

**Valtra BT150, BT170, BT190, and
BT210
SmarTrax™ Installation Manual**

P/N 016-5033-101 Rev A 09/15

E18638

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CHAPTER

1

Important Safety Information

NOTICE

Read this manual and the operation and safety instructions included with your implement and/or controller carefully before installing the SmarTrax™ system.

- Follow all safety information presented within this manual.
- If you require assistance with any portion of the installation or service of your Raven equipment, contact your local Raven dealer for support.
- Follow all safety labels affixed to the SmarTrax system components. Be sure to keep safety labels in good condition and replace any missing or damaged labels. To obtain replacements for missing or damaged safety labels, contact your local Raven dealer.

When operating the machine after installing SmarTrax, observe the following safety measures:

- Be alert and aware of surroundings.
- Do not operate SmarTrax or any agricultural equipment while under the influence of alcohol or an illegal substance.
- Remain in the operator's position in the machine at all times when SmarTrax is engaged.
- Disable SmarTrax when exiting the operator's seat and machine.
- Do not drive the machine with SmarTrax enabled on any public road.
- Determine and remain a safe working distance from other individuals. The operator is responsible for disabling SmarTrax when the safe working distance has diminished.
- Ensure SmarTrax is disabled prior to starting any maintenance work on SmarTrax or the machine.

WARNING

- When starting the machine for the first time after installing SmarTrax, be sure that all persons stand clear in case a hose has not been properly tightened.
- The machine must remain stationary and switched off during SmarTrax installation or maintenance.

 **CAUTION**

Hydraulic Safety

- Raven Industries recommends that appropriate protective equipment be worn at all times when working on the hydraulic system.
- Never attempt to open or work on a hydraulic system with the equipment running. Care should always be taken when opening a system that has been previously pressurized.
- When disconnecting the hydraulic hoses or purging is required, be aware that the hydraulic fluid may be extremely hot and under high pressure. Caution must be exercised.
- Any work performed on the hydraulic system must be done in accordance with the machine manufacturer's approved maintenance instructions.
- When installing SmarTrax hydraulics or performing diagnostics, maintenance, or routine service, ensure that precautions are taken to prevent any foreign material or contaminants from being introduced into the machine's hydraulic system. Objects or materials that are able to bypass the machine's hydraulic filtration system will reduce performance and possibly damage the SmarTrax valve.

Electrical Safety

- Always verify that the power leads are connected to the correct polarity as marked. Reversing the power leads could cause severe damage to the equipment.
- Ensure that the power cable is the last cable to be connected.

CHAPTER

2

Introduction

Congratulations on your purchase of the SmarTrax system! This system is designed to provide cutting-edge, hands-free steering of the machine via Global Positioning System (GPS) coordinates.

This manual applies to the following machines:

MAKE: Valtra

MODEL: BT150, BT170, BT190, and BT210

FIGURE 1. Valtra BT



Updates

Software and manual updates are available on the Raven Applied Technology website:

<http://www.ravenhelp.com>

Preparing for Installation

Before installing the SmarTrax system, park the machine where the ground is level, clean, and dry. Turn off the machine and leave it turned off for the duration of the installation process. Bleed pressure from the hydraulic system by loosening the hydraulic fittings slowly, where applicable.

During the installation process, follow good safety practices. Be sure to carefully read the instructions in this manual as you complete the installation process.

Recommendations

Raven Industries recommends the following best practices when installing or operating the SmarTrax system for the first time, at the start of the season, or when moving the SmarTrax system to another machine:

- Ensure the machine’s hydraulic filters have been recently changed and there are no issues with the machine’s hydraulic system (e.g., pump issues, faulty hydraulic motors, fine metal deposits in the hydraulic hoses, etc.).
- Ensure the machine’s hydraulic valve is using fresh oil and debris is flushed from the hydraulic hoses, valves, and filters.

Raven Industries recommends the following best practices when installing the SmarTrax system:

- Use part numbers to identify the parts.
- Do not remove the plastic wrap from a part until it is necessary for installation.
- Do not remove plastic caps from a part until it is necessary for installation.

Point of Reference

The instructions in this manual assume that you are standing behind the machine, looking toward the cab.

Kit Contents

This section contains a list of the components that are included in the SmarTrax kit. Before beginning the SmarTrax installation, compare the items in the kit with the components on this list. If you have questions about the kit, contact your Raven dealer.

TABLE 1. SmarTrax Installation Kit (P/N 117-5033-101)

Picture	Item Description	Part Number	Qty.
Not Pictured	Manual - Valtra BT150, BT170, BT190, and BT210 SmarTrax Installation Manual	016-5033-101	1
	Valve - SmarTrax Hydraulic	334-0003-088	1

TABLE 1. SmarTrax Installation Kit (P/N 117-5033-101)

Picture	Item Description	Part Number	Qty.
	Bracket - Node Mounting	107-0172-084	1
	Bracket - Hydraulic Valve Mounting	107-0172-122	1
	Cable - Hydraulic Valve Harness	115-4001-096	1
	Transducer - 0-3000 PSI Pressure	422-0000-086	1
	Bolt - 5/16"-18 x 5/8" Hex	311-0052-102	4
	Bolt - 5/16"-18 x 7/8" Hex	311-0052-104	4
	Bolt - 3/4"-10 x 2-3/4" Hex	311-0062-155	2
	Nut - 3/8"-16 Nylon Insert Lock	312-4000-061	3
	Nut - 3/4"-10 Nylon Insert Lock	312-4000-071	2
	Washer - 5/16" Lock	313-1000-019	4
	Washer - 0.75" ID x 1.25" OD x .14 Thick Flat	313-2300-132	4

TABLE 2. Hydraulic Installation Kit (P/N 117-0199-112)

