

GVM Mako SmarTrax™ Installation Manual

P/N 016-5035-001 Rev. B

08/18

E31535

Disclaimer

While every effort has been made to ensure the accuracy of this document, Raven Industries assumes no responsibility for omissions and errors. Nor is any liability assumed for damages resulting from the use of information contained herein.

Raven Industries shall not be responsible or liable for incidental or consequential damages or a loss of anticipated benefits or profits, work stoppage or loss, or impairment of data arising out of the use, or inability to use, this system or any of its components. Raven Industries shall not be held responsible for any modifications or repairs made outside our facilities, nor damages resulting from inadequate maintenance of this system.

As with all wireless and satellite signals, several factors may affect the availability and accuracy of wireless and satellite navigation and correction services (e.g. GPS, GNSS, SBAS, etc.). Therefore, Raven Industries cannot guarantee the accuracy, integrity, continuity, or availability of these services and cannot guarantee the ability to use Raven systems, or products used as components of systems, which rely upon the reception of these signals or availability of these services. Raven Industries accepts no responsibility for the use of any of these signals or services for other than the stated purpose.

Table of Contents

Chapter 1	Important Safety Information.....	1
	Instructions for Wire Routing	2
	Instructions for Hose Routing	3
Chapter 2	Introduction.....	5
	Preparing for Installation	5
	Recommendations	5
	Point of Reference	6
	Updates	6
	Kit Contents	7
Chapter 3	Hydraulic System Installation.....	11
	Install Fittings in the SmarTrax Valve	12
	Install Fittings in the Load Sense Priority Valve	13
	Install the Load Sense Priority Valve on SmarTrax Valve	14
	Mount the SmarTrax Valve	15
	Mount the Dual Transducer Hydraulic Manifold	16
	Install the Pressure Hoses	17
	Left Steering Hose Installation	18
	Right Steering Hose Installation	19
	Install the Tank Hose	19
	Hydraulic Diagram	20
Chapter 4	Cab Component Installation.....	23
	Install the SmarTrax Node	23
	Mount the SmarTrax NOde	23
	Node Mounting Locations	24
	Install the Foot Switch	24
	Install the Valve Harness	25
	Install the Chassis Cable - SmarTrax-Only Systems (If Applicable)	28
	Connect SmarTrax to an Existing Chassis Cable (If Applicable)	28
Chapter 5	Startup Procedures	29
	Verify the SmarTrax System Installation	29
	Calibrate the SmarTrax System	30

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 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 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, observe the following safety measures:

- Be alert and aware of surroundings.
- Do not operate agricultural equipment while under the influence of alcohol or an illegal substance.
- Remain in the operator's position or a safe working distance away from the booms at all times when SmarTrax is engaged.
- Disable SmarTrax when exiting from 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, with the booms unfolded and supported, during installation or maintenance.

 **CAUTION**

INSTRUCTIONS FOR WIRE ROUTING

The word “harness” is used to mean all electrical leads and cables, bundled and unbundled. When installing harness, secure it at least every 30 cm (12in) to the frame. Follow existing harness as much as possible and use these guidelines:

Harness should not contact or be attached to:

- Lines and hoses with high vibration forces or pressure spikes
- Lines and hoses carrying hot fluids beyond harness component specifications

Avoid contact with any sharp edge or abrading surfaces such as, but not limited to:

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads
- Ends of adjustable hose clamps
- Wire exiting conduit without protection, either ends or side of conduit
- Hose and tube fittings

Routing should not allow harnesses to:

- Hang below the unit
- Have the potential to become damaged due to exposure to the exterior environment. (i.e. tree limbs, debris, attachments)
- Be placed in areas of or in contact with machine components which develop temperatures higher than the temperature rating of harness components
- Wiring should be protected or shielded if it needs to route near hot temperatures beyond harness component specifications

Harnessing should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

- Drive shafts, universal joints and hitches (i.e. 3-point hitch)
- Pulleys, gears, sprockets
- Deflection and backlash of belts and chains
- Adjustment zones of adjustable brackets
- Changes of position in steering and suspension systems
- Moving linkages, cylinders, articulation joints, attachments
- Ground engaging components

For harness sections that move during machine operation:

- Allow sufficient length for free movement without interference to prevent: pulling, pinching, catching or rubbing, especially in articulation and pivot points

- Clamp harnesses securely to force controlled movement to occur in the desired harness section
- Avoid sharp twisting or flexing of harnesses in short distances
- Connectors and splices should not be located in harness sections that move

Protect harnesses from:

- Foreign objects such as rocks that may fall or be thrown by the unit
- Buildup of dirt, mud, snow, ice, submersion in water and oil
- Tree limbs, brush and debris
- Damage where service personnel or operators might step or use as a grab bar
- Damage when passing through metal structures

IMPORTANT: Avoid directly spraying electrical components and connections with high pressure water. High pressure water sprays can penetrate seals and cause electrical components to corrode or otherwise become damaged. When performing maintenance:

- Inspect all electrical components and connections for damage or corrosion. Repair or replace components, connections, or cable as necessary.
- Ensure connections are clean, dry, and not damaged. Repair or replace components, connections, or cable as necessary.
- Clean components or connections using low pressure water, pressurized air, or an aerosol electrical component cleaning agent.
- Remove visible surface water from components, connections, or seals using pressurized air or an aerosol electrical component cleaning agent. allow components to dry completely before reconnecting cables.

