

WABCO

Technical Bulletin

Trailer ABS with Roll Stability Support (RSS 1M) for Constant Power Trailers with Air or Mechanical Suspensions

2S/1M with Roll Stability Support (RSS)
Using RSS 1M

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

The ABS is an electrical system. When you work on the ABS, take the same precautions that you must take with any electrical system to avoid serious personal injury. As with any electrical system, the danger of electrical shock or sparks exists that can ignite flammable substances. You must always disconnect the battery ground cable before working on the electrical system.

CAUTION

High voltages can damage the electronic control unit (ECU). Disconnect all connectors from the ECU before you perform any welding, electrostatic painting, or any other activity that applies high voltage to the vehicle frame. Install blind plugs into the ECU to protect the connector openings. Ground the welding or painting equipment to the part you are working on. If you are working on a moving or insulated component such as an axle, make sure it is correctly grounded through the frame. Refer to the equipment manufacturer's recommended instructions for correct procedures.

If you have any questions regarding the material covered in this bulletin, or for more information about the WABCO product line, please contact the WABCO Customer Care Center at 855-228-3203, by email at wnacustomer care@wabco-auto.com, or visit our website:

wabco-na.com

Overview

WARNING

RSS 1M is an advanced vehicle control system from WABCO that reduces the risk of a rollover and assists the driver in maintaining control of the vehicle. However, any vehicle may overturn in some situations with or without RSS 1M.

Having RSS 1M does not allow drivers to take unnecessary risks. Make sure drivers do not take curves or turns faster than they would without RSS 1M and always use safe driving techniques. Failure to do so can result in serious personal injury, damage to components, or both. An alert unimpaired driver remains the primary element in maintaining control of the vehicle and reducing the chances of rollover accidents.

Trailer roll stability utilizes precision-tuned equipment that must be installed correctly. Failure to carefully read and follow all instructions in this manual can result in personal injury, damage to components, or both.

WABCO's roll stability support provides an independent stability system for single, tandem or tri-axle constant-powered trailers equipped with air or mechanical suspensions. It is compatible with both disc and drum foundation brakes. The system consists of:

- An electronic control unit (ECU)/modulator valve assembly with built-in pressure sensors to monitor control and supply pressure, as well as axle load. A lateral accelerometer incorporated into the ECU monitors trailer stability.
- RSS 1M ECU/modulator valve assembly is fully serviceable with NPTF threads.
- PLC communication fully integrated
- Two wheel speed sensors
- Diagnostics are incorporated into WABCO TOOLBOX™ Software version 11.0 or higher

- Easy-to-use blink codes
- Multiple generic input/outputs, digital or analog

Trailer Configurations

- This installation guide covers 2S/1M trailer ABS with RSS 1M installations. Sensor installation procedures are based on using ABS-prepped axles.

RSS 1M System Requirements

- A WABCO trailer in-line filter (or WABCO gladhand with integrated filter) is required for **ALL** RSS 1M installations and is to be installed in the control line, upstream of the RSS ECU/dual modulator valve assembly.
- For proper ABS and RSS 1M functionality, LED brake lights must be used.
- To complete the RSS 1M installation, you must have 120 psi air pressure available. A 12-volt DC (10 amp minimum) power supply must also be available.
- For diagnostics or installation testing, ensure only constant power (blue pin) is applied. Do not apply power to the stoplight circuit (red pin).

NOTE: Blink codes for level one diagnostics are a standard capability for the RSS 1M ECU. In-depth level two diagnostics are available in WABCO TOOLBOX™ Software.

⚠ WARNING

Failure to meet stated requirements could result in personal injury, damage to equipment, or both.

RSS 1M Definitions

These features are integrated into the RSS 1M system.

Table A

Lateral Accelerometer	A sensing device that monitors differences in acceleration from side to side.
Axle Load Pressure Sensor	A pressure sensor with a pneumatic port for the air suspension that provides load measurement for the ECU.

RSS 1M Components

ECU/Modulator Valve Assembly

The valve portion of the electronic control unit (ECU) modulator valve assembly contains one separate modulator valve with four delivery ports. The mounting orientation — whether the valve is mounted with the sensors facing the front or the rear of the trailer — determines sensor hookup. Figure 1 through Figure 5.

- **Mounted with sensors facing front of trailer:** The **d** sensor connection goes to the curbside and the **c** sensor connection goes to the roadside.
- **Mounted with sensors facing rear of trailer:** The **c** sensor connection goes to the curbside and the **d** sensor connection goes to the roadside.

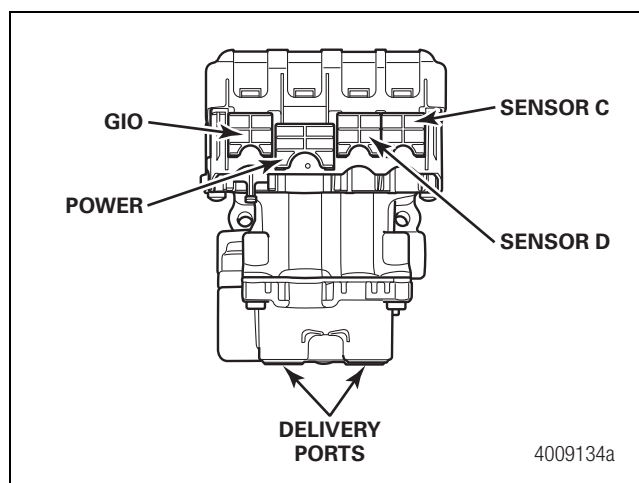


Figure 1

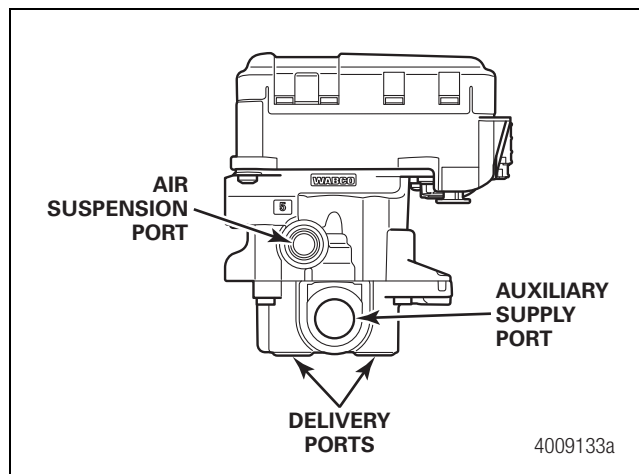


Figure 2

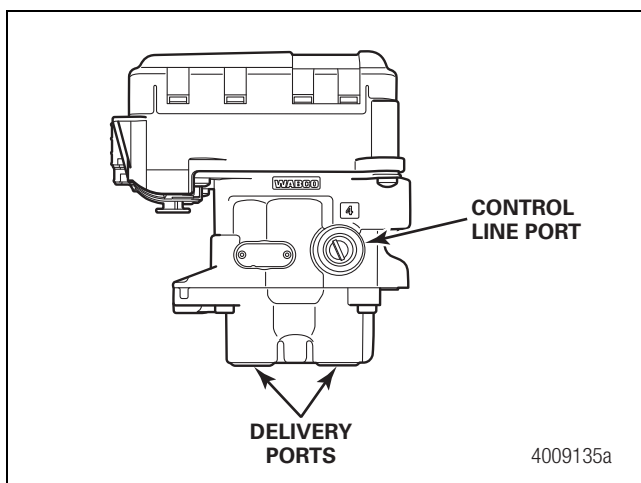


Figure 3

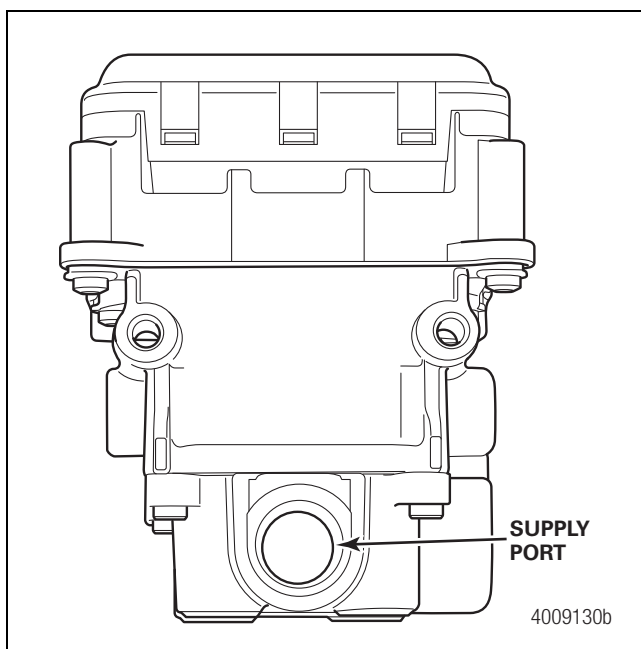


Figure 4

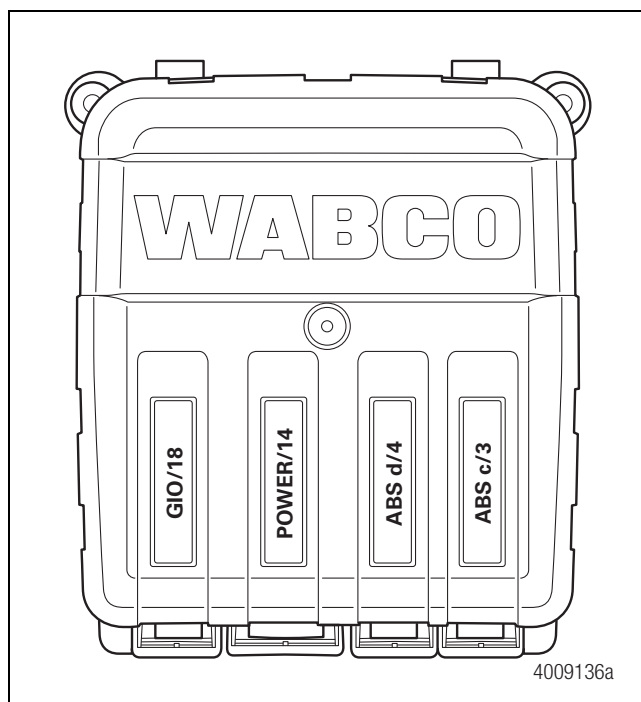


Figure 5

RSS 1M Software

NOTE: Complete RSS 1M software instructions are included in this publication.

End of line testing is required on all trailer RSS 1M installations. Use WABCO TOOLBOX™ Software to perform this test. This software must be available at all trailer manufacturers where RSS 1M is being installed. If you do not have this software program, please contact the WABCO Customer Care Center at 855-228-3203 or by email at wnacustomercenter@wabco-auto.com. Do not begin the RSS 1M installation if you do not have this software.

End of line testing must be completed before the trailer is released into service. The RSS portion of TOOLBOX™ Software is used to conduct the sign-off.

Installation

⚠ WARNING

RSS 1M will not function correctly if the mounting location does not meet the following specification, possibly resulting in personal injury, damage to equipment, or both.

Do not mount the ECU/modulator valve assembly facing sideways. The ECU/modulator valve assembly must be mounted facing the front or rear of the trailer.

NOTE: The 2S/1M RSS 1M is typically center mounted directly on the air reservoir. Alternately, a bracket may be fabricated using steel at least 3/16-inch (4 mm) thick or mounted directly to the cross member. Figure 8.

Mounting Requirements for Air Suspensions

The ECU modulator valve assembly contains a lateral accelerometer that provides data for stability control. For optimum lateral accelerometer function, **the ECU must be mounted level in the center of the width of the trailer, midway between the axle spacing.** Figure 6.

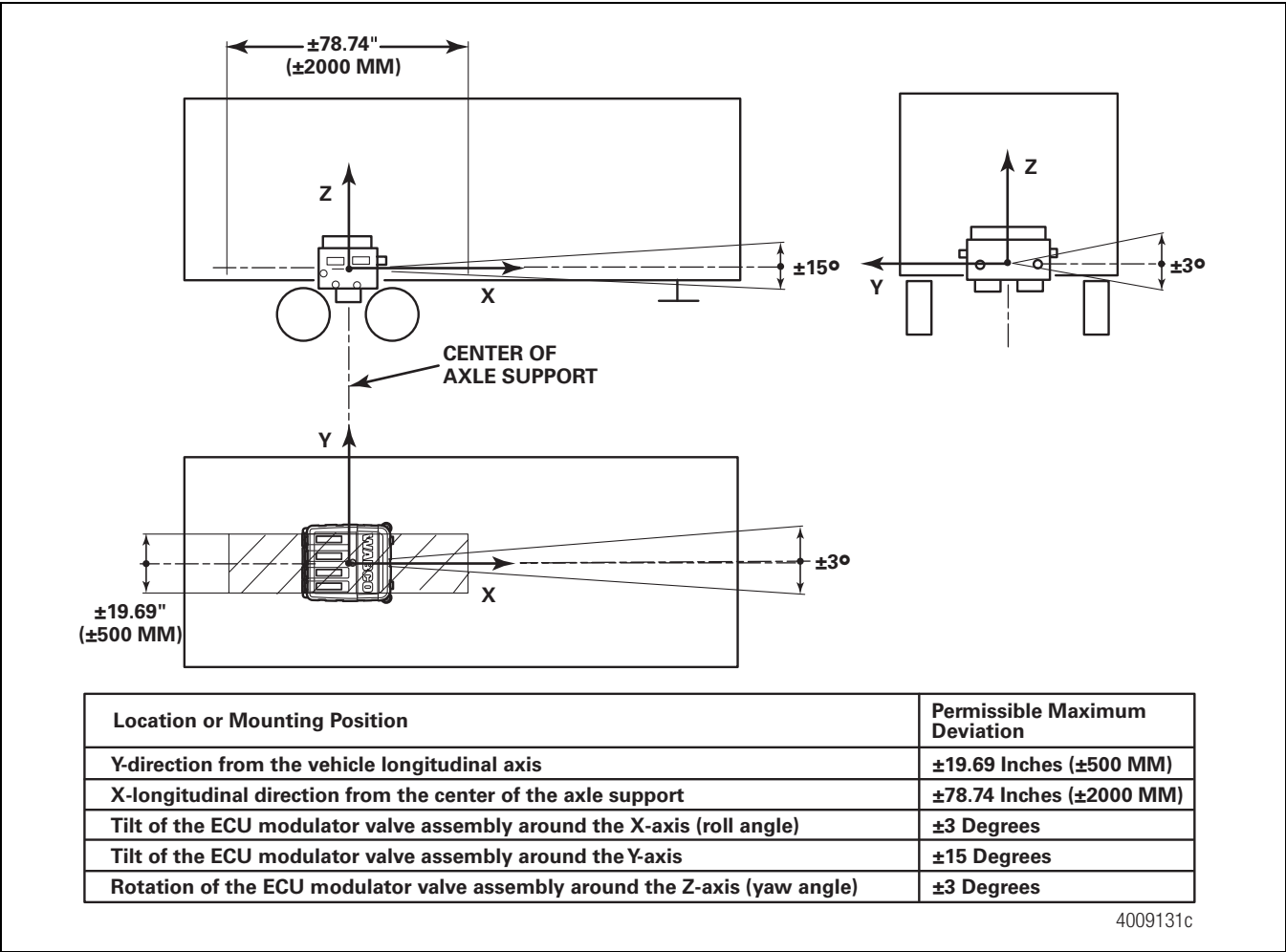


Figure 6

Preparation

Before beginning the installation procedure, perform the following.

1. Inspect the ECU modulator valve assembly for damage that may have occurred during shipping or storage.
 - Look for crushed or bent connectors.
 - Verify that the yellow retainer clips have not been bent or otherwise damaged.
2. Ensure that the following installation components are available. Refer to page 34.
 - **Do not install a damaged ECU modulator valve assembly.** Notify your supervisor, or contact WABCO if there is any apparent damage.

WABCO Components

- ECU modulator valve assembly
- RSS 1M power cable
- Sensor extension cables, two pieces for 2S/1M system
- Sensors and sensor holding clips, two for each non-ABS-prepped axle
- WABCO trailer ABS in-line filter and label
- WABCO TOOLBOX™ Software version 11.0 or higher
- ABS indicator label, TP-95172
- Constant power label (part number 899 201 833 4)

Non-WABCO Components

- **Minimum 5/8-inch O.D. nylon tubing for supply**
- 3/8-inch O.D. nylon tubing for axle load sensor
- SAE standard, DOT-approved thread sealant
- Incandescent-type DOT-approved Trailer ABS Indicator lamp, or an LED with integral load resistor
- Grade 8 (3/8"-16 UNC) bolts and washers (remote mounted ECUs only)

Component Installation

ECU Modulator Valve Assembly

NOTE: The RSS 1M ECU is typically tank mounted. Alternately, a bracket may be fabricated using steel at least 3/16-inch (4 mm) thick or mounted directly to the cross member. Figure 8.

RSS 1M will not function correctly if the mounting location does not meet the following requirements.

Standard ECU Mounting

- To complete the RSS 1M installation, you must have 120 psi air pressure available. A 12-volt DC (10 amp minimum) power supply must also be available.
- The ECU assembly must be mounted level and must be mounted facing either the front or the rear of the trailer. Figure 6.
- Mount the ECU modulator valve assembly in the center of the air reservoir, midway between the axle spacing. Figure 6.
- **Do not mount sideways.**

Remote ECU Mounting

When mounting the ECU modulator valve assembly to the trailer, refer to SAE specification J447, Prevention of Corrosion of Motor Vehicle Body and Chassis Components. Follow all recommendations and procedures. Your supervisor should have a copy of this specification or be able to tell you how to obtain one.

1. Apply SAE-standard, DOT-approved paste-type thread sealant to all NPTF threads. Do not use excessive amounts of sealant. DO NOT cover first two threads.
 - Supply ports are 3/4-inch NPTF.
 - Delivery control and air suspension ports are 3/8-inch NPTF.
2. Mount the assembly level midway between the side rails, close to the brake chambers the valve serves.
 - Drill two 1/2-inch (13 mm) mounting holes. The center-to-center distance between the two holes must be 3-1/2-inches (89 mm) and mount directly to a rigid structure. Figure 7.

OR

- Build a mounting bracket with two 1/2-inch (13 mm) mounting holes with 3-1/2-inches (89 mm) center-to-center distance between the two holes. The bracket must be made of cold rolled 1040 to 1080 steel with a reinforcing gusset. Figure 8.

