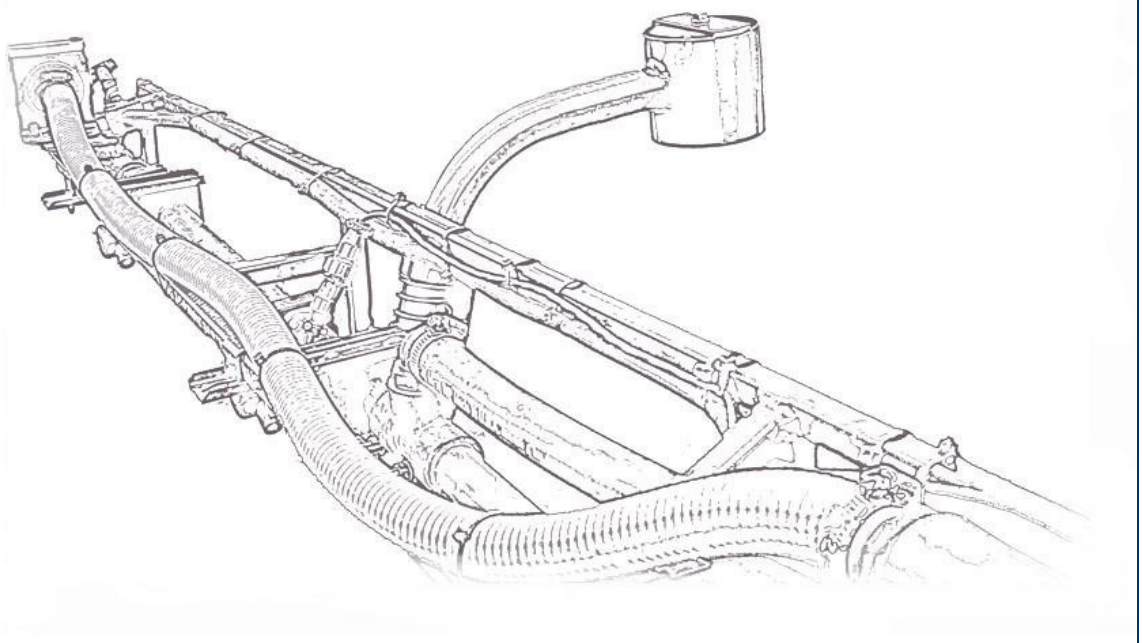
NORAC®

UC5™ CAN BUS Spray Height Control System



Rogator 700 Series Aftermarket Installation Manual

RG13

Printed in Canada
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Reorder P/N: UC5-BC-RG13-INST Rev D (Rogator 700 Series Aftermarket)

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

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1 Introduction

Congratulations on your purchase of the NORAC UC5 Spray Height Control System. This system is manufactured with top quality components and is engineered using the latest technology to provide operating reliability unmatched for years to come.

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

Please take the time to read this manual completely before attempting to install the system. A thorough understanding of this manual will ensure that you receive the maximum benefit from the system.

Your input can help make us better! If you find issues or have suggestions regarding the parts list or the installation procedure, please don't hesitate to contact us.

⚠ Important

Every effort has been made to ensure the accuracy of the information contained in this manual. All parts supplied are selected to specially fit the sprayer to facilitate a complete installation. However, NORAC cannot guarantee all parts fit as intended due to the variations of the sprayer by the manufacturer.

Please read this manual in its entirety before attempting installation.

2 Technical Specifications

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

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

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

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

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

Table 1: System Specifications

Supply Voltage (rated)	12VDC
Supply Current (rated)	10A
Hydraulic Pressure (maximum)	3300 psi
Baud Rate	250 kbps
Clock Frequency (maximum)	96 MHz
Solenoid Valve PWM Frequency	300 Hz
Ultrasonic Sensor Transmit Frequency	50 kHz
Operating Temperature Range	0°C to 80°C

3 General UC5 System Layout

Figure 1 illustrates the general layout of the UC5 system components:

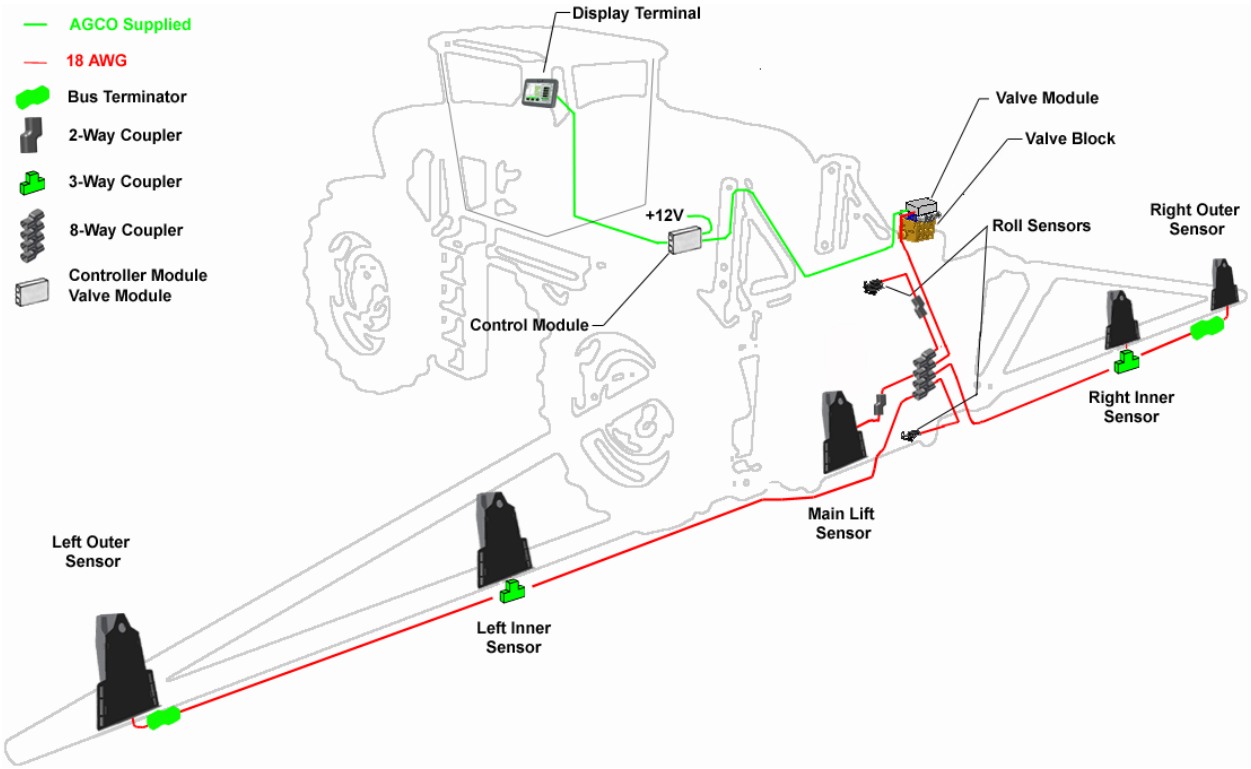


Figure 1: General UC5 System Layout

Important

Do not use high speed power tools/drills when installing hardware.

Important

The use of dielectric grease is not recommended on any NORAC electrical connections.

Important

To ensure all stainless steel hardware does not gall or seize apply a light coating of the supplied Permatex Anti-seize grease to all threaded parts upon installation. Permatex Anti-seize lubricant is preferred, but other similar anti-seize products may be used.