INSTRUCTIONS FOR HOSE ROUTING

The word "hose" is used to mean all flexible fluid carrying components. Follow existing hoses as much as possible and use these guidelines:

Hoses should not contact or be attached to:

- Components with high vibration forces
- Components carrying hot fluids beyond component specifications

Avoid contact with any sharp edge or abrading surfaces such as, but not limited to:

- Sheared or flame cut edges
- Edges of machined surfaces
- Fastener threads or cap screw heads
- Ends of adjustable hose clamps

Routing should not allow hoses to:

- Hang below the unit
- Have the potential to become damaged due to exposure to the exterior environment. (i.e. tree limbs, debris, attachments)
- Be placed in areas of or in contact with machine components which develop temperatures higher than the temperature rating of hose components
- Hoses should be protected or shielded if it needs to route near hot temperatures beyond hose component specifications

Hoses should not have sharp bends

Allow sufficient clearance from machine component operational zones such as:

- Drive shafts, universal joints and hitches (i.e. 3-point hitch)
- Pulleys, gears, sprockets
- Deflection and backlash of belts and chains
- Adjustment zones of adjustable brackets
- Changes of position in steering and suspension systems
- Moving linkages, cylinders, articulation joints, attachments
- Ground engaging components

For hose sections that move during machine operation:

- Allow sufficient length for free movement without interference to prevent: pulling, pinching, catching or rubbing, especially in articulation and pivot points
- Clamp hoses securely to force controlled movement to occur in the desired hose section
- Avoid sharp twisting or flexing of hoses in short distances

Protect hoses from:

- Foreign objects such as rocks that may fall or be thrown by the unit
- Buildup of dirt, mud, snow, ice, submersion in water and oil
- Tree limbs, brush and debris
- Damage where service personnel or operators might step or use as a grab bar
- Damage when passing through metal structures
- High pressure wash

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: GVM

MODEL: Mako

FIGURE 1. GVM Mako



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.

Verify that SmarTrax running software version 7.7.31 or higher.

RECOMMENDATIONS

Before 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 in the recommended location. Refer to the following table for the machine-specific antenna mounting location.

NOTE: If your machine is not listed, install the antenna on the front-center of the cab.

Machine Preset	Antenna X Position (left to right)	Antenna Y Position (from the rear wheel axle to the antenna position on the cab)	Antenna Z Position (ground to top of antenna)
Mako	Centered	7 ft./2.134 m	10 ft. 7 in./3.226 m

- 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 system 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.

UPDATES

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

<https://portal.ravenprecision.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.

Your feedback will help shape the future of our product documentation and the overall service we provide. We appreciate the opportunity to see ourselves as our customers see us and are eager to gather ideas on how we have been helping or how we can do better.

To serve you best, please send an email with the following information to

techwriting@ravenind.com

- GVM Mako SmarTrax™ Installation Manual
- P/N 016-5035-001 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 117-5035-001)

Item Description	Part Number	Qty.
Valve - Load Sense Priority	334-0003-072	1
Valve - SmarTrax Hydraulic	334-0003-088	1
Manifold - Dual Transducer Hydraulic	334-0003-085	1
Bracket - Valve Mounting	107-0171-907	2
Bracket - Node Mounting	107-0172-055	1
Cable - Valve Harness	115-4001-269	1
Bolt - 5/16"-18 x 7/8" Hex	311-0052-104	4

TABLE 1. SmarTrax Installation Kit (P/N 117-5035-001)

Item Description	Part Number	Qty.
Bolt - 1/4"-20 x 2" Hex	311-0049-109	2
Nut - 1/4"-20 Nylon Insert Lock	312-4000-057	2
Nut - 3/8"-16 Nylon Insert Lock	312-4001-109	3
Washer - 5/16" Split Lock	313-1000-019	4
Tape - 3.5" Double-Sided	332-0000-019	5

TABLE 2. Hydraulic Installation Kit (P/N 117-0199-155)

Item Description	Part Number	Qty.
Fitting - -6 JIC M/F 45° Swivel Elbow	333-0012-027	2
Fitting - -6 JIC M/F 90° Swivel Elbow	333-0012-042	6
Fitting - -6 JIC M/M/F Swivel Run Tee Adapter	333-0012-043	4
Fitting - -6 ORB to -6 JIC (M) Straight Adapter	333-0012-045	2
Fitting - -8 ORB to -6 JIC (M) Straight Adapter	333-0012-046	2
Fitting - -6 JIC (M) to -4 SAE O-Ring (M) Straight Adapter	333-0012-050	1
Fitting - -4 SAE O-Ring (M) Internal Hex Plug	333-0012-051	2
Fitting - -8 JIC (M) to -10 SAE O-Ring (M) Straight Adapter	333-0012-056	1
Fitting - -8 JIC M/F 90° Swivel Elbow	333-0012-064	1
Fitting - -6 JIC (M) to -10 SAE O-Ring (M) Straight Adapter	333-0012-106	2