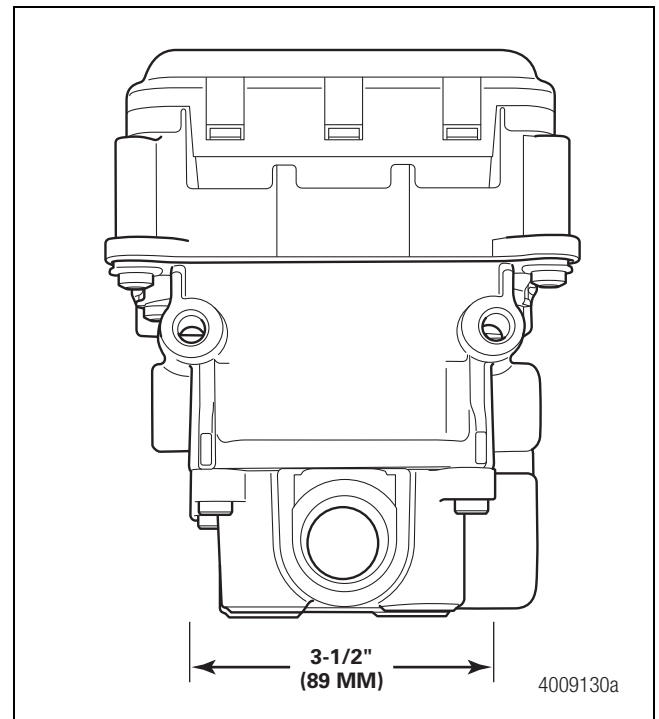


Figure 7

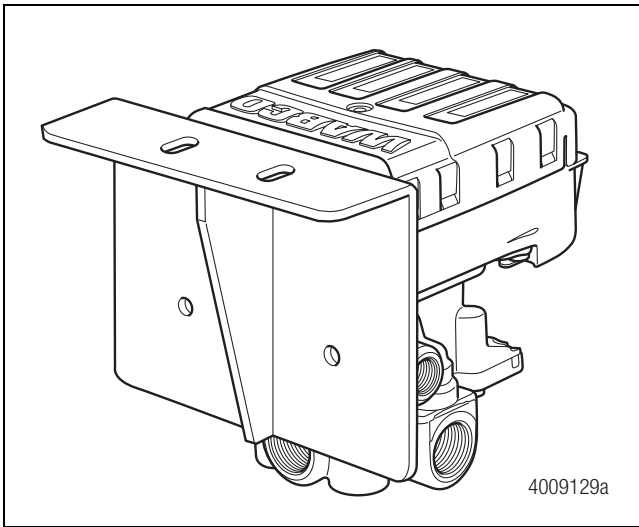






Figure 8

3. Use two 3/8"-16 UNC bolts with corresponding flat and locking washers. Install the nuts and tighten them to 50 ft-lb (68 N•m).

4. For additional corrosion protection, the ECU modulator assembly may be painted. Mask the exhaust ports before painting. Remove the masking after painting.
5. The bracket or mounting area must completely cover the bearing surface of the mounting flange.

Air Lines

Before connecting the air lines, plumb the spring brake relay or emergency brake relay into the system as usual.

1. For tank-mounted ECUs, first connect the ECU/modulator valve assembly directly to the air reservoir using a schedule 80 NPTF fitting. Tighten the fitting between the supply port of the ECU/modulator valve assembly and the air reservoir to 122 ft-lb (165 N•m). Refer to Figure 2 and Figure 4 for supply port location. 
2. For remote-mounted ECUs, connect the air supply line from the supply tank to the 3/4-inch NPTF supply port on the ECU/modulator valve assembly. **Use 5/8-inch minimum O.D. nylon tubing.** Tighten the fitting to 122 ft-lb (165 N•m). Plug the unused supply port. Refer to Figure 2 and Figure 4 for supply port location. 
3. Connect air delivery lines to the ECU valve assembly. The ports labeled 2 are 3/8-inch NPTF. Tighten the fittings to 59 ft-lb (80 N•m). Refer to Figure 1 and Figure 2 for deliver port location. 
4. Connect the air delivery lines to the appropriate brake chambers, 3/8-inch NPTF. Refer to Figure 9 for valves mounted with sensors facing the rear of the trailer and Figure 10 for valves mounted with sensors facing the front of the trailer.

TYPICAL INSTALLATION – VALVE MOUNTED FACING REAR OF TRAILER

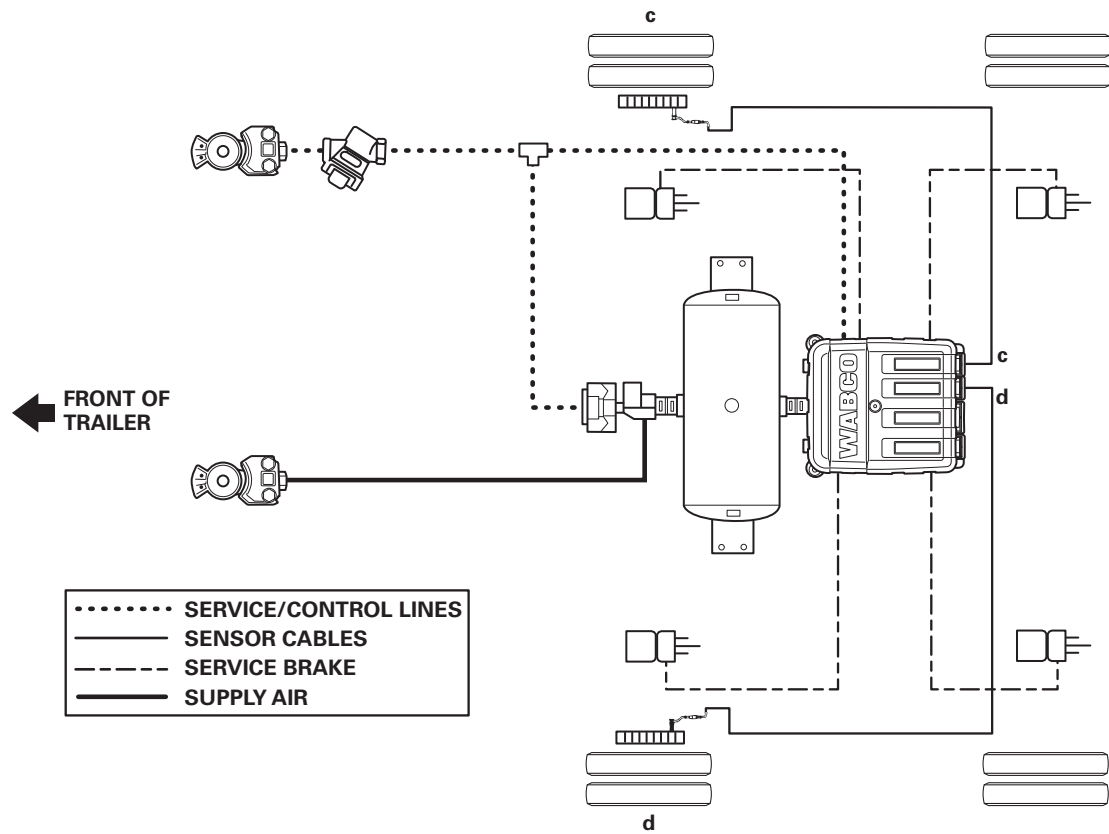
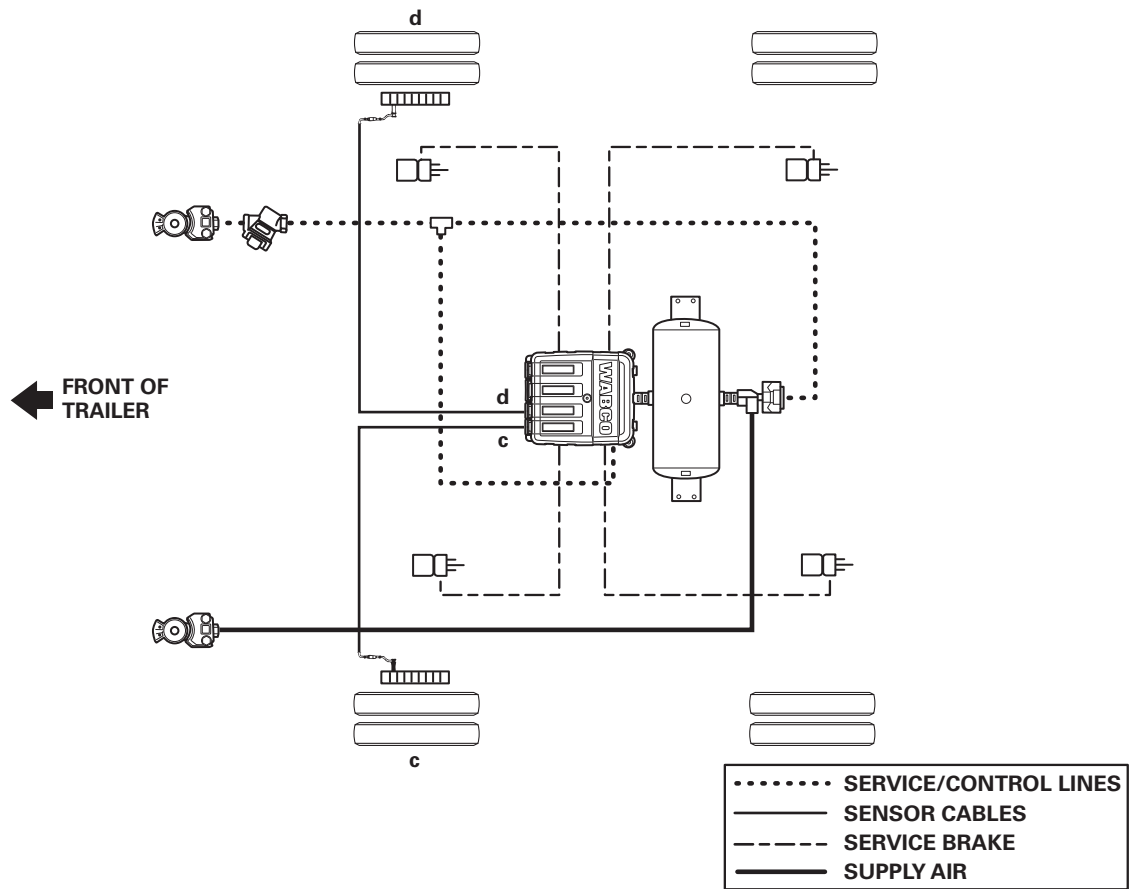


Figure 9

TYPICAL INSTALLATION — VALVE MOUNTED FACING FRONT OF TRAILER



4009731b

Figure 10

NOTE: The valve portion of the ECU modulator valve assembly contains one valve which has four delivery ports.

- Connect the brake service or control line to the ECU/dual modulator valve's Port 4. Port 4 is 3/8-inch NPTF.
- Connect the air bag or bellows line to Port 5 of the ECU valve assembly. Port 5 is 3/8-inch NPTF.
- Plug any unused ports.
- For mechanical suspensions, refer to the procedure in this guide in Mechanical Suspension Preparation on page 13.

Sensor and Sensor Extension Cables

- Do not install tooth wheels that show signs of damage such as chipped or missing teeth.
- The sensor should be installed to initially contact the tooth wheel. The center of the sensor should contact the tooth wheel near the center of the tooth width, at least 0.0035-inch (0.0889 mm) from the edge of the tooth.

- Lubricate the sensor, the sensor spring clip and the base of the sensor block using a mineral oil based lubricant containing molydisulfide with a temperature range of -40°F to 300°F (-40°C to 150°C). Lubricants approved for use on WABCO sensors and spring clips are:
 - Mobilith SHC-220 (Mobil)
 - TEK 662 (Roy Dean Products)
 - Staburags NBU 30 PTM (Klüber Lubrication)
 - Valvoline Moly-Fortified Multi-Purpose Grease
- WABCO Sensor Maintenance Wall Chart, TP-0465, is an excellent reference guide for ABS sensor maintenance. Contact WABCO Customer Care Center at 855-228-3203 to request a copy.

NOTE: WABCO recommends placing sensors on the axle that will provide the most braking performance. The suspension manufacturer can provide this information.

1. Visually inspect the tooth wheel and sensor to ensure there was no damage during shipping. Make repairs or replace as necessary.
2. Connect the sensor and cables on the prepped axles to the sensor extension cables. Verify that each connection is secure. Figure 11.

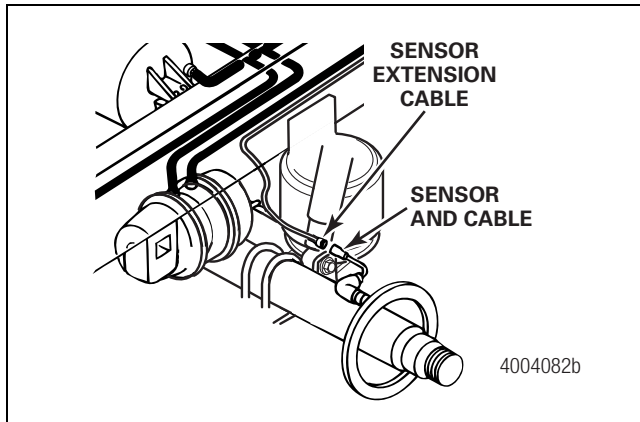


Figure 11

3. Route the sensor extension cable along the back side of the trailer axle and up the brake hose to the ECU modulator valve assembly.

CAUTION

Do not overtighten the tie wraps on a cable. Overtightening can damage the cable. Do not tie wrap the molded sensor plug. The sensor extension cable must follow the brake hose to the ECU modulator valve assembly to allow for axle jounce and rebound.

4. Secure every eight inches (203 mm) with tie wraps or cable clips.
5. Pull the sensor retainer clip on the ECU modulator valve assembly OUT.
6. Plug the sensor extension cables into the ECU modulator valve assembly. To secure the connection, push the sensor retainer clip IN. Retainer clips must fit in the groove of the sensor connectors to ensure correct connection. Connect the sensors to the extension cables.

ECU Modulator Valve Assembly Mounted with the Sensors Facing the Front of the Trailer

- 2S/1M (Figure 16)
 - Connect the curbside sensor to **d** location on ECU.
 - Connect the roadside sensor to **c** location on ECU.

ECU Modulator Valve Assembly Mounted with the Sensors Facing the Rear of the Trailer

- 2S/1M (Figure 17)
 - Connect the curbside sensor to **c** location on ECU.
 - Connect the roadside sensor to **d** location on ECU.

7. Create a strain relief to protect the terminals. Without this strain relief, normal trailer jounce and vibration will cause the terminals to spread and loosen. Use a tie wrap or clip to secure the cable to the air hose as close to the fitting as possible. Slots for tie straps may be found on the valve body. Figure 12.

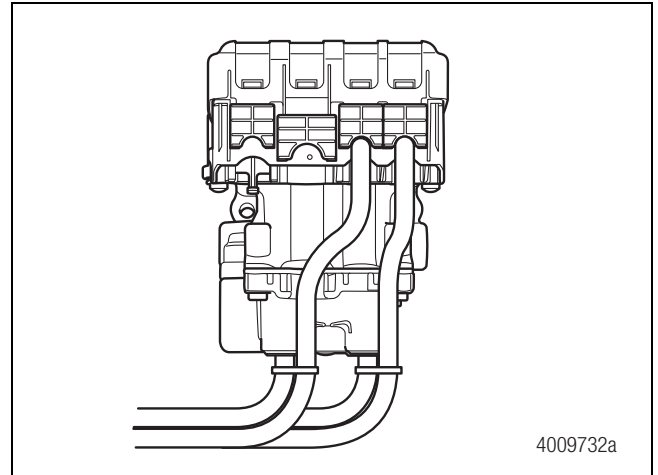


Figure 12

8. Bundle any excess cable into a bow tie. Figure 13.

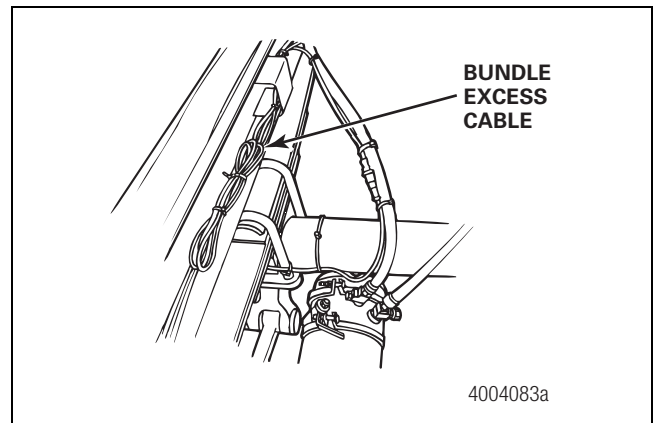


Figure 13

NOTE: Various cable lengths are available.

9. Secure the excess cable in the subframe of the vehicle or along the air hoses as appropriate. Excess cable should not exceed two feet (609 mm).

RSS 1M Power Cable

1. Select a location to run the cable on a frame rail or cross member.
2. Verify that the cable is long enough to reach the ABS dropout for the main trailer harness from the ECU.
3. Attach the WABCO connector to the ECU modulator assembly.
 - A. Pull the power connector retainer clip OUT from the ECU modulator valve assembly.
 - B. Attach the RSS power cable into the ECU assembly.
 - C. Push the power connector retainer clip on the ECU modulator valve assembly IN to securely lock in place.

NOTE: If you are routing this cable to a junction box, or if it is necessary to cut the cable, please contact the OnTrac Customer Service Center at 866-OnTrac1 (668-7221) for assistance. Refer to the pinout information in Figure 14 for additional cable information.

4. Route the end of the cable with the five-pin Weather Pack connector to the ABS dropout of the main trailer harness.

NOTE: Leave enough slack in the cable to compensate for flexing of the trailer and subframe.

5. Secure the cable correctly in the subframe to prevent cable damage.
6. Bundle any excess cable into a bow tie. Figure 13.
7. Plug the five-pin Weather Pack connector into the ABS dropout of the mating receptacle on the main trailer harness. Figure 14.

