

**Buehler Versatile 4WD 305-575  
SmarTrax™ Installation Manual**

*P/N 016-5031-001 Rev C*

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*E19564*

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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**

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## ***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.

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## ***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.

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## 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: Buhler Versatile**

**MODEL: 305, 340, 375, 400 - Serial Number 307000 and Lower  
435, 485, 535, 575 - Serial Number 704000 and Lower**

**FIGURE 1. Buhler Versatile 4WD 535**



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## *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:

- Install the GPS antenna on the front center of the machine's cab.
- 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.

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## Updates

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

<http://www.ravenhelp.com>

*At Raven Industries, we strive to make your experience with our products as rewarding as possible. One way to improve this experience is to provide us with feedback on this manual.*

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[techwriting@ravenind.com](mailto:techwriting@ravenind.com)

*-Buhler Versatile 4WD 305-575 SmarTrax™ Installation Manual*

*-Manual No. 016-5031-001 Rev. B*

*-Any comments or feedback (include chapter or page numbers if applicable).*

*-Let us know how long have you been using this or other Raven products.*

*We will not share your email or any information you provide with anyone else. Your feedback is valued and extremely important to us.*

*Thank you for your time.*





## 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 117-5031-001)**

Picture	Item Description	Part Number	Qty.
Not Pictured	Manual - Buhler/Versatile 4WD 305-575 SmarTrax Installation	016-5031-001	1
	Valve - SmarTrax Hydraulic	334-0003-089	1
	Bracket - Valve Mounting	107-0171-911	1
	Bracket - Node Mounting	107-0171-914	1
	Cable - SmarTrax Valve Harness	115-4001-148	1
	Transducer - 0-3000 PSI Pressure	422-0000-086	1
	Bolt - 5/16"-18 x 7/8" Hex	311-0052-104	11
	Nut - 5/16"-18 Nylon Insert Lock	312-4000-059	7

**TABLE 1. SmarTrax Installation Kit (P/N 117-5031-001)**

Picture	Item Description	Part Number	Qty.
	Washer - 5/16" Lock	313-1000-019	4
	Washer - 5/16" Flat	313-2300-012	7

**TABLE 2. Hydraulic Installation Kit (P/N 117-0199-001)**

Picture	Item Description	Part Number	Qty.
	Fitting - -12 ORFS M/M/F Swivel Run Tee Adapter	333-0012-029	4
	Fitting - -12 ORFS (F) to -8 ORFS (M) Reducer	333-0012-030	4
	Fitting - -6 ORFS (M) to -6 SAE O-Ring Straight Adapter	333-0012-084	2
	Fitting - -8 ORFS (M) to -8 SAE O-Ring (M) Straight Adapter	333-0012-168	1
	Fitting - -6 ORFS (M) to -8 SAE O-Ring (M) Straight Adapter	333-0012-199	1
	Fitting - -6 ORFS (M) to -10 SAE O-Ring (M) Straight Adapter	333-0012-233	2
	Hydraulic Hose - -8 ORFS (F) to -8 ORFS (F) 90° - 50"	214-1000-876	1
	Hydraulic Hose - -6 ORFS (F) to -6 ORFS (F) 90° - 50"	214-1000-877	1

TABLE 2. Hydraulic Installation Kit (P/N 117-0199-001)







Picture	Item Description	Part Number	Qty.
	Hydraulic Hose - -6 ORFS (F) to -6 ORFS (F) 90° - 50"	214-1000-879	1
	Hydraulic Hose - -6 ORFS (F) to -8 ORFS (F) - 50"	214-1000-911	2
	Hydraulic Hose - -6 ORFS (F) to -8 ORFS (F) 90° - 18"	214-1000-912	1

TABLE 3. Node Installation 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 RTK	063-0173-228	1
	Assembly - Enable Foot Switch	063-0172-470	1
	Cable - SmarTrax Node Harness	115-4001-109	1

**Note:** The node installation kit is sold separately.



**CHAPTER**

**3**

***Hydraulic System  
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.

	<b>NOTICE</b>
<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 (P/N 334-0003-089) 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.