Picture	Item Description	Part Number	Qty.
	Fitting - -4 ORFS M/F 90° Swivel Elbow	333-0012-023	1
	Fitting - -4 ORFS (M) to -6 SAE O-Ring (M) Straight Adapter	333-0012-195	2
	Fitting - -6 ORFS (M) to -8 SAE O-Ring (M) Straight Adapter	333-0012-199	2
	Fitting - -6 ORFS (M) to -10 SAE O-Ring (M) Straight Adapter	333-0012-233	2
	Fitting - 12L, M18 x 1.5 M/M/F Swivel Run Tee Adapter	333-0012-356	3
	Fitting - 16S, M24 x 1.5 M/M/F Swivel Run Tee Adapter	333-0012-360	1
	Fitting - 8L, M14 x 1.5 M/F 90° Swivel Elbow	333-0012-367	1
	Hydraulic Hose - -6 ORFS 90° (F) to 16S, M24 X 1.5 (F) 45° - 77"	214-1000-865	1
	Hydraulic Hose - -6 ORFS 90° (F) to 12L, M18 X 1.5 (F) 45° - 77"	214-1000-866	3
	Hydraulic Hose - -4 ORFS 90° (F) to 8L, M14 X 1.5 (M) - 77"	214-1000-867	1
	Hydraulic Hose - -4 ORFS to 8L, M14 X 1.5 (F) 90° - 77"	214-1000-868	1

TABLE 3. Wheel Angle Sensor Installation Kit (P/N 117-0192-038)

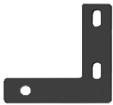
Picture	Item Description	Part Number	Qty.
	Sensor - 250 mm Non-Contact Linear Wheel Angle	063-0181-017	1
	Bracket - WAS	107-0172-076	1
	Bracket - WAS	107-0172-077	1
	Mount - M10 Stud Linear Sensor	103-0001-030	2
	Clamp - 1-3/8" Chrome Muffler	435-3003-054	1
	Nut - M10 x 1.5 Pitch x 5 mm Thick Jam	312-1002-035	2
	Nut - 5/16"-18 Nylon Insert Thin Lock	312-4001-107	2
	Nut - M10 x 1.5 Nylon Insert Lock	312-4000-208	2
	Washer - 0.406" ID x 0.812" OD x 0.065" Thick	313-2300-014	4

TABLE 4. Node Mounting Kit (P/N 117-5030-005)

Picture	Item Description	Part Number	Qty.
Not Pictured	Manual - SmarTrax and SmartSteer Calibration & Operation	016-0171-277	1
	Node - SmarTrax 3D CAN Control	063-0173-228	1
	Harness - SmarTrax Node	115-4001-109	1
	Assembly - SmarTrax Enable Switch	063-0172-470	1

Note: The node mounting kit is sold separately.

CHAPTER

3

Hydraulic Installation



⚠ WARNING

Hydraulics are under pressure. Care should always be taken with a system that has been pressurized.

Before beginning the SmarTrax hydraulic installation, turn off the machine and relieve pressure by turning the steering wheel left and right.

Never work on a hot machine. Always allow it to cool before performing diagnostics, maintenance, or routine service.

When disconnecting or purging hydraulic hoses, be aware that the hydraulic fluid within the machine's system may be extremely hot and under high pressure.

Tampering with hydraulic valves may cause serious injury or death, and will void the warranty.



⚠ CAUTION

When installing SmarTrax hydraulics or performing diagnostics, maintenance, or routine service, ensure precautions are taken to prevent any foreign material from being introduced into the machine's hydraulic system.

Objects or materials that are able to bypass the machine's hydraulic filtration system will reduce performance and possibly damage the SmarTrax hydraulic valve.

	NOTICE
<p>The appearance of the SmarTrax hydraulic valve may vary slightly from the images contained in this manual. However, the fittings, hose connections, and cable connections remain the same.</p>	

Install Fittings in the SmarTrax Valve

Before mounting the SmarTrax valve on the machine, install the proper fittings in the valve. This prepares the valve for installation and simplifies the hose connection process later in the procedure. Refer to the following table to install the fittings in the appropriate ports of the SmarTrax valve.

Fitting	Part Number	Port
Fitting - -4 ORFS (M) to -6 SAE O-Ring (M) Straight Adapter	333-0012-195	LSPV, LS STEER
Fitting - -6 ORFS (M) to -8 SAE O-Ring (M) Straight Adapter	333-0012-199	P, T
Fitting - -6 ORFS (M) to -10 SAE O-Ring (M) Straight Adapter	333-0012-233	A, B
Transducer - 0-3000 PSI Pressure	422-0000-086	PS

Mount the SmarTrax Valve

FIGURE 1. SmarTrax Valve Mounting Location



1. Identify the valve mounting location on the left frame rail, just in front of the fuel tank.
2. Locate the machine's two existing mounting holes.

FIGURE 2. Valve Bracket Installed on Machine



3. Mount the hydraulic valve mounting bracket (P/N 107-0172-122) to the existing holes in the left frame rail using two 3/4"-10 x 2-3/4" hex bolts (P/N 311-0062-155), two washers (P/N 313-2300-132), and two 3/4"-10 nylon insert lock nuts (P/N 3132-4000-071).



