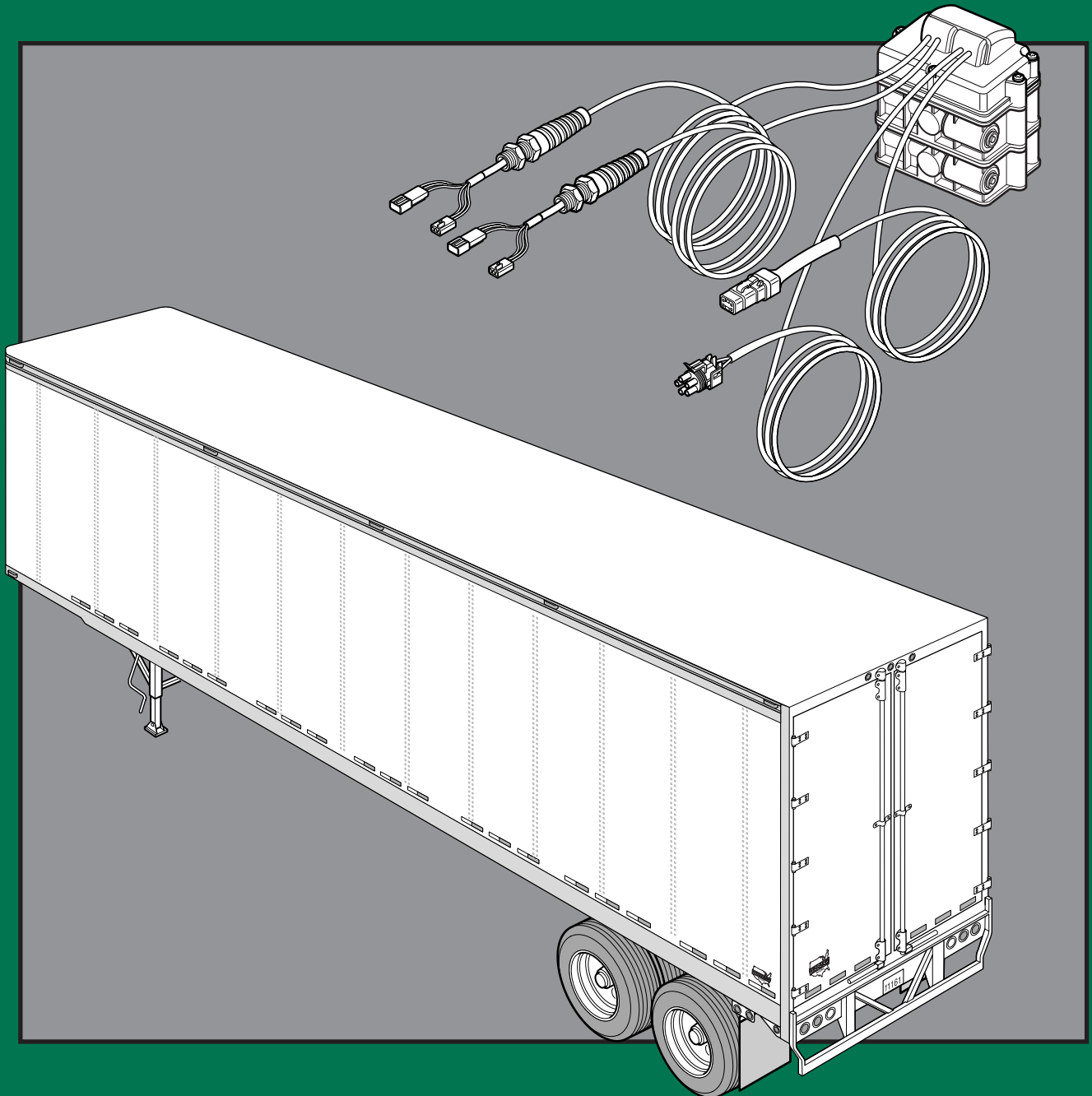


# MBS-2



## Installation Guide

AUGUST 2002



**Heavy Duty Trailer ABS  
by Wabash National**

## Notes, Cautions, and Warnings



This manual contains Notes, Cautions, and Warnings in addition to the assembly instructions.

**Notes:** Provide additional comments to help with installation and set up.

**Cautions:** Provide notification of situations that can cause damage to machinery and tools.

**Warnings:** Provide alerts to situations that can cause personal injury or death.

Please take the time to read and understand this manual before beginning assembly.

**CAREFULLY FOLLOW THE SAFETY AND OPERATING INSTRUCTIONS IN THIS MANUAL.**

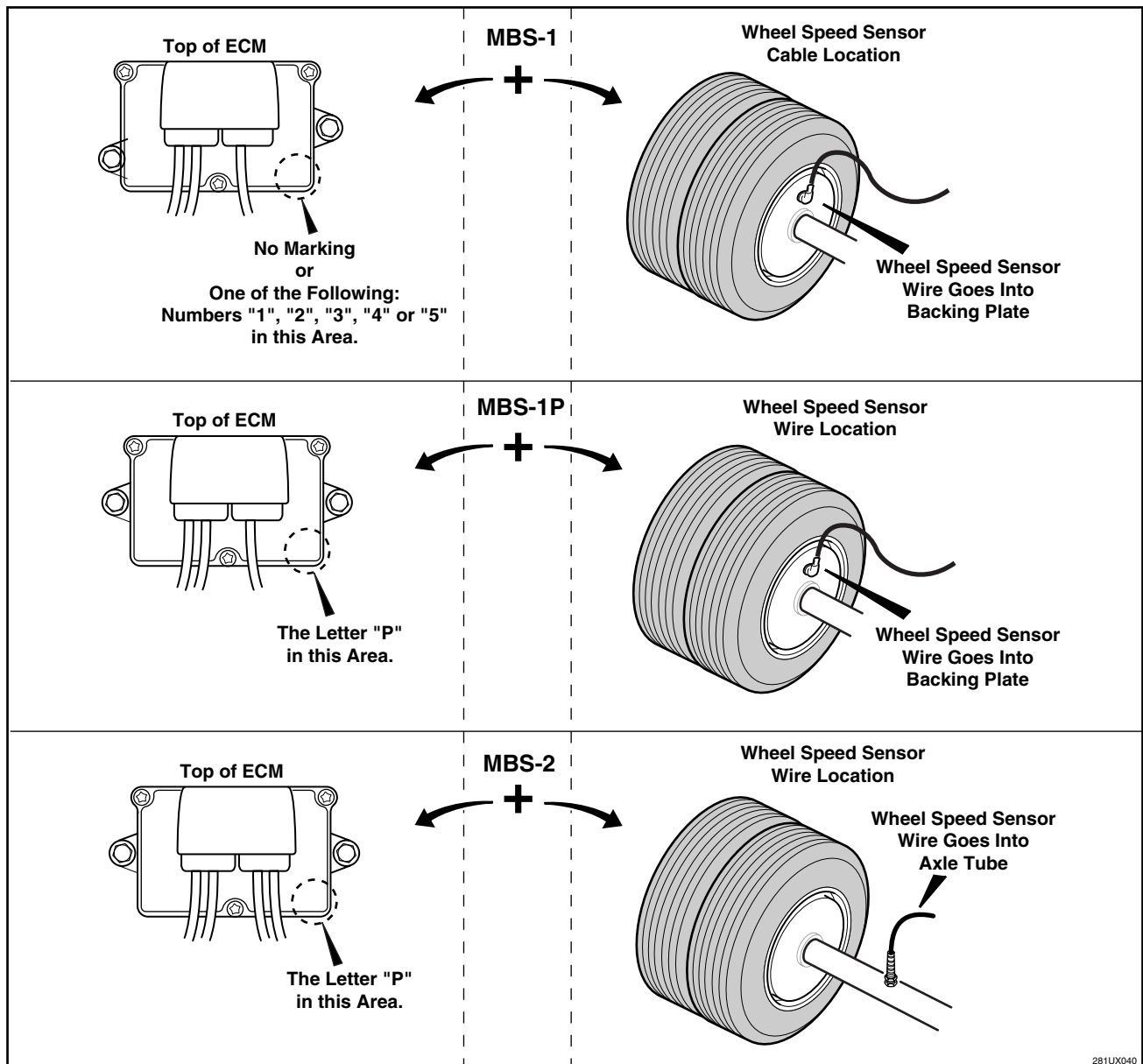
Due to a policy of continuous product improvement, we reserve the right to make changes at any time, without notice, in prices, materials, colors, specifications, equipment, models, and availability. Some photos and drawings in this manual contain optional equipment. Since some information may have been updated since the time of printing, please check with your Wabash dealer for complete details.

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## MBS Identification

Before service or diagnostics is performed on a Wabash MBS unit, the system design must be verified. Do not rely on labels or verbal descriptions to identify the MBS system. Refer to the illustration below and compare the marking in the lower right-hand corner of the ECM with the location(s) of the wheel speed sensor wire or cable on the trailer's axle(s). Make sure to properly identify the Wabash MBS; flash codes and system components are different for each system.





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## **Wabash MBS-2 ABS Introduction**

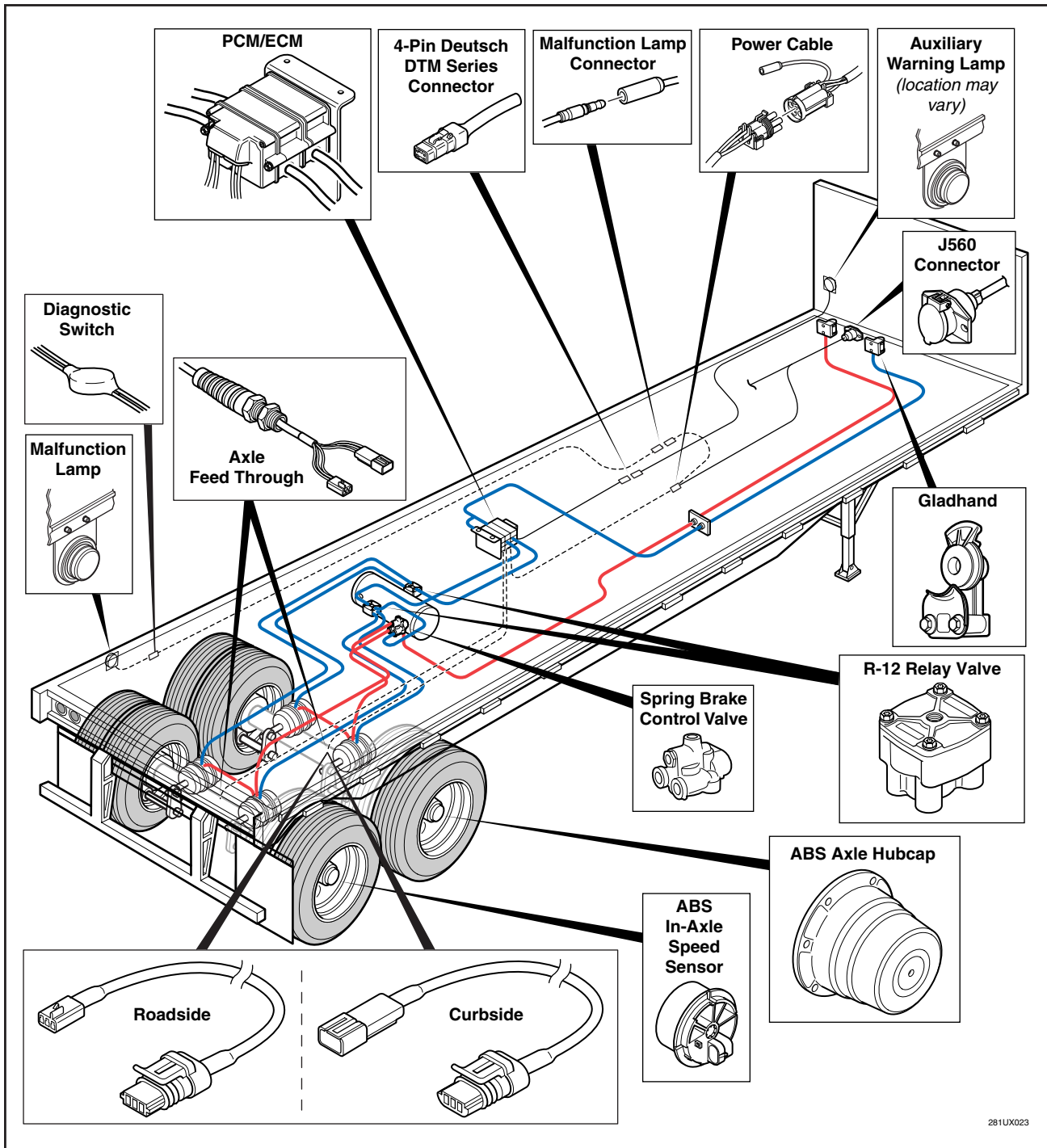
The Wabash National Modular Brake System –2 (MBS-2) is Wabash’s second generation Trailer Antilock Brake System. All MBS-2 controllers incorporate the new PLC (power line carrier) data link that permits tractor to trailer communications. In addition MBS-2 systems incorporate the new Wabash active wheel speed sensor based on Hall Effect technology. The use of this new sensor adds several new advantages:

- Mounting the sensor inside the hubcap provides a protected environment as well as a fixed location for the sensor and magnet. This reduces fleet maintenance by avoiding excessive gap issues associated with the traditional VR sensor.
- Ability to detect when the trailer is moving in reverse. The ECM reads the reverse signal and provides output drives that can be used to light a back up light or to raise a self steering lift axle.
- Ability to read temperature at the wheel ends. If excessive wheel-end temperature is detected, the ECM lights a warning lamp and also transmits a warning signal over the PLC bus.



## MBS-2 System Components

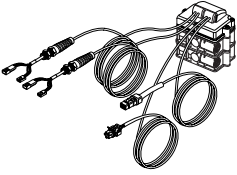

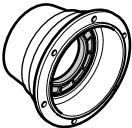
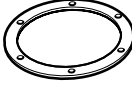








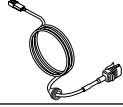

Wabash's MBS-2 system includes unique ABS components as well as interfacing with standard trailer components (see Figure 1). Refer to Figures 2 and 3 for part number and description of Wabash parts.



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Figure 1, Wabash MBS-2 Antilock Brake System



Component Item	Description	Quantity Required	Supplied in Kit
	10800316 2S-1M w/168" Power Cable 10800317 2S-1M w/30" Power Cable 10800318 2S-2M w/168" Power Cable 10800319 2S-2M w/30" Power Cable 10800320 4S-1M w/168" Power Cable 10800321 4S-1M w/30" Power Cable 10800315 4S-2M Side-by-Side w/168" Power Cable 10800324 4S-2M Side-by-Side w/30" Power Cable 10800322 4S-2M Axle-by-Axle w/168" Power Cable 10800323 4S-2M Axle-by-Axle w/30" Power Cable	1	yes
	14401905 MBS-2 Accessory Cable Extension 114" Long	1	no
	10600482 ABS Hub Cap for In-Axle Sensor with TP Spindle (6-hole)	2 or 4	yes
	10600483 Gasket	2 or 4	yes
	10800294 Spindle Extension Adapter for In-axle Sensor/Aluminum Hub (use with aluminum hubs only)	2 or 4	no
	10800282 Curbside In-Axle Speed Sensor	1 or 2	yes
	10800283 Roadside In-Axle Speed Sensor	1 or 2	yes
	10600526 Freeze Plug	2 or 4	yes
	BLT00722 Speed Sensor Mounting Bolt (standard hubs)	2 or 4	yes
	BLT00511 Speed Sensor Mounting Bolt (aluminum hubs only)	2 or 4	yes
	WSH00152 Mounting Bolt Wave Washer (standard hubs)	2 or 4	yes
	WSH00153 Mounting Bolt Lockwasher (aluminum hubs only)	2 or 4	yes
	10800291 Curbside In-axle Speed Sensor Harness	1 or 2	yes
	10800292 Roadside In-axle Speed Sensor Harness	1 or 2	yes

281UX031

Figure 2, MBS-2 System Components

# MBS-2 Installation



Component Item		Description	Quantity Required	Supplied in Kit
	BLT00650	Bolt 1/4-20 x 3-1/2" Grade 8 (1M System)	2	yes
	BLT00732	Bolt 1/4-20 x 5-1/2" Grade 8 (2M System)	2	yes
	NUT00007	Nut 1/4-20 Nylon Insert Locknut	2	
	WSH00010	Washer 1/4" SAE Flat	2	
	14401359	ABS Wiring Harness	1	yes
	14401744	ABS Malfunction Lamp Harness w/Diagnostic Switch	1	yes
	14200428	Yellow ABS Malfunction Lamp	1	yes
	14200623 14200002	Green TL-30 Series Trailer Warning Lamp Red TL-30 Series Trailer Warning Lamp	1	no
	14200018	Closed Back Malfunction Lamp Grommet	1*	yes
	12S00475	MBS-2 Mounting Bracket (optional)	1	yes
	14A00049	Straight Malfunction Lamp Mounting Bracket	—	no
	14A00050	90° Malfunction Lamp Mounting Bracket	—	no
	12900570	Relay Valve	1	yes
	25000945	MBS-2 Flash Code Decal	1	yes
	25000985	MBS-2 Enhanced Function Decal	1	yes
	25000984	MBS-2 Reverse Notice Decal	1	yes

\* Two grommets required when installing the trailer warning system.