TABLE 2. Hydraulic Installation Kit (P/N 117-0199-155)

Item Description	Part Number	Qty.
Fitting - -8 SAE O-Ring (M) TO -6 JIC (F) Straight	333-0012-140	1
Fitting - -6 JIC (M) to -6 JIC (m) Straight Adapter	333-0012-250	3
Fitting - -8 JIC (M) to -10 SAE O-Ring (M) 90° Elbow	333-0012-263	1
Fitting - Adapter, Straight, 3/4" JIC M/M	333-0012-164	1
Hydraulic Hose - -8 JIC (F) 90 Deg to -8 JIC (F) -84"	214-1001-196	2
Hydraulic Hose - -6 JIC (F) to -6 JIC (F) - 20"	214-1001-176	5
Hydraulic Hose - -6 JIC (F) to -6 JIC (F) - 48"	214-1001-177	1
Hydraulic Hose - -6 JIC (F) to -6 JIC (F) - 18"	214-1001-179	2

TABLE 3. Node Installation Kit (P/N 117-5030-005)

Item Description	Part Number	Qty.
Manual - SmarTrax Calibration & Operation	016-0171-277	1
Node - SmarTrax	063-0173-228	1
Cable - Node Harness	115-4001-109	1
Assembly - Enable Foot Switch	063-0172-470	1

CHAPTER

3

HYDRAULIC SYSTEM INSTALLATION



WARNING

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

Before beginning 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 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 hydraulic valve.



NOTICE

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.

INSTALL FITTINGS IN THE SMARTRAX VALVE

Before mounting the SmarTrax valve (P/N 334-0003-088) 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 figure and table below to install the fittings in the proper ports of the SmarTrax valve.

FIGURE 1. Fittings Installed in SmarTrax Valve



Fitting	Part Number	Port
Fitting - -6 JIC (M) to -8 SAE O-Ring (M) Straight Adapter	333-0012-046	P, T
Fitting - -6 JIC M/M/F Swivel Run Tee Adapter	333-0012-043	P, T
Fitting - -4 SAE O-Ring (M) Internal Hex Plug	333-0012-051	PS
Fitting - -6 ORB to -6 JIC (M) Straight Adapter	333-0012-045	LSPV, LS STEER

Fitting	Part Number	Port
Fitting - -6 JIC M/F 90° Swivel Elbow	333-0012-042	LSPV, LS STEER
Fitting - -6 JIC (M) to -10 SAE O-Ring (M) Straight Adapter	333-0012-106	A, B

INSTALL FITTINGS IN THE LOAD SENSE PRIORITY VALVE

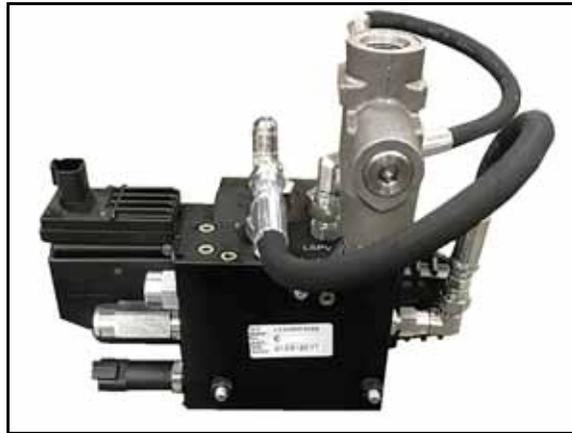
Before mounting the load sense priority valve (P/N 334-0003-072) on the machine, install the proper fittings in the valve. This prepares the valve for installation and simplifies the hose connection process later in the procedure. Refer to the table below to install the fittings in the proper ports of the load sense priority valve.

Fitting	Part Number	Port
Fitting - -6 JIC (M) to -4 SAE O-Ring (M) Straight Adapter	333-0012-050	LS
Fitting - -6 JIC M/F 90° Swivel Elbow	333-0012-042	LS
Fitting - -8 JIC (M) to -10 SAE O-Ring (M) Straight Adapter	333-0012-056	P
Fitting - -8 JIC (M) to -10 SAE O-Ring (M) 90° Elbow	333-0012-263	EF
Fitting - -8 JIC M/F 90° Swivel Elbow	333-0012-064	EF (if necessary to achieve connection)
Fitting - -8 SAE O-Ring (M) TO -6 JIC (F) Straight	333-0012-140	CF



INSTALL THE LOAD SENSE PRIORITY VALVE ON SMARTRAX VALVE

FIGURE 2. Priority Valve Installed on SmarTrax Valve



1. Install the load sense priority valve (P/N 334-0003-072) on the SmarTrax valve by connecting the fitting installed in Port CF of the priority valve to the fitting installed in Port P of the SmarTrax valve.

