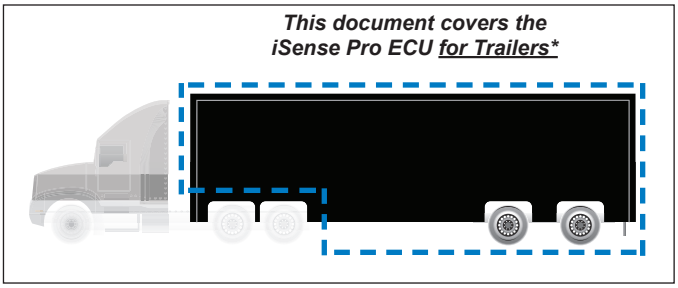
Bendix® iSense™ Pro Air Disc Brake (ADB) Continuous Wear-Sensing Electronic Control Unit (ECU) for TRAILERS



** Refer to SD-31-70082 on B2Bendix.com for information related to the **tractor** iSense and iSense Pro ECU.*

INTRODUCTION

The Bendix® iSense™ Pro Air Disc Brake (ADB) Continuous Wear-Sensing Trailer Electronic Control Unit (ECU) is a device designed to help improve the brake pad and rotor life-monitoring ability of vehicles equipped with Bendix trailer ADBs.

The ADB ECU uses wear sensors to actively monitor the wear life remaining percentage of each wheel-end as a combined measurement of the inboard pad, outboard pad, and rotor. The ADB ECU can monitor continuous wear sensors on up to eight (8) wheel-ends on a single vehicle.

Figure 1 – ADB Wear-Sensing ECU

⚠ WARNING

Bendix wear-sensing ECUs are designed to be warning-only devices. The information broadcast by the ECU shall not be used to make adjustments to the braking characteristics of the vehicle.

⚠ WARNING

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix wear-sensing ECU does not replace the need for a skilled, alert, professional driver, performing pre-trip inspections, reacting appropriately and in a timely manner, and using safe driving practices. Wear-sensing ECUs do not remove the need to perform normal inspections and perform preventative maintenance.

⚠ IMPORTANT

Wear sensing does not replace routine inspections. Routine inspections should always be conducted. *Refer to SD-23-7541, Bendix® ADB22X®, ADB22X-V™ and ADB22X®-LT Air Disc Brakes, on B2Bendix.com for further inspection details.*

HARDWARE CONFIGURATION

The ADB wear-sensing ECU is designed to work on a 12-volt system and is compatible with 250k and 500k baud rate J1939 CAN buses.

ECU MOUNTING

The ADB wear-sensing ECU can be mounted within the trailer box or on the frame and is compatible with continuous wear sensors. The ECU connector should be installed only by hand until it clicks into place. The ECU has two (2) through-hole mounting tabs to be used for mounting; please refer to OE documentation regarding mounting methods and torques.

To ensure the product performs as intended and to prevent corrosion, all unused wire slots in the ECU connectors must be plugged and receive any necessary protection from moisture, etc. The ADB wear-sensing ECU utilizes a connector from the Deutsch DT product family.

GENERAL SAFETY GUIDELINES

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following guidelines should be observed AT ALL TIMES:

- **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear personal protection equipment.**
- **Stop the engine and remove the ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated, or electrically charged components.**
- **Do not attempt to install, remove, disassemble, or assemble a component until you have read, and thoroughly understand, the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.**
- **If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with a Bendix® AD-IS® air dryer system, a Bendix® DRM™ dryer reservoir module, a Bendix® AD-9si®, AD-HF®, or AD-HFi® air dryer, be sure to drain the purge reservoir.**
- **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
- **Never exceed manufacturer's recommended pressures.**
- **Never connect or disconnect a hose or line containing pressure; it may whip and/or cause hazardous airborne dust and dirt particles. Wear eye protection. Slowly open connections with care, and verify that no pressure is present. Never remove a component or plug unless you are certain all system pressure has been depleted.**
- **Use only genuine Bendix® brand replacement parts, components, and kits. Replacement hardware, tubing, hose, fittings, wiring, etc. must be of equivalent size, type, and strength as original equipment and be designed specifically for such applications and systems.**
- **Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.**
- **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
- **For vehicles with Automatic Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.**
- **The power MUST be temporarily disconnected from the radar sensor whenever any tests USING A DYNAMOMETER are conducted on a vehicle equipped with a Bendix® Wingman® system.**
- **You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.**

SOFTWARE CONFIGURATION

Bendix® Air Disc Brake (ADB) wear-sensing Electronic Control Units (ECUs) are not re-configurable and are sold with a pre-configured software set that is identified by a part number. *Refer to B2Bendix.com.*

ELECTRONIC CONTROL UNIT (ECU) INPUTS AND OUTPUTS

The ADB wear-sensing ECU has one (1) ignition and one (1) ground input and is designed to operate at a nominal supply voltage of 12 volts. The ignition input is the power source for the ECU and should be supplied through a 5-amp fuse. The operating voltage range is 9.0 to 18.0 VDC. **NOTE**: ECU operation is not guaranteed outside of the operating range.