**FIGURE 1. Fittings Installed in the SmarTrax Valve**



Fitting	Part Number	Port
Fitting - -6 ORFS (M) to -6 SAE O-Ring (M) Straight Adapter	333-0012-084	LSPV, LS STEER
Fitting - -6 ORFS (M) to -8 SAE O-ring (M) Straight Adapter	333-0012-199	P
Fitting - -8 ORFS (M) to -8 SAE O-Ring (M) Straight Adapter	333-0012-168	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 2. SmarTrax Valve Mounting Location



1. Install the SmarTrax valve on the mounting bracket (P/N 107-0171-911) using four 5/16" hex bolts (P/N 311-0052-104) and four 5/16" lock washers (P/N 313-1000-019).

FIGURE 3. SmarTrax Valve Mounted on the Machine



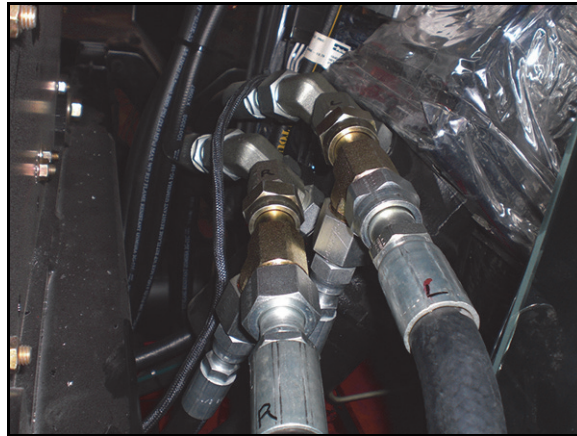
2. Mount the mounting bracket to the machine's hood support bracket using four 5/16" hex bolts (P/N 311-0052-104), four 5/16" washers (P/N 313-2300-012) and four 5/16"-18 lock nuts (P/N 312-4000-059).

## Install the Left and Right Steering Hoses

1. Disconnect the machine's left steering hose from the steering orbital.

**FIGURE 4. Left and Right Steering Hoses Installed**

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2. Install a -12 ORFS M/M/F swivel run tee adapter fitting (P/N 333-0012-029) in the open port of the steering orbital.
3. Connect the machine's left steering hose to the opposite end of the installed tee fitting.
4. Install a -12 ORFS (F) to -8 ORFS (M) reducer adapter fitting (P/N 333-0012-030) on the 90° end of the installed tee fitting.
5. Install the -8 end of the supplied hydraulic hose (P/N 214-1000-911) on the installed reducer fitting.
6. Connect the -6 end of the installed hydraulic hose to the fitting installed in Port A of the SmarTrax valve (P/N 334-0003-089).
7. Disconnect the machine's right steering hose from the steering orbital.
8. Install a -12 ORFS M/M/F swivel run tee adapter fitting (P/N 333-0012-029) in the open port of the steering orbital.
9. Connect the machine's right steering hose to the opposite end of the installed tee fitting.
10. Install a -12 ORFS (F) to -8 ORFS (M) reducer adapter fitting (P/N 333-0012-030) on the 90° end of the installed tee fitting.
11. Install the -8 end of the supplied hydraulic hose (P/N 214-1000-911) on the installed reducer fitting.
12. Connect the -6 end of the installed hydraulic hose to the fitting installed in Port B of the SmarTrax valve.

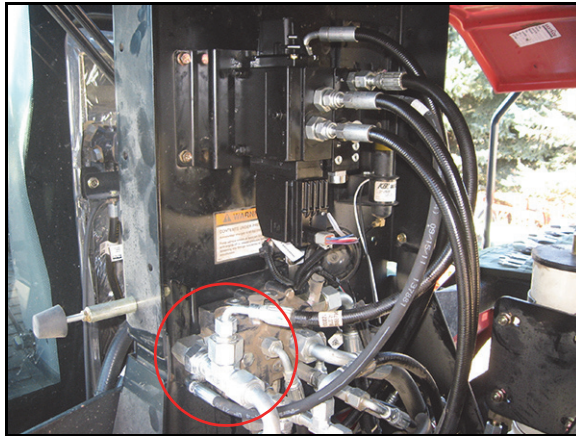
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## ***Install the Pressure Hose***

