



UNIVERSAL HYDRAULIC STEERING KIT  
INSTALLATION GUIDE FOR CLOSED  
CENTER, LOAD-SENSE W/SHUTTLE  
CHECK, HYDRAULIC SYSTEMS

117-9001-021



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# Introduction

About This Guide  
Installation Safety Requirements  
Safety Warning Labels  
Driving Safety Requirements  
Other References  
Contacting RAVEN INDUSTRIES

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## About This Guide

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The aim of this guide is to provide up to date reference information about installation of the SmarTrax product.

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## Who it is for

This guide is intended for use by distributors who install new SmarTrax systems for Raven Industries.

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## What it covers

This guide presents:

- a parts checklist for the steering installation;
- installation procedures for the SMARTRAX hydraulic kit and cable routing

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## Updates

This guide will be updated periodically to reflect changes and additions to the range of SmarTrax products and to ensure that this guide fulfills users' needs for reference information. Updates will be supplied as soon as they are available.

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## Installation Safety Requirements

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This section is divided between general safety precautions, specific safety measures in respect of the hydraulic and electrical system, and safety symbols used in this document.

**The machine must remain stationary and switched off, and Steering Assist™ disengaged while installation or maintenance is being carried out.**

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## Safety Precautions

When working with or near a machine with SmarTrax installed, the following safety measures must be observed. The operator *must*:

- Be alert and aware of surroundings.
- Not operate the SmarTrax while under the influence of alcohol or an illegal substance.
- Remain in the operator's position in the machine at all times when the SmarTrax is engaged.
- Be in complete control of the machine at all times when the SmarTrax is engaged.
- Disengage the SmarTrax when exiting from the operator's position and machine.
- Remain within the boundaries of a defined field when the SmarTrax is engaged.
- Not drive the machine with the SmarTrax engaged on any public thoroughfare or main road.
- Determine and remain a safe working distance from other machinery, equipment, and obstacles. The operator is responsible for disengaging the SmarTrax when the safe working distance has diminished.
- Determine and remain a safe working distance from other farm personnel or people. The operator is responsible for disengaging the SmarTrax when the safe working distance has diminished.
- Ensure the SmarTrax is disengaged prior to starting any maintenance work on the SmarTrax or machine.

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## Hydraulic Safety Precautions

When disconnecting hydraulic hoses or when purging is required, be aware that the hydraulic oil within the machine system may be hot and under high pressure. Caution must be exercised. Any work carried out on the hydraulics system must be performed in accordance with the machine manufacturer's approved maintenance instructions.

Raven Industries recommend that appropriate protective equipment be worn when working on the hydraulics system.

It is imperative that, when installing the SmarTrax hydraulics, performing diagnostics, maintenance, or routine machine servicing, that installers and customers **ensure all 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 adversely reduce performance, and possibly damage the SmarTrax hydraulic valves.

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## Electrical Safety Precautions

Do not reverse the power leads. Doing so will cause severe damage to the equipment. Always check to make sure that the power leads are connected to the right polarity as marked. Ensure that the power cable is the last cable to be connected.

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## Safety Symbols



**WARNING:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Warning statements help you to:

- Identify a hazard.
- Avoid a hazard.
- Recognize consequences.

**NOTE:** Identifies information that is critical for successful application and understanding of the product.



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## Safety Warning Labels

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Safety Warning Labels have been provided to highlight to users the importance of:

- Being aware not to damage the wheel angle sensor.
- Not tampering with the SmarTrax hydraulics valves.

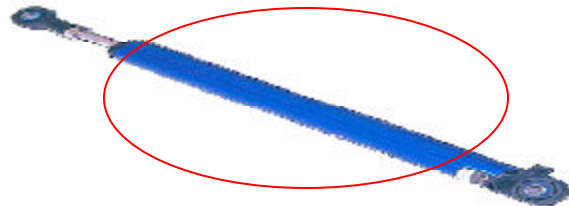
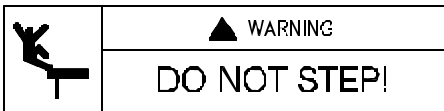
These warning labels are to be placed in the specified locations as indicated below.

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### Steering Position Sensor Warning Label

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It is essential that the Steering Position Sensor (SPS) is not damaged. Therefore Raven Industries has provided a **'Do Not Step'** warning label. This label is placed on the top surface of the Steering Position Sensor (as shown below in **Figure 1**) with the label facing up where it should be visible to the operator.



Steering Position Sensor Warning label

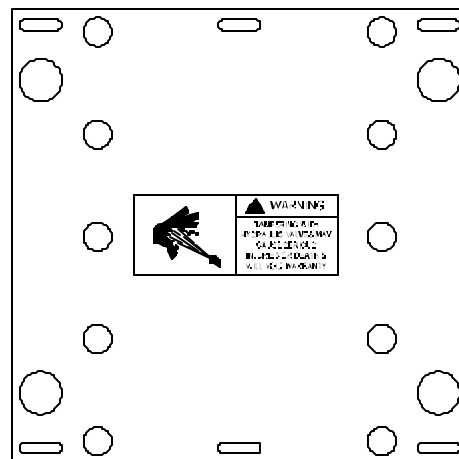
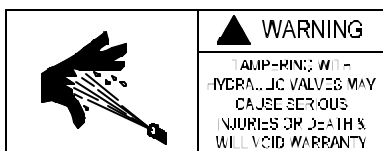
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### Hydraulic Warning Label

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This label should be placed on the steering assist manifold or on the Hydraulic Valve Mounting Bracket as shown below in **Figure 2**. **'Tampering with hydraulic valves may cause serious injuries or death & will void warranty'**.

**NOTE:** That the picture shown below is only an example on where the hydraulic warning label is to be positioned on the steering assist manifold. Placement will vary depending on the valve used.



Hydraulic Warning label

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## Driving Safety Requirements

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This section outlines the safety requirements used when driving a vehicle using the SmarTrax system.

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### Areas of operation

The SmarTrax must only be used on private property without public access. It must only be used within cleared fields. It must NOT be used when traveling on any public roads or access ways. Raven Industries advise that users familiarize themselves with the SmarTrax operations by first reading the Machine Operator Guide.

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### Avoidance of people

The SmarTrax must not be operated in the vicinity of people. People must be well outside of the machine's path while it is operating with Steering Assist engaged.

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### Avoidance of machinery and equipment

The SmarTrax operator must allow a safe distance between the machine's path and other machinery or equipment. To determine the safe distance, take into account the incorrect operation of the guidance system and the distance required for the machine to stop.

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### Avoidance of obstacles

The SmarTrax **CANNOT** detect obstacles such as fences, trees or boulders that are located within a defined Field. The SmarTrax assists the machine operator to steer the machine in straight lines in cleared fields. The machine operator must identify and avoid the obstacles while working a field.

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### Responsibilities of operator

The machine operator must remain in complete control of the machine at all times. Only when steering assist is enabled can there be hands-free operation.

The machine operator remains fully responsible for the operation of the machine and must remain in the operator's position within the machine at all times while the Steering Assist is engaged.

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## Disengaging steering assist

The operator must disengage the Steering Assist if an obstacle is in the line of travel. The operator must disengage Steering Assist by using one of the following methods listed below.

Turning the steering wheel in the normal manner, stopping the machine, or pressing the remote activation switch can disengage steering Assist.

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## Operational emergency safety steps

In case of an emergency, take one of the following steps to disengage Steering Assist:

- Press the brake and decelerate to under 0.6 mph / 1 kph;
- Turn the steering wheel in the normal manner; or
- Pressing the remote activation switch.

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## Other References

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## Contacting RAVEN INDUSTRIES

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We welcome your feedback about this guide.

