



Installation/Service Manual

TRUELINE LEVELING SYSTEM

Diagnostics, Troubleshooting, and Parts List

Air/Hydraulic

FIRMWARE VERSIONS:

CONTROLLER 2.18

FRONT SENSOR 2.6

REAR SENSOR 2.9

PNEUMATIC I/O MODULE 2.4

INSTALLATION

Installation of the Leveling System can be broken into 4 basic steps:

1. Mounting the sensors and harnesses.
2. Mounting the valve manifolds, and hydraulic components.
3. Installing the control panel in the vehicle's dash.
4. Programming the level position

Before beginning the installation, ensure that all you have all the required parts and that there is adequate blocking beneath the vehicle you are about to work on.

Level Sensor Modules

The two level sensing modules must be mounted in the front and the rear. They are mounted differently at each end.

Note: When mounting the sensors, try to place the units in such a way that the direction arrows point as true as possible. There is no need to manually fine-tune the placement because the leveling system software will determine where 'level' is during initial calibration.

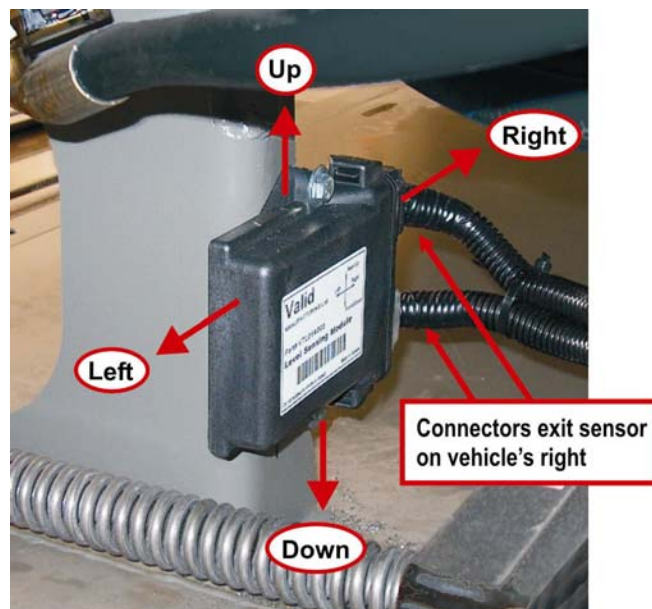
A. To install the front level sensor:

5. Mount it as far forward under the coach as possible.

Allow for the connectors to exit the sensor on the right-hand side of the unit with respect to the coach.

The front sensor is mounted in the following orientation:

- Left and Right arrows pointing directly left and right, respectively.
- Up and Down arrows pointing to the sky and ground, respectively.



Front level sensor, mounted

Note: To achieve proper alignment, place a level on either of the sensor body edges that are above and below the label.

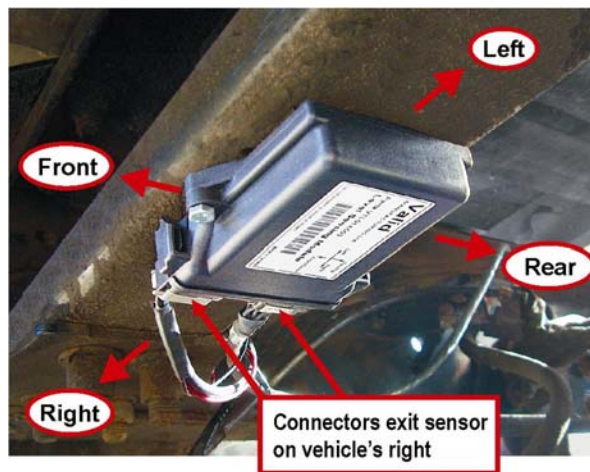
B. To install the rear level sensor:

6. Mount it on the chassis as close as possible to the centerline of the steering and driving axle, and as far back as possible. To avoid high temperatures, do not place it in the engine compartment.

Allow for the connectors to exit the sensor on the right-hand side of the unit with respect to the coach.

The rear sensor is mounted in the following orientation:

- Left and Right arrows pointing directly left and right, respectively.
- Rear and Front arrows pointing to the rear and front of the vehicle, respectively.



Rear level sensor, mounted

Connecting the sensors:



The sensor connections are indicated on the enclosed Leveling System 4-Axis Schematic.

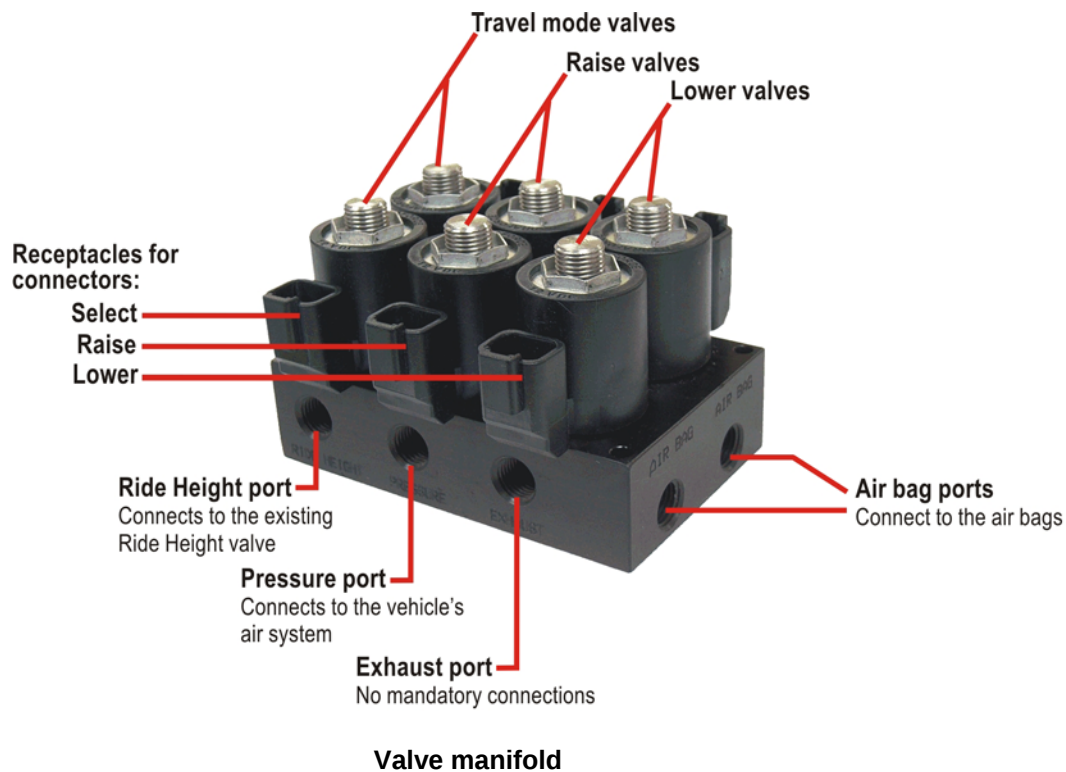
Valve Manifolds and Connectors

Valve manifolds

There are two valve manifolds that need to be installed as part of the Leveling System.