4 Kit Parts

4.1 Kit Overview

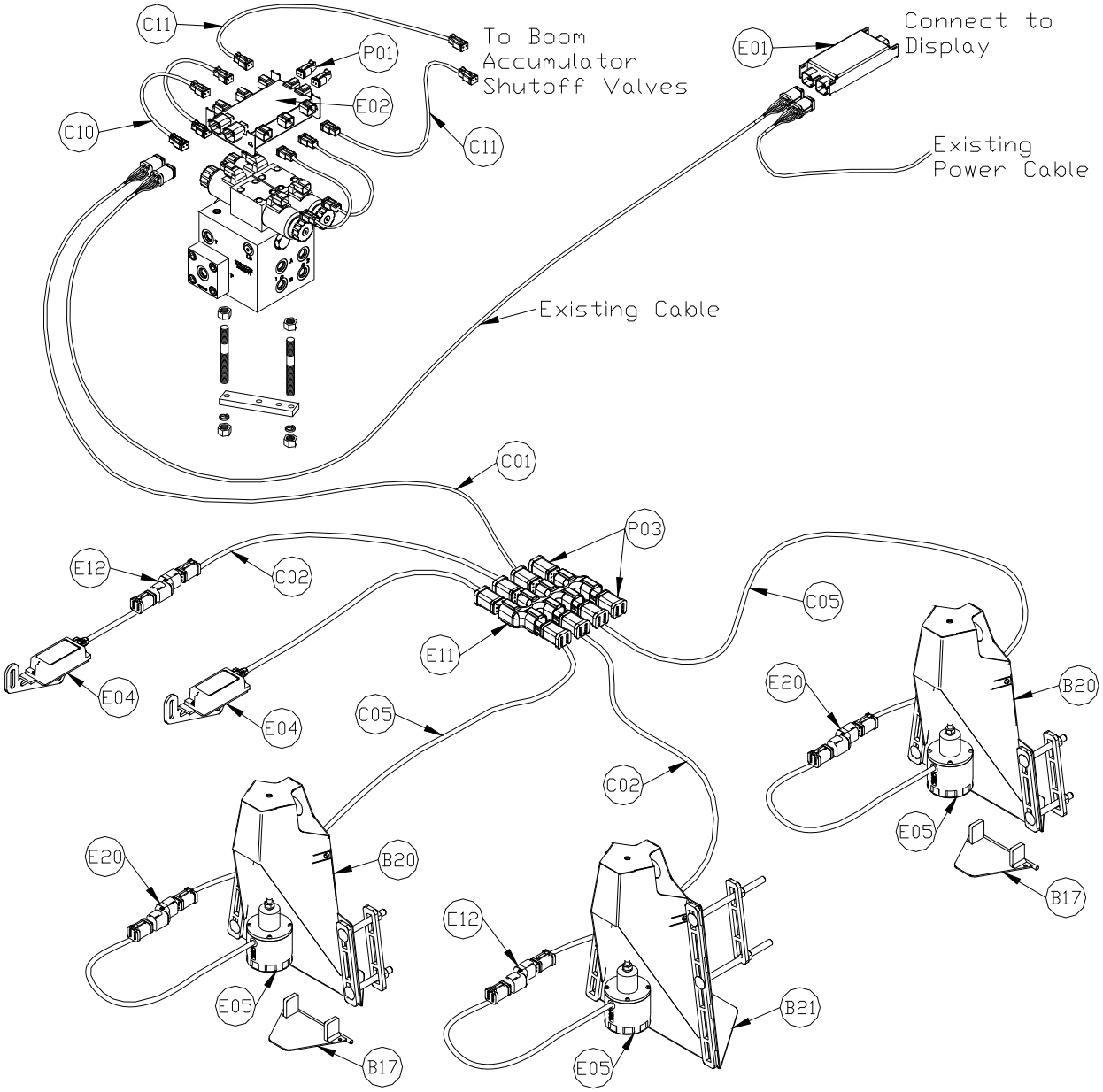


Figure 2: RG13 System Parts

4.2 Hydraulic Plumbing

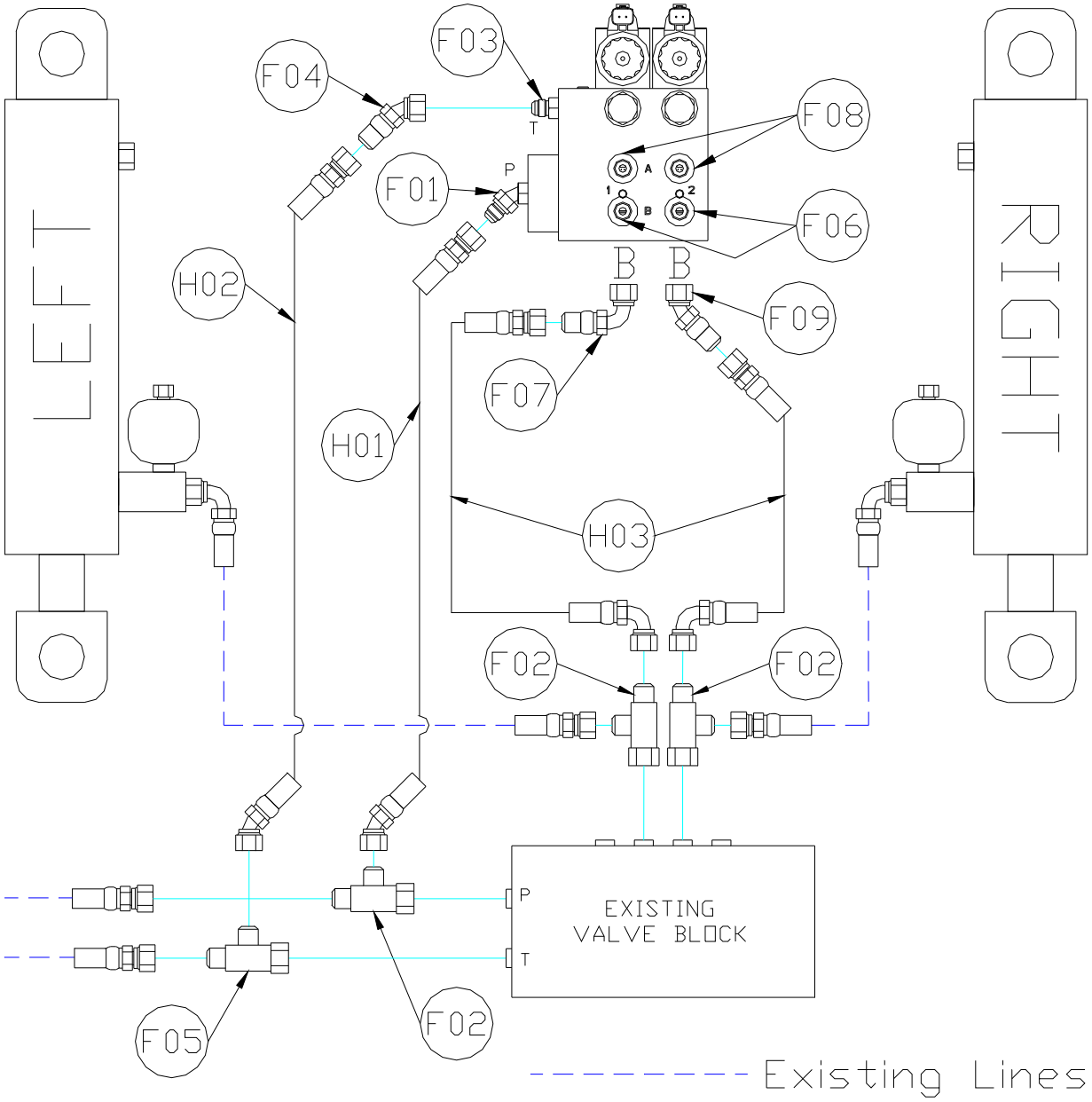


Figure 3: RG13 Hydraulic Plumbing

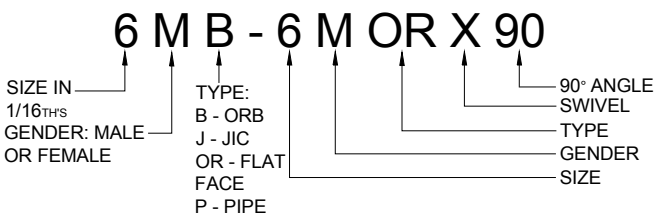
4.3 List of Parts

Item	Part Number	Name	Quantity
B05	44706-01	KIT CABLE TIE BLACK 10 PCS 21 IN 150 PCS 7.5 IN	1
B17	44972	SENSOR MOUNTING BRACKET LOW PROFILE RAINFLAP 16GA	2
B20	44971	SENSOR MOUNTING BRACKET LOW PROFILE 16GA	2
B21	44973-02	SENSOR MOUNTING BRACKET LOW PROFILE 16 GA LARGE FLANGE TALL CLAMP	1
C01	43220-01	CABLE UC5 NETWORK 14 AWG 1M	1
C02	43220-03	CABLE UC5 NETWORK 14 AWG 3M	2
C05	43210-15	CABLE UC5 NETWORK 18 AWG 15M	2
C10	43230-04	CABLE UC5 VALVE 2PIN DT TO 2PIN DT	4
C11	43230-07	CABLE UC5 VALVE 2PIN DT TO 2PIN DT (L = 84")	2
E01	43710	UC5 CONTROLLER MODULE	1
E02	43720	UC5 VALVE MODULE	1
E04	43741	UC5 ROLL SENSOR VER. 2	2
E05	43750	UC5 ULTRASONIC SENSOR	3
E11	43765	UC5 NETWORK COUPLER 8-WAY	1
E12	43764	UC5 NETWORK COUPLER 2-WAY	2
E20	43764T	UC5 NETWORK COUPLER 2-WAY WITH TERMINATOR	2
H01	44863-61	HOSE ASSEMBLY 122R2-06 32IN L 6FORX 6FORX45	1
H02	44864-06	HOSE ASSEMBLY 122R2-08 18 IN L 8FORX 8FORX45	1
H03	44863-62	HOSE ASSEMBLY 122R2-06 12 IN L 6FORX 6FORX90	2
H10	44865-69	HYDRAULICS FITTING KIT - RG13	1
H20	106685	ACCUMULATOR LOCKING COIL	2
H21	106686	ACCUMULATOR LOCKING SOLENOID VALVE	2
M01	UC5-BC-MANUAL-AGCO-RMC	MANUAL UC5 OPERATORS - AGCO RMC	1
M02	UC5-BC-RG13-INST	MANUAL INSTALLATION UC5 ROGATOR 700 SERIES AFTERMARKET	1
P01	106034	UC5 NETWORK 2 PIN PLUG	2
P03	105882	UC5 NETWORK 6 PIN PLUG	2
V01	44963D	VALVE BLOCK ASSEMBLY 2 STATION CC/LS PROP DT 4 BOLT	1

4.4 Hydraulic Fitting Kit Details (P/N: 44865-69)

Item	Part Number	Name	Quantity	Picture
F01	106617	MALE ADAPTER - 6MB 6MOR45	1	
F02	104586	TEE ADAPTER - 6FORXR 6MORT	3	
F03	105151	MALE TO MALE ADAPTER - 6MB 8MOR	1	
F04	106618	MALE TO FEMALE ADAPTER - 8FORX 8MOR45	1	
F05	104885	TEE ADAPTER - 8FORXR 8MORT	1	
F06	44917	MALE ADAPTER - 6MB 6MOR	2	
F07	104590	ELBOW ADAPTER - 6MOR 6FORX90	1	
F08	104369	PLUG - 6MBP	2	
F09	106619	MALE TO FEMALE ADAPTER - 6MOR 6FORX45	1	

Fitting Name Example:



5 Pre-Install Checklist

The pre-install checklist is necessary to check the existing sprayer functionality before the installation.

1. Unfold the sprayer over a flat, unobstructed area (i.e. no power lines…etc.).
2. Ensure all boom-fold operations are functional (place a check mark in boxes below).
3. Bring engine to field-operational RPM and record below.
4. Record the time (seconds) it takes for a full stroke for all boom functions. To ensure repeatable measurements, take the average of 3 trials.
5. Not all sprayers will have the functions listed below in **Figure 4**.

⚠ Important

Ensure the boom has sufficient travel so it does not contact the ground during these tests.

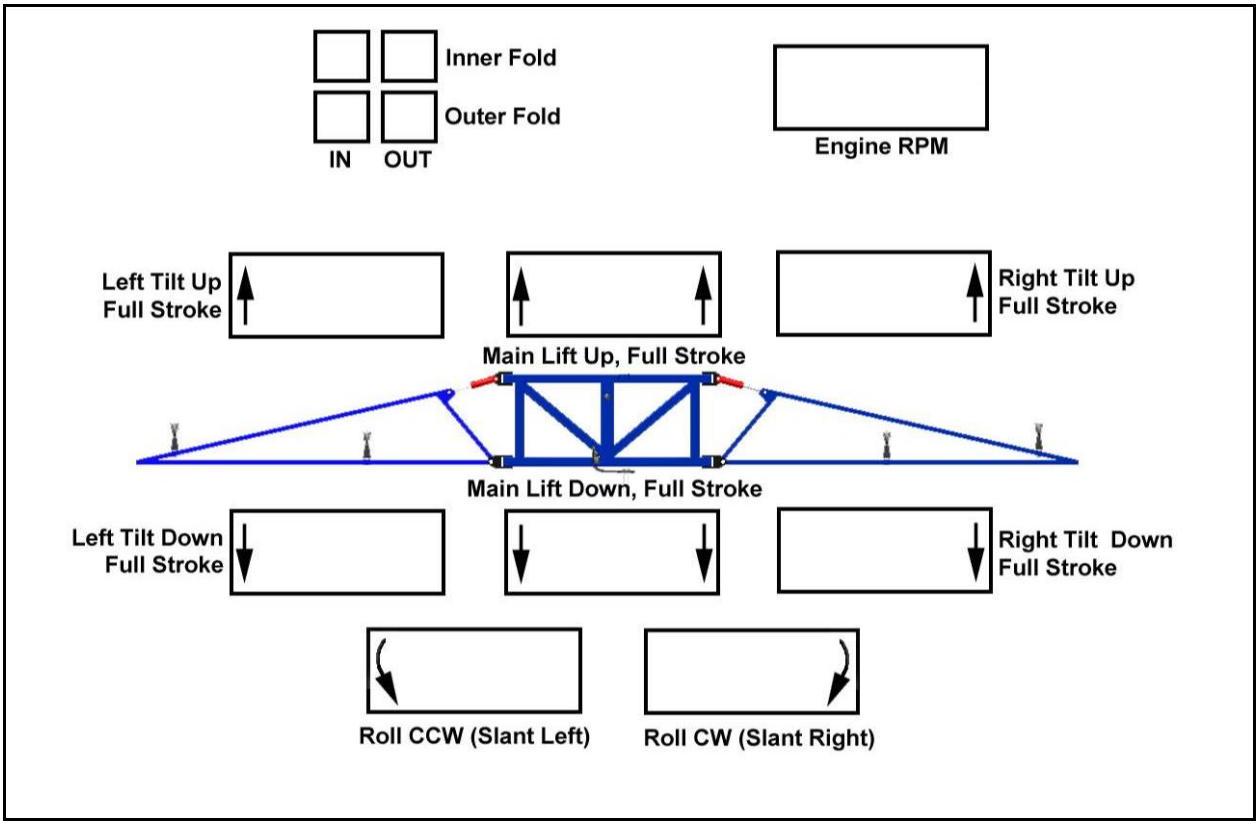


Figure 4: Pre-Install Boom Speeds

6 Ultrasonic Sensor Installation

6.1 Ultrasonic Sensor Serial Number Arrangement

When installing the UC5 sensors, start with the smallest serial number on the left-hand side, and proceed to the largest serial number on the right hand side. Each UC5 sensor has a serial number stamped on the sensor housing.