If you have any comments or suggestions for improvements, please let us know by contacting our Customer Support Center by any of the methods below:

**By phone**

1-800-243-5435

**By mail**

Raven Industries  
Flow Controls Division  
205 E. 6th St.  
Sioux Falls, SD 57104

**By Email**

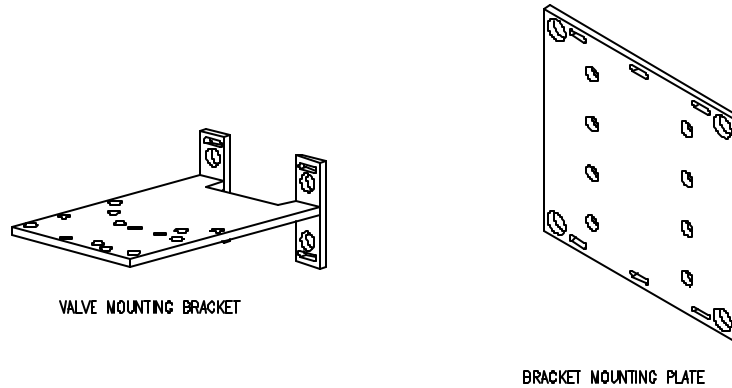
[fcinfo@ravenind.com](mailto:fcinfo@ravenind.com)

# Installing Hydraulic Components

- Installing the Hydraulic Bracket
- Mounting the Valve to the Bracket
- Hydraulic System Installation
- Safety Precautions for Connecting Hydraulic Hoses
- Hydraulic Steering Setup Before & After Installation
- Installing Hydraulic Components
- Installing the Steering Control Valve Hoses
- Hydraulic System Checks and Setup
- Setting the Valve Spool Stops
- Adjusting the Sequence Valve
- Setting the Override Pressure Switch
- Installing the Rotary Steering Position Sensor (SPS)

## INSTALLING THE HYDRAULIC BRACKET

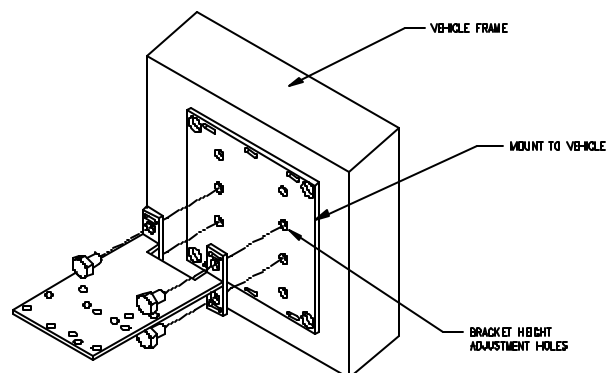
- ◆ The bracket is intended to be universal to accommodate valve mounting on various types of machines. It may be necessary to modify the provided brackets, such as drilling additional mounting holes, to fit the desired application.
- ◆ The valve-mounting bracket is made of two parts. The bracket with the valve mounting holes may be used independently and the secondary mounting plate may be discarded if not needed.



- ◆ Mount the bracket as close as possible to the steering orbital, in order to keep the hydraulic hoses as short as possible. Also, mount the bracket in a position that will protect the valve from getting damaged from mud, crops, etc.
- ◆ Mount the bracket mounting plate by using existing holes in the vehicle frame. The bracket mounting plate may need to have additional holes drilled in order to accommodate various hole patterns.

### **\*\*NOTE: NEVER DRILL NEW HOLES INTO THE VEHICLE FRAME**

- ◆ If both brackets are used in the installation, first mount the bracket mounting plate to the vehicle. Once the plate is installed, mount the valve mounting bracket to the mounting plate using the supplied bolts and washers.
- ◆ The bracket mounting plate is designed to provide valve height adjustment for easier hose routing by using the five pairs of mounting holes. To adjust the bracket up or down, unbolt the valve mounting bracket and move to the desired height and reattach using the supplied bolts.

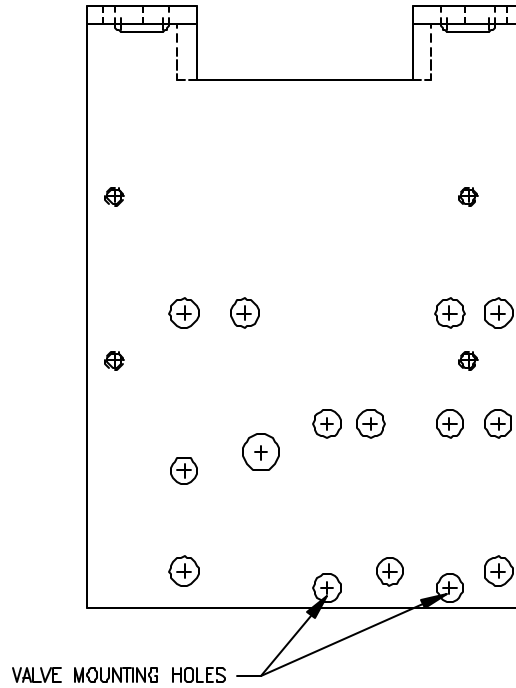


- ◆ In some installations, it may be more appropriate to use only the valve mounting bracket. If only the valve mounting bracket is used, mount the bracket using existing holes in the frame to securely fasten the bracket to the frame.

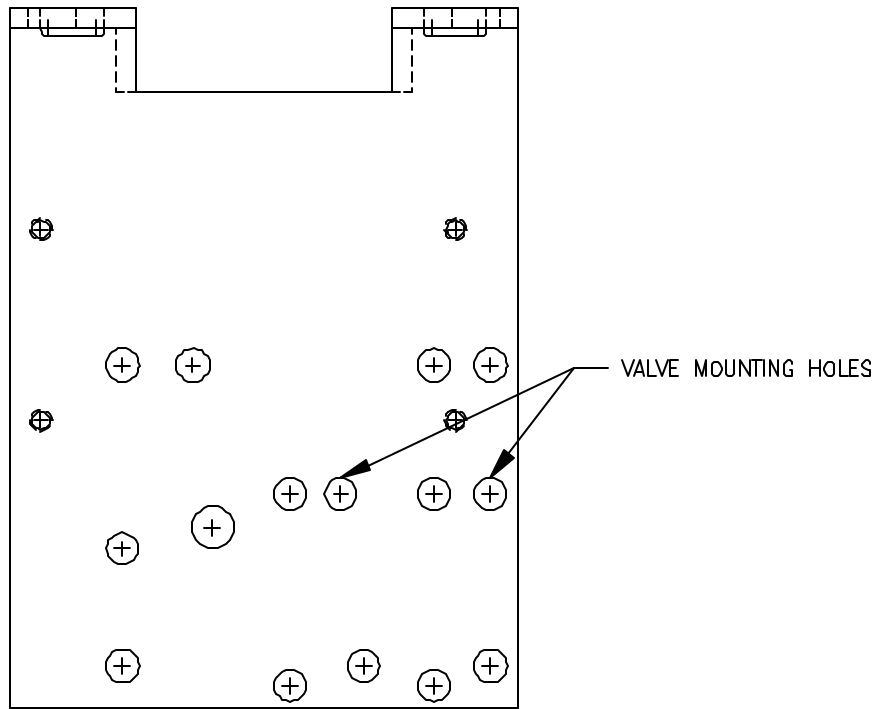
## MOUNTING THE VALVE TO THE BRACKET

- ◆ Six different hydraulic valves are designed to mount to this bracket. To determine the hole pattern needed, look at the part number printed on the cover of this manual and reference the six following schematics for appropriate hole patterns.
- ◆ Bolts and washers needed to mount the valve are provided in the hardware kit.