FIGURE 3. Hoses Installed on SmarTrax and Load Sense Priority Valves



2. Install one end of the supplied hydraulic hose (P/N 214-1001-179) to the fitting installed in Port LS of the priority valve.
3. Connect the other end of the installed hydraulic hose to the fitting installed in Port LSPV of the SmarTrax valve.
4. Install one end of the supplied hydraulic hose (P/N 214-1001-179) to the fitting installed in Port LS STEER of the SmarTrax valve.
5. Connect the other end of the installed hydraulic hose to the straight end of the tee fitting installed in Port T of the SmarTrax valve.

MOUNT THE SMARTRAX VALVE

FIGURE 4. SmarTrax Valve Mounting Location



1. Identify the SmarTrax valve mounting location on the hood support on the left side of the machine.

FIGURE 5. SmarTrax Valve Installed on Valve Mounting Bracket



2. Install the SmarTrax valve (P/N 334-0003-088) on the 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).

FIGURE 6. SmarTrax Valve Mounting Bracket Installed



NOTE: Figure 6 does not show the SmarTrax and load sense priority valves installed on the valve mounting bracket. This figure is meant to demonstrate the method used to install the valve mounting bracket only.

3. Secure the valve mounting bracket (P/N 107-0171-907) to the machine's hood support using the machine's existing hardware.

MOUNT THE DUAL TRANSDUCER HYDRAULIC MANIFOLD

FIGURE 7. Dual Transducer Hydraulic Manifold Mounting Location



1. Identify the dual transducer hydraulic manifold (P/N 334-0003-085) mounting location on the hood support on the left side of the machine.
2. Secure the valve mounting bracket (P/N 107-0171-907) to the machine's hood support using the machine's existing hardware.

3. Install the dual transducer hydraulic manifold on the valve mounting bracket using two 1/4"-20 x 2" hex bolts (P/N 311-0049-109) and two 1/4"-20 nylon insert lock nuts (P/N 312-4000-057).

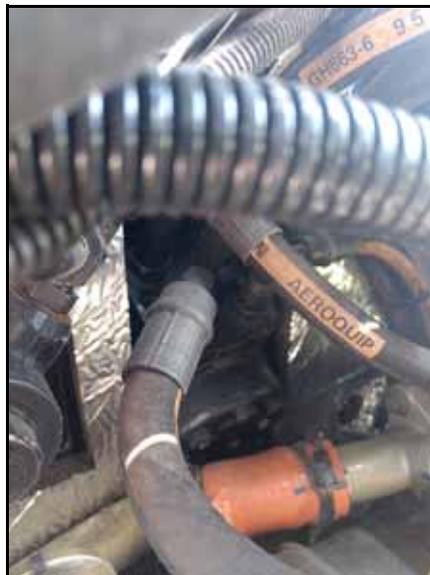
INSTALL THE PRESSURE HOSES

FIGURE 8. Machine's Steering Orbital Location



1. Locate the machine's steering orbital.
2. Disconnect the pressure line from the steering orbital.

FIGURE 9. Pressure Hose Installed on Machine's Steering Orbital



3. Install the straight end of the supplied hydraulic hose (P/N 214-1001-196) on Port P of the load sense priority valve (P/N 334-0003-072).

- Using a -8 JIC M/M fitting, connect the 90° end of the installed hydraulic hose to the pressure hose disconnected from the steering orbital..
- Install the straight end of the supplied hydraulic hose (P/N 214-1001-196) to the fitting installed in Port EF of the priority valve.

FIGURE 10. Machine's Pressure Hose Connected to Installed Pressure Hose



- Connect the 90° end of the installed hydraulic hose to the open port of the steering orbital.

LEFT STEERING HOSE INSTALLATION

- Locate the machine's left and right hoses that run over the top of the engine and down to the tee fittings above the front axle.
- Disconnect the machine's left steering hose from the exiting tee fitting.
- Install a -6 JIC M/M/F swivel run tee fitting (P/N 333-0012-043) on the machine's existing tee fitting.
- Install a -6 JIC M/M adapter to the left steering hose that was removed from the machine's existing tee fitting.
- Connect one end of the supplied hydraulic hose (P/N 214-1001-176) to the -6 JIC M/M installed on the machine's left steering hose.
- Connect the other end of the supplied hydraulic hose to port A1 on the hydraulic override manifold (P/N 334-0003-085).
- Connect one end of the supplied hydraulic hose (P/N 214-1001-176) to Port B3 on the hydraulic override manifold (P/N 334-0003-085).
- Route the other end of the supplied hydraulic hose to the open horizontal port of the -6 JIC M/M/F swivel run tee that installed in step 3.
- Connect one end of the supplied hydraulic hose (P/N 214-1001-176) to the open vertical port of the -6 JIC M/M/F swivel run tee that was installed in step 3.
- Connect the other end of the supplied hydraulic hose to Port A on the SmarTrax Valve (P/N 334-0003-088).

