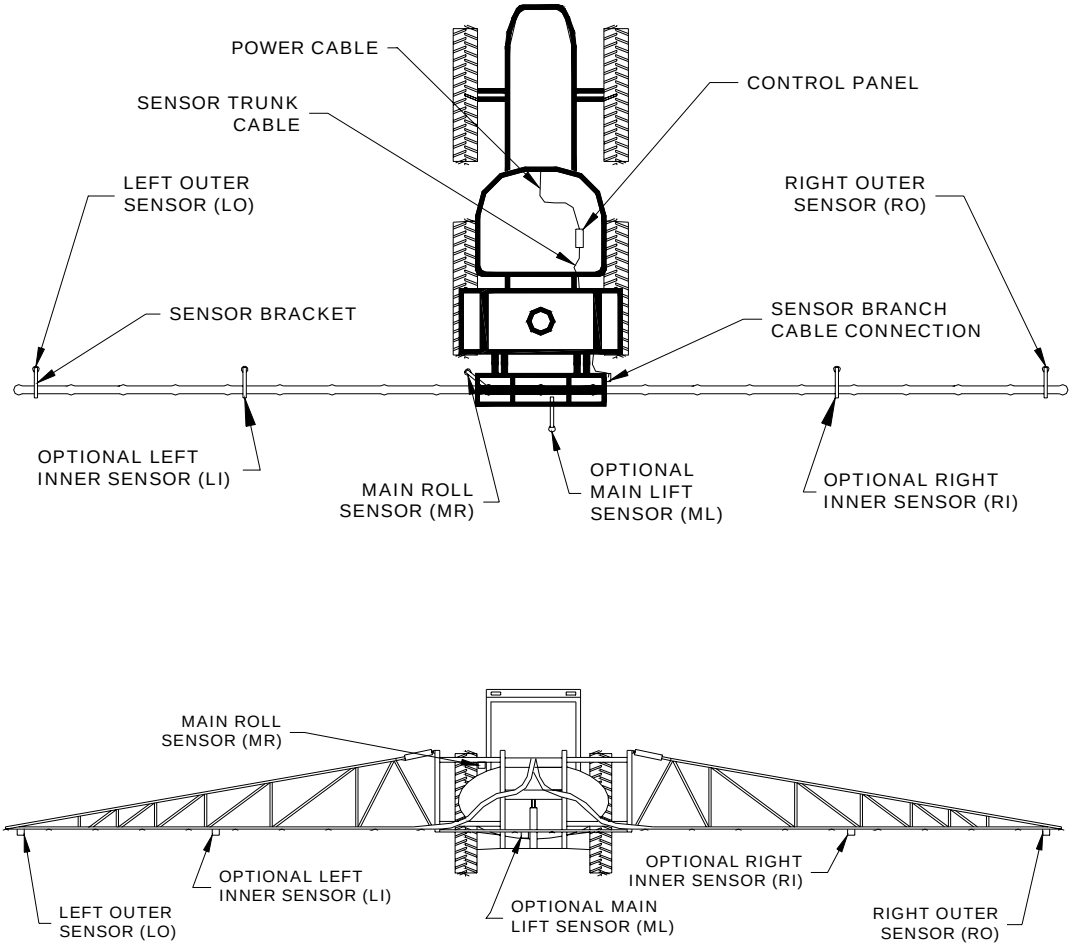


Figure 1 - System Components and General Location

For more information on each component, please refer to the UC4 Installation Manual and UC4 Quick Guide.

4.1 INSTALLATION

For proper installation of the UC4 boom control system, please refer to the UC4 Installation Manual for your model of sprayer.

4.2 SENSORS

Three sensors are provided with your UC4 boom control kit (with the exception of certain kits). The sensors use an ultrasonic signal to measure the distance to the ground, or the top of the crop. Three sensors are required to provide good overall height management of the boom. Two sensors are mounted on the outer sections of each wing (**Figure 2**). These sensors maintain each wing at the set target height independently.

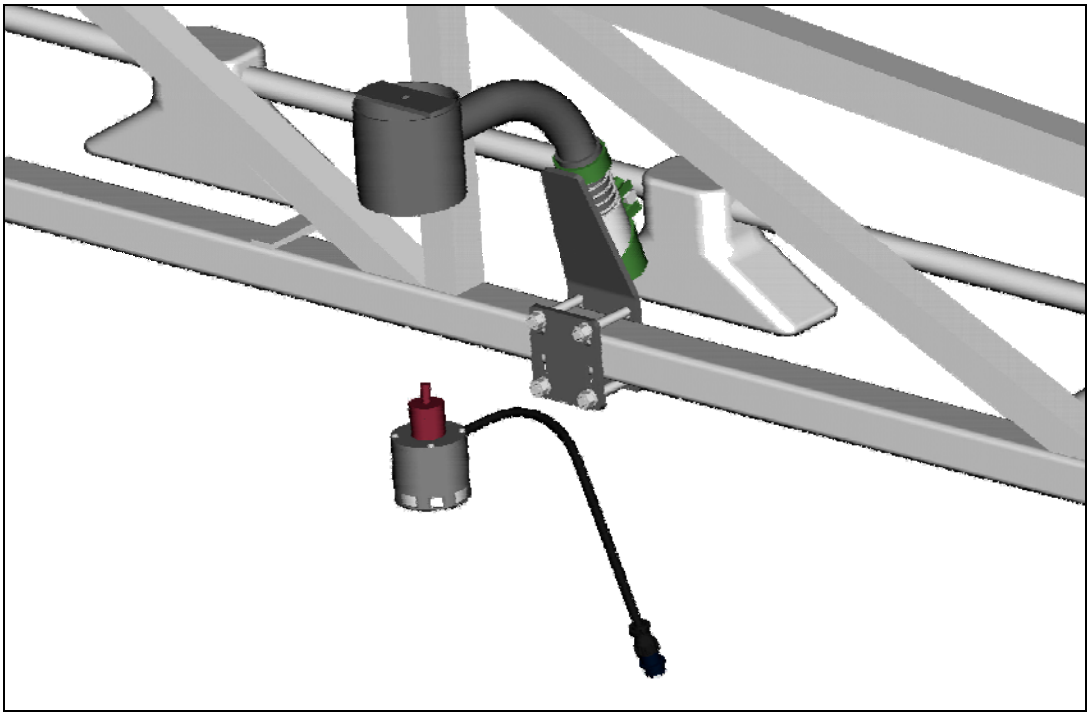


Figure 2 – UC4 Sensor and Mounting Bracket

The third sensor (if applicable) is mounted on the main (center) boom section. The main boom sensor is useful for setting your initial spray height when you begin spraying in a field.

It is true that the main boom height will not change much, in consistent soil conditions, since both ends of the main boom follow the height of the power unit. However, it is extremely difficult to judge the boom's actual height accurately from the cab. It is also very difficult for the operator to see the main section nozzles. It is common for operators to be in error from 8 to 12 inches or more (How often does the operator check nozzle height with a tape measure?). The UC4 control panel will give you an actual height reading in the cab, and allow active control to the desired height.

Another good reason for the main boom sensor is that soil conditions change along with the weight of the machine. As the sprayer tank fluid level changes throughout the day and soil conditions vary, the main boom height will change because of the amount the tires sink into the soil.

Special attention must be taken into consideration when mounting the main boom sensor, as explained in the UC4 Installation Manual for your sprayer.

NORAC ultrasonic sensors are designed to work best in the brackets provided (**Figure 2**). If you decide to use a different style of sensor mount, you may limit the performance of the sensor and/or void your warranty. Further, it is important to follow the guidelines in the UC4 Installation Manual for mounting the sensors. The sensors should be at least 9 inches above and 9 inches in front of the spray nozzles.

For large boom or severe terrain applications, an additional sensor may be mounted near the midpoint of each boom to obtain an average height reading. The average height reading will provide improved height control over the length of the boom, and protect the boom in severe terrain conditions (**Figure 3**).

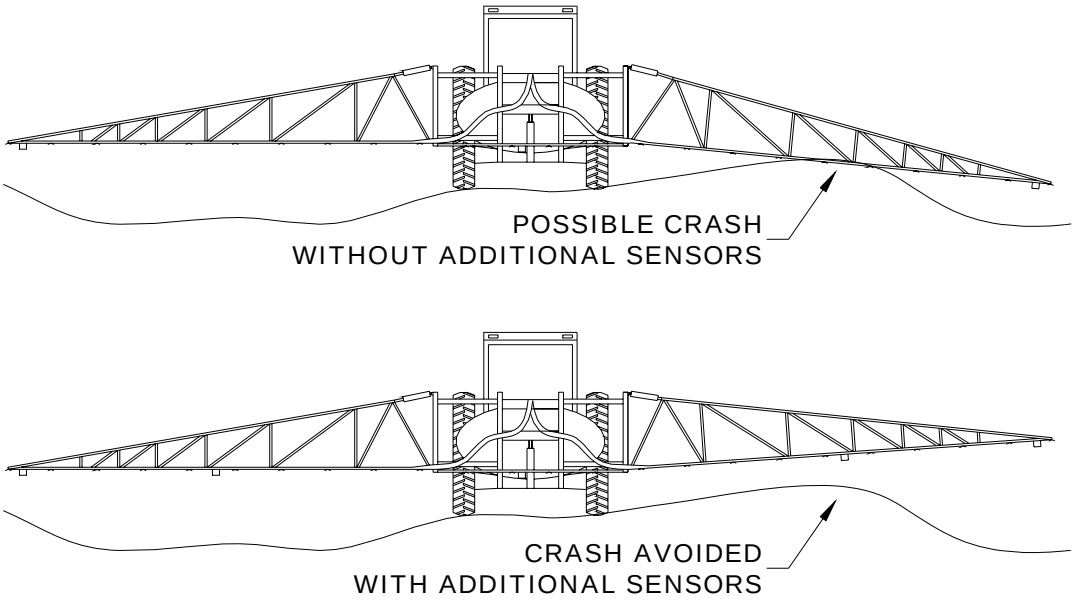


Figure 3 – Severe Terrain – Additional Sensors Required

On sprayer models with main frame roll capability (as illustrated in **Figure 4**), the main boom sensor can also be used to adjust the roll angle of the entire boom. Addition of this sensor to the UC4 system can greatly improve the speed and stability of the automatic control actions. Contact NORAC for more information on the availability of roll control for your sprayer model.

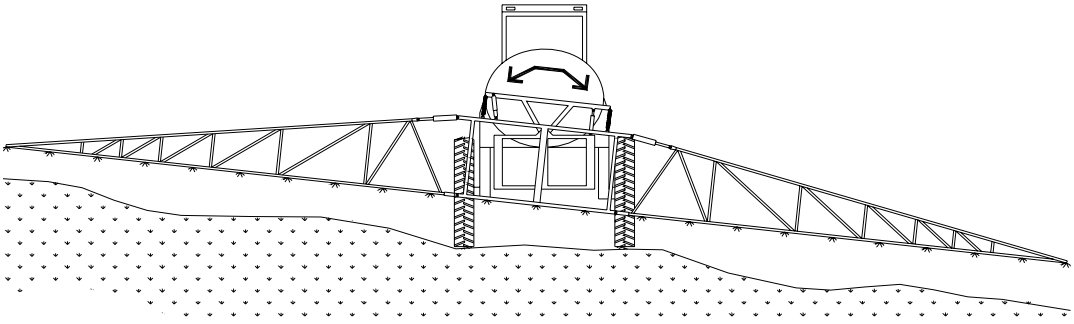


Figure 4 – Roll Control of the Main Frame

4.3 POWER CABLE

The power cable supplies 12 volt D.C. negative ground power to the control panel and sensors. The system will function properly with a supply between 12 and 28 volts and may draw up to 10 amperes during normal operation.