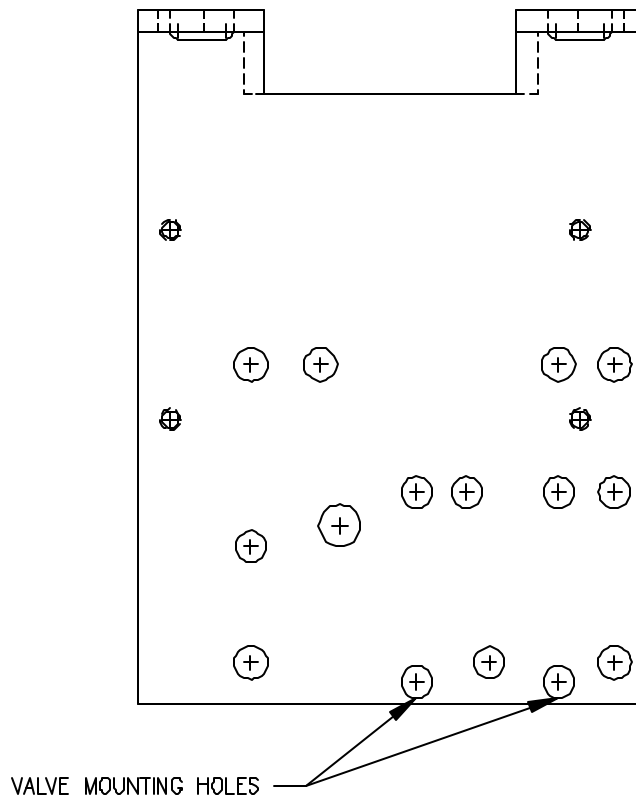
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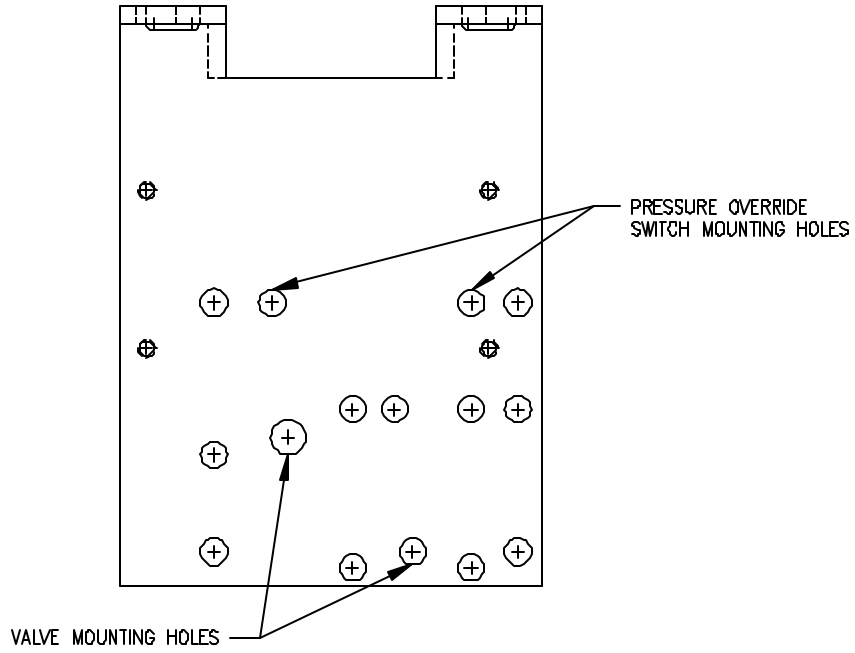


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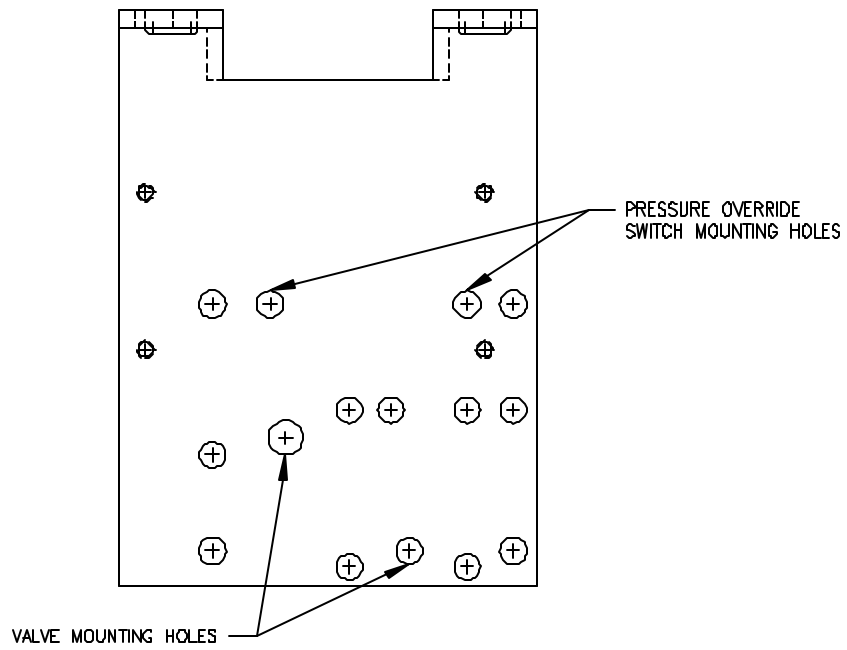


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NOTE: FOR THIS CONFIGURATION, THE STEERING CONTROL VALVE IS TO BE MOUNTED ON THE TOP SURFACE OF THE BRACKET AND THE OVERRIDE SWITCH IS TO BE MOUNTED ON THE UNDERSIDE OF THE BRACKET

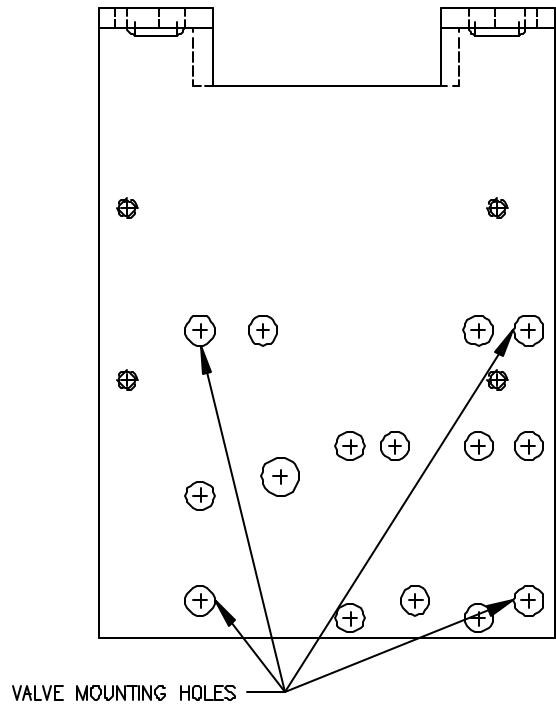


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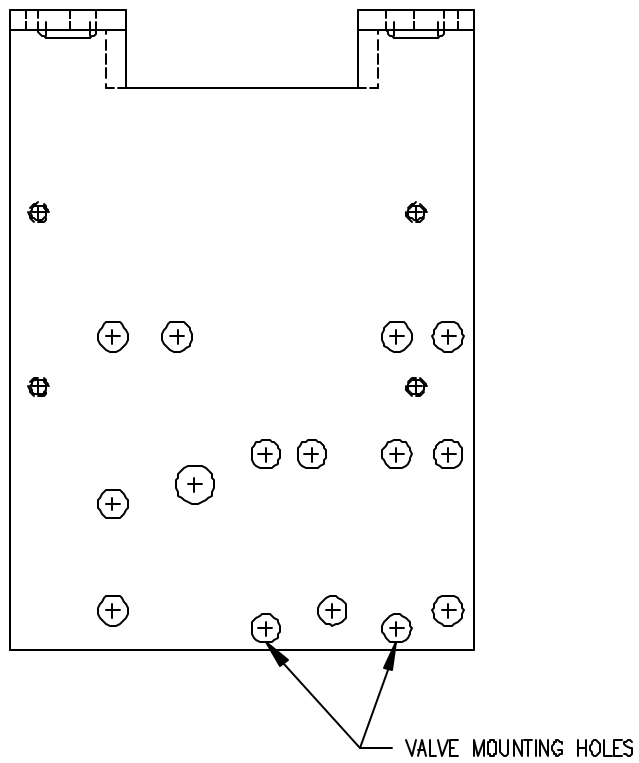




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## HYDRAULIC SYSTEM INSTALLATION

- ♦ The Raven Universal Hydraulic Kit does not come with hydraulic hoses. Hoses should be made per specifications noted on the installation worksheet.
- ♦ Adapter fittings will be needed for proper installation. Adapter fittings are not provided with the Steer Kit, but a kit is available (P/N 117-9001-015).