1. Disconnect the machine's pressure hose from the machine's hydraulic valve.



FIGURE 5. Pressure Hose Installed

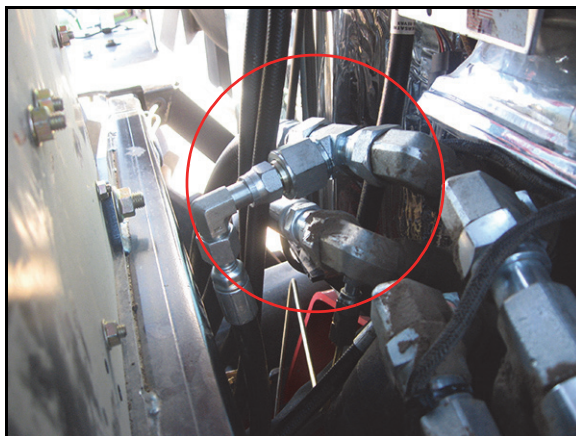


2. Install a -12 ORFS M/M/F swivel run tee adapter fitting (P/N 333-0012-029) in the open pressure port.
3. Connect the machine's pressure hose to the opposite end of the installed tee fitting.
4. Install a -12 ORFS (F) to -8 ORFS (M) reducer adapter fitting (P/N 333-0012-030) on the 90° end of the installed tee fitting.
5. Install the 90° end of the supplied hydraulic hose (P/N 214-1000-912) on the installed reducer fitting.
6. Connect the straight end of the installed hydraulic hose to the fitting installed in Port P of the SmarTrax valve (P/N 334-0003-089).

## *Install the Tank Hose*

1. Disconnect the machine's tank hose from the tank port of the steering orbital.

FIGURE 6. Tank Hose Installed



2. Install a -12 ORFS M/M/F swivel run tee adapter fitting (P/N 333-0012-029) on the open tank port on the steering orbital.
3. Connect the machine's tank hose to the opposite end of the installed tee fitting.
4. Install a -12 JIC (F) to -8 JIC (M) reducer adapter fitting (P/N 333-0012-063) on the 90° end of the installed tee fitting.

5. Install the 90° end of the supplied hydraulic hose (P/N 214-1000-876) on the installed reducer fitting.
6. Connect the straight end of the installed hydraulic hose to the fitting installed in Port T of the SmarTrax valve (P/N 334-0003-089).

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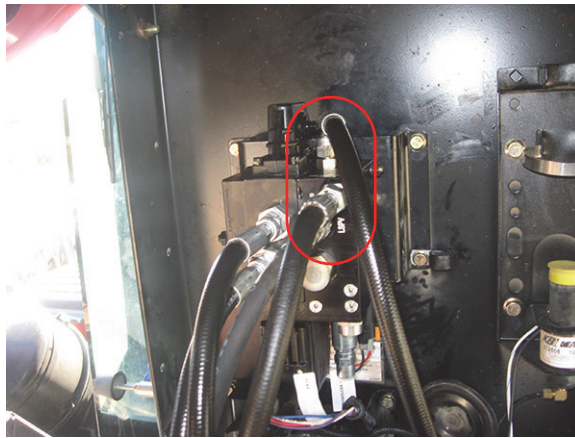
### ***Install the Load Sense Hoses***

1. Disconnect the machine's load sense hose from the steering orbital.
2. Disconnect the other end of the load sense hose from the machine's hydraulic valve.