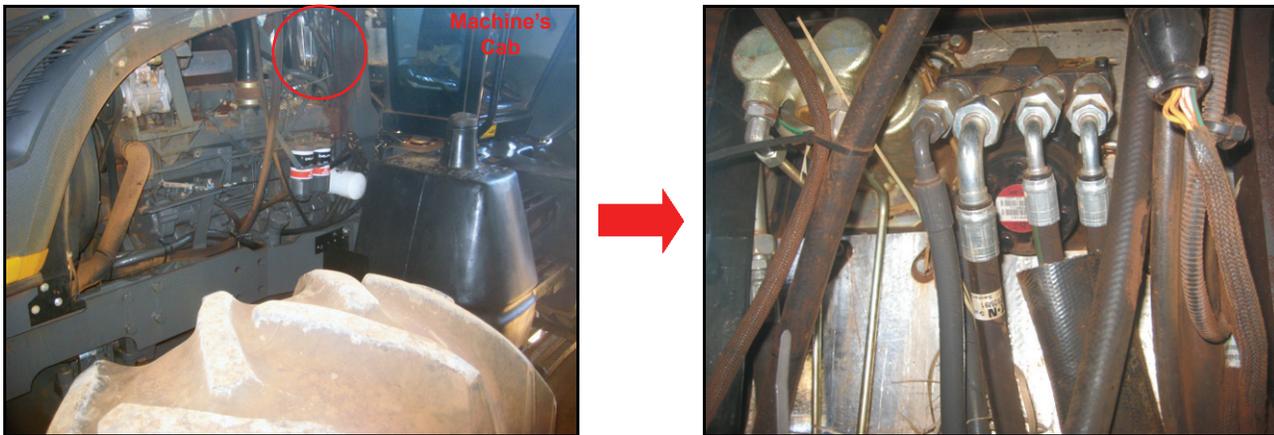
FIGURE 3. SmarTrax Valve Installed



4. Install the SmarTrax valve (P/N 334-0003-088) on the hydraulic valve mounting bracket using four 5/16"-18 x 7/8" hex bolts (P/N 311-0052-104) and four 5/16" lock washers (P/N 313-1000-019).

Install the Left/Right Steering, Pressure, and Tank Hoses

FIGURE 4. Machine's Steering Orbital Location



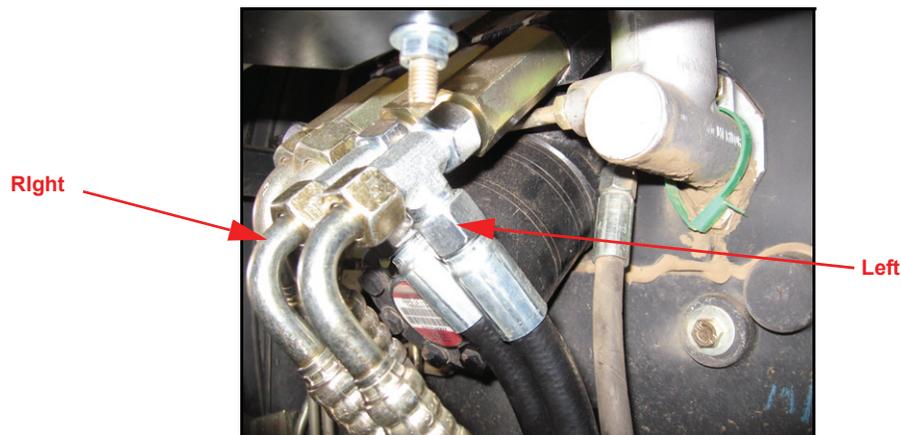
1. Raise the machine's hood and locate the steering orbital directly in front of the cab.

FIGURE 5. Machine's Left and Right Steering Hoses



2. Locate the machine's left and right steering hoses on the steering orbital.

FIGURE 6. Left and Right Steering Hoses Installed



3. Disconnect the machine's left steering hose from the steering orbital port labeled 'L'.
4. Install a 12L, M18 x 1.5 M/M/F swivel run tee adapter fitting (P/N 333-0012-356) in the open L port of the steering orbital.
5. Connect the machine's left steering hose to the opposite end of the installed tee fitting.
6. Install the 45° end of the supplied hydraulic hose (P/N 214-1000-866) on the 90° end of the installed tee fitting.
7. Connect the 90° end of the installed hydraulic hose to the fitting installed in Port B of the SmarTrax valve (P/N 334-0003-088).
8. Disconnect the machine's right steering hose from the steering orbital port labeled 'R'.
9. Install a 12L, M18 x 1.5 M/M/F swivel run tee adapter fitting (P/N 333-0012-356) in the open R port of the steering orbital.
10. Connect the machine's right steering hose to the opposite end of the installed tee fitting.
11. Install the 45° end of the supplied hydraulic hose (P/N 214-1000-866) on the 90° end of the installed tee fitting.
12. Connect the 90° end of the installed hydraulic hose to the fitting installed in Port A of the SmarTrax valve.

FIGURE 7. Machine's Pressure and Tank Hoses



13. Locate the machine's pressure and tank hoses on the steering orbital.
14. Disconnect the machine's pressure hose from the steering orbital port labeled 'P'.
15. Install a 16S, M24 x 1.5 M/M/F swivel run tee adapter fitting (P/N 333-0012-360) in the open P port of the steering orbital.
16. Connect the machine's pressure hose to the opposite end of the installed tee fitting.
17. Install the 45° end of the supplied hydraulic hose (P/N 214-1000-865) on the 90° end of the installed tee fitting.
18. Connect the 90° end of the installed hydraulic hose to the fitting installed in Port P of the SmarTrax valve.
19. Disconnect the machine's tank hose from the steering orbital port labeled 'T'.
20. Install a 12L, M18 x 1.5 M/M/F swivel run tee adapter fitting (P/N 333-0012-356) in the open T port of the steering orbital.
21. Connect the machine's tank hose to the opposite end of the installed tee fitting.
22. Install the 45° end of the supplied hydraulic hose (P/N 214-1000-866) on the 90° end of the installed tee fitting.
23. Connect the 90° end of the installed hydraulic hose to the fitting installed in Port T of the SmarTrax valve.