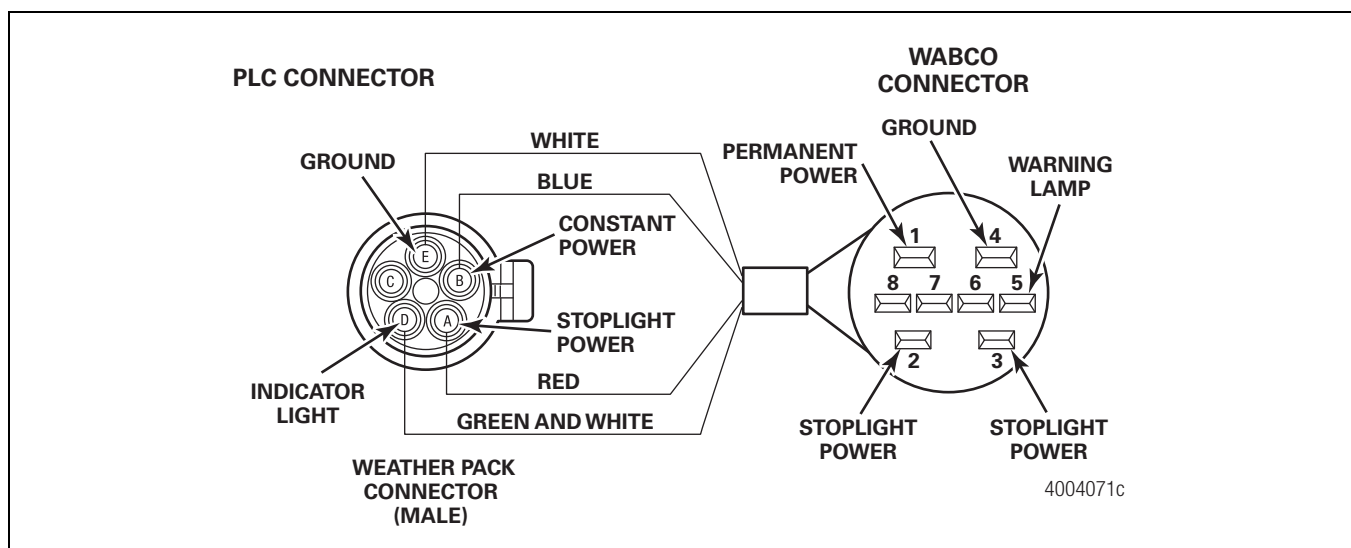


Figure 14

Trailer ABS Indicator Lamp

Refer to the vehicle specification sheet for the recommended mounting location of the indicator lamp.

- Use a DOT-approved lamp with ABS etched on the lens. These lamps are available from major trailer parts suppliers.
- To ensure correct lamp operation, use an incandescent-type DOT-approved lamp or an LED with integral load resistor.
- Affix the approved ABS indicator lamp operation label to the trailer near the lamp location.

Trailer ABS In-Line Filter Valve

Install the WABCO in-line filter valve in the control line, upstream of the RSS 1M ECU modulator valve assembly.

- The in-line filter valve must be installed with the filter portion facing DOWNWARD so that the air line ports are horizontal. Figure 15.
- Allow sufficient clearance for servicing the valve. A minimum of 3-1/2-inches (89 mm) to release the retainer slide bar and a minimum of two-inches (50 mm) to allow for the removal and installation of the internal components is required. Figure 15.
- The in-line filter valve must be rigidly supported (e.g., nipple mounted to gladhand or supported by a bracket and clamp).
- Refer to Technical Bulletin TP-03100, Trailer ABS In-Line Filter Valve, for service information covering the in-line filter valve.

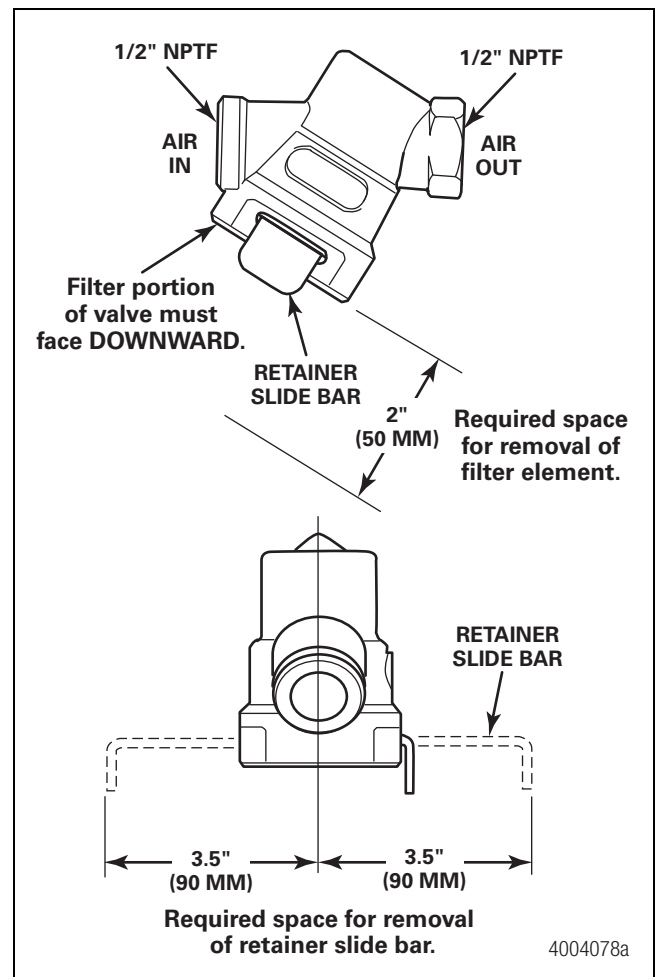


Figure 15

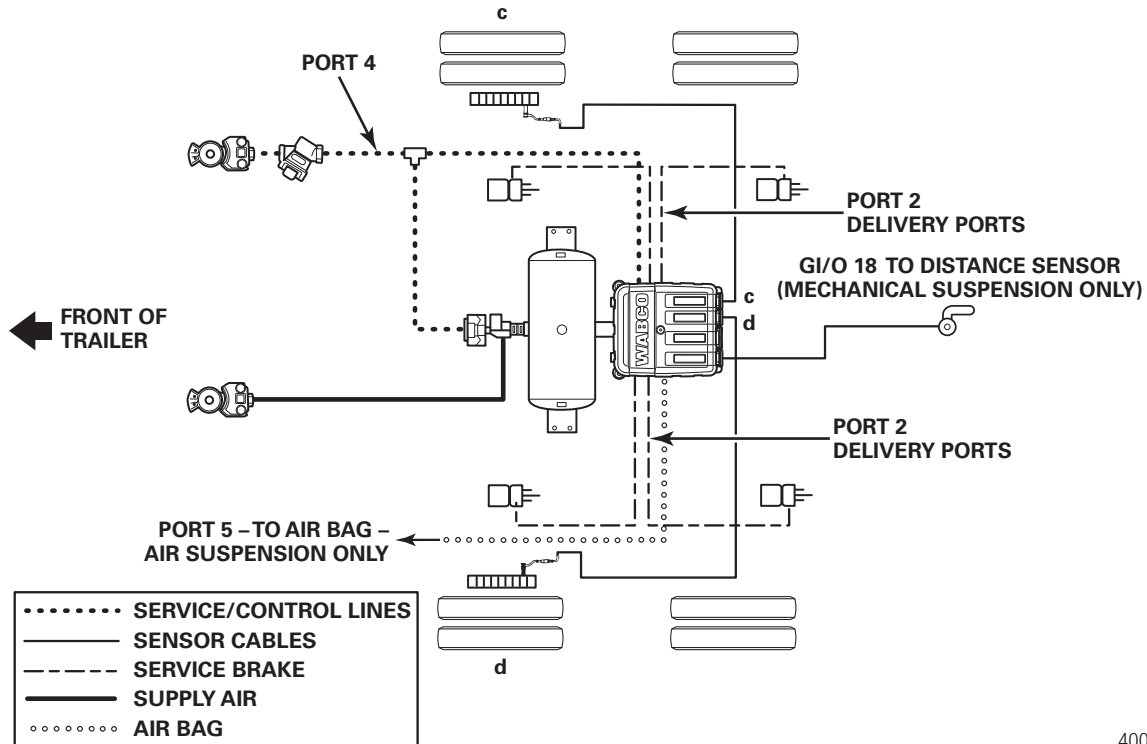
System Layouts

NOTE: WABCO recommends placing sensors on the axle that will provide the most braking performance. The suspension manufacturer can provide this information.

NOTE: Layouts cover both air and spring suspensions.

Typical trailer RSS 1M layouts are illustrated in Figure 16 and Figure 17.

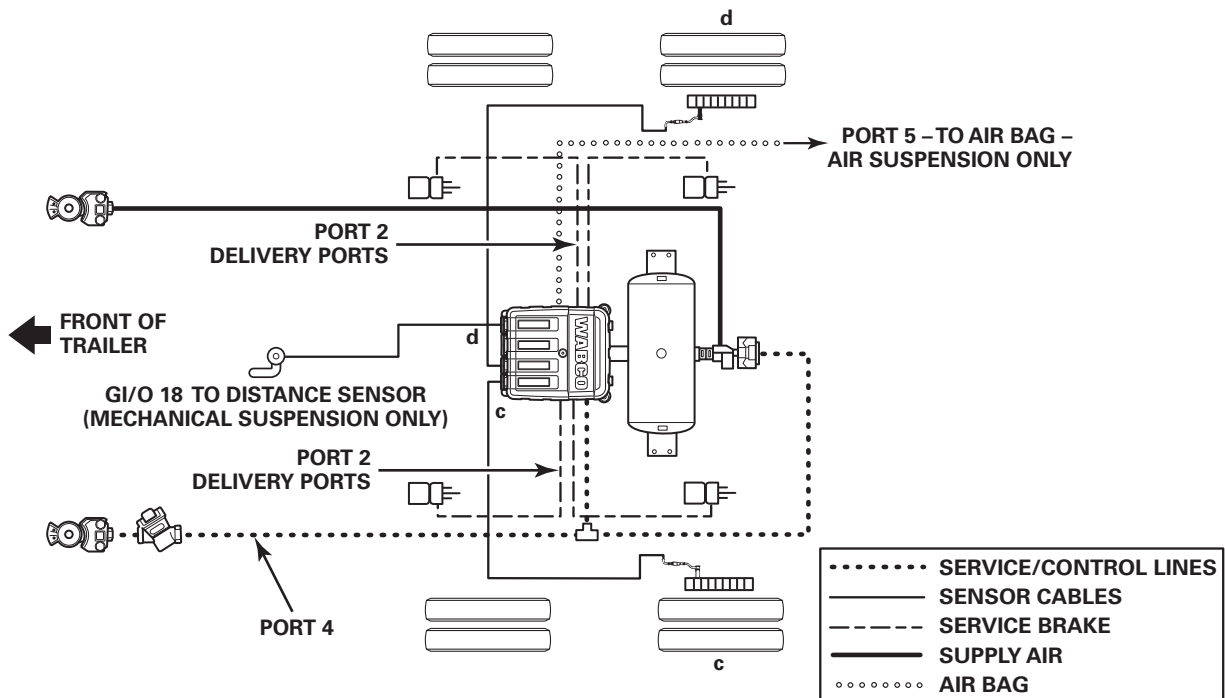
**2S/1M TANDEM AXLE TRAILER ECU FACING REAR OF TRAILER,
SENSORS ON FRONT AXLE**



4009127b

Figure 16

**2S/1M TANDEM AXLE TRAILER ECU FACING FRONT OF TRAILER,
SENSORS ON REAR AXLE**



4009127d

Figure 17

Air Suspension Preparation

Connect port 5 to the air bags or leveling valve with 3/8-inch nylon tubing and the corresponding fittings.

Mechanical Suspension Preparation

Installation of the RSS 1M system on a mechanical suspension is similar to the installation on an air suspension with the following differences:

- A. Port 5, labeled 'air suspension port' in Figure 2, **MUST** be plugged.
- B. The WABCO Distance Sensor must be attached to the trailer structure directly above the axle, close to the axle's center. Figure 19.
- C. Insert the Distance Sensor Cable into GI/O #1 on the RSS ECU and connect it to the Distance Sensor. Figure 18.

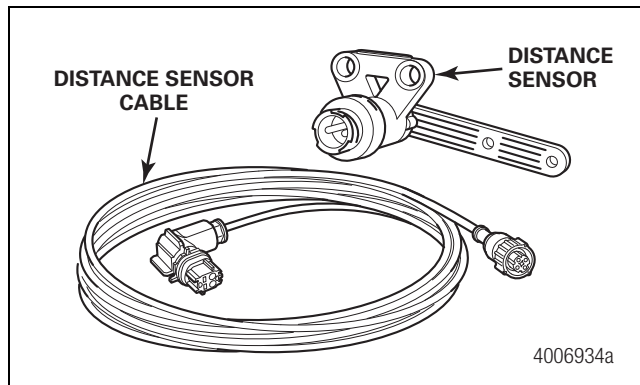


Figure 18

Mechanical Suspension Installation

The Distance Sensor is mounted to the cross member above the axle. Figure 19. It must be mounted directly to the trailer structure. If needed, a steel bracket may be fabricated and then welded to the cross member, in order to bring the Distance Sensor to the appropriate mounting height. The distance sensor should be mounted close to the center of the trailer.

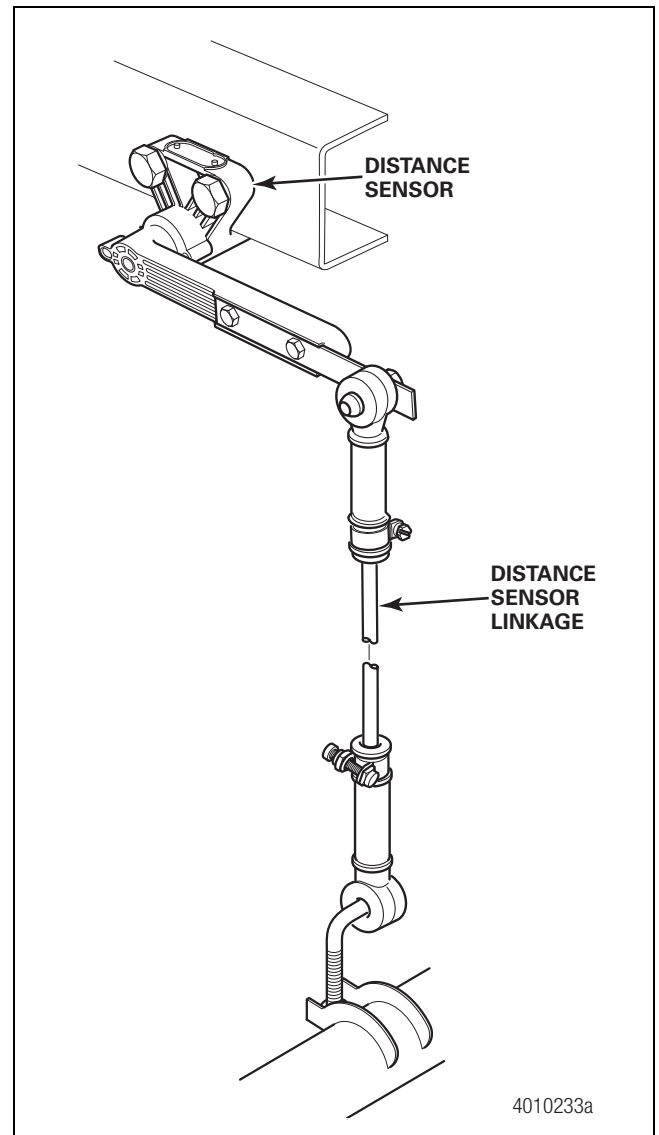


Figure 19

The Distance Sensor Linkage must be attached to the axle with a standard leveling valve axle clamp or to a fabricated bracket that is welded to the axle.

NOTE: The Distance Sensor Linkage is installed perpendicular between the Distance Sensor arm and the axle.

The Distance Sensor must be mounted so that the sensor arm is parallel to the ground when the trailer is unladen (empty). This allows the Distance Sensor to be correctly calibrated with the RSS 1M software. When installing the Distance Sensor, a small roll pin must be temporarily installed to keep the Distance Sensor arm from moving. Remove this pin after installation and before the End of Line test. Figure 20.

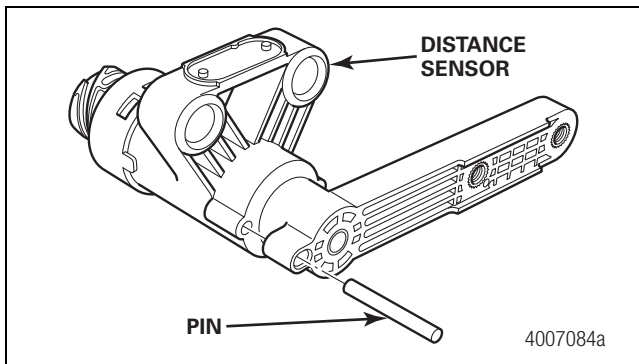


Figure 20

The rod that connects the Distance Sensor Lever to the Distance Sensor Linkage, is found in WABCO part number 105 100 002 0, or can be provided by the trailer OEM. This metal rod needs to be 3/16-inch (6 mm) in diameter.

Refer to Figure 21 for the correct installation of the Distance Sensor and its components.