Each manifold can be thought of as being split down the middle, where each set of valves controls each lateral half of the vehicle. It doesn't matter which side of the manifold is which, but it is important to be consistent once you have made your decision.

For example: Connect all 'R' labeled connectors to the same (right-hand) side of the manifold.



Connectors

There are three connectors for each side of the valve manifold: Select, Raise, and Lower. These connectors run to the level sensors, allowing the valves to respond to the level information received by the sensors.

- The **Select** connectors correspond to the Travel valves and the Ride Height port(s). They allow the manufacturer's Ride Height valve to take control when the vehicle moves at a speed higher than the designated speed limit (as set in the initial configuration—see page **Error! Bookmark not defined.**).
- The **Raise** connectors correspond to the Raise valves and the Pressure port.
- The **Lower** connectors correspond to the Lower valves and the Exhaust port.



Connectors
Connect valve manifold to sensors

Connector harness

Installation and connection

To mount the valve manifolds:

Mount each manifold in a suitable place on the chassis. You may wish to place them relatively close to each sensor to ensure that your connector cables will reach.

To connect the ports:

On each manifold, connect the ports as follows:

- Ride Height port(s): to the manufacturer-installed Ride Height valve(s).
- Pressure port: to the vehicle's air system.



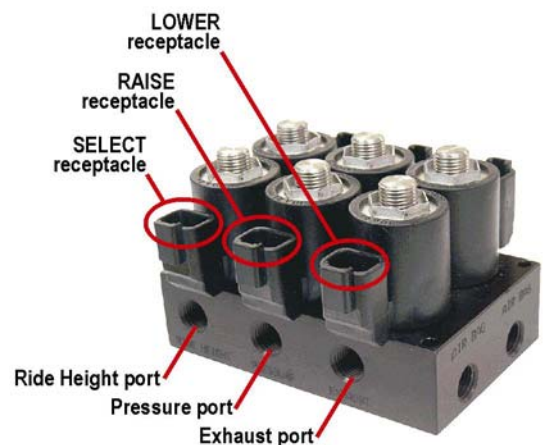
Note: The pressure port requires a check valve connector to prevent air from flowing back out of the pressure port. See the Leveling System 4-Axis Schematic at the back of this manual for clarification.

- Airbag ports: to the coach's airbags.
- Exhaust port: There is no connection requirement for this port.

To connect the connectors to the receptacles:

Noting the labels on each of the connector cables, insert the connectors into the receptacles as follows on each manifold:

- R Select into right-hand Select receptacle.
- L Select into left-hand Select receptacle.
- R-Raise into right-hand Raise receptacle.
- L-Raise into left-hand Raise receptacle.
- R-Lower into right-hand Lower receptacle.
- L-Lower into left-hand Lower receptacle.



Note: Don't forget—the Select receptacle is aligned with the Ride Height port; the Raise receptacle is aligned with the Pressure port, and the Lower receptacle is aligned with the Exhaust port.

Controller Installation



7. Cut a hole in the dash to accommodate the leveling control panel.
8. Route all necessary cabling to the dash access point. Ensure that there is enough cable to connect the control panel before inserting the panel into the cutout.



Mounted control panel

Mount the control panel so the image of the vehicle on the controller is oriented the same as the actual vehicle. This will make it easier for the operator to visualize the operation of the system.

Once all cable harnesses are connected to their corresponding port on the controller, fasten the control panel into the dash.

See the following paragraphs for information on connecting the vehicle speed signal to the dash harness.

Vehicle Speed Signal Requirements

The leveling system requires a standard square wave signal representing the vehicle speed. The signal must have a peak-to-peak voltage between 8 and 30 volts and a maximum frequency of 2 kHz.

The leveling system is pre-calibrated for a speed signal input of 30,000 pulses per mile (500 Hz at 60 MPH). Typically, this signal will originate from the vehicle's transmission. However, to determine an appropriate source for this signal you should contact your dealer.

Connector “A” Vehicle interface connections

PIN	WIRE COLOUR	DESCRIPTION
A	BLACK	I/O COMMON
B	BLUE	PUMP SOLENOID
C	GREEN	EXTEND VALVE
D	BROWN	PRESSURE SWITCH
E	WHITE	P. SWITCH POWER
F	YELLOW	ROADSIDE REAR
G	ORANGE	CURBSIDE REAR
H	VIOLET	ROADSIDE FRONT
J	RED	CURBSIDE FRONT
K	BLACK	I/O COMMON

Pump connections

CONNECTOR 'B' - CONTROLLER POWER

PIN	COLOR	DESCRIPTION
1	BLACK	CONTROLLER COMMON
2	RED	CONTROLLER POWER
3	PINK	IGNITION
4	YELLOW	GP OUT 1
5	VIOLET	PARK BRAKE
6	TAN	SPEED SIGNAL
7	GRAY	SPEED SIGNAL COMMON
8	LIGHT GREEN	GP OUT 2

Connector at touch pad controller

SYSTEM SETUP & CONFIGURATION

The control configuration for leveling system behavior and performance has been preset with defaults per coach and chassis. Consult Power Gear if programming changes are needed. Defaults can be easily changed on site once instructions and consultation have been received. In normal circumstances no changes to the preset configurations will be needed.

Zero Set

The Zero Set function resets the system's level reference to the current vehicle position. While it is necessary to do this step as part of the initial configuration of the leveling system, you may also perform this function any time you wish to re-zero the vehicle's level settings.

Note: This procedure requires the use of at least one leveling tool (for example, a bubble-type level).

To set to zero:

1. Ensure that the vehicle is level and on a relatively flat and level surface.
2. Manually level the coach. Note that the control panel's level display will not be accurate at this time, so use a leveling tool to determine where level is. You may wish to measure level in more than one place if you have several leveling tools. Otherwise, choose a key location in the coach such as a table or stove top.
 - To adjust the corners of the vehicle, press and hold **MANUAL**.
 - While holding **MANUAL**, press the appropriate **RAISE** or **LOWER** buttons to raise and/or lower corners.
3. Once the vehicle is manually leveled, go into service mode (see test diagnostics page) and press Front Left **LOWER** to select the Zero Set function. This tells the leveling system that the current position is to be considered level.



DIAGNOSTIC FUNCTIONS

The Trueline Leveling System has a number of diagnostic features that provide information on the functioning of the system.

There are two types of diagnostic functions:

- Test diagnostics – these allow you to test the system for normal functionality.
- Fault diagnostics – these alert you to problems detected in the system.