**Note:** *This hose is not used in the SmarTrax system installation. Keep the hose for future use.*

**FIGURE 7. Load Sense Hoses Installed**

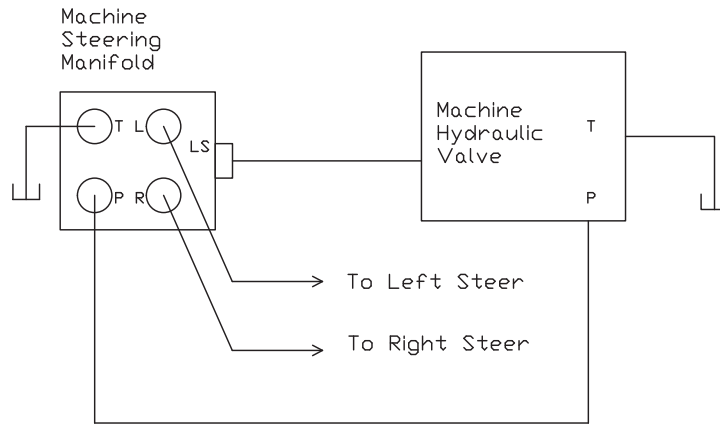
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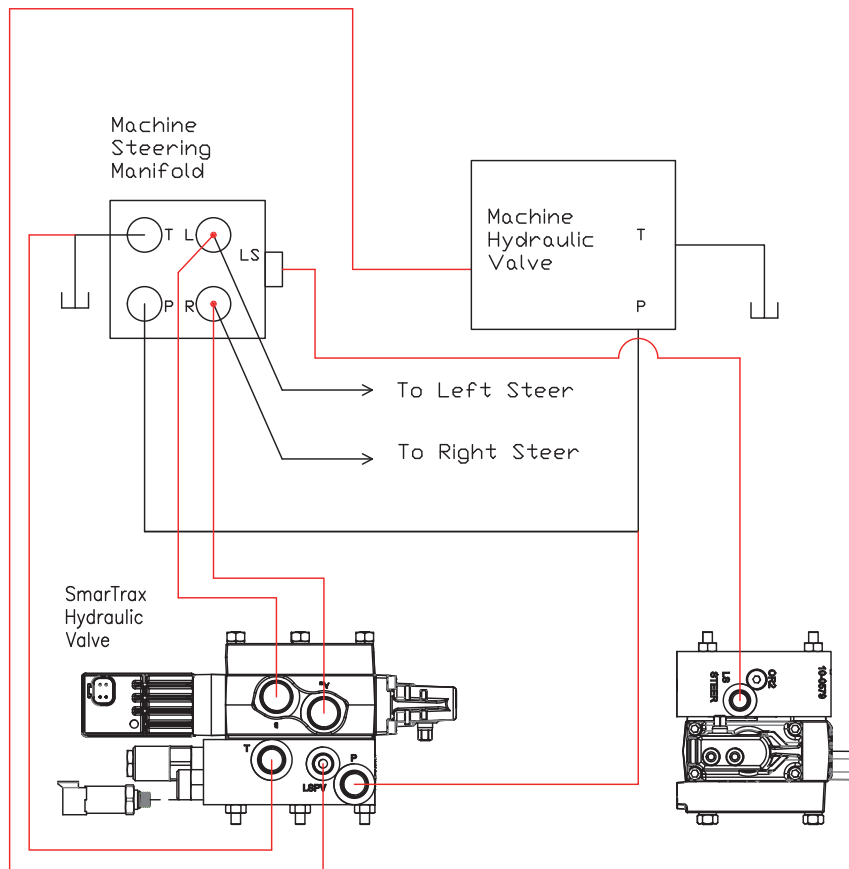
3. Install the straight end of the supplied hydraulic hose (P/N 214-1000-879) in the open port on the steering orbital.
4. Connect the 90° end of the installed hydraulic hose to the fitting installed in Port LS STEER of the SmarTrax valve (P/N 334-0003-089).
5. Install the 90° end of the supplied hydraulic hose (P/N 214-1000-877) in the open load sense port of the machine's hydraulic valve.
6. Connect the straight end of the installed hydraulic hose to Port LSPV of the SmarTrax valve.