Apply a light coating of the supplied Permatex Anti-seize grease to all threaded parts upon installation.

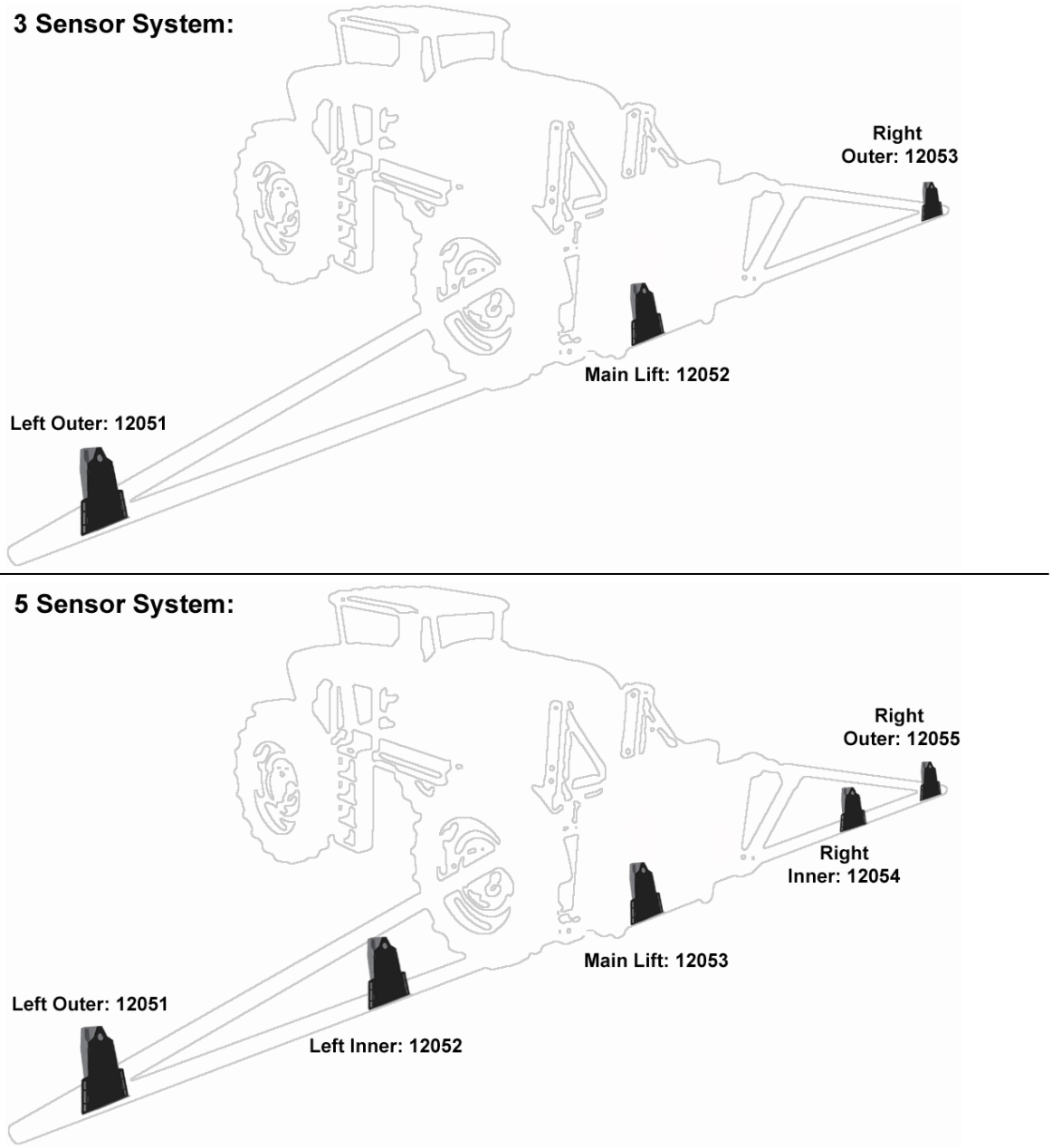


Figure 5: Sensor Serial Number Arrangement

6.2 Ultrasonic Sensor Mounting Guidelines

The following guidelines will ensure optimal sensor performance and prevent sensor measurement error. These rules should be followed for both the wing sensors and the main lift (middle) sensor.

1. In its lowest position, the sensor must be 9 inches (23 cm) or more from the ground.

2. Ensure that there are no obstructions within a 12-inch diameter circle projected directly below the center of the sensor.

3. The sensor should be approximately vertical at normal operating heights.

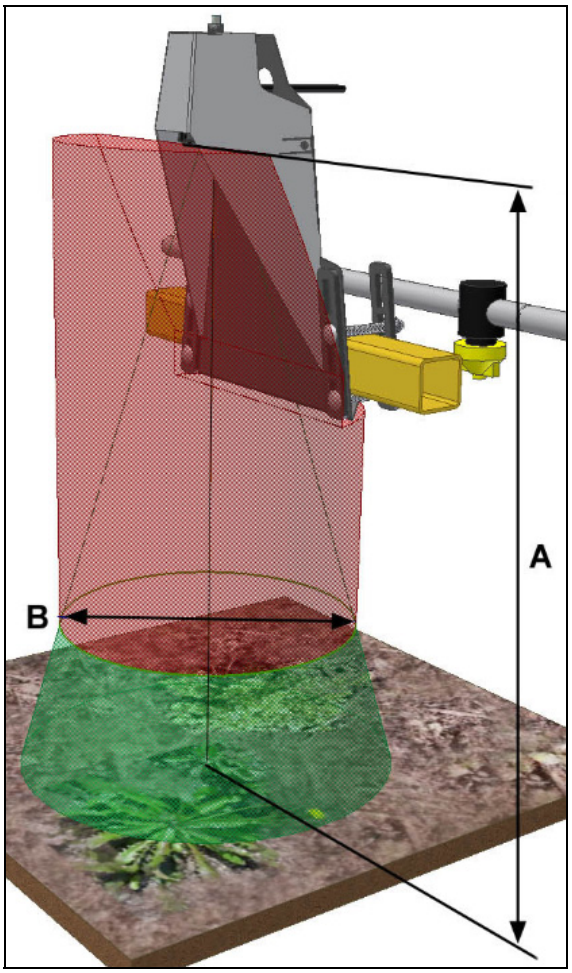


Figure 6: Sensor Mounting Guidelines

6.3 Low Profile Bracket Mounting Guidelines

1. Minimize the distance between the bolts to prevent bending the bracket and prevent the bracket from loosening over time.

2. Ensure the bracket is mounted tight against the bottom of the boom, minimizing the distance between the boom structure and the angled flange.

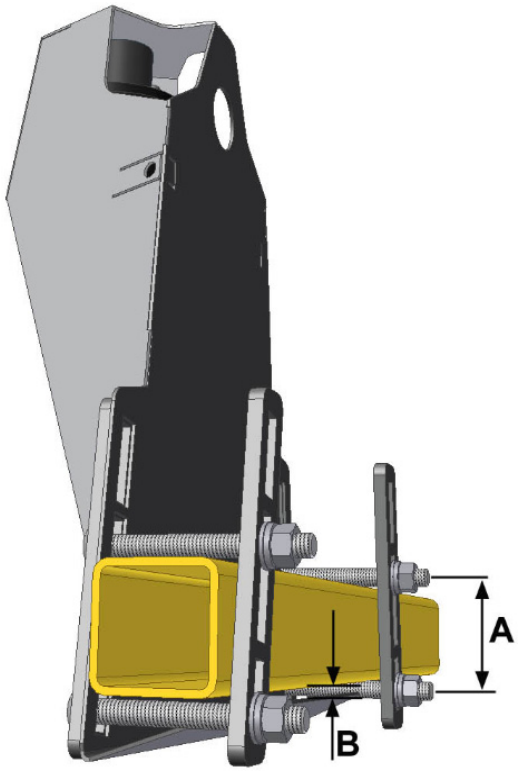


Figure 7: Bracket Mounting Guidelines

Important

A problem can arise if a sensor is not mounted correctly. It is possible for the sensor to read off of the boom instead of the ground. This may only become apparent once the control system is switched from soil to crop mode.

Also be careful that the sensor bracket does not collide with any other part of the boom when the boom is folded to transport position. If possible, mount the sensor brackets while the booms are folded to ensure they will not cause interference.

6.4 Wing Sensor Installation

1. The wing sensor mounting brackets (B20) are the two brackets with the shorter mounting flange.

2. The sensor bracket should be oriented forward (ahead of the boom).

3. Typically the best mounting location for the wing sensor brackets will be near the end of the boom tips, approximately 5 feet (1.5 m) from the end.

4. Mount the NORAC UC5 ultrasonic sensor into the sensor bracket and run the sensor cable either through hole in the back or through the side cut-out and behind the bracket. Ensure the cable is clear of moving parts and will not be damaged during folding.

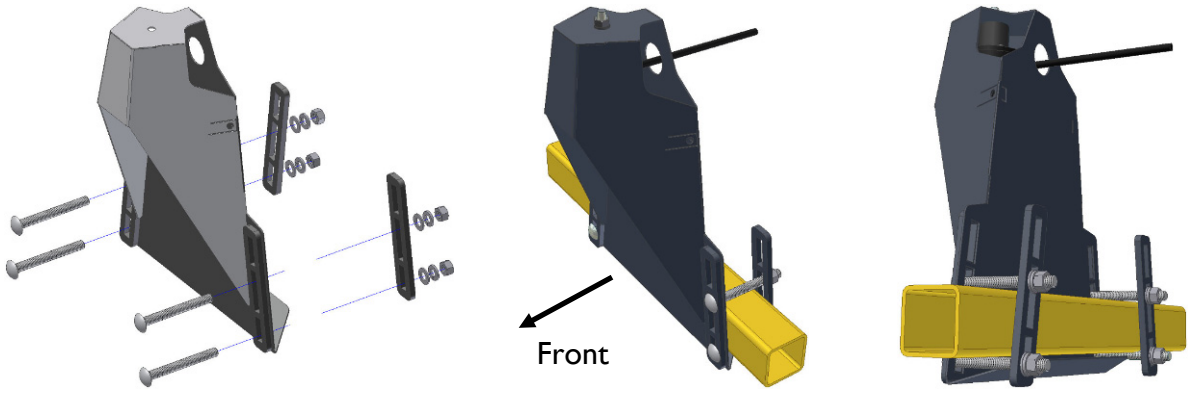


Figure 8: Bracket Mounting Example

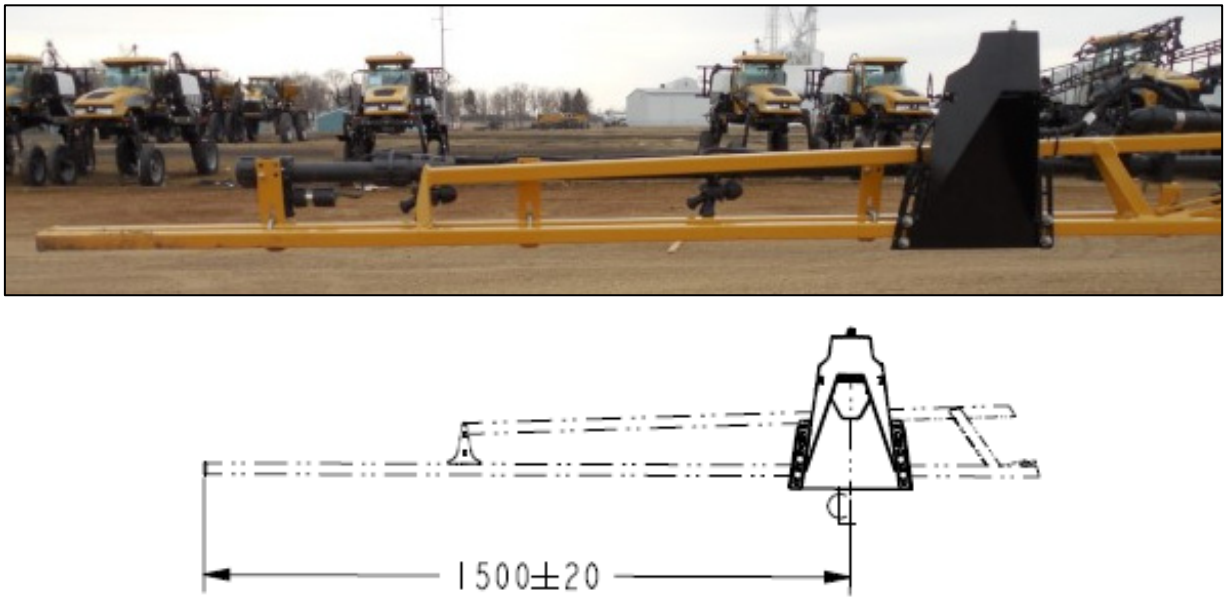


Figure 9: Mounted Wing Sensor Bracket (Distance is mm)

6.5 Rainflap Installation

Important

Rainflaps are only installed in the wing sensor brackets.

