



RH430 RiteHeight

Sprayer Boom Height Controller

Installation and User Manual

Rev. 1.22A

Mar 18, 2021

(c) Copyright Greentronics Ltd., 2021

Greentronics Ltd.
75 Arthur Street North
Elmira, Ontario, Canada
N3B 2A1
Ph: (519)669-4698
Fax: (519)669-2880
E-mail: support@greentronics.com
Web: www.greentronics.com

CE Declaration of Conformity

Greentronics Ltd. declares that the products covered by this manual have been tested and found to conform with the requirements of European Council directive 2009/64/EC for EMC. Contains a Bluetooth radio module.



Table of Contents

1 Introduction.....	4	6.17 Config Avg. Sensors.....	31
1.1 Distances in Inches or Centimetres.....	4	6.18 Config Reference Filter Time.....	31
2 Installation.....	4	6.19 Config No-Range Lower.....	31
2.1 Overview of Installation Procedure.....	5	6.20 Config Length Unit.....	31
2.2 Console Installation.....	5	6.21 Config User Controls.....	32
2.3 Junction Box Installation.....	6	7 Alarm Configuration Menu.....	32
2.4 Sonar Junction Box Installation (optional) ..	8	7.1 Sensor Alarm Delay.....	32
2.5 Wiring the Control Solenoids.....	8	7.2 Override Alarm.....	32
2.6 Sonar Range Sensor Installation.....	9	7.3 Time-Out Alarm.....	32
2.7 Test the Connections.....	11	7.4 Low-Power Alarm.....	32
2.8 Perform Self-Calibration.....	11	7.5 Open Cct Alarm.....	33
2.9 Test and Adjust Operating Parameters.....	12	7.6 Voltage Alarm.....	33
3 Operating RiteHeight with LCD User Interface... 12		7.7 Alarm Volume.....	33
3.1 Keypad and LCD User Controls.....	12	8 Test Menu.....	33
3.2 LCD Contrast Adjustment.....	12	8.1 Test Sonar Sensors.....	33
3.3 Automatic Mode Operation with Keypad and LCD.....	12	8.2 Test Valve Wiring.....	35
3.4 Using the LCD Menu System.....	13	8.3 Test Try Valves.....	35
3.5 LCD Menu Tree Overview.....	14	8.4 Test Diagnostics.....	36
3.6 Reduced LCD Menu in ISOBUS VT Mode. 17		9 Machine Setup Menu.....	36
4 Operating RiteHeight with ISOBUS VT User Interface.....	17	9.1 Machine Setup Control Type.....	36
4.1 VT Diagnostics.....	17	9.2 Machine Setup Sonar Sensors.....	37
4.2 VT Number.....	18	9.3 Machine Setup Offset Left / Right / Left2 / Right2 / Left3 / Right3 / Centre / Centre2.....	37
4.3 VT Start Delay.....	18	9.4 Machine Setup Directional Valve.....	37
4.4 Device Index.....	18	9.5 Machine Setup Secondary Directional Valve.....	37
4.5 Automatic Mode Operation with ISOBUS VT.....	18	9.6 Machine Setup Directional Valve Left / Right / Centre.....	37
4.6 Using the ISOBUS VT Menu System.....	19	9.7 Machine Setup Auto Input (DIR is Auto In)	38
4.7 ISOBUS VT Menu Tree Overview.....	19	9.8 Machine Setup Auto On/Off Delay.....	38
5 Error Messages.....	22	9.9 Machine Setup Master Valve.....	38
6 Configuration Options.....	24	9.10 Machine Setup PWM Control.....	38
6.1 Config Dead Band.....	24	10 Self Calibration.....	39
6.2 Config Delay for Up.....	24	10.1 Testing for Control Stability.....	40
6.3 Config Delay for Down.....	24	11 LCD Update Menu and VT OPT screen.....	40
6.4 Config Target Height.....	24	11.1 Update Options.....	40
6.5 Config Quick Raise Ht.....	25	11.2 Update Firmware.....	41
6.6 Config Sonar Mode.....	25	12 Troubleshooting.....	42
6.7 Config Sonar Sensitivity.....	25	12.1 Connection between Console and Junction Box.....	42
6.8 Config No-Range Filter.....	26	12.2 Sensor Operation.....	42
6.9 Config Up/Dn Buttons.....	26	12.3 Boom Rocking or Overshooting.....	43
6.10 Config Override.....	26	12.4 Boom Height Corrections Too Slow.....	43
6.11 Config Centre Override.....	27	13 System Components.....	44
6.12 Config Lower Time-Out.....	27	14 Specifications.....	44
6.13 Config Raise Time-Out.....	28	15 Abbreviated End-User Firmware License Agreement, Warranty and Limited Liability Statement.....	45
6.14 Config Motion Control.....	28	16 Important Notes Related to Product Return Process.....	46
6.15 Config Headland Mode.....	28		
6.16 Config Valid Window Low / High.....	30		

1 Introduction

The RiteHeight Sprayer Boom Height Controller system is intended for use on agricultural sprayers and other equipment where a constant height needs to be maintained. The RiteHeight system automatically adjusts the sprayer's booms up and down to maintain a fixed distance above the ground or crop canopy. This relieves the operator of the need to constantly adjust boom height in uneven or hilly terrain. It also allows the operator to select the optimal spraying height to maintain an even spray pattern.

The RiteHeight system consists of the following major components:

- Console, for mounting in the cab.
- Junction box, for mounting on the sprayer.
- Two or more sonar (ultrasonic) range sensors, mounted on the booms.

The Console has a backlit LCD display to show information messages to the operator. It uses a simple keypad for operator input, and an alarm buzzer to alert the operator when an alarm condition occurs. The Console has a detachable power cable to connect to +12V in the cab, and a detachable communication cable to connect to the Junction box on the sprayer.

The Console has a third connector for connecting an optional ISOBUS cable to connect to an ISOBUS Virtual Terminal (VT) display. This provides a more sophisticated graphical user interface and eliminates the need to mount the Console in the cab.

*NOTE: Throughout this manual the Console's built-in user interface is referred to as the **LCD** user interface, while the ISOBUS VT is referred to as the **VT** user interface.*

The Junction box connects to the sonar sensors, and to the hydraulic valves that control the up and down motion of the booms. The Junction box also requires a power connection to supply the current needed to operate the hydraulic valves. Connections inside the Junction box are made using individual wire terminals. All cables enter the Junction box through liquid-tight cable glands to protect the Junction box electronics from moisture and dust.

The sonar sensors have a quick-disconnect connector to simplify sensor installation. Mounting brackets are supplied for the sonar sensors to facilitate easy mounting.

1.1 Distances in Inches or Centimetres

The RiteHeight system can be configured to display distances in inches (common in North America) or in centimetres. To change the display unit, go to the Config menu and find the LENGTH UNIT setting. Set it to "in" for inches, or to "cm" for centimetres.

Most of the examples in this manual use inches. The common short form of a double-quote (") is used to denote inches. An inch is equivalent to approximately 2.5 cm.

2 Installation

***CAUTION:** While installing the RiteHeight kit, while doing tests on the installed kit, and while operating the sprayer, you **MUST** follow all safety precautions as listed in the operator's manual for your machine model. These safety precautions are designed to keep you, any bystanders, and the equipment itself safe while doing repairs, installing components, and testing various functions.*

WARNING: *If you are installing on a late model John Deere, Hardi, or Hagie sprayer, be sure to read the warning note in section 2.5 below!*

2.1 Overview of Installation Procedure

To install the RiteHeight system on your sprayer, follow these steps:

1. Install the Console in the cab, and connect it to 12V DC power. For ISOBUS installations, the Console can be installed outside the cab, as long as there is access to the ISOBUS.
2. Install the Junction Box near the valve bank, and connect it to 12V DC power.
3. Route the Console-to-Junction cable from the Junction Box to the Console.
4. Connect the solenoid valves to the Junction Box.
5. Mount the sonar sensors on the booms, and route their cables to the Junction Box.
6. Test the sensor and solenoid connections.
7. Run the Self Calibration procedure to calibrate the system to your sprayer.
8. Test the system, and adjust its response to suit your needs.

Please read through all of the installation instructions before starting the installation work. You will also need to read section 3 to learn how to operate the Console.

If you have excess length on any of the cables, you can simply coil it up and tie it in place in any convenient location. Alternatively, you can cut off the excess cable length at the Junction box, cut back the cable jacket, strip the wire ends approximately 1/4 inch (6mm), and solder to prevent loose strands.

2.2 Console Installation

The Console should be mounted in a position where the operator can easily see the display. A RAM mount is provided with one adhesive pad to mount to the rear of the Console. Use the supplied alcohol wipe to clean both surfaces before installing the adhesive pad. Use screws to mount the base of the RAM mount to a sturdy panel or frame member in the cab.

Connect the Console to 12V power using the supplied power cord (part # RH230). Connect the black wire to Ground and the red wire to +12V. It is usually preferable to use a source of power that turns off with the ignition to avoid draining the vehicle battery if the Console is accidentally left on. To protect against short circuits in the power cable, a fused power source should be used. Recommended fuse rating is in the range of 1A to 5A.

CAUTION: Be sure to turn off power to the Console before connecting the cable to the Junction Box. Working with the power on can result in sparks, blown fuses, and destroyed electronics.

Section 3.1 explains the user controls of the Console.

Connecting the Console to ISOBUS

If you have purchased the ISOBUS option, the Console does not need to be mounted in the cab. Mount it in any convenient location with easy access to the ISOBUS connector.

The Console's ISOBUS "Tee" harness provides two Deutsch DT 4-pin connectors, one plug and one socket. This allows inserting the Console into an existing ISOBUS daisy-chain connection.

If the ISOBUS you are connecting to is not terminated, you can enable the Console's internal terminator. Remove the lid from the Console, and locate the four small switches. Set switch 3

ON (up) to enable the ISOBUS terminator.

You can also configure the Console to always turn on when power is applied. This is done by setting switch 1 ON.

2.3 Junction Box Installation

CAUTION: When replacing the Junction Box lid, be careful to align it correctly. Although the lid is square, it must be rotated correctly so that the gasket fits with the box edge.

The Junction Box should be mounted in a location that minimizes the distance to the +12V power and hydraulic valve connections.

NOTE: Make sure to mount the Junction Box so that the side on top has no cable entry glands. This side has a sticker “This side up”.

The Junction Box should be protected as much as possible from the elements and from pressure washing. It is recommended to mount the Junction Box in an area on the machine which affords some protection from the elements. If no convenient protected area is available, it is recommended to install a shield over the Junction Box to reduce exposure to rain and moisture.

Mount the Junction Box using the supplied mounting brackets. The mounting brackets provide pre-drilled mounting ears on either side of the case that make it easy to mount the case. To use the brackets, first remove the lid from the Junction box. There are 4 mounting holes near the corners of the box. Use the supplied 1/4” #6 machine screws (with lock washers) to attach the mounting brackets to the Junction Box.

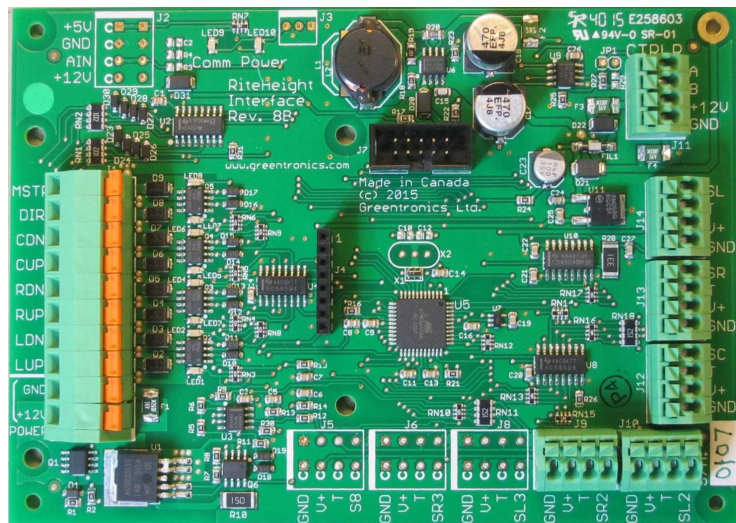
NOTE: The Junction Box is supplied with all necessary cables pre-wired, eliminating the work of connecting each wire inside the Junction Box. The following detailed instructions are included in case you need to disconnect one or more cables during installation.

Take a look at the circuit board in the Junction Box, and the labels beside the various terminal blocks. These labels match the wiring instructions in this manual and on the inside of the Junction Box lid.

All wiring connects to the circuit board using spring clamp terminals. To insert or release a wire from a terminal, push down on the button for the terminal using a small screwdriver.