281LUX024

Figure 3, MBS-2 System Components





## General Air Brake Requirements

FMVSS-121 identifies minimum requirements for air brake systems on commercial vehicles built in the U.S. (Requirements in Canada are covered under CMVSS-121 and are virtually identical.) These regulations cover requirements for new construction. Once put into operation, proper use and maintenance is covered under standards such as:

- FMCSR 393 – Covers required equipment
- FMCSR 396 – Covers inspection and repair

The requirements for spring brake performance and operation, reservoir size and air timing have not been changed with the introduction of ABS. Because the addition of ABS components can have an affect on air brake timing, it is important to verify acceptable performance on new ABS installations. The maximum application and release times permitted under FMVSS-121 are shown in Figure 4.

	Apply Time (mSec)		Release Time (mSec)	
	From pedal movement to reach 60 PSIG	From pedal movement to reach 60 PSIG	From pedal movement to reach 5 PSIG	From pedal movement to reach 5 PSIG
<b>Measured at</b>	Brake Chamber	50 CI Reservoir	Brake Chamber	50 CI Reservoir
<b>Initial Condition</b>	0 PSIG	0 PSIG	95 PSIG	5 PSIG
<b>Towing Trailer</b>	500	500	1000	1000
<b>Converter Dolly</b>	550	550	1100	1000
<b>Single Trailer</b>	600	N/A	1200	N/A

281UX032

Figure 4, Air Timing Requirements



## **ABS**

### **Key Dates**

- March 1, 1997 Tractors must be equipped to provide full time power to trailers.
- March 1, 1998 Newly manufactured trailers must be equipped with ABS. Some special use cases are exempt. (Refer to FMVSS-121 for specific details.)
- April 1, 2000 ABS required on newly manufactured Canadian Vehicles
- March 1, 2001 Trailer malfunction lamp is required in the tractor cab.
- March 1, 2008 Trailer mounted malfunction lamp no longer required.

### **ABS Design Requirements**

Under FMVSS-121, an approved ABS must automatically control the degree of rotational wheel slip during braking by:

1. Sensing the rate of angular rotation of the wheels.
2. Transmitting signals regarding the rate of wheel angular rotation to one or more controlling devices which interpret those signals and generate responsive controlling output signals.
3. Transmitting those controlling signals to one or more modulators which adjust brake actuating forces in response to those signals.

### **Type of ABS Required for Trailers**

ABS control is required on trailers as follows:

- Full Trailers – Direct ABS Control is required on at least one front and one rear axle.
- Semi Trailers and Dollies – Direct ABS Control is required on at least one axle.

Direct Control refers to an axle that is equipped with wheel speed sensors and is controlled by a modulator valve or valves in response to the wheel speed sensor signals. If this valve(s) also controls the brakes of another axle(s) that does not have sensors, the axle(s) is referred to as an indirectly controlled axle(s).



### Power Requirements for ABS

For trailers built after March 1 of 1998, the trailer wiring system must provide two sources of power for the antilock system.

1. Full-time power (when ignition is on) must be provided by the tractor. This full-time power source may be shared with other trailer circuits. The SAE J560 Blue (AUX) circuit is commonly used as the full-time power source. In other cases, a separate ISO 3731 connector is provided.
2. Brake light power. This input provides a source of backup power for cases where an older tractor (without full-time power) is used to tow a trailer or in case of a failure of the permanent power source.

Industry standards (TMC RP-137 and SAE2247) require that the tractor provide at least 10 amps at 12 volts at the trailer end of the SAE J560 or ISO cable on all ABS power circuits. Suppliers of Trailer ABS have agreed to provide for proper antilock brake operation down to a minimum of 8.5 volts. The ABS malfunction lamp will light if voltages drop too low to maintain reliable solenoid operation.

Wabash National antilock systems operate at voltages down to 7.0 volts. Current requirements are approximately 330 milliamps per control unit and 1.25 amps per PCM.

### ABS Malfunction Lamp

Rules for the location, color, labeling, intensity and photometrics for external ABS malfunction lamps have been established by the National Highway Transportation Safety Administration (NHTSA). These requirements are effective as of March 1, 1998.

#### Location

The lamp mounting location shall be near the left side rear of the trailer, no closer than 150 mm (5.9 inches) and not more than 600 mm (23.6 inches) from the rear red side marker indicator lamp. On a converter dolly, the lamp mounting location shall be on a permanent structure of the dolly at least 375 mm (14 inches) above the road surface. After March 1st, 2001 a second ABS malfunction lamp must be located in the cab.



### **Color and Labeling**

The malfunction indicator lamp must be yellow in color and identified with the letters “ABS” to distinguish the lamp from other yellow side markers. The letters may be on the lens, on the lens housing, or on the trailer itself, near the lamp.

### **Intensity and Photometric Requirements**

The external ABS malfunction indicator lamp must conform to SAE-J592 JUN92. Trailers shall use a combination clearance/side marker lamp marked with a “PC” or “P2”. These lamps offer a widely diffused beam pattern throughout a full 180-degree left and right range.

### **Power Line Carrier (PLC)**

In order to meet the (March 2001) requirement to provide a tractor-mounted trailer ABS malfunction lamp, the industry has adopted power line carrier (PLC) technology. The use of a power-line-carrier permits transmission of data between tractors and trailers without adding wires or connectors. Data is transmitted as a series of high frequency chirps that appear on the ABS full-time power line (the blue wire). The chirps vary in frequency between 100K Hz and 400K Hz. The PLC signals are transmitted between trailer ABS control units and tractor ABS control units. The tractor ABS unit has an additional output signal that controls the cab-mounted trailer ABS malfunction lamp.

The cab-mounted trailer ABS malfunction lamp:

- Lights to indicate a bulb check at start-up
- Remains lit at start-up if a fault code is set
- Will turn OFF after two seconds if the trailer is disconnected
- Lights during vehicle operation to indicate a fault has occurred.

In order for PLC to function, tractors and trailers must both be equipped with PLC versions of ABS. All Wabash National MBS-2 systems manufactured after March 1, 2001 are PLC capable.

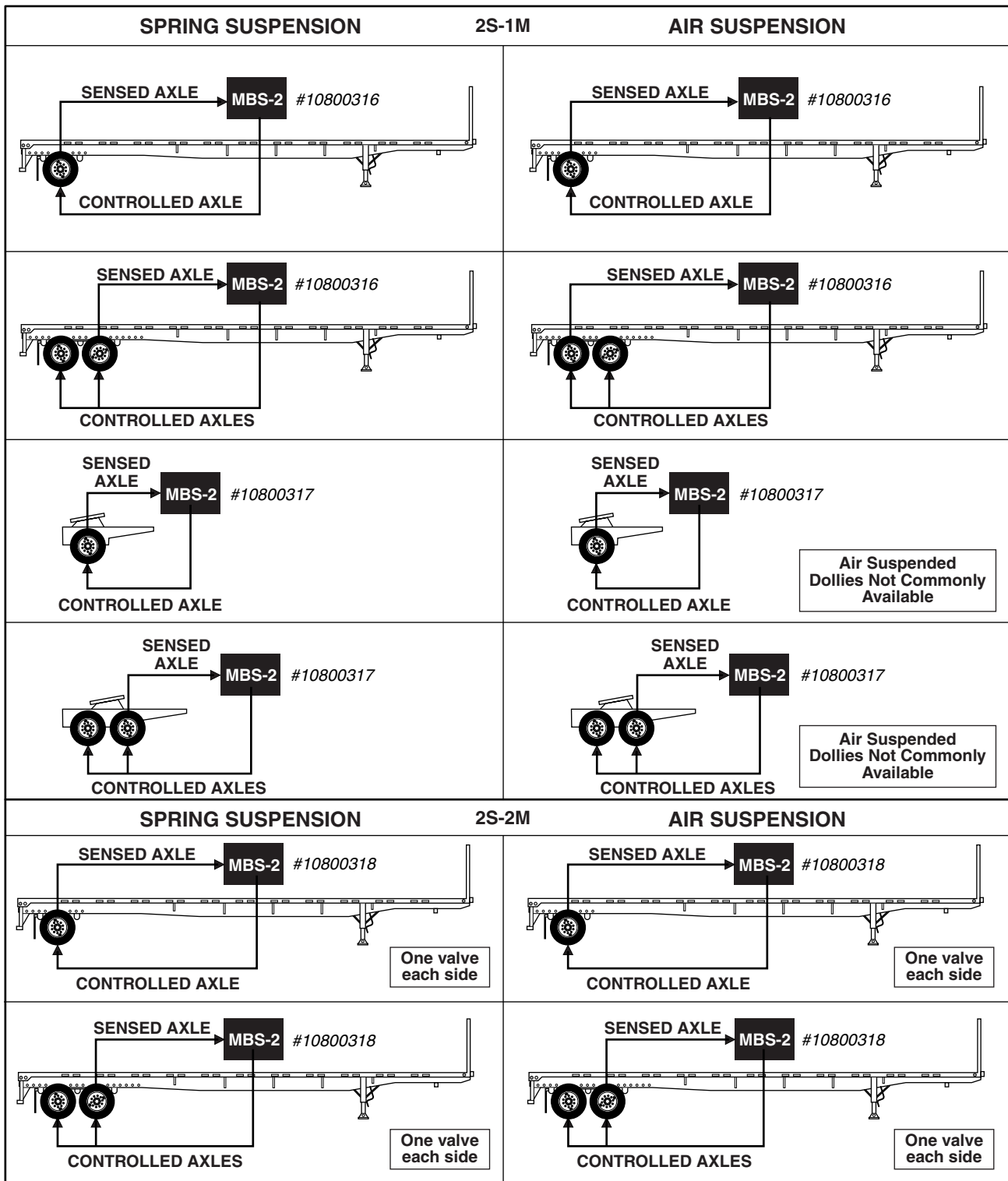


### Applications

The performance of the Wabash MBS-2 ABS depends upon proper installation of all components. Trailer suspension, axle configuration, and other brake components will affect the level of ABS performance.

The “Sensed” and the “Controlled” axles must be considered prior to installation of the MBS-2. Wabash recommends the following guideline for typical MBS-2 installations.

When locating the sensors on the tandem, choose the axle that locks up first during hard braking. Typically, the front axle tends to lock up first on spring suspension trailer applications. On air suspension systems, the axles tend to lock up at the same time, so it is recommended that the rear axle be sensed because of the added stability.



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Figure 5, Wabash MBS-2 Application Chart

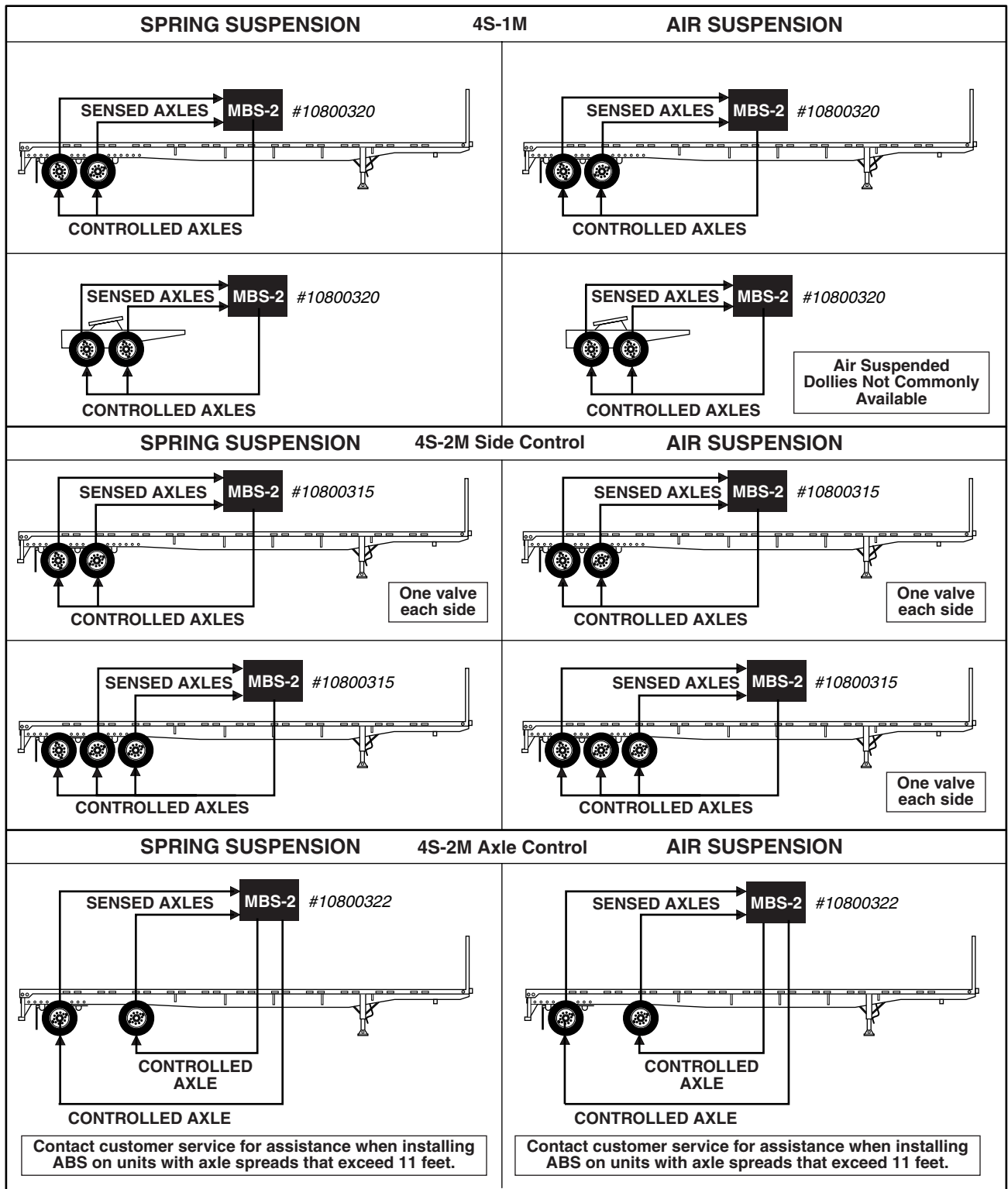
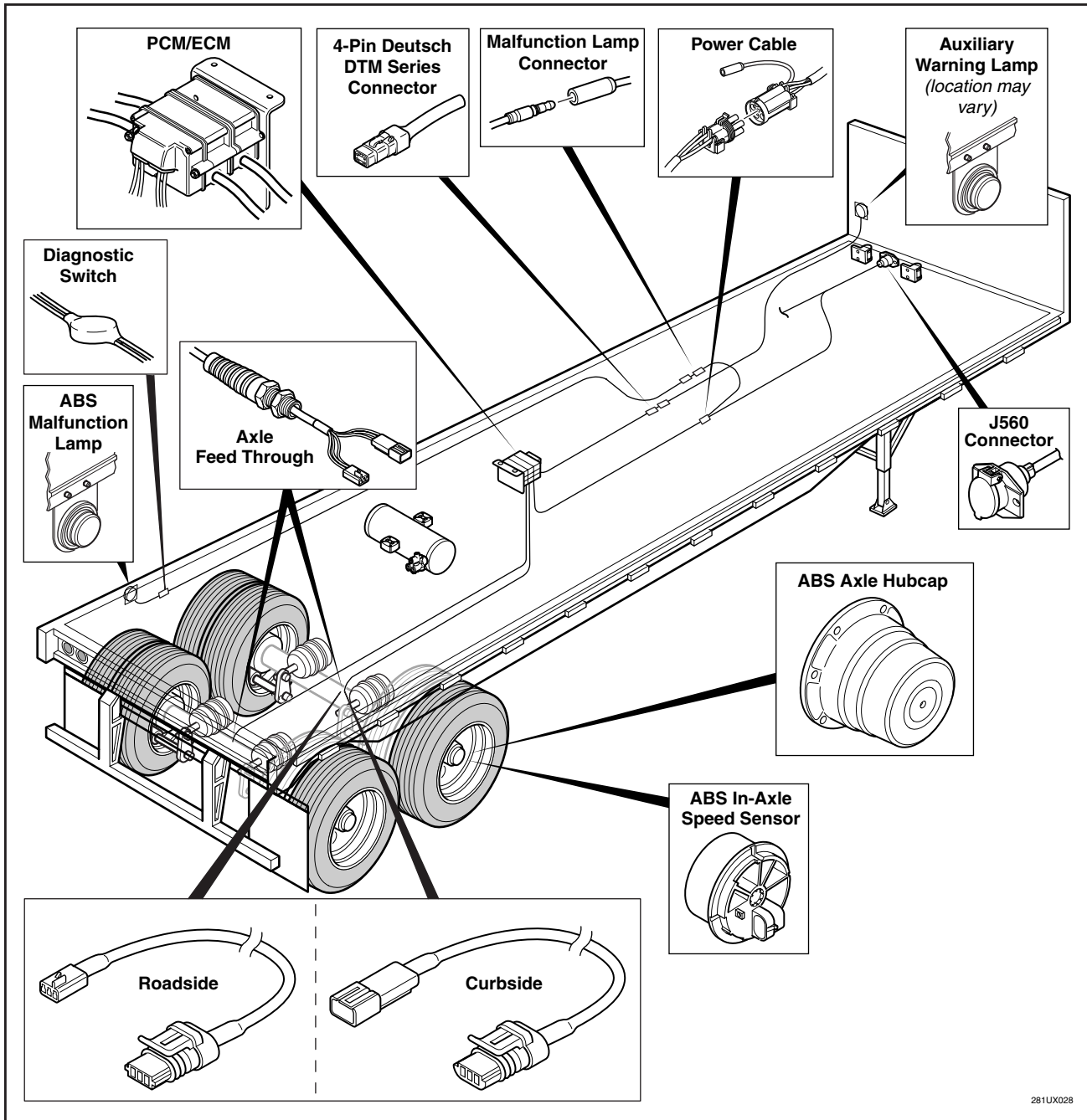