The UC4 control panel contains intelligent valve drive circuitry that helps to protect the sprayer's system against short circuits and other wiring problems. However, it is still recommended to connect the UC4 power cable to a fused supply, that turns on and off with the ignition key of the sprayer/tractor.

4.4 SENSOR CABLES

The UC4 ultrasonic sensors are connected to the control panel via sensor cables. A generic power cable and a generic extension cable (or a "trunk" cable) run(s) from the panel to the sprayer boom. From the extension cable, a standard "branch" cable allows for connection of the two standard boom sensors and an optional main roll (center) sensor (**Figure 5**). Another optional branch cable is required to connect additional sensors.

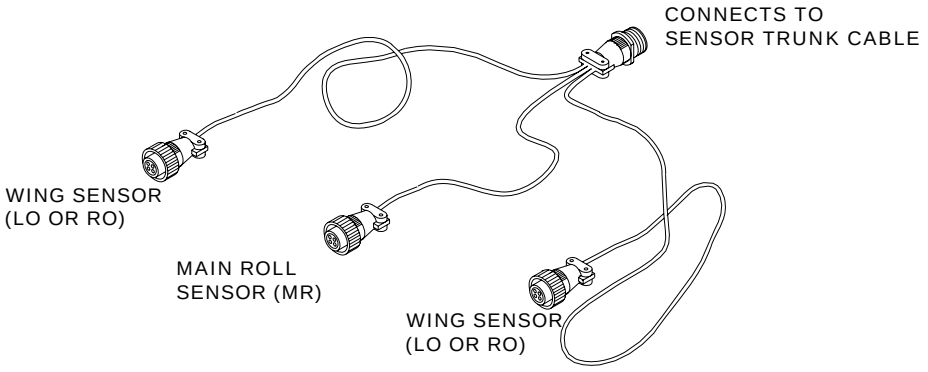


Figure 5 – Sensor Branch Cable

4.5 CONTROL PANEL

The UC4 control panel (**Figure 6**) is the main component of the UC4 sprayer boom height control system because it regulates the operation of the entire system. The control panel uses the readings from the ultrasonic sensors to control solenoid operated valves (usually hydraulic) that in turn adjust the boom height. The control panel will:

(1) indicate when the system is in **AUTOMATIC** or **MANUAL** mode,

(2) indicate any hydraulic action which is underway, and

(3) accept input to adjust all control system settings.

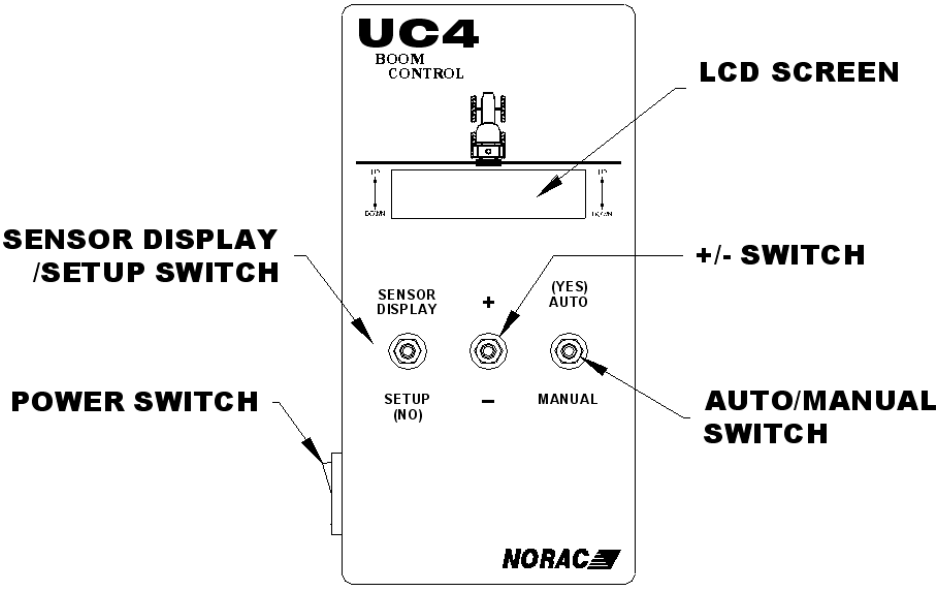


Figure 6 – UC4 Control Panel

4.5.1 LCD Screen

During normal operation, the LCD screen will show the UC4 system status and allow you to examine or change settings. All settings for the UC4 system are stored in cyclic menus. This type of menu allows the operator to access each menu entry by progressively toggling the appropriate switch.

4.5.2 SENSOR DISPLAY/SETUP (NO) Switch

Toggling UP on the "**SENSOR DISPLAY / SETUP (NO)**" switch will access the **SENSOR DISPLAY** menu. This menu provides information about the sensors. Toggling DOWN on the "**SENSOR DISPLAY / SETUP (NO)**" switch will access the **SETUP** menu. This menu provides options and settings regarding the UC4 system parameters.

Toggling this switch in the **SETUP (NO)** direction also provides the alternate function "**NO**". In some instances the control panel may prompt the operator with a question that requires a yes or no response. For a more

detailed description of the **SENSOR DISPLAY** and **SETUP** menus, refer to **Section 7** on page 22.

4.5.3 The " +/- " switch

Use the " **+/-** " toggle switch to change various settings in each of the **SETUP** and **SENSOR DISPLAY** menus. Use the " **+/-** " switch to increment/decrement numerical entries. If the switch is held, the number will continue to automatically increase/decrease. If the selections for the menu item are to be picked from a list, this switch will present the next selection in the list. When in **AUTOMATIC (AUTO)** mode, use this switch to modify the control height set point.

Not all menus allow the operator to change the setting with the " **+/-** " switch. Some menus are only for informational purposes. In a menu where a setting cannot be changed, the " **+/-** " switch is ignored.

4.5.4 AUTO (YES) /MANUAL switch

The UC4 boom control system has two operational modes – **AUTOMATIC (AUTO)** and **MANUAL**. This toggle switch changes the operational mode of the system. In **AUTOMATIC (AUTO)** mode, the control panel will regulate the height of each boom to a predetermined set point. In **MANUAL** mode, the sprayer functions as if no automatic control system is present.

When the system is in **AUTO**, the operator can override automatic control by operating the manual switches on the sprayer's boom controls (usually a joystick or multifunction handgrip).

The "**AUTO (YES)**" switch also provides the alternate function "**YES**". In some instances the control panel may prompt the operator with a question that requires a yes or no response.

4.5.5 POWER switch

The power switch is located on the left side of the control panel. For safety reasons, the UC4 system always powers up in **MANUAL** mode. Consequently it is important to make sure that the power switch cannot be accidentally bumped during field operation.

5 SYSTEM OPERATION

This section outlines the UC4 system's features and controls during field operation. Before you can operate your UC4 system in **AUTO** mode, it needs to be configured either automatically or manually. If your control panel shows the power up sequence below and will allow **AUTO** mode, it has been configured. If your panel shows different messages after being powered up or will not allow **AUTO** mode, it will attempt to begin or resume Automatic System Setup. Refer to **Section 8** for System Setup instructions.

5.1 POWER UP SEQUENCE

The LCD screen messages shown below are displayed temporarily when power is turned on to the UC4 control panel. Once the Normal Operating Screen is shown the system is ready to use.

Table 1 – Power Up Screens

Screen	Meaning
UC-4	UC4 Control Panel
V. 5A	Version 5 software
Type AN2	Sprayer Type: AN2. See **Table 12** on page **54** – for a list of types.
* Nodes	The control panel is looking for connected sensors.
3 HeighT	Three height sensors are connected
Allocate	The control panel is preparing to set up each sensor
Setup LO	The control panel is setting up the Left outer (LO) sensor, followed by the other attached sensors (LI , RO, RI , MR, ML)
Ready	The control panel is ready to begin operation
35 MM 35	The Normal Operating Screen. This screen is shown until input is received from the operator. Refer to **Section 5.2.1** for further details.

5.2 TYPICAL OPERATION

5.2.1 Normal Operating Screen

The Normal Operating Screen provides information pertaining to the height and mode of both booms. **Figure 7** shows a typical Normal Operating Screen.

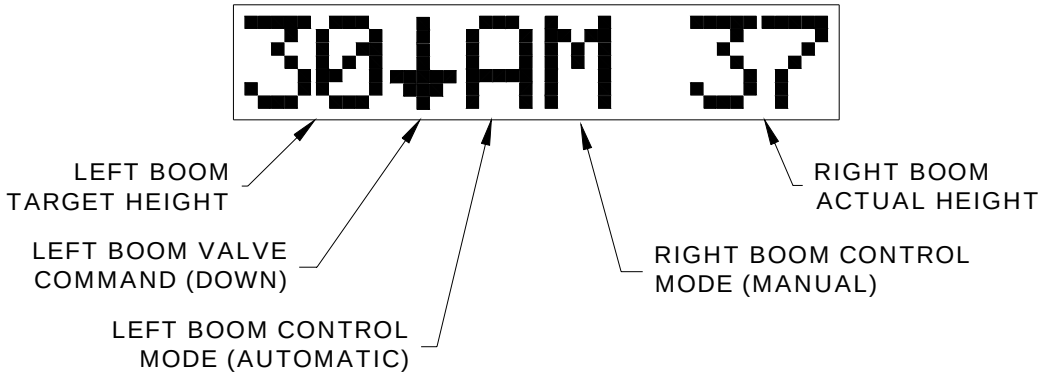


Figure 7 – Normal Operating Screen

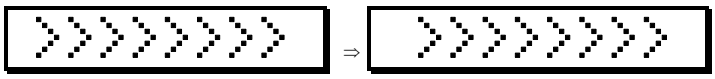
When a boom is in **AUTO** mode, indicated by an "A" in the control mode portion of the screen, the UC4 panel shows the target boom height. In **MANUAL** mode, indicted by an "M" in the control mode portion of the screen, the UC4 control panel shows the current boom height reading.

In both **AUTO** and **MANUAL** modes, the screen will also show arrows to indicate that the boom is being commanded to move. **Table 2** explains some examples of typical Normal Operating Screens.

Table 2 – Examples of Normal Operating Screens

Screen	Meaning
	Both sides in **AUTOMATIC** mode, the target boom height is 36 inches.
	As above, but now the left side is taking corrective action, upwards.
	As above, but now the right side is taking corrective action, downwards.
	As above, but now the main lift (center) boom is taking corrective action, downwards. Mode temporarily disappears on left side while the main is active.
	A curved arrow in this direction indicates that the main roll section is taking action in the clockwise direction (left boom up). Mode temporarily disappears on right side while the main is active
	Left boom is in **MANUAL** mode, current actual boom height is 34 inches. Right boom is in **AUTOMATIC** mode, the target boom height is 36 inches.
	Left boom is in **MANUAL** mode, the current actual height is 34 inches. The operator is manually lowering the right boom, the current actual height is 36 inches.