# Hydraulic Diagram

Before SmarTrax Installation



After SmarTrax Installation





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## CHAPTER

# 4

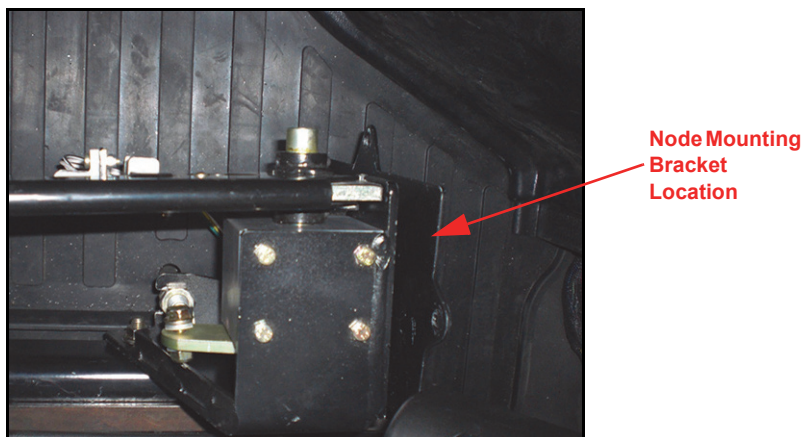
# *Cab Component Installation*

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## *Install the SmarTrax Node*

### Mount the SmarTrax Node

FIGURE 1. SmarTrax Node Mounting Location



1. Remove the parking brake from the base of the seat by removing the existing M10 x 30 mm bolts.

FIGURE 2. SmarTrax Node Installed

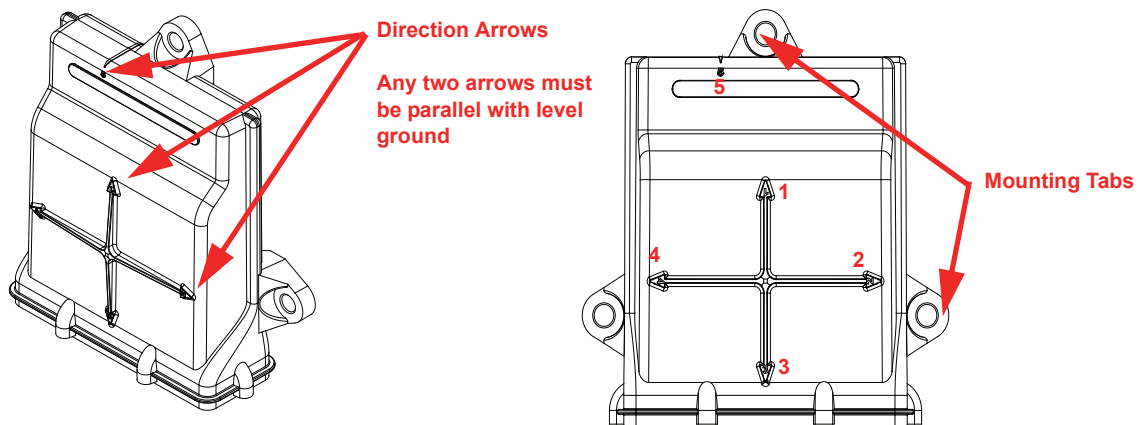


**Note:** The forward vehicle direction is 6 in the pictured node orientation.

2. Install the SmarTrax node (P/M 063-0173-228) on the node mounting bracket (P/N 107-0171-914) using three 5/16" hex bolts (P/N 311-0052-104), three 5/16" washers (P/N 313-2300-012), and three 5/16"-18 lock nuts (P/N 312-4000-059).
3. Install the two large, rectangular connectors of the node harness (P/N 115-4001-109) into the correct ports of the node.
4. Tighten the bolts on the harness connectors to secure the connections.
5. Position the node mounting bracket over the parking brake holes.
6. Secure the node mounting bracket to the machine using the M10 x 30 mm bolts that were removed in step 1.