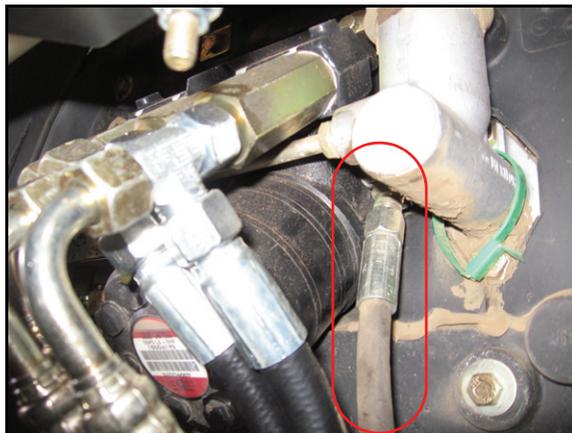
Install the Load Sense Hoses

FIGURE 8. Machine's Load Sense Hose



1. Locate the machine's existing load sense hose on the side of the steering orbital.
2. Disconnect the machine's load sense hose from the steering orbital.

FIGURE 9. Load Sense Hoses Installed



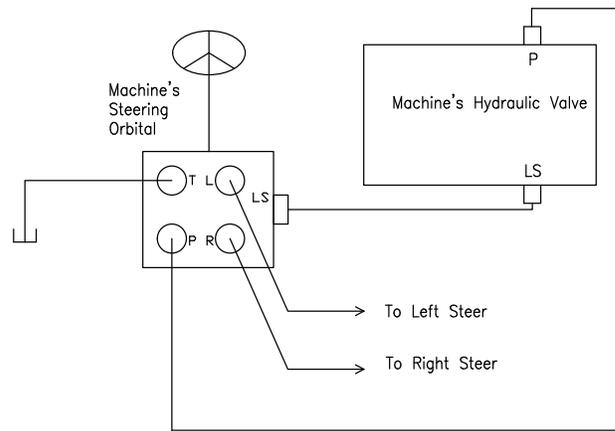
3. Install the 90° end of the supplied hydraulic hose (P/N 214-1000-868) to the open load sense port of the steering orbital.
4. Connect the straight end of the installed hydraulic hose to the fitting installed in Port LS STEER of the SmarTrax valve (P/N 334-0003-088).

Note: Depending on the machine's configuration, it may be necessary to install a -4 ORFS M/F 90° swivel elbow fitting (P/N 333-0012-023) on the installed adapter fitting to achieve the connection.

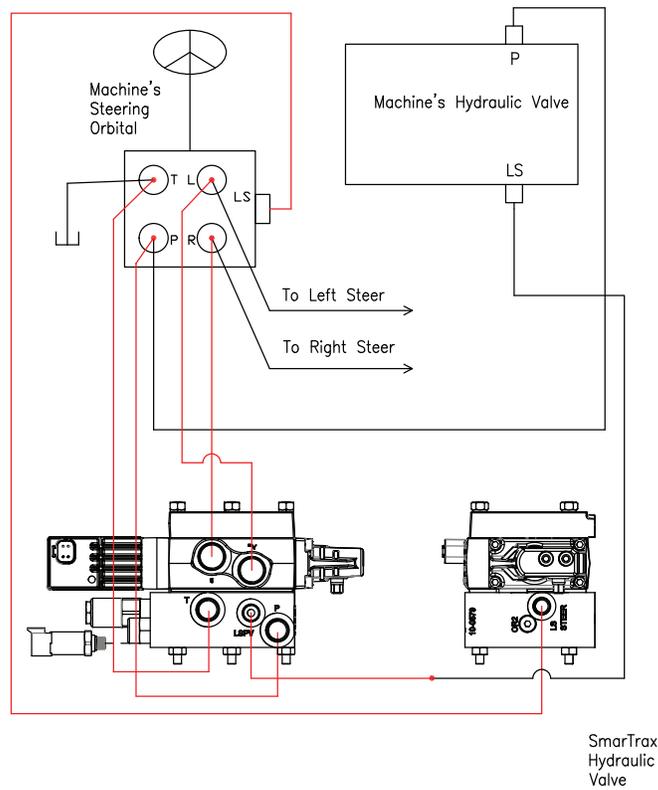
5. Install an 8L, M14 x 1.5 M/F 90° swivel elbow fitting (P/N 333-0012-367) on the end of the machine's existing load sense hose that was disconnected from the steering orbital in step 2.
6. Install straight end of the supplied hydraulic hose (P/N 214-1000-867) on the adapter fitting installed on the machine's load sense hose.
7. Connect the 90° end of the installed hydraulic hose to the fitting installed in Port LSPV of the SmarTrax valve.

Hydraulic Diagram

Before SmarTrax Installation



After SmarTrax Installation



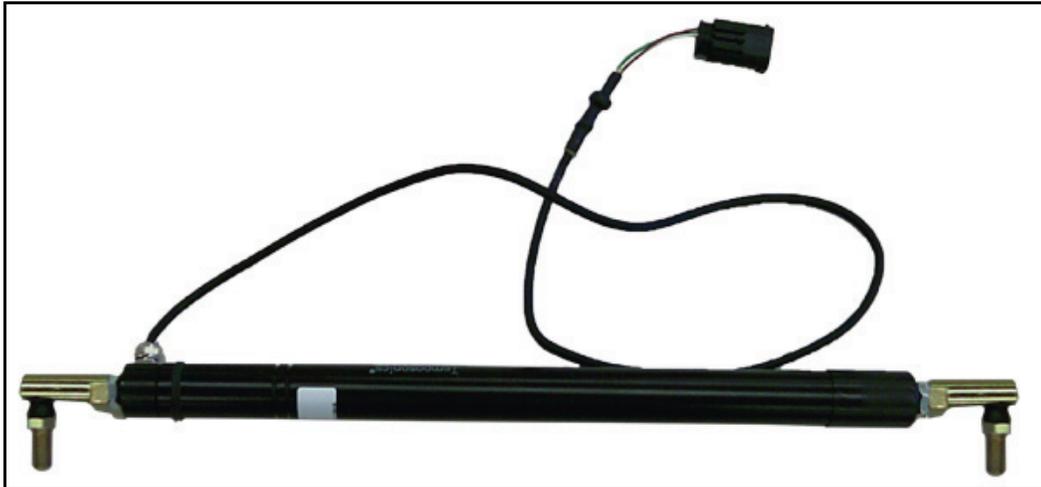
CHAPTER

4

Wheel Angle Sensor Installation

Assemble the Wheel Angle Sensor (WAS)