Table 3 – Special Screens

 This screen indicates that one of the configured sensors was not found during a power up sequence. An audible alarm is also sounded to warn the operator of a missing sensor. Check that all sensors are operating. Refer to the UC4 Quick Guide for troubleshooting information.
 The control panel is busy with a task that may take a few seconds. Wait for the arrows to disappear before activating any UC4 control panel's toggle switches.

5.2.2 Using the Toggle Switches

All functions on the UC4 control panel are activated using its three toggle switches. To access either the **SENSOR DISPLAY** or **SETUP** menus, make sure you are at the Normal Operating Screen. Toggle toward the word describing the menu you wish to access. To adjust the setting of individual menu items, use the " **+/-** " switch while the item is displayed.

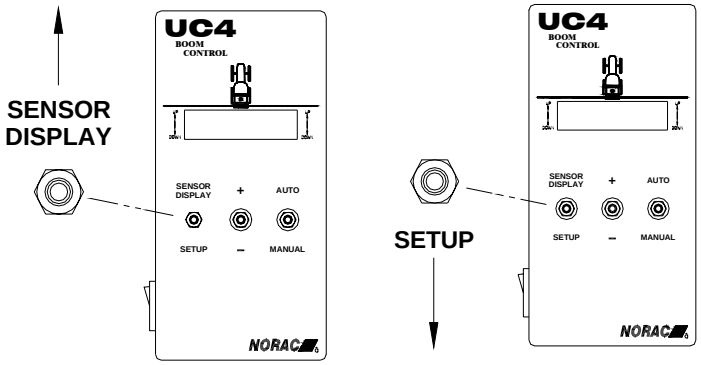


Figure 8 – SENSOR DISPLAY / SETUP (NO) Switch

Menu items will time out and return to the Normal Operating Screen after 30 seconds. If you wish to return to the Normal Operating Screen sooner, toggle and hold the "**SETUP (NO)**" switch for two seconds. Any new settings will take effect once the Normal Operating Screen is displayed.

If you wish to lock the sensor height readings on the screen indefinitely, toggle the " **+** " switch once while viewing the desired sensors.

5.2.3 Changing to AUTOMATIC or MANUAL Mode

Change the mode between **MANUAL** and **AUTO** with the "**AUTO (YES) / MANUAL**" toggle switch. Ensure you are at the Normal Operating Screen.

When the UC4 system is in **MANUAL** mode, the boom may be controlled

as usual with the boom control switches on the sprayer's multifunction handgrip.

When the UC4 system is in **AUTO** mode, operating the sprayer's left or right boom control switches will immediately cause that boom to revert to **MANUAL** mode. The sprayer (joystick) switches will override automatic boom height control on either the left or right side. The "**AUTO (YES)** " switch must be activated to return that boom to **AUTO** mode.

The sprayer's main lift control (main up or main down) switches provide a target height adjustment feature (**Section 5.2.4**). If you press and hold either the main up or the main down switches for more than two seconds, the UC4 control panel will switch ALL booms (left, right, main, and roll) to **MANUAL** mode. This feature provides a convenient method of switching to **MANUAL** mode when folding the sprayer for transport.

5.2.4 Adjusting the Target Height (Setpoint)

Adjust the target height setting with the " **+/-** " switch while in **AUTO** mode. The smallest target height setting allowed is called the minimum height override. The default minimum height settings are programmed before shipped from the factory.

NOTE: The minimum height settings are adjustable. – If you wish to adjust them, please contact NORAC for details.

You can also adjust your main boom target height by pressing the sprayer's main lift control switches. Each press of the up switch will increase the target height by one inch. Each press of the down switch will decrease the target height by one inch.

5.2.5 Viewing the Actual Boom Height

Toggle the "**SENSOR DISPLAY**" switch to view the actual boom heights. This menu will show you the left, main (center), and right boom heights. Toggle the "**SENSOR DISPLAY**" switch again to view additional sensors if they are installed. You can view the height menus in both **AUTO** and **MANUAL** modes. Refer to **Section 7.2** on page 23 for more information on the sensor height menus.

5.2.6 Changing the Sensitivity of the System (Sensi)

The Sensitivity (Sensi) setting (**Section 6.1.1**) can be adjusted in both **MANUAL** and **AUTO** modes. Toggle the "**SETUP (NO)**" switch to view the current Sensi setting. While viewing this menu, toggle the " **+/-** " switch to adjust the value.

A lower number will reduce the system sensitivity and improve stability. Increasing the number will speed up the response.

Five is the normal setting. At the start of operation, before the sprayer is warmed up, a lower Sensi setting may be required for stable control. As the sprayer warms up, increase the Sensi setting up until the performance reaches an optimum level.

Changes in terrain that include driving through ditches and over terraces are special performance cases. This type of terrain can cause the sprayer to pitch and roll significantly. See **Section 6.1** on page 16 for a discussion of performance issues.

5.2.7 Changing Between SOIL and CROP Mode

The **SOIL** or **CROP** mode (**Section 6.2**) setting can be adjusted in both **MANUAL** and **AUTO** modes. Toggle the "**SETUP (NO)**" switch twice to view the current setting. While viewing this menu, use the " **+/-** " switch to change between **SOIL** and **CROP** mode.

6 UNDERSTANDING YOUR UC4 SYSTEM

6.1 UNDERSTANDING PERFORMANCE ISSUES

Your UC4 height control system will work well in most situations. However, as with any equipment, it is important that the operator remains alert at all times. There may be some field and terrain situations where performance is diminished. In these situations the operator must resume height control of the booms manually (**Section 5.2.3**). A discussion of performance issues is given below to help clarify these situations.

6.1.1 Sensitivity (Sensi) Setting

The UC4 system is configured to work well in most conditions, with warm hydraulic oil, at a sensitivity (Sensi) setting of five. When you first begin operation at the start of a day, it may be necessary to operate at a lower sensitivity until the oil has reached normal temperature. Keep increasing the Sensi setting until the performance is optimized.

Different types of terrain may require different Sensi settings. The Sensi setting controls more than just response time. It also determines how accurately the UC4 system will try to correct for height errors. The higher the sensitivity the higher the accuracy. At low sensitivity a few inches of error will be tolerated. At high sensitivity, virtually no error will be tolerated. Therefore, the system will be much more active at high sensitivity than at low sensitivity.

NOTE: Field conditions and operator preferences determine the appropriate Sensi setting. On some sprayer models, it may be difficult to reach an optimum level of sensitivity while maintaining good boom stability. This could be an indication that the boom is mechanically under-damped for control purposes. Additional shock absorbers/dampers can dramatically improve automatic control performance. Some UC4 kits come complete with additional damper kits. Other sprayer models have damper kits available from the sprayer manufacturer or from NORAC as optional equipment. Contact NORAC or your sprayer dealer for more assistance.

6.1.2 Boom Reaction Time

There are two key factors that determine how quickly your boom can react to changes in terrain. The first factor is the available hydraulic speed. The maximum hydraulic speed of your boom was designed by the sprayer manufacturer and is not improved or diminished with the addition of the UC4 height control system.

The second factor is the mechanical design of the sprayer. The Sensi setting does affect the reaction time of your boom – the higher the number the quicker the response. However, how high you can run the Sensi setting is determined to a large extent by mechanical issues related to the boom and sprayer.

Important design issues include the style of main boom mount (for example, center pivot or nonparallel links), the amount of mechanical damping and spring centering on the main boom mount, and whether a main boom roll system is available on the sprayer. All of these factors together determine the maximum Sensi setting you can run on your UC4 system. This, in turn, will set the reaction time of the boom in a given situation.

The UC4 electronics are rarely the limiting factor in determining overall automatic height control performance.

6.1.3 UC4 over Ditches, Waterways and Outside Rounds

Many situations exist where one sensor may be reading over terrain that does not accurately reflect the situation for the rest of the boom. For example, if you are spraying along a waterway, it may be necessary to run the outer boom sensor out into the waterway itself. This situation is similar to the picture in **Figure 3**. In this example, the outer sensor will bring the boom lower than desired and may put the mid-point of the boom at risk. Outside rounds adjacent to very weedy areas or tall thick grass are examples of the opposite situation.

In these situations the operator must remain alert and override **AUTO** mode when necessary. Addition of the optional severe terrain (inner) sensors will greatly improve performance in these situations.

6.1.4 Driving Through Ditches and Over Terraces

Changes in terrain that include driving over terraces or through ditches are special performance cases. This type of terrain can cause the sprayer or spray cart to pitch and roll significantly. Sprayer operation at speeds of 10-20 mph in severe terrain may result in rapid changes in boom tip height. In these situations, typical sprayer hydraulic systems are not capable of tip speeds high enough to correct for the induced error.

There are two solutions to this problem. The first solution is for the operator to recognize these situations before they occur and manually raise the boom section(s) to a safe height. To return to **AUTO** mode, use the "**AUTO (YES)**" switch.

The second solution is to add a roll control system to your sprayer (if one is available). This type of system will compensate for the sprayer roll in this situation and also add stability to your boom in normal operating conditions.

6.1.5 Sensing Further Ahead of the Boom

Installing the sensor farther ahead of the boom is not an acceptable solution to any performance issues. The reason is that, as the sensor is moved further ahead, there will be an increasing height error at the nozzles. In other words, the sensor and nozzle are at two different points in space, thus introducing an error for all but the most level terrain. In severe terrain, this height error can bring the nozzles close to the ground as the sensor reads over the crest of a hill, or down into a ditch.

6.1.6 Sensor Capabilities

In order for the UC4 system to work at its maximum level of performance, the UC4 sensors must be returning accurate height readings at the designed frequency. Under typical conditions, the sensors can provide accurate height readings from 9 inches to over 120 inches, and return many height readings in one second. The target in **SOIL** mode can be identified through stubble, young crops, row crops, and normal trash. The target in **CROP** mode can be identified over cereal grains, specialty crops, and row crops. See the next section for more information on **CROP** and **SOIL** mode guidelines

There are two main steps to ensure sensor performance. The first step is proper mounting. See **Section 4.2** on page 5 for more information on sensor mounting. The second step is to ensure that the protective foam covers on the sensors are kept clean, and that the ultrasonic transducer behind the foam does not become corroded or excessively dirty. Extra foams are shipped with your kit. The transducer is a maintenance item and can be replaced at NORAC service locations. Transducers can last from three to ten years, depending on conditions. Refer to **Section 9** on page 48 and the UC4 Quick Guide for more maintenance information.

If the mouth of the sensor becomes wet, it is normal for the sensor to return error messages until the transducer has dried off. This could include rain or excessive overspray. Material can build up on the transducer if the sensor is mounted too close to the spray nozzles. This is the reason that the sensor must be mounted at least 9 inches in front of the nozzles. It keeps the sensor housing out of the normal region of overspray.

In the sprayer boom application, the sensors ignore any target that is closer than 9 inches from the bottom of the sensor housing. This region is called the blanking range. Operating the sensor at heights near the blanking range is dangerous and will affect performance because height readings can be very intermittent. This is the reason that each sensor must be mounted at least 9 inches above the spray nozzles.