Figure 6, Wabash MBS-2 Application Chart



## Electrical System

The Antilock Control Module (ACM) consists of an Electronic Control Module (ECM) and a Pneumatic Control Module (PCM) combined as one unit. However, they are individually field replaceable. The wheel sensor, malfunction lamp, and power harness circuits are connected to the ECM.



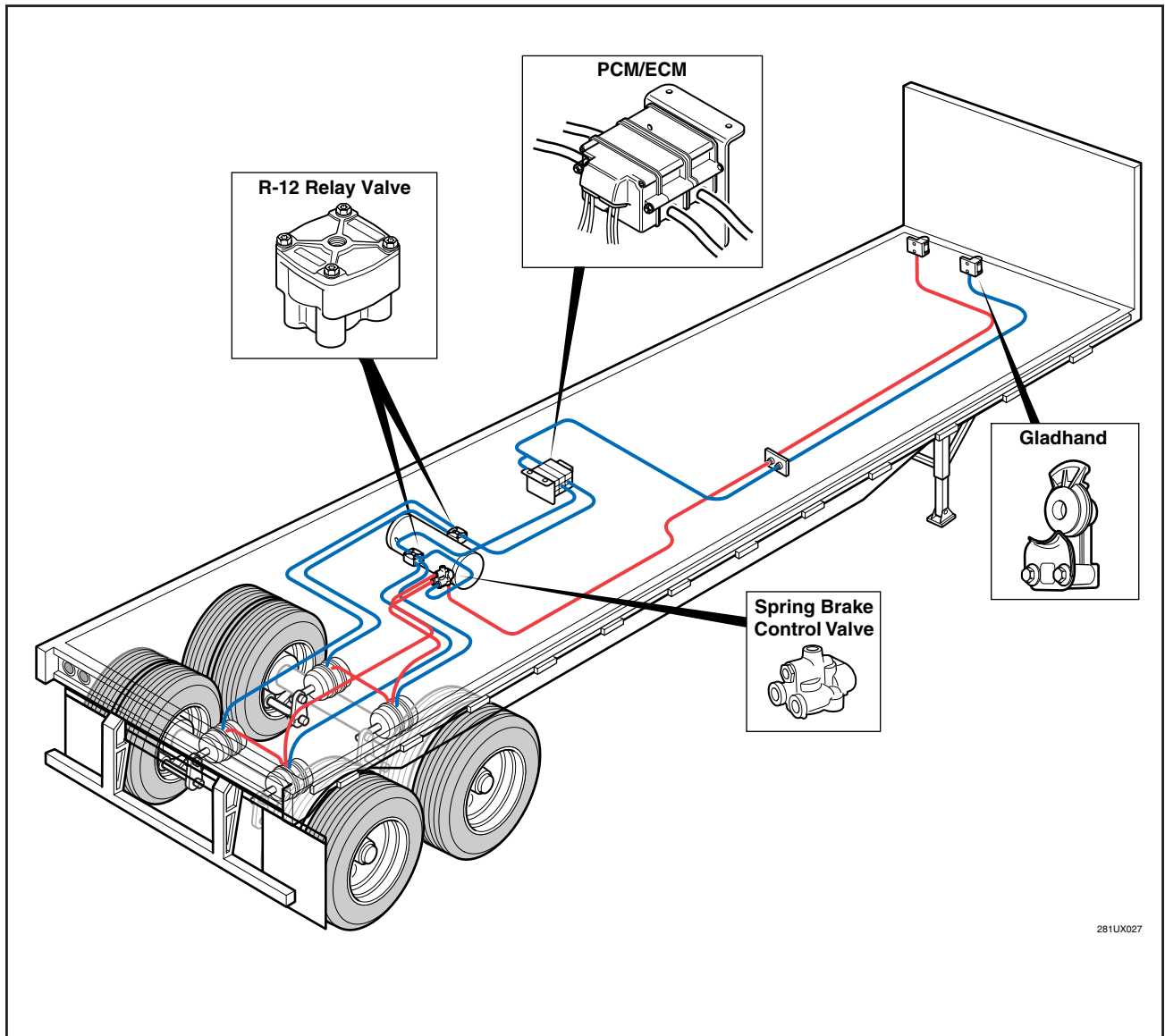
281UX028

Figure 7, Typical Electrical System Layout



## Pneumatic System

The PCM contains the pneumatic solenoids that physically control pressure in the service line to the relay valve. The 3/8" service line enters and exits the PCM through integrated quick connect fittings. The PCM also incorporates a quick exhaust valve that minimizes delays during brake release and helps purge contaminants that may enter the service control line.



281UX027

Figure 8, Typical Pneumatic Layout for a 2M System



## **Installation of Electrical System**

### **Power and Sensor Cables**

One power cable, one or two sensor cables, and one accessory cable are integrated into the MBS-2. The power cable runs to the Weather Pack 5-way connector on the trailer. The sensor cables terminate in three-pin connectors that mate with the 3-pin active speed Sensor Cable. The accessory cable terminates in a Deutsch 4-pin DTM series connector.

### **MBS-2 Cable Options**

The MBS-2 can be configured with either a long or short power cable. Refer to the system component charts on page 3 and 4 for specific system and part number information.

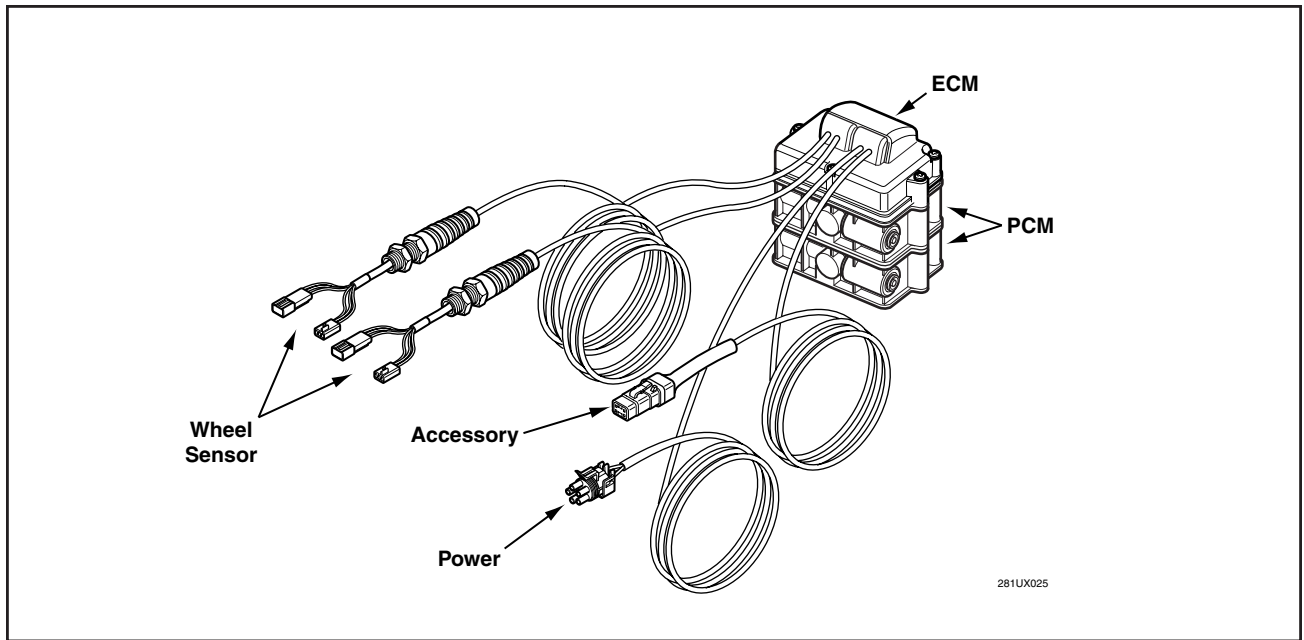
The short power cable is typically used with fixed bogies.

The long power cable is typically used with sliding bogies. Route the power cable with the slider hoses to the trailer frame.

---

**NOTE: The long cable can also be used on fixed bogies if required.**

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**Figure 9, MBS-2 Components and Connectors**