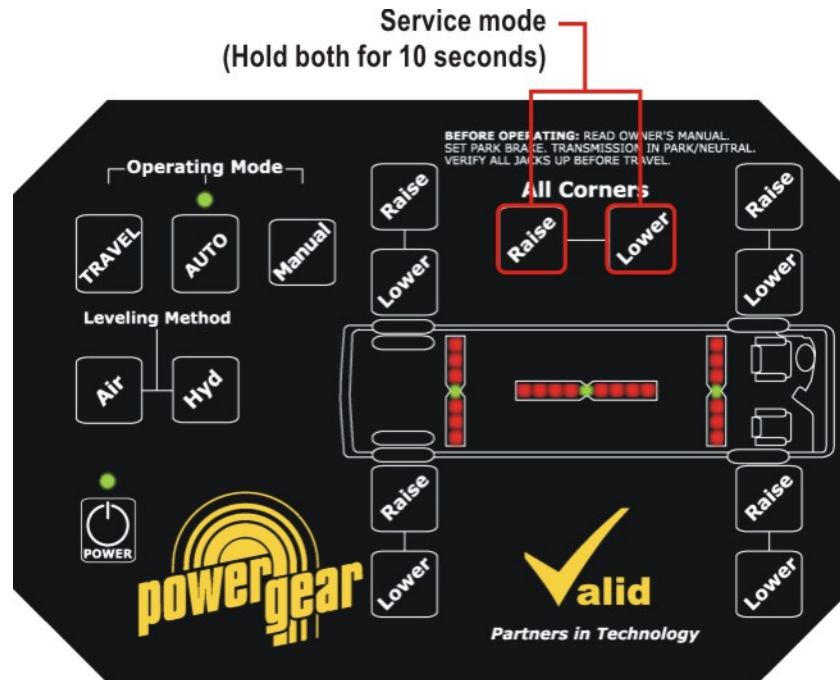
Test Diagnostics

There are two test diagnostics available, to check the functionality of the indicator lamps and the GP outputs. Both tests require the system to be in service mode.

To place the unit into service mode:

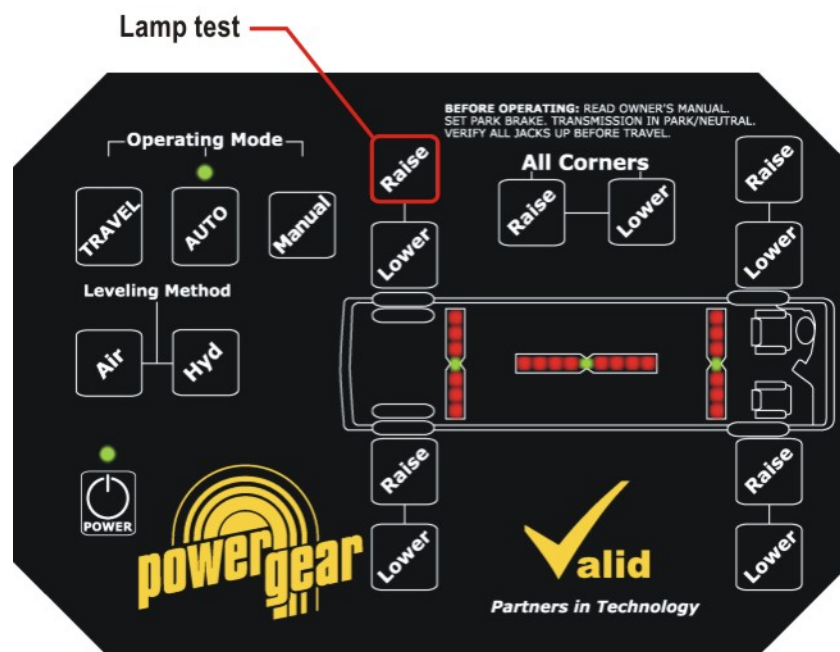
1. Ensure the system is powered off.
2. Press **POWER** to turn the system on.
3. Press and hold **ALL CORNERS RAISE** and **ALL CORNERS LOWER** simultaneously for approximately 10 seconds until the **AUTO** and **MANUAL** indicators flash alternately and an alternating tone is sounded.
4. Release **ALL CORNERS RAISE** and **ALL CORNERS LOWER**. You are now ready to proceed with one of the test diagnostics.

Note: If you do not select a function within 5 seconds after the tone is heard, the system will exit service mode.



Lamp Test

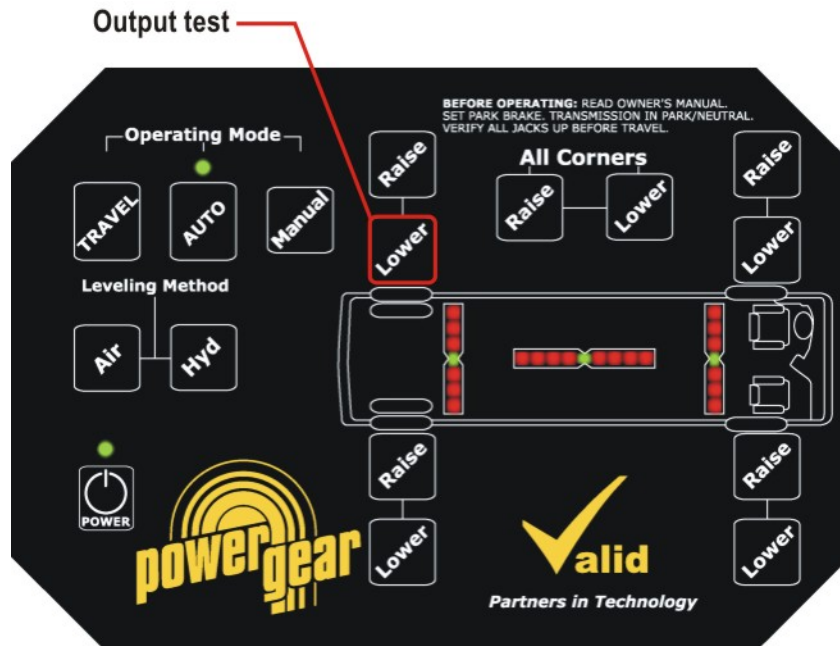
Enter service mode and press the 'Lamp Test' function button (Rear Left **RAISE**). The system will then cycle through all of the indicators, illuminating them one at a time. Visually verify that each of the indicators illuminates.



Output Test

Enter service mode and press the 'Output Test' function button (Rear Left **LOWER**). The system will then cycle the two GP (general purpose) outputs for a few seconds. Electrically verify that each of the outputs activates.

Warning: Do not perform this function while the unit is being installed, since this will activate the GP outputs.



Fault Diagnostics

Fault diagnostics provide information about problems detected in the leveling system; such as a loss of communication, or a short or open circuit.

If there is a fault in the system, the **FAULT** indicator light will illuminate, along with one or more LEDs in the level indication displays.