6.2 UNDERSTANDING CROP MODE AND SOIL MODE

A unique feature of UC4 sensors is their ability to operate in **CROP** mode. In this mode the sensor will track the first available sonic target. That is, when positioned over standing crop, the sensor will return the average height of the heads in a circular area below the sensor. In the same situation in **SOIL** mode, the sensor will track the last available sonic target. That is, signals from the heads, leaves, and trash will be ignored in favor of the ground.

It is important to note that the targets must be available and of sufficient strength for the sensor to "see" them. There may be some crop and terrain situations that do not work well for **CROP** mode or **SOIL** mode. In these situations the operator must resume height control of the booms manually.

In general, the addition of the severe terrain kit will improve performance in **CROP** mode. All of the problems discussed below are lessened by the addition of the extra sensors on the wings.

6.2.1 Areas of "No Crop" in CROP Mode

If, while operating in **CROP** mode, the sensor encounters an area where there is no crop, the system will behave as follows. The sensor will track the soil because only one target is available. The boom will lower as shown below. Areas like this may include missed areas during seeding, alkaline areas, and so on. When the problem area ends, it may not be possible for the sensor to see the crop again unless the operator raises the boom manually. The sensor may be closer than required nine inches from heads of the crop, thus blanking out the desired target.

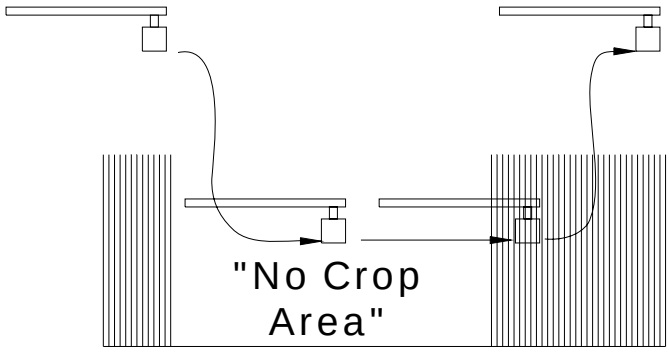


Figure 9 – Area of "No Crop" When Operating CROP Mode

6.2.2 Boom Stability in Crop

In general the top of the crop is a more inherently variable target than soil. To put it simply, given identical control settings, your height control would be more active when operating in **CROP** mode than in **SOIL** mode. To allow for this, many settings are customized automatically when you change modes on the UC4 control panel. This is designed to provide a more stable

response in **CROP** mode. The tradeoff is that the system will also be slightly slower to respond in **CROP** mode than in **SOIL** mode.

6.2.3 Thin Crop

The UC4 ultrasonic sensors operate by bouncing sound waves off the desired target. A minimum signal level is required from the crop in order to use it for control purposes. This is no different than the fact that your radio must be at a certain minimum volume level before you can physically hear it. Different types of crop, and crops at different stages of development return varying levels of sound. The following are some general guidelines.

- Crops in growing stages are relatively good sonic targets.
- Bearded crops are relatively poor sonic targets.
- In row crops, the sensor must be positioned over the row to use the crop signal, or between the rows to use the ground signal.
- The desired target must cover roughly 60 percent of the area to be tracked consistently. That is, when looking at the ground, the heads should cover about 60 percent of the ground. Otherwise, you can use **SOIL** mode.
- If the sensor runs too close to the heads, they may not return enough signal to be seen, or they may be blanked out. The nozzles must be at least 22 inches from the crop. Slightly higher target height settings will work better in thin crop.

6.2.4 Main Boom Sensor in Wheel Track

The required location for the main boom sensor is determined by the UC4 Installation Manual for your sprayer and by the options you have installed. Special attention is necessary when mounting the main roll sensor. Mounting the main roll sensor directly behind a sprayer tire may impair main lift control when operating in **CROP** mode. Height readings from crop that is flattened by the sprayer wheel do not provide an accurate measurement of canopy height, resulting in poor performance.

Moving the main roll sensor to a different location away from the wheel is the easiest solution, however, this may not be possible given the other requirements for mounting this sensor in your situation. If the sensor cannot be moved, three possible options are:

1) Disabling the main section's **AUTOMATIC** control (main boom height will still be viewable on the UC4 LCD screen)
2) Compensating for the lack of crop in the "wheel track"
3) Adding a fourth sensor to handle the main lift height measuring duties.

Please refer to **Section 0** on page 39 for details of these options.

7 MENU NAVIGATION

7.1 NORMAL OPERATING SCREEN

When the control panel is turned on, the LCD screen will flash the current setup type, followed by the control panel software version. The Normal Operating Screen will then be displayed (**Figure 10**). A detailed description of operating screens is given in **Section 5.2** on page 11. The Normal Operating Screen is the starting point, and ending point, for navigation through the menu structure.



Figure 10 – Normal Operating Screen

The following pages describe the menu prompts that are shown as you proceed through the **SENSOR DISPLAY** and **SETUP** menus. To navigate through these menus, use the "**SENSOR DISPLAY / SETUP (NO)**" toggle switch. **Table 4** in the following section shows the structure of the main menu. The start of the main menu (the Normal Operating Screen) is shown in bold at the center of the table.

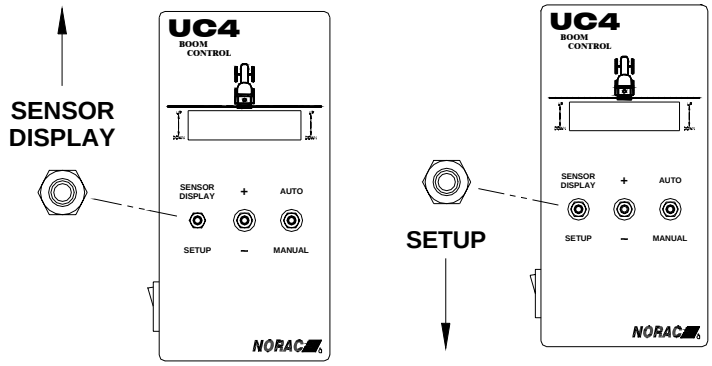


Figure 11 – SENSOR DISPLAY / SETUP (NO) Switch

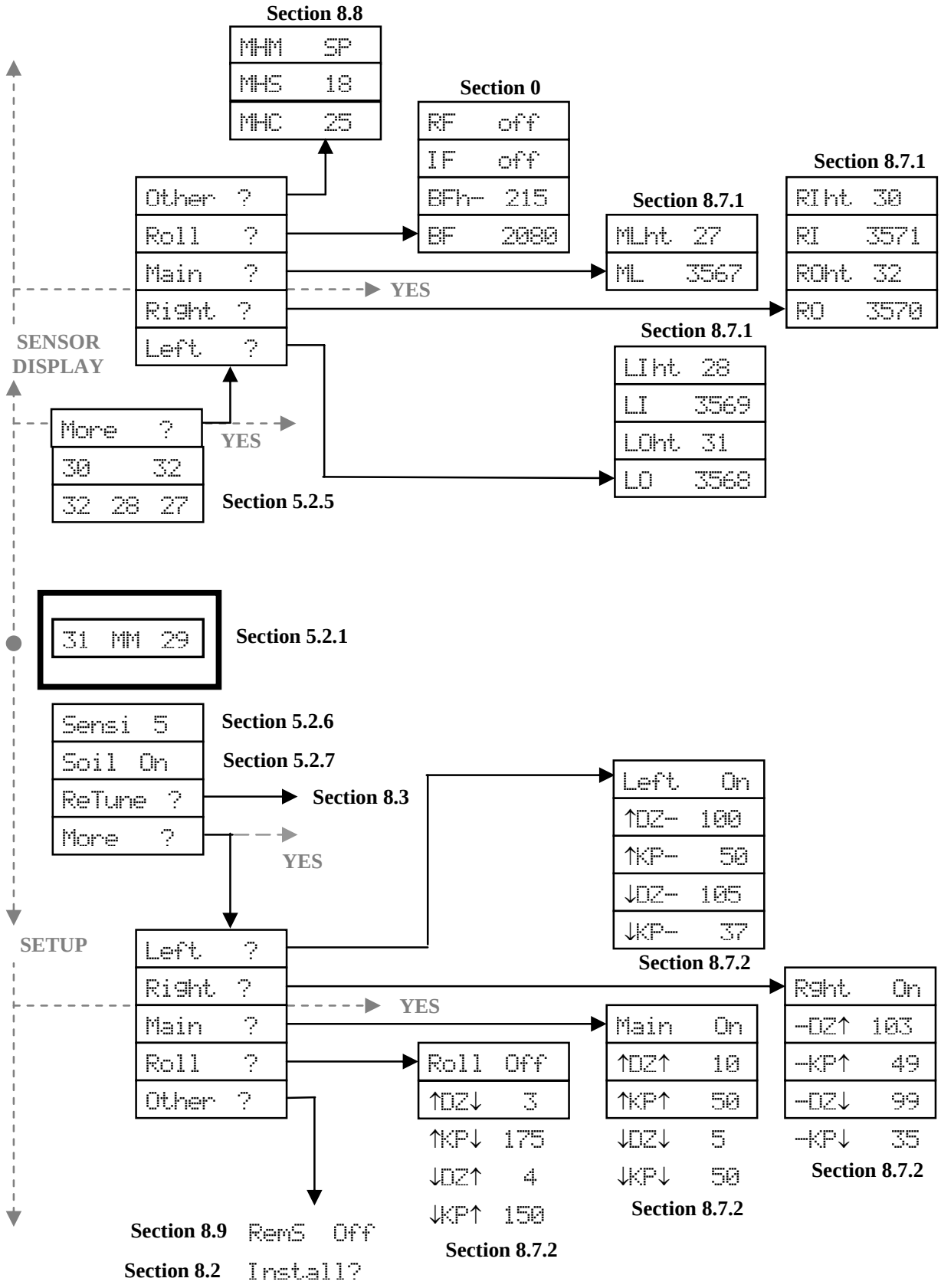
The menu is organized in a cyclic fashion, where the "**SENSOR DISPLAY / SETUP (NO)**" switch advances you through the menu. Toggling up on the switch toward **SENSOR DISPLAY** will change the menu to the next higher row shown in **Table 4**. Toggling down on the switch toward **SETUP (NO)** will change the menu to the next lower row shown in the table. If at any time you wish to return to the Normal Operating Screen, toggle and hold the "**SETUP (NO)**" switch down for two seconds. Also, if you remain in a menu prompt for 30 seconds, the menu prompt will time out and return to the Normal Operating Screen.