FIGURE 1. WAS Assembly



1. Install one M10 stud linear sensor mount (P/N 103-0001-030) and one M10 jam nut (P/N 312-1001-035) on the base-end (where the cable connects) of the 250 mm non-contact linear wheel angle sensor (WAS) (P/N 063-0181-017).
2. Install the other M10 stud linear sensor mount and M10 jam nut on the rod-end of the WAS.

Mount the WAS

1. Turn the machine's front wheels to the right to access the left front axle area.

FIGURE 2. Steering Cylinder Bolt



2. Remove the bolt on the bottom-right corner of the left steering cylinder cap.

FIGURE 3. Base-End of Sensor Installed on the Machine



3. Align the base WAS mounting bracket (P/N 107-0172-077) over the hole, rotating it as shown in Figure 3 above.
4. Replace the cylinder bolt.
5. Secure the base-end of the WAS (P/N 063-0181-017) to the bottom of the base mounting bracket using one M10 x 1.5" nylon insert lock nut (P/N 312-4000-208) and one washer (P/N 313-2300-014).

FIGURE 4. Rod-End Mounting Bracket



6. Remove the nuts and clamp from the 1-3/8" muffler clamp (P/N 435-3003-054) and install the U-bolt around the left tie-rod with the U-bolt ends facing up.
7. Install the clamp on the ends of the U-bolt.
8. Install the WAS rod mounting bracket (P/N 107-0172-076) over the ends of the U-bolt and secure it using two 5/16" nylon insert thin lock nuts (P/N 312-4001-107) as shown in Figure 4 above.

FIGURE 5. Rod-End of Sensor Mounted to the Machine



9. Mount the rod-end of the WAS to the rod mounting bracket using two washers (P/N 313-2300-014) and one M10 x 1.5 nylon insert lock nut (P/N 312-4000-208).

Important: Verify that the WAS cannot be overextended or compressed when the wheels are turned to their extremes. Also verify that the sensor moves freely and is not being damaged within its range of motion.

10. Route the cable from the base-end of the WAS along the tractor frame so that it is not near moving parts or heat sources. Secure with plastic cable ties as necessary.

CHAPTER

5

Cab Component Installation

Install the SmarTrax Node

Mount the SmarTrax Node

FIGURE 1. Node Mounting Location



1. Remove the plastic cover to the right of the operator's seat.
2. Move the machine's existing cables out of the way to expose the machine's existing mounting posts.

FIGURE 2. Node Installed



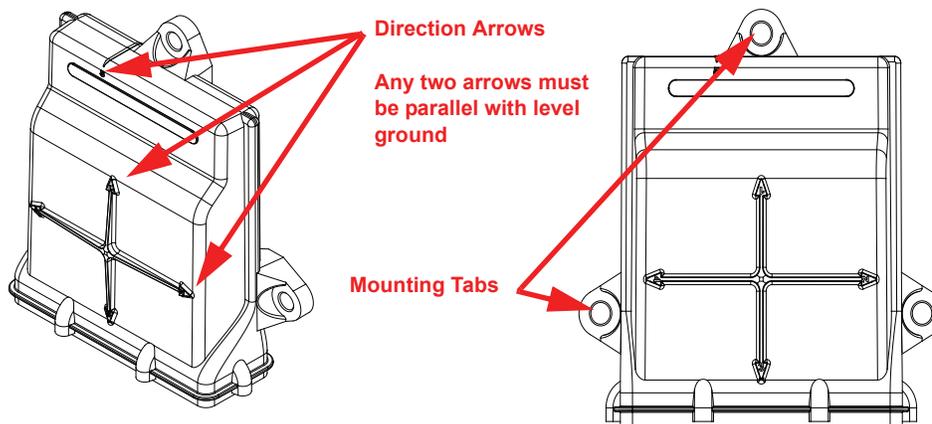
3. Install the node mounting bracket (P/N 107-0172-084) on the machine's mounting posts using four 5/16" x 5/8" hex bolts (P/N 311-0052-102).

Note: Position the mounting bracket so that arrow #1 on the node will point forward when installed.

4. Secure the SmarTrax node (P/N 063-0173-228) to the node mounting bracket using three 3/8"-16 nylon insert lock nuts (P/N 312-4000-061).

Node Mounting Locations

FIGURE 3. Node Mounting



When choosing the location for the SmarTrax node, consider the following points:

- Mount the SmarTrax node inside the machine's cab on a flat, level surface for proper performance and cable connection.
- One of the six numbered direction arrows on the node must be oriented in the direction of forward vehicle travel, one arrow pointing straight up, and two of the arrows parallel to the ground.

Note: Make a note of the number of the arrow that is oriented in the direction of forward vehicle travel. This number will be needed during the SmarTrax calibration process.

- The node mounting location must not create tripping hazards.
- Mount the node in a location where it will not be kicked or jarred during normal equipment operation.

- The location must allow cable routing to avoid crimping or damaging the cables or the node connections.
- Securely fasten the node using bolts or screws through at least two of the three mounting holes. When mounted properly, the node should not become loose or rotate.