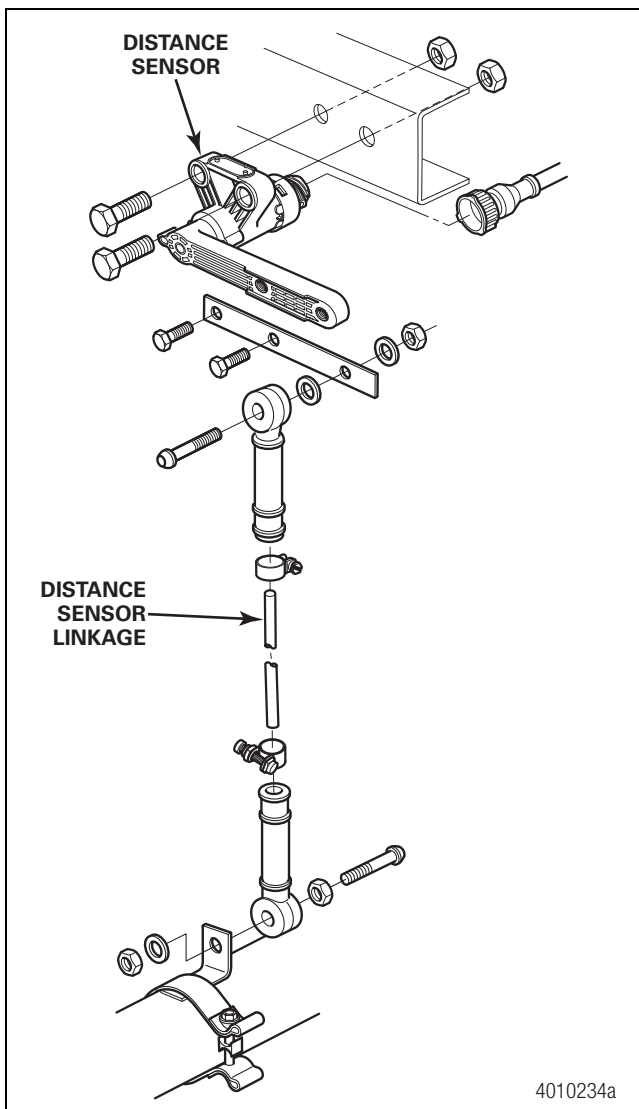


Figure 21

Distance Sensor Extension Lever

Some trailers experience jounce due to certain spring suspensions' characteristics and require an extension of the distance sensor. This extension lever (part number 441 901 715 4) will provide the lever length parameter in TOOLBOX™ software to be a maximum of 150 mm. Mounting hardware for the extension lever is found in the linkage kit, part number 105 100 002 0. Figure 22.

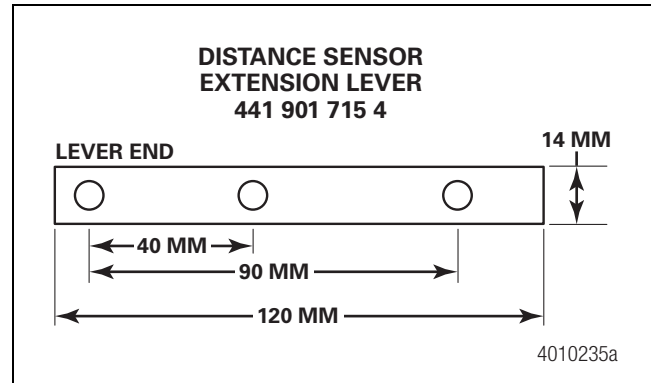


Figure 22

Interaxle Rod

If the variation in saddle height exceeds the calculated limits, it is necessary to compensate for this effect by using an interaxle rod to connect the sensor to the axles. This interaxle rod must be connected to both axles via rubber elements, installation may change due to spring attachment method used by suspension supplier. Figure 23.

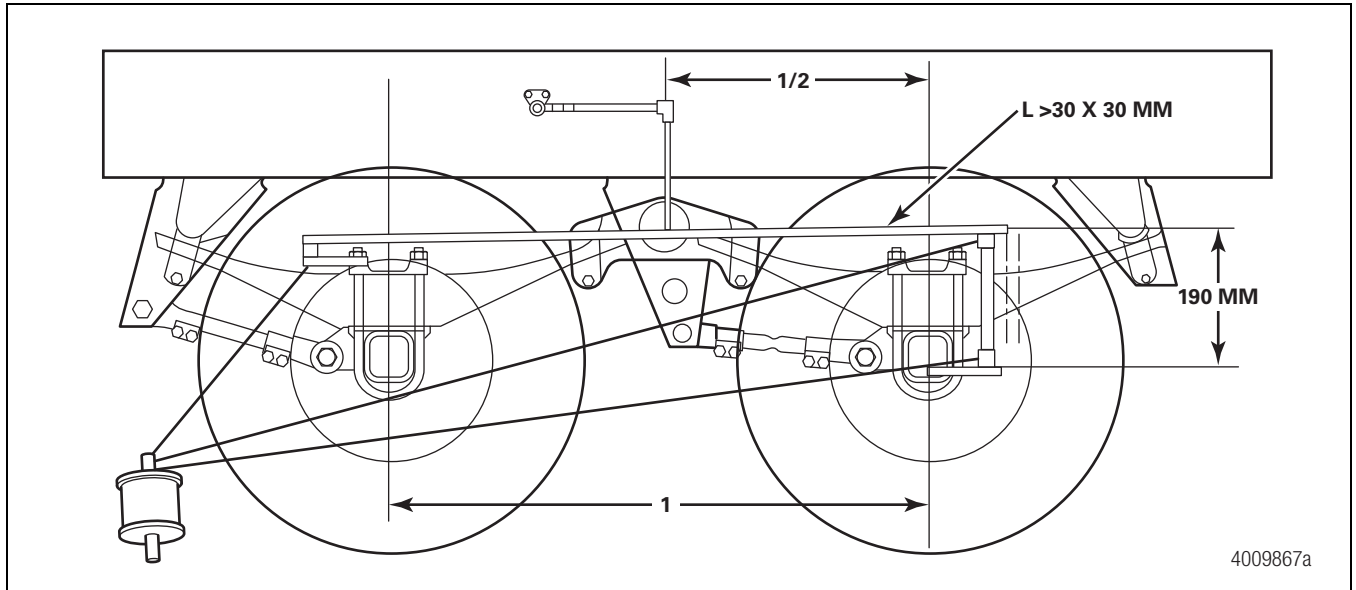


Figure 23

The distance sensor must be connected at half of the distance between both axles using the rod with a coupling piece, part number 433 401 033 0. The rod, which will be provided by the trailer manufacturer, must have an L-profile of at least 30 x 30 mm or a tube with at least a 25 mm diameter. Figure 24.

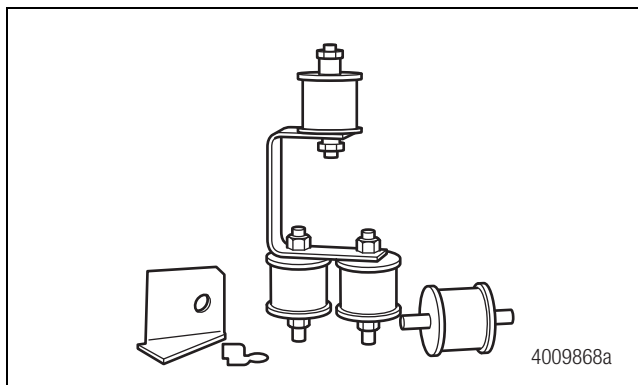


Figure 24

Distance Sensor Applications for Trailers with Mechanical Suspension

Calibration and Restrictions

Single-Axle Semi Trailer

No special precautions must be taken into account. The calibration of single axle trailers must be performed according to the calibration instructions that follow.

Two-Axle Semi Trailer

Two-axle trailers with mechanical suspension deflection values can be affected by the tractor fifth wheel height variance. A change in this value from the calibrated value can affect the performance of the RSS interventions. Figure 25.

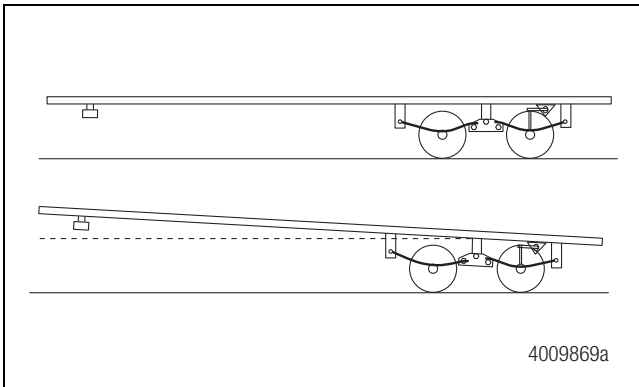


Figure 25

Fifth Wheel Height Variation Restrictions

To minimize the effect of variation in fifth wheel height that might occur during operation, the following conditions need to be satisfied:

- Installation of the distance sensor on the rear axle
- Calibration to be performed with the lowest fifth wheel height which may occur during operation.

This procedure will minimize the load measurement error caused by any increase of fifth wheel height from the calibration height. The following diagram (Figure 26) shows the limitations for the admissible increase of the fifth wheel height:

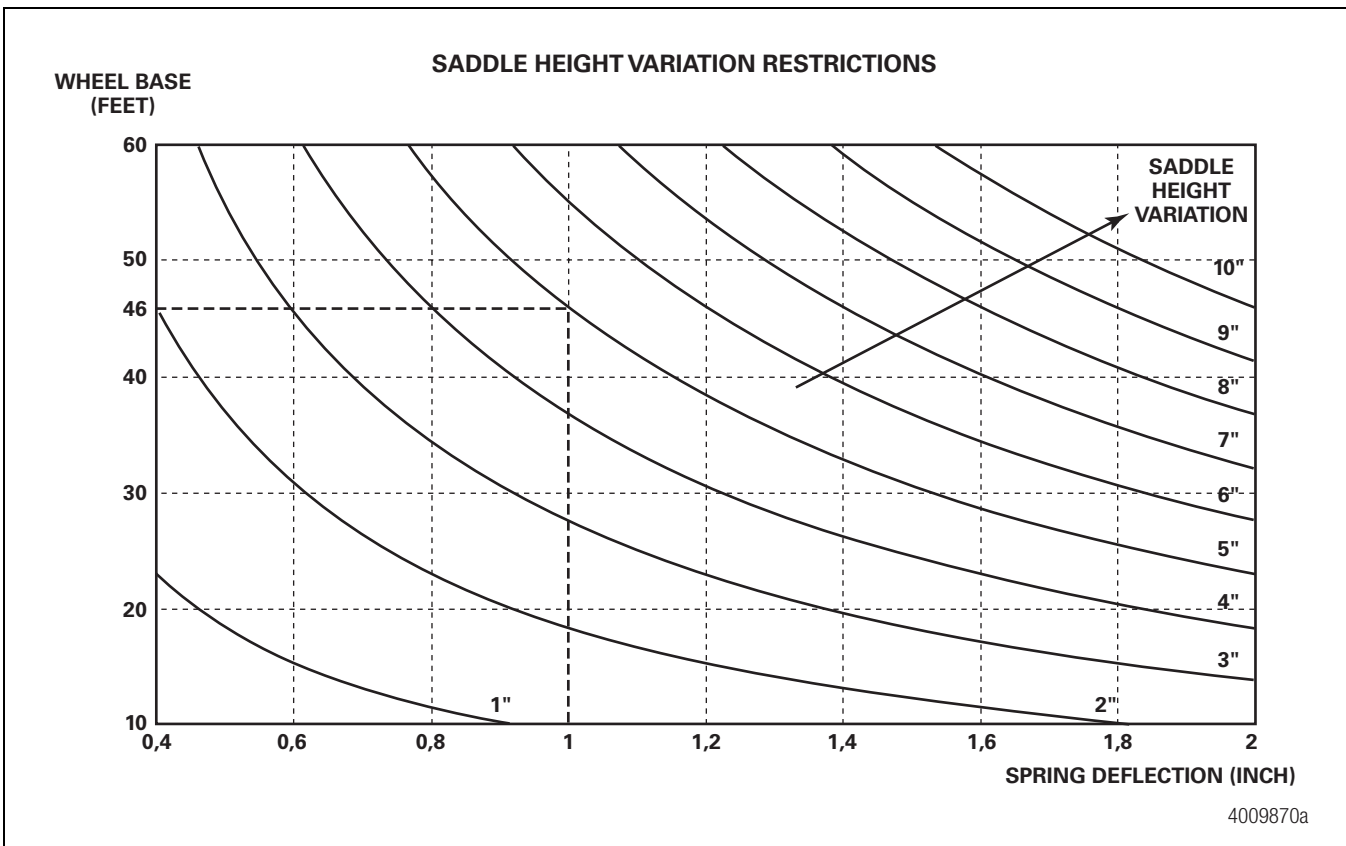


Figure 26

The engineering-generated diagram reflects the relationship between vehicle wheel base, spring deflection and admissible variation of fifth wheel height. Wheel base means the distance between king pin and middle of the bogie. Deflection means the maximum deflection between laden and unladen status.

Example:

For a vehicle with a wheel base of 46 ft and a suspension deflection of 1 inch, a variation of fifth wheel height of 5 inches is acceptable (e.g. if vehicle was calibrated at 45 inches initially, the saddle height may vary between 45 inches and 50 inches).

NOTE:

- In case of slider bogies, the shortest possible wheel base is to be considered
- In case of bogies with wide spread axles (rocker length bigger than 20 inches), the admissible range of saddle height variation is reduced by 30%
- If the distance sensor needs to be installed on the front axle, please contact WABCO for assistance

Calibration

To calibrate the mechanical suspension, the following data has to be available.

Deflection of the Bogie from Unladen to Laden Condition

The deflection is very important to provide the RSS with the right information to calculate the actual axle load.

NOTE: Incorrect information regarding the axle load can cause undesired interventions of the RSS system.

The values can be supplied by the suspension supplier. Figure 27. It is important to determine the correct suspension unladen load value, if calculating values from suspension supplier load versus deflection graph. Refer to the example below.

Example:

Characteristic of spring deflection provided by axle or spring manufacturer

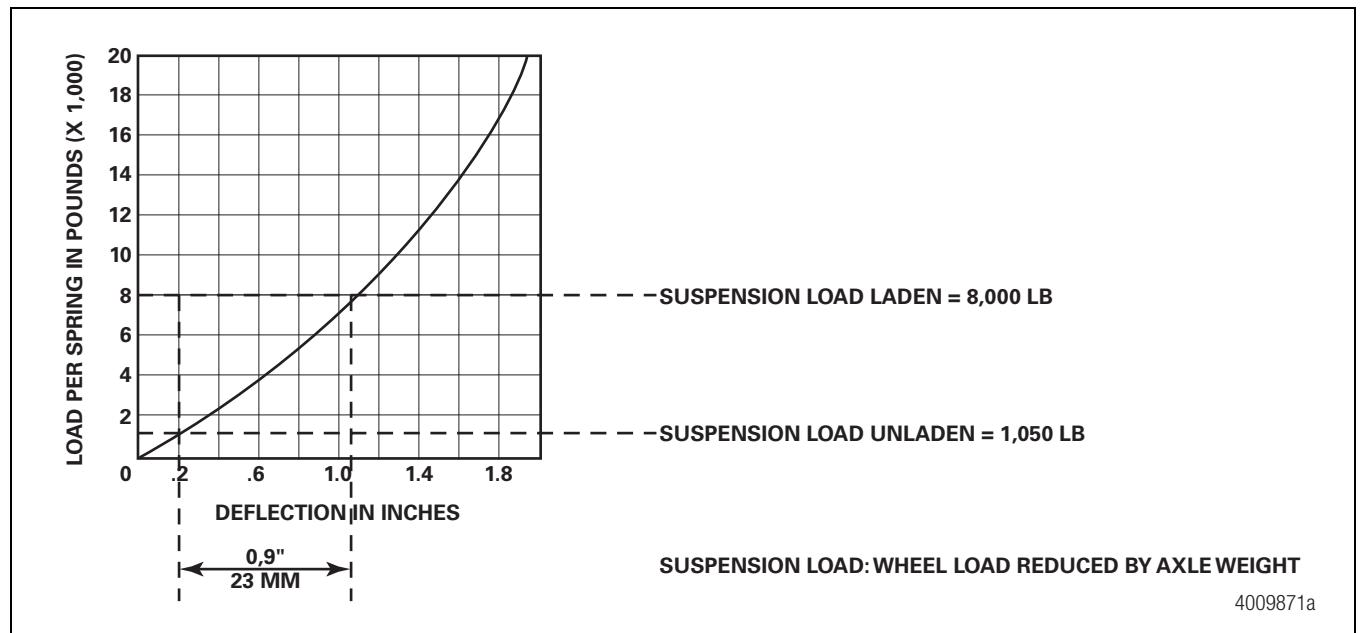


Figure 27

Table B: Example for Two Axle Semi Trailer

	Bogie Load	Bogie Load without Axle Weight	Suspension Load per Wheel
Max. Load:	34,000 lb	32,000 lb	8,000 lb
Unladen Load:	6,000 lb	4,200 lb	1,050 lb
Unladen Deflection:			0.25 inch
Laden Deflection:			1.15 inch
Difference (Input for Parameter Setting)			0.9 inch = 23 mm

Alternative Method to Determine Suspension Deflection

1. With the trailer **unloaded**, measure from the top of the axle tub (A) to a fixed point (B) on the underside of the trailer. Note the distance. Figure 28.

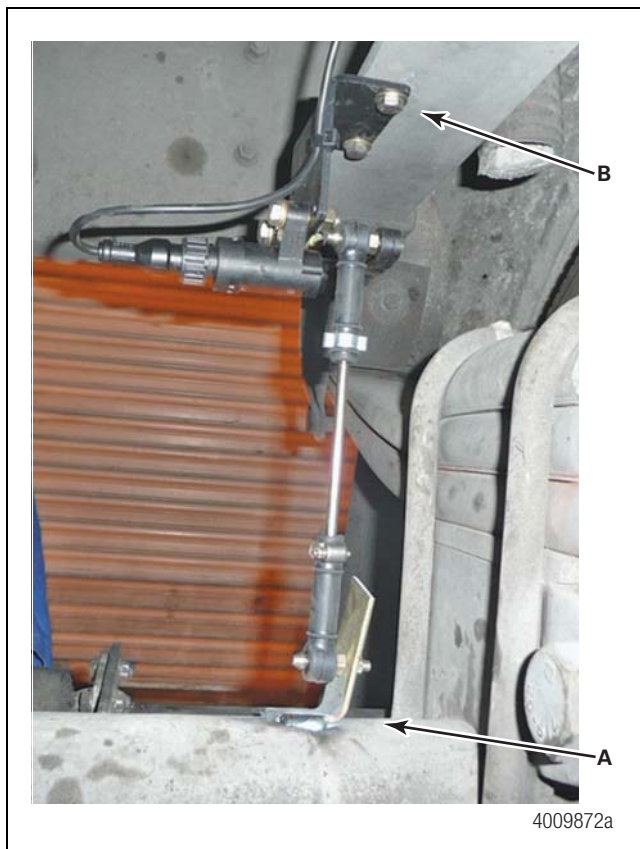


Figure 28

2. With the trailer loaded (maximum load), measure from the same points (A and B) that were used for the trailer **unloaded** measurement. It is important to ensure the maximum load is distributed uniformly (front to back, left to right) to avoid an inclined trailer condition. Note the distance.
3. Subtract the trailer **loaded** distance from the trailer **unloaded** distance. Note the difference. This is the spring deflection rate for this trailer.

NOTE: Provide the deflection rate in millimeters.