7.2 MAIN MENU OVERVIEW

Table 4 – Main Menu Structure

Navigating past the end of the menu will return the control panel to the Normal Operating Screen		
More ?		Toggle the "**AUTO (YES)**" switch to edit or view more sensor settings. *For more information, refer to **Section 7.3** on page 24.*
25 29		Displays readings from optional boom sensors (left inner and right inner). *This menu prompt may not be displayed.*
31 31 32		Displays the current boom heights, in inches, from left to right. The heights are adjusted for the offset between the sensor and nozzles. *If any sensor errors are detected the type of error will be displayed here*.
30 MM 35	**SENSOR DISPLAY Menu** ↑ **SENSOR DISPLAY / SETUP (NO) Switch** ↓ **SETUP Menu**	The Normal Operating Screen is usually displayed. If no switch is toggled for 30 seconds, the LCD will revert to this screen. Also, from any menu prompt, if you toggle and hold the "**SETUP (NO)**" switch for two seconds, the control panel will return to this screen. ***To navigate to the other menu prompts in this table, toggle the "SENSOR DISPLAY / SETUP (NO)" switch in the indicated direction***
Sensi 5		Displays the current control sensitivity (Sensi) setting. A higher number means a higher sensitivity resulting in more control actions and quicker response. A lower number will tend to stabilize the boom and make it less active. Range is from 1 to 10.
Soil ON **Or** Crop ON		Use the " **+/-** " switch to set the sensor target to **SOIL** or **CROP** mode.
ReTune?		Use the "**AUTO (YES)**" switch to initiate the automatic hydraulic evaluation of your system. The ReTune will optimize your system for the best performance possible. The evaluation will take from one to three minutes. *For a description of the ReTune menu prompt, refer to **Section 8.3***
More ?		Toggle the "**AUTO (YES)** " switch to edit or view more control settings *For more information on this menu prompt, refer to **Section 7.3** on page 24.*
Navigating past the end of the menu will return the control panel to the Normal Operating Screen		

7.3 MENU STRUCTURE MAP



8 SYSTEM SETUP

Before the UC4 boom height control system will function properly, some information about the sprayer and connected sensors is necessary. When the control panel is turned on for the first time, the UC4 control panel guides the operator through the Automatic System Setup. This procedure is described in **Section 8.4** on page 27. Normally the UC4 system will automatically configure and calibrate itself to the sprayer. If this process does not produce the desired results, perform Manual System Setup described in **Section 8.5** on page 36.

8.1 LEVELING CHAINS

NORAC UC4 ultrasonic sensors are calibrated to measure height accurately when shipped from the factory. However, in order to measure the absolute height of your spray nozzles, each sensor needs to know how far above the nozzles it is mounted. To speed up this process, NORAC provides three leveling chains in the kit that contains the UC4 sensors. These chains are to be used during the Automatic/Manual System Setup procedure.

Before starting the System Setup, attach the leveling chains to your booms. On the wings, position the chains near the nozzle closest to each outer wing sensor. Attach the third to one side of the main boom such that it can be seen from the cab. The chains should just touch the ground when the nozzle is at a 35-inch height (**Figure 12**).

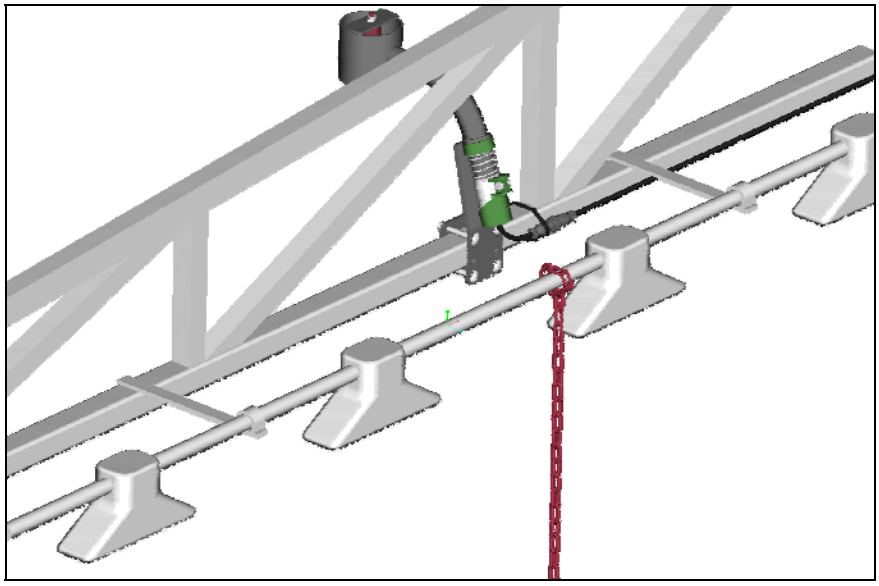


Figure 12 – Leveling Chain Attached Directly Behind Sensor

8.2 INSTALL (AUTOMATIC SYSTEM SETUP)

The first time the UC4 system is powered up, it will guide you through the Automatic System Setup to customize the UC4 system settings to your

sprayer. The details of the Automatic System Setup are discussed in **Section 8.4.** The entire procedure should take approximately two to seven minutes.

At any point during the setup procedure, you can exit by toggling the "**SETUP (NO)**" switch. However, if you exit without completing the System Setup, you may not be able to use the UC4 system in **AUTO** mode.

If you wish to restart/rerun this procedure after an initial setup has been completed, navigate to the "Install?" prompt in the **SETUP** menu and confirm the action with the "**AUTO (YES)**" switch.

NOTE: This is useful if a previously configured UC4 system is being moved to a different sprayer.

NOTE: If you confirm the "Install?" menu prompt by accident, you can exit by toggling "SETUP (NO)" before confirming a sprayer type. No settings will be lost. However, if you confirm a sprayer type and the "Dfalting" message (STEP 4 in Section 8.4.5) appears, all previous system settings will be lost. You may need to perform Automatic System Setup again.

8.3 RETUNE

From time to time it may be necessary to recalibrate (**ReTune**) the UC4 electronics to your sprayer's hydraulics. Examples of such times are:

- when a hydraulic solenoid valve is changed
- when the hydraulic pump is changed or adjusted
- when the normal working temperature of the hydraulic oil has shifted significantly from when the system was previously calibrated

If you are running a pull type sprayer and use different tractors to operate the sprayer, you should run the **ReTune** procedure each time the tractor is changed. If you have a flow control for the boom hydraulics, set it prior to tuning. If you change the flow setting by more than 20 percent, you should **ReTune**.

Follow **Section 8.4.1** to **8.4.3** (level booms, working RPM, etc.) on page 27 before beginning **ReTune**. Navigate to the "ReTune?" menu prompt in the **SETUP** menu and confirm with the "**AUTO (YES)**" switch. The procedure described in **Section 8.4**, starting at **STEP 7** will begin.

NOTE: The booms are to be leveled at a normal working height when ReTune starts – it is not necessary to set them to 35 inches. The 35 inch height is only required during the Automatic/Manual System Setup.

8.4 AUTOMATIC SYSTEM SETUP

WARNING!:

- **AT POINTS DURING THE SYSTEM SETUP (RETUNE) ALL BOOM SECTIONS NEED TO MOVE.**
- **PERSONNEL AND EQUIPMENT MUST BE CLEAR OF ALL BOOMS.**
- **MAKE SURE ALL BOOMS HAVE ROOM TO LIFT FULLY AND ARE CLEAR OF POWER LINES.**

8.4.1 STEP 1: Prepare the Equipment (1)

Find a location for the sprayer that is relatively level, and where the sensors are over bare soil or gravel. Unfold the booms and (optionally) attach the leveling chains to each boom section.

Do not conduct the System Setup or **ReTune** procedure over standing crop, or tall weeds/grass. Refer to **Section 8.1** on page 25 for information on the use of leveling chains.

8.4.2 STEP 2: Prepare the Equipment (2)

Check the pads between the sprayer boom and the boom carrier frame to ensure no friction because of wear. Use grease or other lubricants, if necessary.

This is important and will increase the UC4 system performance significantly, especially on Active Roll systems.

8.4.3 STEP 3: Prepare the Equipment (3)

Start the solution pump and run the sprayer's engine at a normal working RPM for the entire setup.

Make sure that you can manually adjust the height of all your booms. If your manual controls do not work normally, check the UC4 Installation Manual that came with your kit for troubleshooting information.

For best results, the hydraulic system should be under a normal load and at a normal working temperature. An effective way to warm the oil is to cycle all boom sections up and down manually for 5 minutes. Longer warm up times may be required in cold weather. For pull-type sprayers,

ensure any hydraulic flow controls are adjusted for normal field operation.

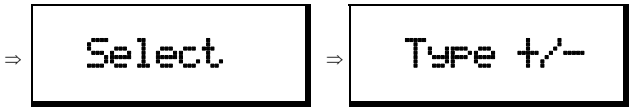
NOTE: Changing the flow controls during or after System Setup will affect UC4 operation.

8.4.4 STEP 4: Turn On the UC4 Control Panel.

If this is the first setup for the panel, this process will begin automatically. If the panel was previously setup, you need to select "Install?" from the **SETUP** menu to initiate Automatic System Setup.

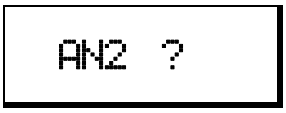
If other messages appear on the LCD screen during the following steps, refer to the UC4 Quick Guide for information.

8.4.5 STEP 5: Select the Sprayer Type



- **Use the " +/- " switch to toggle through a list of available sprayer types.** Types are listed in **Table 12** on page **54**.

NOTE: If this is not the first menu prompt that appears after first power-up, contact NORAC for details.

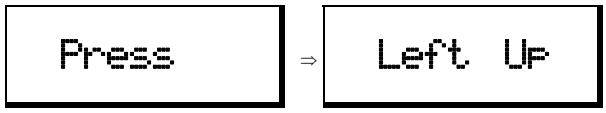


- **When the desired type is shown, confirm the selection with the "AUTO (YES)" switch. Toggle "SETUP (NO)" to exit.**



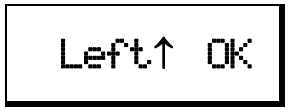
- **Control panel is loading all the settings for your sprayer.**

8.4.6 STEP 6: Wiring Test *



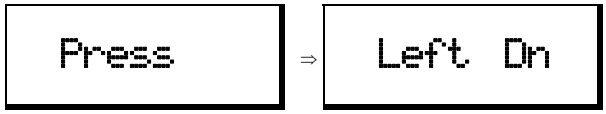
- **Use the sprayer's manual controls to move the left boom up. Stop the Setup if the wrong boom moves or if the direction is incorrect.**

  Use the multifunction hand-control (joystick) on the sprayer to raise the left boom. If nothing happens, or the wrong boom moves, or the boom direction is wrong, turn off the control panel. Consult the UC4 Installation Manual to check the hydraulic plumbing and electrical wiring of your system. Turn on the control panel again to resume System Setup.