Note: A flashing LED indicates an open circuit, and a solid LED indicates a short circuit.

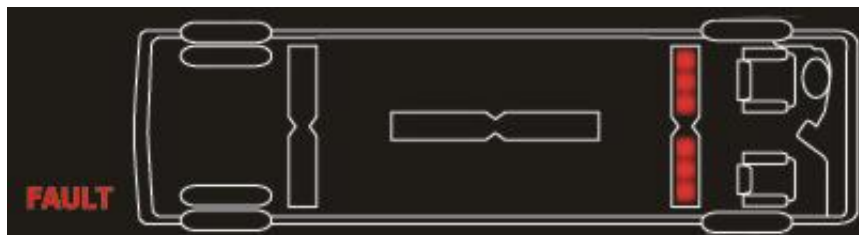
The following table describes the various fault LED configurations and what they mean.

If you see:	The problem is:	See example below
Fault indicator + a full axle lit up (all red, not the green LED).	A loss of communication in that sensor.	A.1
Fault indicator + front half of longitudinal axle lit up.	A loss of communication in the hydraulic module.	A.2
Fault indicator + lowest LED on right/left side in front/rear axle. Flashing LED = open circuit Solid LED = short circuit	A short/open circuit in the Travel valve for the right/left side on the front/rear axle.	B.3
Fault indicator + middle LED on right/left side in front/rear axle. Flashing LED = open circuit Solid LED = short circuit	A short/open circuit in the Lower valve for the right/left side on the front/rear axle.	B.4
Fault indicator + upper LED on right/left side in front/rear axle. Flashing LED = open circuit Solid LED = short circuit	A short/open circuit in the Raise valve for the right/left side on the front/rear axle.	B.5
Fault indicator + 2 nd LED from left on longitudinal bar. Flashing LED = open circuit Solid LED = short circuit	A short/open circuit in the front curbside hydraulic valve.	C.6
Fault indicator + 3 rd LED from left on longitudinal bar. Flashing LED = open circuit Solid LED = short circuit	A short/open circuit in the front roadside hydraulic valve.	C.7
Fault indicator + 4 th LED from left on longitudinal bar.	A short/open circuit in the rear curbside hydraulic valve.	C.8

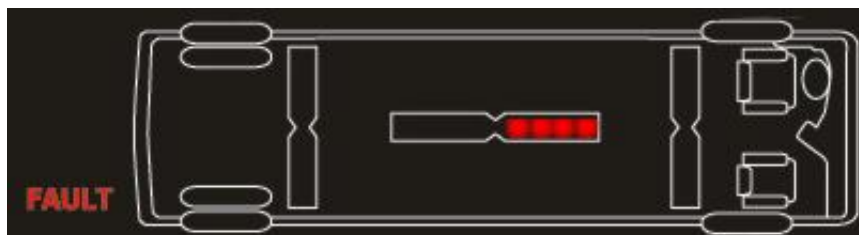
Flashing LED = open circuit Solid LED = short circuit		
Fault indicator + 4 th LED from right on longitudinal bar. Flashing LED = open circuit Solid LED = short circuit	A short/open circuit in the rear roadside hydraulic valve.	C.9
Fault indicator + 3 rd LED from right on longitudinal bar. Flashing LED = open circuit Solid LED = short circuit	A short/open circuit in the pump solenoid.	C.10
Fault indicator + 2 nd LED from right on longitudinal bar. Flashing LED = open circuit Solid LED = short circuit	A short/open circuit in the hydraulic extend valve.	C.11

Examples:

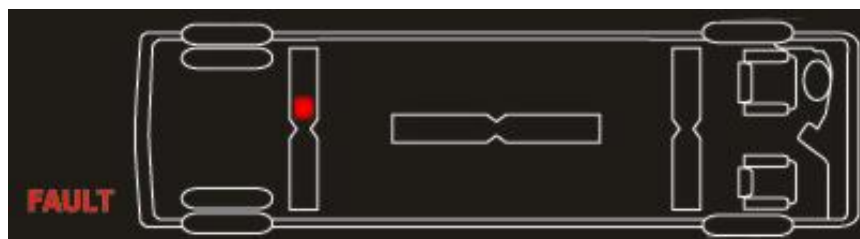
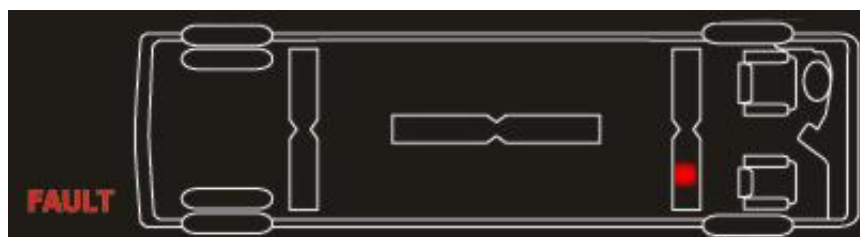
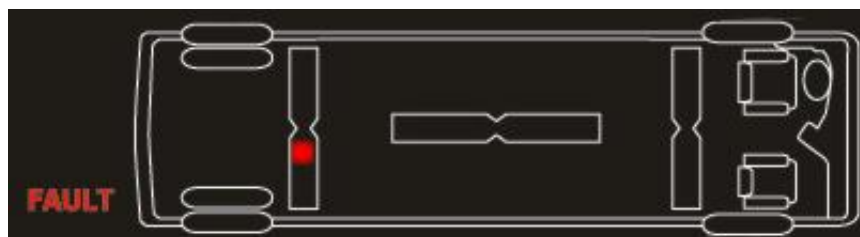
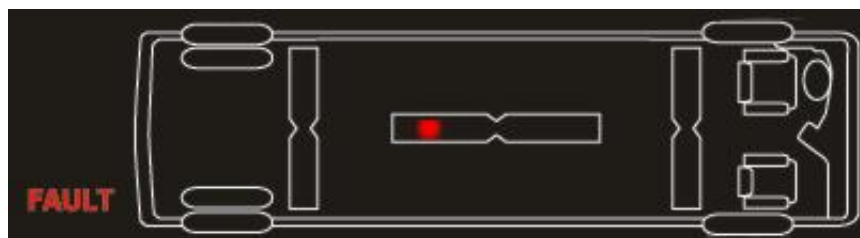
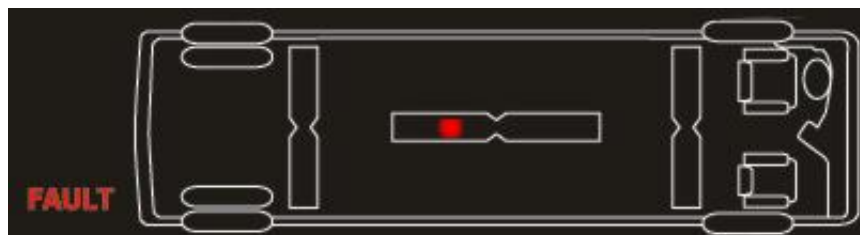
A. Communication loss