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### Safety Precautions For Connecting Hydraulic Hoses

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#### WARNINGS:

- The machine must remain switched off, isolated, and stationary, while installation and maintenance is being done.
- When disconnecting hydraulic hoses, or when purging is required, it is important to be aware that hydraulic oil may be hot. **Caution** must be exercised.
- The risk of contamination of the hydraulic system is at its greatest when any fitting is removed. It is **essential** that, prior to the loosening of any fitting, the fitting is cleaned thoroughly with a spray cleaner such as Brake Clean™.
- **Note:** Brake Clean™ can cause premature failure to o-rings such as those used in ORFS fittings. If a fitting is to be cleaned internally, the o-ring should be removed first and cleaned with fiberless cloth.
- Lines should be capped with plastic blanking covers immediately on removal, to help prevent foreign matter contamination.

**To install each component of the hydraulic steering kit as efficiently as possible; it is important to follow the order in which this procedure is outlined. Failure to do so can result in damage to components such as hydraulic hoses due to incorrect hose routing.**

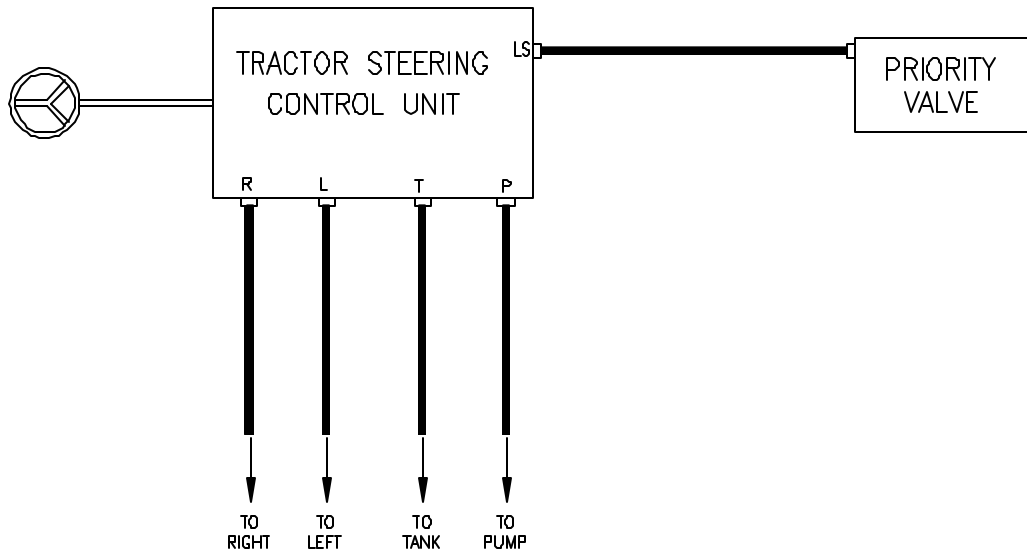
**Prior to starting the installation of hydraulic hoses, ensure that the machine is switched off and that all pressure is relieved from the machine hydraulic system. This can be done by turning the steering wheel left and right.**

**It is important to make sure that the pressure hose is connect to the “P” Port on the Raven Valve and the Return Line is connected to the “T” Port on the Raven Valve. Connecting these lines backwards WILL DAMAGE VALVE SEALS!**

# Hydraulic Steering Setup Before and After Installation

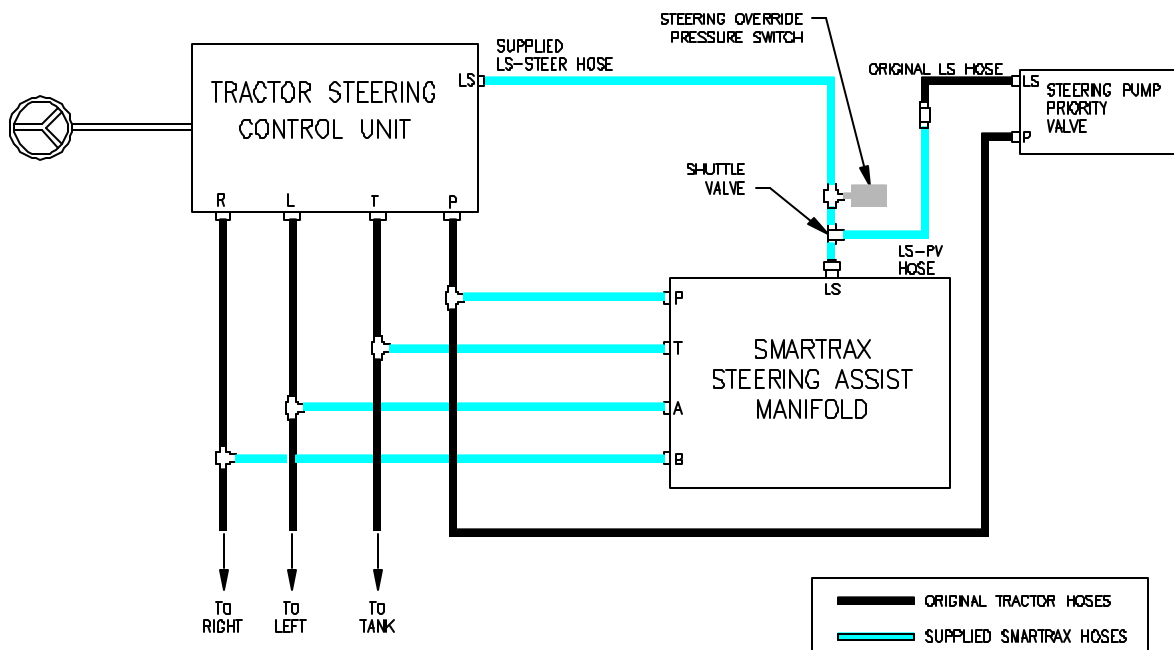
The following block diagrams shows how to setup the hydraulic steering setup before and after installation, including all hydraulic hose connections leading to each of their specified ports.