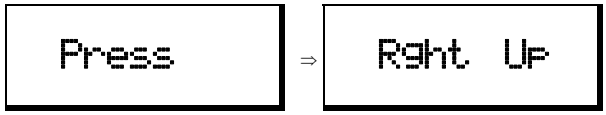


- **Control panel confirms the wiring is correct.**
- **Continue the process with the remaining booms, as shown below.**

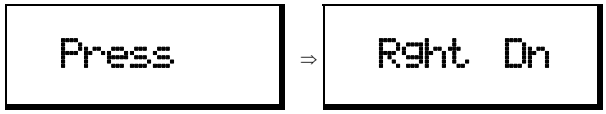
Lower Left Boom



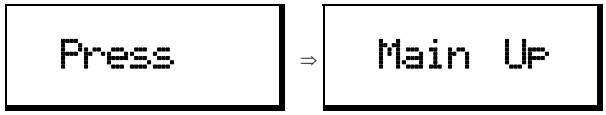
Raise Right Boom



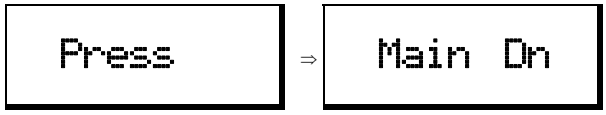
Lower Right Boom



** **Raise Main Boom**



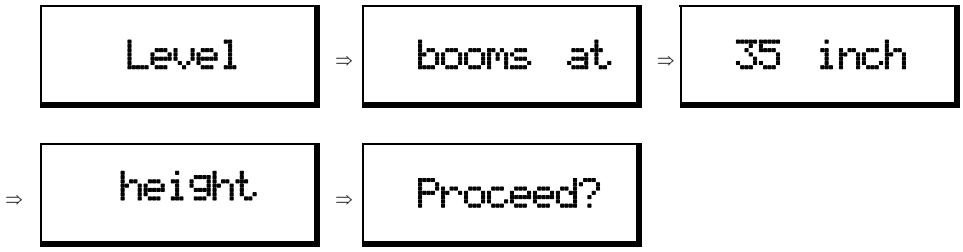
** **Lower Main Boom**



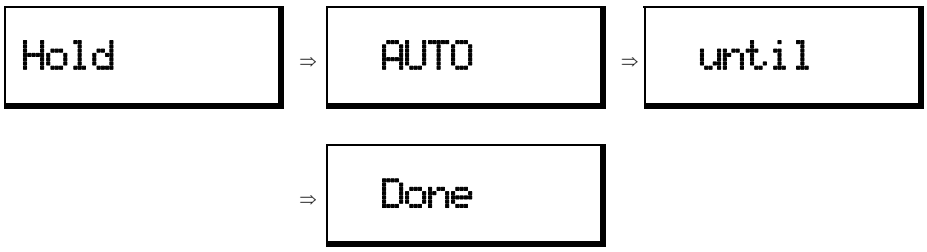
* *Some sprayer types do not support a wiring test or they may support a different style of test. If you do not see any of the messages in this step, simply continue as prompted by the panel.*

** *These prompts are only shown for sprayer types that support automatic main boom height control.*

8.4.7 STEP 7: Sensor Detect



- **If you have main boom roll control, manually level the boom.**
- **Use the leveling chains supplied with your kit to position all other boom sections such that the nozzles are 35 inches from the ground.**
- **Toggle "AUTO (YES)" to continue.**



- **Hold the "AUTO (YES)" switch to begin the sensor detect sequence.**

  During the procedure you must hold the "**AUTO (YES)**" switch. If "**AUTO (YES)**" is released, simply toggle and hold again to continue the procedure.

- **Control panel reads serial numbers of all connected sensors.**



- **Number of sensors found is displayed. Stop the Setup if the number of sensors is incorrect.**

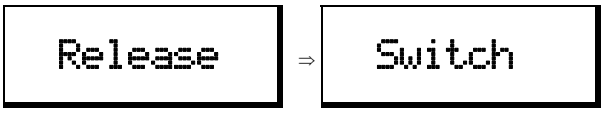
  The number of sensors reported should match the number of sensors on your system. If it does not, turn off the control panel and ensure that all sensors are plugged in and operating. Turn on the control panel to resume the System Setup.

- **Control Panel indicates the detection stage as it progresses.**

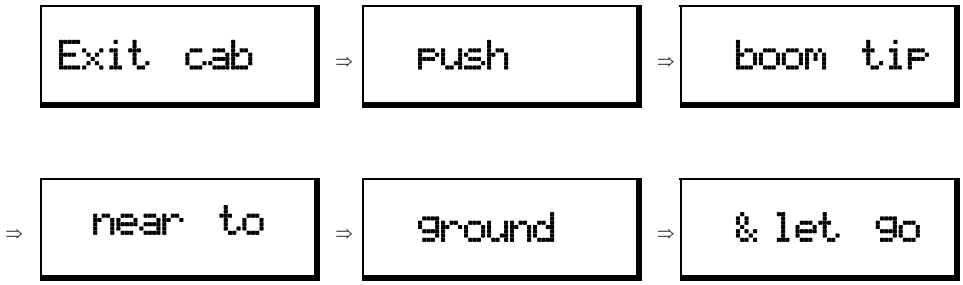
  The panel will display various messages while it is working. They are for informational purposes only.

8.4.8 STEP 8: Boom Geometry Tuning

- **Do not activate any hydraulic functions during this step.**



- **Release the "AUTO (YES)" switch to continue.**



- **Exit the cab of the machine and manually push either boom tip near to the ground for a moment and then let go. ***

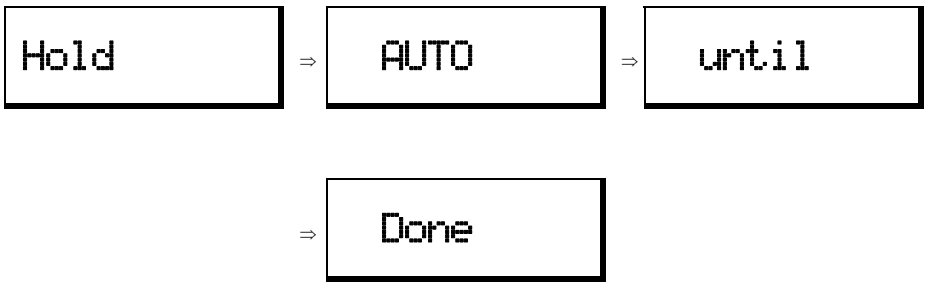
<u>CAUTION!</u>:

DO NOT WALK NEAR THE SENSORS WHEN APPROACHING THE BOOM. STAY AT LEAST 3 FEET FROM THE SENSOR IN ORDER NOT TO INDUCE MEASUREMENT ERROR.

Push either boom tip such that the tip moves at least 15 inches (more if you can).

- **Once the control panel has detected your sprayer's geometry, the next menu prompt will appear.**
- **Toggle "SETUP (NO)" or toggle and hold "AUTO (YES)" at this menu to accept the default parameters and continue.**

**This step is not applicable to system type UK2*



- **Hold the "AUTO (YES)" switch to continue the boom geometry tuning.**

  During the boom geometry tuning procedure, you must hold the "**AUTO (YES)**" switch. If "**AUTO (YES)**" is released before "Done" is displayed, simply toggle and hold again to continue the procedure.

- **Control panel indicates the tuning stage as it progresses.**

  The panel will display various messages as it is working. The messages are displayed for informational purposes only.



- **Release the "AUTO (YES)" switch, the boom geometry tuning is complete.**

8.4.9 STEP 9: Control System Test



- **Normal Operating Screen is shown above.**

⚠ **CAUTION!:**

IN THE FOLLOWING PROCEDURE, SWITCH CONTROL PANEL TO MANUAL MODE IMMEDIATELY IF THE BOOM MOVEMENTS ARE ERRATIC.

Toggle "AUTO (YES)" to start AUTO mode. Observe the behavior of the booms while correcting to the target height.



- **The operating screen shows the system is in AUTO mode and the target height is 45 inches.**

The boom movements should be smooth and stable. Boom corrections should stop after a few seconds, under normal conditions (excessive wind may cause small corrections to continue).



- **Toggle the "MANUAL" switch to return to MANUAL mode.**

If the boom corrections are done in an acceptable manner your system is ready to use.

Automatic System Setup Complete

If the setup is not done in an acceptable manner, you have three options:

(1) Retry the entire Automatic System Setup

(2) Try a Manual System Setup as described in **Section 8.5** on page 36

(3) Contact NORAC for assistance

- **If your boom does not appear to be sufficiently level at the desired height, refer to Section 4.1.6 in the UC4 Quick Guide. Otherwise your system is ready to use.**

8.5 MANUAL SYSTEM SETUP

The UC4 control panel will not permit **AUTO** mode unless the system has been completely configured. In other words, **Section 8.2** must be completed successfully. In the event that you cannot complete **Section 8.2**, it is possible to setup the system manually.

8.5.1 Manual Setup Procedure

To manually setup a system you should follow these steps.

1. Perform Automatic System Setup and record the error messages at the point just before the Automatic System Setup fails. Also record the Setup STEP number and the screen prompt(s) just before the error messages show up on the LCD screen.
2. Review the UC4 Quick Guide.
3. Perform a Quick Install (**Section 8.6**).
4. Retry the Automatic System Setup (**Section 8.4**) if possible.
5. If necessary, perform a Full Manual Setup (**Section 8.7**).

8.6 QUICK INSTALL

The Quick Install feature of the UC4 system is designed to help diagnose problems that cannot be identified during the Automatic System Setup. It will instantly setup the system with typical values for valve calibration and sprayer geometry, based on the sprayer type selected.

Perform the following procedure for a Quick Install

- **STANDARD SYSTEM** (Including Passive Roll)

  A1. Your system must have a minimum of two sensors.

  A2. Verify the sensors are installed with the lowest serial number on the left side increasing to the highest serial number on the right side (Refer to the UC4 Installation Manual).

  A3. Level the boom at 35 inches height (**Section 8.1**).

  A4. Navigate into the **SETUP** menu to the "Install?" screen (**Section 7.3**) and toggle "**AUTO (YES)**" switch.

  A5. At the "Select" "Type +/-" menu prompt, select the appropriate type for your sprayer (e.g. JD7). Sprayer types are listed in **Table 12** on page **54**. Toggle and hold "**AUTO (YES)**" for 5 seconds.

  A6. When the word "Sensor" is displayed, release the switch. Your system will be configured with the standard settings based on the type you have selected and the number of sensors present.

  A7. Perform a **ReTune** (**Section 8.3**).

♦ **ACTIVE ROLL SYTEM**

B1. Perform the Quick Install for **STANDARD SYSTEM A1** to **A6**, as described above.

B2. Navigate to the "Roll ?" menu prompt in the **SETUP** menu. Toggle "**AUTO (YES)**", and then change it to "Roll OnA" using the " **+/-** " switch. Toggle "**AUTO (YES)**" to confirm.

B3. Navigate to the "Roll ?" menu prompt in the **SENSOR DISPLAY** menu. Toggle "**AUTO (YES)**", and then set the "IFh" (intermediate frame height) and "BFh" (boom frame height) to zero using the " **+/-** " switch. Toggle "**AUTO (YES)**" to confirm.

NOTE: Refer to Section 0 for more information about "IFh" and "BFh".

B4. Perform a **ReTune** (**Section 8.3**).

NOTE: In some conditions, it may be necessary to reset the control panel's settings to the ones before being shipped from the factory (Factory Default) rather than performing Quick Install. Contact NORAC for more information about the Factory Default.

8.7 FULL MANUAL SETUP

Full Manual Setup will require setting up each sensor (programming serial numbers and sensor locations) manually as described in **Section 8.7.1**. It also requires tuning hydraulic parameters manually as described in **Section 8.7.2**.

8.7.1 Setting Up Sensors

Table 5 – Left Channel SENSOR DISPLAY Menus

Navigating past the end of the menu will return the panel to the Sensor…More Menu	
LI off	Informs you that no left inside (LI) sensor is installed; or else shows the information as described for LO.
LOht. 25	Informs you that the current height reading of the LO sensor is 25 inches.
LO 1240	Informs you that serial number 1240 is installed as the left outer (LO) sensor.
Navigating past the end of the menu will return the panel to the Sensor…More Menu	

Sensor information (serial numbers, locations) can be entered in the **SENSOR DISPLAY** menu manually. You need to know the serial number of the sensor you wish to enter and the physical location. The serial number is stamped on the sensor housing opposite the cable. Refer to **Figure 1** for

the possible locations of sensors and **Section 7.3** on page 24 to find that sensor in the UC4 LCD screen menu structure.