Route the communication cable (part # WA1055) from the Console to the Junction Box. The 4-pin connector of this cable will plug into the Console. Run the other end of this cable into the Junction Box using the top right cable gland. Connect the four wires to the 4-position “CTRLR” terminal block as follows:

A	Black
B	White
+12V	Red
GND	Bare wire



Junction Box Circuit Board

The Junction Box requires its own source of +12V power to provide power to drive the hydraulic valve solenoids. Use the supplied 2-conductor cable (RH224) to connect to a source of +12V power, connecting the red wire to +12V and the black wire to Ground. To protect against short circuits in the power cable, a fused power source should be used. Recommended fuse rating is in the range of 10A to 15A. Run the power cable into the Junction Box through the bottom left cable gland. Connect the two wires to the 2-position POWER terminal block as follows:

GND	Black
+12V	Red

NOTE: Some equipment (e.g. **Brandt, Spudnik, Double L**) uses a common +12V connection for the hydraulic solenoids instead of the usual common ground. If your equipment has this kind of electrical setup, you will need to install the Active Low add-on circuit board (part number EXP400) in the Junction Box. Please refer to the instructions included with the Active Low circuit board.

Use the 6-conductor cable (RH225) to connect to the hydraulic solenoid valves that control raising and lowering of the booms. Run this cable into the Junction Box through the left cable gland and connect it to the output terminal block as follows:

CDN	Blue	Lowers the centre boom (or Secondary Dir. Valve)
CUP	Brown	Raises the centre boom (or Raise/Lower w. Dir. Valve)
RDN	Green	Lowers the right boom
RUP	White	Raises the right boom (or Raise/Lower with Dir. Valve)
LDN	Black	Lowers the left boom
LUP	Red	Raises the left boom (or Raise/Lower with Dir. Valve)

The CDN and CUP outputs are only used in installations where the centre rack height is to be controlled.

NOTE: For Lift/Tilt control the “Left” outputs are used to control lift, while the “Right” outputs are used to control tilt.

If your sprayer has an open centre hydraulic system or uses a directional valve, use the remaining 2-conductor cable (RH226) to connect these valves:

MSTR	Black	Master valve (for open centre systems)
DIR	Red	Directional valve (also known as Shuttle Valve, or SH)

If your sprayer has only one of these valves, connect only one wire, and cut off the other wire end.

The *Master valve* output is used in open centre hydraulic systems. In an open centre hydraulic system, when no valves are activated, the oil is permitted to flow freely through the centre of the valve block. When a valve is activated, the valve block's centre opening must be closed to force the hydraulic oil through the activated valve. This is done by activating a solenoid valve that blocks this centre flow. The *Master* output is provided to activate this solenoid. It can also be used to drive the “jam valve” or “priority valve” used in some hydraulic systems.

A *directional valve* (labelled “SH” on older RiteHeight systems) is used in some hydraulic valve blocks to choose the direction of oil flow. With this arrangement, a bank of non-directional valves is used to select which cylinder to move, while the directional valve chooses the direction the selected cylinder will move. In this configuration, outputs LUP, RUP, and CUP are used to

power the valves that select the Left, Right, and Centre boom cylinders, respectively. Each output will be activated for both raising and lowering of its boom. The directional valve output will determine whether the boom is raised or lowered.

If your sprayer's directional valve uses two solenoid valves, connect one solenoid to DIR, and the other to CDN. One valve is activated to raise the booms, and the other to lower the booms. DIR is the primary directional output, and will be activated according to your Directional configuration (see "Directional Valve" in section 9). Whenever a boom function is raised or lowered, CDN will be activated if DIR is not, mirroring the action of the primary directional output.

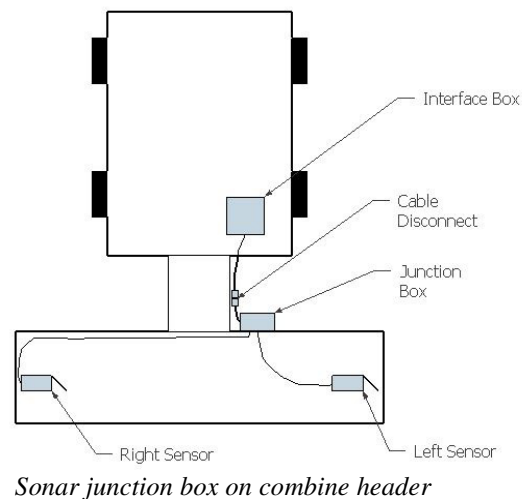
NOTE: If not all wires in each cable are used, insulate the unused wire ends with electrical tape.

NOTE: If not all of the cable entry glands of the Junction Box are used, be sure to "plug" each unused gland with a short piece of cable. This prevents dirt and moisture from entering the Junction Box.

2.4 Sonar Junction Box Installation (optional)

On a combine header installation the sonar sensors are installed on the header, while the main Junction Box (also called "Interface Box") is installed on the combine. To provide a single disconnect cable, a small Sonar Junction Box is supplied. The Sonar Junction Box is mounted on the header, and all the sonar sensors cables run to the Sonar Junction Box.

A single cable (WA1026) runs from the Sonar Junction Box to the centre of the header. The connector on the WA1026 cable mates with the connector on the WA1027 cable, which runs to the main Junction Box on the combine. This provides a single disconnect for all the sonar sensors installed on the header.



Mount the Sonar Junction Box using two #6 screws through the integral mounting holes in the back of the box.

2.5 Wiring the Control Solenoids

WARNING: If you are installing on a late model **John Deere, Hardi or Hagie** sprayer, you need to install a diode kit. **Failure to use the diode kit may result in damage to the sprayer's control electronics as well as to the RiteHeight system!** As of this writing, the diode kit is known to be required on John Deere models 4630, 4730, 4830, 4920, 4930, 4940, and R series, all Hardi sprayer models made since 2009, and Hagie sprayer models since 2005. If in doubt, contact Greentronics before proceeding with the installation.

After connecting the 6-conductor solenoid cable to the Junction Box, you must connect the wires at the other end of the cable to the respective solenoids.

You can make these wire connections at the control switches you use to manually control the boom height. However, these switches are often mounted on a control joystick or console that is

difficult to open or work within.

It is therefore generally much easier to connect directly to the hydraulic solenoid valves. You can determine which solenoid valve controls which function from a diagram of the hydraulic connections on the sprayer, which might be found in the owner's manual for the sprayer. Alternatively, you can follow the hydraulic lines from the control cylinders back to the solenoid valves to find out which solenoid controls which function. Or you can work with an assistant in the cab pressing the control switch for each function, and use a meter or test light to identify the solenoid wire that goes live for that function. Label each solenoid as you identify it (Left Up, Left Down, Right Up, Right Down, and optionally Centre Up and Centre Down).

Once you have located all the solenoids, connect the respective wires from the RH225 cable to each of the solenoids. There is just one wire per solenoid valve. If your solenoid valves have two wires, one wire is common (usually ground), while the other wire is switched (usually to +12V). Connect the RH225 wires to the switched wire of each solenoid.

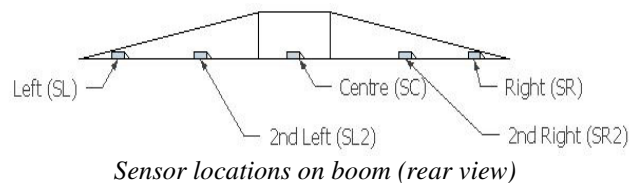
Sometimes these wires can connect directly to the terminals on the solenoids. You can also splice into the existing wires using self-stripping tap connectors, crimp connectors, or by soldering the wires together. Make sure that all connections are secure, and that all exposed conductors are insulated with electrical tape or heat shrink tubing.

If you have a Centre sensor, connect the Centre Up and Down wires. If you do not have a Centre sensor, there is no need to connect these wires. Simply cut off and insulate the wire ends.

If your sprayer uses an open centre hydraulic system, or a directional valve, you may need to refer to the owner's manual for your sprayer to determine the location of these solenoid valves. If your sprayer uses a directional valve, be sure to read the “Directional Valve” description in section 9.

2.6 Sonar Range Sensor Installation

The sonar range sensors measure the distance between each boom and the ground or crop canopy. The sonar sensors are mounted horizontally inside a protective bracket, with a sound “mirror” to deflect the sonar beam down toward the ground.



The sensors should be mounted near the tip of each boom. To reduce the possibility of damage to the sensors, it is best not to mount the sensors right at the boom tip, but to mount them some distance from the tip. If the boom has a break-away section, a good location for the sonar sensors is usually just inside the break-away section.

If you have purchased a 4-sensor system, install the additional sensors near the mid-point of each boom. For a 6-sensor system, space the 3 sensors out evenly on each boom.

If you have a sensor for the centre section, mount it anywhere on the centre section that gives the sensor a clear view of the ground. If you have two sensors for the centre section, install them at least 36” apart to avoid interference between the two sensors.

To minimize the possibility of interference from spray, it is best to mount the sonar sensors midway between spray nozzles.

The sonar sensors are supplied pre-installed in their mounting brackets. The sensor mounting brackets provide for easy mounting on most sprayer booms.

CAUTION: *If it is determined a sensor has failed, DO NOT try to remove the sensor from the sensor bracket (tube). Instead, remove the entire sensor assembly and return it to your dealer. Follow the instructions in section 16 for Product Return.*

When deciding where to mount the sonar sensors, keep in mind that the sensors need an unobstructed view of the ground. Also note that the sensors cannot measure any distance less than 10 inches. If you plan to operate very low above the crop canopy, you may wish to mount the sonar sensor brackets to the top of the boom.

The sonar beam is cone shaped. It starts very small in the middle of the 45 degree sound mirror at the end of the sensor bracket. As the sonar beam travels, its diameter increases. The beam diameter is approximately half the distance from the sensor. That means the centre of the beam must be at least 1/4 of the distance from the sensor away from any obstructions. Keep this in mind when mounting the sensors, and ***make sure there are no obstructions in the path of the sonar beam.***

For example, if the sensor is mounted to the top of the boom, and the lowest part of the boom structure is 12 inches below the sensor, then the centre of the sonar beam must be at least 3 inches away from the boom structure.

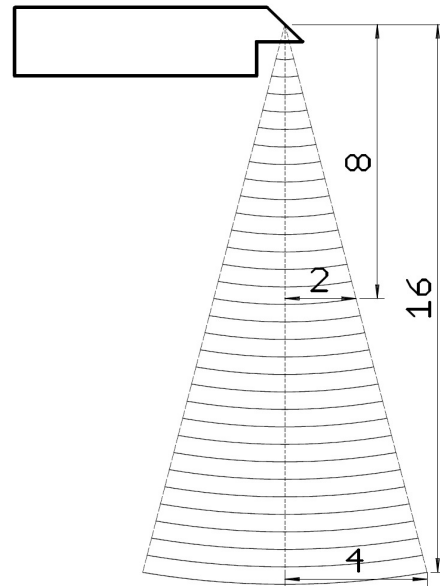
To protect the sensors from damage, it is best to mount them within the boom, or protruding from the rear of the boom.

The sensor mounting brackets provide a simple two-plate clamp to fit around the square or round tubing used in the construction of most sprayer booms. Position the top and bottom clamp plates around the boom's tubing in the selected location, and insert the rear bolt through the plates as close as possible to the tubing. Use the supplied P-clamps to mount the sensor brackets to the clamp plates. Tighten the nuts on both clamp bolts until the bracket assembly is held securely in place.

The sensor cable (WA1022) to the Junction Box plugs into the connector on the sonar sensor's short cable. Route the sensor cables to the Junction Box, and insert them into the Junction Box using the cable glands on the right and bottom of the box. There are five sonar terminal blocks inside the Junction Box. Connect the 4 wires of each sonar cable to the matching sonar terminal blocks as follows:



Sonar sensor on top of boom



Sonar Beam

S*	Green
T	White
V+	Red
GND	Black

Connect each sensor cable to the terminal block with the matching sensor input:

SL	Left
SR	Right
SC	Centre
SL2	Left 2
SR2	Right 2
SL3	Left 3
SR3	Right 3
S8	Centre 2

2.7 Test the Connections

Once everything is installed and connected, use the MACHINE SETUP menu to configure the RiteHeight system for your machine (see section 9). Then use the TEST menu to check that each part of the system is connected correctly and working (see section 8). Refer to the Troubleshooting section (section 12) for more information about how to diagnose and correct problems.

Before starting any tests, extend the sprayer's booms in a safe area, and set the boom at normal working height.

Use the SENSORS option of the TEST menu to check the sonar sensors (see section 8.1). All sonar sensors should show correct distance readings. Ensure the Sensitivity is set to at least 25% (see section 6.7). If a sensor does not show a good reading, check the connection to that sensor.

To check the connections to the solenoids, use the VALVE WIRING option (see section 8.2). Activate the up and down controls for each boom in turn, and watch the display. As you activate each function, the corresponding signal name should appear: LU for Left Up, LD for Left Down, etc. If you have connected a Master and/or Directional solenoid, its status will be indicated in the top line of the display (showing MSTR and DIR).

If you have a Directional solenoid, configure its operation in the Directional Valve option of the Machine Setup menu (see section 9).