1. Insert one side of the rainflap rod into the pre-bent hinge tab on the sensor bracket. (**Figure 10**)

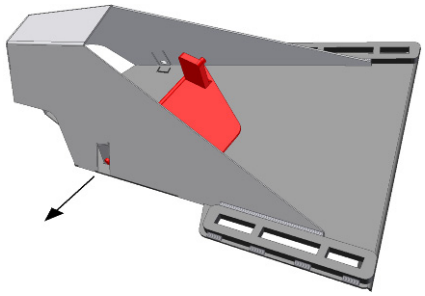


Figure 10: Rainflap Rod in Pre-Bent Hinge Tab

2. Align the other side of the rainflap rod with the unbent hinge tab. (**Figure 11**)

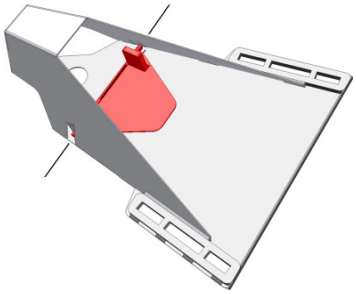


Figure 11: Align Rainflap Rod

3. Bend the hinge tab inward over the rainflap rod until the hinge tab fits securely in the detent groove on the backside of the sensor bracket. (**Figure 12**)

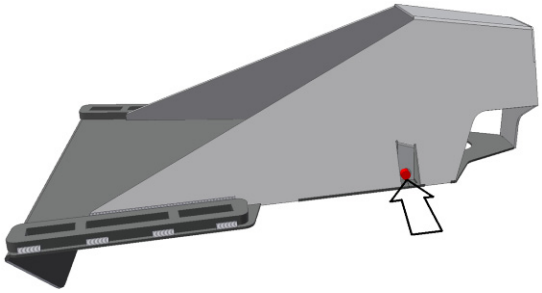


Figure 12: Bend Rainflap Hinge Tab

4. Ensure the rainflap actuates smoothly when the bracket is turned upside down and returns to the open position when the sensor bracket is returned to its operating position (sensor pointing downwards toward the ground).

6.6 Main Lift Sensor Installation

1. The main lift mounting bracket (B21) is the bracket with the longer mounting flange.

2. Mount the bracket as shown in **Figure 14**.

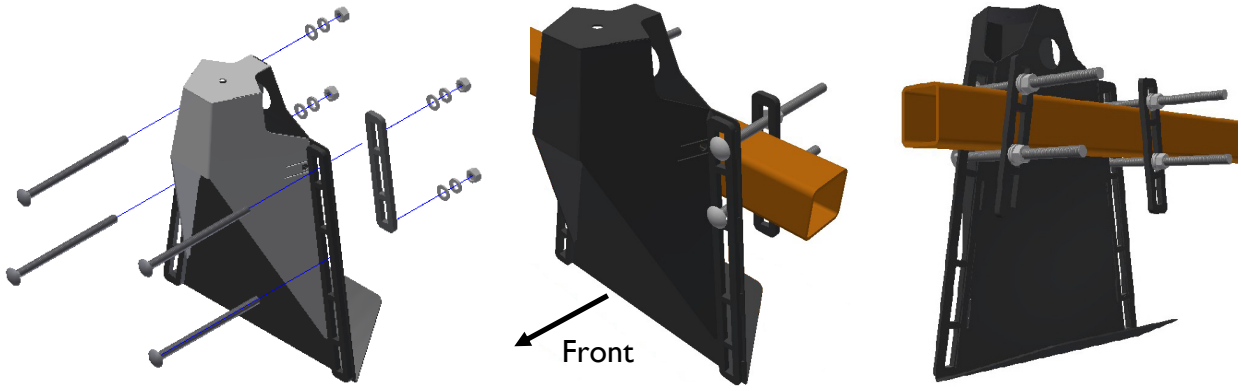


Figure 13: Bracket Mounting Example

3. Mount the ultrasonic sensor to the main lift bracket. Run the sensor cable through hole and behind the bracket.

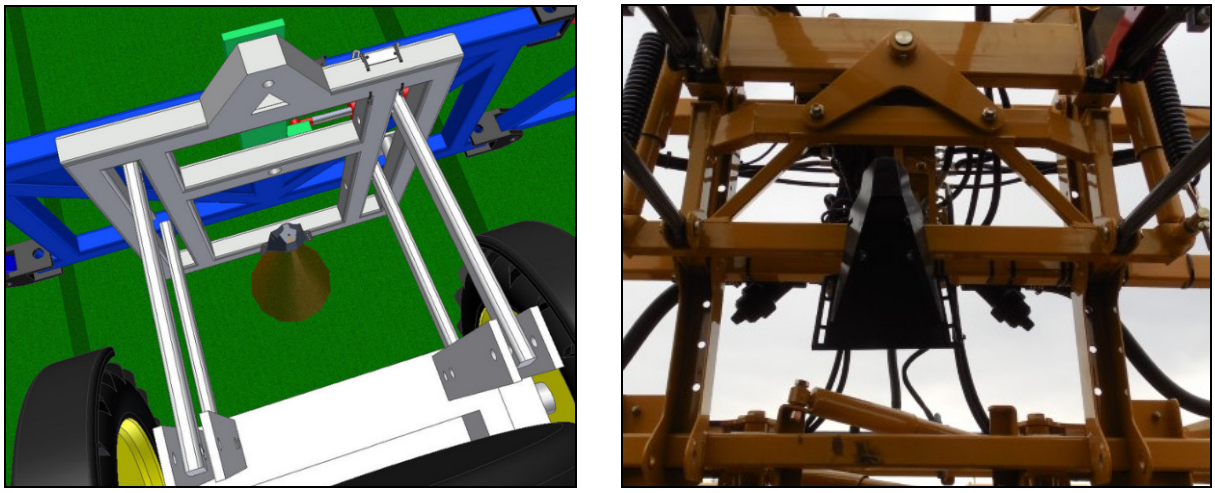


Figure 14: Example Mounting of the Main Lift Bracket

⚠ Important

Avoid mounting the main lift sensor over or near a wheel-track. Measurements from the wheel-track do not provide an accurate crop height and will cause measurement and control error.

Ensure the bracket does not collide with any other part of the sprayer throughout the full range of main lift motion.

7 Roll Sensor Installation

7.1 Bracket Assembly

1. Securely mount the roll sensors to the included roll sensor brackets using the #6 machine screws. Tighten screws to 10 in-lbs (1.1 Nm).

2. The orientation of the mounted roll sensor to the roll sensor bracket will depend on the bracket mounting. The roll sensor CANbus connector must be pointing towards the right side of the sprayer (when looking from the rear of the sprayer).

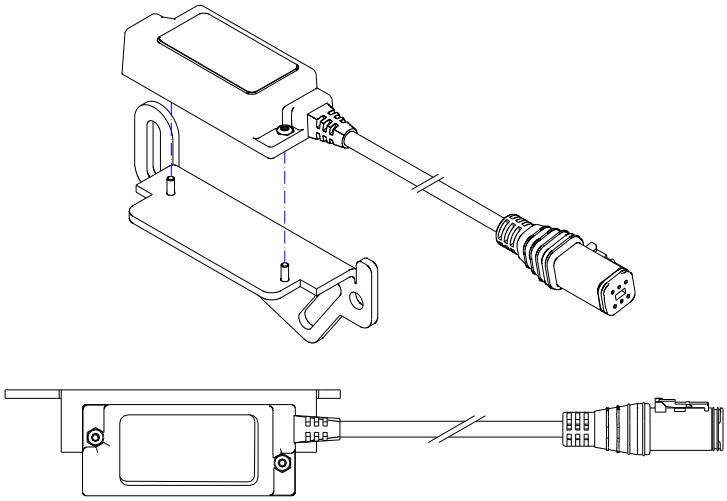


Figure 15: Mounting Roll Sensor to Bracket

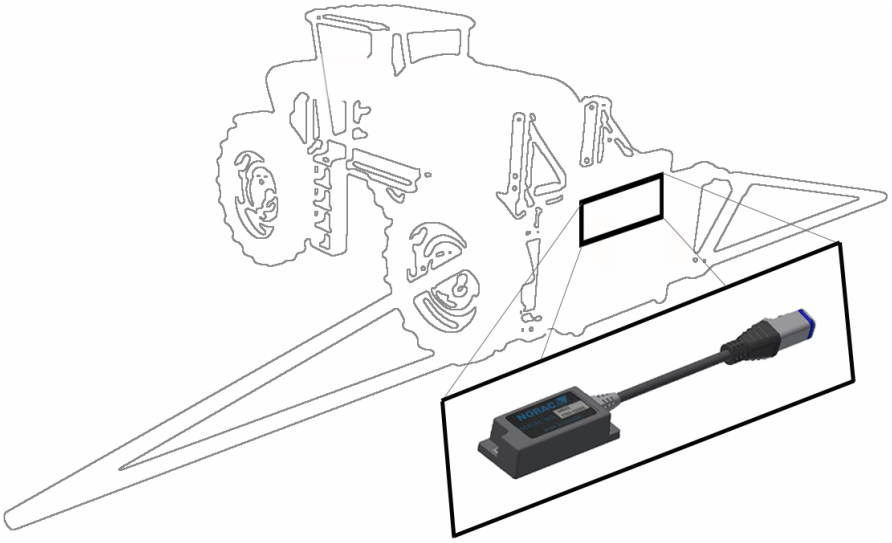


Figure 16: Roll Sensor Orientation - Connector Facing Right Wing

7.2 Roll Sensor Mounting Guidelines

1. When mounting the roll sensors, mount one to the boom frame (Figure 19) and one to the chassis (Figure 17) (non-pivoting portion of the sprayer). If the mounting plate shown in Figure 17 is not installed, use cable ties to mount the chassis roll sensor as shown in Figure 18.