Negative Spring Deflection

Negative spring deflection means that the suspension is moving beyond the unladen position due to the clearance in the suspension.

This value is important to determine the correct length "l" of the distance sensor. Figure 29. It must be ensured that under every condition, the length of the lever is longer than the negative deflection to prevent the lever from turning over. If the lever is too long, the optimal resolution will be affected and lead to less precise axle load measurements. A lever length of 150 mm should be sufficient for the most types of axles. The negative deflection can be measured by lifting the axle without the distance sensor with a suitable jack until the other axle does not touch the ground. Contact WABCO for applications which may require a longer extension arm length greater than 150 mm.

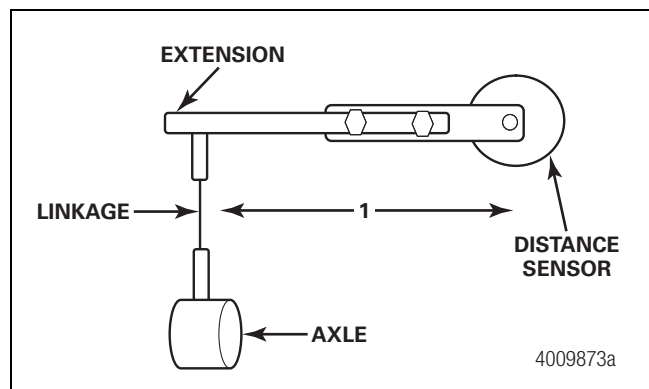


Figure 29

Conditions for Calibration

- The correct values are entered and stored in the ECU for unladen and laden deflections and loads.
- The trailer must be located on a level surface.
- The trailer has to be in an unladen condition.
- In the unladen condition, the lever of the distance sensor has to be in the horizontal position.
- Ensure that the distance sensor has been installed correctly and the lever can move without collision with the trailer frame. Refer to the installation guide.

- Chassis level

— Single-Axle Semi Trailer:

No special requirements.

— Two-Axle Semi Trailer:

The king pin must be in the lowest position which may occur during trailer operation with different tractors.

- During calibration, the trailer brakes have to be released (service brake and spring brake).

The final calibration is done using TOOLBOX™ Software. Please follow the software instructions.

Trailer Labels

Before releasing the trailer:

1. Affix the ABS indicator label to the trailer. The label should be on the side of the trailer near the ABS indicator lamp. Figure 30.

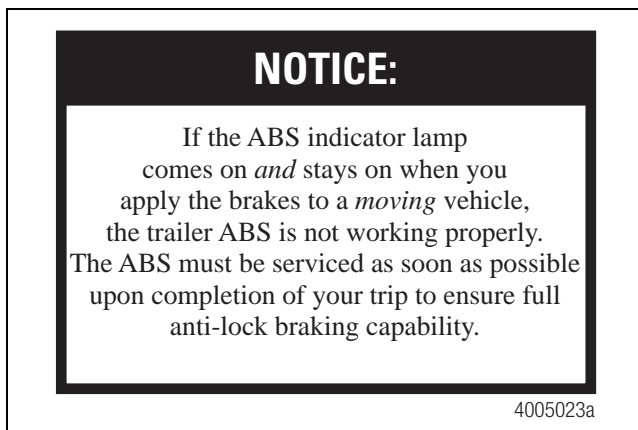


Figure 30

2. Affix the constant power label (part number 899 201 833 4) to the front of the trailer, near the seven-way connector. Figure 31.

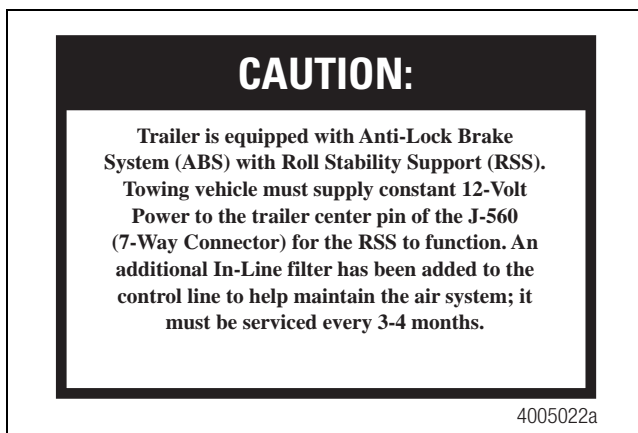


Figure 31

3. Affix the in-line filter label (part number 899 201 842 4) to the front of the trailer near the control (blue) gladhand. Figure 32.

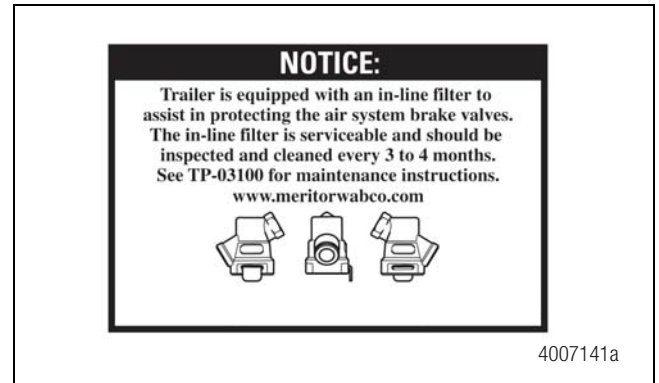


Figure 32

Parameter Entry

Vehicle Parameter Settings

All RSS 1M ECUs have default parameters already programmed into the unit. If you are installing the system with the ECU facing FORWARD on an air suspension, there is no need to change any parameters. Once the system is installed, you may proceed in this manual directly to Preparing to Release the Trailer. However, additional trailer information may be input at the parameter portion of TOOLBOX™ Software.

If you are installing the RSS 1M system in a non-default configuration or wish to enter additional trailer information, you will need to access the vehicle parameters. Contact your WABCO representative for assistance with non-default configurations.

From the TOOLBOX™ Software main screen, select the RSS icon. Figure 33.

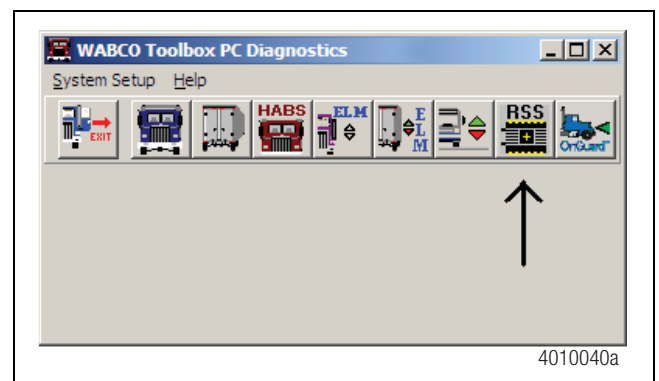


Figure 33

The Roll Stability Support main screen appears. Figure 34.

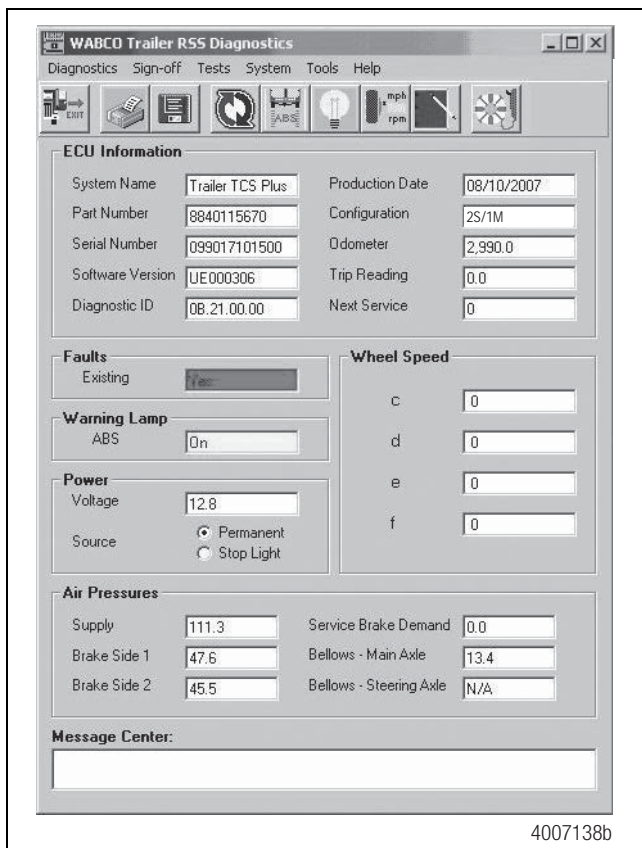


Figure 34

From the main screen, select **System** and then **Edit Parameters From ECU**. Figure 35.

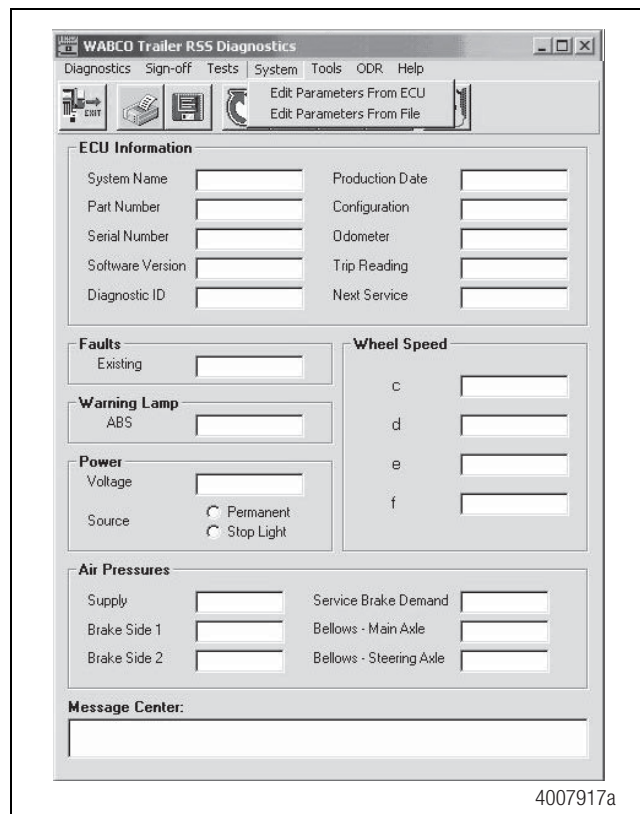


Figure 35

RSS System Parameters allows you to correctly configure the system to match the trailer's specific characteristics. The RSS 1M ECU comes preprogrammed with default parameters and requires no further programming. In all configurations, you may add additional information. Press **Next** to continue. Figure 36.

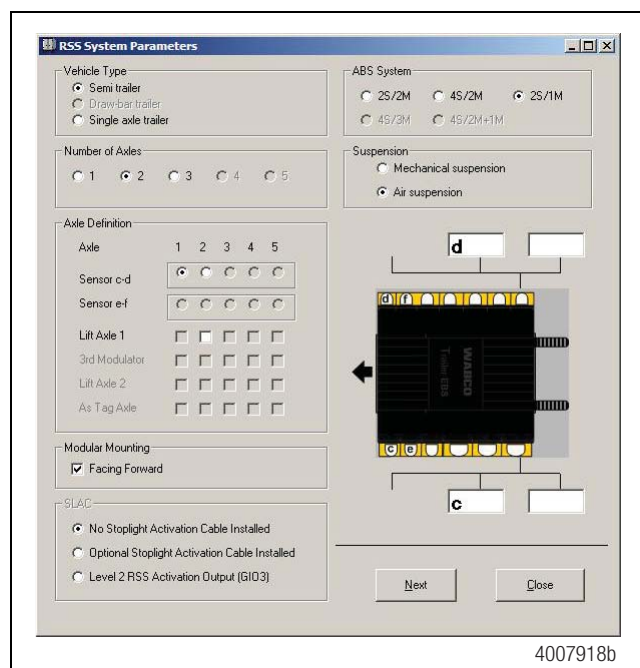


Figure 36

Air Suspension Parameters

Vehicle Type — Select the appropriate trailer type.

Number of Axles — Select the total number of axles on the trailer.

Axle Definition — Select the sensed axles by indicating the location of each sensor pair. Lift axles are not sensed and are controlled by generic I/O function. The on-screen illustration will change to reflect the sensor configuration.

Modulator Mounting — A modulator facing FORWARD will have the mount bolts pointing TOWARD the rear of the trailer. A forward facing ECU will have this box checked.

ABS System — Select 2S/1M.

Suspension — Select air suspension. **NOTE:** Mechanical suspensions are covered in the Mechanical Suspension Parameters section, starting on page 23.

Optional Stoplight Activation Cable — Select this field ONLY if the stoplight activation cable is installed. This optional cable has additional capabilities over the standard power cable.

Once all the parameters are correctly input, press the **NEXT** button to advance to the GIO Selection screen. Figure 37.

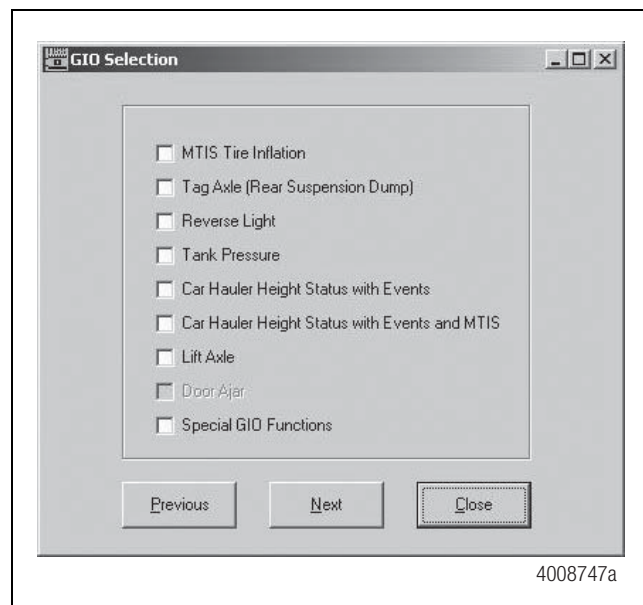


Figure 37

The GIO Selection Screen allows the user to pick which Generic Input/Output files are to be loaded into the ECU. Many of these optional functions are utilized in conjunction with the WABCO PLC Display.

MTIS Tire Inflation — The Meritor Tire Inflation System Remote Warning.

Tag Axle (Rear Suspension Dump) — Releases air from a designated axle to facilitate tight turning.

Reverse Light — Activates a light that should illuminate when the trailer is being moved in reverse.

Tank Pressure — Alerts if the trailer air reservoir experiences low pressure.

Car Hauler Height Status with Events — Alerts if car decks are not in the locked-down position.

Car Hauler Height Status with Events and MTIS — Alerts if car decks are not in the locked-down position, coupled with the MTIS function.

Lift Axle — Activates the automatic Lift Axle function.

Door Ajar — Alerts driver if a secure door is not in the locked position.

Special GIO Functions — Customized functions specific to the trailer. Click in the appropriate check box to select the function that has been installed on the trailer.

Press **NEXT** to advance to the RSS LSV Parameters screen. Figure 38.

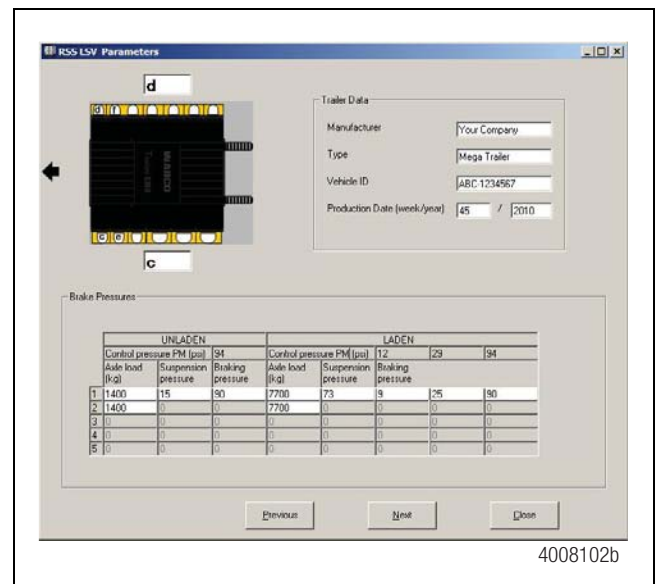


Figure 38

Trailer Data — This area contains important data about the trailer.

Manufacturer — Enter the manufacturer of the trailer.

Type — Enter the trailer type such as tanker, flatbed, van, etc.

Vehicle I.D. — Enter the last seven digits of the trailer VIN number or the fleet's trailer number. Do not leave this field blank as the software creates files using what is entered in this field as file names.

Production Date — Enter the trailer's production date by week number and year.

Brake Pressures — This area contains parameters affecting how the trailer brakes perform. These fields are unavailable with mechanical suspensions.

Additional Characteristic Point — This box is normally left blank. Checking this box allows brake pressure characteristics to be altered across four bands instead of the standard three.

Unladen Axle Load (kg) — Enter the amount of weight each axle will bear when the trailer is empty. The weight in kilograms can be converted from pounds with the formula 2.2 pounds equals 1 kilogram.

Unladen Suspension Pressure — The amount of air pressure found in the suspension air bags when the trailer is empty. The suspension pressure is measured in psi (pounds per square inch).

Unladen Braking Pressure — The default setting is 90 psi. If brake proportioning is desired, the setting may be less than 90 psi. Do not set this value below 38 psi.

Laden Axle Load — Enter the amount of weight each axle will bear when the trailer is fully loaded. The weight in kilograms can be converted from pounds with the formula 2.2 pounds equals 1 kilogram.

Laden Suspension Pressure — The amount of air pressure found in the suspension air bags when the trailer is fully loaded. The suspension pressure is measured in psi (pounds per square inch).

Laden Braking Pressure — Values in these output fields affect the trailer's brake performance in the laden condition. There are three columns (left to right) that affect light, medium, and heavy braking. Please contact OnTrac at 866-OnTrac1 (668-7221) for assistance if changing these values from the default values.

Once all the values have been correctly determined and entered, press the **NEXT** button to advance to the RSS/ABS Parameters screen. Figure 39.

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Figure 39

Roll Stability Support — If the trailer will have a single wheel on each side of the axle ("Wide Based"), select **RSS ON — Single Tires**. If the trailer will have dual wheels on each side of the axle, select **RSS On — Twin Tires**. Only select **RSS Off** if no roll stability is desired.