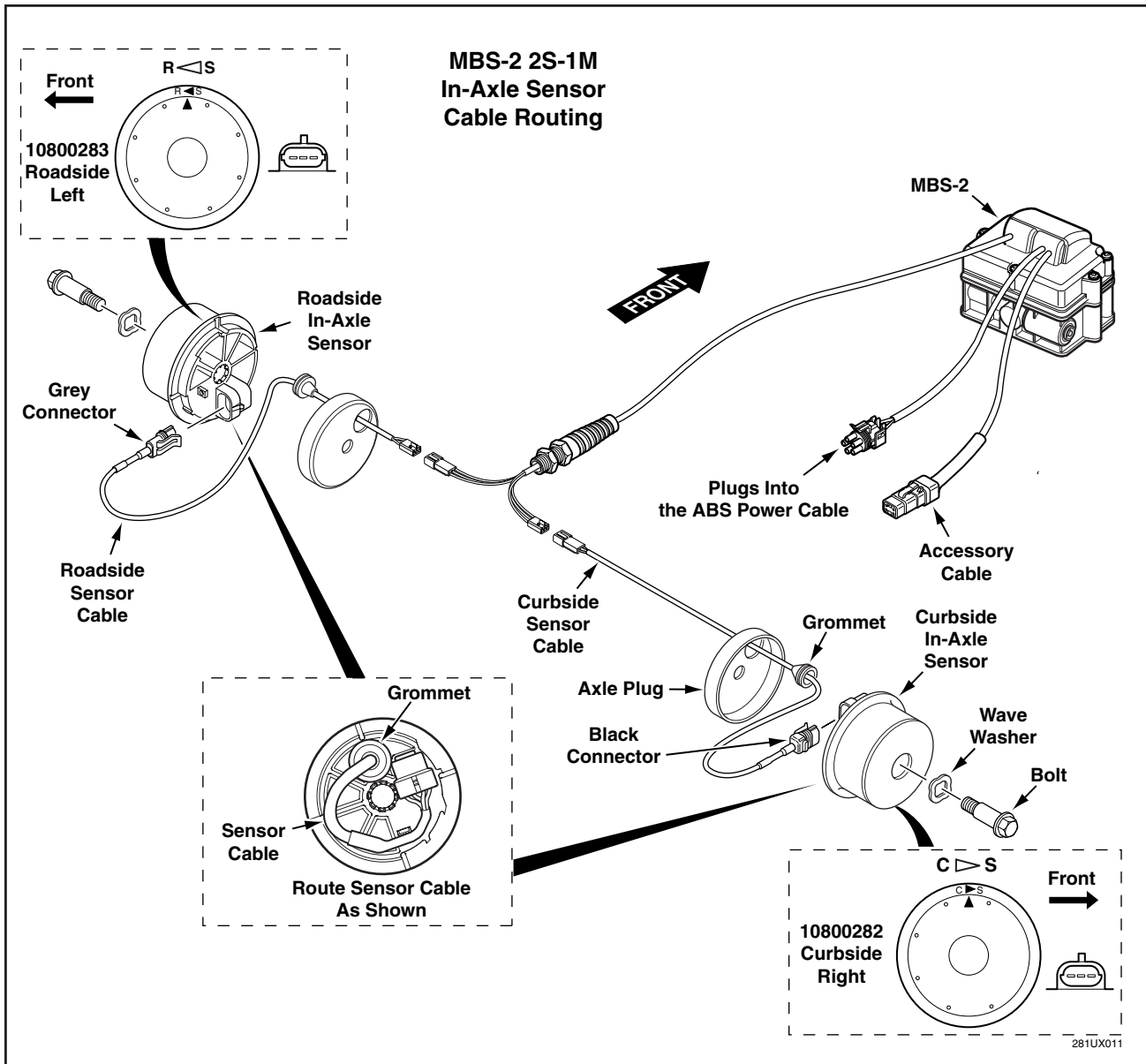


Figure 10, MBS-2 In-Axle Sensor Cable Routing for 2S-1M Systems

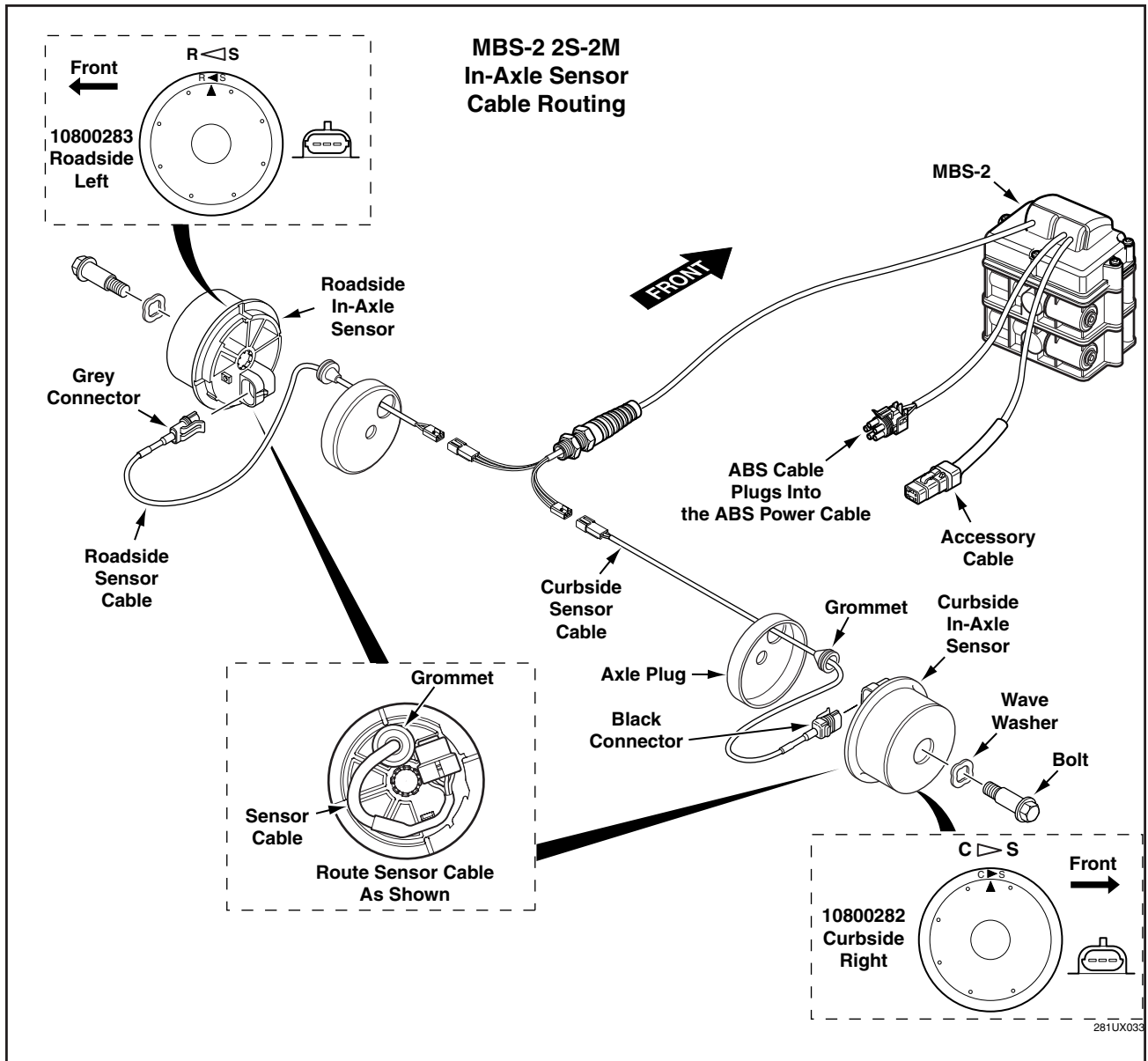


Figure 11, MBS-2 In-Axle Sensor Cable Routing for 2S-2M Systems

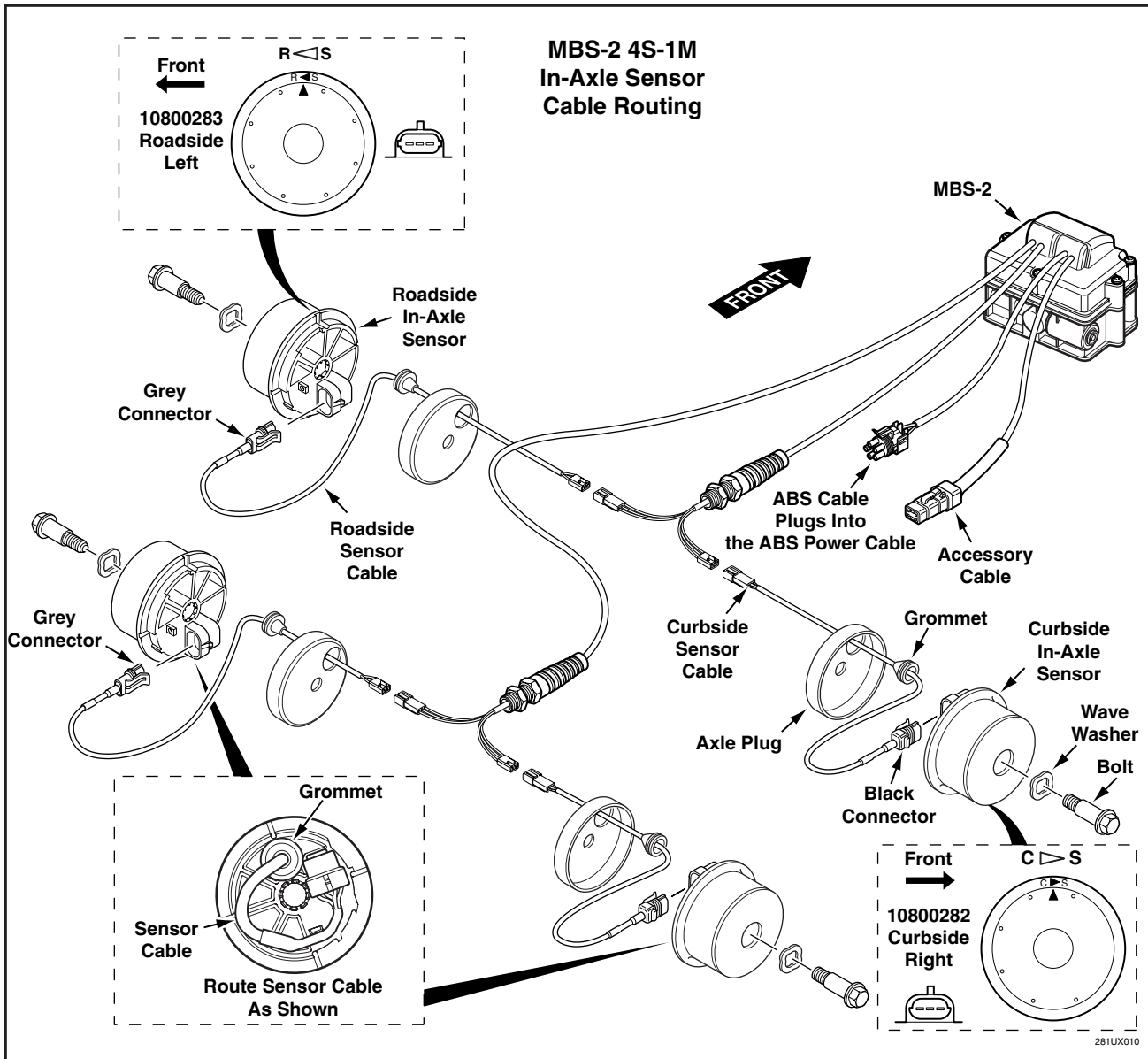


Figure 12, MBS-2 In-Axle Sensor Cable Routing for 4S-1M

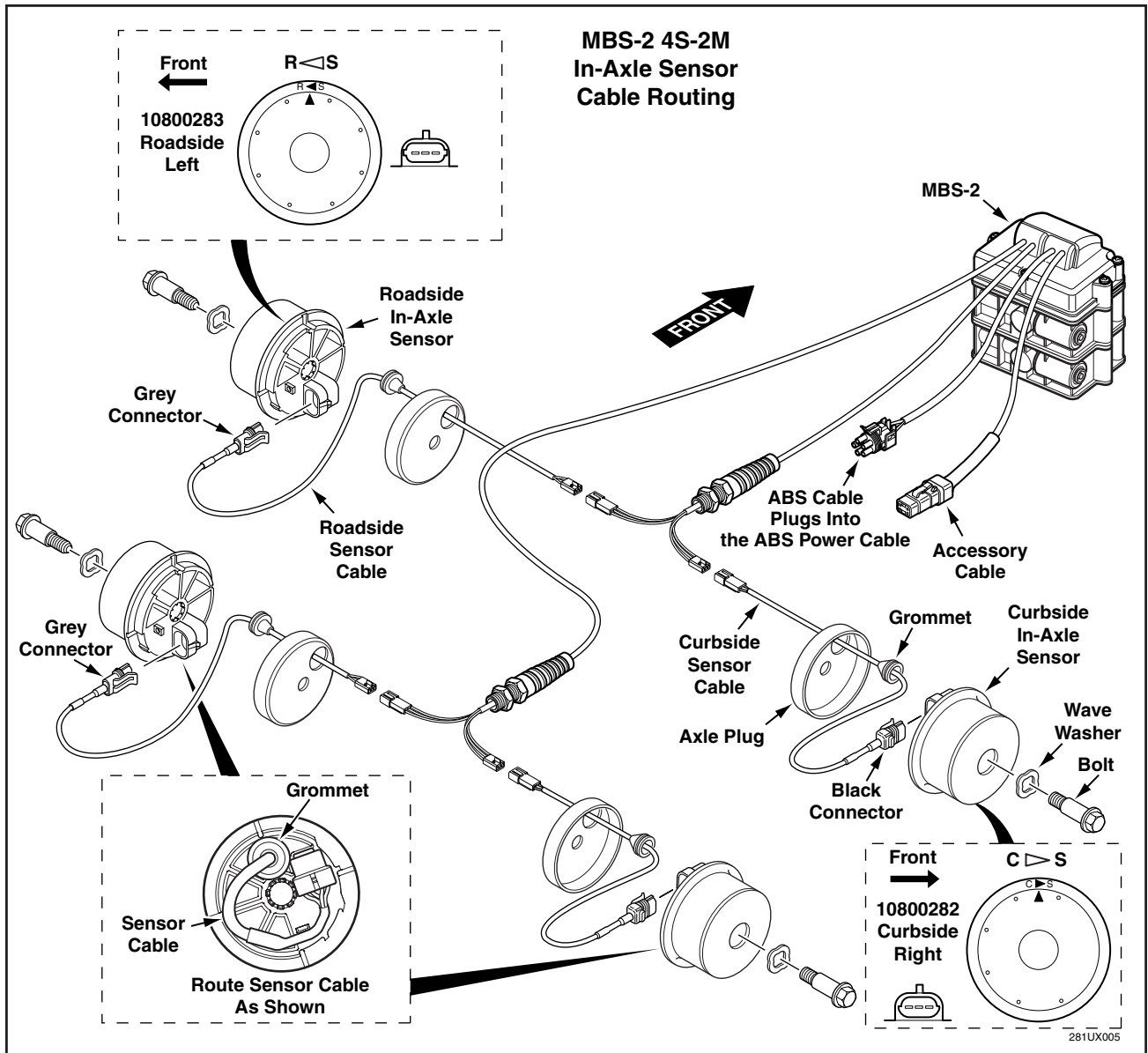


Figure 13, MBS-2 In-Axle Sensor Cable Routing for 4S-2M



### Circuit Requirements

The solenoid valves used in the Wabash MBS products allow higher airflow and require less voltage and current than most trailer ABS systems. For a nominal 12-volt supply, current consumption is about 1.25 amperes maximum during ABS activity. Satisfactory operation is available down to 7 volts. The MBS-2 minimizes trailer issues caused by inadequate voltage (typically found in 3-trailer units).

### Malfunction Lamp and Malfunction Lamp Diagnostic Switch

**NOTE: The malfunction lamp bulb must be incandescent. Always replace the bulb with another incandescent bulb of the same value.**

A diagnostic switch is located near the ABS malfunction lamp. A malfunction lamp harness incorporating this switch is included in the MBS-2 kit.

**NOTE: While this feature is desirable, it is not essential. Diagnostic flash codes can also be activated from the tractor cab via the ignition switch.**

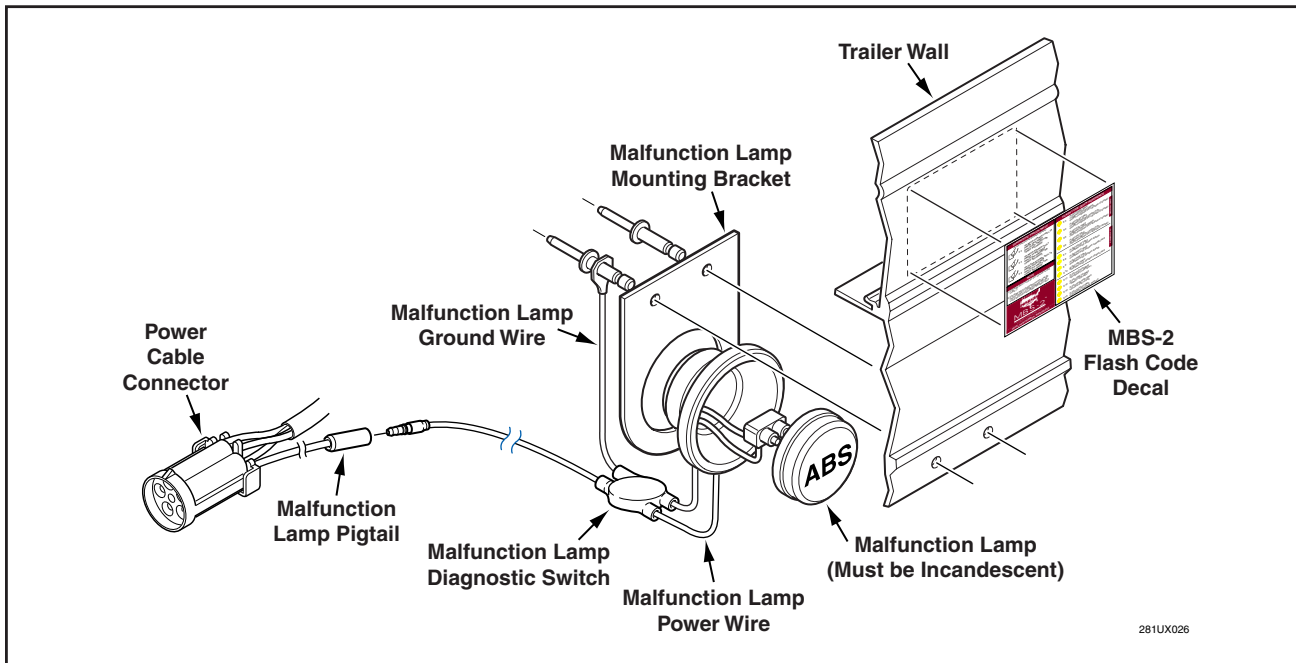


Figure 14, ABS Malfunction Lamp Installation



## Pneumatic System

### MBS-2 Location and Mounting

The MBS-2 can be located some distance from the relay valve. The air line connecting the PCM to the relay valve should be 3 to 5 feet in length. This allows some mounting flexibility, provides good ABS performance, and complies with brake application and release timing requirements.

Mount the MBS-2 using two grade 8 bolts WNC part number BLT00650 (1/4-20 x 3-1/2") for 1M systems, BLT00732 (1/4-20 x 5-1/2") for 2M systems.

**NOTE: Use the grade 8 bolts included with the MBS-2 installation kit. The bolts must be inserted from the bracket side when installing 2M systems.**

An optional mounting bracket (WNC part number 12S00475) is available from Wabash.

The MBS-2 may also be mounted directly to a crossmember by drilling two mounting holes on 5-3/8" centers.