The left channel menu prompts are described in **Table 5**. For the other channels, the basic structure and behavior of the prompts is the same.

Entering Sensor Serial Numbers

To enter a sensor serial number in one of the boom locations, perform the following.

1. Ensure the UC4 control panel is in **MANUAL** mode, at the Normal Operating Screen.
2. Navigate to the "More ?" menu prompt in the **SENSOR DISPLAY** menu (**Section 7.3** on page 24 for help on getting to this menu). Toggle "**AUTO (YES)**" to confirm.
3. Navigate to the boom section you put the sensor on, for example, "Right ?", if the sensor is mounted on the right hand boom. Toggle "**AUTO (YES)**" switch.
4. Navigate to the boom location you mounted the sensor on, for example, "LO" for the left outer sensor. This screen will show the previously installed sensor serial number (if any) as shown in **Table 5**.
5. Toggle the " **+** " switch once to search for the all connected sensors.
6. Use the " **+** " switch to toggle through a list of available sensor serial numbers. If you wish to turn this sensor off, toggle " **–** " switch.
7. When the desired serial number is shown, toggle "**AUTO (YES)**" switch to confirm.
8. Proceed to "LOht." menu prompt to check/calibrate the sensor's height reading (see next section).
9. Toggle and hold "**SETUP (NO)**" switch for two seconds to return to the Normal Operating Screen.

Calibrating the Sensor's Height Reading (Zero Height)

NOTE: The Main Roll sensor's readings are exceptions to the procedure described below. For more information on these readings refer to the next section.

1. Ensure the sprayer boom is unfolded and the sensors are located over bare soil or gravel. Position the boom at a normal working height. Do not conduct this procedure over standing crop or tall grass/weedy areas.

2. Using a tape measure, measure the distance from the bottom of the spray nozzle closest to the sensor to the ground. Round this measurement to the nearest half-inch.
3. Navigate to the "LOht." menu prompt as described in the previous section.
4. If the currently displayed height reading is not correct, adjust it using the " **+/-** " switch. The " **+** " switch will increase the reading, the " **–** " switch will decrease the reading.
5. To return to the Normal Operating Screen, toggle and hold "**SETUP (NO)**" switch for two seconds.

*Special Features of the Main Roll (MR) Sensor**

The main roll sensor provides readings necessary for control of the main roll boom section. The sensor readings are boom frame height ("BFh"), intermediate frame height ("IFh") and reference frame height ("RFh"). The "RFh" is only displayed on Active Roll systems. Unlike all other readings displayed on the LCD screen, these readings are in millimeter resolution. These readings are primarily used for technical staff during trouble shooting procedures.

Options for Main Boom Sensor in Wheel Track

Mounting the main roll sensor directly behind a sprayer tire may impair main lift control when operating in **CROP** mode. Height readings from crop that is flattened by the sprayer wheel do not provide an accurate measurement of canopy height, resulting in poor performance (**Section 6.2.4**). Three possible solutions are explained below.

A. Turning the Main (Center) Section Off

This workaround will disable the main section's **AUTOMATIC** control, however, manual height readings from this section will still be available. The sprayer's wing booms will still be controlled automatically. Perform the following procedure:

1. Ensure the UC4 control panel is in **MANUAL** mode, at the Normal Operating Screen.



2. Navigate to the "More ?" prompt in the **SETUP** menu. Toggle "**AUTO (YES)**" switch.
3. Navigate to the "Main ?" prompt in the **SETUP** menu. Toggle "**AUTO (YES)**" switch.
4. At the "Main On" prompt, toggle the " **+/-** " switch to change to "Main Off".



5. Toggle and hold "**SETUP (NO)**" switch for two seconds to return to the Normal Operational Screen.

B. Adjusting the Sensor Offset

To compensate for the lack of crop in the “wheel track”, adjust the main lift sensor’s height reading offset (zero height) so that the sensor will read higher to match the average height of your crop. Perform the following procedure using the UC4 control panel:

1. Ensure the UC4 control panel is in **MANUAL** mode, at the Normal Operating Screen.



2. Navigate to the "More ?" prompt in the **SENSOR DISPLAY** menu. Toggle "**AUTO (YES)**" switch.

3. Navigate to the "Main ?" prompt in the **SENSOR DISPLAY** menu. Toggle "**AUTO (YES)**" switch.

4. Toggle "**SENSOR DISPLAY**" switch to display the main lift height ("MLht.") menu prompt.



5. Decrease the reading by the difference in height between standing crop and trampled crop in the “wheel track”. Adjust this until ALL three sections (right, left, main) are level in the field while in **AUTO** mode. The " **+** " switch will increase the reading, the " **–** " switch will decrease the reading.

NOTE: This may take some experimentation in field conditions.

6. To return to the Normal Operating Screen, toggle and hold "**SETUP (NO)**" switch for two seconds.

NOTE: This is subject to a “trial and error” approach to getting this set adequately. The advantage is that AUTOMATIC control will be retained for the main section. Depending on the crop, the depression caused by the wheel might vary. Keep in mind that when turning the implement the “wheel track” will follow a different path. If the main roll sensor detects standing crop in this situation, the main section will lift momentarily.

NOTE: Zero height (for the main lift sensor) will need to be reset when using SOIL mode operation.

C. Adding an Additional Sensor

The final option would be to add a fourth sensor to your system to handle the main lift measuring duties. This sensor would need to be mounted on the main section such that it will NOT read in the wheel track. If you use this option, ensure that the main roll sensor and the added sensor are located at least 36 inches apart to avoid cross-talk. Contact NORAC and describe your situation to get pricing for an additional sensor, cabling, and mounting brackets/hardware.

Once you have your additional sensor in place and electrically connected, perform the following steps via the UC4 control panel to configure your system for four-sensor operation.

1. Ensure the UC4 control panel is in **MANUAL** mode, at the Normal Operating Screen.



2. Navigate to the "More ?" prompt in the **SENSOR DISPLAY** menu. Toggle "**AUTO (YES)**" switch.
3. Navigate to the "Main ?" prompt in the **SENSOR DISPLAY** menu. Toggle "**AUTO (YES)**" switch.
4. At the main lift ("ML") menu prompt, it will likely show the following message:



5. Toggle the " **+** " switch once to search for the all connected sensors.
6. Then use the " **+** " switch to scroll through the list of sensor serial numbers. When the serial number (that matches the additional main sensor that you have installed) is shown, toggle "**AUTO (YES)**" switch to confirm.
7. Toggle "**SENSOR DISPLAY**" switch once to display the "MLht." menu prompt to check/calibrate the additional main sensor's height.
8. Toggle and hold "**SETUP (NO)**" switch for two seconds to return to the Normal Operational Screen.

NOTE: Configuring the additional sensor may also be accomplished by performing an "Install?", as described in Section 8.2 on page 25.

8.7.2 Setting Up Hydraulic Valves

There are two key settings for each valve direction (for example, the left up direction). These settings are valve DeadZone, "DZ", and valve GAIN, "KP".

The DeadZone ("DZ") setting represents the size of electrical signal required at the solenoid valve to cause a boom speed of one inch per second.

The GAIN ("KP") setting is inversely related to the maximum speed of the boom. That is, the faster the boom the lower the GAIN setting.

The left channel is described in **Table 6**. For the other channels the basic structure and behavior is the same.

Table 6 – Left Channel SETUP Menus

Navigating past the end of the menu will return the panel to the Setup…More Menu	
Left On	Informs you that the left valve channel is ON. To change the status to OFF, use the " +/- " switch (**Section 8.7.5**).
↑DZ- 100	Informs you that the left up DeadZone setting is 100. To adjust the reading use the " +/- " switch.
↑KP- 53	Informs you that the left up GAIN setting is 53. To adjust the reading use the " +/- " switch.
↓DZ- 100	Informs you that the left down DeadZone setting is 100. To adjust the reading use the " +/- " switch.
↓KP- 42	Informs you that the left down GAIN setting is 42. To adjust the reading use the " **+/-** " switch.
Navigating past the end of the menu will return the panel to the Setup…More Menu	

These settings will be determined during the "Install?", initial setup (**Section 8.2**) and "ReTune?" (**Section 8.3**) sequences automatically. However, it is possible to check and adjust these settings manually as described below.

8.7.3 Valve DeadZone Test

1. Follow the steps, **8.4.1** to **8.4.3** (level booms, working RPM, etc.), listed in **Section 8.4** on page 27 before proceeding.
2. Ensure the UC4 control panel is in **MANUAL** mode, at the Normal Operating Screen.
3. Navigate to the "More ?" menu prompt in the **SETUP** menu (Refer to **Section 7.3** for help on getting to this menu). Toggle the "**AUTO (YES)**" switch to confirm.
4. Navigate to the boom section you wish to setup, for example, "Right ?" to adjust the right up and/or the right down settings. Toggle the "**AUTO (YES)**" switch to confirm.
5. Toggle the "**SETUP (NO)**" switch to access the next menu prompt, in this case the right up DeadZone ("-DZ↑").

6. While viewing the DeadZone ("DZ") menu prompt, perform one of the two tests: AUTO DeadZone Test or Manual DeadZone Test.

   NOTE: You do not need to run both the AUTO and Manual tests. The tests are entirely independent.

   a) AUTO DeadZone Test

   Toggle and hold the "**AUTO (YES)**" switch.
   When the "Done" message is displayed, release the "**AUTO (YES)**" switch to view the new setting.

   b) Manual DeadZone Test

   - Toggle and hold the "**MANUAL**" switch.
   - The valve will turn on at the indicated setting for exactly one-second. The LCD screen will show the actual change in height.
   - The change in height reading is live as long as you hold the "**MANUAL**" switch. Wait until the height reading has settled to a stable value and record this reading.
   - Repeat steps to three times.
   - Average your three readings. The acceptable average change in height should be from 0.5 to 1.5 inches (ideal would be 1 inch exactly).
   - If the average is less, increase the DZ setting with the " **+/-** " switch. If the average is more, decrease the DZ setting with the " **+/-** " switch.
   - Repeat steps 8.7.3b) until the average falls into the acceptable range.

8.7.4 Valve GAIN Test

1. Follow the steps, **8.4.1** to **8.4.3** (level booms, working RPM, etc.), listed in **Section 8.4** on page 27 before proceeding.
2. Ensure the UC4 control panel is in **MANUAL** mode, at the Normal Operating Screen.
3. Navigate to the "More ?" menu prompt in the **SETUP** menu (Refer to **Section 7.3** for help on getting to this menu). Toggle the "**AUTO (YES)**" switch to confirm.
4. Navigate to the boom section you wish to setup, for example "Right ?" to adjust the right up and/or the right down settings. Toggle the "**AUTO (YES)**" switch to confirm.
5. Toggle the "**SETUP (NO)**" switch twice to access the right up GAIN ("–KP↑") menu prompt.
6. While viewing the GAIN ("–KP↑") menu prompt, perform one of the two tests: AUTO GAIN Test or Manual GAIN Test.

NOTE: You do not need to run both the AUTO and Manual tests. The tests are entirely independent.