ECU WIRING HARNESS

Bendix does not provide the wiring harness that connects to the ECU. It is the responsibility of the vehicle manufacturer to incorporate the wear-sensing ECU wiring harness into their vehicle harness. The minimum wire gauge for connectors is 20 AWG. The ECU connector should be secured by hand until the connector clicks into place. *Refer to the Troubleshooting: Electronic Control Unit (ECU) Wiring Harness Connectors section of this document.*

SENSOR POWER AND GROUND

The ECU supplies three (3) 5-volt power and ground outputs to be utilized by the continuous wear sensor. *Refer to Table 2.*

SAE J1939 SERIAL COMMUNICATIONS

A Controller Area Network (CAN) data link (SAE J1939) is provided for communication. This link is used for various functions, including broadcasting the brake pad and rotor life remaining and circuit diagnostic messages.

The wear-sensing ECU utilizes SAE J1939 CAN protocol to communicate brake pad and rotor wear status. The ECU utilizes *PGN 64512 - Trailer Wheel Brake Wear Life Remaining Information* message to broadcast brake pad and rotor wear information.

DIAGNOSTIC TROUBLE CODES (DTCs) FOR CONTINUOUS WEAR SENSORS

If an issue is detected with one of the continuous wear sensors, a DTC will be broadcast to indicate what kind of failure that sensor is experiencing. All other wear sensors should maintain normal function. *Refer to the Troubleshooting section for more information.*

CONTINUOUS WEAR SENSOR

Continuous wear sensors provide a combined measurement (as a percentage) of the inboard and outboard brake pads plus the rotor remaining on each ADB. The sensor is incorporated into the ADB for wear sensing from the factory. The calibrated wear sensor provides a voltage output to the ECU. This signal is then converted to a percentage and broadcast over the J1939 CAN bus. The continous wear sensor functions on a 5V supply voltage. If the sensor outputs a voltage signal of less than 4V, the brake wear life remaining is in the “good” range. If the sensor outputs a voltage signal of greater than or equal to 4V, the brake wear life remaining is considered to be “worn.”

IMPORTANT

This sensor does not substitute routine inspection and maintenance.

NOTE: Request of ADB wear sensing must be specified at the time of order, as continuous wear sensors cannot be installed after the caliper has already been assembled.

COMMUNICATION

The ADB wear-sensing ECU can utilize all eight (8) SPNs of PGN 64512 correlating to trailer axle #1-#4 depending on the ECU axle configuration. *Refer to Table 1.*

Refer to Table 5 for further information on SPN/FMI.

PGN	PARAMETER GROUP LABEL	ACRONYM	SPN	SPN LABEL	DATA RANGE	ECU AXLE CONFIGURATION			
						1 AXLE	2 AXLE	3 AXLE	4 AXLE
64512	Trailer Wheel Brake Wear Life Remaining Information	TWBW	22754	*Brake Wear Life Remaining, Trailer Axle #1, Left Wheel*	0% to 100%	X	X	X	X
			22755	*Brake Wear Life Remaining, Trailer Axle #1, Right Wheel*	0% to 100%	X	X	X	X
			22756	*Brake Wear Life Remaining, Trailer Axle #2, Left Wheel*	0% to 100%		X	X	X
			22757	*Brake Wear Life Remaining, Trailer Axle #2, Right Wheel*	0% to 100%		X	X	X
			22758	*Brake Wear Life Remaining, Trailer Axle #3, Left Wheel*	0% to 100%			X	X
			22759	*Brake Wear Life Remaining, Trailer Axle #3, Right Wheel*	0% to 100%			X	X
			22760	*Brake Wear Life Remaining, Trailer Axle #4, Left Wheel*	0% to 100%				X
			22761	*Brake Wear Life Remaining, Trailer Axle #4, Right Wheel*	0% to 100%				X
			22762	*Brake Wear Life Remaining, Trailer Axle #5, Left Wheel*	0% to 100%				
			22763	*Brake Wear Life Remaining, Trailer Axle #5, Right Wheel*	0% to 100%				
			22764	*Brake Wear Life Remaining, Trailer Axle #6, Left Wheel*	0% to 100%				
			22765	*Brake Wear Life Remaining, Trailer Axle #6, Right Wheel*	0% to 100%				
			22766	*Brake Wear Life Remaining, Trailer Axle #7, Left Wheel*	0% to 100%				
			22767	*Brake Wear Life Remaining, Trailer Axle #7, Right Wheel*	0% to 100%				
			22768	*Brake Wear Life Remaining, Trailer Axle #8, Left Wheel*	0% to 100%				
			22769	*Brake Wear Life Remaining, Trailer Axle #8, Right Wheel*	0% to 100%				
65216	Service Information	SERV	911	Service Component Identification *Service Component Identification*	Not Broadcast (or 15)	X	X	X	X