RIGHT STEERING HOSE INSTALLATION

1. Locate the machine's left and right hoses that run over the top of the engine and down to the tee fittings above the front of the axle.
2. Disconnect the machine's right steering hose from the existing tee fitting.
3. Install a -6 JIC M/M/F swivel run tee fitting (P/N 333-0012-043) on the machine's existing tee fitting.
4. Reconnect the machine's right steering hose to the open horizontal port of the -6 JIC M/M/F swivel run tee that was installed in step 3.
5. Connect one end of the supplied hydraulic hose (P/N 214-1001-176) to the open port of the -6 JIC M/M/F swivel run tee install in step 3.
6. Route the other end of the supplied hydraulic hose to Port B on the SmarTrax Valve (P/N 334-0003-088).

INSTALL THE TANK HOSE

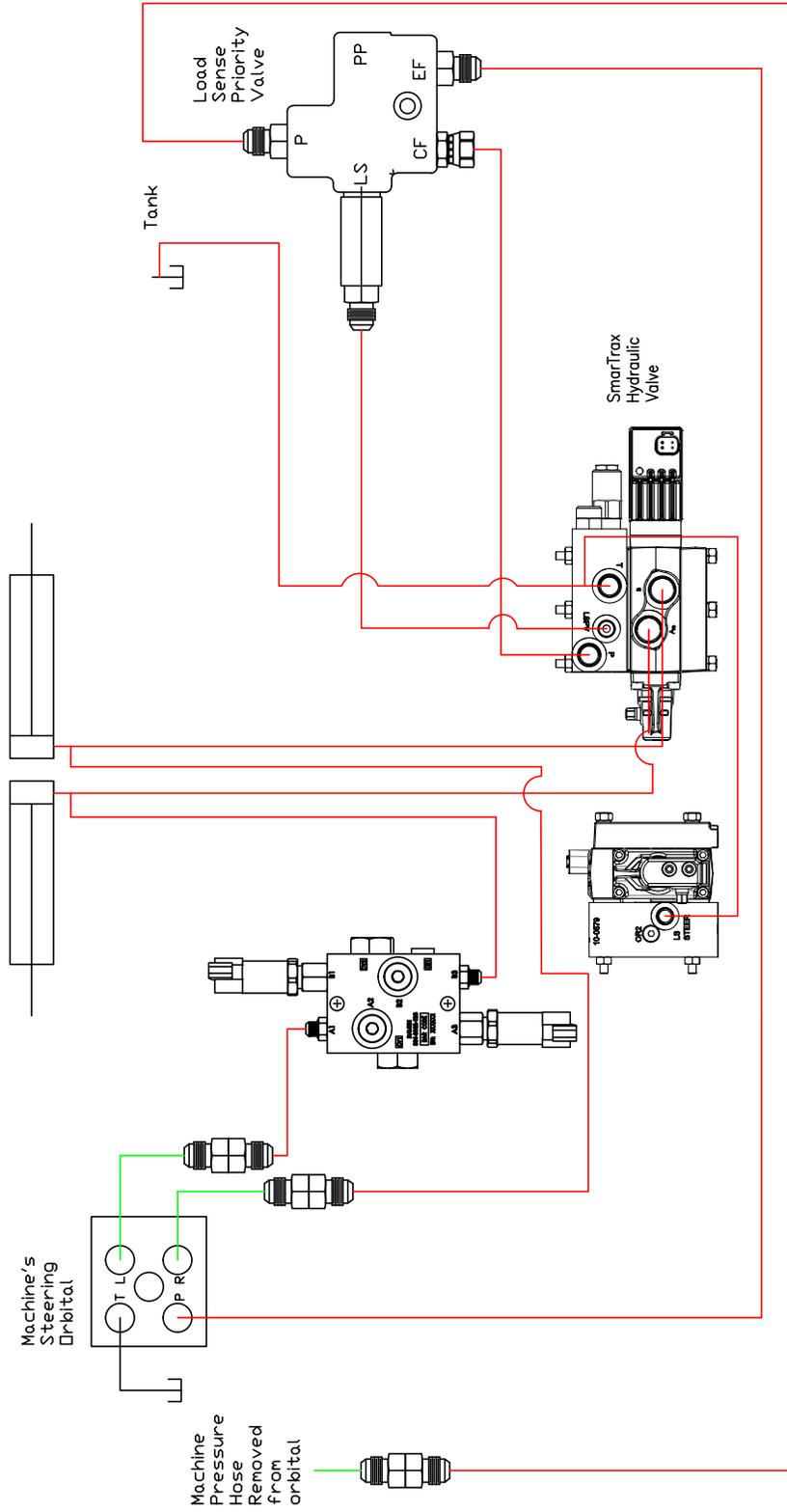
FIGURE 11. Tank Hose Installed on Hydraulic Reservoir