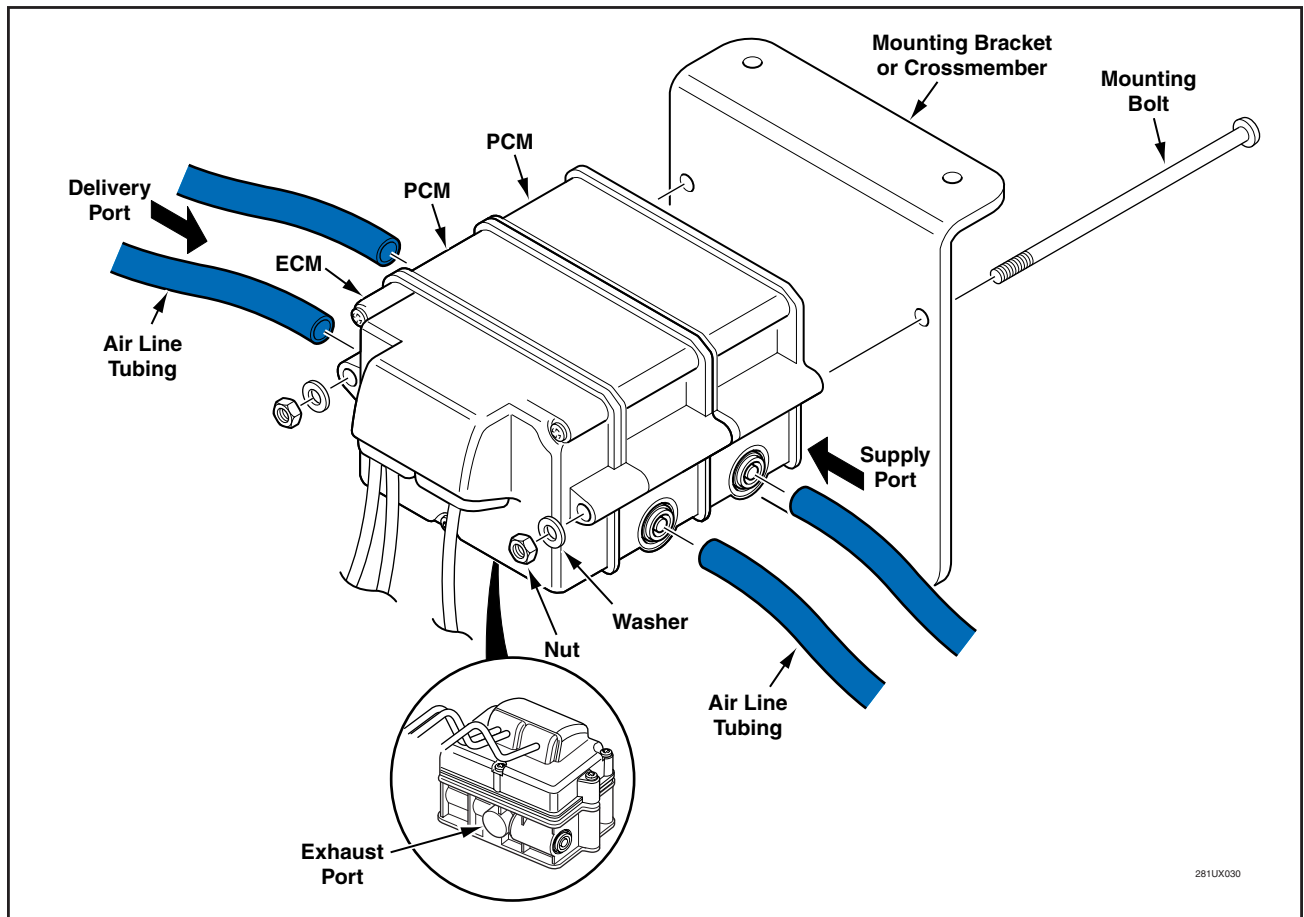


Figure 15, Typical MBS-2 Mounting



### Plumbing Instructions

Install the MBS-2 as follows:

1. Select a suitable mounting location near the front of the bogie.
2. Install the MBS-2 in the blue service line (see Figure 16).
3. Connect the port marked "SUP" to the glad-hand side.
4. Connect the port marked "DEL" to the relay valve side.

---

**NOTE: Because of volume considerations discussed later, the spring brake valve may be supplied from either the "upstream" (glad-hand side) or the "downstream" (relay side) of the MBS-2. Wabash recommends that it be supplied from the downstream side to help purge contaminants from the anti-compounding supply line.**

---



---

**⚠ IMPORTANT: When the Trailer Emergency Valve (TEV) is supplied downstream of the MBS-2, the line from the MBS-2 must be routed to the relay valve first, and from there, to the trailer emergency valve (TEV). Circumstances where the TEV is supplied downstream of the MBS-2 then 1/4" airline must be used from the R-12 to the TEV.**

---

Wabash requires the following pneumatic plumbing:

1. From "DEL" of MBS-2, route 3/8" tubing to a tee at the relay valve.
2. From the tee at the top of the relay valve, route 1/4" tubing to the spring brake valve anti-compounding port.

---

**⚠ IMPORTANT: The line lengths are significant. The combined volume in the two lines mentioned in steps 1 and 2 above must equal the volume of between three and five feet of 3/8" tubing. The volume of 1/4" tubing is about 40% that of 3/8" tubing of equal length.**

---

Calculate tubing equivalents using the following formula:

Leq = equivalent length of the combined 3/8" and 1/4" tubes

L3/8 = actual length of 3/8" tubing

L1/4 = actual length of 1/4" tubing

Then:

$$\text{Leq} = \text{L}_{3/8} + (0.4 \times \text{L}_{1/4})$$

<b>Example:</b>
3 feet of 3/8"
2.5 feet of 1/4"
Leq= 3 + 0.4 (2.5)= 4.0

281UX036

The air volume in the tubing after the MBS-2 is a significant performance factor. Leq must be between three and five feet.

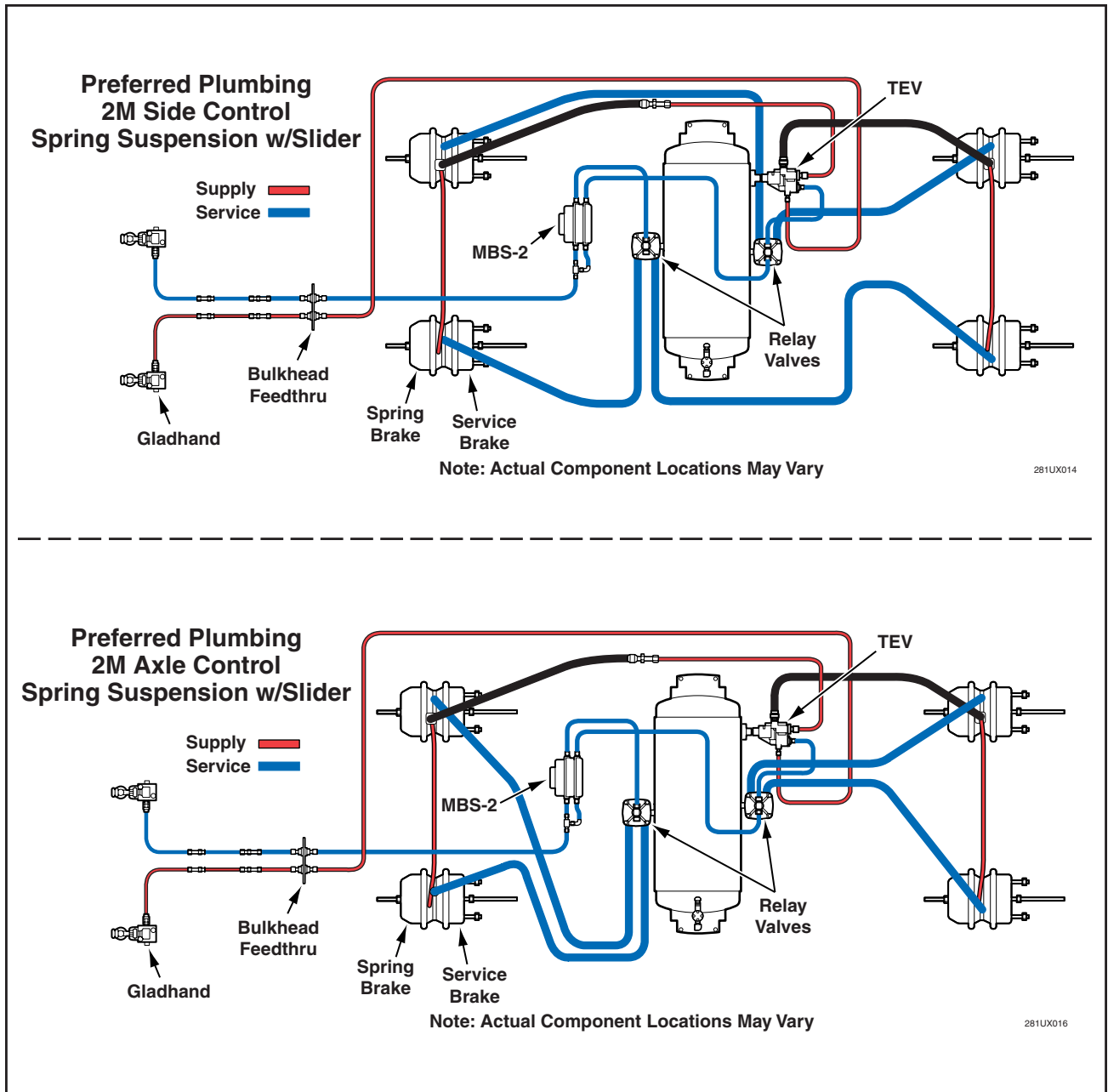


Figure 16, MBS-2 “Downstream” Air Supply Configurations (Preferred Plumbing)



---


**NOTE:** If the plumbing cannot be accomplished within the five foot maximum length, the relay valve can be fed directly with a 3/8" tube from the "DEL" port of the MBS-2. The feed for the trailer spring brake valve can be taken from a tee connection upstream of the MBS-2. Use a 3/8" line to the Trailer Emergency Valve (TEV).

---

For this configuration, the volume of the line to the spring brake valve is not included in the calculation.

Following these guidelines will usually result in an installation that complies with application and release brake timing requirements. However, always check application and release times for each configuration.

---


 **IMPORTANT:** When the anti-compounding port of the Trailer Emergency Valve (TEV) is plumbed in before the PCM the straight through connection must be plumbed to the PCM and the branch connection to the TEV. All airline used in this case can be 3/8" tubing because the PCM does not exhaust this portion of the airline during an ABS event. For this plumbing configuration, omit this length of airline when calculating allowable tubing lengths.

---

### Relay Valve

Provided that all brake application and release timing requirements are met, a Bendix relay valve (WNC part number 12900570) is approved for all applications. This valve is normally included with the MBS-2 installation kit.

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 **IMPORTANT:** Wabash National must approve all installations that use other relay valves.

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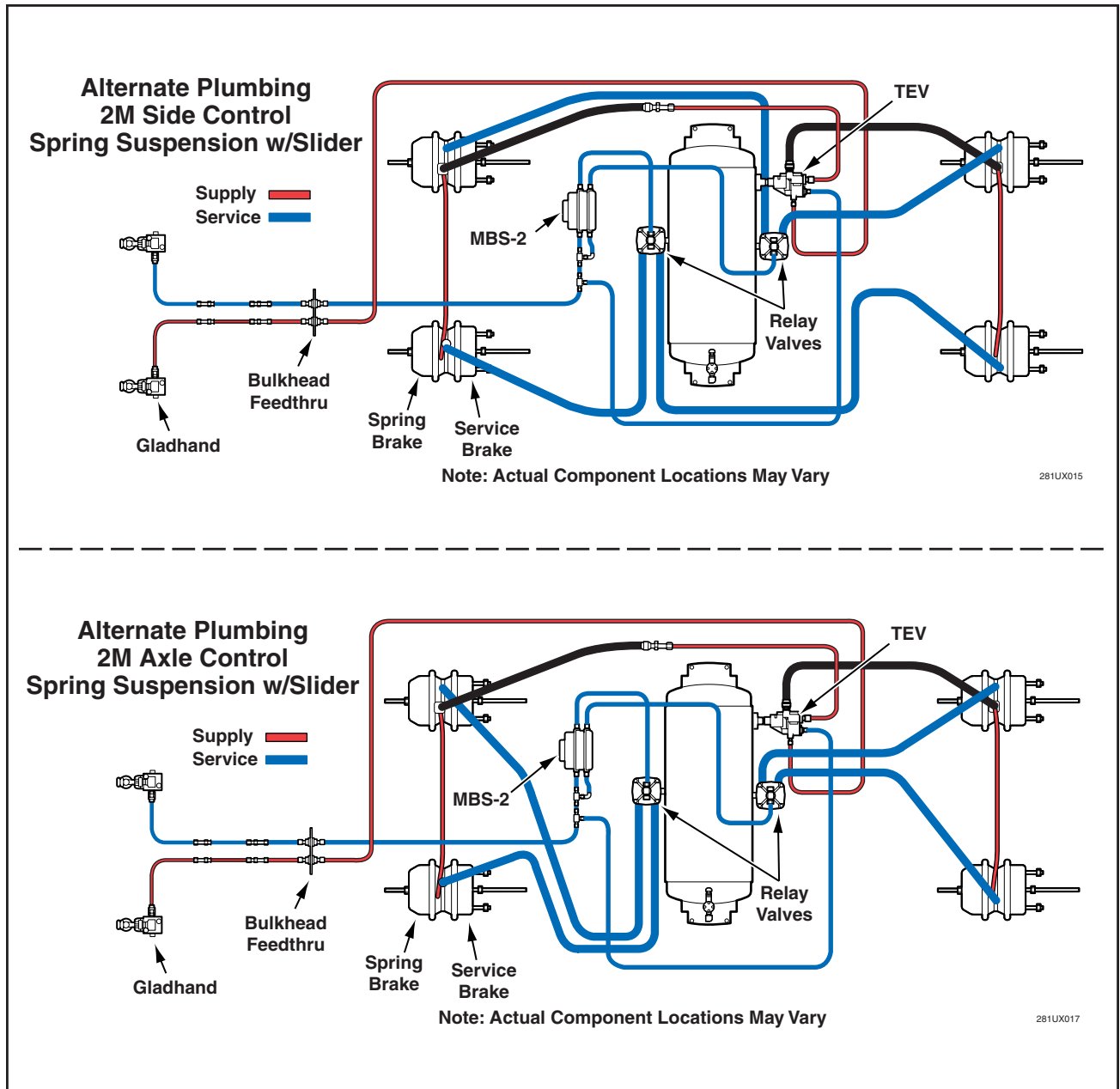


Figure 17, MBS-2 “Upstream” Air Supply Configurations (Alternate Plumbing)



### Active Wheel Speed Sensors

The new Wabash National wheel speed sensor incorporates an Application Specific Integrated Circuit (ASIC) that contains two Hall cells and a temperature sensor. The temperature sensor is used to infer wheel bearing temperature. The use of the dual Hall Effect sensors allows detection of the direction of the wheels by using a technique known as quadrature. The sensor is mounted at the end of the trailer axle spindle and retained by a shoulder bolt. When final assembly is complete, the sensor is setting well protected within the hubcap. The sensor harness is located in the axle tube and exits through a strain relief at the center of the tube. The Hall cells are triggered by a series of magnetic poles embedded in a magnet ring that is pressed into a unique Wabash National Hubcap. Use of the Wabash active sensor eliminates the need for the traditional tone ring and mounting blocks. Wabash active sensors are not adjustable, eliminating sensor out-of-adjustment issues.

**⚠ IMPORTANT:** The in-axle sensor is designed to interface with steel hubs. When aluminum hubs are installed on the trailer, use a Wabash Spindle Extension Adapter (10800294) at each sensor. The aluminum hub is longer than a steel hub. This pushes the hubcap interface on the aluminum hub outboard and causes misalignment between the sensor pick-up and the magnet in the hubcap. The result is that the ABS does not receive wheel speed information and the unit will not do ABS and will not turn on the backup lamps! When the spindle extension adapter is installed, longer sensor mounting bolts and lock washers must be used as well. The part number for the longer bolt is BLT00511. The part number for the washer is WSH00153. Using aluminum hubs creates a more complex assembly, however Wabash supports its use.