Table 1 – Communication

DRIVER WARNING DEVICES

Individual Original Equipment Manufacturers (OEMs) are responsible for integrating this information into their dash. OEMs shall follow those rules laid out in Federal Motor Vehicle Safety Standards (FMVSS) for warning light operation, symbol, and color for brake pad and rotor wear.

IMPORTANT

The ADB wear-sensing ECU may broadcast the "Service Component Identification" message with the number "15" if any wheel position is below 10% life remaining or there is a Diagnostic Trouble Code (DTC) present. That message will not stop broadcasting until all wheel positions are above 15% life remaining and there are no DTCs active.

REMOVING THE BENDIX® AIR DISC BRAKE (ADB) WEAR-SENSING ELECTRONIC CONTROL UNIT (ECU)

1. Turn the vehicle ignition off.
2. Remove as much contamination as possible prior to disconnecting the electrical connections.
3. Note the Electronic Control Unit (ECU) assembly mounting position on the vehicle.
4. Disconnect the electrical connector from the ECU.
5. Remove and retain the mounting bolts that secure the ECU.

INSTALLING A NEW BENDIX ADB WEAR-SENSING ECU

⚠ WARNING

When replacing the ADB wear-sensing ECU, verify that the unit you are installing has the correct default settings.

Verify correct operation of the ADB wear-sensing ECU by evaluating the system function with Bendix® ACom® PRO™ Diagnostic Software. *Refer to the section titled Using PC-based Diagnostics in this document.*

For further information, contact either the vehicle manufacturer, Bendix®, or your local authorized Bendix® dealer.

1. Position and secure the ADB wear-sensing ECU in the original mounting orientation using the mounting bolts retained during removal. When mounting the unit in the cab, use no more torque than is necessary to firmly secure the ECU into position. The ECU connector should be installed only by hand until it clicks into place. The ECU has two (2) through-hole mounting tabs to be used for mounting; please refer to OE documentation regarding mounting methods and torques.
2. Reconnect the electrical connector to the ECU. The connector should be installed only by hand until it clicks into place.
3. Start the vehicle and monitor a PC-based diagnostic tool to verify unintended faults are not active.

Refer to the section titled Troubleshooting: Electronic Control Unit (ECU) Wiring Harness Connectors for more information on wiring harnesses.

ECU DIAGNOSTICS

The ADB wear-sensing ECU contains self-testing diagnostic circuitry that continuously checks for the normal operation of external wear-sensing ECU components and wiring.

ACTIVE DIAGNOSTIC TROUBLE CODES (DTCs)

When a DTC is detected, the ADB wear-sensing ECU performs the following:

1. The ECU places the appropriate DTC information in the ECU memory.
2. The ECU communicates the appropriate DTC information over the serial communication diagnostic link as required.

ACTIVE DIAGNOSTIC TROUBLE CODE (DTC) MODE

For troubleshooting, the active and inactive DTC retrieval modes are typically used. All active DTCs may also be retrieved using a hand-held or PC-based diagnostic tool, such as ACom PRO Diagnostic Software.

INACTIVE DIAGNOSTIC TROUBLE CODE (DTC) MODE

The ADB wear-sensing ECU stores past Diagnostic Trouble Codes (DTCs) in its memory. The record is commonly referred to as “event history.” When an active DTC is cleared, the ECU stores it in the event history memory as an inactive DTC. Inactive DTCs and event history may be retrieved and cleared by using a PC-based diagnostic tool, such as ACom PRO Diagnostic Software.