Tire Size and Pole Wheel — The Number of Teeth field is for the quantity of teeth on the tone ring. Nearly all tone rings have 100 teeth. The **Tire Circumference** is the dynamic tire radius of the tire in millimeters. The default setting of 3250 will be applicable to most tires, although an exact figure can be obtained from the tire's manufacturer.

Once the parameters have been entered, press the **Save to ECU** button. The parameters are then saved to the ECU. You are now ready to proceed to the sign-off procedure.

After storing parameters in the ECU, the End-of-Line Start-Up Procedure must be performed. Proceed to the System Sign-Off procedure.

Mechanical Suspension TOOLBOX™ Parameters

There are additional parameters for a mechanical suspension trailer that must be configured before releasing the trailer into service.

From the main screen, select **System** and then **Edit Parameters From ECU**. Figure 40.

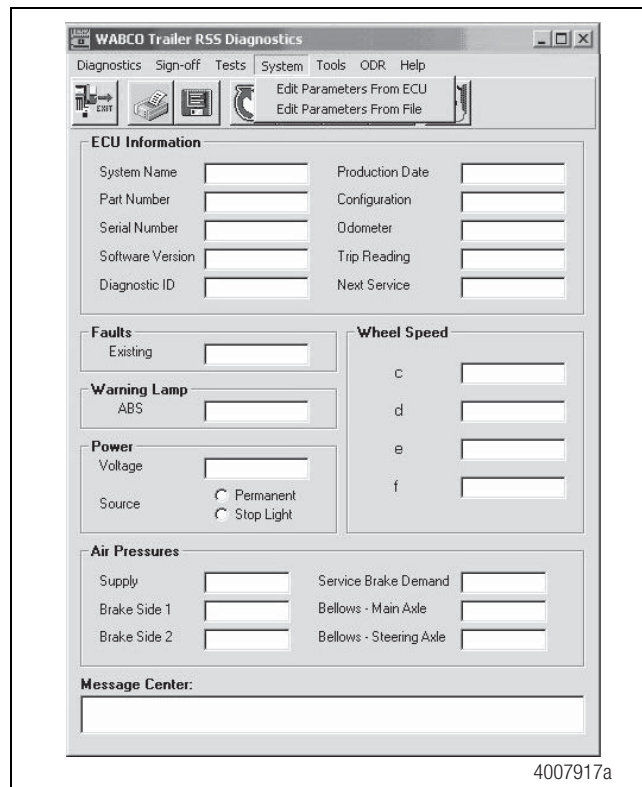


Figure 40

Input the correct values for each data area. Figure 41.

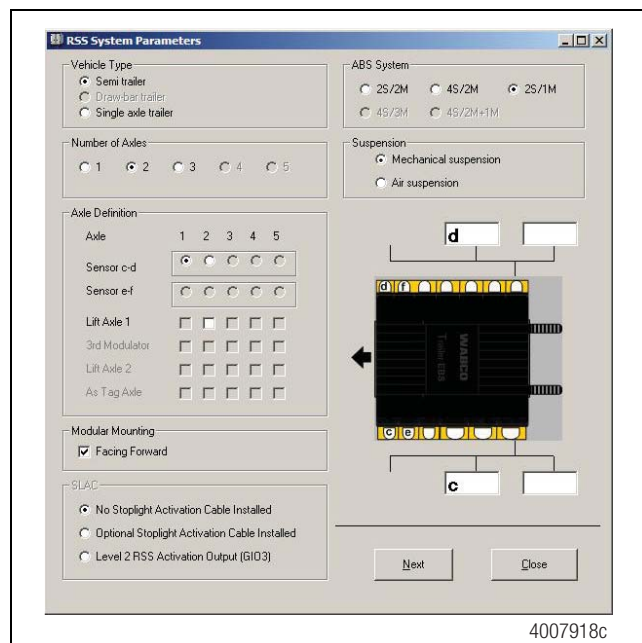


Figure 41

Vehicle Type — Select the appropriate trailer type.

Number of Axes — Select the total number of axes on the trailer.

Axle Definition — Select the sensed axes by indicating the location of each sensor pair. Lift axles are not sensed and are controlled by generic I/O function. The on-screen illustration will change to reflect the sensor configuration.

Modulator Mounting — A modulator facing FORWARD will have the mount bolts pointing TOWARD the rear of the trailer. A forward facing ECU will have this box checked.

ABS System — Select 2S/1M.

Suspension — Select Mechanical Suspension.

Optional Stoplight Activation Cable — Select this field ONLY if the stoplight activation cable is installed. This optional cable has additional capabilities over the standard power cable.

When all fields are correctly configured, press **NEXT** to advance to the second parameter screen. Figure 42.

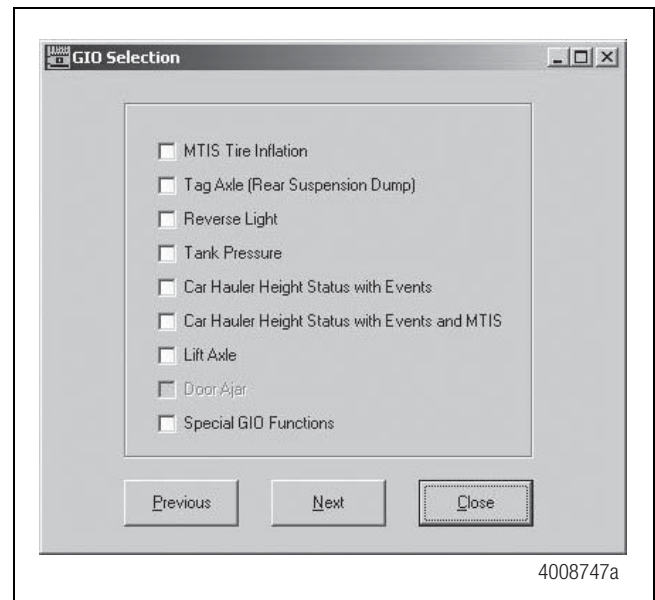


Figure 42

The GIO Selection Screen allows the user to pick which Generic Input/Output files are to be loaded into the ECU. Many of these optional functions are utilized in conjunction with the WABCO PLC Display.

MTIS Tire Inflation — The Meritor Tire Inflation System Remote Warning.

Tag Axle (Rear Suspension Dump) — Releases air from a designated axle to facilitate tight turning.

Reverse Light — Activates a light that should illuminate when the trailer is being moved in reverse.

Tank Pressure — Warns if the trailer air reservoir experiences low pressure.

Car Hauler Height Status with Events — Warns if car decks are not in the locked-down position.

Car Hauler Height Status with Events and MTIS — Warns if car decks are not in the locked-down position, coupled with the MTIS function.

Lift Axle — Activates the automatic Lift Axle function.

Door Ajar — Warns driver if a secure door is not in the locked position.

Special GIO Functions — Customized functions specific to the trailer. Click in the appropriate check box to select the function that has been installed on the trailer.

Press **NEXT** to advance to the RSS LSV Parameters screen.
Figure 43.

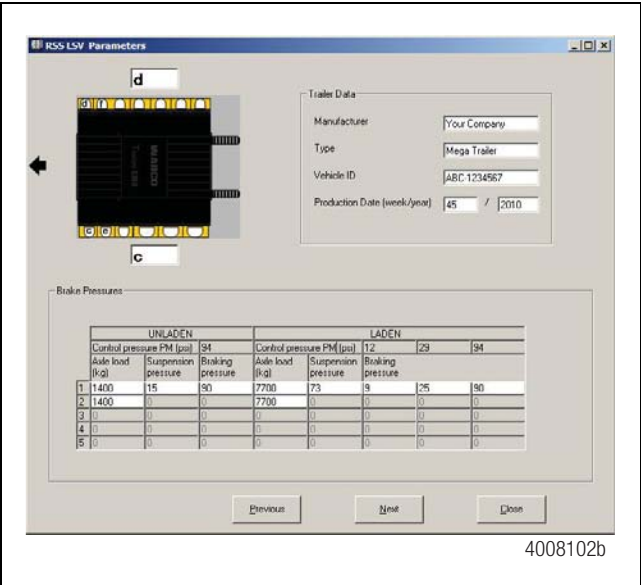


Figure 43

Trailer Data — This area contains important data about the trailer.

Manufacturer — Enter the manufacturer of the trailer.

Type — Enter the trailer type such as tanker, flatbed, van, etc.

Vehicle I.D. — Enter the last seven digits of the trailer VIN number or the fleet's trailer number. Do not leave this field blank as the software creates files using what is entered in this field as file names.

Production Date — Enter the trailer's production date by week number and year.

Unladen Axle Load (kg) — Enter the amount of weight each axle will bear when the trailer is empty. The weight in kilograms can be converted from pounds with the formula 2.2 pounds equals 1 kilogram.

Unladen Suspension Path — This value is typically zero for an empty (unladen) trailer.

Unladen Braking Pressure — The default setting is 90 psi. If brake proportioning is desired, the setting may be less than 90 psi. Do not set this value below 38 psi.

Laden Axle Load — Enter the amount of weight each axle will bear when the trailer is fully loaded. The weight in kilograms can be converted from pounds with the formula 2.2 pounds equals 1 kilogram.

Laden Suspension Path — This value is the amount of spring compression (in millimeters) when the trailer is fully laden. This value is obtained by the trailer builder from the mechanical suspension manufacturer.

Laden Braking Pressure — Values in these output fields affect the trailer's brake performance in the laden condition. There are three columns (left to right) that affect light, medium, and heavy braking. Please contact OnTrac at 866-OnTrac1 (668-7221) for assistance if changing these values from the default values.

Distance Sensor Lever Length — The software defaults to 100 mm. This is the setting when the distance sensor lever is mounted to the farthest integrated nut on the distance sensor. If the lever is mounted to the center integrated nut on the distance sensor arm, the value is 50 mm.

Once all the values have been correctly determined and entered, press the **NEXT** button to advance to the RSS/ABS Parameters screen. Figure 44.

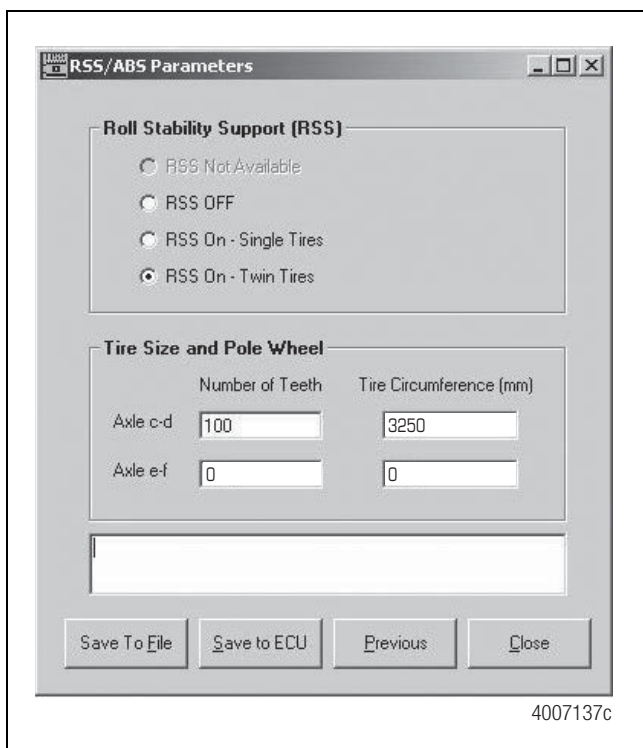


Figure 44

Roll Stability Support — If the trailer will have a single wheel on each side of the axle (“Wide Based”), select **RSS ON — Single Tires**. If the trailer will have dual wheels on each side of the axle, select **RSS On — Twin Tires**. Only select **RSS Off** if no roll stability is desired.

Tire Size and Pole Wheel — The Number of Teeth field is for the quantity of teeth on the tone ring. Nearly all tone rings have 100 teeth. The **Tire Circumference** is the dynamic tire radius of the tire in millimeters. The default setting of 3250 will be applicable to most tires, although an exact figure can be obtained from the tire’s manufacturer.

Once the parameters have been entered, press the **Save to ECU** button. The parameters are then saved to the ECU. You are now ready to proceed to the sign-off procedure.

System Sign-Off (End of Line Testing)

End of line testing is required on all trailer RSS 1M installations. Use WABCO diagnostic software to perform this test. This software must be available at all trailer manufacturers where RSS 1M is being installed. If you do not have this software program, please contact the OnTrac Customer Service Center at 866-OnTrac1 (668-7221).

System Sign-Off Procedure

1. Connect the vehicle to a computer with WABCO diagnostic software installed.
 - Attach the serial or USB cable from your computer to the Noregon interface box.
 - Attach one end of the vehicle diagnostic connector to the adapter box. Attach the other end to the diagnostic connector on the trailer. Figure 45.

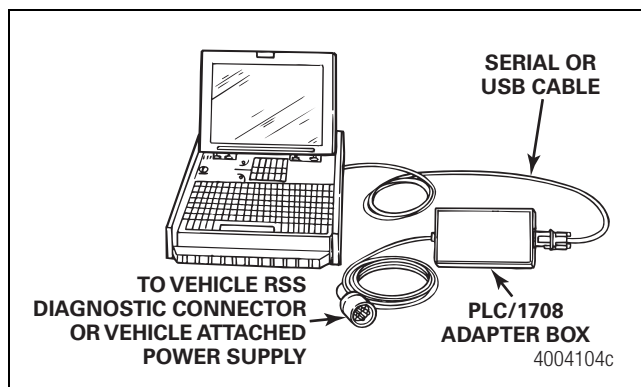


Figure 45

2. Double click on the TOOLBOX™ Software icon on your computer to launch the program.
 - Click the RSS icon. Figure 46.

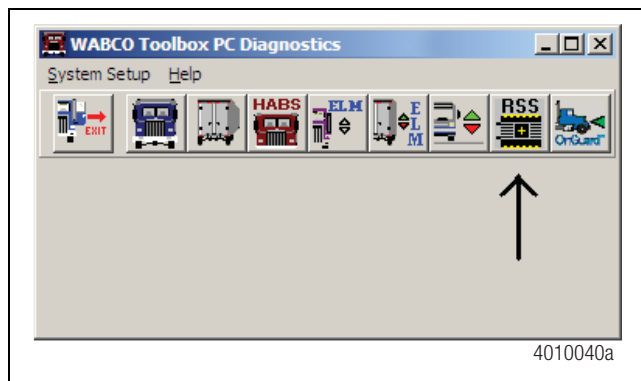


Figure 46

Preparing to Release the Trailer

NOTE: No existing (active) faults, other than Parameter Setting (Special Faults) can be present during System Sign-Off. All faults must be cleared before proceeding. Figure 47.

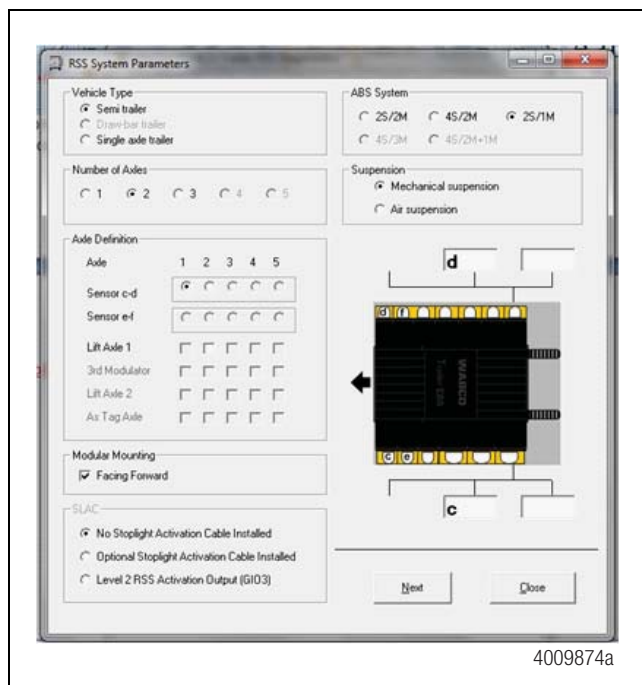


Figure 47

Putting the Trailer into Service

The RSS 1M comes with factory set default parameters for a tandem axle system with air suspension. If you are installing the RSS 1M system in a non-default configuration, or wish to take advantage of the RSS 1M's additional capabilities, you must edit and save the parameters before performing the End of Line test.

Sign-Off Procedure

Once installed, the WABCO RSS 1M system must go through a sign-off procedure. This ensures that the system has been correctly installed and the pneumatic functions of the trailer are supporting the Roll Stability ABS.

In order to run the sign-off procedure, the trailer must be connected to 12 volt DC power (10 amp minimum), be connected to supply air (120 psi), have the capability to have control line air applied and released, and have the sensed axles raised off the ground.

From the Main Screen, select **Sign-Off** from the pull-down menu bar. Then select **Begin Sign-Off Procedure** to begin the automated test procedure. Figure 48.

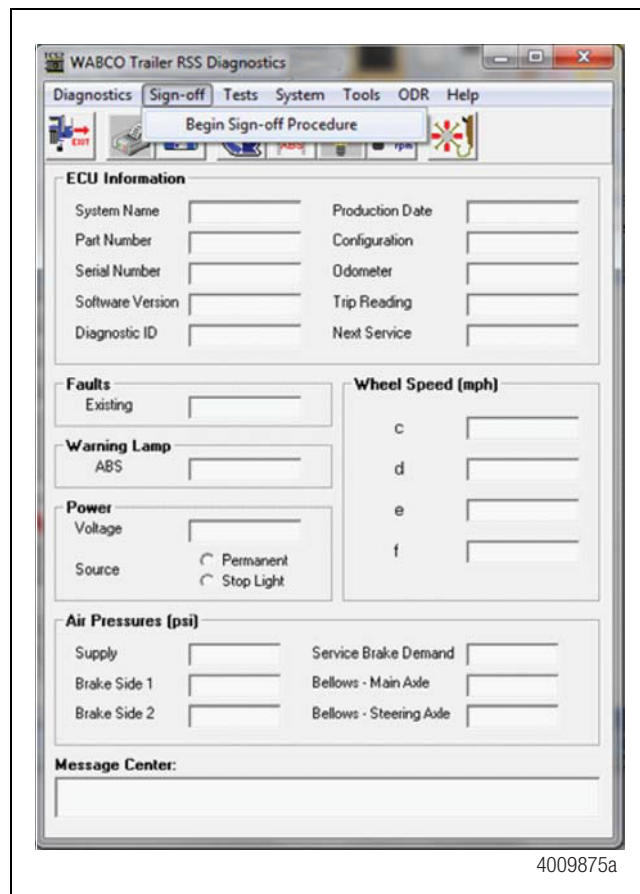


Figure 48

The Sensor Test

This portion of the sign-off will check the placement of the ABS wheel sensors. Ensure there is no pressure on the control (blue) line and that the trailer has all ABS sensed axles off the ground. The following message will appear. Press **OK** after all safety precautions have been taken and release the **blue** air line to begin the test. Refer to the Warnings on page 1. Figure 49.