If all the solenoid connections look right, use the TRY VALVES option (see section 8.3) to test the RiteHeight system's ability to raise and lower each boom section (Left, Right, Centre).

2.8 Perform Self-Calibration

After you have confirmed that all the system connections are correct, run the Self-Calibration procedure to calibrate the RiteHeight system to your sprayer. Refer to section 10 for more information.

2.9 Test and Adjust Operating Parameters

Once you have confirmed all the connections, ensure that both booms are extended in a safe area and put the system in Automatic mode. Both booms should move to the target height automatically. You can use the Up and Down buttons to adjust the target height.

As the final installation step, take your sprayer for a test drive. Extend the booms and activate Automatic mode. Watch the control of the booms as you drive, and see how the booms respond to changes in the terrain. You can speed up or slow down the response to changes by adjusting the DELAY parameters of the CONFIG menu (see section 6.2 and 6.3). You can change how closely the system maintains the target height by adjusting the DEAD BAND parameter (see section 6.1). Refer to section 6 for information on various other parameters you may wish to adjust to maximize performance.

3 Operating RiteHeight with LCD User Interface

NOTE: If you are using an ISOBUS Virtual Terminal (VT), refer to section 4.

3.1 Keypad and LCD User Controls

The Console has a backlit LCD display, and a membrane keypad with 7 buttons.

The PWR button is used to turn the system on and off. When the Console is off, briefly pressing the PWR button will turn on power to the Console. To turn off Console power, press the PWR button and hold it down for 1 second until the Console displays:

Power off...

When you see this message, release the PWR button, and the Console will turn off.

NOTE: With the ISOBUS VT option, the Console may be configured to turn on when power is applied (see section 2.2). In this configuration the Console can only be turned off by removing power.

The left and right arrow buttons are used to move to the previous or next item in a menu.

The up and down arrow buttons are used to change the value of a parameter.

The ENT button is used to accept the current selection.

The ESC button exits the current menu without saving the current selection.

3.2 LCD Contrast Adjustment

You can adjust the contrast of the LCD display. In the Main menu, the up and down arrow buttons change the LCD contrast. Press down for a darker display, or up for for a lighter background.

3.3 Automatic Mode Operation with Keypad and LCD

When you turn on the Console, it starts up in the Auto screen, but in Idle mode. Pressing ENT will put the system into Automatic mode. *Be sure to have both booms fully extended before engaging Automatic mode.* In Automatic mode the system will raise or lower the booms to maintain the desired height above the ground or crop canopy.

You can exit Automatic mode by pressing ENT to return to Idle mode, or by pressing ESC to exit to the main menu. If the OVERRIDE configuration option is set to “Exit Auto”, then you can

also exit Automatic mode by manually raising or lowering a boom (see section 6.10).

In Automatic mode, the display will show something like the following example for a 3-sensor system:

```
AUTO: 38.0
      37      39      40
```

The first line of the display indicates the system is in AUTO (Automatic) mode, and shows the target height. The RiteHeight system will move the booms to keep them close to the target height.

In Automatic mode, you can use the up and down arrow buttons to adjust the target height up or down. This is useful for making on-the-go height adjustments.

If you have configured the up and down buttons to manually move one of the boom functions (see section 6.9), the selected boom will be displayed in the top right corner of the display (eg. “Centr”). The up and down buttons will raise or lower the selected boom. The left and right arrow buttons select which boom function is controlled by the up and down buttons, or if the up and down buttons control target height (top right corner blank).

If the centre sonar sensor is used as the height reference, the target height is set by the centre sensor, and cannot be adjusted manually (see section 9.1). No separate target height is displayed in the top line in this configuration. Instead, the centre sensor height displayed on the second display line defines the target height.

If Headland Mode is engaged (see section 6.15), the top line will show “HLM” in place of “AUTO”.

The second line of the display is the status line. The status line is used to display the status of the system, or to display alarm messages. In normal operation, the height measured by each sonar sensor is displayed (Left, Centre, Right). If there are more than 3 sensors, there is not enough room to show all the individual sensor readings. Therefore only the lower of the sensor readings for each boom is shown.

If a sensor cannot provide a good distance reading, it will show “--”. If a sensor does not provide a good distance reading, the system will normally not adjust the height of that boom, and may sound an alarm (depending on the SENSOR ALARM setting, see section 7). If the NO-RANGE LOWER option is enabled (section 6.19), the system will lower the boom in an attempt to get the sonar sensor back in range. (Note that this option is not intended for use of sprayers.)

When the system activates one of its outputs to raise or lower a boom, it will indicate this by showing U or D (for “Up” or “Down”) beside the respective sensor distance reading on the status line.

If the OVERRIDE configuration option is set to “Enable/Disable” or a time-out value, each sensor reading will be replaced by “Man” (for “Manual”) whenever the respective boom is not under automatic control (see Configuration OVERRIDE, section 6.10).

If the system encounters an error condition, an alarm message will be displayed on the status line, and the alarm buzzer will sound. In some cases the control outputs are turned off when an alarm is active. Refer to section 5 for details about each error.

3.4 Using the LCD Menu System

During normal operation, you will generally not need to make any changes to the Console's configuration settings. However, for initial configuration and adjusting operating parameters,

and for problem diagnosis, you will need to use the Console's menu system.

To get the most out of the instructions below, read through them with the Console in front of you and powered up.

When the Console is powered up, it starts up in the Auto screen, but in Idle mode. Press ESC to exit the Auto screen and go to the main menu. Use the left and right arrow buttons to highlight the desired menu option, and then press ENT to select that menu option.

You can always return to the main menu by pressing ESC several times.

In the main menu the first option is named RUN. Selecting this option takes you to the Run screen, but with the system in Idle mode. Pressing ENT will put the system into Automatic mode, where it controls boom height. *Be sure to have both booms fully extended in a safe area before engaging Automatic mode.*

The Console's display has two lines of text. In each menu, the top line is used to display the name of the menu. The bottom line is used to display the currently selected menu item. As you choose different menu items, the bottom line changes to show the newly selected item. Arrows at the far left and right of the bottom line indicate whether there are more items to be selected to the left or right.

Changing a parameter value works in a similar way to selecting a menu item. Use the Up and Down arrow buttons to choose the desired value, and then press ENT to save that value and return to the previous menu.

3.5 LCD Menu Tree Overview

This section provides a summary of all the menu options in the Console keypad and display user interface. Details of these options are provided in later sections of this manual.

All the various options are organized into a menu tree. At the root of the menu tree is the main menu, which provides the following options:

Main:

RUN
CONFIG
ALARM CONFIG
TEST
MACHINE SETUP
SELF CAL.
UPDATE

Most of these options have sub-menus.

NOTE: If configured for Lift/Tilt mode, LIFT and TILT options will replace the LEFT and RIGHT options.

CONFIG:

DEAD BAND
DELAY FOR UP
DELAY FOR DOWN
HEIGHT

QUICK RAISE HT
SONAR MODE
SONAR SENS.
NO-RANGE FILTR
UP/DN BUTTONS
OVERRIDE
CNTR OVERRIDE
LOWER T.O.
RAISE T.O.
MOTION CONTROL:
 LEFT UP
 LEFT DOWN
 RIGHT UP
 RIGHT DOWN
 CENTRE UP
 CENTRE DOWN
HEADLAND MODE
 ACTIVATE HLM
 REF HEIGHT
 HT. INCREASE
 L/R INCREASE
 HLM MOVE DOWN
 HLM DOWN DELAY
 HLM DEAD BAND
VALID WIN. LO
VALID WIN. HI
AVG. SENSORS
REF. FILTER
NO-RANGE LOWER
LENGTH UNIT
USER CONTROLS

ALARM CONFIG:

SENSOR ALARM
OVERRIDE ALARM
TIMEOUT ALARM
LOW-PWR ALARM
OPEN CCT ALARM

VOLTAGE ALARM

TEST:

SENSORS

VALVE WIRING

TRY VALVES

DIAGNOSTICS

MACHINE SETUP:

CONTROL TYPE

SONAR SENSORS

OFFSET LEFT

OFFSET RIGHT

OFFSET LEFT 2

OFFSET RIGHT 2

OFFSET LEFT 3

OFFSET RIGHT 3

OFFSET CENTRE

OFFSET CENTRE2

DIR. VALVE

DIR. SECOND

DIR. LEFT

DIR. RIGHT

DIR. CENTRE

AUTO INPUT

AUTO IN ON DLY

AUTO IN OFF DLY

MASTER

PWM CONTROL:

LEFT UP

LEFT DOWN

RIGHT UP

RIGHT DOWN

CENTRE UP

CENTRE DOWN

DIR. VALVE

MASTER VALVE

SELF CAL. :

LEFT/RIGHT
LEFT ONLY
RIGHT ONLY
CENTRE

UPDATE :

Console ID
New License
List Options
Product Info
Firmware

3.6 Reduced LCD Menu in ISOBUS VT Mode

When using an ISOBUS VT as the user interface, the Console presents a reduced set of options through the LCD user interface. These options are required for configuration of the VT interface and for system updates.

Main:

USER CONTROLS
VT DIAGNOSTICS
VT NUMBER
VT START DELAY
DEVICE INDEX
UPDATE:
Console ID
New License
List Options
Product Info
Firmware

4 Operating RiteHeight with ISOBUS VT User Interface

If you are using an ISOBUS Virtual Terminal (VT), the RiteHeight user interface is provided through the VT. The VT display provides an intuitive graphical user interface, with soft keys to select menu options, and on-screen fields to display and change values.

4.1 VT Diagnostics

In ISOBUS VT mode, the LCD menu includes a VT Diagnostics option. This option shows the status of the ISOBUS communication bus as an aid to troubleshooting problems on the ISOBUS connection.

4.2 VT Number

The ISOBUS protocol allows multiple Virtual Terminal servers to be present. Each VT server is identified by an index number ranging from 1 to 16. By default the Greentronics console will connect to VT number 1. The VT Number option lets you connect to a different VT server. After changing the VT Number you must reboot the console to connect to the new VT server.

4.3 VT Start Delay

After the RiteHeight system is powered up, its display will appear on the VT. There is normally a delay of about 15 seconds after power-up. Some VT's require a longer delay for reliable start-up of communication with the RiteHeight system. The start-up delay can be adjusted using the RiteHeight's LCD interface to change the VT START DELAY setting.

4.4 Device Index

If you are operating two or more identical devices with the same VT, you need some way of identifying each device. Set the Device Index of each device to a unique number. The VT will display the index along with the device name so you always know which device you are controlling.

Device Index can be set to any value from 0 to 9. Default is 0.

4.5 Automatic Mode Operation with ISOBUS VT

When the RiteHeight system is powered up, it starts up in the RUN screen, but with height control disabled ("Off"). Pressing GO will put the system into Automatic mode, where it controls boom height. *Be sure to have both booms fully extended in a safe area before engaging Automatic mode.*

You can exit Automatic mode by pressing STOP to return to Idle mode, or by pressing HOME to exit to the main menu. If the OVERRIDE configuration option is set to "Exit Auto", then you can also exit Automatic mode by manually raising or lowering a boom.

In Automatic mode, the display will show something like the following:

```
Height Control: Auto
Target Height: 38.0 in
Sonar Mode: Bare Ground
```

UP	UP	UP
DN	DN	DN
Auto	Auto	Auto
37.2	39.8	40.1

You can adjust the Target Height by entering a new number. Or you can make small adjustments using the UP and DOWN soft key buttons beside the main display area to change Target Height by 0.5 inch or 1 cm increments.

If Headland Mode is engaged (see section 6.15), Height Control will show "HLM" in place of "AUTO".

If the centre sonar sensor is used as the height reference, the target height is set by the centre sensor, and cannot be adjusted manually.

You can change the Sonar Mode by choosing from Bare Ground, Partial Canopy, or Full Canopy modes.

At the bottom of the display are the sonar sensor readings (Left, Centre, Right). If there are more than 3 sensors, there is not enough room to show all the individual sensor readings. Therefore only the lower of the sensor readings for each boom is shown.

If a sensor cannot provide a good distance reading, it will show "--.-". If a sensor does not provide a good distance reading, the system will normally not adjust the height of that boom, and may sound an alarm (depending on the SENSOR ALARM setting). If the NO-RANGE LOWER option is enabled, the system will lower the boom in an attempt to get the sonar sensor back in range. (Note that this option is not intended for use of sprayers.)

Just above the sonar readings is the control status for each boom section. When the system activates one of its outputs to raise or lower a boom, it will indicate this by showing Up or Down for that boom. If the OVERRIDE configuration option is set to "Enable/Disable" or a time-out value, the status will show "Man" (for "Manual") whenever the respective boom is not under automatic control (see Configuration OVERRIDE).

If the Up/Dn buttons are enabled (see section 6.9), then each boom section will have an UP and a DN button to allow manually raising or lowering each boom section. If the Centre section is not controlled, the middle button pair will raise and lower both the left and right boom sections together (L+R).

If the system encounters an error condition, an alarm message will be displayed in the middle of the screen, and the alarm buzzer may sound. In some cases the control outputs are turned off when an alarm is active. Refer to section 5 for details about each error.