USING PC-BASED DIAGNOSTICS

Bendix® ACom® PRO™ Diagnostic Software is an RP-1210-compliant PC-based diagnostic software program. With ACom PRO diagnostic software, maintenance personnel can:

- Obtain Diagnostic Trouble Code (DTC) information (both active and inactive DTCs)
- Retrieve event history
- Clear inactive DTCs and event history
- Verify Electronic Control Unit (ECU) configuration
- Perform system and component tests
- Read/write customer information in the scratch pad
- Save and print information
- Receive troubleshooting assistance

PC-based diagnostic tools attach to the vehicle diagnostic connector. *See Figure 2.*

When using ACom PRO diagnostic software to diagnose the Air Disc Brake (ADB) wear-sensing ECU, the computer's serial, parallel, or USB port needs to be connected to the vehicle's diagnostic connector. For more information and to download ACom PRO diagnostic software, visit B2Bendix.com.

Figure 2 – Vehicle Diagnostic Connector

TECHNICAL ASSISTANCE

For additional assistance, the Bendix Tech Team can be reached by email at techteam@bendix.com or by phone at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Bendix Tech Team representatives are available Monday through Thursday, 8:00 a.m. – 6:00 p.m., and Friday, 8:00 a.m. – 5:00 p.m. ET.

WIRING HARNESS CONNECTOR PIN ASSIGNMENTS

The ADB wear-sensing ECU utilizes one (1) Deutsch connector for wire harness connections. *See Figure 3 and refer to Table 2.*

⚠ WARNING

All unused pin positions must be populated by the appropriate wire plug.

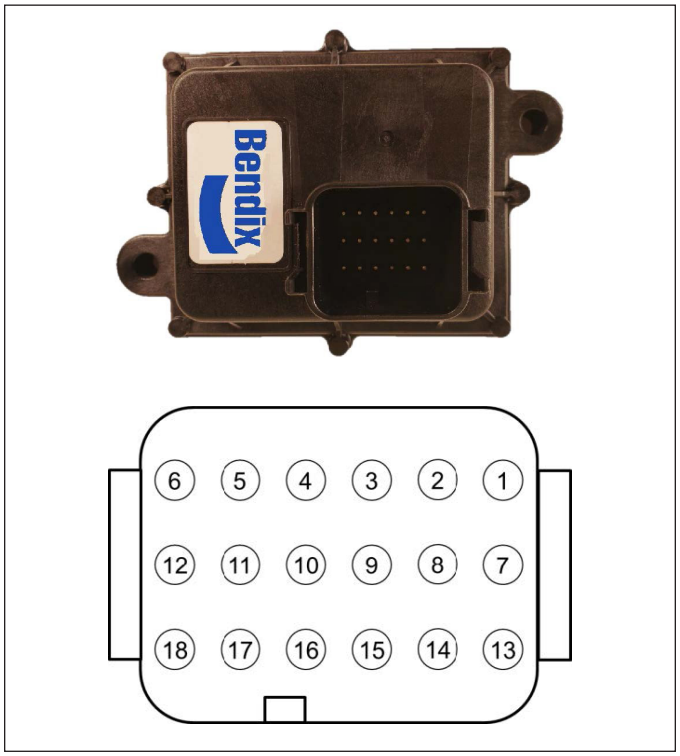


Figure 3 – Pin Assignments

PIN	DESIGNATION	PIN	DESIGNATION	PIN	DESIGNATION
1	Ignition Power	7	Sensor Signal - Trailer Axle #1 Left	13	Sensor Signal - Trailer Axle #4 Left
2	Ground	8	Sensor Signal - Trailer Axle #1 Right	14	Sensor Signal - Trailer Axle #4 Right
3	J1939 CAN High	9	Sensor Signal - Trailer Axle #2 Left	15	Sensor Power Out (+5V), Trailer Axle #2
4	J1939 CAN Low	10	Sensor Signal - Trailer Axle #2 Right	16	Sensor Power Out (+5V), Trailer Axles #3 and #4
5	Sensor Power Out (+5V), Trailer Axle #1	11	Sensor Signal - Trailer Axle #3 Left	17	Sensor Ground, Trailer Axle #2
6	Sensor Ground, Trailer Axle #1	12	Sensor Signal - Trailer Axle #3 Right	18	Sensor Ground, Trailer Axles #3 and #4