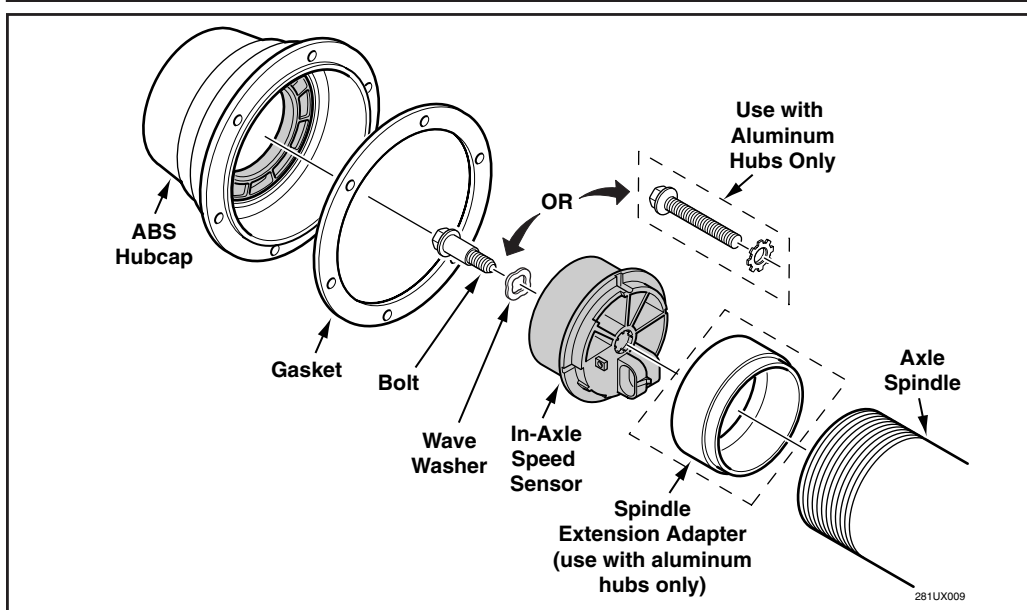


Figure 18, In-Axle Speed Sensor and ABS Hubcap



## **ABS System Diagnostics**

### **Initial System Checkout**

When the system is first powered up the ABS malfunction lamp will come ON for two seconds then go OFF, indicating the system has passed all self-tests. All MBS-2 units and optional features must pass operation checks before the trailer is placed in service.

### **Pneumatic Diagnostics**

The Wabash ABS system does not monitor the air system of the vehicle. For example, if there is an air leak, kink in the line, or faulty relay valve, the ABS malfunction lamp will not show a fault in the system. However, if a malfunction in the air system arises and it cannot be determined if the ABS valve is causing the problem, the ABS can simply be bypassed using a short length of airline and two push-in unions. For example, if an unknown kink exists in the control line and the brakes will not apply, simply remove the airlines from the quick connect fittings on the ABS valve and insert the short length of airline using the push-in unions. The system can then be reexamined without the ABS affecting the system. If the brakes still do not apply it can then be assumed that the ABS valve is not causing the problem.

### **Electrical Diagnostics**

The malfunction lamp is an important tool when assessing the status of the ABS system. When the system is operating properly the malfunction lamp will illuminate briefly, then go OFF every time the system is powered up. If the vehicle is stationary at power up, the lamp will remain ON for two seconds and the PCM will perform a functional test causing an audible clicking or puffing. If the vehicle is mobile at power up, the lamp will remain ON for one second and the PCM self-test will be aborted. The PCM self-test is performed at each stationary power up to give the operator an audible sign that everything is performing normally.

The ABS system receives power from the stop lamp circuit (pin 4 of J560 connector – red) and the auxiliary circuit (pin 7 of J560 connector – blue). This means the system will operate on a tractor with or without the auxiliary circuit powered at tractor ignition. In a situation where the system only receives power from the stop circuit, the malfunction lamp will illuminate briefly each time the brakes are applied and the PCM self test will be performed at each stationary brake application.

Upon power up, if the system behaves differently than described above, such as the malfunction lamp remains illuminated or does not come ON at all, follow the instructions in the next section to determine the cause of the problem.



## Troubleshooting The System

















DIAGNOSTIC SWITCH INPUT	FLASH CODE QUICK REFERENCE	
(ALLOW ONE SECOND BETWEEN PRESSES)		
 X 2 TO READ CURRENT FAULTS PRESS TWO TIMES (HOLD 2ND PRESS FOR THREE SECONDS)	2S AND 4S SYSTEMS	
 X 3 TO READ STORED FAULT PRESS THREE TIMES (HOLD 3RD PRESS FOR THREE SECONDS)		
 X 4 TO CLEAR STORED FAULTS PRESS FOUR TIMES (HOLD 4TH PRESS FOR THREE SECONDS)		
NOTE		4S SYSTEMS ONLY
1) SYSTEMS WITH 1 PCM DO NOT UTILIZE FLASH CODE 11		
2) SYSTEMS WITH 2 SENSORS DO NOT UTILIZE FLASH CODES 7-10 AND SENSORS MAY BE LOCATED ON EITHER FRONT OR REAR AXLE		
 <p style="font-size: x-small; margin-top: 5px;">DECAL PART NUMBER: WN#25000945</p>	 X 3 FLASH THREE TIMES CURBSIDE SENSOR SIGNAL (FRONT CURBSIDE ON 4 SENSOR SYSTEMS)	
	 X 4 FLASH FOUR TIMES CURBSIDE SENSOR CONNECTION (FRONT CURBSIDE ON 4 SENSOR SYSTEMS)	
	 X 5 FLASH FIVE TIMES ROADSIDE SENSOR SIGNAL (FRONT ROADSIDE ON 4 SENSOR SYSTEMS)	
	 X 6 FLASH SIX TIMES ROADSIDE SENSOR CONNECTION (FRONT ROADSIDE ON 4 SENSOR SYSTEMS)	
	 X 7 FLASH SEVEN TIMES CURBSIDE REAR SENSOR SIGNAL	
	 X 8 FLASH EIGHT TIMES CURBSIDE REAR SENSOR CONNECTION	
	 X 9 FLASH NINE TIMES ROADSIDE REAR SENSOR SIGNAL	
	 X 10 FLASH TEN TIMES ROADSIDE REAR SENSOR CONNECTION	
	 X 11 FLASH ELEVEN TIMES SECONDARY PCM FAULT	
	 X 12 FLASH TWELVE TIMES PRIMARY PCM FAULT	
	 X 14 FLASH FOURTEEN TIMES LOW VOLT AGE TO ABS	
	 X 15 FLASH FIFTEEN TIMES ELECTRONIC CONTROL MODULE	

Figure 19, MBS-2 Flash Code Decal



### Entering the flash code diagnostic mode

Fault identification is provided via flashes of the ABS malfunction lamp. To enter the flash code diagnostic mode, it must be possible to power the auxiliary circuit. On March 1997 and newer tractors, this circuit is switched with the ignition. Alternately, a suitable light tester may be used.

### Suitable Light Tester

When using a light tester to power any ABS system, supply power directly from a battery, not a charger. The charger may remain connected to the battery to keep the battery charged, but the charger can not be used as the power source. See figure 20.

Faults are categorized in two types:

- Current Faults – Faults that are active when the system is powered up, causing the malfunction lamp to remain illuminated. All current faults become stored faults after they are repaired.
- Stored Faults – Faults that were current faults at one time, but are no longer active and allow the malfunction lamp to go OFF at power up. Typically they may be caused by intermittent problems that only occur when the vehicle is moving.

Both, stored faults and current faults can be identified using the ABS flash code system.

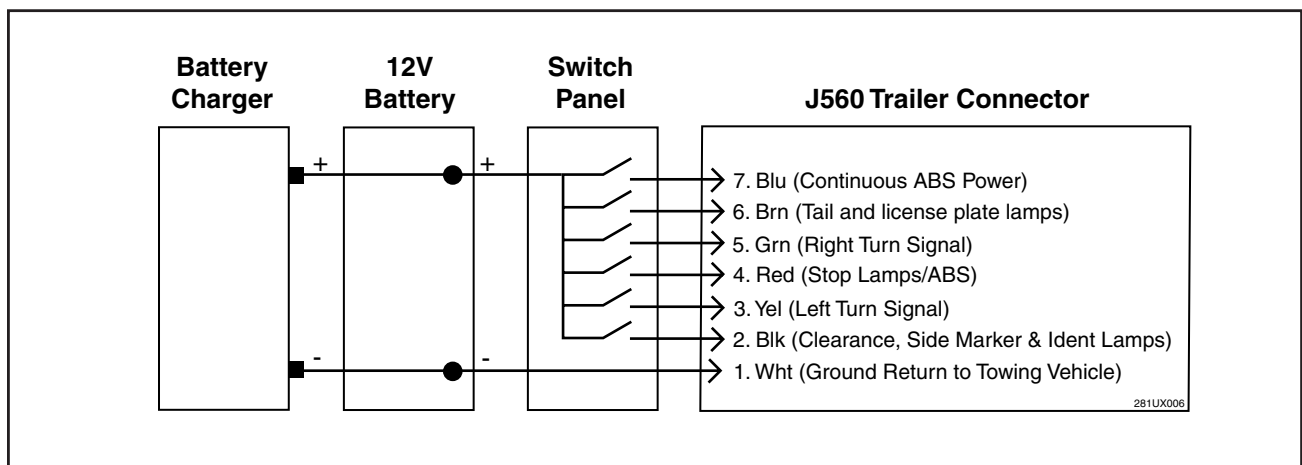


Figure 20, Typical Trailer Light Test Unit Suitable for Use with ABS



### **Current Faults**

To access the flash code identification for a current fault, turn all power OFF to the ABS and perform the following steps.

1. Power the stop lamp circuit (red) and allow power to remain ON this circuit until the flash code has been identified (see step 3 below). The malfunction lamp will light with the stop lamps and remain ON (if the lamp goes out, there are no current faults).

---

**NOTE: This circuit can be powered with a suitable light tester or by pulling down on the trailer brake lever in the cab.**

---

2. Power the auxiliary circuit (blue) for one second, then power down for one second, then power back up and allow the power to remain ON until the flash code has been identified (power ON two times).

---

**NOTE: This circuit can be powered with a suitable light tester or by turning the ignition ON and OFF on newer model tractors.**

---

3. The malfunction lamp will begin flashing a code. The code is identified by the number of times the lamp illuminates.

---

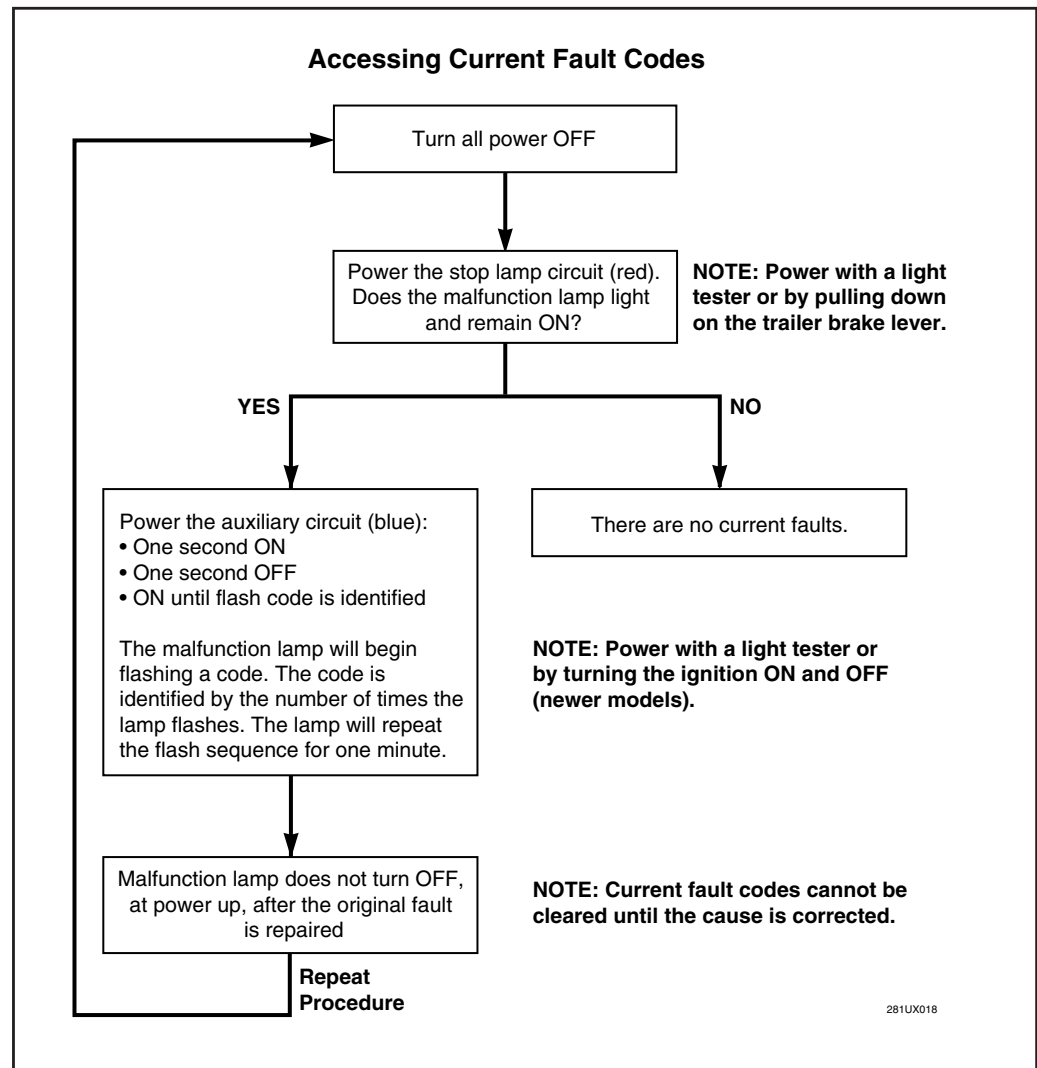
**NOTE: After the first flash sequence, the lamp will turn OFF briefly then repeat the flash sequence. This will continue for one minute allowing time to reach the trailer ABS light and record the number of flashes.**

---

To identify the fault, the code will correspond to a specific fault found in the Flash Code Identification Table on page 37. Before any maintenance is performed, disconnect all power from the system.

In the unlikely event that more than one fault is present, the malfunction lamp will not turn OFF at power up after the original fault is repaired. Repeat the above steps to identify other faults. This allows repair personnel to focus on one fault at a time.

If a stored fault exists, it will be identified after you clear the last stored fault (see Clearing Stored Faults). Current faults will always be displayed first and cannot be cleared.



**Figure 21, Accessing Current Fault Codes**



### **Stored Faults**

To access the flash code identification for a stored fault, turn all power OFF to the ABS and perform the following steps.

---

**NOTE: This procedure should only be required during annual routine maintenance or when there is an intermittent problem that does not show up at stationary power up. For example, if a wheel locks up for an extended period of time because of a foundation brake malfunction.**

---

1. Power the stop lamp circuit (red) and allow power to remain ON this circuit until the flash code has been identified (see step 3 below). The malfunction lamp will light with the stop lamps and then turn OFF.

---

**NOTE: This circuit can be powered with a suitable light tester or by pulling down on the trailer brake lever in the cab.**

---

2. Power the auxiliary circuit (blue) for one second, power down for one second, power back up for one second, power down for one second, then power back up and allow the power to remain ON until the flash code has been identified (power ON three times).

---

**NOTE: This circuit can be powered with a suitable light tester or by turning the ignition ON and OFF on newer model tractors.**

---

3. The malfunction lamp will begin flashing a code. The code is identified by the number of times the lamp illuminates.

---

**NOTE: After the first flash sequence, the lamp will turn OFF briefly then repeat the flash sequence. This will continue for one minute allowing time to reach the trailer ABS light and record the number of flashes.**

---

To identify the fault code, refer to the Flash Code Identification Table on page 37.

Before any maintenance is performed, all power must be disconnected from the system.

If more than one stored fault exists, it will be identified after you clear each fault.