4.6 Using the ISOBUS VT Menu System

During normal operation, you will generally not need to make any changes to the RiteHeight configuration settings. However, for initial configuration and adjusting operating parameters, and for problem diagnosis, you will need to use the menu system.

To get the most out of the instructions below, read through them with the VT in front of you and powered up.

Press HOME to exit the RUN screen and go to the main menu.

4.7 ISOBUS VT Menu Tree Overview

This section provides a summary of all the menu options in the RiteHeight ISOBUS VT user interface. Details of these options are provided in later sections of this manual.

All the various options are organized into a menu tree. At the root of the menu tree is the main menu, which provides the following options:

Main Menu:

RUN

CFG

ALARM

MACH .

TEST

CAL.

OPT

Most of these options have sub-menus to provide access to all the options.

NOTE: If configured for Lift/Tilt mode, LIFT and TILT options will replace the LEFT and RIGHT options.

RUN:

Target Height

Sonar Mode

CFG:

Dead Band

Sonar Sens.

Delay for Up

Delay for Down

Quick Raise Ht.

Lower Time-out

Raise Time-out

On Override

Centre Override

No Range Filter

Valid Window Lo

Valid Window Hi

Avg. Sensors

Ref Filter Time

No Range Lower

Unlock Code

Motion Control:

Left - Up

Left - Down

Right - Up

Right - Down

Centre - Up

Centre - Down

Up/Dn Buttons

Length Unit

Headland Mode:

Activate HLM on

Ref Height
Height Increase
L/R Increase
HLM Move Down
HLM Down Delay
HLM Dead Band

ALARM:

Sensor Delay
Override Alarm
Time-out Alarm
Low-power Alarm
Open Cct Alarm
Voltage Alarm
Alarm Volume

MACH. :

Sonar Sensors
Control Type
L Sonar Offset
L2 Sonar Offset
L3 Sonar Offset
C Sonar Offset
C2 Sonar Offset
R3 Sonar Offset
R2 Sonar Offset
R Sonar Offset
Dir. Valve
Sec. Dir. Valve
Dir. Valve L
Dir. Valve R
Dir. Valve C
Master Valve
DIR is Auto in
AUTO On Delay
AUTO Off Delay
PWM Valves:
Left Up
Left Down

Right Up
Right Down
Centre Up
Centre Down
Directional
Master

TEST:

VALVE
SONAR

CAL. :

Left/Right
Left
Right
Centre

OPT:

Serial
License
Options

5 Error Messages

Following is a list of error messages you may encounter, and their meaning.

Solenoid FAULT: Open on LUP

This message may be displayed upon entering Run, Test, or Self-calibration. It indicates the respective output (LUP in this example) is not connected to a solenoid. Press ESC to clear this message.

Solenoid FAULT: Short on RDN

This message may be displayed upon entering Run, Test, or Self-calibration. It indicates the respective output (RDN in this example) is shorted to ground. Note that some equipment requires installation of a diode kit to isolate the RiteHeight's outputs from the manual controls. Contact Greentronics for details. Press ESC to clear this message.

Solenoid FAULT: Conflict on LDN

This message may be displayed upon entering Run, Test, or Self-calibration. It indicates the respective output (LDN in this example) is connected to another control circuit that does not allow a shared connection to the solenoid valve. This requires the installation of a diode kit to isolate the RiteHeight's outputs from the machine's controls. Contact Greentronics for details. Press ESC to clear this message.

Output FAILURE: RUP

The system attempted to activate the output, but the output did not show the expected voltage. The line following the message lists the affected output(s). This may indicate a missing or inadequate power supply to the Junction Box. It may also indicate a short circuit in the output wiring. Press ESC to clear this message.

ERROR: Voltage on CUP

This message may be displayed upon entering Run, Test, or Self-calibration. It indicates the respective output (CUP in this example) had voltage applied to it. This interferes with the ability of the RiteHeight system to test its connections to the solenoids. Ensure that no solenoids are activated when engaging RUN. If that is not possible, this error can be disabled by going to the Alarm Config menu and disabling the Voltage Alarm.

L Lower time-out

May appear for Left (L), Right (R), or Centre (C) boom section. The measured boom height is too high, but the controller was unable to lower the boom to correct it within the time set by the LOWER timeout configuration parameter (see section 6.12). The boom may have reached its minimum height. This alarm can be disabled by the TIMEOUT ALARM configuration option (see section 7).

Comm. error

The Console is not receiving data from the Junction Box. If you see this message, check that the Junction Box cable is correctly connected to the Console, and that the cable has not been pinched or damaged. Refer to section 12 for more information.

Valve power low

The Junction Box requires a separate power supply connection to supply the high current needed to drive the hydraulic solenoid valves. This error message indicates that this power supply voltage is too low (or missing altogether). Check that the Junction Box power supply is connected to a good source of power with sufficient current supply to drive all the solenoids. If this message appears briefly whenever an output is activated, there may be too much voltage drop in the power supply wiring to the Junction Box. Ensure that the power supply cable is as short as possible.

--

When a sonar sensor reading shows dashes, it means that sensor is not getting a valid distance reading. This usually happens when the boom is too far above the ground, or the sonar sensor sensitivity is set too low. It can also happen if dirt or debris build up on or in front of the sensor.

XX

A sonar sensor reading of XX indicates the sonar sensor is not responding. Check the wiring to the sonar sensor.

WW

If a VALID WINDOW is configured, this display means the sensor reading is outside the valid range. See section 6.16 for more information. *VALID WINDOW*

must always be DISABLED for RiteHeight systems on sprayers!

6 Configuration Options

This section describes all the options accessed through the CONFIG menu.

All height parameters are in units of inches (also denoted with the " symbol) or centimetres, and are entered in increments of 0.5 inches or 1 cm. Time parameters are in units of seconds. Some time parameters are entered in whole seconds, while others are entered in increments of 0.1 second.

6.1 Config Dead Band

The DEAD BAND option sets the amount of error allowed in the measured boom height before the system will adjust the boom. The system will not raise or lower the boom unless the measured height is greater than the Target Height plus the Dead Band, or less than Target Height minus the Dead Band. Choose the desired dead band in the range of 0.5" to 10.0" (1 to 25 cm). The default value is 6.0" (15 cm). Typical values range from 4.0" to 8.0" (10 to 20 cm).

6.2 Config Delay for Up

The DELAY FOR UP option sets how long the system waits before raising the boom when it is too low. When the system sees the distance is below the acceptable range, it will wait this amount of time before raising the boom. This avoids responding to momentary impulses, such as a tall weed.

Choose the desired delay in the range of 0.2 seconds to 5.0 seconds. The default value is 1.0 secs. Typical values range from 0.5 to 1.5 secs.

6.3 Config Delay for Down

The DELAY FOR DOWN option sets the time the system waits before lowering the boom when it is too high. When the system sees the distance is above the acceptable range, it will wait this amount of time before lowering the boom. This avoids too-frequent adjustments and ensures stable boom control.

Choose the desired delay in the range of 0.1 seconds to 5.0 seconds. The default value is 2.0 secs. Typical values range from 1.0 to 2.0 secs.

6.4 Config Target Height

The HEIGHT option sets the default target height. This is the height of the sensors above the ground or crop canopy that the system attempts to maintain in Automatic mode.

Choose the desired distance in the range of 10.0" to 90.0" (25 to 225 cm). The default value is 40.00" (100 cm).

Note that the minimum possible value may be reduced when Offset values are set in the Machine Setup menu (see section 9.3).

6.5 Config Quick Raise Ht.

The QUICK RAISE HT option sets the minimum height the RiteHeight system will accept for normal operation. If a sonar sensor reads a height smaller than this height, the system will immediately raise the boom without waiting for the usual DELAY FOR UP time.

Choose the desired height in the range of 10.0” to 90.0” (25 to 225 cm). Selecting “Disabled” or 0.0” will turn off the Quick Raise feature. The default value is 15.0” (38 cm).

Note that the minimum possible value may be reduced when Offset values are set in the Machine Setup menu.

***NOTE:** The Quick Raise Height is intended as a kind of emergency override when the boom gets too close to the ground. It should normally be set at least 10” (25 cm) lower than the Target Height. Setting Quick Raise Height close to the Target Height may result in unstable operation.*

6.6 Config Sonar Mode

The SONAR MODE option determines whether the sonar sensors read off the crop canopy or the ground.

Choose from three options:

- **BARE GROUND:** Use this option when working over bare ground. The sonar sensors will read the distance to the ground with maximum range.
- **PARTIAL CANOPY:** Use this option when working in an immature crop with a partially closed canopy. The sonar sensors will read the distance to the ground that is visible between the plants, ignoring the plants. Maximum range may be reduced.
- **FULL CANOPY:** Use this option when working over a crop with a full canopy, with little or no ground visible. The sonar sensors will read the distance to the crop canopy with maximum range.

Note that the Sonar Mode can also be adjusted in the Test Sensors display screen.

***WARNING:** In PARTIAL CANOPY mode, at close range, it is possible for the sonar sensors to occasionally show a false reading of double the actual distance. This happens only if the ground surface is hard and smooth. See the warning in section 8.1.*

6.7 Config Sonar Sensitivity

The SONAR SENS. option adjusts how sensitive the sonar sensors are in Bare Ground and Full Canopy modes. The higher the value of this parameter, the more sensitive the sensors will be.

Choose the desired sensitivity in the range of 0% to 100% and press ENT to save the new value. The default value is 100%. Typical values are in the range of 10% to 100%.

A higher value will extend the maximum range at which the sonar sensors can still get a valid echo. A lower value will allow the sonar sensors to better detect objects at very close range. See section 8.1 for more information.

6.8 Config No-Range Filter

The NO-RANGE FILTR option of the CONFIG menu determines how the system deals with out-of-range readings from a sonar sensor.

Normally the system will not take any action (raise or lower a boom) when a sonar sensor reads out-of-range. The No-Range Filter option allows you to configure the system to tolerate brief out-of-range conditions. This allows the system to adjust boom height even when the sonar is only barely getting distance readings. The selected time determines how long a time period a sonar is allowed to be out-of-range before the system stops making height adjustments.

Choose the desired setting in the range of 0.0 to 1.0 secs, and press ENT to save the new value. The default value is 0.0 secs. Typical values are 0.0 to 0.3 secs.

6.9 Config Up/Dn Buttons

This option selects the function of the up and down buttons in the Console's Auto screen.

For the ISOBUS VT Auto screen this option determines whether or not the manual Up and Down boom control buttons are displayed.

Choose from the following options for Up/Dn Buttons in the Console Auto screen:

- Height
- Move Left
- Move Right
- Move Centre
- Move L+R

The default value is “Height”, which means the up and down buttons adjust the target height, and cannot be used to control boom functions.

If you choose “Move Left”, the Auto screen up and down buttons will default to raise and lower the left boom. Similarly, the other options provide default manual control of other boom sections using the up and down buttons. However, in the Run screen you can switch to control any other boom function by using the left and right arrow buttons.

This feature is useful on machines that do not have convenient manual controls available. The “Move L+R” option is provided to fold or unfold both left and right boom sections at the same time.

6.10 Config Override

The OVERRIDE option determines how the system responds when you manually activate the boom hydraulics in Automatic mode.

Choose from the following options for Override:

- Exit Auto
- Enable/Disable
- 1 sec
- 2 secs
- 3 secs
- 4 secs

5 secs

The simplest setting is “Exit Auto”. This means that when the system detects manual activation of the boom hydraulics it will exit Automatic mode and return to Idle mode. You will need to press ENT or GO to re-engage Automatic mode.

The default setting is “Enable/Disable”. In this mode the system interprets manual activation of the boom hydraulics as a trigger to enable or disable automatic control of each boom. Pressing the Up switch for a boom will disable automatic control of that boom. The status display for the boom will show “Man.” to remind you that the boom is under manual control, and automatic control of that boom is disabled. Pressing the Down switch will re-enable automatic control.

You can also select a time-out value (in the range of 1 to 5 seconds). This is useful if you frequently need to temporarily override the operation of the RiteHeight system to deal with obstructions or other unusual features in the field. If a time-out value is selected, the system will temporarily suspend automatic control of a boom when it detects manual activation of the boom hydraulics. The status display for the boom will show “Man.” to remind you that the boom is under manual control, and automatic control of that boom is disabled. After the time period expires, it will resume automatic control of the boom.

In Enable/Disable, or when an OVERRIDE time-out value is selected, it is possible to operate the sprayer with one boom in AUTO mode and the other under manual control. This is useful when you drive the sprayer along a fence-row or other obstacle where manual control of that boom is needed for best and safe control while the other can continue in AUTO mode.

When the sprayer is equipped with the centre boom sensor, briefly touching “UP” on the manual control switch for the centre boom will disable AUTO for the entire boom. Briefly touching centre “DOWN” will re-enable AUTO. This is a useful feature when turning on head lands where AUTO mode is not desirable.