2. Both roll sensor cables should be pointing towards the right hand wing of the sprayer.

3. Ensure both roll sensor cables provide enough slack to allow sufficient boom roll.

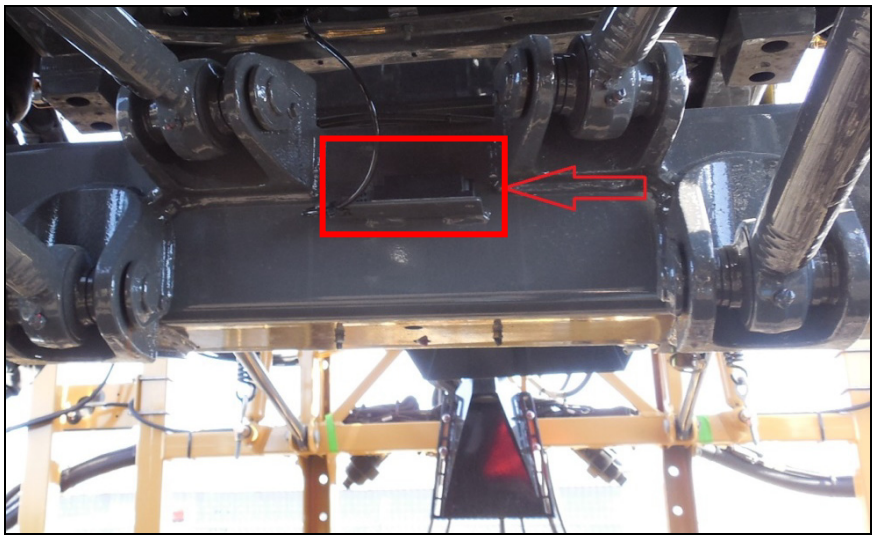


Figure 17: Chassis Roll Sensor Mounting

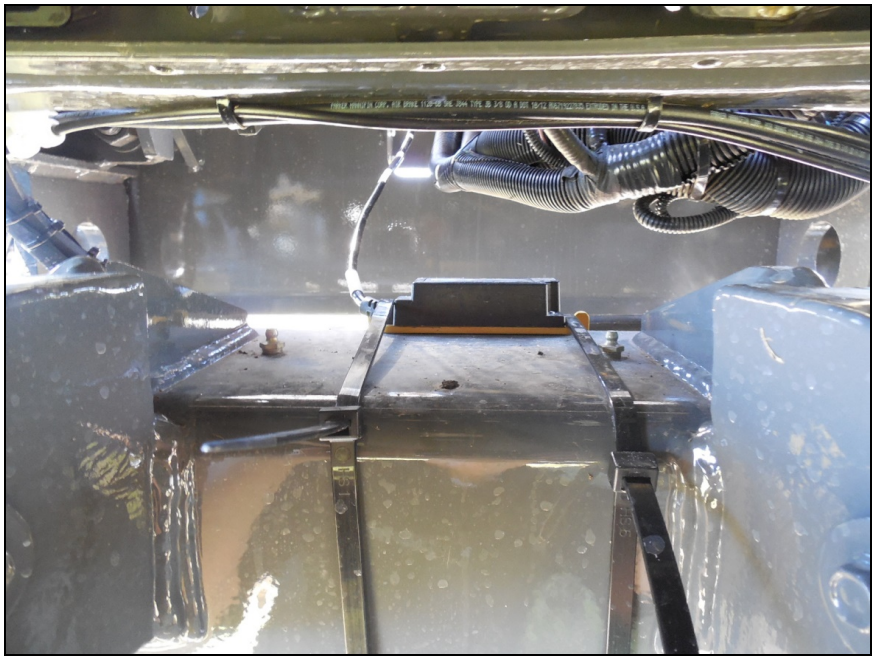


Figure 18: Alternate Chassis Roll Sensor Mounting

Figure 19: Boom Frame Roll Sensor Mounting

8 Module Installation

8.1 Control Module

1. Refer to **Figure 1** and **Figure 20**.
2. Securely mount the control module (E01) inside the electrical box (Figure 21).
3. All cables that connect to the control module are located in the electrical box.
4. Connect the cable marked "NORAC C1" to the end of the control module with only one Deutsch connector.
5. Connect the cables marked "NORAC C2" and "NORAC C3" to the control module CANbus connectors.

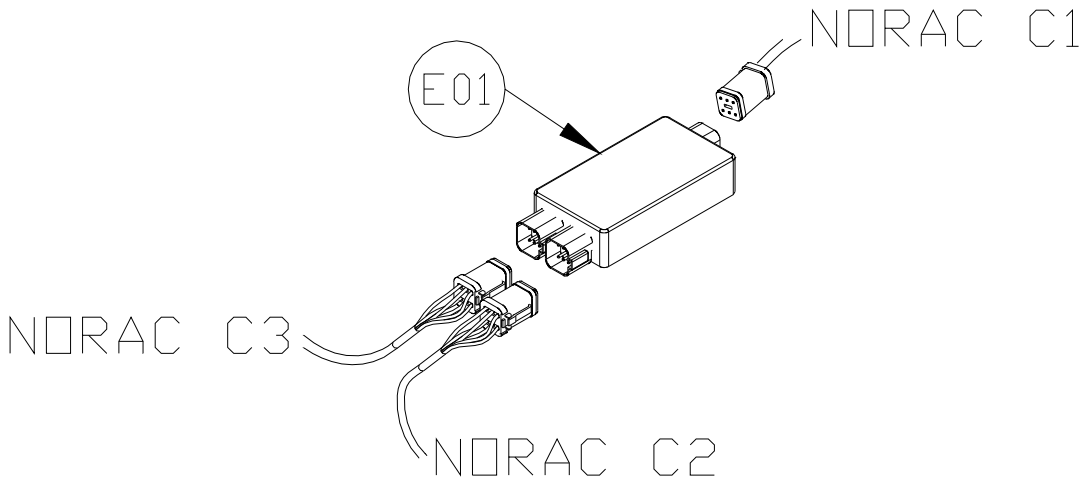


Figure 20: Control Module Mounting

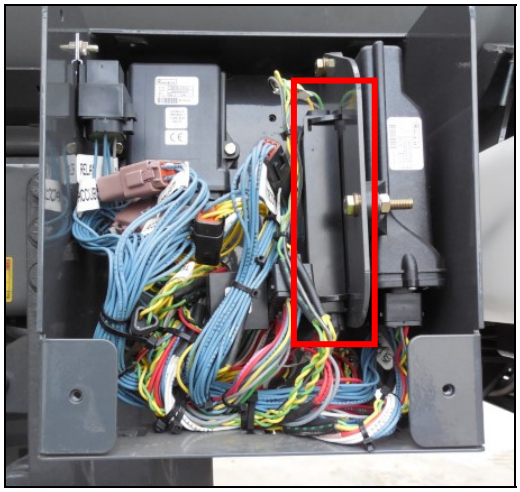
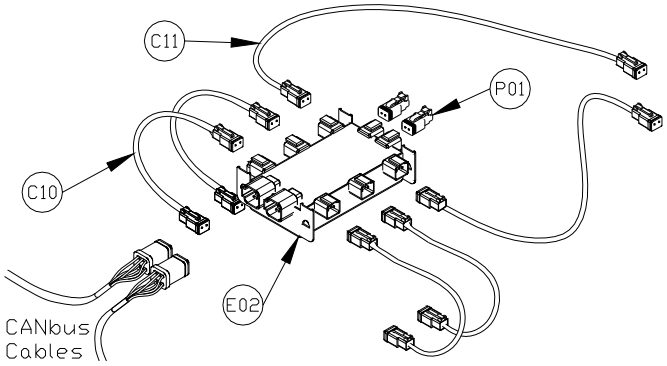


Figure 21: Control Module Location

8.2 Valve Module

1. Install the valve module (E02) to the top of the NORAC valve block. Orient the 6-pin Deutsch (CANbus) connectors towards the "P" and "T" ports with the label facing up.



Output Number	Normal Function
1	Left Up
2	Left Down
3	Right Up
4	Right Down
5	Left Accumulator
6	Right Accumulator
7	Option 3
8	Option 4

Figure 22: Valve Module

2. Verify the valve coil connectors are oriented vertically (**Figure 23**).

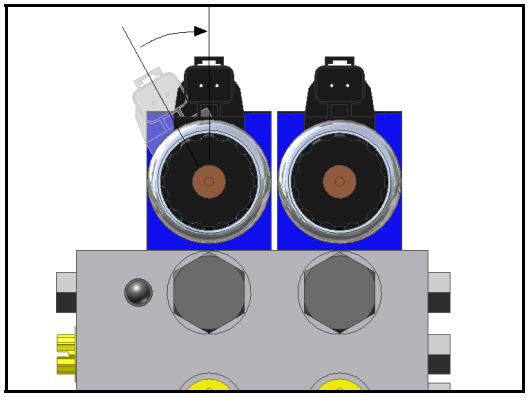


Figure 23: Align Coils

3. Place the valve module between the valve coils. Slide a valve mounting bracket over the connectors of the valve module and the valve coil connectors. This may require flexing the plastic bracket slightly (**Figure 24**). Ensure the bracket is pushed over the connectors far enough to allow the clips to engage behind the valve connectors.

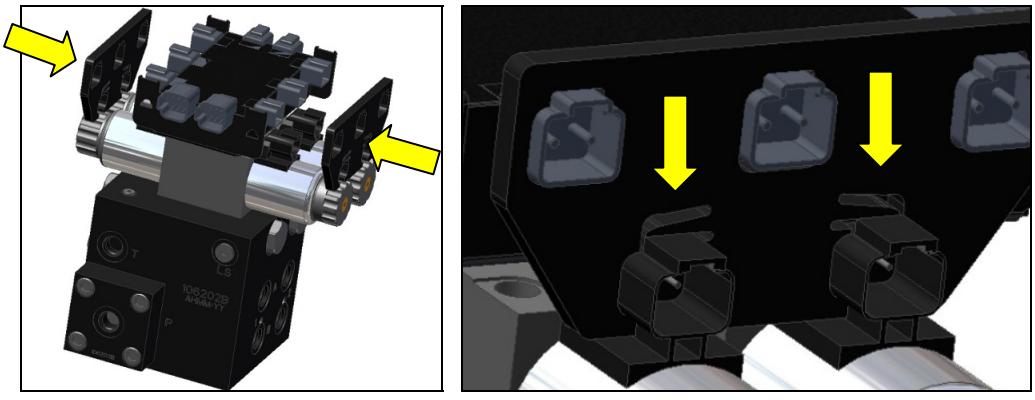


Figure 24: Valve Module Bracket Installation

4. Connect one of the valve module CANbus connectors to the existing cable labeled "NORAC" running to the rear of the sprayer from the electrical box. Route cable C01 from the other CANbus connector to the 8-way coupler (E11).

5. With the valve module securely mounted to the valve block, connect the valve cables (C10), to the valve coils.

6. If locking valves are not installed on the accumulators, install H20 and H21 onto the accumulators.

7. Connect cable C11 from the valve module channel 5 connector to the left boom accumulator shutoff valve.

8. Connect cable C11 from the valve module channel 6 connector to the right boom accumulator shutoff valve.

Figure 25: Boom Accumulator Shutoff Valve

9. Insert the 2-pin plugs (P01) into the unused 2-pin connectors on the valve module.

10. Connect the temperature probe to the valve block using the supplied 3/8" x 1/2" hex bolt.

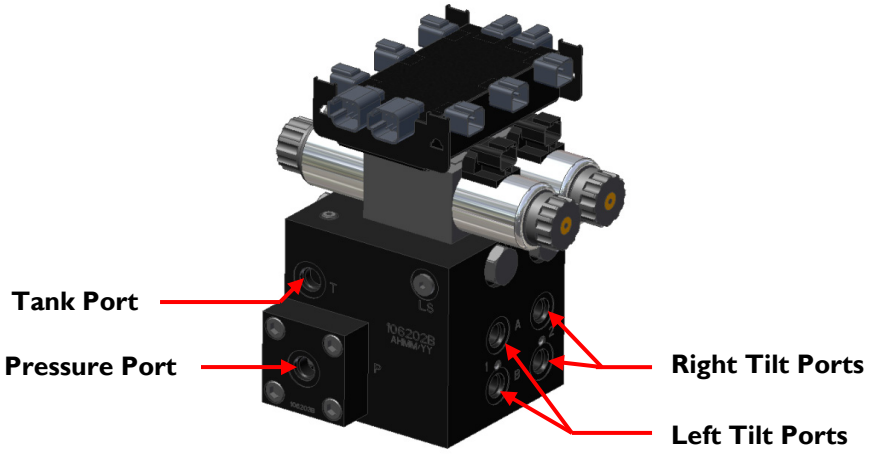


Figure 26: Valve Module - Valve Coil Connections

9 Hydraulic Installation

Warning!