1. Locate and disconnect the machine's tank hose from the rear of the machine's hydraulic reservoir.
2. Install a -6 JIC M/M/F swivel run tee adapter fitting (P/N 333-0012-043) on the open port of the hydraulic reservoir.
3. Connect the machine's tank hose to the opposite end of the installed tee fitting.
4. Install one end of the supplied hydraulic hose (P/N 214-1001-177) on the 90° end of the installed tee fitting.
5. Connect the remaining end of the installed hydraulic hose to the fitting installed in Port T of the SmarTrax valve (P/N 334-0003-088).

HYDRAULIC DIAGRAM

After SmarTrax Installation





CHAPTER

4

CAB COMPONENT INSTALLATION

INSTALL THE SMARTRAX NODE

MOUNT THE SMARTRAX NODE

FIGURE 1. SmarTrax Node Installed



1. Install the SmarTrax node (P/N 063-0173-228) on the node mounting bracket (P/N 107-0172-055) using three 3/8"-16 zinc flanged lock nuts (P/N 312-4001-109).
2. Place double-sided tape strips (P/N 332-0000-019) on the back of the node mounting bracket.
3. Identify the node mounting bracket installation location on the floor of the cab.

NOTE: Ensure that the selected mounting location is free of dust, dirt, and debris.

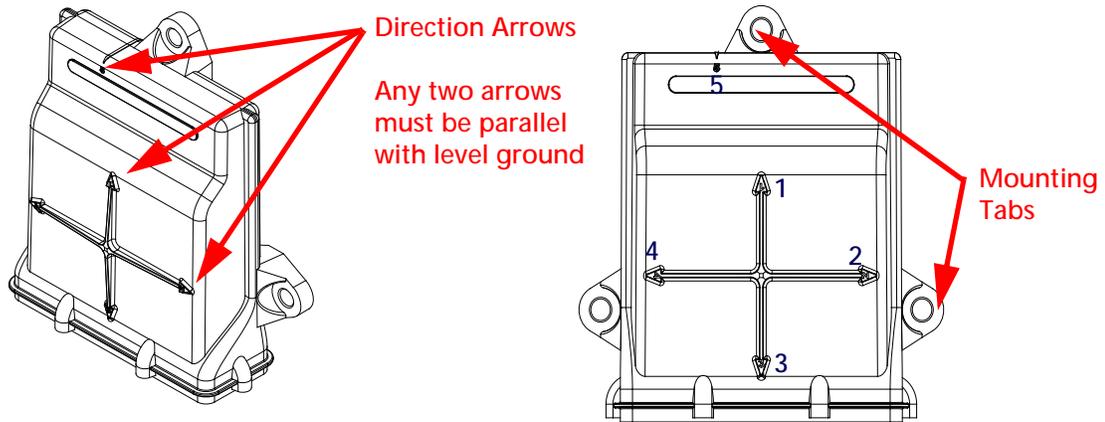
4. Remove the backing from the double-sided tape and adhere the node mounting bracket to the floor, pressing firmly to ensure that the tape adheres firmly to the floor.

NOTE: The node may also be secured to the floor using bolts or self-tapping screws (not included).

5. Insert the two large, rectangular connectors of the node harness (P/N 115-4001-109) into the correct ports of the node.
6. Tighten the bolts on the harness connectors to secure the connections.

NODE MOUNTING LOCATIONS

FIGURE 2. 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 3. 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 connector 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.

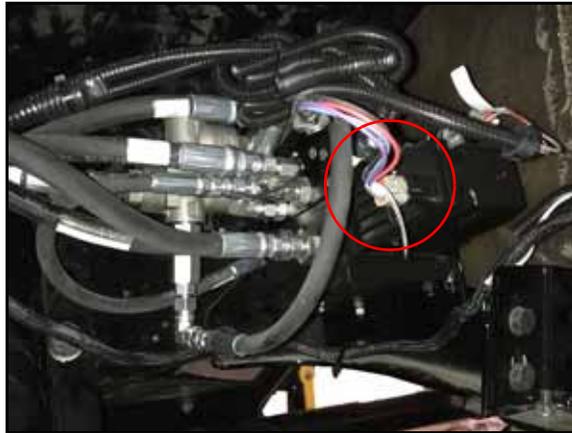
INSTALL THE VALVE HARNESS

FIGURE 4. Valve Harness Connected to Node Harness



1. Route the 12-pin connector of the valve harness cable (P/N 115-4001-269) into the cab through the access hole in the back of the cab.
2. Connect the 12-pin connector of the valve harness cable to the mating connector of the node harness (P/N 115-4001-109).