Every time automatic mode is disabled or enabled for a boom, a short beep will sound to alert you to the change in control mode. If these beeps are unnecessary, you can disable them by disabling the Override Alarm (see below).

6.11 Config Centre Override

This option determines whether the system responds to activation of the Centre Up and Down (CUP and CDN) signals even if the Centre section is not being automatically controlled. Choose from the following options for Centre Override:

Disabled

Enabled

If set to Enabled, any manual activation of CUP or CDN will be treated as manual override.

The default is Disabled.

6.12 Config Lower Time-Out

This feature prevents needlessly burdening the hydraulic system when a boom cannot be brought low enough, such as when the sprayer is on top of a ridge.

The Lower Time-Out option sets the maximum amount of time the system will keep its Lower output on to try to achieve the desired target distance. If the measured distance is not within the target distance range after the time set by Lower Time-out, the system will turn off its Lower output and raise an alarm to alert the operator (unless disabled by the Time-Out Alarm option). When the boom comes back within target distance, automatic control will resume.

Choose the desired time-out in the range of 1 second to 60 seconds. You can also choose to disable the lower time-out by selecting Never (or Disabled in the ISOBUS VT). The default value is 10 secs.

6.13 Config Raise Time-Out

This feature prevents needlessly burdening the hydraulic system when a boom cannot be brought high enough, such as when the sprayer is at the bottom of a steep hill.

The Raise Time-Out option sets the maximum amount of time the system will keep its Raise output on to try to achieve the desired target distance. If the measured distance is not within the target distance range after the time set by Raise Time-out, the system will turn off its Raise output and raise an alarm to alert the operator (unless disabled by the Time-Out Alarm option). When the boom comes back within target distance, automatic control will resume.

Choose the desired time-out in the range of 1 second to 60 seconds. You can also choose to disable the raise time-out by selecting Never (or Disabled in the ISOBUS VT). The default value is 10 secs.

6.14 Config Motion Control

The MOTION CTRL options determine how aggressively the system makes upward and downward corrections to the boom height. There are separate Motion Control settings for the UP and DOWN corrections of each boom (Left, Centre, and Right).

Choose the desired value between 1 (fastest) and 7 (slowest). The default value is 3, which strikes a balance between quick corrections and stable boom control. With Motion Control set to 3, the system will typically make two or three corrections to return the boom to the target height.

Note that stable operation requires running the Self Calibration procedure! See section 10.

On some sprayers a fast setting of 2 or 1 can be used, which returns the boom to the target height with one or two large corrections, and therefore returns the boom to the target height quickly. However, this quicker operation can result in unstable operation, with a continuous back-and-forth rocking motion. If you see this happen, change the Motion Control back to a slower setting.

If the operation of the system is unstable at a setting of 3, choose a slower setting. This will cause the system to make height corrections in smaller steps, leading to reduced overshoot and less back-and-forth rocking. The drawback is that it will take somewhat longer to reach the target height.

6.15 Config Headland Mode

Headland Mode is a modification of the normal Auto operation of the RiteHeight system. The Headland Mode sub-menu provides a set of options to select how Headland Mode is activated, and what actions are taken in Headland Mode.

Headland Mode: Activate HLM

This option determines how Headland Mode is activated. Choose from the following options:

Disabled
Double-tap CUP
Reference Ht
OFF with DIR or OFF with RDN
ON with DIR or ON with RDN

By default, Headland Mode is Disabled.

If you select “Double-tap CUP”, then Headland Mode is engaged by tapping the machine's Centre Up switch twice in quick succession. To return to normal Auto mode, tap the Centre Down switch (once).

The “Reference Ht” is only available if you have selected a Control Type of “L/R Centre Ref.” in the Machine Setup menu. With this option selected, the system will enter Headland Mode as soon as the centre (reference) sonar sensor reads a height greater than the HLM Reference Height (see below). This means that when you raise the centre section above the Reference Height, the RiteHeight system will automatically switch to Headland Mode. Dropping the centre section slightly below the Reference Height will return the system to normal Auto mode.

The last two options use an electrical control signal to engage and disengage Headland Mode. Normally the DIR signal is used for this purpose. However, if the DIR signal is used to drive a directional valve, then the RDN signal is used instead. Note that these modes also support the Double-tap CUP functionality.

Most commonly a sprayer has a pump control signal that turns on (+12V) when the sprayer's pump is operating, and turns off (0V) when the sprayer is not operating. To use this type of signal to control Headland Mode, connect the pump control signal to the DIR (or RDN) terminal inside the RiteHeight junction box. Then select the “Off with DIR” option. This will cause the RiteHeight system to enter Headland Mode whenever the pump control signal is off. As soon as the pump control signal turns on, the RiteHeight system will resume Auto height control mode.

WARNING: A configuration error could cause the RiteHeight system to drive the DIR or RDN signal to +12V. It is recommended to install a blocking diode to prevent back-feeding the Headland Mode control signal. The diode must be installed with its stripe toward the RiteHeight junction box terminal.

The “On with DIR” option is useful if your equipment does not have the usual pump control signal, but instead has a signal that turns on when you want Headland Mode. When the signal is on (+12V), the RiteHeight system will enter Headland Mode. When the signal turns off (0V), the RiteHeight system will resume Auto height control mode.

Headland Mode: Reference Height

If Activate HLM is set to “Reference Ht”, this option sets the height at which the RiteHeight system switches to Headland Mode.

Headland Mode: Height Increase

In Headland Mode, the Target Height will be increased by the Height Increase setting.

This lets you specify a greater height to keep the booms well off the ground while turning on the headland.

Headland Mode: L/R Increase

While turning on the headland, you may want to keep the left and right wings higher than the centre section. The “L/R Increase” option specifies how much higher the left and right wings should be raised than the centre section.

Headland Mode: HLM Move Down

If the booms swing out over ditches or other low areas while turning on the headlands, you may not want the RiteHeight system to lower the booms on the headlands.

Setting the HLM Move Down option to “Disabled” will prevent the RiteHeight system from making any downward corrections in Headland Mode. It will still make upward corrections to raise the booms to the required height.

The default value is “Enabled”, which will make both up and down corrections as usual, but with a different delay-for-down, as set by HLM Down Delay (see below).

Headland Mode: HLM Down Delay

If HLM Move Down is Enabled, this option determines the delay-for-down while in Headland Mode. This lets you choose a longer delay time to avoid responding needlessly to depressions in the nearby terrain while turning on the headland.

Headland Mode: HLM Dead Band

In Headland Mode, height control usually does not need to be very accurate. The HLM Dead Band option lets you set a larger Dead Band for Headland Mode to avoid frequent unnecessary height corrections while turning on a headland.

The default value is 0.0, which means the system will use the same Dead Band value used in normal operation. Set to a non-zero value to use a different Dead Band in Headland Mode.

6.16 Config Valid Window Low / High

NOTE: These options must NEVER be used for boom height control on sprayers!

The VALID WIN options limit the range of sonar sensor height readings that are accepted. Any height reading outside the valid range will be rejected. This feature is intended for height control applications with a limited range of operation. For example, when controlling header depth on a potato harvester, the Valid Window Lo can be used to exclude too-short readings due to tall weeds.

Two options allow configuring the valid range below and above the target height. The Lo value sets the range of valid height readings below the target height, while the Hi value sets the range of valid height readings above the target height.

Choose “Disabled” or 0.0 to disable the Valid Window option. Choose a value in the range of 0.5” to 40.00” (1 to 100 cm) to enable it. The default value is “Disabled”.

When set to “Disabled” or 0.0, the Valid Window has no effect. When set to some other value, the valid range of heights is calculated based on the current Target Height plus the High value and minus the Low value. For example, if the Target Height is 35.0”, the Valid Window Lo is set to 4.0”, and the Valid Window Hi is set to 8.0”, only height readings between 31.0” and 43.0” will be accepted. Readings outside this range will be treated as out-of-range.

6.17 Config Avg. Sensors

NOTE: This option is not intended for boom height control on sprayers.

When two or three sensors are used to control a single function, the RiteHeight system normally uses the lowest of the readings. In some implement depth control applications it makes more sense to use the average of the sonar readings instead. This is done by enabling the Avg. Sensors option.

6.18 Config Reference Filter Time

NOTE: This option is only available when using the centre sonar sensor as reference (see section 9.1).

When Control Type is set to “L/R Centre Ref” (in the Machine Setup menu), the centre sonar height reading is used as the target height for the left and right sensors. Because it is not generally desirable to have the target height fluctuate rapidly, the centre sensor readings can be filtered in this mode. The REF. FILTER option controls the degree of filtering of the centre sonar sensor.

Choose a value from 0.0 secs to 1.6 secs. The longer the time chosen, the more slowly the centre sensor height reading will change. The default value is 0.8 secs.

6.19 Config No-Range Lower

NOTE: This option must NEVER be enabled for boom height control on sprayers. It is only intended for use on certain vegetable harvesting equipment!

The NO-RANGE LOWER option controls the behaviour of the system when a sonar sensor does not report a distance reading (“No Range”). This usually happens when the sensor is too high above the ground. When the distance to the ground is beyond the sonar sensor's range, or if the received echo is too weak, the sonar sensor will not be able to provide a distance reading. This shows up on the Console display as “--”.

Choose “Disabled” or 0.0 to disable this feature. Choose a value in the range of 0.5” to 10.0” (1 to 25 cm) to enable it. The default value is “Disabled”.

When No-Range Lower is set to “Disabled”, the RiteHeight system will take no action when a sonar sensor reports No Range.

If a different value is chosen, the RiteHeight system will lower the boom whenever the sonar sensor reports No Range. The larger the value selected, the more quickly the boom will be lowered.

CAUTION: *Be careful in using this option. It is possible for a sonar sensor to report No Range for other reasons, such as dirt or moisture build-up on or near the sensor. This could cause the boom to be lowered unexpectedly!*

6.20 Config Length Unit

The RiteHeight system can be configured to display distances in inches (common in North America) or in centimetres. Set the Length Unit to “in” for inches, or to “cm” for centimetres.

Most of the examples in this manual use inches. The common short form of a double-quote (”) is used to denote inches. An inch is equivalent to approximately 2.5 cm.

6.21 Config User Controls

If the ISOBUS option is installed, the User Controls option is used to switch between the ISOBUS VT user interface and the standard user interface using the Console's LCD and keypad.

While in ISOBUS mode, the User Controls option is available at the main menu in the limited LCD menu. While in standard mode, the User Controls option is available in the Config menu.

When you select a new User Controls option, the Console will reboot to initialize the new user interface.

7 Alarm Configuration Menu

The Alarm Configuration menu controls whether an alarm is raised in various situations.

7.1 Sensor Alarm Delay

The Sensor Alarm Delay option sets how quickly the Console sounds an alarm when it encounters an out-of-range sensor reading.

Choose from 0 to 5 seconds, or set it to Never. The default setting is 1 sec. This means that when the system detects an out-of-range sensor reading, it will wait 1 second before sounding an alarm. Brief out-of-range readings will therefore not cause any activation of the alarm, avoiding nuisance alarms.

Choose the alarm delay setting that best suits your operation. Choosing "Never" means the system will never sound an alarm to indicate an out-of-range condition (and you may therefore have to keep an eye on the readings).

7.2 Override Alarm

The OVERRIDE ALARM option controls whether an alarm beep is sounded when manual override turns automatic mode off or on for a boom.

The default setting is "Enabled". If you find the beeps more annoying than useful, change this option to "Disabled" to turn off these audible alerts.

7.3 Time-Out Alarm

The TIMEOUT ALARM option controls whether or not the Console sounds an alarm when the Lower or Raise Time-Out expires. If the Time-Out alarms are disabled, the system will not sound an alarm when a time-out occurs, but will display "T" for the boom status.

The default value is Enabled.

7.4 Low-Power Alarm

The power supply voltage to the Junction Box is monitored by the system to ensure there is sufficient voltage to drive the solenoid valves. If the voltage is too low, the system sounds an alarm with the message "Valve power low".

In some installations, the solenoid valves operate fine even though the power supply voltage dips below the minimum threshold when a valve is activated, causing nuisance alarms. The LOW-PWR ALARM option allows you to disable the Low-Power alarm.

The default value is Enabled.

7.5 Open Cct Alarm

The RiteHeight system tests all its solenoid connections for electrical faults. These tests include an open circuit test, intended to alert you in case of a loose or missing wire.

In some installations the solenoid outputs of the RiteHeight system are not connected directly to solenoids, but instead are connected to a low-current load such as a relay coil or other high impedance control input. In this case the RiteHeight system may report an “Open” circuit fault.

The Open Cct Alarm option lets you disable the open circuit alarm to avoid this problem. The default value is Enabled.

7.6 Voltage Alarm

The RiteHeight system tests all its solenoid connections for electrical faults upon entering Run, Test, or Self-calibration. If there is voltage present at any of the solenoid connections, the electrical fault tests cannot be performed, and you will see “ERROR: Voltage on ...”. Try to ensure that no solenoid signals are activated when engaging RUN. If that is not possible, the error can be avoided by disabling the Voltage Alarm.