Ensure all pressure has been bled from the system before disconnecting any lines or fittings. Hydraulic pressure will exist on the wing tilt circuits unless the wings are being supported by other means. The hydraulic installation may be performed with the wings in transport position, resting on the ground or with the tilt cylinders fully extended.

Important

Component failure due to oil contamination is not covered under the NORAC UC5 system warranty. It is recommended that a qualified technician perform the hydraulic installation.

9.1 Valve Assembly

1. On a clean surface remove the plastic plugs from the block.
2. Install the 6MB 8MOR (F03) fitting into the "T" port. Tighten to 18 ft-lbs (24 Nm).
3. Install the 6MB 6MOR45 (F01) fitting into the "P" port. Tighten to 18 ft-lbs (24 Nm).
4. Install the 6MB 6MOR (F06) fittings into the "B" ports. Tighten to 18 ft-lbs (24 Nm).
5. Install the 6MBP (F08) plugs into the "A" ports. Tighten to 18 ft-lbs (24 Nm).

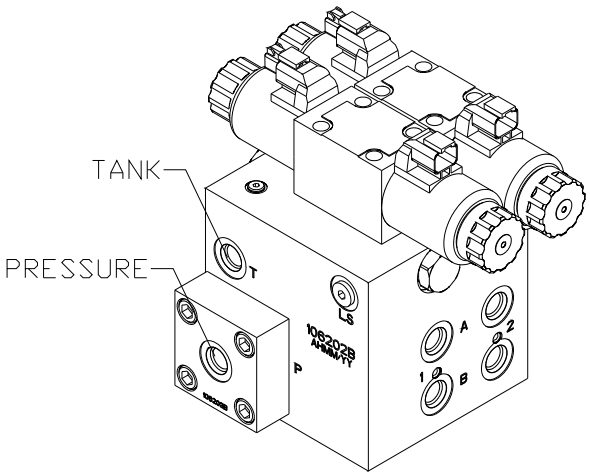


Figure 27: NORAC Valve Block Details

9.2 Valve Block Mounting

1. A suitable mounting location for the valve block on the Rogator 700 is illustrated in **Figure 28**.

2. Insert the threaded rod into the block and use a hex nut to hold the rod. The block holes are 3/8" NC-1" deep. If bolts are used instead of the threaded rod, ensure the bolts thread in at least 3/8".

3. Use the remaining hardware to secure the block to the sprayer.

4. Cut off excess threaded rod, if necessary.

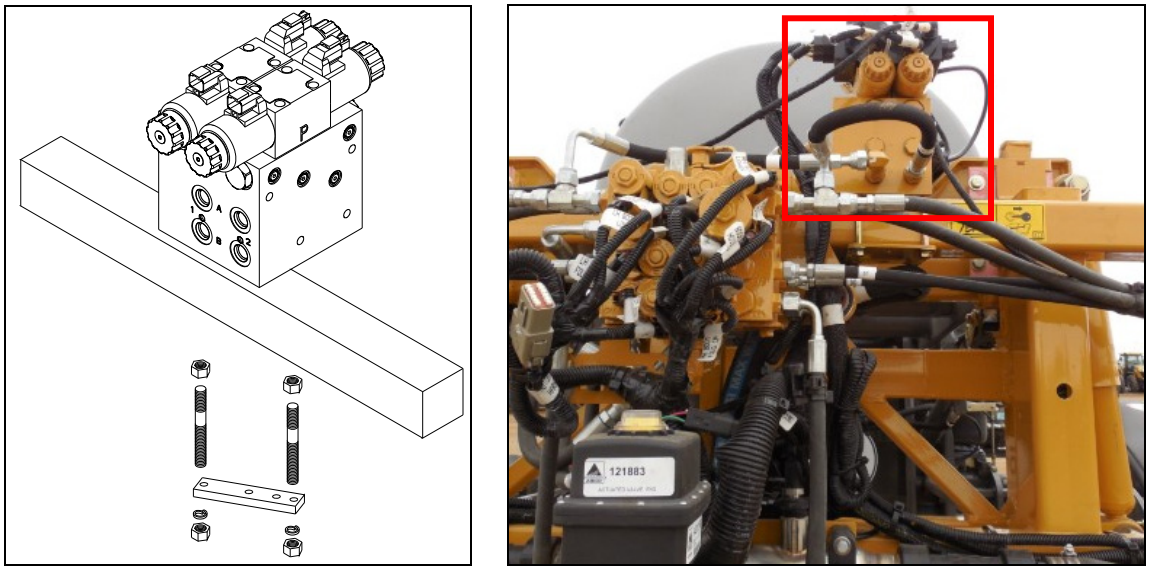


Figure 28: Valve Block Mounting

9.3 Hydraulic Plumbing

Warning!

From this point on in the installation the booms will be inoperative until the hydraulics are fully installed.

1. After the NORAC valve is mounted, the hydraulic hoses and fittings can be plumbed. The plumbing for the hydraulic circuit is shown schematically in **Figure 3.**

2. Install the 8FORX 8MOR45 (F04) fitting onto fitting F03 on the "T" port of the NORAC block.

3. Disconnect the tank line at the Rogator valve block and insert the 8FORXR 8MORT tee (F05).

4. Connect the 45 degree end of hose H02 to the tee (F05) and route to the NORAC valve block. Connect the straight end of hose H02 to F04 on the "T" port.

5. Disconnect the pressure line at the Rogator valve block and insert the 6FORXR 6MORT tee (F02).

6. Connect the 45 degree end of hose H01 to the tee and route to the NORAC valve block. Connect the straight end of hose H01 to F01 on the "P" port.

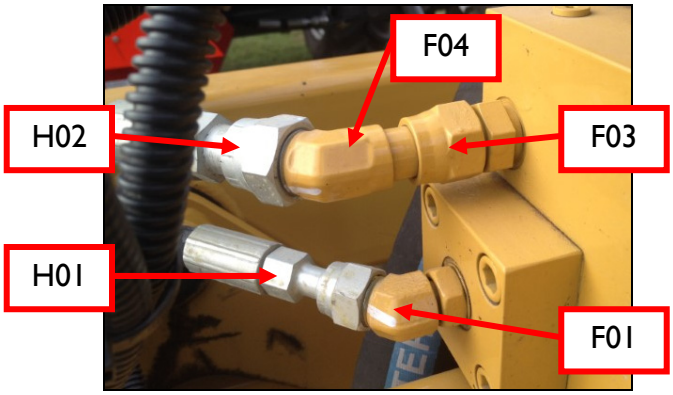


Figure 29: Pressure and Tank Plumbing at NORAC Valve Block

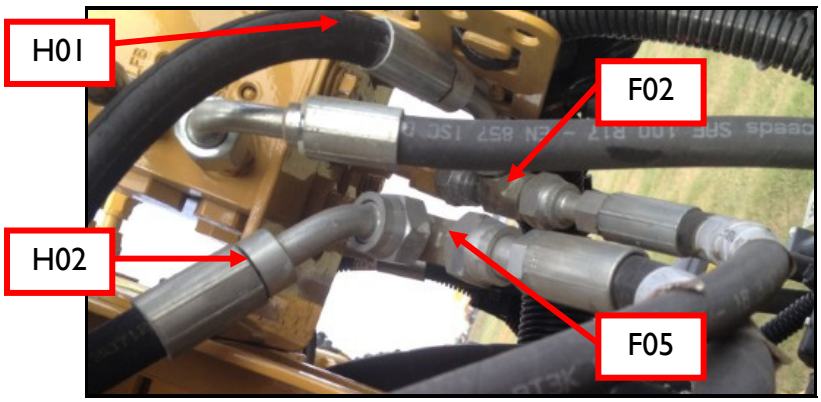


Figure 30: Pressure and Tank Plumbing at Rogator Valve Block

7. Disconnect the left and right raise lines from the Rogator valve block and insert the 6FORXR 6MORT tees (F02).

8. Connect the 90 degree ends of hoses H03 to the F02 tees and route the hoses to the NORAC valve block.

9. Install the 6MOR 6FORX90 (F07) fitting onto fitting F06 on the left "B" port of the NORAC valve block.

10. Install the 6MOR 6FORX45 (F09) fitting onto fitting F06 on the right "B" port of the NORAC valve block.

11. Connect the straight end of the hose H03 from the left raise line to fitting F07.

12. Connect the straight end of the hose H03 from the right raise line to fitting F09.

13. The existing lower lines do not need to be modified. Leave these lines connected to the Rogator valve block.

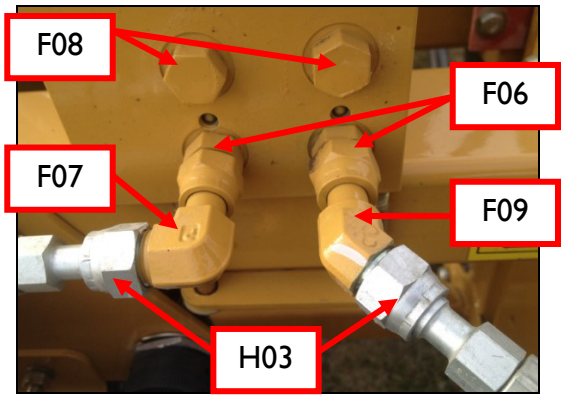


Figure 31: NORAC Valve Block Tilt Cylinder Plumbing

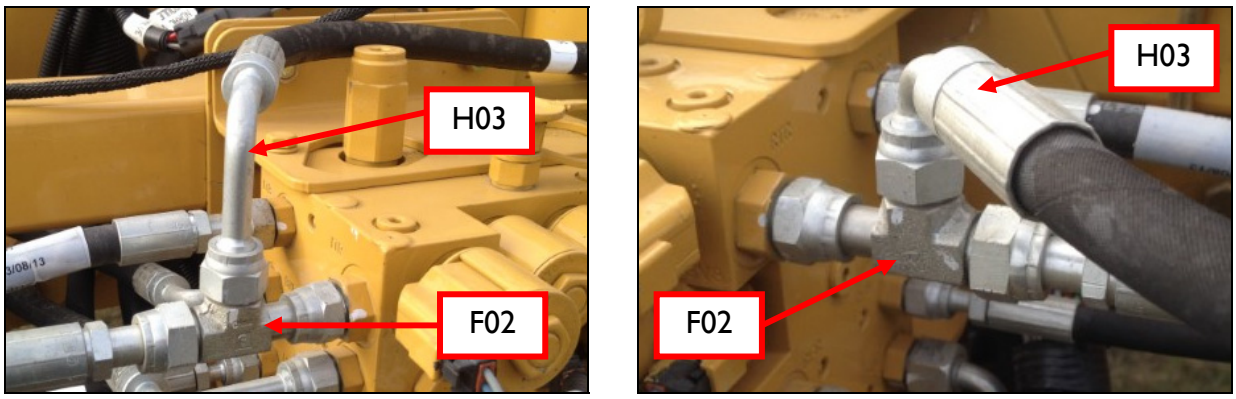


Figure 32: Right and Left Tilt Cylinder Plumbing at Rogator Valve Block

10 Connecting the Sensors to the CANbus

1. Fasten the 8-way coupler (E11) to the boom with cable ties. Connect cable C01 from the valve module to the 8-way coupler.