## 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.*

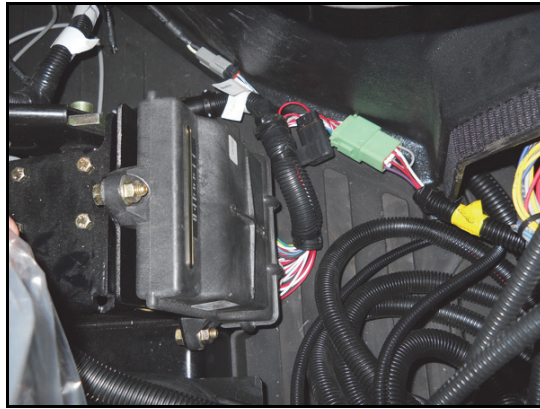
2. Using the holes in the foot switch as a template, drill holes in the floor of the cab.
3. Secure the foot switch to the floor by installing the supplied screws in each of the mounting holes.
4. Locate the ENABLE connector on the node harness (P/N 115-4001-109) and connect it to the foot switch cable connector.



## ***Install the Valve Harness***

**FIGURE 5. Valve Harness Connected to Node Harness**

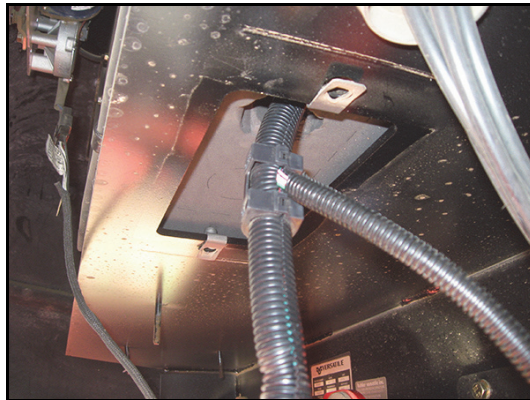
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1. Connect the 12-pin connector of the valve harness (P/N 115-4001-148) into the mating connector of the node harness (P/N 115-4001-109).

**FIGURE 6. Valve Harness Routed Outside Cab**

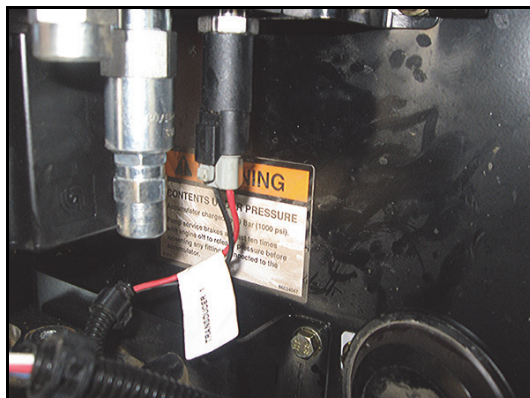
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2. Route the valve harness cable outside and under the cab through the access hole located under the floor mat behind the seat toward the SmarTrax valve (P/N 334-0003-089).