Table 2 – Pin Assignments

TROUBLESHOOTING DIAGNOSTIC: POWER SUPPLY

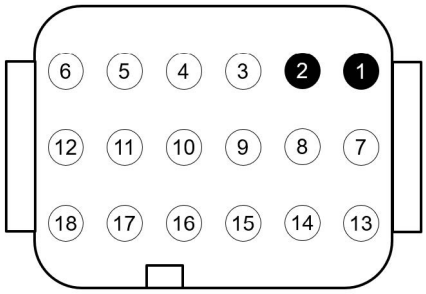
Possible symptoms that may indicate an issue with the power supply include:

- Lack of Electronic Control Unit (ECU) function
- Erratic ECU function

Perform the following to diagnose potential power supply issues:

- Take all measurements at the ECU harness connector.
- Place a load (i.e. an 1157 stop lamp) across ignition and ground connection and measure the ignition and battery voltage with the load. Ignition-to-ground should measure between 9.0 to 18.0 VDC.
- Check for damaged wiring and damaged or corroded connectors and connections.
- Check the condition of the vehicle battery and associated components.
- Check the alternator output for excessive noise.

See Figure 4 and refer to Table 3.



View from Back of Connector

PIN	DESIGNATION
1	Ignition Power
2	Ground

Figure 4 – Power Supply Tests

ISSUE	POTENTIAL SOLUTION
Voltage below 9 V	• Check the vehicle battery and associated components. • Check for damaged wiring. • Check for damaged or corroded connectors and connections. • Contact the vehicle manufacturer for further assistance.
Voltage above 18 V	• Ensure the battery voltage is correct for the ECU. • Check vehicle battery and associated components. • Check for damaged wiring. • Check for damaged or corroded connectors and connections. • Contact the vehicle manufacturer for further assistance.

Table 3 – Power Supply Troubleshooting

TROUBLESHOOTING DIAGNOSTIC: J1939 CAN COMMUNICATIONS

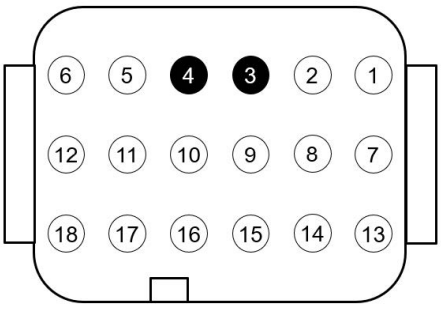
Possible symptoms that may indicate an issue with the J1939 CAN communication include:

- Lack of J1939 CAN communication
- Sporadic J1939 CAN communication

Perform the following to diagnose potential J1939 CAN communication issues:

- Take all measurements at the ECU harness connector.
- Check for corroded or damaged wiring connector problems such as opens or shorts to voltage or ground.
- Check for damaged or reversed J1939 wiring.
- Check for other J1939 devices which may be loading down (inhibiting) J1939 communication.

See Figure 5 and refer to Table 4.



View from Back of Connector

PIN	DESIGNATION
3	J1939 High
4	J1939 Low

Figure 5 – J1939 CAN Communication Tests

ISSUE	POTENTIAL SOLUTION
ECU not identified in Bendix® ACom® PRO™ Diagnostic Software	• Check for damaged or corroded connectors and connections. • Check the EC part number and confirm it is configured to the correct baud rate. Refer to B2Bendix.com. • Check for damaged or reversed J1939 wires or power/ground wires. • Using Bendix® ACom® PRO™ Diagnostic Software, check to see if the wear-sensing ECU is broadcasting CAN messages from a source address other than 206 (CE). • Confirm ECU failure by installing an ECU that has been verified to function properly.