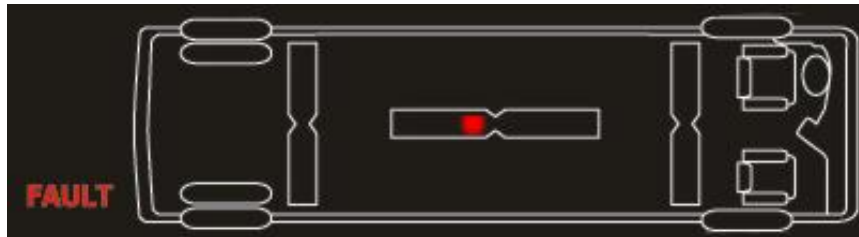
1. Communication loss in front sensor



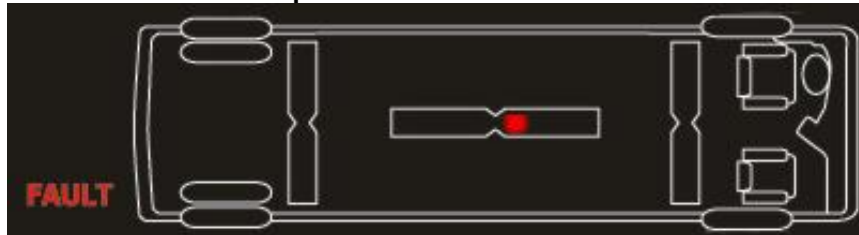
2. Communication loss in hydraulic module

B. Short/open circuits in pneumatic valves**3. Short/open circuit in rear left Travel valve****4. Short/open circuit in front right Lower valve****5. Short/open circuit in rear right Raise valve****C. Short/open circuits in hydraulic valves****6. Short/open circuit in front curbside valve**

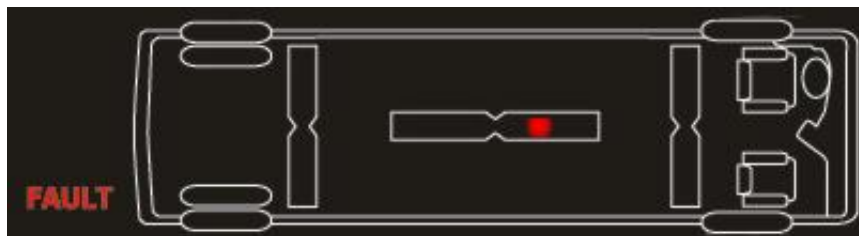
7. Short/open circuit in front roadside valve



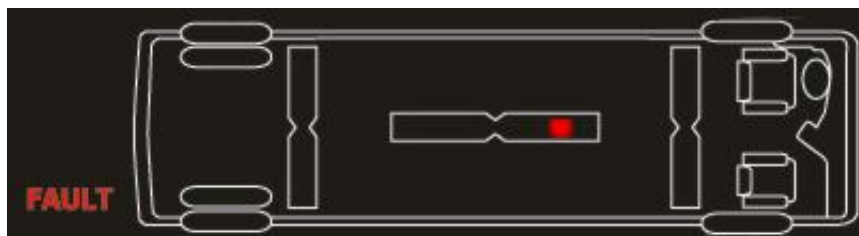
8. Short/open circuit in rear curbside valve



9. Short/open circuit in rear curbside valve



10. Short/open circuit in pump solenoid



11. Short/open circuit in extend valve

Troubleshooting Chart (Air/Hydraulic)

Trouble with selecting leveling functions

Unable to enter "air auto level" mode	• Check that vehicle is stopped and park brake is on • Check that ignition is on • Check that hydraulic jacks are fully stored
Unable to enter "hydraulic auto level" mode	• Check that vehicle is stopped and park brake is on • Check that ignition is on and vehicle is in neutral (or park) • Check that hydraulic jacks are fully stored
Unable to enter "air manual level" mode	• Check that vehicle is traveling slower than 10 mph
Unable to enter "hydraulic manual level" mode	• Check that vehicle is stopped and park brake is on • Check that ignition is on and vehicle is in neutral (or park)

Diagnosing Fault Codes

Loss of communication with sensor or I/O module	• Check fuse for sensor or I/O module • Check power to sensor or I/O module (refer to schematic) • Check integrity of harness to sensor or I/O module • Check condition of sensor or I/O module
Failure of valve (open circuit)	• Check for low battery voltage • Check valve solenoid for open circuit • Check integrity of harness to sensor or I/O module controlling valve • Check condition of sensor or I/O module
Failure of valve (short circuit)	• Check for low battery voltage • Check valve solenoid for short circuit • Check integrity of harness to sensor or I/O module controlling valve • Check condition of sensor or I/O module
Accelerometer Fault	• Reset system. If problem persists, replace sensor

Troubleshooting Chart (Hydraulic Only)

Trouble with selecting leveling functions

Unable to enter "hydraulic auto level" mode	• Check that vehicle is stopped and park brake is on • Check that ignition is on and vehicle is in neutral (or park) • Check that hydraulic jacks are fully stored
Unable to enter "hydraulic manual level" mode	• Check that vehicle is stopped and park brake is on • Check that ignition is on and vehicle is in neutral (or park)

Diagnosing Fault Codes

Loss of communication with sensor	• Check fuse for sensor • Check power to sensor (refer to schematic) • Check integrity of harness to sensor • Check condition of sensor
Failure of valve (open circuit)	• Check for low battery voltage • Check valve solenoid for open circuit • Check power to sensor (refer to schematic) • Check integrity of harness to sensor controlling valve • Check condition of sensor
Failure of valve (short circuit)	• Check for low battery voltage • Check valve solenoid for short circuit • Check integrity of harness to sensor controlling valve • Check condition of sensor
Accelerometer Fault	• Reset system. If problem persists, replace sensor

Troubleshooting Chart (Air Only)

Trouble with selecting leveling functions

Unable to enter "air auto level" mode	• Check that vehicle is stopped and park brake is on • Check that ignition is on
Unable to enter "air manual level" mode	• Check that vehicle is traveling slower than 10 mph

Diagnosing Fault Codes

Loss of communication with sensor	• Check fuse for sensor • Check power to sensor (refer to schematic) • Check integrity of harness to sensor • Check condition of sensor
Failure of valve (open circuit)	• Check for low battery voltage • Check valve solenoid for open circuit • Check integrity of harness to sensor controlling valve • Check condition of sensor
Failure of valve (short circuit)	• Check for low battery voltage • Check valve solenoid for short circuit • Check integrity of harness to sensor controlling valve • Check condition of sensor
Accelerometer Fault	• Reset system. If problem persists, replace sensor

EMERGENCY OVERRIDE PROCEDURES

If there is a problem with your Trueline Leveling System, there are procedures that can be followed to minimize potential damage until you can reach a service depot. These include initiating a travel override, and resetting the system. Other diagnostic methods are available for qualified service technicians upon consultation with Power Gear's technical service department.