Install the Foot Switch

FIGURE 4. Foot Switch Installed



1. Select a suitable location for the foot switch (P/N 063-0172-470) to be installed.

Note: *The foot switch should be installed in a location where the operator has easy access to it and is able to fully press the pedal.*

2. Using the holes in the foot switch as a template, drill holes in the floor of the cab.
3. Secure the foot switch to the floor by installing the supplied screws in each of the mounting holes.

Install the Node Harness

1. Install the two large, rectangular node connectors of the node harness (P/N 115-4001-109) into the correct ports of the node.
2. Tighten the bolts on the harness connectors to secure the connections.
3. Locate the ENABLE connector on the node harness and connect it to the foot switch cable connector.

Install the Valve Harness

Note: *It may be necessary to bore a hole in the cab floor near the node mounting location in order to route the valve harness into the cab.*



FIGURE 5. Valve Harness Routed into the Cab



1. Route the 12-pin connector of the valve harness (P/N 115-4001-096) into the cab.
2. Connect the 12-pin connector of the valve harness into the mating connector of the node harness (P/N 115-4001-109).

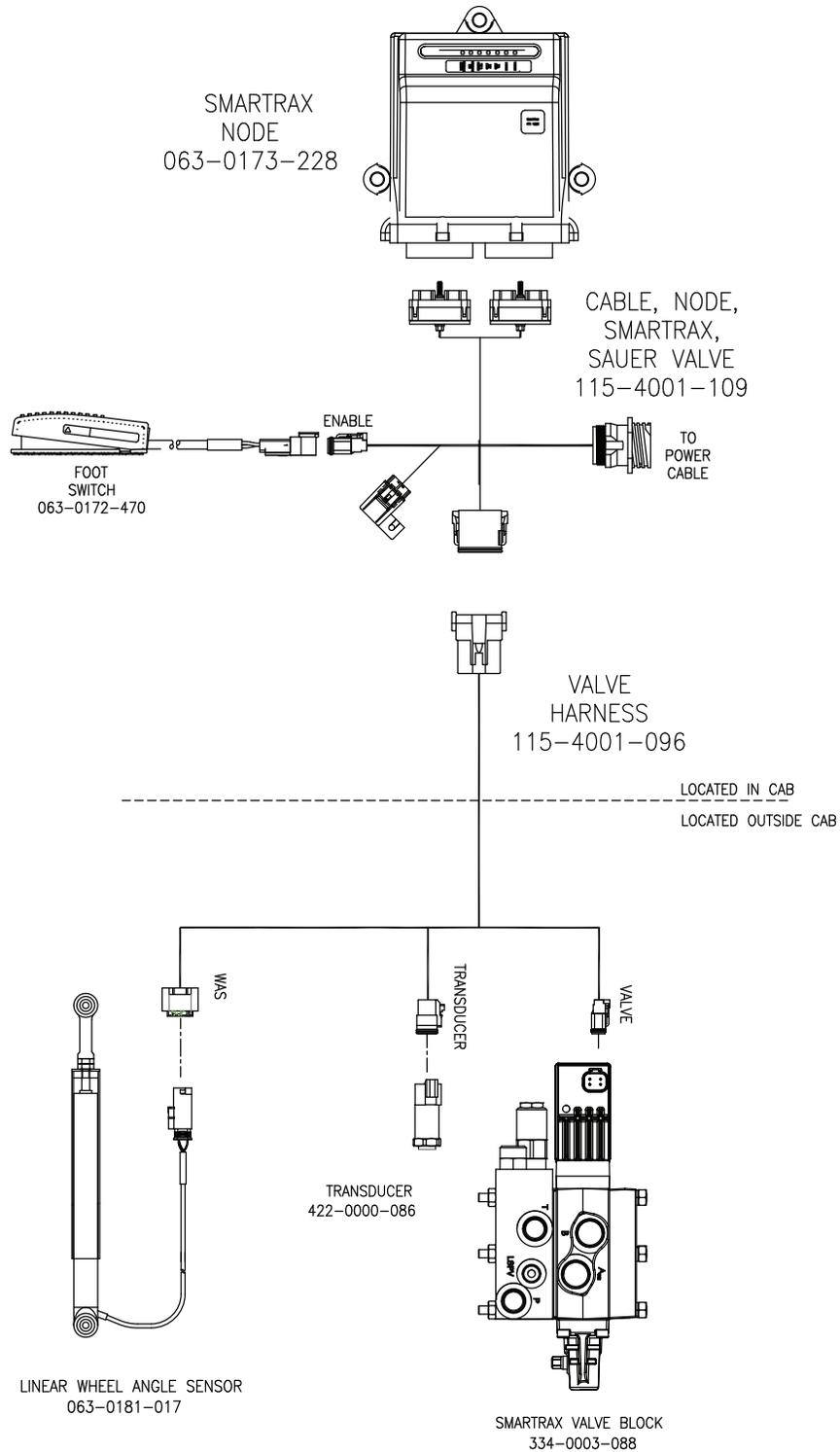
FIGURE 6. VALVE Harness Connection



3. Connect the VALVE connector to the open 4-pin port of the SmarTrax valve (P/N 334-0003-088).
4. Connect the TRANSDUCER connector to the pressure transducer (P/N 422-0000-086) installed in Port PS of the SmarTrax valve.
5. Route and connect the WAS connector to the cable of the installed WAS (P/N 063-0181-017).

Note: *Secure cable with plastic cable ties.*

FIGURE 7. Valve Harness Wiring Diagram



Install the Chassis Cable - SmarTrax-Only Systems (If Applicable)

If the machine does not contain an existing chassis power system (such as AutoBoom, product control, etc.), it is necessary to install the chassis power cable to operate the SmarTrax system. If a CAN system already exists on the machine, refer to *Connect SmarTrax to an Existing Chassis Cable (If Applicable)* below to connect the power to the SmarTrax system.