FIGURE 5. VALVE Connector Installed on SmarTrax Valve



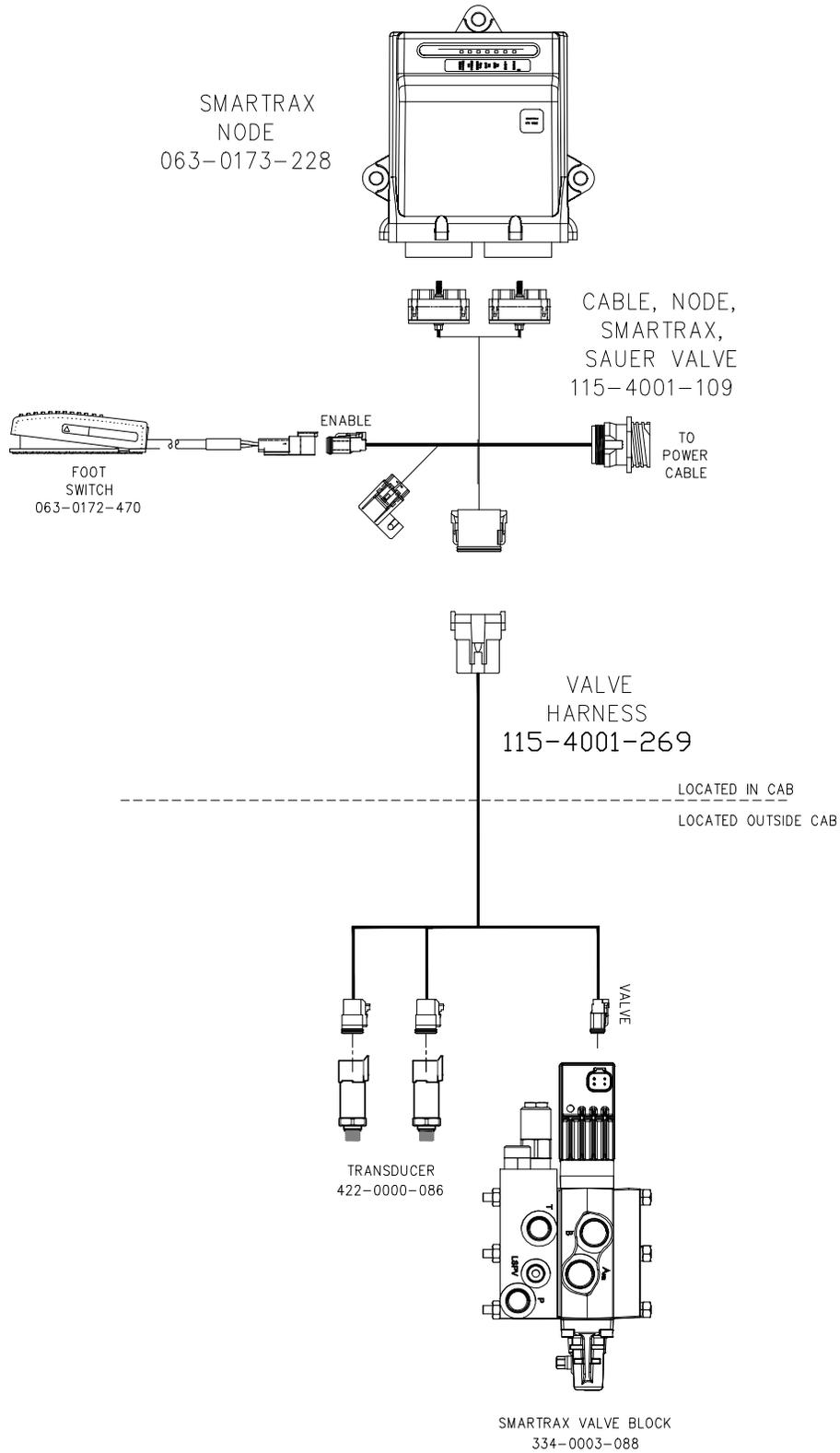
3. Route the 4-pin VALVE connector of the valve harness cable to the SmarTrax valve mounting location.

NOTE: Route the cable away from moving parts and heat sources.

4. Connect the VALVE connector to the open 4-pin port of the SmarTrax valve.
5. Route the PSI connectors of the valve harness cable to the dual transducer hydraulic manifold mounting location.
6. Connect the PSI connectors to the pressure transducers installed in the dual transducer hydraulic manifold.

NOTE: These connectors may be installed in either transducer.

FIGURE 6. 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.