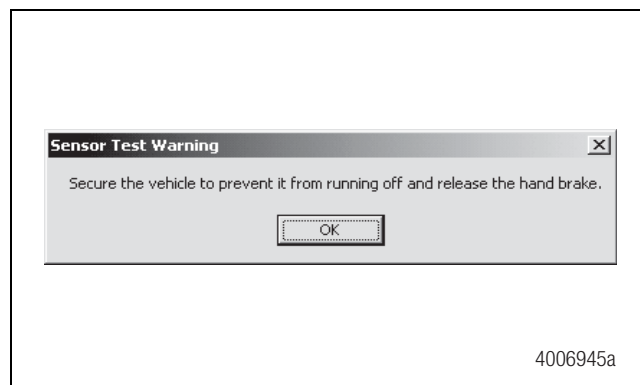


Figure 49

Lift all sensed wheels off the ground by jacking the appropriate axle. Rotate each wheel individually (in the order shown on the screen) and check the on-screen diagram to ensure correct sensor placement. Once the placement of all sensors has been correctly verified, press the **Close** button. Figure 50.

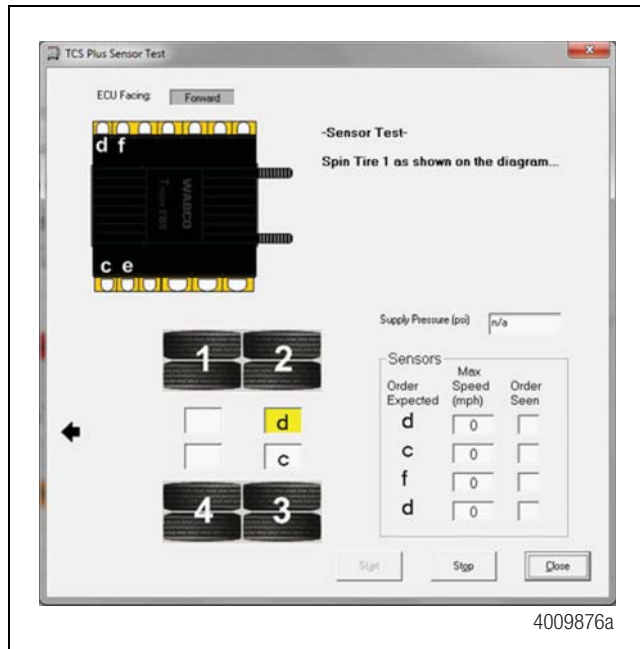


Figure 50

The Warning Lamp Test

This portion of the sign-off will ensure correct operation of the ABS warning lamp. The warning light will flash on and off. Wait for the test to end before pressing the **Close** button. Figure 51.



Figure 51

Distance Sensor Calibration

If the trailer has a spring suspension, the Mechanical Suspension Calibration screen will appear. Ensure that the trailer is now lowered so that all axles are fully on the ground. Confirm all conditions for calibration have been met before pressing **Yes**. Figure 52 and Figure 53.

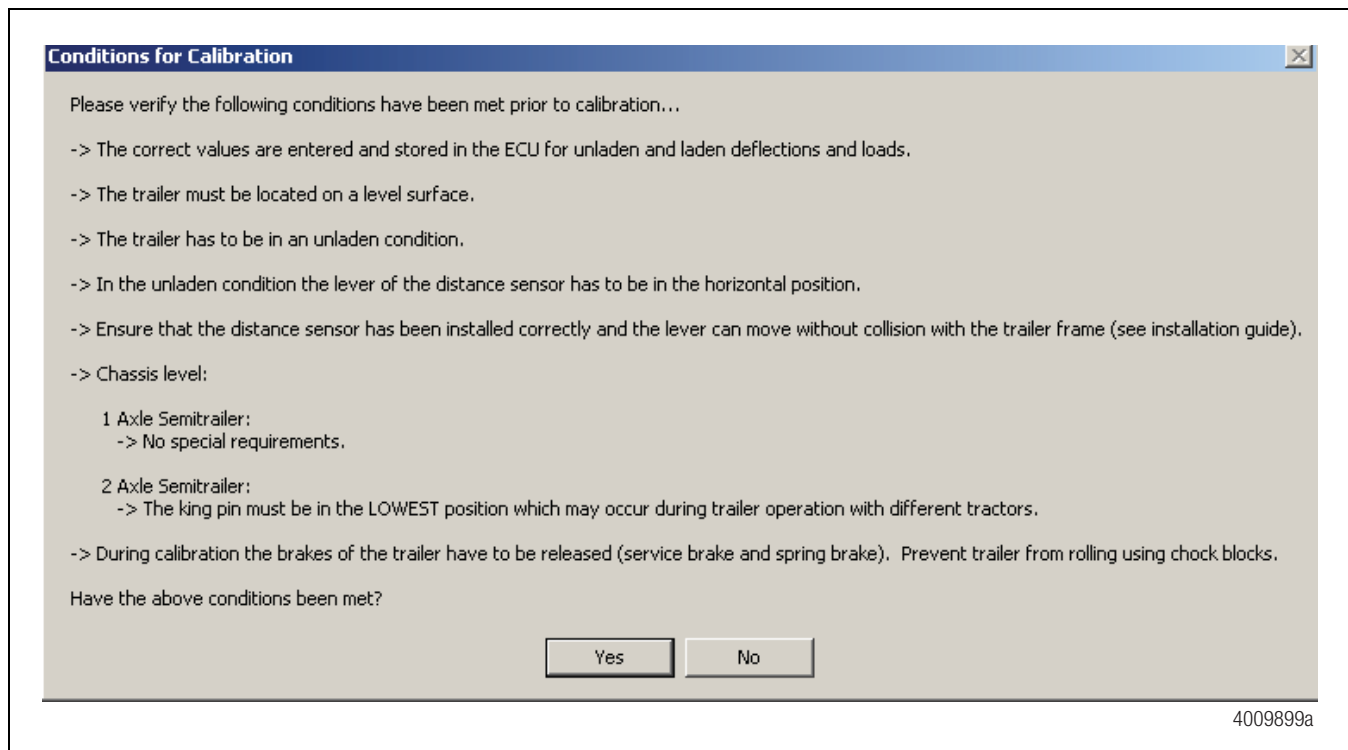


Figure 52

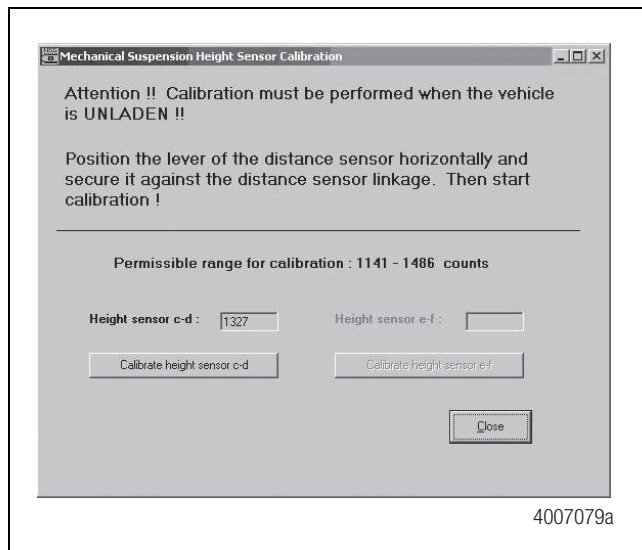


Figure 53

The Distance Sensor arm must be parallel to the ground. The trailer should be on a flat, level surface and must be in the unladen (empty) state. If the displayed value is beyond the listed range, you will need to adjust the Distance Sensor. Once the value in the "Height Sensor" field no longer changes and is within the specified range, press the button labeled **Calibrate Height Sensor**.

A message appears if the calibration is successful. Press OK. Figure 54.

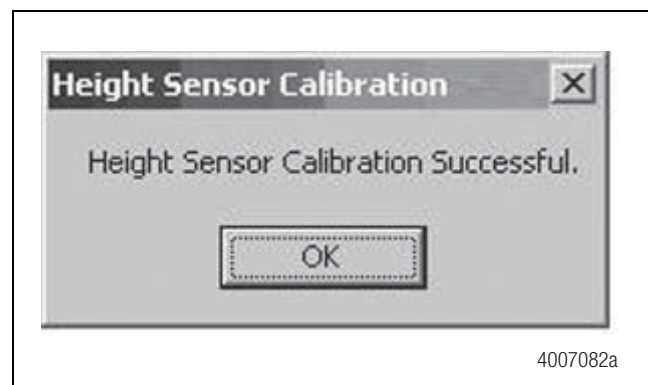


Figure 54

Successfully signing off the trailer will produce the confirmation screen and allow the tester the opportunity to save the results. Click on the **Yes** button and save the file in the appropriate data directory. Figure 55.

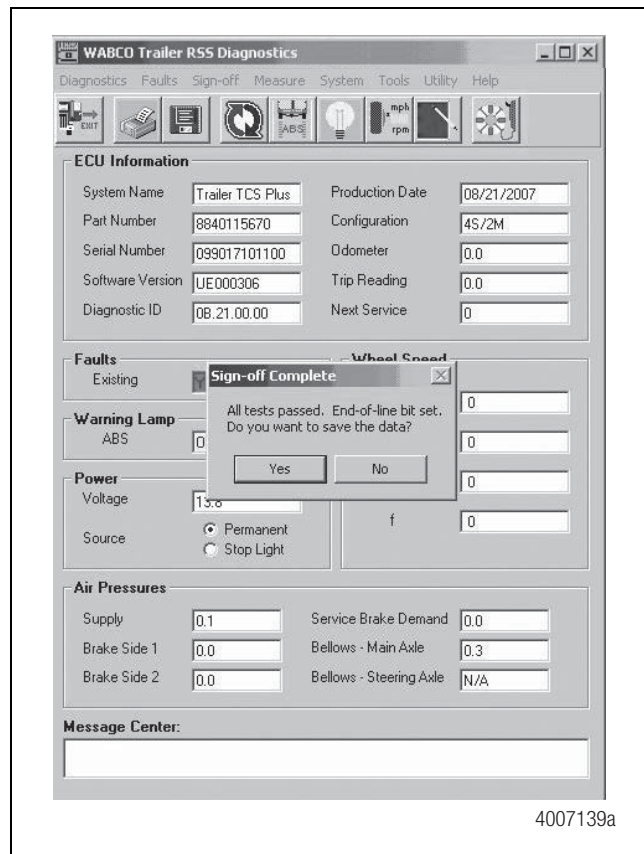


Figure 55

A message appears confirming the file has been saved and shows the location of the data. Figure 56.

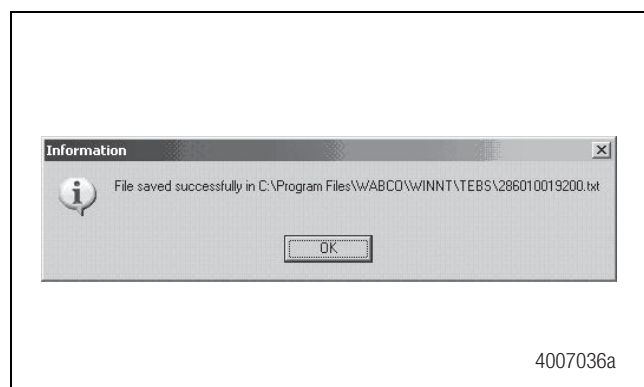


Figure 56

RSS 1M Diagnostics

Blink Code Diagnostics

The WABCO RSS 1M ABS ECU detects any electrical fault in the trailer ABS. Each of the faults has a code. When a fault occurs, the ECU stores the code for that fault in the memory.

There are two kinds of faults: active and stored. Active faults are those currently existing in the system, such as a broken wire. Stored faults are faults that have occurred but do not presently exist. Active faults can be cleared only after repairs are completed. Both Active and Stored faults can be diagnosed with TOOLBOX™ Software. Active faults can be diagnosed with blink codes. Repair active faults at the first opportunity.

The ECU signals a malfunction by lighting both the internal and external indicator lamp when a fault exists. The external ABS indicator lamp is usually mounted on the left rear of the trailer, near the rear wheels.

Blink codes may be initiated by Ignition Power Activation (recommended method).

Although the ECU can store multiple faults in its memory, it only displays one blink code at a time. This is why it is important to recheck the blink codes after repairing a fault. If there are additional codes in the memory, they only blink after you have repaired the first fault.

Clearing stored faults is performed with the TOOLBOX™ Software.

Ignition Power Activation

Ignition Power Activation is the process of using the vehicle's ignition switch (or interrupting the power on the blue wire by some other means) to display blink codes on the trailer ABS indicator lamp located on the side of the trailer. This method is for constant power vehicles only.

To obtain blink codes using ignition power activation, perform the following procedure:

1. Turn the ignition switch on for no longer than five seconds. The ABS indicator lamp will be on.
2. Turn the ignition switch off for one second. The ABS indicator lamp will go out.
3. Turn the ignition switch on. The ABS indicator lamp will then come on, then go out.
4. The blink code will be displayed three times by the ABS indicator lamp on the trailer.

The following blink codes are defined:

Blink Code Counts	Component Name
0	No failure
3	Sensor failure c
4	Sensor failure d
7	External modulator failure
10	Internal modulator failure H1
11	No speed failure
14	Power supply failure
15	ECU internal failure*
16	SAE J 1708 failure
17	PLC failure
18	Generic IO failure
19	Load sensing failure
20	Roll stability system failure

*This error code will also appear on newly installed ECUs that have not been put into service with TOOLBOX™ Software End-of-Line test.

Computer Diagnostics

TOOLBOX™ Software

TOOLBOX™ Software is a PC-based diagnostics program that can display wheel speed data, test individual components, verify installation wiring and is required to perform a sign-off for the RSS 1M installation.

WABCO TOOLBOX™ Software, Version 11.0 (or higher) supports RSS 1M. Figure 57. Available from SPX (Kent-Moore), 800-328-6657.

Computer requirements for TOOLBOX™ Software Version 11.0 are as follows.

- 32/64 Bit CPU-based PC
- CD-ROM drive
- Windows® XP, Vista (32-bit only) or Windows 7
- 512 MB RAM, 2 GB RAM for Windows® Vista™ or Windows® 7
- 60 MB hard drive disc space for full installation
- RP1210A compliant communications adapter for SAE J1939, J1708/J1587 or PLC
- Serial port or USB port diagnostic adapter

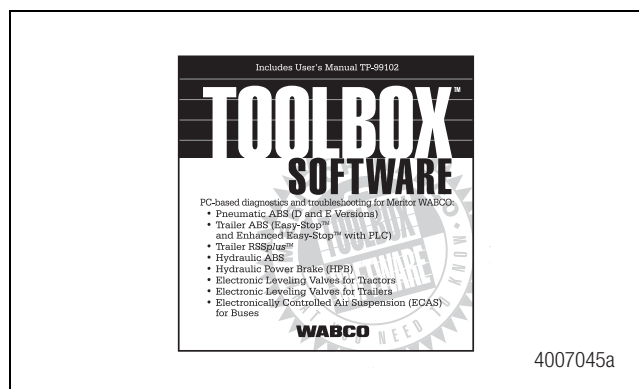


Figure 57

Interface Adapter

A diagnostic interface is also required to connect the computer to the RSS 1M ECU/valve.

For PCs with dedicated serial ports, the Noregon PLC/J1708 adapter is highly recommended along with an appropriate trailer connection cable. Available from Noregon Systems as the JPRO® PLC adapter, 336-768-4337 ext 150 or www.noregon.com. Figure 58.

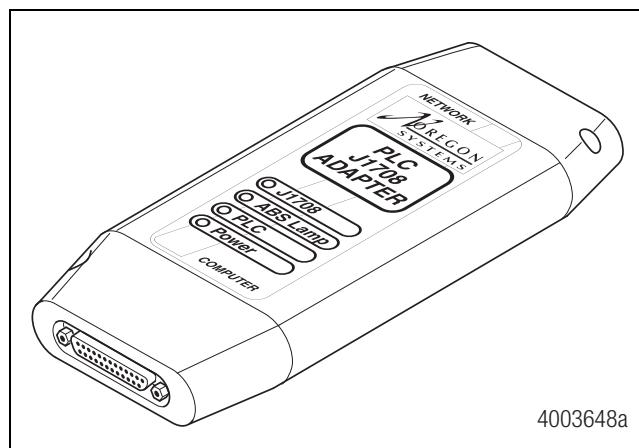


Figure 58

For PCs with USB ports, the Noregon DLA + PLC adapter is highly recommended along with an appropriate trailer connection cable. It is available from Noregon Systems as the JPRO® DLA + PLC adapter, 336-768-4337 ext 150 or www.noregon.com. Figure 59.

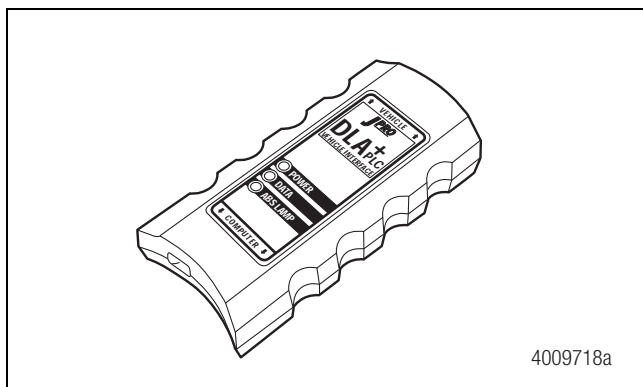


Figure 59

NOTE: USB/serial adapters do not work. The port must be either serial or USB.

Contact WABCO Trailer Engineering before purchasing these components to be certain that they will be compatible with your personal computer, version of Windows® and latest version of WABCO TOOLBOX™ Software.