Note: *The chassis cable is sold separately. Contact your local Raven dealer for ordering information.*

1. Locate the SmarTrax chassis cable (P/N 115-4001-085).
2. Connect the TO SMARTRAX NODE connector from the chassis cable to the round 16-pin connector of the node harness (P/N 115-4001-109).
3. Connect the TO CONSOLE CABLE connector to the Raven console cable.
4. Install a terminator (P/N 063-0172-369) on the CAN cable connector.
5. Loop and tie-off the REMOTE SWITCH cable connection, securing it with plastic cable ties as necessary.

Note: *The REMOTE SWITCH connector is not used in the SmarTrax system. Ensure the cable is secured away from moving parts and heat sources.*

6. Connect the ring terminals to the battery.

Note: *The positive connectors are fused.*

Connect SmarTrax to an Existing Chassis Cable (If Applicable)

Note: *The SmarTrax interface tee is sold separately. Contact your Raven dealer for ordering information.*

1. Locate and disconnect the connection between the Raven console cable and chassis cable on the machine's existing CAN system.
2. Install the SmarTrax interface tee cable (P/N 115-4001-070 or 115-4001-071) between the chassis and Raven console harness.
3. Connect the SmarTrax node cable (P/N 115-4001-109) to the remaining SmarTrax interface tee.

System Diagrams

FIGURE 8. Existing Chassis System Wiring Diagram

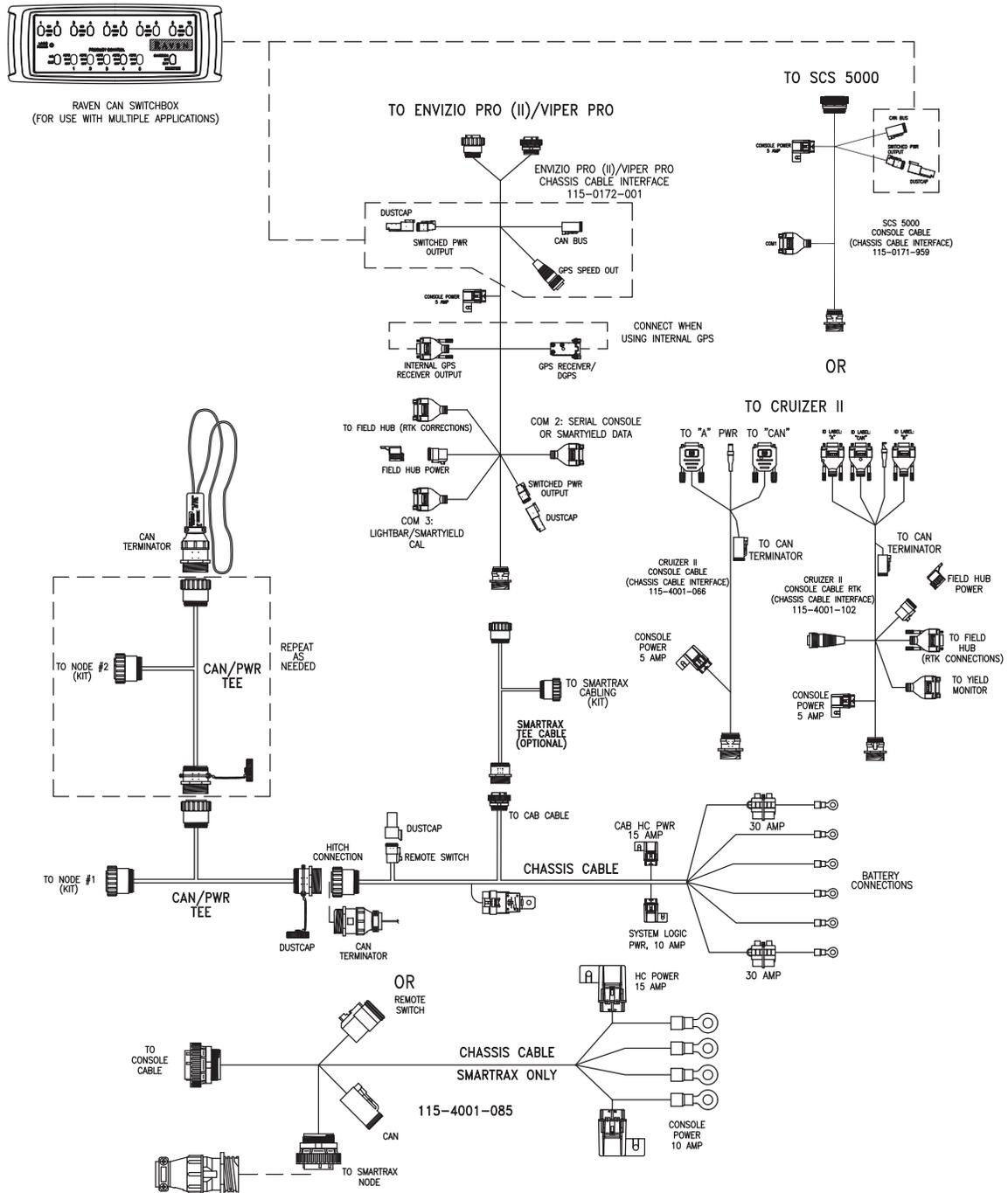
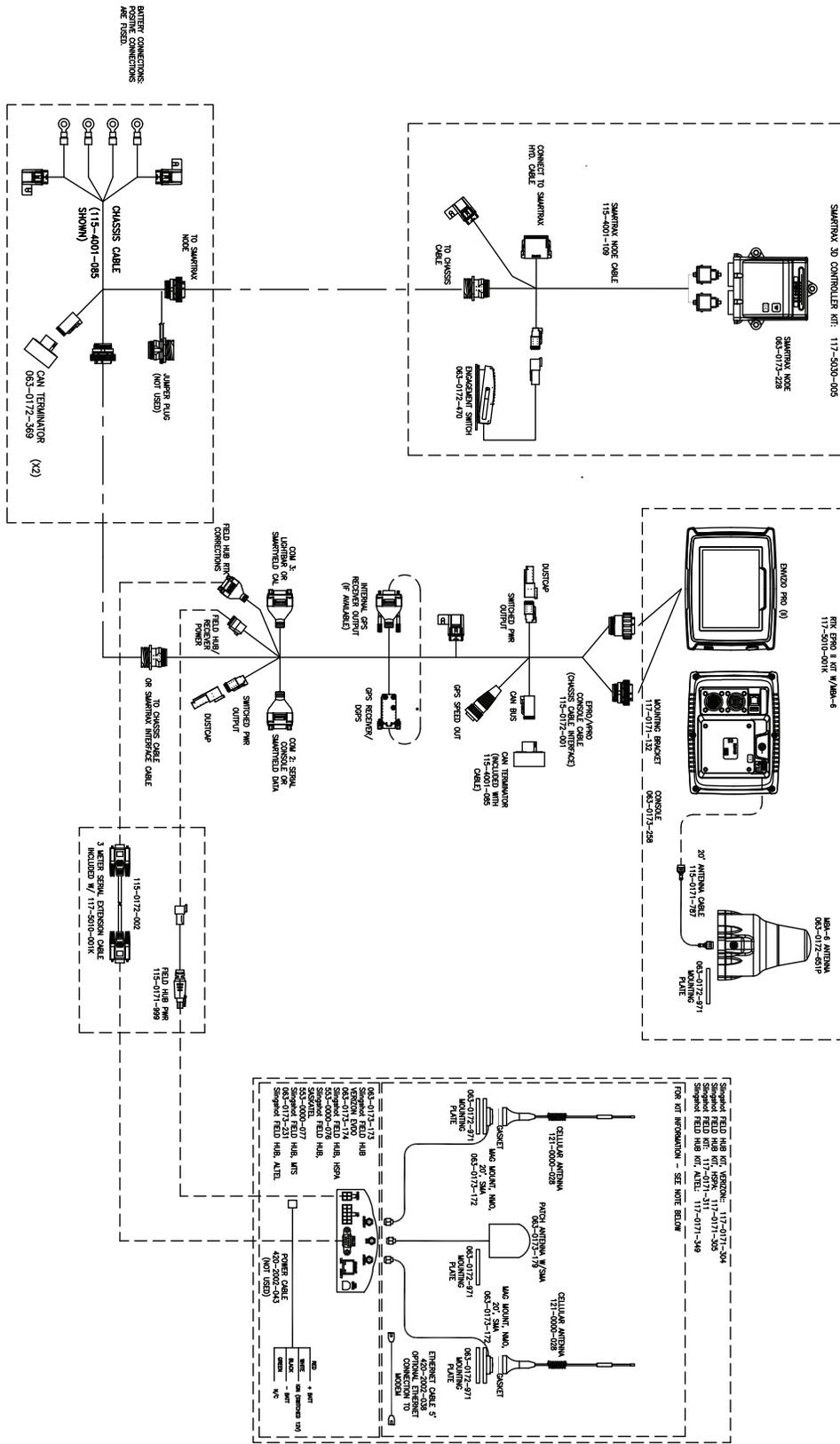