**FIGURE 7. Transducer Connection**

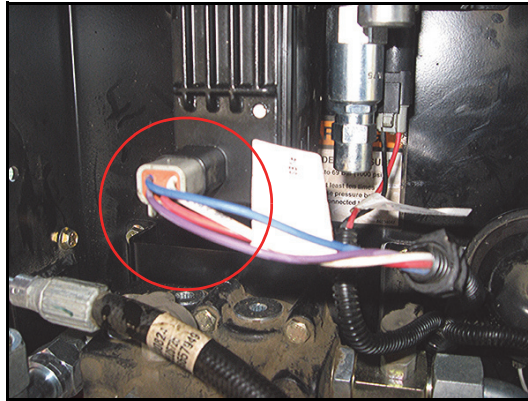
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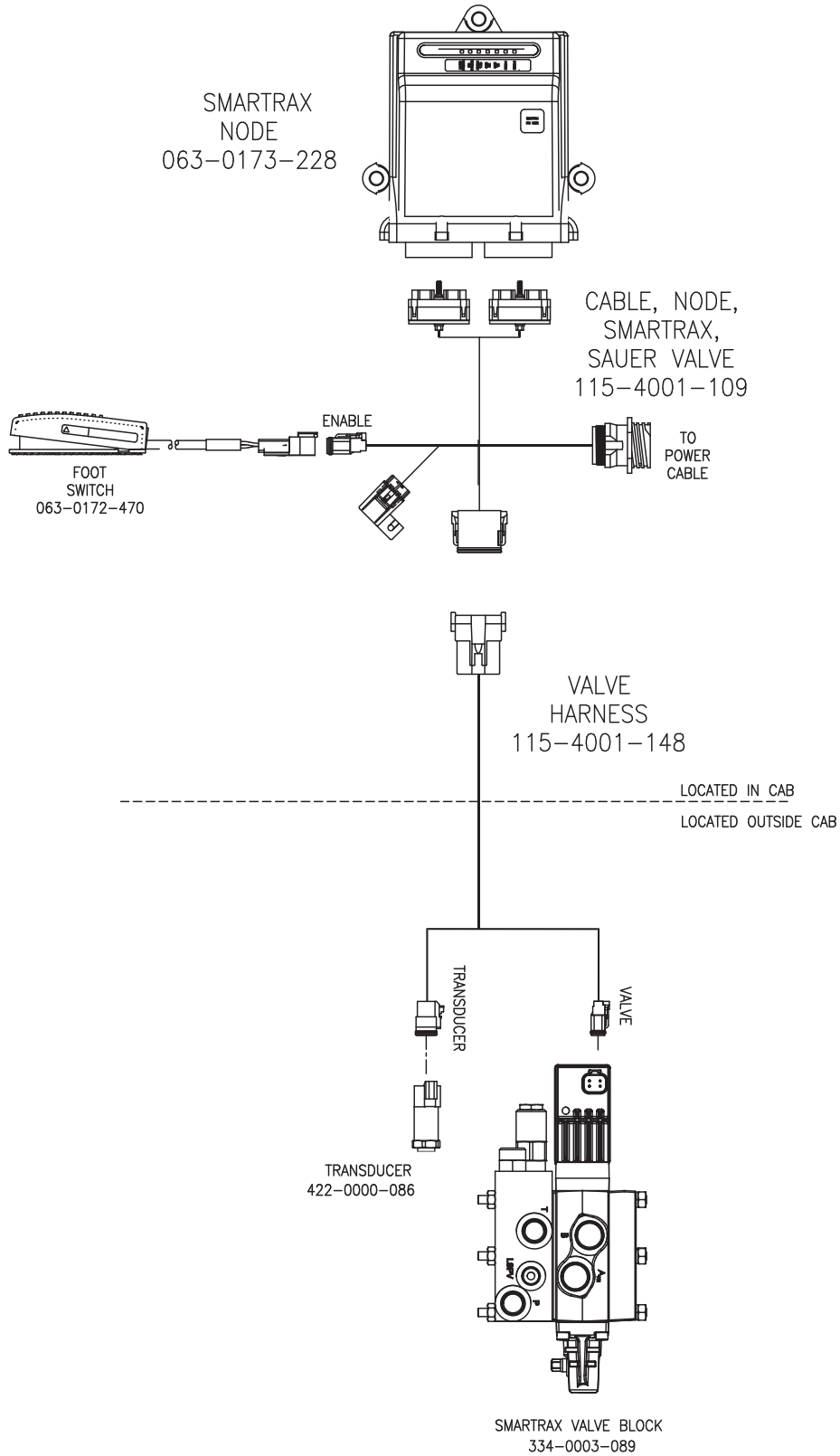
3. Connect the PSI connector to the pressure transducer (P/N 422-0000-086) installed in Port PS of the SmarTrax valve.

**FIGURE 8. Valve Connection**



4. Connect the PVES connector to the open PVE port of the SmarTrax valve.

FIGURE 9. Valve Harness Wiring Diagram



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## ***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 the connect 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 on 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.*

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## ***Connect SmarTrax to an Existing Chassis Cable (If Applicable)***

**Note:** *The SmarTrax interface tee is sold separately. Contact your local 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.









## CHAPTER

# 5

## *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.*

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## ***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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**RAVEN**

# **RAVEN INDUSTRIES**

## **Limited Warranty**

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### ***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.