**The Block Diagram below shows the Steering system setup before Installation of the SMARTRAX Steering has started.**



Steering Block Diagram Before Installation

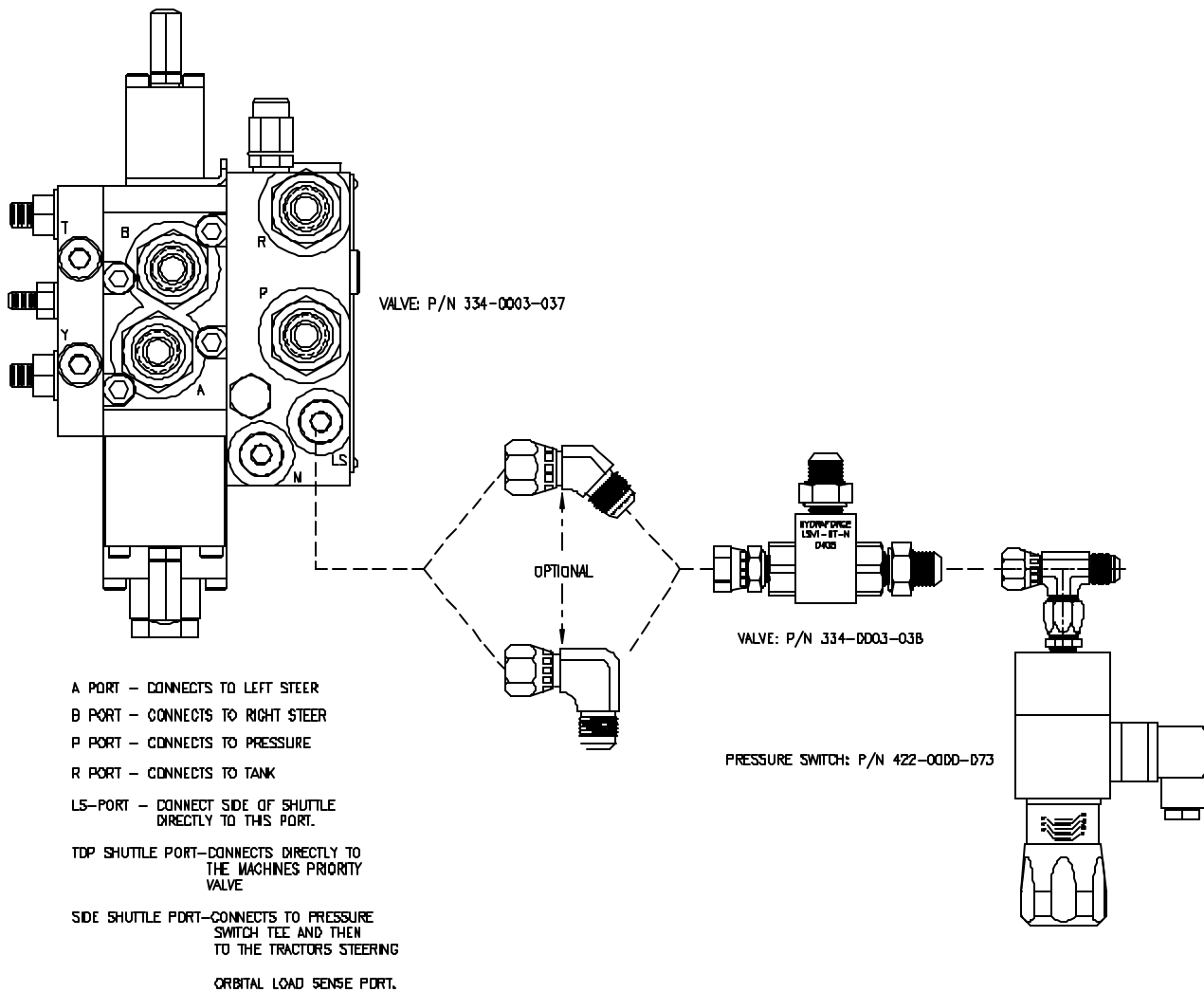
**The Block Diagram below shows the Steering system setup after the Installation of the SMARTRAX Steering has been completed.**



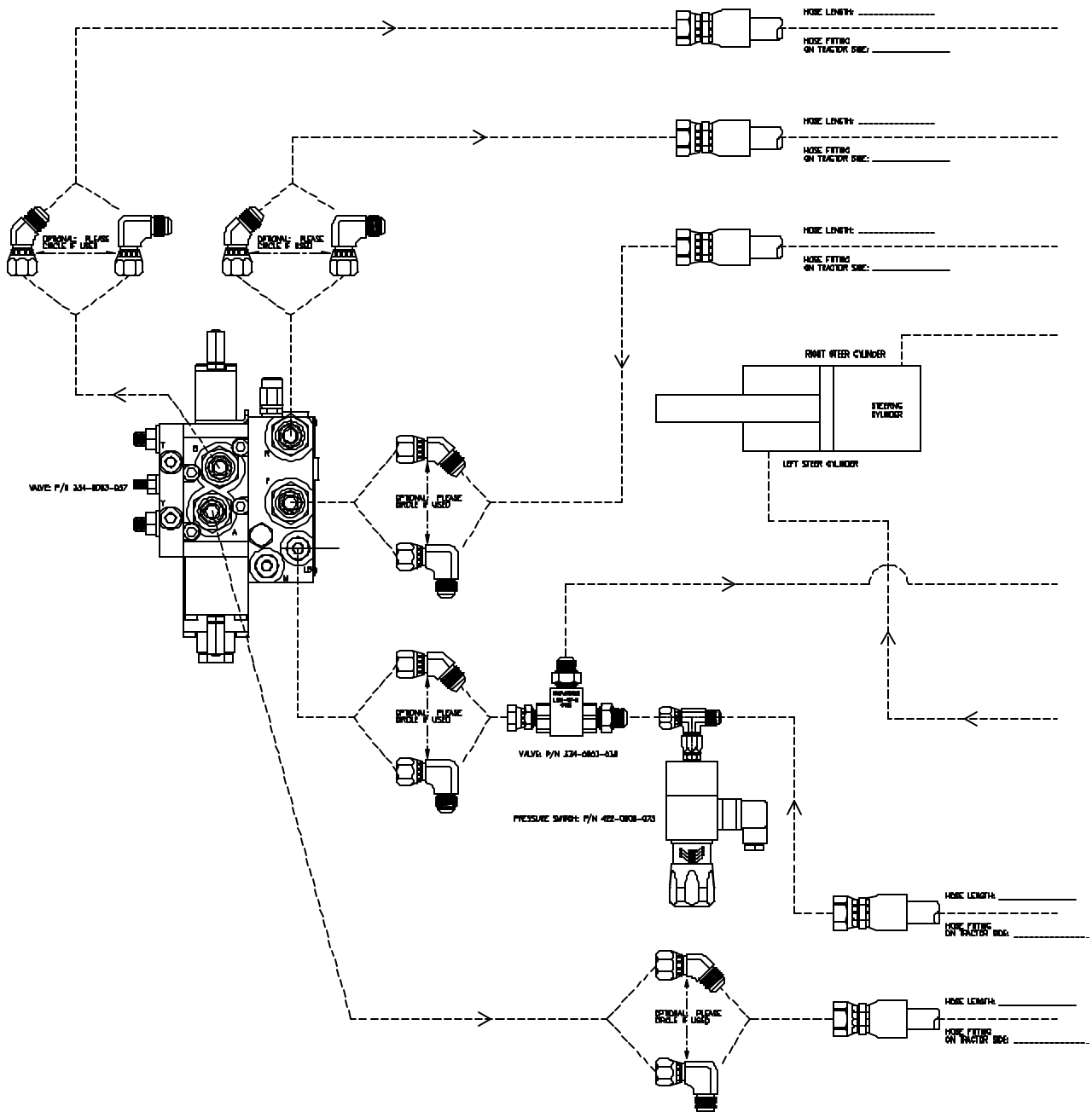
Steering Block Diagram After Installation