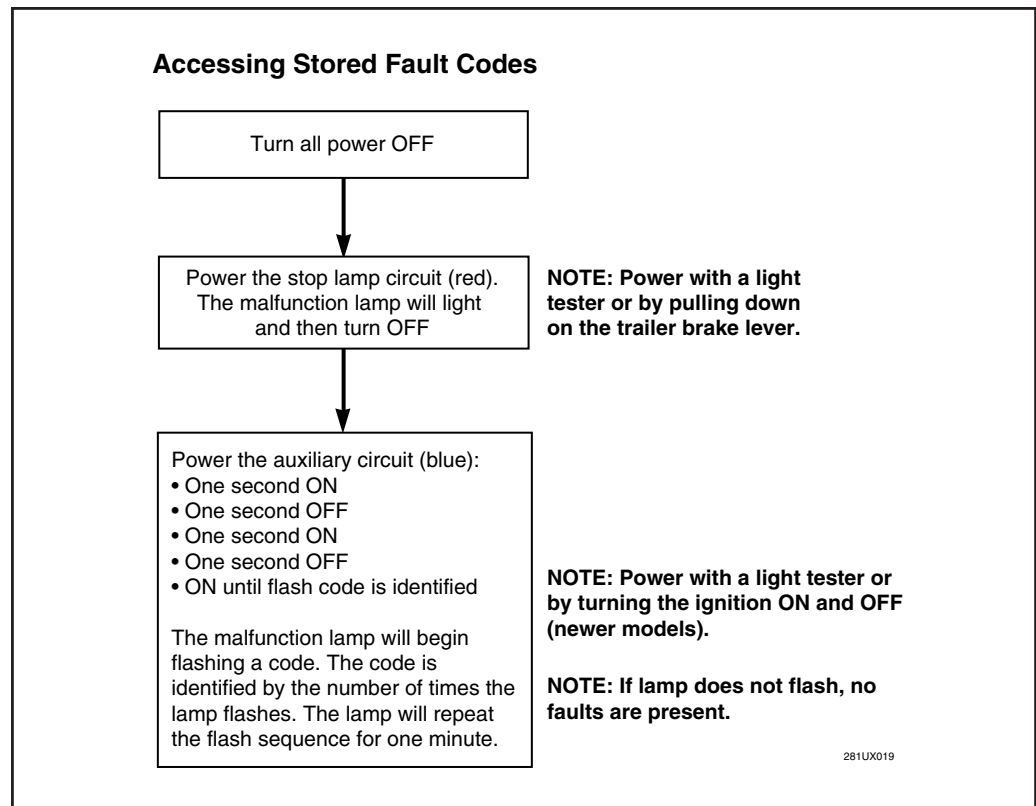


Figure 22, Accessing Stored Fault Codes



### **Clearing Stored Faults**

To clear a stored fault, turn all power OFF to the ABS and perform the following steps:

1. Power the stop lamp circuit (red) and allow power to remain ON this circuit until the faults have been cleared (see step 3 below). The malfunction lamp will light with the stop lamps and turn OFF.

---

**NOTE: This circuit can be powered with a suitable light tester or by pulling down on the trailer brake lever in the cab.**

---

2. Power the auxiliary circuit (blue) for one second, power down for one second, power back up for one second, power down for one second, power up for one second, power down for one second, then power back up and allow the power to remain ON (power ON four times).

---

**NOTE: This circuit can be powered with a suitable light tester or by turning the ignition ON and OFF on newer model tractors.**

---

3. The malfunction lamp will begin flashing rapidly for ten seconds signaling the system is in the fault clear mode. The fault is actually cleared in the first fraction of a second but the delay is designed to allow time for the technician to confirm the fault clear mode was entered.

---

**NOTE: This rapid flashing will occur even if no fault is present.**

---

After the rapid flash sequence, the malfunction lamp will turn OFF and remain OFF unless another stored fault exists.

The malfunction lamp will flash a fault code shortly after the rapid flash sequence if more than one fault was stored in memory. After the appropriate number of flashes, the lamp will turn OFF briefly, then repeat the flash sequence. This will continue for one minute, giving personnel time to return from the tractor cab to check the count. To identify the code, refer to the Flash Code Identification Table.

---

**NOTE: The ON and OFF periods for entering the above modes do not have to be exactly one second. However, one should use slow and deliberate motions when powering ON and OFF.**

---

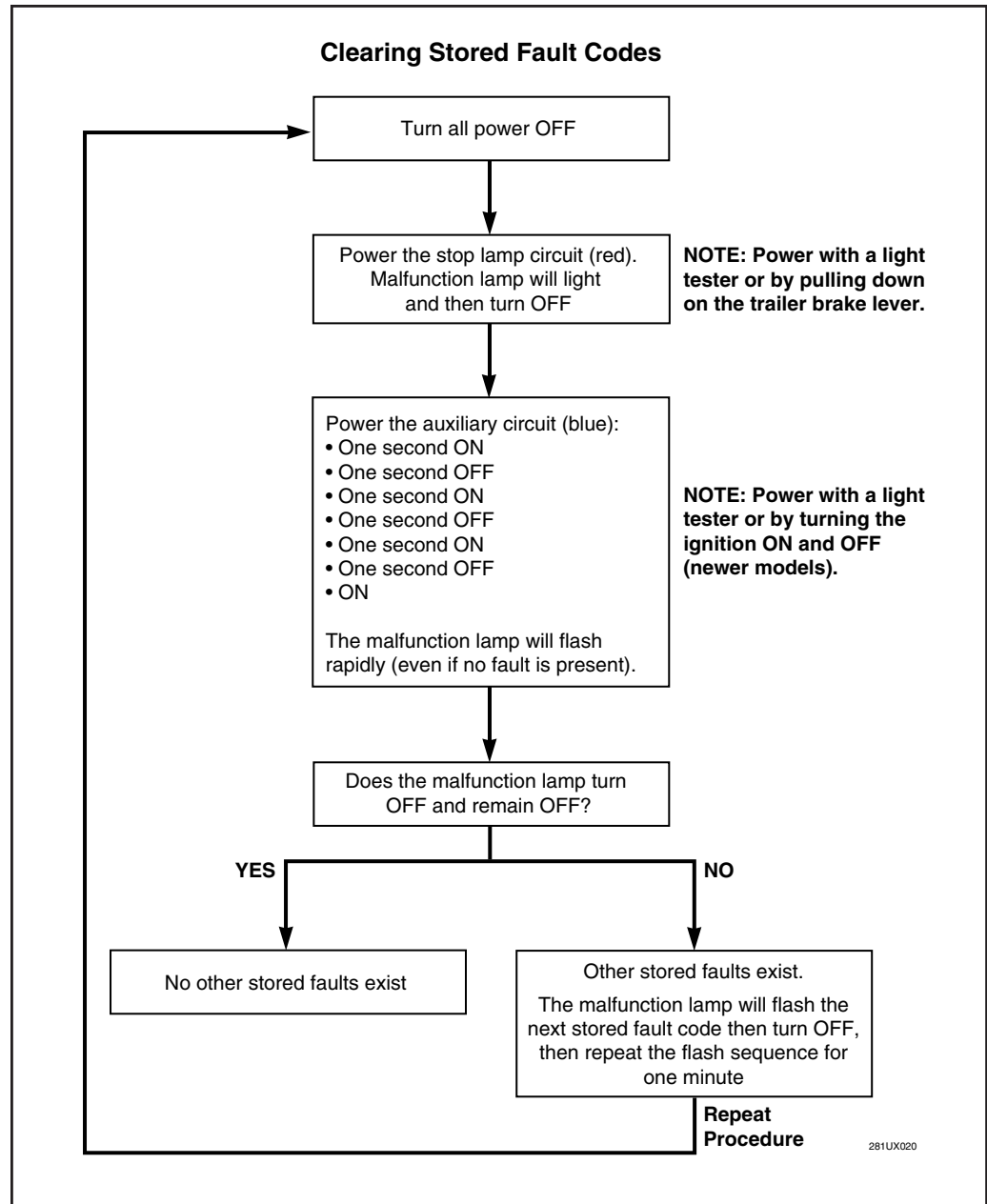


Figure 23, Clearing Stored Fault Codes



## **Malfunction Lamp Diagnostic Switch**

All MBS-2 units have a malfunction lamp diagnostic switch. This diagnostic switch is located in the malfunction lamp wiring harness, behind the base rail where the malfunction lamp is mounted. The diagnostic switch works much like turning the auxiliary circuit ON and OFF on a newer model tractor. Pressing the button on the diagnostic switch two times will produce the same result as turning the auxiliary circuit ON and OFF two times to view a current fault.

There are subtle differences between using the diagnostic switch and the auxiliary circuit. When using the diagnostic switch, for instance, the warning lamp will not illuminate while the diagnostic switch is being pressed. Therefore, instead of holding the button down on the last desired cycle (equivalent to leaving the auxiliary circuit ON after the last desired cycle when using the auxiliary circuit method), the diagnostic switch must be released after three seconds to view the fault code. For example, to view a stored fault, perform the following steps:

1. Power the system using the stop lamp circuit (red) and/or the auxiliary circuit (blue), until the malfunction lamp goes OFF.

---

**NOTE: This circuit can be powered with a suitable light tester or by turning the ignition ON for newer model tractors.**

---

2. Press and hold the button for one second, release it for one second, press for one second, release for one second, then press and hold for three seconds then release.
3. The malfunction lamp will then flash a stored fault code if one is present.

---

**NOTE: The malfunction lamp diagnostic switch will not operate once wheel speed is detected. Therefore, a stationary power up is required to activate the switch.**

---

The malfunction lamp diagnostic switch is an exclusive Wabash National feature and has significant advantages. The technician is in close proximity to the malfunction lamp where all information from the ECM is received. A quick reference decal listing fault codes is located adjacent to the malfunction lamp for convenience. Another advantage is that it's not important which circuit is powered or if both are powered, thereby eliminating some confusion.





Flash Code	Fault	Comments
3	Curbside front sensor signal fault.	Check hubcap and sensor for proper attachment to the wheel end. Check wiring to sensor.
4	Curbside front sensor connection fault.	Check all harnesses to the sensor for damage.
5	Roadside front sensor signal fault.	Check hubcap and sensor for proper attachment to the wheel end. Check wiring to sensor.
6	Roadside front sensor connection fault.	Check all harnesses to the sensor for damage.
7	Curbside rear sensor signal fault.	Check hubcap and sensor for proper attachment to the wheel end. Check wiring to sensor.
8	Curbside rear sensor connection fault.	Check all harnesses to the sensor for damage.
9	Roadside rear sensor signal fault.	Check hubcap and sensor for proper attachment to the wheel end. Check wiring to sensor.
10	Roadside rear sensor connection fault.	Check all harnesses to the sensor for damage.
11	Secondary PCM fault.	Separate the ECM from the <b>secondary</b> PCM. Check that the connector and socket are secured together properly. If the fault persists, replace the secondary PCM.
12	Primary PCM fault.	Separate the ECM from the <b>primary</b> PCM. Check that the connector and socket are secured together properly. If the fault persists, replace the primary PCM.
14	Low voltage to ABS.	Check tractor and trailer wiring on auxiliary and stop lamp circuits. Check tractor battery and charging system.
15	Electronic Control Module failure.	Replace the ECM.
<p><b>NOTE:</b> A two-sensor system does not contain 7 through 10 blink codes and a one-PCM system does not include the 11-blink code. The primary PCM is the PCM closest to the Electronic Control Module (ECM) and the secondary PCM is the furthest from the ECM.</p>		

281UX029

Figure 24, Flash Code Identification Table



## **In-Axle Wheel Speed Sensor and Reverse Detect Feature**

The MBS-2 system incorporates an active Hall effect in-axle wheel speed sensor in place of the passive VR wheel speed sensor used in all other ABS systems. This wheel speed sensor is mounted on the axle end using the freeze plug to secure it in place while the magnet is located inside the hubcap. The use of this technology provides several advantages. The sensor can detect reverse motion of the vehicle. This allows the ABS to control backup lights or any other accessory needed to be turned ON or OFF during reverse motion. Other advantages are that the sensor and wiring harnesses are located in a protected environment and sensor gap issues simply do not apply. The sensor also contains a temperature sensor that is used to alert the operator and maintenance personnel of an elevated bearing temperature. This is done with the use of an optional secondary trailer warning lamp. The location of this lamp is also optional according to customer preference and legal requirements. See pages 44 and 45 for more information.

The reverse detect feature activates based on input from two sensors. On a four-sensor system this means that the feature is activated from the front axle sensors input. Both wheels must be rotating in reverse at a speed less than fifteen miles per hour and auxiliary power must be present in order for the feature to be activated. The reverse detect feature is not activated immediately when the vehicle moves backward for the first time to avoid turning on the lamps when the vehicle inadvertently drifts backward at a stoplight. There is a 2.5-second delay built into the system to avoid this. Once the vehicle is moving in reverse for 2.5 seconds the backup lights will come on and remain on until the vehicle is stopped for ten seconds or the operator pulls forward for more than five seconds. However, they will illuminate immediately every time the vehicle is reversed until the vehicle exceeds 10 miles per hour while moving forward or the vehicle moves forward for more than five seconds. Then the reverse detection system is reset back to the 2.5-second delay.

---

**NOTE: When performing an installation of MBS-2 with backup lamps, always check backup lamp operation before releasing the unit for service.**

---

In the event the reverse lights do not illuminate when they should, here are some troubleshooting steps to follow:

1. Make certain there are no current faults on the system. (The malfunction lamp will go out at power up.) If a current fault exists, correct the problem and recheck the operation of backup lamps.



2. Check for auxiliary power at the J560 connector from the tractor (center pin). If a light tester is used, be sure to supply voltage to the tester using a battery. A battery charger may be used to keep the battery charged but may not be connected to the tester if a battery is not present. If there is no power on the center pin, the backup feature will not operate. Auxiliary power should also be present at the ABS power connector, pin B of the Weather Pack 5-way located in front of the slider hose bracket mounted to the trailer underbody. If no power is present, check the connections of the ABS power cable in the J560 connector. The red wire should be on the bottom pin (red) the blue wire should be on the center pin (blue) and the white wire should be on the ground circuit (white). If power is present at the J560 connector, check the ABS harness for damage.



**IMPORTANT: When performing the troubleshooting step below spin the wheels in a slow, deliberate manner.**

---

3. The reverse lamp circuit receives power from the accessory cable (the eighteen-inch long harness exiting the ECM housing and terminating in a Deutsch four-socket DTM06-4S connector). When holding the connector with the sockets facing you and the connector clasp at the top, the sockets are numbered one through four counterclockwise, starting in the top left position. Socket one is the backup circuit. Using a voltage tester, confirm that 12 VDC is present on socket one when the wheels are rotated in the reverse direction. Socket two works the opposite way, power is present full time until the wheels are reversed. Socket two can be checked for power to confirm the ABS is receiving adequate power. If power is not present on socket one when the wheels are reversed, but is present on socket two, the system is not receiving a wheel speed signal from one of the sensors. If this is the case, a sensor signal fault should be present on the system (a three or five flash fault). Check sensor wiring for damage.
4. If power exists in all the above areas, there is a problem with the backup harness (the harness between the ABS and the backup lamps). Check the pins in the mating plug on the backup harness to be sure they are not bent or missing, and verify the lamps have sufficient ground.



5. The following troubleshooting scheme should only be performed after all the above troubleshooting steps have been completed. If in a rare case an in-axle sensor harness is defective, with the speed signal and ground leads crossed, the MBS-2 will not see this as a fault until the trailer is moving. Once moving, the system turns on the warning lamp as it is receiving an inadequate signal from the wheel with the defective harness.



**IMPORTANT: When performing the troubleshooting step below spin the wheels in a slow, deliberate manner.**

To troubleshoot this type of problem, power the auxiliary circuit and check for 12 VDC on pin two of the 4-pin Deutsch connector on the accessory cable. (See figure 29 on Page 46 “MBS-2 Electrical Schematic”) Voltage should be present at power up. Locate the wheels on the front axle of a four-sensor system or the sensed wheels of a two-sensor system. Spin the wheels in opposite directions, one forward and the other in the reverse direction, for ten seconds. The power on pin two of the accessory cable should drop to zero. If it does not the wheel that was spun in the reverse direction has a defective harness. If power does drop to zero spin the wheels forward to reestablish power on pin two. Spin the wheels in the opposite direction again, only spin the wheel that was spinning in the reverse direction before in the forward direction and spin the wheel that was spinning in the forward direction before in the reverse direction for ten seconds. As before if the power does not drop to zero then the wheel spinning in the reverse direction has the defective harness. If the power still drops to zero after both above cases have been performed then the problem exists in the backup harness, not the in-axle harnesses.



Figure 25, Backup Light Decal

### Sensor Signal Faults (Trace)

While the trailer is moving, the MBS-2 continually compares the wheel speed signals from each sensor. If a wheel speed signal becomes inadequate, a sensor signal fault is detected. The malfunction lamp illuminates and the fault code is stored in memory. However, the fault detection mechanism is different from other faults because a bad signal fault is only detected when the trailer is moving. All other faults are electrical in nature and are detected at power up.