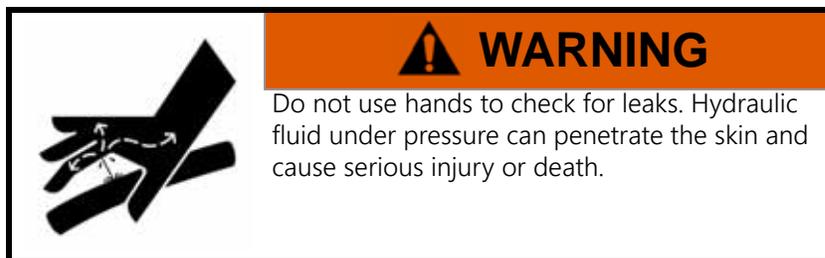
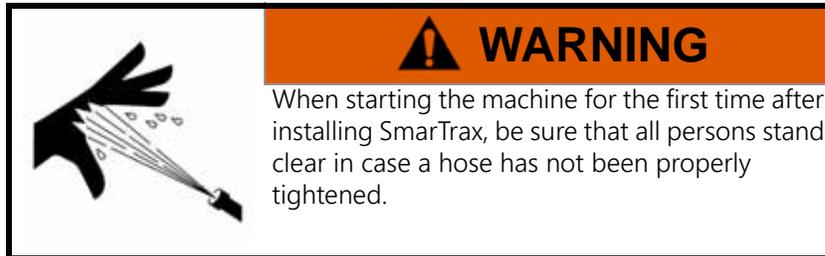
NOTE: The chassis cable is sold separately. Contact your local Raven dealer for ordering information.

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 on the node harness (P/N 115-4001-109).
3. Connect the TO CONSOLE CABLE connector to the round 16-pin connector of the console cable..
4. Install a terminator (P/N 063-0172-369) on the CAN cable connector.
5. Connect the ring terminals to the battery.

CONNECT SMARTRAX TO AN EXISTING CHASSIS CABLE (IF APPLICABLE)

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 tee cable (P/N 115-4001-070 or 115-4001-071) between the chassis and Raven console harness.
3. Connect the TO SMARTRAX NODE connector to the round 16-pin connector of the node harness (P/N 115-4001-109)..

NOTE: The SmarTrax tee cables are sold separately. Contact your local Raven dealer for ordering information.



VERIFY THE SMARTRAX SYSTEM INSTALLATION

1. Turn on the machine.
2. Double-check all fittings 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 Calibration & Operation Manual (P/N 016-0171-277) for instructions on calibrating the SmarTrax system, adjusting system settings, and system operation.

C

Cab Component Installation 23

- Connecting SmarTrax to an Existing Chassis Cable 28
- Installing the Chassis Cable - SmarTrax-Only Systems 28
- Installing the Foot Switch 24
- Installing the SmarTrax Node 23
 - Mounting the SmarTrax Node 23
 - Node Mounting Locations 24
- Installing the Valve Harness 25

H

Hydraulic System Installation 11

- Hydraulic Diagram 20
- Installing Fittings in the Load Sense Priority Valve 13
- Installing Fittings in the SmarTrax Valve 12
- Installing the Load Sense Priority Valve on the SmarTrax Valve 14
- Installing the Pressure Hoses 17
- Installing the Tank Hose 19
- Mounting the Dual Transducer Hydraulic Manifold 16
- Mounting the SmarTrax Valve 15

I

Introduction

- Kit Contents 7
- Preparing for Installation 5
 - Point of Reference 6
 - Recommendations 5

K

Kit Contents 7

S

Startup Procedures 29

- Calibrating the SmarTrax System 30
- Verifying the SmarTrax System Installation 29

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 when used for intended purpose.

HOW LONG IS THE COVERAGE PERIOD?

Raven Applied Technology products are covered by this warranty for 12 months from the date of retail sale. In no case will the Limited Warranty period exceed 24 months from the date the product was issued by Raven Industries Applied Technology Division. This warranty coverage applies only to the original owner and is non-transferable.

HOW CAN I GET SERVICE?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries.

WHAT WILL RAVEN INDUSTRIES DO?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

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, labor, or other 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.

EXTENDED 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 when used for intended purpose.

DO I NEED TO REGISTER MY PRODUCT TO QUALIFY FOR THE EXTENDED WARRANTY?

Yes. Products/systems must be registered within 30 days of retail sale to receive coverage under the Extended Warranty. If the component does not have a serial tag, the kit it came in must be registered instead.

WHERE CAN I REGISTER MY PRODUCT FOR THE EXTENDED WARRANTY?

To register, go online to www.ravenhelp.com and select Product Registration.

HOW LONG IS THE EXTENDED WARRANTY COVERAGE PERIOD?

Raven Applied Technology products that have been registered online are covered for an additional 12 months beyond the Limited Warranty for a total coverage period of 24 months from the date of retail sale. In no case will the Extended Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology division. This Extended Warranty coverage applies only to the original owner and is non-transferable.

HOW CAN I GET SERVICE?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries. In addition, the words "Extended Warranty" must appear on the box and all documentation if the failure is between 12 and 24 months from the retail sale.

WHAT WILL RAVEN INDUSTRIES DO?

Upon confirmation of the product's registration for the Extended Warranty and the claim itself, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

WHAT IS NOT COVERED BY THE EXTENDED 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, labor, or other damages. Cables, hoses, software enhancements, and remanufactured items are not covered by this Extended Warranty. 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.