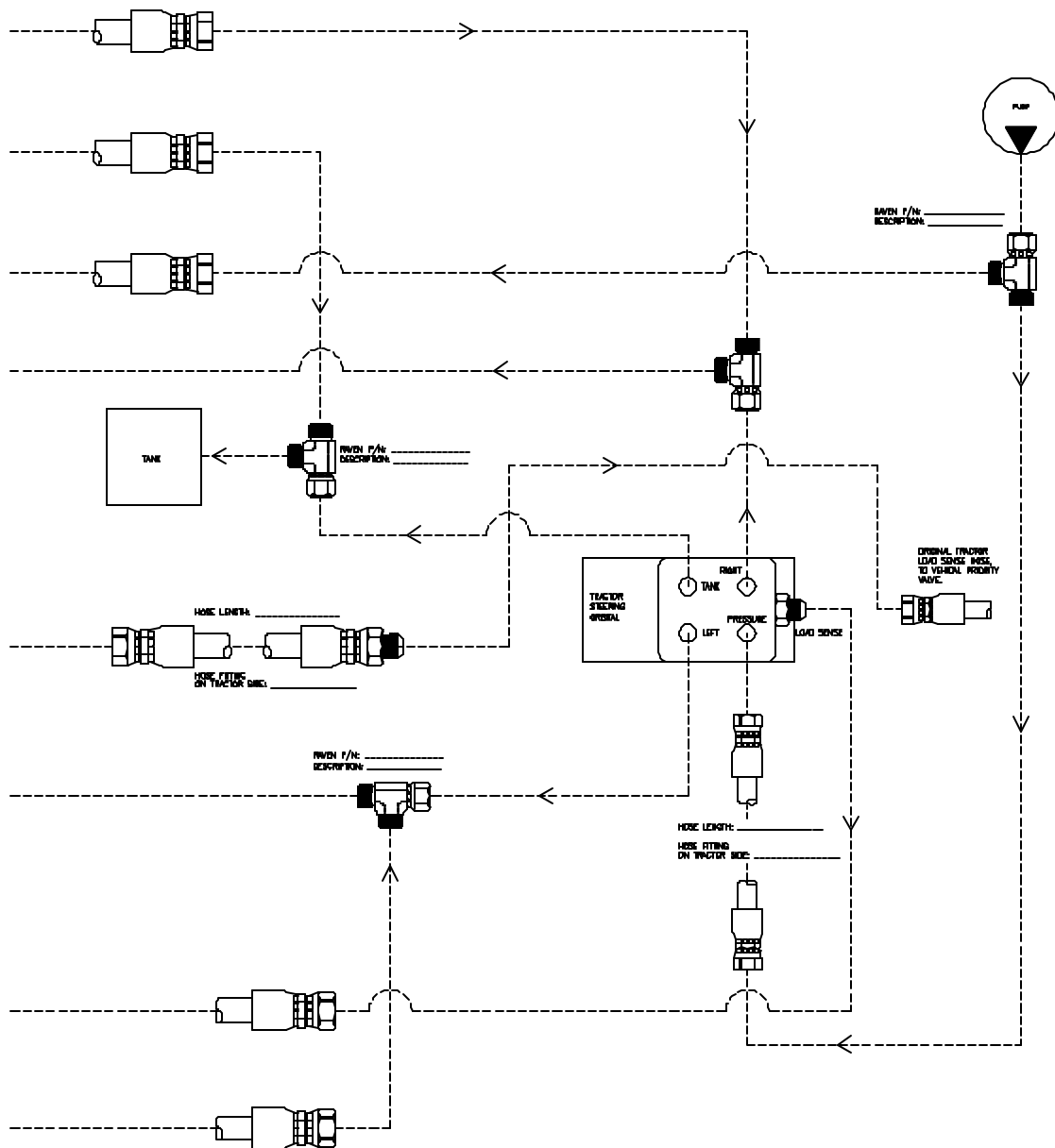
# INSTALLING HYDRAULIC COMPONENTS

- ◆ The Raven universal steering kit does not come supplied with hoses. Hoses must be made per specifications stated on the provided installation sheet. It is important that when new hoses are made, that every effort is made to properly clean out the new hose, to prevent any contamination to the vehicles hydraulic system.
- ◆ An installers worksheet has been provided, which gives a detailed layout of the Auto Steer Hydraulic System. It is important that all parts are identified and documented and returned to Raven upon completion of the installation, using the postage paid envelope.



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## INSTALLING THE SHUTTLE VALVE AND PRESSURE SWITCH

SEE HYDRAULIC DIAGRAM FOR SYSTEM LAYOUT

1. Connect 9/16" (F) JIC fitting coming out of the side of the check valve directly to the LS port of Smartrax Steering valve. **NOTE:** A 90° fitting may be used if desired.
2. Connect pressure switch to 9/16" (M) JIC port coming out of other side of check valve using the supplied run tee installed on the pressure switch. **NOTE:** The pressure switch can be moved to the other fitting of the tee if desired.

## INSTALLING THE STEERING CONTROL VALVE HOSES

See the diagram on pages 20 and 21 for hydraulic system layout.

### Left Steer Hose

1. Identify the left steer port on the tractor steering orbital. Hoses may need to be traced to the hydraulic cylinders for proper identification. Once the port has been identified, remove the hose from the tractor steering orbital and install an appropriate tee fitting, found in the Raven adapter kit, to the steering orbital. Once the tee fitting is installed reattach the original hose.
2. Construct a new hose to run from the A-Port on the Raven steering control valve to the open branch on the installed tee fitting. (For more details, see the installers worksheet)
3. An additional 45 or 90 degree elbow may be installed on the Raven valve to help hose routing. These elbows will be found in the hydraulic fitting kit.

### Right Steer Hose

1. Identify the right steer port on the tractor steering orbital. Hoses may need to be traced to the hydraulic cylinders for proper identification. Once the port has been identified, remove the hose from the tractor steering orbital and install an appropriate tee fitting, found in the Raven adapter kit, to the steering orbital. Once the tee fitting is installed, reattach the original hose.
2. Construct a new hose to run from the B-Port on the Raven steering control valve to the open branch on the installed tee fitting. (For more details, see the installers worksheet)
3. An additional 45 or 90 degree elbow may be installed on the Raven valve to help hose routing. These elbows will be found in the hydraulic fitting kit.

### Pressure Hose

1. Identify the pressure port on the tractor steering orbital. Hose may need to be traced to the hydraulic pump for proper identification. Once the port has been identified, remove the hose from the tractor steering orbital and install an appropriate tee fitting, found in the Raven adapter kit, to the steering orbital. Once the tee fitting is installed, reattach the original hose.
2. Construct a new hose to run from the P-Port on the Raven steering control valve to the open branch on the installed tee fitting. (For more details, see the installers worksheet)
3. It is extremely important that the pressure line running to the Raven steering control valve goes to the port designated "P". Failure to do so will result in internal o-ring failure on the valve.



4. An additional 45 or 90 degree elbow may be installed on the Raven valve to help hose routing. These elbows will be found in the hydraulic fitting kit.

#### Tank Hose

1. Identify the tank port on the tractor steering orbital. Hose may need to be traced to the hydraulic reservoir for proper identification. Once the port has been identified, remove the hose from the tractor steering orbital and install an appropriate tee fitting, found in the Raven adapter kit, to the steering orbital. Once the tee fitting is installed, reattach the original hose.
2. Construct a new hose to run from the T-Port on the Raven steering control valve to the open branch on the installed tee fitting. (For more details, see the installers worksheet)
3. It is extremely important that the tank line running to the Raven steering control valve goes to the port designated "T". Failure to do so will result in internal o-ring failure on the valve.
4. An additional 45 or 90 degree elbow may be installed on the Raven valve to help hose routing. These elbows will be found in the hydraulic fitting kit.