2. Connect the chassis roll sensor to the 8-way coupler using cable C02 and a 2-way coupler (E12). Connect the boom frame roll sensor directly to the 8-way coupler.

3. Connect the main lift sensor to the 8-way coupler using cable C02 and a 2-way coupler (E12). Cable C04 and item E12 may not be needed if the 8-way coupler is mounted close enough to the main lift sensor.

4. Connect two cables (C05) to the 8-way coupler and route along the booms to the wing sensors. Follow existing cables and hoses to be sure the cable will not be pinched or stretched.

5. At the sensor brackets, attach a 2-way coupler with terminator (E20) to the sprayer boom. The 2-way coupler with terminator is the white two way coupler. Plug the sensor and the CANbus cable into the 2-way coupler.

6. Insert the 6-pin plugs (P03) into the unused connectors on the 8-way coupler.

⚠ Important

Ensure that all unused connectors are plugged with the plugs provided.

11 Software Setup

1. Start up the sprayer and test the sprayer's functionality. The display terminal does not need to be powered on for the original boom function switches to operate. Unfold the booms and raise/lower each boom and the main section.

⚠ Important

Confirm that the cabling and hoses are agreeable to the entire range of motion.

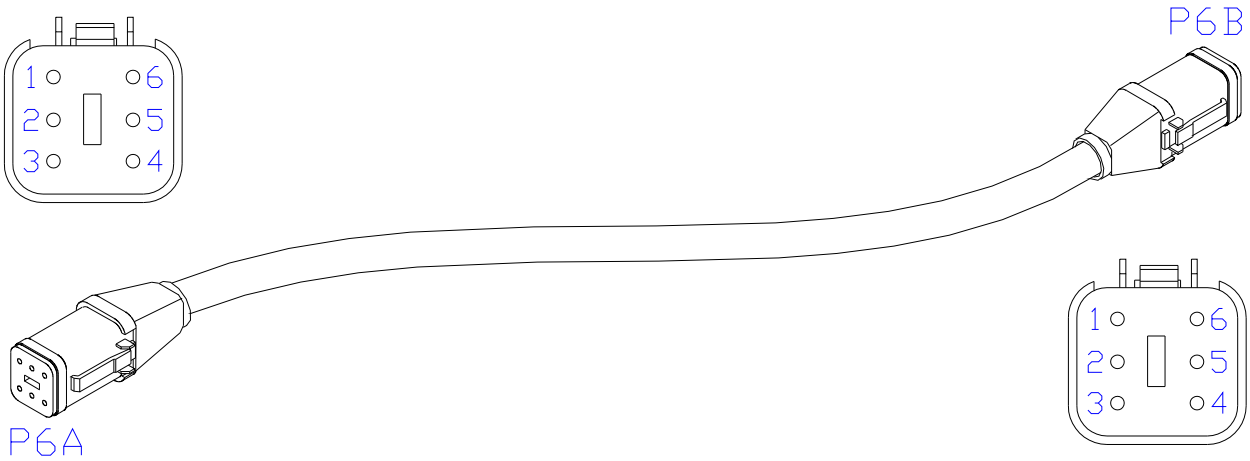
2. If any functions do not work, review the hydraulic and electrical portions of this manual to check for proper installation.

3. Turn on the power for the display terminal using the switch on the side.

4. The procedure for the installation of the UC5 Spray Height Control system is now complete. Begin the AUTOMATIC SYSTEM SETUP procedure as described in the UC5 Spray Height Control Operator's Manual.

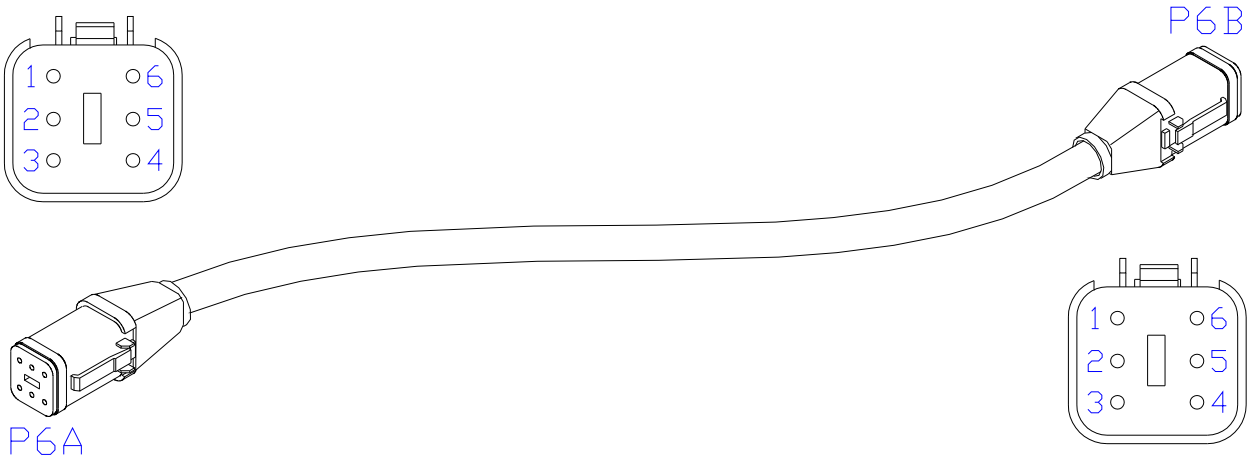
12 Cable Drawings

12.1 ITEM C01: 43220-01 - CABLE UC5 NETWORK 14 AWG - 1M



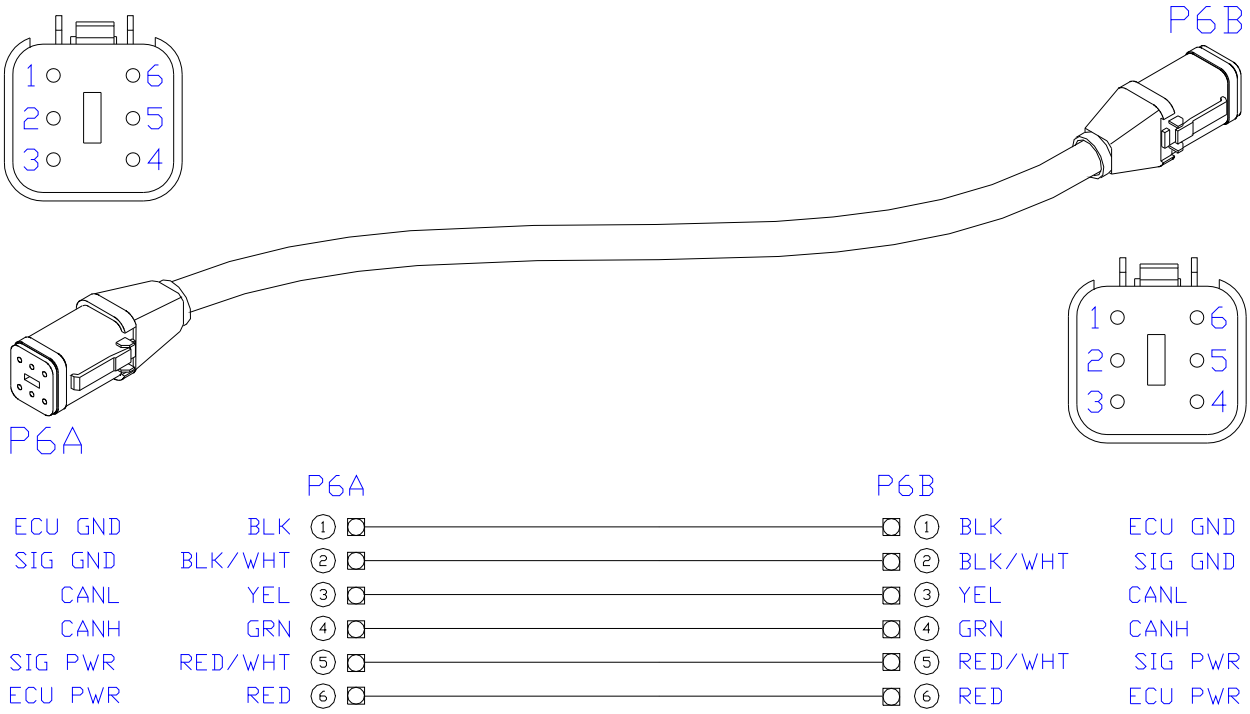
P6A			P6B	
ECU GND	BLK	1	BLK	ECU GND
SIG GND	BLK/WHT	2	BLK/WHT	SIG GND
CANL	YEL	3	YEL	CANL
CANH	GRN	4	GRN	CANH
SIG PWR	RED/WHT	5	RED/WHT	SIG PWR
ECU PWR	RED	6	RED	ECU PWR

12.2 ITEM C02: 43220-03 - CABLE UC5 NETWORK 14 AWG - 3M

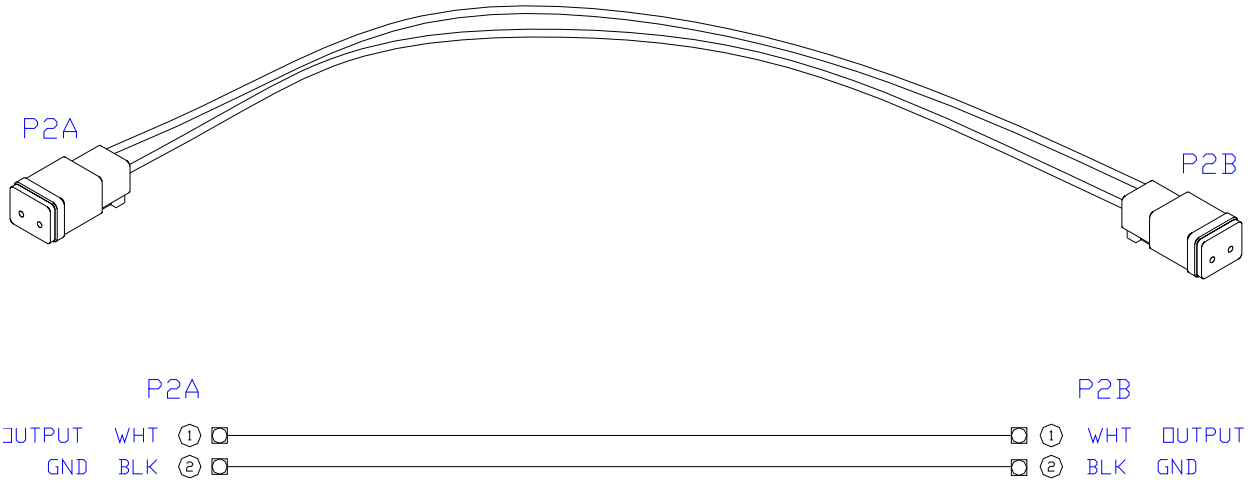


P6A			P6B	
ECU GND	BLK	1	BLK	ECU GND
SIG GND	BLK/WHT	2	BLK/WHT	SIG GND
CANL	YEL	3	YEL	CANL
CANH	GRN	4	GRN	CANH
SIG PWR	RED/WHT	5	RED/WHT	SIG PWR
ECU PWR	RED	6	RED	ECU PWR