Vista™/Windows 7 Installations

If you have Microsoft Vista™/Windows 7 installed on your computer, the UAC (User Access Control) must be disabled before installing the TOOLBOX™ Software. Have your computer support personnel or your IT (Information Technology) department perform this change. Once disabled, TOOLBOX™ Software can be installed without issue.

WABCO does not provide computer support.

If TOOLBOX™ Software has already been installed on your personal computer with Vista™/Windows 7, your computer support personnel (IT department) must disable the UAC manually. Refer to Vista™/Windows 7 support documentation for the procedure.

Initiating RSS 1M Diagnostics

1. From the main screen of TOOLBOX™ Software, click on the RSS icon. Figure 60.

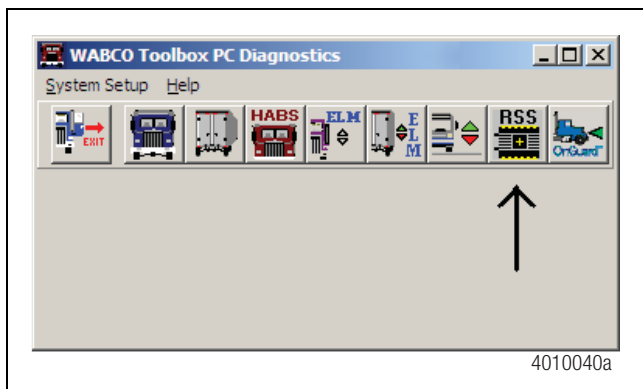


Figure 60

2. From the main screen of the WABCO trailer RSS diagnostics software, select **Diagnostics** from the top menu bar. Figure 61.

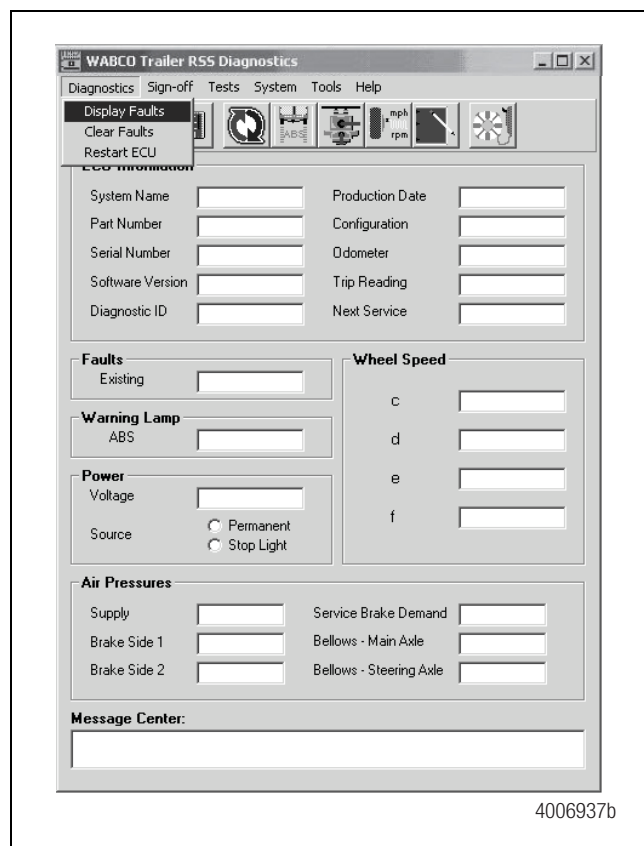


Figure 61

3. Select **Display Faults** from the pull-down menu. All active and stored faults are displayed. Figure 62.

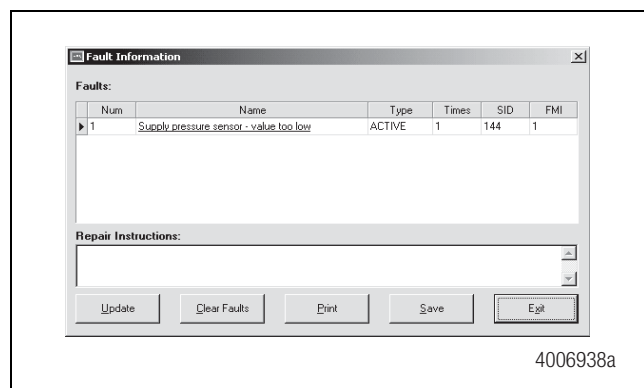


Figure 62

4. Repair active faults and take corrective action on stored faults. Once repaired, faults may be cleared by using the **Clear Faults** button.

Testing Components with TOOLBOX™ Software

The warning light, wheel sensors and the ECU valve can be tested as individual components. From the RSS main screen, activate the pull-down menu labeled TESTS. Select the component to be tested from the menu. Figure 63.

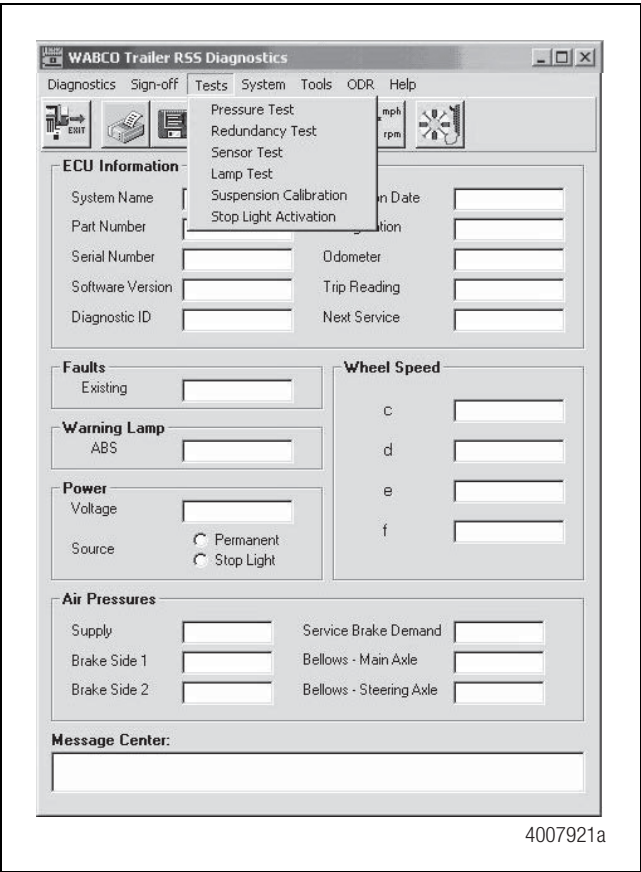


Figure 63

The Sensor Test

Initiating the menu selection labeled SENSOR TEST will check the placement of the ABS wheel sensors. The following warning will appear. Press **OK** when all safety precautions have been taken. Refer to the Warnings on page 1. Figure 64.

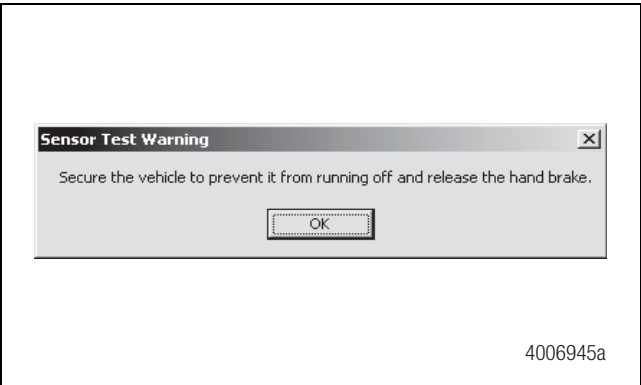


Figure 64

Lift the ABS sensed axles off the ground. Ensure there is no air pressure on the Control Line (blue) of the pneumatic brake system. Press **START** to begin the test. Rotate each wheel individually (in the order shown on the screen) and check the on-screen diagram to ensure correct sensor placement. Once the placement of all sensors has been correctly verified, press the **Close** button. Figure 65.

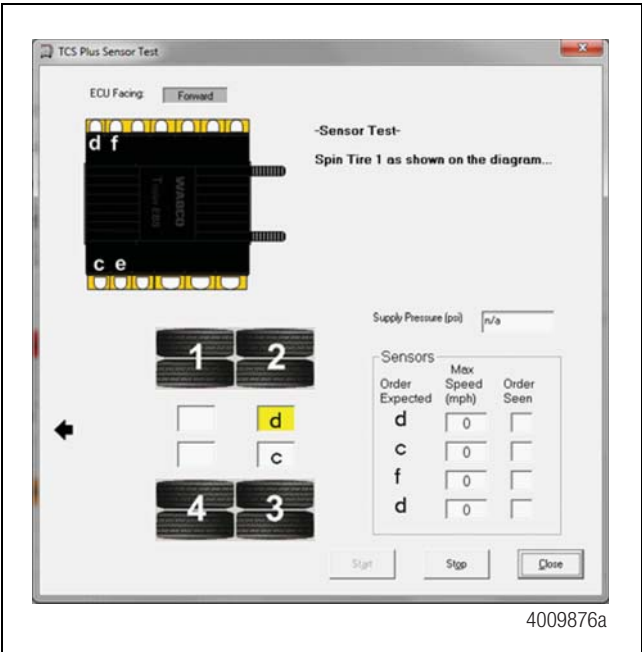


Figure 65

The Warning Lamp Test

Initiating the menu selection labeled LAMP TEST will check the activation of the trailer ABS warning light. Press the **TEST** button to begin the warning light test. The warning light will flash on and off. Press **Yes** to confirm the warning light is functioning correctly. Figure 66.



Figure 66

Distance Sensor Calibration

If the trailer has a spring suspension, the Mechanical Suspension screen will appear. Ensure that the trailer is now lowered so that all axles are fully on the ground. Confirm all conditions for calibration have been met before pressing **Yes**. Figure 67 and Figure 68.

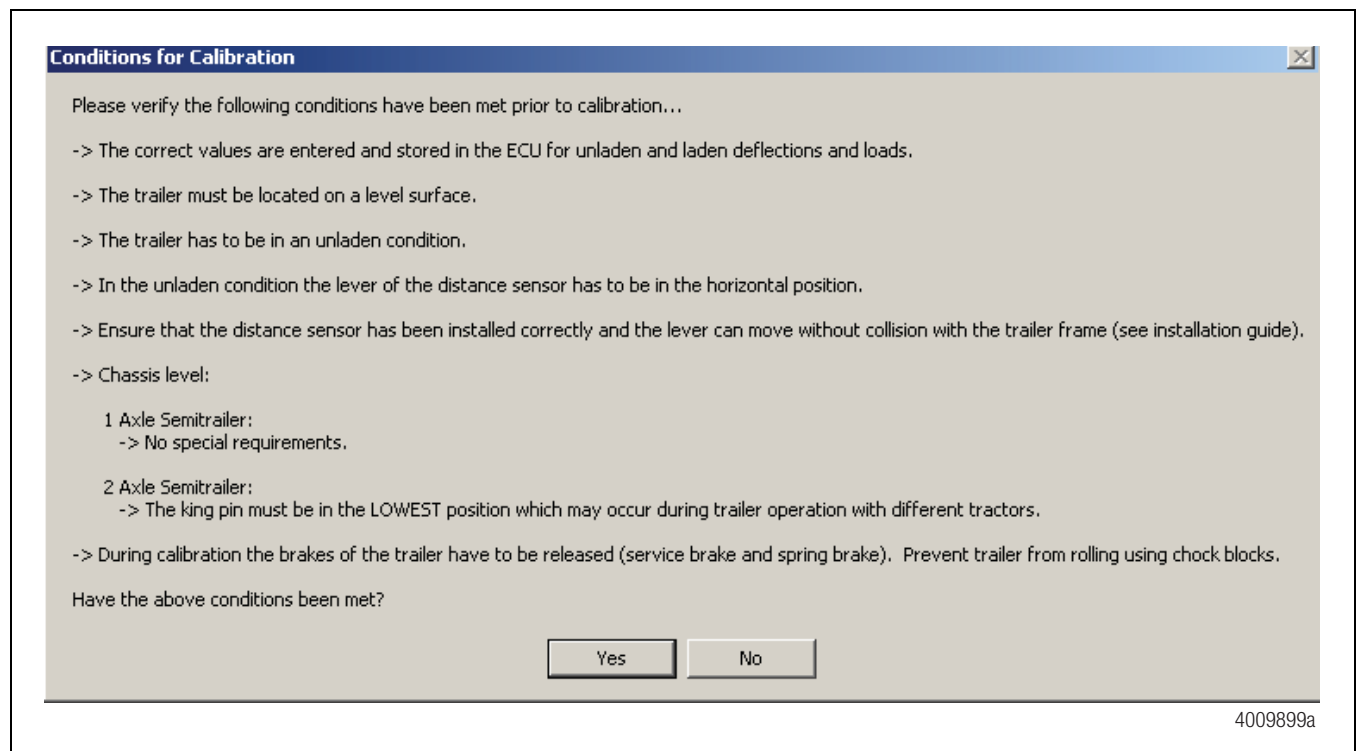


Figure 67

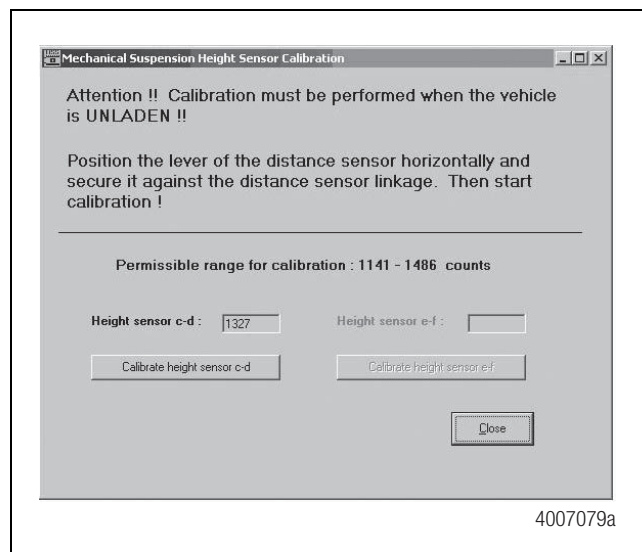


Figure 68

Ensure the Distance Sensor arm is parallel to the ground. The trailer must be in the unladen (empty) state with all tires on the ground. If the displayed value is beyond the listed range, you will need to adjust the Distance Sensor. Once the value in the "Height Sensor" field no longer changes and is within the specified range, press the button labeled **Calibrate Height Sensor**.

A message appears if the calibration is successful. Press **OK**. Figure 69.

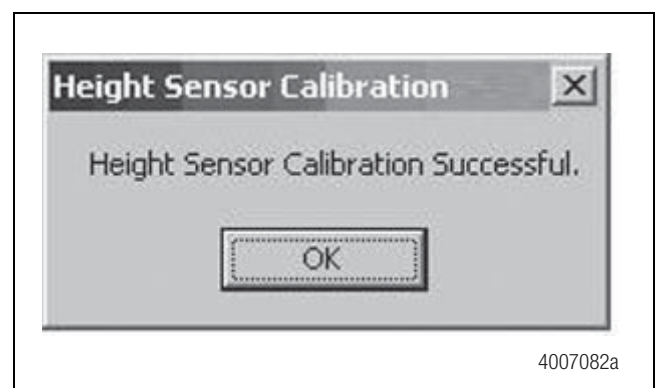


Figure 69

Stoplight Activation Cable

The activation of RSS event stoplights may be checked using this test. This test is conducted only if the optional stoplight activation cable is installed. Pressing the **Trailer 1 On** button turns the stoplights on. Press the **Trailer 1 Off** button to turn the stoplights off. Press the **Close** button to exit. Figure 70.

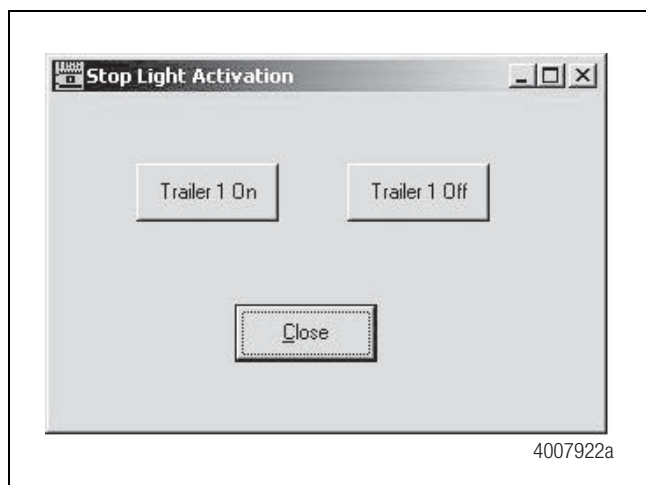


Figure 70

RSS 1M Parts List

Part Number	Nomenclature	Detail
480 110 001 0	RSS 1M ECU	2S/1M
449 351 010 0	Power Cable	1 Meter
449 351 047 0	Power Cable	4.7 Meters
449 443 030 0	TAG Generic I/O Cable	3 Meters
884 490 443 0	Tire Inflation I/O Cable	1 Meter
449 765 018 0	Sensor Extension Cable	1.8 Meters
449 765 030 0	Sensor Extension Cable	3 Meters
449 765 051 0	Sensor Extension Cable	5.1 Meters
449 765 120 0	Sensor Extension Cable	10 Meters
449 535 020 0	Generic I/O Cable (Blunt)	2 Meters
449 535 040 0	Generic I/O Cable (Blunt)	4 Meters
449 535 060 0	Generic I/O Cable (Blunt)	6 Meters
100 001 012 4	RSS Label	Adhesive
TP-95172	ABS Label	Adhesive
899 201 833 4	Power Label	Adhesive
899 201 842 4	In-Line Filter Label	Adhesive
441 050 100 0	Distance Sensor	
449 811 020 0	Distance Sensor Cable	2 Meters
441 050 712 2	Distance Sensor Linkage	Replacement Only
100 400 005 0	Distance Sensor "L" Bracket	Steel
105 100 002 0	Adjustable Distance Sensor Linkage	
441 901 715 4	Extension Lever	150 MM
449 865 046 0	Wheel Speed and GIO "Y" Cable	2 Meters – 1 Meter
449 865 048 0	Wheel Speed and GIO "Y" Cable	3 Meters – 1 Meter
894 607 434 0	Stoplight Activation Cable	1 Meter
449 866 010 0	Multi-Function Octopus Cable	1 Meter
100 400 004 0	Axle Clamp	5.8" diameter

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