#### LS-PV Hose

1. Remove the load sense hose from the tractors steering orbital and connect the hose directly to the top port of the shuttle check. To identify the load sense port on the valve, a general rule of thumb is that the smallest hose on the orbital is the load sense hose. Once the hose is identified, follow the hose to its origin and verify that the hose is running from the tractors priority valve.
2. In some cases, an extension hose may need to be used to reach the Raven steering control valve. If an extension hose is made, be sure that the extension hose is the same inside diameter as the original hose. If the hose inside diameter is too large or too small, the vehicles hydraulic system will not perform as expected. (For more details, see the installers worksheet)

#### LS-Steer Hose

1. Once the pressure switch is installed, run a new hose from the open port on the tee to the Load Sense port on the tractors steering orbital. This port should be open as the original hose was removed and run to the LS-PV port in the previous step.
2. When making the hose for this connection, it is important to use hose with the same inside diameter as the original load sense hose. Failure to use identical size hose will effect the vehicles hydraulic system. (For more details, see the installers worksheet)

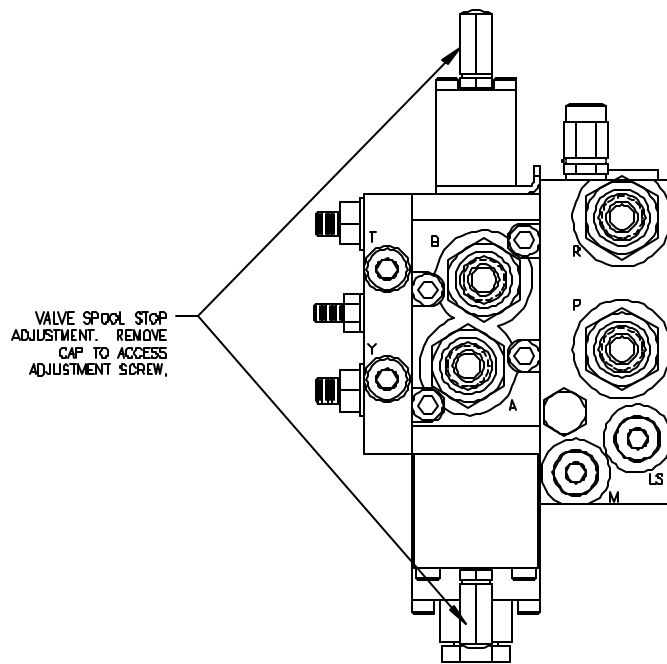
## HYDRAULIC SYSTEM CHECKS AND SETUP

- ◆ Once all of the hoses have been hooked up, go back and verify that all hose fittings and connections are tight, and that the hoses are attached to their appropriate ports.
- ◆ Once the hydraulic system has been plumbed, it is important to start the tractor and verify that there are no leaks and that the hoses have been hooked up correctly.
  - ◆ **WARNING!** Upon initial system start up, it is important that any person near the machine stand clear, in the case that a hose has not been completely tightened.
- ◆ Once the machine is started and running, a complete inspection of the hoses, fittings and valves should be done to verify that the system is leak free.
- ◆ In some instances, it may be found that air has gotten into the hydraulic system. If this happens, it is important to remove the air from the system by turning the steering wheel from lock to lock several times.
- ◆ Once the valve is tested, attach the supplied warning label on or near the valve.

## SETTING THE VALVE SPOOL STOPS

- ◆ The steering control valve will not come from the factory preset. Flow rates to the cylinders must be set so that the wheels turn left and right at the same rate.
- ◆ It is recommended that lock to lock turning time achieved by the steering control valve should be approximately 15 seconds in both directions. To verify this setting, the steering control valve must be manually stroked. (NOTE: If a vehicles operational speed, while using Smartrax, is less than 10 mph, the lock to lock time can be set to 12-13 secs.)
- ◆ To manually stroke the steering control valve, the steering wheel should be turned all the way to the left, and then manually stroked to the right by using the lever provided with the valve.

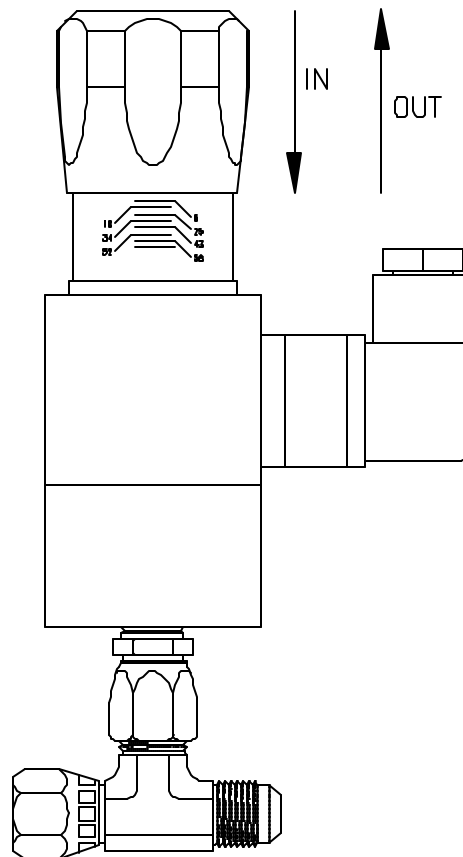
- ◆ Once user is ready to manually control the steering control valve, it is important the the user measure the amount of time it takes for the wheel to turn all the way from the left to the right.
- ◆ If the time is **more or less than 15 seconds, the valve must be adjusted!**
  - ◆ For times less than 15 seconds, the valve spool stop must be turned in to slow the valve speed. To do this, user must first remove acorn nut from adjustment screws. Once the setscrew is loose, turn in the spool stop screw in to slow the wheels down. Adjust accordingly until left to right time is approximately 15 seconds.
  - ◆ Left and right lock to lock times are set independently by each spool stop.
  - ◆ For times more than 15 seconds, the valve spool stop must be turned out. Repeat the same process as stated above to adjust spool stop.
- ◆ Once the valve has been adjusted, tighten down the spool stop set screw, and replace acorn nuts.
- ◆ **WARNING!** Failure to secure the spool stop adjustment screw with the set screw and/or remove the manual stroking lever could result in a loss of auto steering.



- ◆ Once the valve has been adjusted, return the wheels to the center position and turn tractor OFF.

## SETTING THE OVERRIDE PRESSURE SWITCH

- ◆ The Override Pressure Switch must be set in order for the Auto-Steer system to disengage when the operator moves the steering wheel.
- ◆ The pressure switch can not be set until the Smartrax Controller is wired and all wiring to the hydraulic system is complete.
- ◆ To set the pressure switch, go to the Solenoid Configuration Menu on the Smartrax Controller. Once at this menu, arrow down to the “<Les R>” screen.
- ◆ With the tractor running and no movement of the steering wheel, the “s” should display as lower case. If the “S” is capital, the pressure switch knob must be turned in until a lower case “s” is displayed.
- ◆ Once the display reads lower case “s” while the vehicle is running and stationary, begin to turn the steering wheel. When the wheel is turned, the “s” should turn into a capital “S” indicating that the system is deactivated. If this does not happen, the pressure switch knob must be turned out to the point where, when the wheel is turned, the “s” is displayed as a capital letter.



# Cable Connection and Routing

Overview of Cable Connection & Routing

Smatrix Loom Routing

Solenoid Cable Connection & Routing

Steering Position Sensor (*SPS*) Cable Connection and Routing

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## Overview of Cable Connection & Routing

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**NOTE: The Cable Connection & Routing section of this manual is generic and has been designed to cover all tractor types currently available.**

Before starting the Cable Connection and Routing section of this document you should first ensure that all components of the hydraulic steering kit are installed securely and neatly.

The cable connection and routing instructions that are included in this section consists of:

- Smartrax Loom connection and routing;
- Solenoid cable connection and routing
- Steering Position Sensor (*SPS*) cable connection and routing.

## Smartrax Loom Routing

### STEPS

- 1) Route the Smartrax Loom from the Valve towards the tractor cab. It should lead into the tractor cab through a suitable entry point.

**NOTE:** Ensure Smartrax Loom is mounted neatly. Secure it (where possible) to existing points on the tractor using cable ties. Ensure it is not routed near heated areas such as the exhaust. Do not route it in close proximity to moving parts.

### KEY POINTS

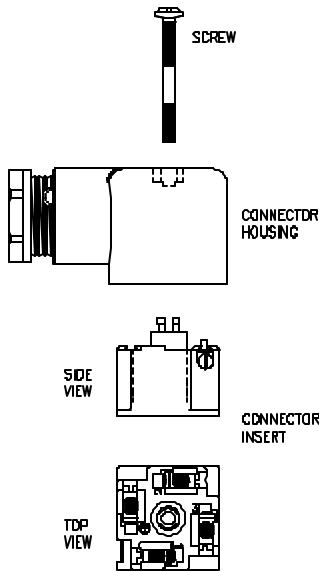
**NOTE:** Ensure Smartrax Loom is securely connected to the Valve.