6.a AUTO GAIN Test

- Toggle and hold the "**AUTO (YES)**" switch.
- When the "Done" message is displayed, release the "**AUTO (YES)**" switch to view the new setting.

6.b Manual GAIN Test

 **CAUTION!:**

BEFORE CONTINUING MAKE SURE THE BOOM HAS ROOM TO MOVE IN THE INDICATED DIRECTION AT FULL SPEED FOR ONE SECOND. BE PARTICULARLY CAREFUL IF YOU ARE WORKING WITH THE ROLL CONTROL SECTION.

- Toggle and hold the "**MANUAL**" switch.
- The valve will turn on at 100 percent speed for exactly one-second. The LCD screen will show the actual change in height.
- The change in height reading is live as long as you hold the "**MANUAL**" switch. Wait until the height reading has settled to a stable value and record this reading. This is your boom speed in inches per second (in/s).
- Repeat steps to three times, repositioning the boom as necessary.
- Average your three readings. Typical values are between 15 and 50 inches/sec.
- Set the GAIN value using the " **+/-** " switch using the tables below as a guideline. Right and left GAIN settings are polarized for direction as shown in **Table 7**.

NOTE: GAIN values depend on many more factors than just speed, and therefore are best set automatically or by an experienced operator.

NOTE: Test the response at a sensitivity (Sensi) of five, because the Sensi setting will scale the GAIN settings (Section 6.1.1). If the booms are not reacting quickly enough a higher GAIN setting will make the boom respond faster. If the booms are too jerky or unstable, you must lower the GAIN setting or improve the boom's mechanical damping.

Table 7 – Right, Left Booms

Boom Speed (in/s)	Up GAIN Setting (↑KP)	Down GAIN Setting (↓KP)
Less than 5	Too Slow	Too Slow
5-15	225-175	100-70
15-25	175-150	70-50
25-40	150-100	50-30
40-70	100-50	30-15
Greater than 70	50-1	15-1

Table 8 – Main (Center) Boom

Boom Speed (in/s)	GAIN Setting (KP)
1-5	100-75
5-10	75-50
10-15	50-30
15-20	30-15

Table 9 – Roll Section

Boom Speed (in/s)	GAIN Setting (KP)
<10	225-254
10-15	175-225
15-20	175-200
>20	150-100

8.7.5 Turning Booms OFF or ON

You can turn UC4 automatic height control off for each individual boom section. In **AUTO** mode, boom sections that are turned off will not automatically adjust, and are indicated with a "D" in the Normal Operating Screen, as shown below.

Table 10 – Turning Left Boom OFF

36 DA 34	Left boom is turned OFF ("D" = disabled) control, the current actual boom height = 36" Right boom is in **AUTOMATIC** mode, the current target height = 34"

Sections can be turned off or on in the **SETUP** menu. Refer to the menu structure shown in **Table 6**. Locate the menu prompts named below.

1. Ensure the UC4 control panel is in **MANUAL** mode, at the Normal Operating Screen.
2. Navigate to the "More ?" menu prompt in the **SETUP** menu (Refer to **Section 7.3** for help on getting to this menu). Toggle the "**AUTO (YES)**" switch to confirm.
3. Navigate to the boom section you wish to turn off or on, for example "Right ?". Toggle the "**AUTO (YES)**" switch to confirm.
4. At the "Right On" menu prompt toggle the " **+/-** " switch to change the status.
5. Toggle and hold the "**SETUP**" switch for two seconds to return to the Normal Operational Screen.

8.8 "OTHER ?" SETUP OPTIONS

The "Install?" option is available under the "Other ?" menu prompt of the **SETUP** menu.

Table 11 – "Install?" Menu Prompt

Navigating past the end of the menu will return the panel to the Setup/More Sub Menu	
Install?	Use the "**AUTO (YES)** " switch to initiate the complete installation process. The System Setup Assistant will lead you through the setup of your multifunction hand grip, sensors, and valves. *For a description of the "Install? " refer to **Section 8.2** on page 25*
Navigating past the end of the menu will return the panel to the Setup/More Sub Menu	

8.9 REMOTE SWITCHES

Remote control of the **AUTO** and **MANUAL** modes may be wired to the control panel. This feature allows the operator to control the mode of the UC4 system from an external switch or controller. Contact NORAC for further information concerning wiring and enabling Remote Switch control.

9 MAINTENANCE

The UC4 Sprayer Boom Height Control System requires very little maintenance. However, some minor procedures will help ensure that your system operates properly for many years.

Before each day of operation:

- ✓ Peak performance requires low friction on the boom roll mechanism. Used to hold the boom stable, friction pads are often prone to high amounts of friction when dry. Grease as necessary. This is especially important on systems equipped with Active Roll control.
- ✓ Ensure breakaway brackets are well lubricated and function properly.
- ✓ Clear any obstructions between the sensor and the ground. Any object within a 6" diameter circle directly below the sensor could cause improper height readings. Check to ensure hydraulic hoses, sensor cables, or debris is clear of the sensor.
- ✓ Inspect the foam insert in each sensor. Fitted into the bottom of the sensor is a foam shield that can become clogged with dust and dirt. Remove the foam from the sensor, blow it out with an air compressor if available, and reinsert. Replace the foam inserts as necessary.

********** IMPORTANT **********

Do not blow out the foam shield while it is still installed in the sensor. Sensor damage may result. Always remove the foam shield for cleaning.

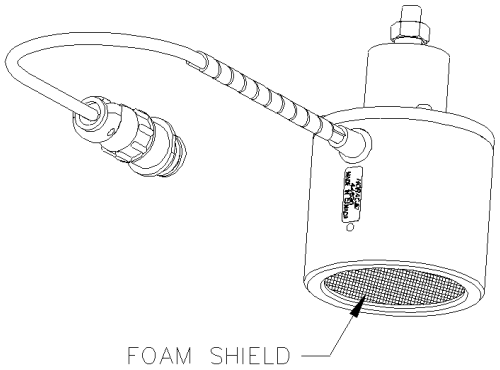


Figure 13 – Protective Foam Shield

At the End of a season:

- ✓ Remove the sensors and store inside.
- ✓ Replace oil filter in the NORAC hydraulic manifold (PT#: 104827) annually.
- ✓ Replace ultrasonic transducer as needed. Over time, performance of the inexpensive transducer element may become degraded from airborne contamination (typical life is 3-10 years). Contact NORAC for information.

10 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 weighing systems, instrumentation, and control systems manufactured by NORAC. Auxiliary components not manufactured by NORAC such as tires, axles, pumps, or rebuilt parts are covered by a 6 month warranty only.

NORAC will repair free of charge items returned within the warranty period to one of NORAC's authorized Service Centers. Freight will be paid one way and returned by the same carrier unless instructed differently.

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 be charged to the purchaser at prevailing rates.

For the nearest Service Center visit our website at www.norac.ca or call 306-664-6711.

Any evidence of, negligent or abnormal use, alteration of serial numbers, or repairs attempted by other than NORAC authorized personnel 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. NORAC will not be held responsible for any consequential loss or damage of any kind.

This warranty is in lieu of all other warranties, except as set forth above. Any implied warranty merchantability or fitness for a particular purpose is hereby disclaimed. This warranty is in lieu of all other warranties, expressed or implied.

NOTES:

Table 12 – Sprayer Types

TYPE	Sprayer Models
AN2	Generic Sprayer Boom
AND	Andros Engineering Vinyard Sprayer
AP1	Apache 790, 859 Year 2000+
AP2	Apache 1010, 1210
BT1	Brandt Pull-type Three Sensor
BT2	Brand Pull-type Year 2001+
CS1	Case 4260, 4410
CS2	Case 3150, 3185, 3200
CS3	Case 4420, 3320
FC1	Flexi-Coil 67 Series Pull-type
FC2	Flexi-Coil/NH/CaseIH 68 Series, SF210/216, SRX100/160
FT1	Fast 7400 Pull-type
FT5	Fast OEM 5 Station
FT6	Fast OEM 6 Station
GM1	Gregson Maverick
HD1	Hardi
HD3	Hardi Factory Install
HG1	Hagie STS12
HG2	Hagie 2100, 2101
HG3	Hagie 2005 STS
HG4	Hagie Active Roll
JD4	John Deere 4700/4710 SN < 6000
JD5	John Deere 4700/4710 SN > 6000
JD6	John Deere 4920
JD7	John Deere 4720
JD8	John Deere Special
NH1	New Holland 550
NT1	Nitro 90'
NT2	Nitro 120'
OM1	Original Equipment Manufacturer (NORAC Wiring & Grip)
PH1	Phoenix Telescoping
PT1	(Case) Tyler Patriot
RB1	RedBall 690
RG2	Rogator Year 2006+
RG4	Rogator Prior 2006
RH1	RHS Bestway 1200/1600 with main lift
RH2	Bestway 1200/1600 without main lift
RP1	Raptor
SC1	Spra Coupe 7000 Series
SM1	Summers Pull-type
TA1	Top Air
UK1	4-Sensor Variable Geometry
UK2	Fixed boom
UK3	4-Sensor Variable Geometry with Active Roll
WR1	Wilmar 8100/8500
WR2	Wilmar 8400/8600

Inputting the sprayer type in the UC4 control panel activates some basic setup information about your sprayer. The three-letter suffix on the NORAC part number indicates the type of your system.

MAIN MENU

Navigating past the end of the menu will return the control panel to the Normal Operating Screen	
More ?	Toggle the "**AUTO (YES)** " switch to edit or view more sensor settings. *For more information, refer to **Section 7.3** on page 24*
Roll 0.5	Displays reading of the main roll sensor. *Depending on sprayer type this menu prompt may not be displayed.*
25 29	Displays readings from optional boom sensors (left inner and right inner). *This menu prompt may not be displayed.*
31 31 32	Displays the current boom heights, in inches, from left to right. The heights are adjusted for the offset between the sensor and nozzles. *If any sensor errors are detected the type of error will be displayed here*.
30 MM 35	**SENSOR DISPLAY Menu** ↑ **SENSOR DISPLAY / SETUP (NO) Switch** ↓ **Setup Menu**	The Normal Operating Screen is normally displayed. While at other menu prompts, if no switch has been toggled for 30 seconds, the control panel will revert to this screen. Also, from any menu prompt, if you toggle and hold the "**SETUP (NO)**" switch for two seconds, the control panel will return to this screen. ***To navigate to the other menu prompts in this table, toggle the "SENSOR DISPLAY / SETUP (NO)" switch in the indicated direction***
Sensi 5		Displays the current control sensitivity (Sensi) setting. A higher number means a higher sensitivity resulting in more control actions and quicker response. A lower number will tend to stabilize the boom and make it less active. Range is from 1 to 10.
Soil ON **Or** Crop ON		Use the " **+/-** " switch to set the sensor target to **SOIL** or **CROP** mode.
ReTune?		Use the "**AUTO (YES)**" switch to initiate the automatic hydraulic evaluation of your system. The ReTune will optimize your system for the best performance possible. The evaluation will take from one to three minutes. *For a description of the ReTune menu prompt, refer to **Section 8.3** on page 26*
More ?		Toggle the "**AUTO (YES)**" switch to edit or view more control settings *For more information on this menu prompt, refer to **Section 7.3** on page 24*
Navigating past the end of the menu will return the control panel to the Normal Operating Screen		

Menu Structure Map