7.7 Alarm Volume

For systems with an ISOBUS interface, this option sets the volume of the VT buzzer when sounding an alarm.

Choose a value from 0 to 100%. The default value is 100%.

8 Test Menu

The TEST menu looks somewhat different between the ISOBUS VT screen and the LCD display, but both provide the same test functionality.

8.1 Test Sonar Sensors

Select SENSORS on the LCD display or SONAR on the VT screen to see a display of the sonar sensor readings:

Sonar	Full	100%
38	41	33

The display shows the sonar operating mode (*Full Canopy*, *Bare Ground*, or *Partial Canopy*). You can change the operating mode by selecting from a list on the VT screen, or using the ENT button on the Console. This allows you to experiment with different modes while viewing the sensors' distance readings.

The display also shows the sonar sensitivity (100% be default). In Full Canopy and Bare Ground mode, you can change the sensor sensitivity. On the console this is done using the up and down arrow buttons.

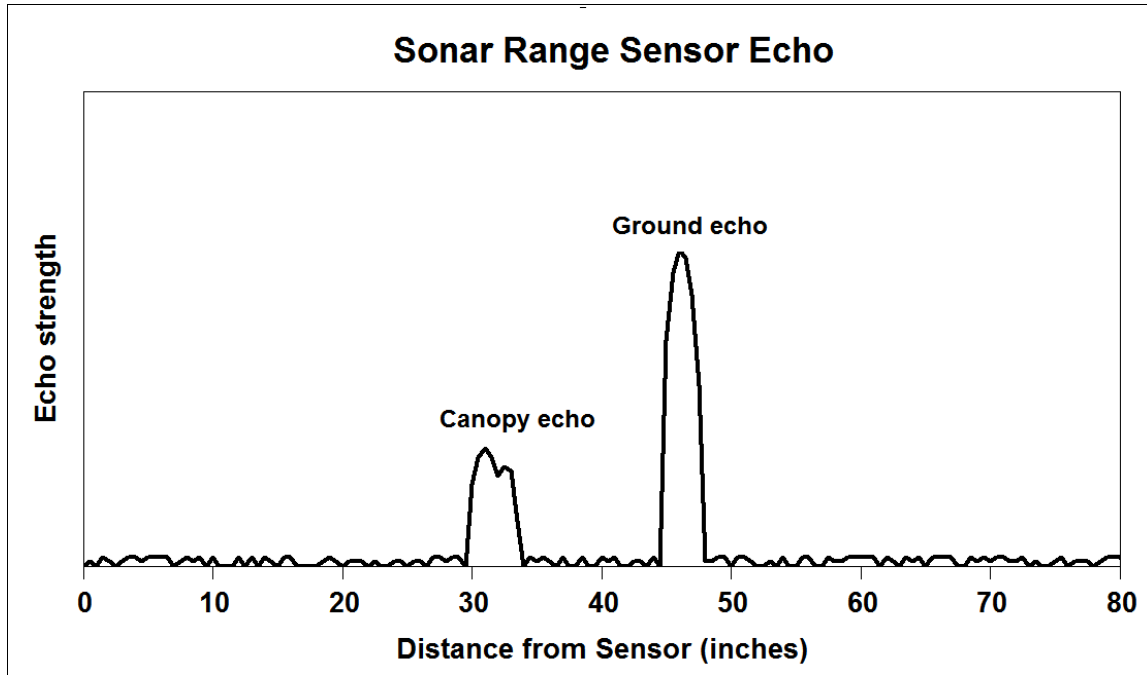
The bottom of the display shows the distance measured by each of the sonar sensors. On the LCD display there is room for up to 3 sensors. If the system is configured for more than 3 sensors, the LCD display will show the sensors for one boom section at a time (Left, Centre, or Right). Use the left and right arrow buttons to select which boom section is displayed.

When a sonar sensor reading shows dashes (--), it means that sensor is not getting a valid distance reading. This usually happens when the boom is too far above the ground. It can also happen if dirt or debris build up on or in front of the sensor.

If a sensor reading shows XX, there is a problem communicating with the sensor. Check the connections and wiring to the sensor.

Sonar Operation in Partial, Full Canopy and Bare Ground Modes

The sonar sensors use sound pulses to measure the distance from the sensor to the ground or crop



canopy. The sonar sensor sends out a short sound pulse and then waits for the echo to return to the sensor. The longer it takes for the echo to return, the farther away the object that reflected the sound back to the sensor.

The diagram shows a sample graph of the sound echo signal received by a sonar sensor. In this case, there is partial crop canopy, so there are echoes from both the canopy and the ground.

The first echo received is from the canopy, at a distance of 30 inches. Because it's a partial canopy, the echo is relatively weak. A little later the sensor receives a second echo, which was reflected by the ground, at a distance of 45 inches. Because the ground offers a bigger surface to reflect the sound, this echo is much stronger.

Given the two different echoes, how does the sonar sensor determine whether the correct distance is 30 inches or 45 inches? This is determined by the Sonar Target setting. In Full Canopy mode, the sonar sensor uses the *first* echo it receives, so it will report a distance of 30 inches. In Partial Canopy mode, the sonar sensor uses the *last* echo it receives, and therefore will report a distance of 45 inches. Note that Bare Ground mode also uses the first echo received, so the sonar sensor would report 30 inches in Bare Ground mode.

Distinguishing between the crop canopy and the ground works well in crops with partial canopies. In a mature crop with a full crop canopy, the sound pulses will not be able to penetrate the canopy, and therefore the sonar sensors will not get any echo from the ground. It is therefore best to use Full Canopy mode when there is a full or nearly full crop canopy.

False Readings in Partial Canopy Mode

Partial Canopy mode can lead to problems if the sensor is very close to the ground and the ground surface is smooth and hard. In this situation it is possible for the sonar sensor to

sometimes report a false reading of twice the actual distance. If the actual distance is 13 inches but the sensor reports 26 inches, that could cause the RiteHeight system to move the boom down instead of up!

To avoid this problem the RiteHeight system provides automatic sonar sensitivity adjustment in Partial Canopy mode. This keeps the sonar sensitivity high enough to ensure that the sensors get good distance readings, but low enough to minimize the occurrence of false double readings. You may still see the occasional double reading, but with “Delay for Down” at a reasonable value, brief double readings are not an issue.

8.2 Test Valve Wiring

Note: In the ISOBUS VT interface, this functionality is included in the VALVE screen of the TEST menu.

The VALVE WIRING option of the test menu shows whether there is voltage on the solenoid wiring to the Junction Box. This is useful to confirm that all the connections have been made correctly. The system does not activate any outputs in this mode. Instead, you activate solenoid valves using the manual controls, and observe whether the expected signal name appears on the display. This can also be used to determine how the Directional valve should be controlled.

As you activate each function, look for the matching valve name to show up on the LCD display. The VT display will highlight each valve name as it is activated.

LU / LD	Left Up / Down
RU / RD	Right Up / Down
CU / CD	Centre Up / Down
MSTR	Master valve
DIR	Directional valve

8.3 Test Try Valves

Note: In the ISOBUS VT interface, this functionality is included in the VALVE screen of the TEST menu.

The TRY VALVES option is used to activate the hydraulic valves through the RiteHeight system to confirm that the system is able to raise and lower the booms.

On the LCD, the bottom line shows the currently selected boom section. Use the Left and Right arrow buttons to select the Left, Right, or Centre boom section. Press the Up or Down arrow button to raise or lower the selected boom section.

On the VT, simply press the UP or DN button for each boom section.

If all connections are correctly made and the RiteHeight system is configured correctly, the selected boom section should respond.

If there is no response, or an incorrect response, check the connections from the Junction Box to the solenoids.

If there is no response at all, you may have an open-centre hydraulic system that requires the Master output to be connected to the Master valve.

Incorrect response may also be due to incorrect configuration of the Directional valve.

The display also shows the solenoid power supply voltage at the Junction Box. Normally this should be between 12V and 14V. It may drop somewhat when an output is activated. If this voltage dips too low when activating outputs, check the power connection to the Junction Box.

The VT display also shows the Sonar Supply voltage, which should be about 15V.

8.4 Test Diagnostics

NOTE: These screens are not intended for operator use.

This option provides access to detailed diagnostic information screens. This information is intended to help Greentronics personnel in troubleshooting issues.

9 Machine Setup Menu

This section describes all the options accessed through the MACHINE SETUP menu.

NOTE: If Control Type is set for Lift/Tilt mode, LIFT and TILT options will replace the LEFT and RIGHT options.

9.1 Machine Setup Control Type

The CONTROL TYPE option defines the number of boom sections (functions) to be controlled, and how they are controlled. Each option is used for a different type of installation.

Choose one of the following options:

Left/Right: Controls the left and right booms of a sprayer, with manually selected target height. When the centre section is raised or lowered, the target height must be adjusted to match.

L/R Centre Ref (Left/Right control with Centre Reference) : Controls the left and right booms of a sprayer, and uses 1 or 2 centre sonar sensors (mounted on the centre section) as a reference to set the target height. When the centre section is raised or lowered, the system will automatically adjust to the new target height, so the left and right booms always work at the same height as the centre section.

L/R Centr Ctrl (Left/Right and Centre control) : Controls the left and right booms of a sprayer, as well as the centre section, using 1 or 2 centre sonar sensors mounted on the centre section. Simply set the desired target height and the system will keep all three sections at that height.

Left: Primarily intended for non-sprayer applications, this option controls a single function, with manually selected target height. The Left sonar sensors (1 to 3) are used to measure height, and the Left control outputs are used to adjust the height of the controlled function. This control mode can also be used on a sprayer to temporarily operate only the left boom in automatic mode.

Right: This control mode can be used on a sprayer to temporarily operate only the right boom in automatic mode. The right sonar sensors (1 to 3) are used to measure height, and the Right control outputs are used to adjust the height of the right boom.

Lift/Tilt: This option is used on fixed geometry booms, where the entire boom can be tilted, but there are no individual wing tilt cylinders. It can also be used for automated control of combine headers that have the ability to tilt the header. The “Left” outputs are used to control lift, while the “Right” outputs are used to control tilt. Sensors are mounted near each end of the boom or header. Lift and tilt are controlled to keep sensors at the selected distance above the ground.

9.2 Machine Setup Sonar Sensors

The Sonar Sensors option sets the total number of sonar sensors installed (1 to 8).

If you have installed 2 or 3 sensors on a boom section, height will normally be controlled based on the *shortest* of the sensor readings.

9.3 Machine Setup Offset Left / Right / Left2 / Right2 / Left3 / Right3 / Centre / Centre2

The OFFSET options set the height offset of each sonar sensor above the spray tips. This offset is subtracted from the sensor readings so that the Console displays the net height of the spray tips above the ground or crop canopy.

Measure the vertical distance (in inches or cm) between the spray tips and the bottom of the sonar sensor. Enter the measured distance. The default value is 0.0.

By introducing different offset values for sensors on different booms, it is possible to “cheat” the RiteHeight system into maintaining different target heights for different booms. This is useful, for example, where the sprayer drives between planted beds with the centre boom over the lower area between the beds and the outer booms above the raised beds.

Note that unused sensors do not show up in the Offset settings.

9.4 Machine Setup Directional Valve

The DIR. VALVE option determines whether the Directional valve output is used.

If Disabled (the default setting) the system will not activate its Directional valve output. Use this option if your sprayer does not have a directional valve. This means the booms operate independently, so that they can be activated simultaneously.

Enabling the Directional valve will force the system to operate only one boom at a time. This is for sprayers with a single valve to select each hydraulic function, and a directional valve to determine the direction of flow. The “Up” output is activated for both raising and lowering the boom, with the Directional output determining the direction.

To support directional valves with two solenoids, the Centre Down output is used to drive the secondary directional solenoid (if enabled by the DIR. SECOND option).

9.5 Machine Setup Secondary Directional Valve

If the Directional valve output is enabled, the DIR. SECOND option of the MACHINE SETUP menu determines whether or not the CDN output is activated as a secondary directional output.

The default value is Disabled. Choose Enabled if your sprayer has two separate solenoid valves to control hydraulic flow direction.

9.6 Machine Setup Directional Valve Left / Right / Centre

These options determine how the Directional valve works to operate each boom. The Directional valve will be activated for one direction, and not activated for the other.

Choose “Down” if the Directional valve needs to be activated to move the boom down. Choose “Up” if the Directional valve needs to be activated to move the boom up.

9.7 Machine Setup Auto Input (DIR is Auto In)

In some equipment installations, there is an electrical signal that controls whether the machine is operating or not. If your machine has such a signal, it may be convenient to use this same control signal to activate automatic height control by the RiteHeight system.

If the DIR (Directional output) is not used, then it can be re-purposed as an “Auto” signal input by setting AUTO INPUT to Enabled.