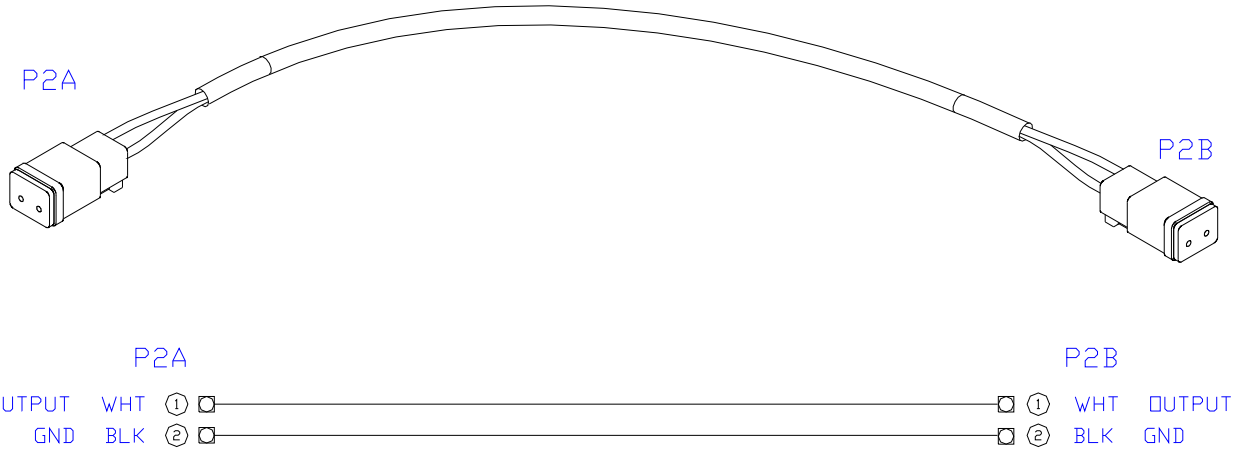
12.3 ITEM C05: 43210-15 - CABLE UC5 NETWORK 18 AWG - 15M



12.4 ITEM C10: 43230-04 – CABLE UC5 VALVE DT TO DT



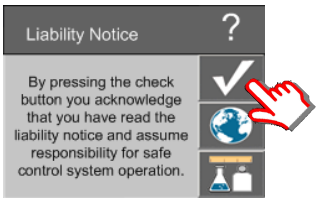
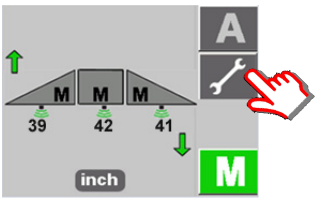
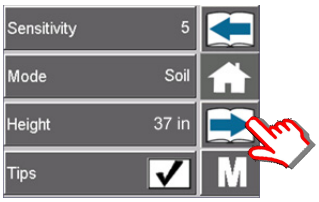
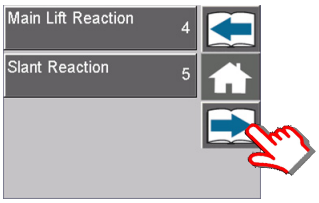
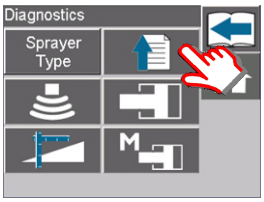
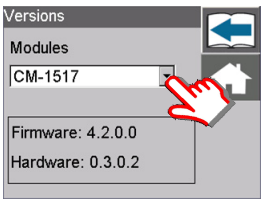
12.5 ITEM C11: 43230-07 – CABLE UC5 VALVE DT TO DT (L=84”)



13 Start Up and System Check

13.1 Pre-Calibration Check

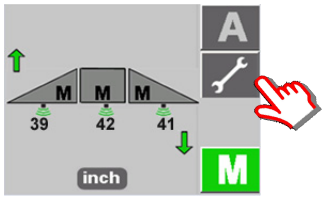
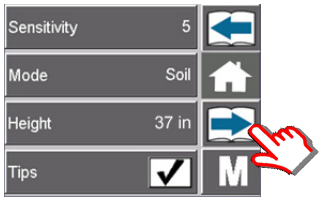
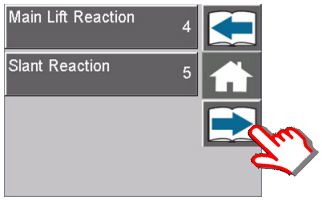
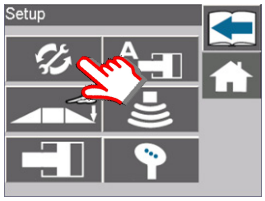
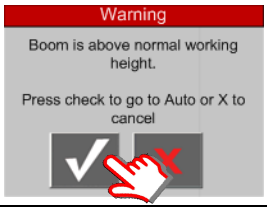
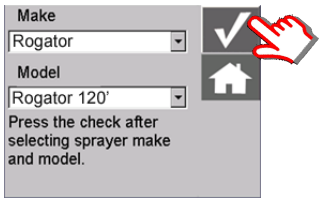
1. Before driving to a suitable setup and test location, verify system communication and firmware versions. Follow the steps below on the ROGATOR Management Center UC5 page to locate the firmware of all components.

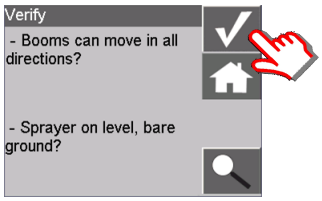
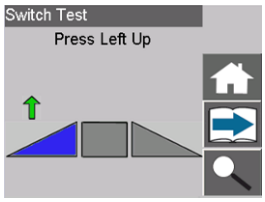
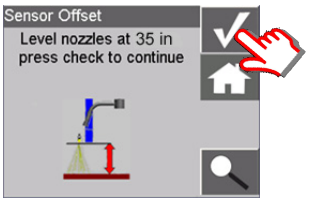
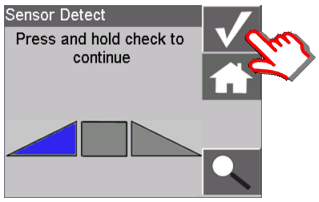
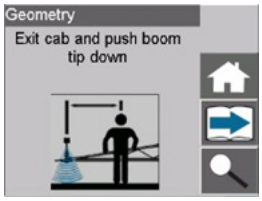
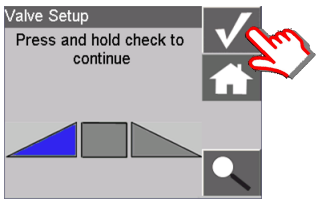
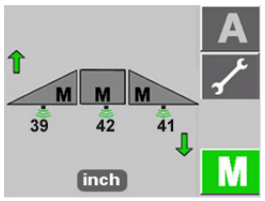
	Turn the key switch to on to supply power to the UC5 system. After a brief system startup, the RMC UC5 Page will display a liability notice. Select the check button to proceed.
	Select the Settings button (wrench).
	Select the Next button (right arrow).
	Select the Next button (right arrow).
	Select the Diagnostics button (magnifying glass).
	Select the Versions button (page with arrow).
	Select the drop down arrow and verify that the appropriate number of each component is shown on the list. Select each module and check that it has the correct firmware version.

2. Park the sprayer on level ground with no vegetation. Calibration must be performed with the sensors "looking at" bare ground, gravel or carpet. Hard surfaces such as concrete and asphalt are not desirable. Snow and puddled water will also cause calibration problems

3. The sprayer should be at operating RPM with the hydraulic oil at operating temperature.

13.2 System Calibration

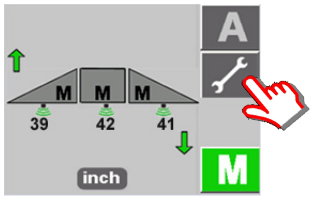
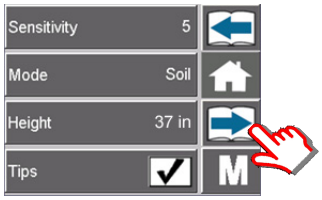
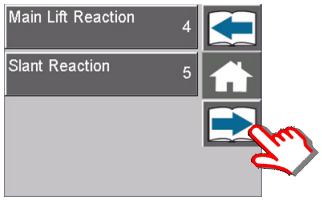
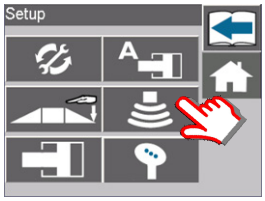
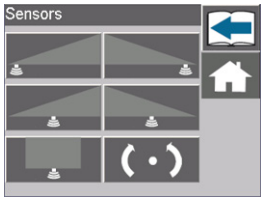
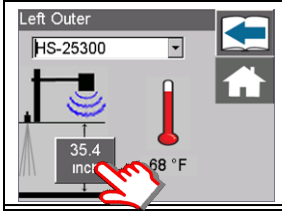
	With the system in Manual Mode, select the Settings button (wrench).
	Select the Next button (right arrow).
	Select the Next button (right arrow).
	Select the Setup button.
	Select Automatic Setup.
	Acknowledge the warning.
	Select the sprayer make and model from the lists. Then select the Check button.

	Read and acknowledge all of the precaution screens by pressing the Check button. It is very important that you read these precautions and follow them.
	Follow the on screen directions by pressing the sprayer's manual boom movement buttons.
	Level the boom at or near 35 inches (actual measurements can be taken and entered later). Adjust the distance from the nozzle to the ground directly beneath. Ensure you are over bare, flat soil. Press the Check button when finished.
	Press and hold the Check button. Continue holding while each boom section is moved. The display will show an arrow. At this time the boom will be in motion. When it is done the display will instruct you to release the Check button. Do not move the booms at this time.
	Exit the cab and with one fluid motion push the left boom tip approximately two (2) feet toward the ground (Do not contact the ground with the boom or the foam tip if equipped.). If the test is successful, the UC5 will automatically advance to the Valve Setup page.
	Press and hold the Check button and continue holding it until instructed to release it. The system will now calibrate the hydraulics. All boom sections will move. If you accidentally release the button, select and hold the Check button to resume.
	The setup is now complete and the controller will return to the main run screen.

13.3 Post-Calibration Check

1. Put the system into Auto Mode by pressing the "A" button. The boom should level out. Put the system back into Manual Mode by pressing the "M" button.

2. Verify that the sensor heights are correct. Measure the distance from the lowest point of the boom to the ground near each sensor.

	With the system in Manual Mode, select the Settings button (wrench).
	Select the Next button (right arrow).
	Select the Next button (right arrow).
	Select the Setup button.
	Select Sensor Setup.
	Select each sensor position and verify that the height reading matches the measured distance.
	The reading can be changed by selecting the reading and entering the appropriate height.

3. Using the NORAC Verification Tool to log data, perform the following:
   a) Save all settings.
   b) **Step Test** - Manually raise the right wing to 60 inches and lower the left wing to 20 inches. Place the system in Auto by pressing the "A". Observe the wing response. The entire wing should level out to the set height and should be stable.
   c) **Automatic Push Test** – With the UC5 system in automatic exit the cab and push the left boom toward the ground (Take care to keep yourself and others clear of the moving boom). After a couple of seconds the boom should settle back into a level position and remain stable.
4. If conditions permit, it is recommended that the sprayer is driven through some terrain in Automatic mode to observe the boom and verify performance.

Canada
NORAC Systems International Inc.
Phone: (+1) 306 664 6711
Toll Free: 1 800 667 3921
Shipping Address:
3702 Kinnear Place
Saskatoon, SK
S7P 0A6

United States
NORAC, Inc.
Phone: (+1) 952 224 4142
Toll Free: 1 866 306 6722
Shipping Address:
6667 West Old Shakopee Road, Suite 111
Bloomington, MN
55438

Europe
NORAC Europe
Phone: (+33) (0)4 26 47 04 42
Shipping Address:
Rue de l'hermitage
01090 GUEREINS
France

www.norac.ca

NORAC