FIGURE 9. Envizio Pro II with Slingshot



ENVIZIO PRO II SMARTTRAX W/SLINGSHOT

CHAPTER

6

Startup Procedures



WARNING

When starting the machine for the first time after installing SmarTrax, be sure that all persons stand clear in case a hose has not been properly tightened.



WARNING

Do not use hands to check for leaks. Hydraulic fluid under pressure can penetrate the skin and cause serious injury or death.

Verify the SmarTrax System Installation

1. Turn on the machine.
2. Double-check all fitting and hose connections to ensure that:
 - Hoses are not rubbing on or interfering with moving parts.
 - Hydraulic fluid is not leaking from the system.
3. Turn the machine's wheels fully from side to side repeatedly to remove air from the hydraulic system.

Note: *During the SmarTrax system installation, whenever the hydraulic system is purged for maintenance, or when fittings are loosened or disconnected, air is introduced into the lines of the hydraulic system. If air pockets are present, the wheels may not move consistently when the steering wheel is turned.*

4. Continue turning the wheels until they move steadily and smoothly when the steering wheel is turned.

5. Access the System Diagnostic screen by selecting the MACHINE TEST option on the Machine Type screen and turn the wheels using the Raven console.

Note: *If there are issues with the SmarTrax system, turn off the machine and correct them immediately. For additional assistance, refer to the SmarTrax and SmartSteer Calibration & Operation Manual (P/N 016-0171-277) or contact your local Raven dealer.*

Calibrate the SmarTrax System

Refer to the SmarTrax & SmartSteer Calibration and Operation Manual (P/N 016-0171-277) for instructions on calibrating the SmarTrax system, adjusting system settings, and system operation.

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Limited Warranty

What Does this Warranty Cover?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service.

How Long is the Coverage Period?

Raven Applied Technology Division products are covered by this warranty for 12 months after the date of purchase. This warranty coverage applies only to the original owner and is nontransferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If your dealer agrees with the warranty claim, the dealer will send the part and proof of purchase to their distributor or to Raven Industries for final approval.

What Will Raven Industries Do?

Upon confirmation of the warranty claim, Raven Industries will, at our discretion, repair or replace the defective part and pay for return freight.

What is not Covered by this Warranty?

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit or other special damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.