Table 4 – J1939 CAN Communication Troubleshooting

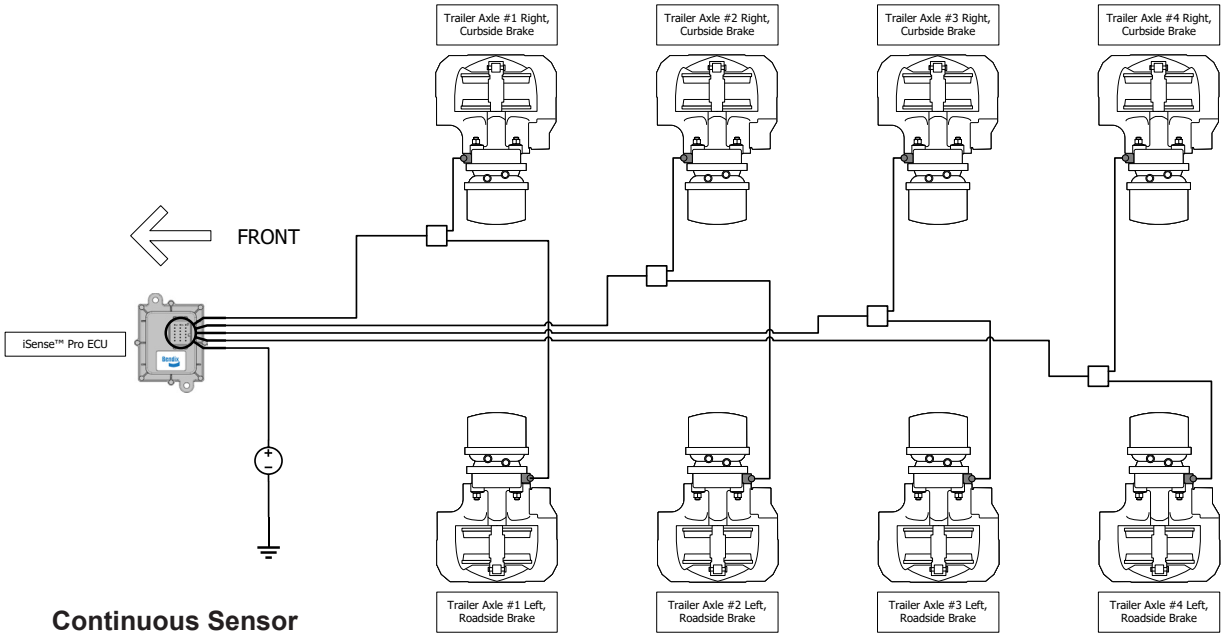
DIAGNOSTIC TROUBLE CODES (DTC) TABLE

Refer to Table 5, Figure 6, and the corresponding service action code in Table 6.

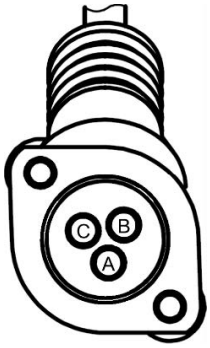
SPN (J1939)	FMI (J1939)	DTC NAME	DTC DESCRIPTION	GO TO SERVICE ACTION CODE LISTED IN TABLE 6
22754	3	Wear Sensor	Trailer Axle #1, Left Wheel, Wear Sensor Shorted to Voltage	A
22754	4		Trailer Axle #1, Left Wheel, Wear Sensor Shorted to Ground or Open Circuit	B
22755	3		Trailer Axle #1, Right Wheel, Wear Sensor Shorted to Voltage	A
22755	4		Trailer Axle #1, Right Wheel, Wear Sensor Shorted to Ground or Open Circuit	B
22756	3		Trailer Axle #2, Left Wheel, Wear Sensor Shorted to Voltage	A
22756	4		Trailer Axle #2, Left Wheel, Wear Sensor Shorted to Ground or Open Circuit	B
22757	3		Trailer Axle #2, Right Wheel, Wear Sensor Shorted to Voltage	A
22757	4		Trailer Axle #2, Right Wheel, Wear Sensor Shorted to Ground or Open Circuit	B
22758	3		Trailer Axle #3, Left Wheel, Wear Sensor Shorted to Voltage	A
22758	4		Trailer Axle #3, Left Wheel, Wear Sensor Shorted to Ground or Open Circuit	B
22759	3		Trailer Axle #3, Right Wheel, Wear Sensor Shorted to Voltage	A
22759	4		Trailer Axle #3, Right Wheel, Wear Sensor Shorted to Ground or Open Circuit	B
22760	3		Trailer Axle #4, Left Wheel, Wear Sensor Shorted to Voltage	A
22760	4		Trailer Axle #4, Left Wheel, Wear Sensor Shorted to Ground or Open Circuit	B
22761	3		Trailer Axle #4, Right Wheel, Wear Sensor Shorted to Voltage	A
22761	4		Trailer Axle #4, Right Wheel, Wear Sensor Shorted to Ground or Open Circuit	B

Table 5 – Diagnostic Trouble Codes (DTCs)

NOTE: Unless otherwise specified, diagnostics should be done with the vehicle ignition on and with the engine not running.