When the Auto Input is Enabled, Auto mode will still work as usual. However, once you are in AUTO mode, any transitions of the Auto signal will cause a change in the Manual Override status of all controlled sections. If the Auto signal goes inactive (from 12V to 0V), all sections will change to Manual Override mode, so no automatic height corrections will be made. When the Auto signal goes active (from 0V to 12V), all sections will return to automatic control.

NOTE: To avoid conflicting with the usual Manual Override methods, the Auto Input only takes effect when manual Override is set to “Enable/Disable”.

9.8 Machine Setup Auto On/Off Delay

When the Auto Input is enabled (see above), any changes in the Auto signal normally take effect immediately. The Auto On Delay and Auto Off Delay options allow you to delay the action of the Auto Input by 0.0 up to 10.0 seconds.

The Auto On Delay option is used to set a delay between the time when the AUTO signal goes active and the time when automatic height control is resumed. The default Auto On Delay is 0.0 seconds, for no delay. This can be used to defer automatic control when first starting up the machine.

Similarly, the Auto Off Delay option is used to set a delay between the time when the AUTO signal goes inactive and the time when automatic height control is stopped. The default Auto Off Delay is 0.0 seconds for no delay. This delay can be used to briefly continue automatic control after the Auto signal is deactivated.

9.9 Machine Setup Master Valve

The MASTER valve option determines how the Master valve output signal works.

Select “Disabled” if the Master output is not needed.

Select “All Outputs” to have the Master valve output activated whenever the RiteHeight system activates any of its control outputs. This is useful in open-centre hydraulic systems to activate the master (or “dump”) valve.

The “Up outputs” option is useful in hydraulic systems that require activation of a central valve or pump only when a boom needs to be lifted. With this option selected, the Master output will be activated only when the system makes an up adjustment to one of the booms.

9.10 Machine Setup PWM Control

NOTE: This option applies only to machines that have proportional solenoid valves. If unsure, leave all values at the default value of 100%

The PWM CONTROL options set the speed at which the booms raise and lower by adjusting the flow rate of the proportional solenoid valves. The flow rate of each solenoid valve can be adjusted individually.

Set the flow rate for each solenoid valve by choosing a percentage between 10% - 100%. The default value is 100% (full flow rate).

10 Self Calibration

NOTE: Do not attempt Self-Calibration in a rough field. The uneven surface will produce erratic sensor readings that make it impossible to obtain an accurate calibration.

Self Calibration is performed with the sprayer standing still. Ensure that the sonar sensors are pointed to clear level ground. A gravel or paved yard is ideal.

Before you initiate Self Calibration, ensure that both booms are fully extended, are reasonably level, and are 36 to 48 inches (90 to 120 cm) above the ground. The booms should be able to move both up and down from the starting position. If the boom cannot go below level, then start it 18 to 24 inches (45 to 60 cm) above level. The hydraulic fluid should be at normal working temperature, and the hydraulic pump should be running at normal operating speed.

The SELF CAL. menu is used to initiate the Self Calibration procedure. This procedure is used by the system to learn how quickly the booms respond when the hydraulics are activated, and how far the booms continue to travel after the hydraulics are turned off. Without running the Self Calibration, the controller may move the booms too quickly, resulting in excess adjustments. In some cases the booms may go into a constant back-and-forth rocking motion. *It is therefore imperative to run Self Calibration before attempting to use the RiteHeight system.*

Note that on some sprayers with loosely suspended booms, the Self Calibration may not correctly gauge the response of the booms. If you find the booms are still overshooting or rocking back and forth after Self Calibration, try adjusting the Motion Control parameters (in the CONFIG menu) to a slower setting (see section 6.14).

In the LCD interface, the SELF CAL menu presents options for which boom(s) to calibrate. In the VT interface, select the boom(s) to calibrate at the top of the screen. Select one of these options:

LEFT/RIGHT
LEFT ONLY
RIGHT ONLY
CENTRE

For the most part only the left boom need to be calibrated, because the left and right booms behave the same way. Choosing the LEFT/RIGHT mode will calibrate the left boom, and when finished, copy all the Control parameters for the left boom into the right boom. This mode will also measure any interaction between the left and right booms.

For machines with hydraulics that differ greatly between the Left and Right boom, you can choose to calibrate each boom separately to set each boom's individual Control parameters.

If you have a centre sensor to control the centre rack, you should also calibrate the centre rack by selecting CENTRE.

Note that for Lift/Tilt control mode, the SELF CAL menu shows the options LIFT and TILT to calibrate the two control functions.

After selecting the function you want to calibrate, press ENT to proceed with Self Calibration. On the VT screen press the GO button.

Once you initiate Self Calibration, the system will begin a series of up and down motions of the boom. Each successive up and down cycle will be a little larger than the preceding one. After several cycles the system will save the calibration values for your sprayer and display a message indicating successful completion. The entire procedure typically takes 2 to 3 minutes.

You can interrupt the Self Calibration procedure at any time by pressing the ESC button (or STOP on the VT). This will leave the calibration values unchanged.

10.1 Testing for Control Stability

After running the Self Calibration, you should check the stability of the system's boom control.

CAUTION: *Be careful when testing the boom operation, as the booms can move up and down rapidly. Be sure to stay clear of the boom when the RiteHeight system is engaged, and always be prepared to disengage the RiteHeight system (by pressing ESC).*

For best results, perform the test over a fairly flat surface such as a paved yard. Extend both booms and raise the booms to normal working height. Engage Automatic mode on the Console, and set the target height to normal working height so that the booms are at rest and the system is not making any corrections.

Now use some large flat object to trick the sensor into seeing a reduced height. A cardboard box works well. Have a helper place or hold the object about 12 inches (30 cm) off the ground. The RiteHeight system should raise the boom to maintain the target height above the object. The boom should move up to its new position with very little overshoot. Depending on the boom construction, the other boom may move up and down somewhat, but it should stay close to its target position.

Now withdraw the object. The boom should move back to its original height, again without much overshoot, and without much action of the other boom.

If there is a lot of overshoot, or if the booms start rocking back and forth, boom control needs to be stabilized. Refer to section 12.3 for information on how to correct instability.

11 LCD Update Menu and VT OPT screen

The Update menu provides facilities for installing optional features and new firmware.

The VT Software Options (OPT) screen also allows viewing and installing optional features, but not installing new firmware.

11.1 Update Options

Optional product features can be added by entering a license key.

The available features can be viewed in the List Options menu. Currently the only option available for RiteHeight systems is the ISOBUS VT user interface option. Contact Greentronics or your dealer to purchase this option.

In order to obtain a license key, you must provide the Console ID of your RiteHeight Controller. Go to the Console ID option, and write down the 10-digit number displayed (eg. 0004-567-890). Provide this Console ID number along with the name of the option you wish to add to your RiteHeight system.

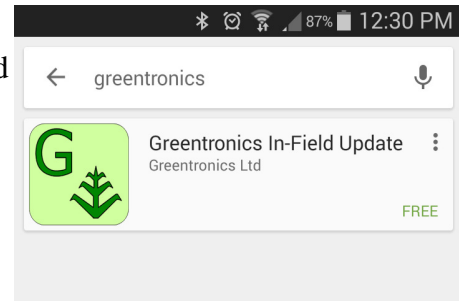
In return you will receive a 10-digit license key. Enter this key in the New License screen.

11.2 Update Firmware

Feedback from customers and dealers often results in firmware updates. The RH430 Console allows in-field firmware upgrades via Bluetooth connection to an Android device using a specific App. This section explains the process of obtaining the Update File and the required App to update Firmware on the Console.

To obtain the Firmware Update File, contact Greentronics or your dealer and provide your email address. The file will be emailed to you. Save the file on your Android device in a location that is easy to remember and find.

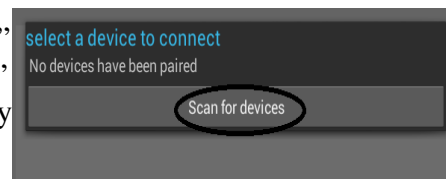
To obtain the App, open up the Google Play Store app on your android device, search for “Greentronics” and select and install the-Greentronics In-Field Update App. The App allows your Android device to connect to the Greentronics' Console via Bluetooth and upload the Update File.



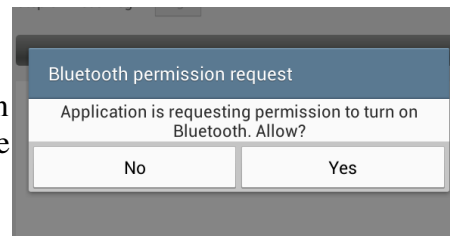
Steps to update Firmware:

- 1) On the RiteHeight Console, at the main menu go to the Update menu and select Firmware. Press ENT to prepare the Console to receive the new firmware. The screen will show “Waiting for file”.

- 2) Launch the Greentronics App, and select “Yes” to continue if a “Bluetooth permission request” window pops up. The App closes automatically if no selection is made.



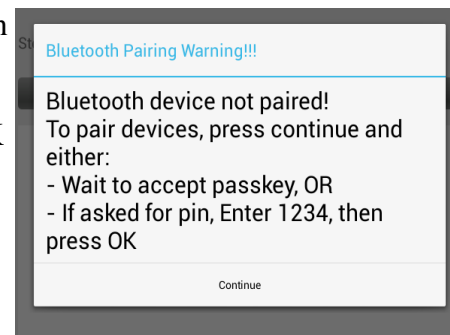
- 3) Press the “Select Bluetooth device” button. A dialogue window will appear asking you to select from a list of paired Bluetooth devices.
 - 3.1) If the device “GRT-CONTROLLER” is in the list, select it, then wait for another dialogue window confirming the Bluetooth device is paired. Press OK and proceed to step 4.



- 3.2) If “GRT-CONTROLLER” is not in the list, press “Scan for devices”. After a moment, you will see “GRT-CONTROLLER”. Select it.

- 3.3) At this point the device needs to go through the pairing process, you will see a message asking you to either accept a passkey, or to enter a PIN.

- 3.4) If a PIN is required, type in the default pin number 1234 and press OK to continue. If a passkey is required, a dialogue box asking to confirm passkey will appear. Simply press OK to confirm. (Note: in both cases the device name of GRT-CONTROLLER should appear in the dialogue box.)



- 3.5) Wait for the dialogue box to confirm pairing was successful. Once a device is paired once, it should not need to be paired again.

- 4) In the App, press-“Select Update File” button- This opens a dialogue box to navigate through the file system on your Android device to the location where you saved the Update File. Update files from Greentronics have a special file extension. For convenience, the App only displays sub-folders to navigate into and files with that extension to select. Select the most recently saved file and the App will exit the dialogue box.
- 5) To begin the process of uploading the Update File to the Console, press the “Begin” button. The App will display the step by step progress of connecting and uploading the file to the Console. A progress bar indicates the progress of the file upload.
- 6) With upload in progress, the Begin button is disabled.
- 7) When the upload is complete, the App will the instruct you to use the Console’s keypad to activate the new Firmware.
- 8) To upgrade the Firmware, press ENT on the Console. The Console will install the new firmware and reset itself.
- 9) On your android device, exit the App by clicking “X Close” or just “X” at the top right corner of the screen. Closing the App will delete it from your Recent App Activity history folder.

NOTE: These screen shots were taken on a device where the app was able to completely fit within the screen. On devices that have a smaller screen size the contents will extend to the height of the screen. In this case, the app will allow you to scroll the screen up and down to the various parts of the content.

12 Troubleshooting

12.1 Connection between Console and Junction Box

The Console communicates with the Junction Box to obtain sensor data. If there is a problem with the communication with the Junction Box, the status line will show:

```
Comm. error
```

If you see this message, check that the Junction Box cable is correctly connected to the Console, and that the cable has not been pinched or damaged.

In the Junction Box, check the red and green LEDs. The red LED is on whenever power is applied to the Junction Box. If the solenoid power supply connected to the Junction Box has too low a voltage (or is missing altogether), the red LED will blink.

The green “Comm” LED is on during normal operation. If the “Comm” LED is off or is blinking, there is a problem with communication. Check that the A and B wires are correctly connected.

12.2 Sensor Operation

You can check the operation of the sonar range sensors in the Test Sensors display (see section 8.1). If some sensors show “--”, try increasing the sensor sensitivity.

Note that sonar sensors have a limited range. If there is no object within 99 inches (250 cm) of the sensor, it will not show a reading (“--”). Even if there is an object closer than 99 inches (250 cm), the sensor may still not show a reading because some objects do not provide a good reflection. A typical soil surface or crop canopy will provide reliable readings up to 80 inches (200 cm) or more.

If you get a reading of “--” even when there is an object close to the sensor, there may be dirt or debris very close to the sensor. The sensors cannot reliably detect objects closer than about 10 inches (25 cm), and may not give a reading when there is an object closer than 10 inches (25 cm).

Similarly, if the reading seems to be stuck at a very low value, check for dirt or debris in front of the sensor.

If the displayed distance readings are still incorrect, check that the sensors are correctly plugged into their respective sensor cables. Check that the wires of the sensor cable are connected to the correct terminals in the Junction Box. Also check for damage to the sensors and their cables.