## Solenoid Cable Connection & Routing

### This series of hydraulics uses the Type 1 Solenoid Cable.

The Solenoid Cable Connection & Routing section will be updated periodically to reflect changes and add any additional tractor types to each of the corresponding types of solenoid cable connections above. Updates will be supplied as soon as they are available.

#### Solenoid cable connection – type 1

STEPS	KEY POINTS
<ol style="list-style-type: none"> <li>1) The Solenoid cable connection - type 1 comprises of 2 terminal points consisting of:                             <ul style="list-style-type: none"> <li>♦ 1 Solenoid Valve connection (labelled as <b>Solenoid</b>) and;</li> <li>♦ 1 Steering Override Pressure Switch connection (labelled as <b>Override</b>).</li> </ul> </li> <li>2) Start by connecting the Solenoid cable to the Smartrax Controller (as shown on the following page).</li> <li>3) Route the Solenoid cable towards the Steering Assist Valve Bank, where the Solenoid Valve and Steering Override Pressure Switch are located.</li> <li>4) Connect the Solenoid Valve and Steering Override Pressure Switch to the wiring harness.</li> </ol> <p><b>NOTE:</b> Refer to Figure on the following page for information on cable connection.</p>	<p><b>NOTE:</b> Ensure Solenoid cable is mounted neatly. Secure it (<i>where possible</i>) to existing points on the tractor using cable ties. Ensure it is not routed near heated areas such as the exhaust. Do not route it in close proximity to moving parts.</p> 

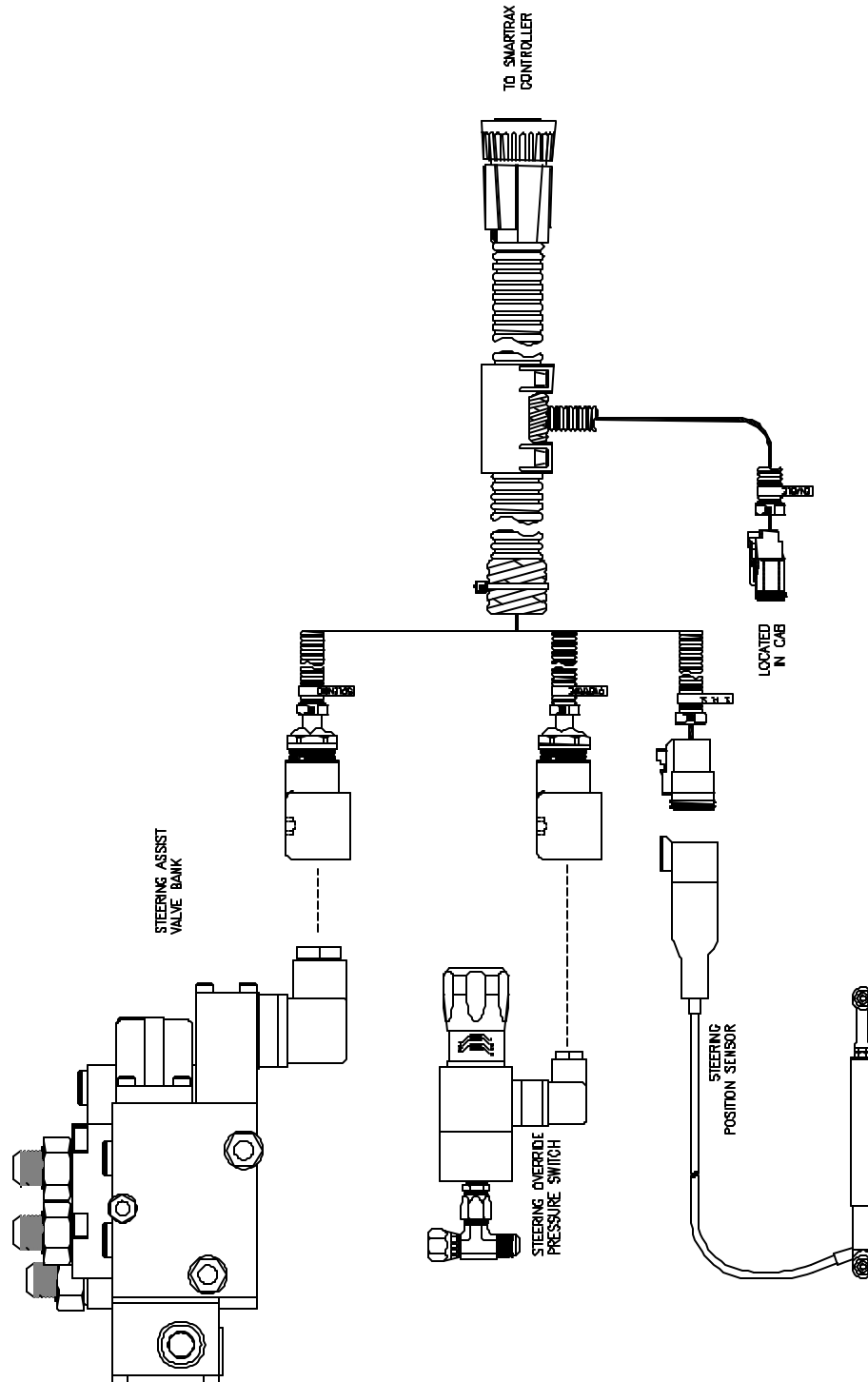
Connection	Hirschmann Plug #	Color
Solenoid	1	Black
	2	Green
	3	Red
Override	1	White
	2	Blue



## STEPS

- 5) Once wiring is connected, ensure the Solenoid cable is cable-tied neatly and securely away from moving parts.

## KEY POINTS



Solenoid cable connection type 1 to Smartrax Loom

## Steering Position Sensor (SPS) Cable Connection and Routing

**NOTE:** For tractors that don't require the SPS to be installed, ensure that the supplied blanking plug is used to blank off the port on the SPS cable section of the Smartrax Loom. This is done to prevent any contamination from being introduced into the Smartrax Loom.

The SPS is only installed on Wheel, Articulated and QUADTRAC tractors. Track tractors do not require a SPS to be installed, but must ensure that the supplied blanking plug is used on the SPS cable section of the Smartrax Loom to prevent any contaminants being introduced into the Smartrax Loom.

### STEPS

- 1) The SPS cable is to connect from the SPS setup on the tractor to the Smartrax Loom (as shown in Figure on page 31).

**NOTE:** The location of the SPS setup is tractor specific.

### KEY POINTS

**NOTE:** Ensure SPS cable is mounted neatly. Secure it (*where possible*) to existing points on the tractor using cable ties. Ensure it is not routed near heated areas such as the exhaust. Do not route it in close proximity to moving parts.

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# **RAVEN INDUSTRIES LIMITED WARRANTY**

## **WHAT IS COVERED?**

This warranty covers all defects in workmanship or materials in your Raven Flow Control Product under normal use, maintenance, and service.

## **HOW LONG IS THE COVERAGE PERIOD?**

This warranty coverage runs for 12 months from the purchase date of your Raven Flow Control Product. This warranty coverage applies only to the original owner and is not transferrable.

## **HOW CAN YOU GET SERVICE?**

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

## **WHAT WILL RAVEN INDUSTRIES DO?**

When our inspection proves the warranty claim, we will, at our option, repair or replace the defective part and pay for return freight.

## **WHAT DOES THIS WARRANTY NOT COVER?**

Raven Industries will not assume any expense or liability for repairs made outside our plant without written consent. We are not responsible for damage to any associated equipment or product 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 is authorized to assume for us any liability. Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.



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