Warning: These procedures must only be used under the direction of qualified service personnel. Do not attempt to use them on your own.

Travel Override

To initiate a travel override if a loss of communication is detected:

If the leveling controller experiences a loss of communication from one of the sensors, you may initiate a travel override procedure.

1. Ensure that the ignition is on.
2. Cycle the power to the affected sensor (for example, by pulling out and reinserting the fuse).

Once the power has been interrupted and restored, the leveling system will check for communication for 30 seconds. If no communication is detected after 30 seconds, the system then activates the Travel valve for whatever end had lost communication.

Warning: Travel in this condition only in an emergency, and have the communication loss fixed by qualified service personnel as soon as possible.

Resetting the Leveling System

In rare cases, you may be required to perform a full reset of your leveling system. Note that this will not reset any forced valves. Please do not reset your system unless directed by qualified service personnel.

To reset the leveling system:

1. Press **POWER** to turn on the leveling controller.
2. Press and hold **POWER** until an alternating tone is heard. The system will turn itself off after this.

Parts List



Leveling controller

140-1194



Leveling sensor

140-1191 front

140-1192 rear



Receptacle 'T' J1939

140-1190



Resistor, termination plug

DT06-3S-P006



Harness, sensor to valve

Call for harness part numbers.



Harness, controller to dash

Call for harness part numbers



Harness, controller to CAN
Call for harness part numbers



Harness, sensor to CAN
Call for harness part numbers



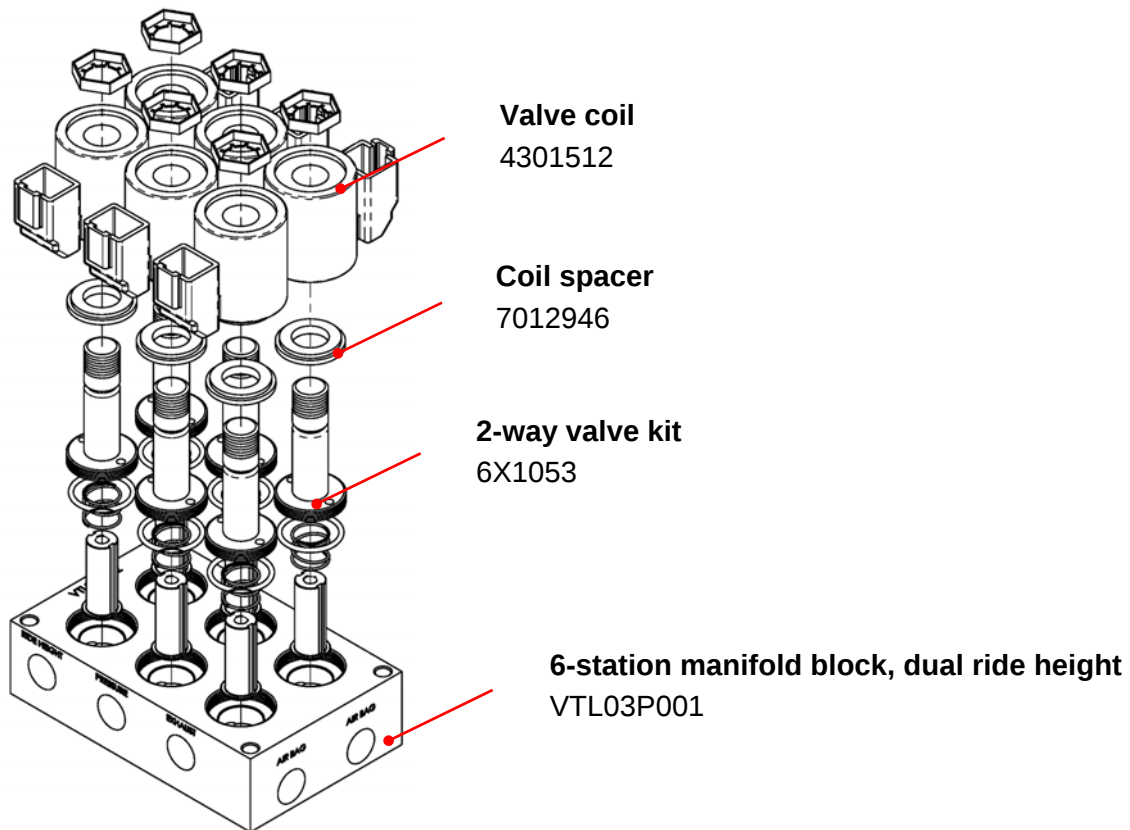
Harness, CAN
Call for harness part numbers



Harness, CAN, grounded
Call for harness part numebers



6-station air manifold, dual ride height
VTL03A001

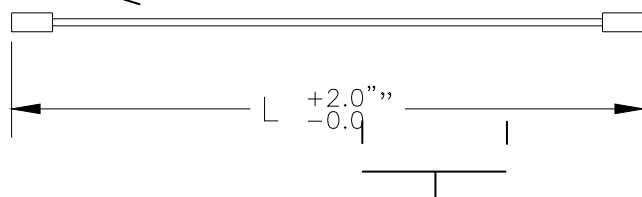


HOSES AND FITTINGS

Hose

080-XX XXX - II

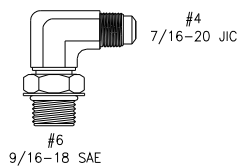
Hose fitting at each end	
Letter	Definition
A	#4 37 deg female swivel end, 7/16-20 thread per S.A.E. J514/J.I.C
B	#6 37 deg female swivel end, 9/16-18 thread per S.A.E. J514/J.I.C
C	90 deg short bend tube, #4 37 deg female swivel 7/16-20 thread per S.A.E. J514/J.I.C
D	90 deg short bend tube, #6 37 deg female swivel 9/16-18 thread per S.A.E. J514/J.I.C
E	45 deg short bent tube, #4 37 deg female swivel 7/16-20 thread per S.A.E. J514/J.I.C
F	#4 37 deg male rigid end 7/16-20 thread per S.A.E. J514/J.I.C
G	#6 37 deg male rigid end 9/16-18 thread per S.A.E. J514/J.I.C



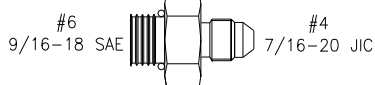
Example: Hose assembly # 080-AA264-II is 264 inches long, with #4 37 deg female swivel end fittings on both ends.