Because of this difference, sensor signal faults result in slightly different malfunction lamp behavior. The concept of a fault “trace” helps explain how the malfunction lamp functions. A fault trace is between a current fault and a stored fault.

- A current fault represents an existing fault condition. It causes the ABS malfunction lamp to be illuminated and disables trailer ABS.
- A stored fault is a record of a previous fault that no longer exists. It has no affect on normal malfunction lamp operation or ABS function.
- A fault trace is a temporary record of an earlier fault that slightly modifies malfunction lamp operation but does not affect ABS function. It normally clears itself within about two minutes of normal driving if the signal is okay.

**NOTE: The concept of a fault trace only applies to sensor signal faults.**

On the next stationary power up after a sensor signal fault is detected, the malfunction lamp remains ON due to the presence of a fault trace, providing an indication of a malfunction. A flash code read for current faults will indicate the appropriate sensor signal fault.

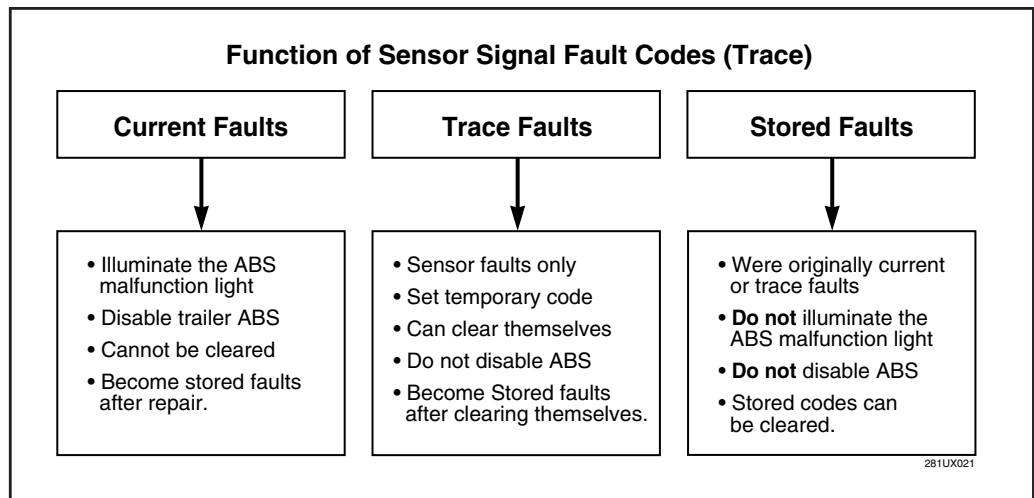


Figure 26, Trace Sensor Signal Codes



Unlike a regular fault, on the next stationary power up after the fault is repaired, the lamp will remain ON because the fault trace is still present. Once the trailer moves, and assuming both signals are now present, the malfunction lamp will go out and ABS function will be available. However, a trace of the fault still remains, even though the fault no longer exists as a current fault. If the trailer immediately stops and goes through a power OFF/ON cycle, the malfunction lamp will again remain illuminated until the trailer starts to move. The ECM still is not satisfied that the sensor signal fault is absolutely gone, taking about two minutes of normal driving above 5 mph before the trace of the fault is completely cleared with a restored signal. After the next power OFF/ON cycle, the malfunction lamp behaves as normal, illuminating for two seconds, then turning OFF. The fault trace is gone and will be replaced by a stored fault in memory.

The fault trace can also be cleared in the shop by either of two methods:

- Jack up and spin only the wheel that had the faulty signal. The malfunction lamp will go OFF immediately and return to normal behavior. This approach does not clear the stored sensor signal fault. It is still available as a record, just like any other stored fault.

---

**NOTE: All other wheels must remain stationary while spinning the wheel that introduced the fault.**

---

- The second method of clearing the fault trace in the shop is to restore the sensor signal, then clear the signal fault. The fault trace will also be cleared. Proceed as usual to clear any stored fault.

The trace fault management philosophy provides an excellent compromise. It assures there is a fault indication on the next power up after sensor signal fault detection. After the signal has been restored, normal malfunction lamp behavior resumes within about two minutes of normal driving.



## **ABS Malfunction and Trailer Warning Lamp Troubleshooting**

---

**NOTE: Refer to the schematic on page 46 when troubleshooting the ABS Malfunction Lamp or the Trailer Warning Lamp.**

---

If the lamp does not illuminate at power up but the solenoids perform the self-test (audible sound) or air brake sounds (chuffing sound) with treadle valve applied, check the following:

- The lamp power harness may be disconnected.
- The bulb may have a bad ground connection.
- The malfunction lamp may be faulty.

If the lamp does not illuminate on power up and the solenoids do not perform the self-test, check the following:

- The MBS-2 may not be receiving power. Check the Weather Pack 5-way power connector for a loose connection.
- The MBS-2 may have failed.

---

**NOTE: When checking for proper operation, keep in mind the malfunction lamp circuit is only powered for two seconds at initial power up.**

---

If a replacement part or other customer service is needed, please contact the Wabash National Corporation Customer Service Department at 765-771-5389.



## Trailer Warning Lamp

### Normal Operation

Like the ABS Malfunction Lamp, the Trailer Warning Lamp will come ON for two seconds then go OFF at each stationary power up. This indicates that the Trailer Warning bulb and wiring harness are operational.

---

**NOTE: On units manufactured June, 2002 or later, either an LED or an incandescent bulb can be used for the Trailer Warning Lamp.**

---

If the lamp does not illuminate at power up, refer to ABS Malfunction and Trailer Warning Lamp Troubleshooting on page 43.

### Continuous Brake Apply Warning

The continuous brake apply warning is a feature of the MBS-2 that signals the operator if the treadle valve on the tractor has become stuck open, resulting in the brakes being applied without the operator’s knowledge. The warning is initiated based on vehicle speed and the duration the stop circuit is powered. The graph below illustrates when the warning becomes active. The line represents when the warning is triggered. See Figure 27.

### Wheel End Temperature Warning

The wheel end temperature warning is initiated when the wheel speed sensor detects a rise in temperature on one of the wheel ends.

Refer to Figure 28 for a description of trailer warning lamp flash codes and their causes.

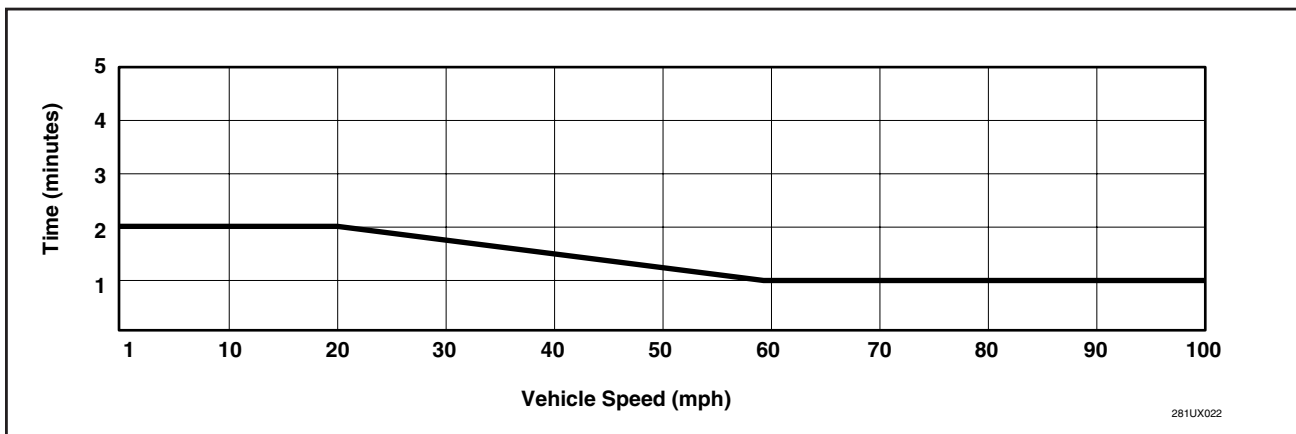


Figure 27, Continuous Brake Apply Warning Graph



### Accessing Trailer Warning Lamp Codes

Trailer warning lamp fault codes are accessed in the same manner as the ABS system faults. Access trailer warning lamp fault codes as follows:

- To view current faults, refer to page 30.
- To view stored faults, refer to page 32.
- To clear stored faults, refer to page 34.

**TRAILER WARNING LAMP (TWL)  
MBS-2 ENHANCED FUNCTIONALITY**

DIAGNOSTIC SWITCH INPUT

(ALLOW ONE SECOND BETWEEN PRESSES)

X 2 TO READ CURRENT FAULTS  
PRESS TWO TIMES  
(HOLD 2ND PRESS FOR THREE SECONDS)

X 3 TO READ STORED FAULT  
PRESS THREE TIMES  
(HOLD 3RD PRESS FOR THREE SECONDS)

X 4 TO CLEAR STORED FAULTS  
PRESS FOUR TIMES  
(HOLD 4TH PRESS FOR THREE SECONDS)

FLASH CODE QUICK REFERENCE

X 2 BLINK 2 TIMES  
CONTINUOUS BRAKE APPLY

X 4 BLINK 4 TIMES  
RS FRONT BEARING TEMPERATURE

X 5 BLINK 5 TIMES  
CS FRONT BEARING TEMPERATURE

X 6 BLINK 6 TIMES  
RS REAR BEARING TEMPERATURE

X 7 BLINK 7 TIMES  
CS REAR BEARING TEMPERATURE

NOTE

*DIAGNOSTIC SWITCH IS OPTIONAL ON TWL.  
REFER TO MBS-2 MANUAL IF NOT PRESENT.*

DECAL PART NUMBER: WNC#25000985

281UX008

Flash Code	Condition	Comments
2	Continuous brake apply	Check air system on service brakes or electrical wiring to stop lamp circuit.
4	Roadside front bearing temperature	Check roadside front wheel end for overheated bearings.
5	Curbside front bearing temperature	Check curbside front wheel end for overheated bearings.
6	Roadside rear bearing temperature	Check roadside rear wheel end for overheated bearings.
7	Curbside rear bearing temperature	Check curbside rear wheel end for overheated bearings.

281UX034

Figure 28, Trailer Warning Lamp Flash Code Identification Table and Decal

# MBS-2 Installation

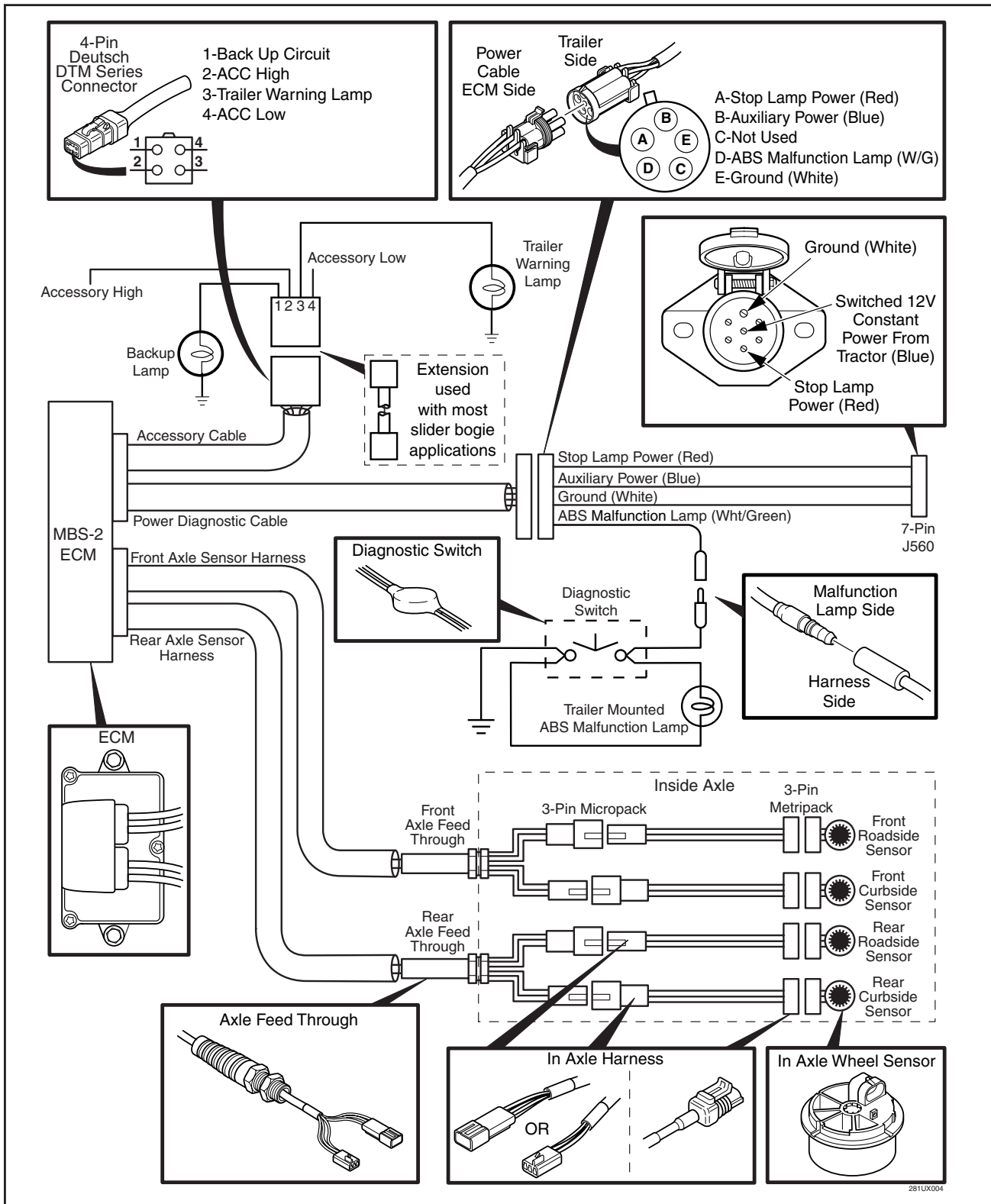


Figure 29, MBS-2 Electrical Schematic



## Glossary

<b>2S-1M</b>	Two sensor, one modulator system.
<b>2S-2M</b>	Two sensor, two modulator system.
<b>4S-1M</b>	Four sensor, one modulator system.
<b>4S-2M</b>	Four sensor, two modulator system.
<b>Axle-by-Axle Control</b>	Axle-by-axle control is available only on 4S-2M systems. Each sensed axle is controlled independently based on wheel speeds from both wheels on a single axle.
<b>Side-by-Side Control</b>	Side-by-side control is available only on 4S-2M systems. Each side of the vehicle is controlled independently based on wheel speeds from sensed wheels on each side of the vehicle.
<b>ACM</b>	Antilock Control Module. Consists of ECM and PCMs.
<b>Current Faults</b>	Faults that are active when the system is powered up which cause the malfunction lamp to remain illuminated.
<b>ECM</b>	Electronic Control Module.
<b>Flash Code</b>	A series of flashes of the malfunction lamp, providing fault code identification.
<b>Malfunction Lamp</b>	Located on the rear driver side corner of the vehicle just forward of the rear marker lamp, the malfunction lamp verifies the system is functioning properly or alerts the operator if a problem arises with the ABS.
<b>Trailer Warning Lamp</b>	Alerts the operator if a problem arises with a system not related to the basic antilock function. For example, elevated wheel end temperatures.
<b>MBS-2</b>	Wabash's ACM that utilizes the in-axle wheel speed sensor system, including backup control and wheel end temperature monitoring.
<b>PCM</b>	Pneumatic Control Module.



<b>Stored Faults</b>	Faults that were current faults at one time, but are no longer present and allow the malfunction lamp to go out at power up.
<b>Trace Fault</b>	A temporary record of a previous fault that slightly modifies malfunction lamp operation but does not affect ABS function.
<b>Wheel Speed Sensors</b>	Located either in the front and/or rear axle, depending on the geometry of each particular tandem, the wheel sensors receive wheel speed information.



## Notes

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