If a sensor reading shows “XX”, there is a problem communicating with the sensor. Check the connections and wiring to the sensor. If you see no obvious problems, you can try unbolting the sensor and plugging it into another sensor cable to see if it works there.

12.3 Boom Rocking or Overshooting

On some sprayers the RiteHeight system may move the booms too far when making height adjustments. This produces poor height control, and can result in a back-and-forth rocking motion of the booms. There are a number of ways to correct this behaviour:

- First make sure you have run the Self Calibration procedure (refer to section 10).
- Ensure that the Delay configuration parameters are not set too low (see sections 6.2 and 6.3). For an unstable boom, the Delay for Up should be at least 1.0 seconds. Also try setting the Delay for Down to a bigger value than Delay for Up (e.g. 2.0 seconds).
- Try changing the Motion Control settings to a slower setting (see section 6.14)
- Check the Quick Raise Height setting and make sure it is not set too close to the target height (see section 6.5).
- You can help stabilize boom control operation by minimizing uncontrolled motion of the boom. Ensure that any shock absorbers are in good condition, and replace them if necessary. If the boom has an auto-leveling feature, adjust it for minimum action or consider locking it out completely.
- If your boom hydraulics are very fast, it may be necessary to install flow restrictors. This reduces the hydraulic flow rate, helping to achieve stable control. You can use one-way flow restrictors to reduce the downward speed of the boom hydraulics but maintain fast upward speed.

12.4 Boom Height Corrections Too Slow

If you find the booms are not brought back to the correct height quickly enough, there are a number of things to check:

- Reducing the CONFIG Delay for Up and Down settings will cause the RiteHeight system to initiate height corrections more quickly.
- Setting the CONFIG Quick Raise Height to 10 inches (25 cm) below the target height will cause the RiteHeight system to lift the boom immediately when it gets too close to

the ground.

- The RiteHeight system can only move the booms as fast as the hydraulics will go. If your sprayer's booms seem to move too slowly, contact your sprayer dealer to see if the hydraulic speed can be adjusted. On some sprayers, restrictor orifices are installed in the lines to the boom lift cylinders. Removing these orifices or replacing them with less restrictive orifices can speed up boom movement.
- If the booms move faster going down than up, consider installing one-way flow restrictors to reduce downward speed but maintain full upward speed.

13 System Components

RH4050	Console
RH4051	Junction Box
RH4020	Long range sonar sensor in mounting bracket
WA1022-90	Sonar sensor cable: 90ft (27m)
WA1022-50	Sonar sensor cable: 50ft (15m)
RH224	Cable: Junction Box power, 2-conductor, 20ft (6m)
RH225B	Cable: Junction Box to solenoids, 6-conductor, 20ft (6m)
RH226	Cable: Junction Box extra solenoids, 2-conductor, 20ft (6m)
WA1055	Cable: Junction to Console, 50ft (15m)
RH230	Cable: Console power, 2-conductor, 10ft (3m)
RH231	Cable: Extension and disconnect for WA1055, 20ft (6m) (optional)
RH4052	Sonar Sensor Junction Box (only for sensor disconnect)
WA1026-25	Cable: Sonar Junction Box Disconnect, 25ft (7.5m, only with RH4052)
WA1027-25	Cable: Main Junction Box Disconnect, 25ft (7.5m, only with RH4052)

14 Specifications

Console supply voltage: +12VDC, 1A max.

Junction Box supply voltage: +12VDC, 15A max.

Sonar sensors:

Type:	Ultrasonic sonar range sensor, 10 degree beam angle
Range:	10" to 99" (25 to 250 cm) (depends on field conditions)
Environment:	Sealed to IP67, mounted in protective casing
Temperature:	-25C to +85C

Solenoid Control Outputs: Normally open, +12VDC, 4A max. current

Console Case: 160 x 90 x 65 mm (6.3 x 3.5 x 2.5 inches)

Junction Box Case: 160 x 160 x 65 mm (6.3 x 6.3 x 2.5 inches)

Liquid tight cable glands for all cable entries

Cases are made of impact resistant and flame retardant ABS, with gaskets to seal out moisture and dirt.

15 Abbreviated End-User Firmware License Agreement, Warranty and Limited Liability Statement

Full length version is available at www.greentronics.com/Downloads/.

Greentronics Ltd. (or “Company”) reserves the right to update its policies and agreements from time to time at its sole discretion and without prior notice to dealers and customers.

IMPORTANT! PLEASE READ BEFORE YOU INSTALL OR USE A PRODUCT OR SERVICE FROM

GREENTRONICS LTD.: Your installation or use of a product(s) or service(s) provided by Greentronics Ltd. will constitute your agreement to all terms and conditions contained in the “**Policies**”. The **Policies** include the expanded full length End-User License Agreement for the use of Firmware as well as the Product Return, Warranty and Limited Liability Statements. Company will repair or replace Products in accordance with this Abbreviated End-User License Agreement, Warranty and Limited Liability Statement and our expanded **Policies** available on our website. Greentronics Ltd. is pleased to provide a hard copy of the expanded **Policies** on request.

1. DEFINITIONS

“Firmware” shall mean software which is embedded or otherwise written in to the Read-Only Memory of the computer contained within a Greentronics Ltd. product.

“Product” shall mean any item of hardware or software, created by or for Greentronics Ltd. exclusively for the economic use and benefit of same through sale or licensing to customers and the general public.

“Service” shall mean action(s) taken by Greentronics Ltd. in support of its products including installation assistance, troubleshooting and technical support in person, by phone, email, fax or any other method.

2. WARRANTY

Greentronics Ltd. warrants to the End-User of each Product that such Product will be free from defects in materials or workmanship from the date of purchase for a period of one (1) year (the “Warranty Period”).

During this warranty period, the Company will, at its option, repair or replace defective Products or defective components thereof. This warranty is limited to the cost of the repaired or replaced product and does not cover time, labour, travel, shipping or any other expenses incurred by the Company and its OEM partners, distributors, dealers, customers and suppliers in meeting obligations herein. This warranty also does not cover damage due to external causes, including wear and tear, accident, abuse, misuse, or use or care not in accordance with Product documentation. Products for repair or replacement must be returned to Company in accordance with our Return Policy. Repair or replacement will not extend warranty except as referenced in the Return Policy. Additional warranties may be provided by suppliers of non-Company branded Products in the documentation for such Products. Company is not liable or responsible for such warranties.

3. LIABILITY

THE ABOVE LIMITED WARRANTY IS THE ONLY WARRANTY APPLICABLE TO THE PRODUCTS. TO THE MAXIMUM EXTENT PERMITTED BY LAW, COMPANY DISCLAIMS ALL OTHER WARRANTIES AND CONDITIONS, EXPRESS OR IMPLIED, IN RESPECT OF PRODUCTS OR SERVICES, INCLUDING, IMPLIED WARRANTIES, CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NO ORAL OR WRITTEN INFORMATION, GIVEN BY COMPANY, ITS AGENTS OR EMPLOYEES WILL IN ANY WAY INCREASE THE SCOPE OF THIS LIMITED WARRANTY.

COMPANY’S SOLE LIABILITY AND RESPONSIBILITY IS LIMITED TO REPAIR OR REPLACEMENT AS SET FORTH IN THIS STATEMENT. COMPANY WILL NOT BE LIABLE FOR LOST PROFITS, LOSS OF BUSINESS, LOST DATA OR DIRECT, INDIRECT, CONSEQUENTIAL, SPECIAL OR PUNITIVE DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY THIRD PARTY. YOU AGREE THAT FOR ANY LIABILITY RELATED TO THE PURCHASE OR SUPPLY OF PRODUCTS OR SERVICES, COMPANY IS NOT LIABLE OR RESPONSIBLE FOR ANY AMOUNT OF DAMAGES ABOVE THE AGGREGATE DOLLAR AMOUNT PAID BY YOU FOR THE PRODUCT OR SERVICE IN QUESTION.

SOME JURISDICTIONS DO NOT PERMIT SOME OF THE FOREGOING EXCLUSIONS, CONDITIONS OR LIMITATIONS. THEREFORE THE FOREGOING DISCLAIMERS MAY NOT APPLY TO YOU.

4. Agreements Incorporated by Reference

This Abbreviated End-User License Agreement, Warranty and Limited Liability Statement and the “**Policies**” including their respective terms form parts of the same Agreement. Together, the “**Policies**” constitute the entire Agreement between You and Greentronics Ltd. in respect of warranties, representations and liability.

5. Inconsistencies and Avoidance of Conflicts

Notwithstanding section 4, in the event that any provision of this Abbreviated version conflicts or is inconsistent with our “**Policies**”, the “**Policies**” will govern to the extent of the inconsistency.

16 Important Notes Related to Product Return Process

Return of Goods procedure

The details below, as well as other details, are available under “Policies” at www.greentronics.com/Downloads.

During the first 30 days from the invoice date, the User may apply for an agreement to return goods for credit. Goods may only be returned with the prior written consent of Greentronics Ltd. The steps to follow are described under “What to do in case of unsatisfactory performance or defects?” below.

Greentronics Ltd. reserves the right to withhold a 25% restocking fee. Returned goods must be in “as new” condition. Further deductions may be applied for goods returned in unsatisfactory condition. Damaged goods will be rejected.

To return Products, you must ship the Products to Company in their original condition, and in original packaging or other packaging suitable for that purpose, prepay shipping charges and accept the risk of loss or damage during shipment. Shipping goods to Company for return will constitute your understanding and acceptance of the foregoing.

What to do in case of unsatisfactory performance or defects?

Sometimes problems are not due to product limitations or defects, but due to incorrect wiring connections, set-up issues, or wrong installation or operation. Most of those problems can be solved quickly and without any expense by re-reading the installation and operation manual and, failing that, with technical assistance via telephone or email from your dealer or Greentronics Ltd.

User satisfaction with our product is of primary importance to Greentronics Ltd. From time to time, a product may not perform as expected. If one of its products fails to perform as needed, User may apply for a Return Merchandise Authorization (“RMA”) number during the first 30 days from invoice date. An RMA will only be issued if User has made use of all the technical support that the retailing dealer and/or Greentronics Ltd. has been able to provide. No RMA will be issued and no credit offered prior to the request for, and the provision of technical assistance by either dealer or Greentronics Ltd. Once User has received an RMA, the steps described below must be followed to return the product and be eligible for a credit.

In the event a product proves defective within the warranty period, complete the simple steps described below to qualify for repairs, replacement, or credit as applicable under warranty. Note that the identical process must be followed if you want to have defective products repaired **outside** the warranty period, or if you are returning complete products within 30 days from the invoice date.

1. Within 30 days of reporting the problem, User must request an RMA (Return Merchandise Authorization) number. If you purchased your product through a dealer, you must send this request to the dealer who will complete the steps below for you. If your product was purchased direct from Greentronics Ltd., call or email Greentronics Ltd. with your request. Provide the following details with each RMA request and keep copies with the items you are planning to return:

- Product name, model, serial number, purchase date and invoice number.
- A brief written description of the reason for the return.

2. Once Greentronics Ltd. consents and issues an RMA#, you, the User or your dealer must complete the next few steps:

·Prepare the return shipment by ensuring the items are clean and free of any chemical contamination. This is important! Dirty or contaminated items will not be accepted, and will be returned to the sender at their expense.

·Package the item(s) in a proper box complete with the details you prepared in Step 1.

·Clearly write the RMA# on the outside of the package and send it freight pre-paid to Greentronics Ltd., **75 Arthur St N, Elmira, ON N3B 2A1 Canada**.

3. Once the parcel arrives at Greentronics Ltd., the items will be examined within a reasonable amount of time to categorize the return as:

- A) New merchandise return due to unsatisfactory performance
- B) Warranty Repair
- C) Out of Warranty Repair.

For A): The item(s) will be examined for cleanliness, contamination and damage, then tested thoroughly to determine functionality. If necessary, repairs and adjustments will be made to bring the item(s) back to original specifications.

Labour and parts costs plus a restocking fee will be applied against any credit. A cheque for the net credit will be issued to you.

For B): The item(s) will be examined for cleanliness and contamination. At its discretion, Greentronics Ltd. will repair or replace the item(s) with a comparable item at no charge and prepare a return to the customer via prepaid freight. The returned item(s) will carry the remainder of the warranty period. Note, labour and return freight charges will be invoiced in cases where items returned under warranty show no fault after diagnostic tests.

For C): After an examination for cleanliness and contamination, the item(s) will go through diagnostic tests to determine the reason for the defect. A repair estimate including estimated return freight costs will be prepared and communicated to you. At that point you must decide and inform Greentronics Ltd. within five business days whether the item(s) are to be repaired, returned "as is", or scrapped. Any repairs must be prepaid according to the estimate. Greentronics Ltd. will not return repaired items until all taxes and charges have been paid in full. All repaired or replaced out of warranty item(s) will carry a 90-day warranty from the date of return to you.