Continuous Sensor Harness Connector



PIN	DESCRIPTION	COLOR*
A	Signal	Black
B	Sensor Power	Yellow
C	Sensor Ground	Brown

**Color applies to sensor harnesses supplied by Bendix or Knorr-Bremse*

Torque Spec: *1.0 - 1.1 N•m*

Figure 6 – Bendix® iSense™ Pro Trailer Wear-Sensing Electronic Control Unit (ECU) Layout

SERVICE ACTION CODE TABLE

Refer to Table 6. To clear active Diagnostic Trouble Codes (DTCs) (as situations are remedied), simply clear (or "self-heal") by removing and re-applying ignition power. Alternately, DTCs may be cleared by using a PC-based diagnostic tool.

Service Action Code	Troubleshooting Measure	Action
A	1. Locate the Faulted Wheel-end Brake. Disconnect the Continuous Sensor Harness Connector, and with a Digital Multi-Meter (DMM), measure the DC voltage between Pin A and Pin B within the Continuous Sensor Harness Connector.	**Measured Voltage** • 0-4.5V – Signal line not shorted to power source. *Proceed to Step 5.* • 4.5-5.5V – Signal line shorted to sensor power. *Proceed to Step 2.* • > 5.5V – Signal line shorted to vehicle power. *Proceed to Step 5.*
	2. Locate the Faulted Wheel-end Brake. Using a DMM in Continuity Check Mode, check the continuity between Pin A and Pin B within the Continuous Sensor Harness Connector.	**Continuity Measurement Results** • Continuity is ***Present***: Short between sensor line and sensor power confirmed. o If secondary connectors are present between the Electronic Control Unit (ECU) Connector and the Continuous Sensor Harness Connector, *proceed to Step 3*. o If secondary connectors are not present between the ECU Connector and the Continuous Sensor Harness Connector, *proceed to Step 4.* • Continuity is ***Not Present***: Short not present between sensor line and sensor power. o Possible intermittent short. Check the entire run of the harness between the ECU Connector and the Continuous Sensor Harness Connector connected to the Faulted Wheel-end Brake. If damaged wire insulation is not found, proceed with replacing the ECU with a known good ECU. If the problem persists, further diagnostics are needed to locate the short. If the problem ceases, then proceed with replacing the ECU through warranty or aftermarket.
	3. Locate the Faulted Wheel-end Brake and follow the Continuous Sensor Harness Connector to any OE-specific connectors between the brake and the ECU Connector. Using a DMM in Continuity Check Mode, check the continuity between the Sensor Power and Sensor Signal Pins at each OE-specific connector.	**Continuity Measurement Results** • Continuity is ***Present***: Short circuit confirmed in supply line. Supply line must be replaced. • Continuity is ***Not Present***: Short not present in supply line. *Proceed to Step 4.*

Table 6 – Service Action Codes

Service Action Code	Troubleshooting Measure	Action
A	4. Locate the Bendix® iSense™ Pro Electronic Control Unit (ECU) and disconnect the ECU Connector. Using a Digital Multi-Meter (DMM) in Continuity Check Mode and referring to *Figure 3* and *Table 2*, check the continuity between the Sensor Power Out Pin corresponding to the axle on which the Faulted Wheel End resides and the Sensor Signal Pin corresponding to the Faulted Wheel End within the ECU Connector.	**Continuity Measurement Results** • Continuity is ***Present***: Short circuit confirmed in vehicle harness. Short must be found and repaired. • Continuity is ***Not Present***: Short not present between sensor line and sensor power. o Possible intermittent short. Check the entire run of the harness between the ECU Connector and the Continuous Sensor Harness Connector connected to the Faulted Wheel-end Brake. If damaged wire insulation is not found, proceed with replacing the ECU with a known good ECU. If the problem persists, further diagnostics are needed to locate the short. If the problem ceases, then proceed with replacing the ECU through warranty or aftermarket.
	5. Locate the iSense Pro ECU and disconnect the ECU Connector. Using a DMM in Continuity Check Mode, check the continuity between Pin 1 and the Sensor Signal Pin corresponding to the Faulted Wheel End within the ECU Connector.	**Continuity Measurement Results** • Continuity is ***Present***: Short circuit confirmed in vehicle harness. Short must be found and repaired. • Continuity is ***Not Present***: Short not present between sensor line and sensor power. o Possible intermittent short. Check the entire run of the harness between the ECU Connector and the Continuous Sensor Harness Connector connected to the Faulted Wheel-end Brake. If damaged wire insulation is not found, proceed with replacing the ECU with a known good ECU. If the problem persists, further diagnostics are needed to locate the short. If the problem ceases, then proceed with replacing the ECU through warranty or aftermarket.
	6. Locate the Faulted Wheel-end Brake. Using a DMM in Continuity Check Mode, check the continuity between Pin C within the Continuous Sensor Harness Connector and a chassis ground.	**Continuity Measurement Results** • Continuity is ***Present***: Ground circuit working properly. Check the entire run of the harness between the ECU Connector and the Continuous Sensor Harness Connector connected to the Faulted Wheel-end Brake. If damaged wire insulation is not found, proceed with replacing the ECU with a known good ECU. If the problem persists, further diagnostics are needed to locate the short. If the problem ceases, then proceed with replacing the ECU through warranty or aftermarket. • Continuity is ***Not Present***: Sensor ground circuit is open. Open circuit must be found and repaired.