Fittings:

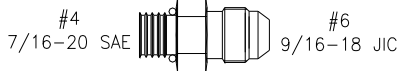
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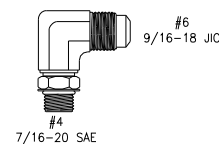
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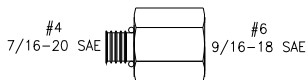
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070-1269

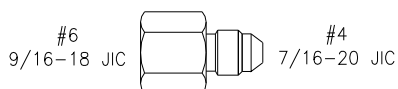


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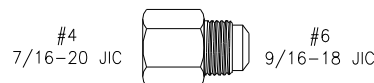


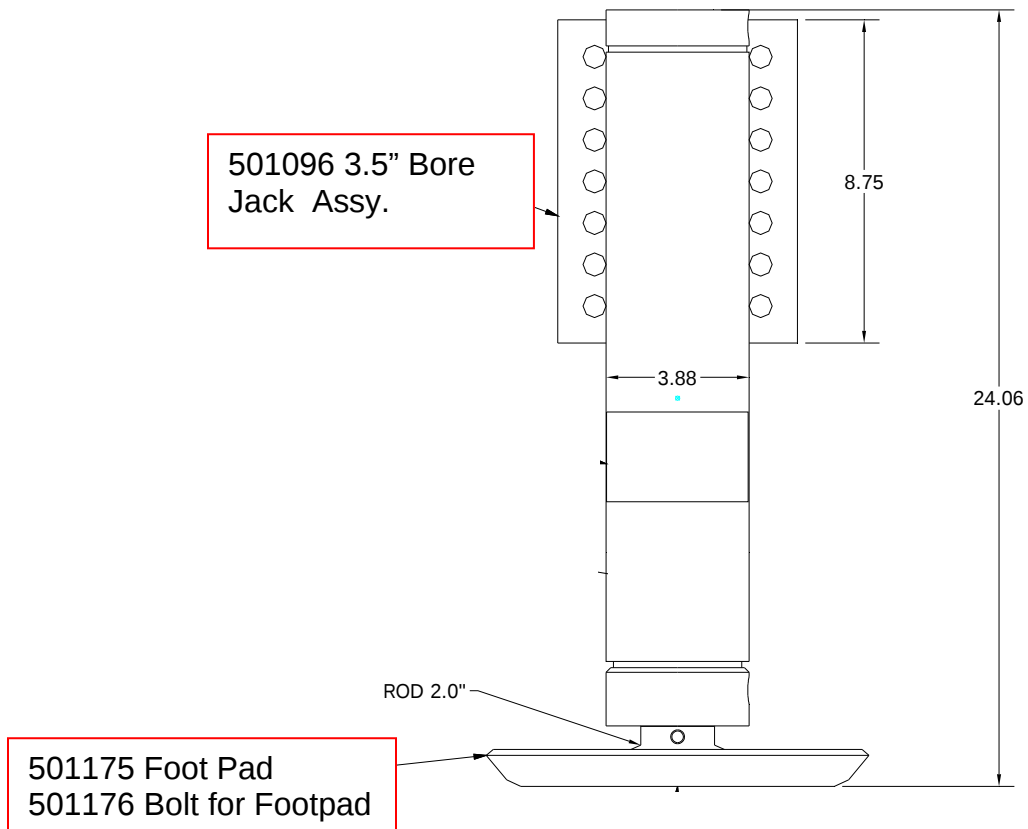
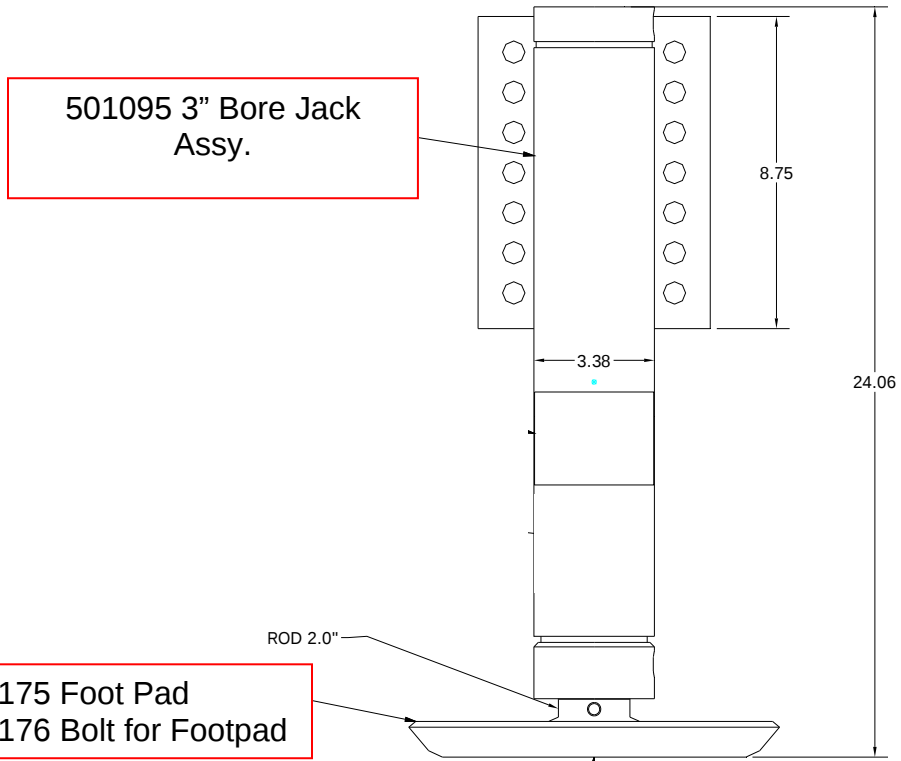
Reducers:

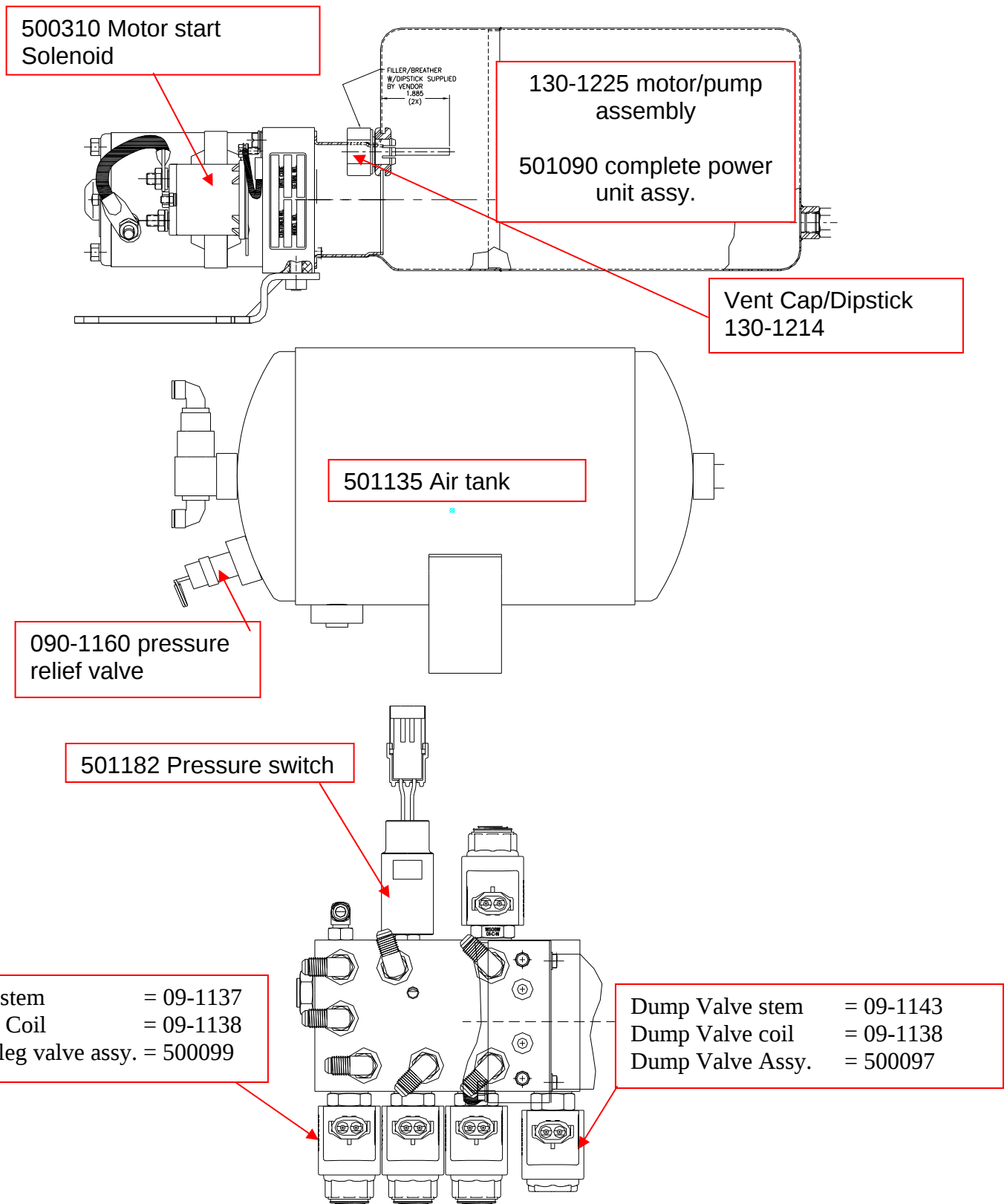
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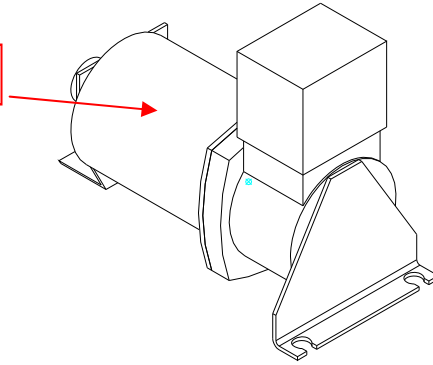
070-1263







130-1250 Air Pump Assy.



RECOMMENDED HYDRAULIC FLUIDS FOR YOUR POWER GEAR LEVELING SYSTEM

The fluids listed here are acceptable to use in your pump assembly. Contact coach manufacturer or selling dealer for information about what specific fluid was installed in your system.

Please consult factory before using any other fluids.

In most applications,

- Type A automatic transmission fluid (ATF, Dexron III, etc.,) will work satisfactorily.
- Mercon V is also recommended as an alternative fluid for Power Gear leveling systems operating in environments with large temperature swings

Operating in cold temperatures (less than -10° F) may cause the jacks may extend and retract slowly. For cold weather operation, fluid specially-formulated for low temperatures may be desirable,

- Mobil DTE 11M, Texaco Rando HDZ-15HVI, Kendall Hyden Glacial Blu, or any Mil. Spec. H5606 hydraulic fluids are recommended for cold weather operation.

PREVENTATIVE MAINTENANCE PROCEDURES

WARNING:

Your coach should be supported at both front and rear axles with jack stands before working underneath, failure to do so may result in personal injury or death.

1. **Check the fluid level every month.** Fill the reservoir with the jacks in the fully **retracted** position. On vertical pump assemblies, the fluid should be within 1/4 inch of the fill port lip and checked only with all jacks retracted. On horizontal pump assemblies, the fluid level should be approximately 1.75" on the dipstick and checked only with all jacks retracted.
2. **Change fluid every 24 months.**
3. **Inspect and clean all hydraulic pump electrical connections every 12 months.**
4. **Remove dirt and road debris from jacks as needed.**
5. If jacks are down for extended periods, it is recommended to **spray exposed chrome rods with a silicone lubricant** every seven days for protection. If your coach is located in a salty environment (within 60 miles of coastal areas), it is recommended to spray the rods every 2 to 3 days.

GLOSSARY

Accelerometer

Traditionally, a sensor used to measure acceleration. DC-coupled accelerometers can be used to measure the acceleration due to gravity, which allows them to be used as an inclinometer to measure tilt.

Auto mode

The leveling mode that should be used by default when the vehicle is at a stop. This mode is the easiest to use and is suitable for most situations.

Controller

The controller is the interface between the operator and the leveling system. It allows the operator to enter commands using keys, and displays information with LEDs.

EEPROM

Electrically Erasable Programmable Read-Only Memory. A memory chip that can be recorded or erased electrically, but that does not lose its content when electrical power is removed.

GP output

General purpose output. The Leveling System has two GP outputs, which can be optionally used as the operator wishes.

Manual mode

Manual leveling mode allows you to raise or lower each corner of the vehicle individually, to the level you want. Manual leveling mode can be used if you wish to have control over the leveling process. It can also be used at low traveling speeds when an uneven surface must be negotiated.

Ride height

Ride height is a manufacturer-assigned height between a vehicle's axle and the chassis. On the valve manifold, there are two ride height inlet ports (left and right) that connect to the left and right travel valves, respectively.

Service mode

The mode that the control panel must be in before certain features can be accessed, including initial configuration, diagnostic functions, and forcing valves. This mode is entered by turning the controller on and then holding down **AUTO** until an alternating tone is heard.

Travel mode

The leveling mode that is used when the vehicle is in motion. By default, this mode will initiate when the vehicle is moving at a speed higher than the designated speed limit (set in the initial configuration of the system), but it is best for the operator to enter this mode before the vehicle begins moving.

Twist

Occurs at the four points in a vehicle's suspension, and puts stress on the chassis and vehicle frame.

Valve manifold

The 2 valve manifolds are the ‘action’ components of the leveling system. They control the intake and release of air to the air springs depending on the information they receive from the sensors. They feature durable components that include IP67 rated electrical connectors, 1-piece molded coil and an anodized body.



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