Table 6 – Service Action Codes

Service Action Code	Troubleshooting Measure	Action
B	1. Locate the Faulted Wheel-end Brake. Disconnect the Continuous Sensor Harness Connector and with a Digital Multi-Meter (DMM) in Continuity Check Mode, check the continuity between Pin B and Pin C within the Continuous Sensor Harness Connector.	**Continuity Measurement Results** • Continuity is ***Present***: Short between sensor line and sensor ground confirmed. o If secondary connectors are present between the Electronic Control Unit (ECU) Connector and the Continuous Sensor Harness Connector, *proceed to Step 2.* o If secondary connectors are not present between the ECU Connector and the Continuous Sensor Harness Connector, *proceed to Step 3.* • Continuity is ***Not Present***: Short not present between sensor line and sensor ground. • Possible intermittent short. Check the entire run of the harness between the ECU Connector and the Continuous Sensor Harness Connector connected to the Faulted Wheel-end Brake. If damaged wire insulation is not found, proceed with replacing the ECU with a known good ECU. If the problem persists, further diagnostics are needed to locate the short. If the problem ceases, then proceed with replacing the ECU through warranty or aftermarket.
	2. Locate the Faulted Wheel-end Brake and follow the Continuous Sensor Harness Connector to any OE-specific connectors between the brake and the ECU Connector. At each OE-specific connector with the DMM in Continuity Check Mode, check the continuity between the Sensor Power and Sensor Signal Pins.	**Continuity Measurement Results** • Continuity is ***Present***: Short circuit confirmed in supply line. Supply line must be replaced. • Continuity is ***Not Present***: Short not present in supply line. *Proceed to Step 3.*
	3. Locate the Bendix® iSense™ Pro ECU and disconnect the ECU Connector. Using a DMM in Continuity Check Mode and referring to *Figure 3* and *Table 2*, check the continuity between the Sensor Ground Pin corresponding to the axle on which the Faulted Wheel End resides and the Sensor Signal Pin corresponding to the Faulted Wheel End within the ECU Connector.	**Continuity Measurement Results** • Continuity is ***Present***: Short circuit confirmed in vehicle harness. Short must be found and repaired. • Continuity is ***Not Present***: Short not present between sensor line and sensor power. *Proceed to Step 4.*

Table 6 – Service Action Codes

Service Action Code	Troubleshooting Measure	Action
	4. Locate the Faulted Wheel-end Brake and disconnect the Continuous Sensor Harness Connector. Locate the Bendix® iSense™ Pro Electronic Control Unit (ECU) and disconnect the ECU Connector. Using a Digital Multi-Meter (DMM) in Continuity Check Mode and referring to *Figure 3* and *Table 2*, check the continuity between the Sensor Signal Pin corresponding to the Faulted Wheel End within the ECU Connector and Pin A within the Continuous Sensor Harness Connector.	**Continuity Measurement Results** • Continuity is ***Present***: Open circuit not present in sensor signal line. *Proceed to Step 5.* • Continuity is ***Not Present***: Open circuit present in sensor signal line. o Check the entire run of the harness between the ECU Connector and the Continuous Sensor Harness Connector connected to the Faulted Wheel-end Brake. If damaged wiring is not found, proceed with replacing the ECU with a known good ECU. If the problem persists, further diagnostics is needed to locate the short. If the problem ceases, then proceed with replacing the ECU through warranty or aftermarket.
B	5. Locate the Faulted Wheel-end Brake and disconnect the Continuous Sensor Harness Connector. Locate the Sense Pro ECU and disconnect the ECU Connector. Using a DMM in Continuity Check Mode and referring to *Figure 3* and *Table 2*, check the continuity between the Sensor Ground Pin corresponding to the axle on which the Faulted Wheel End resides within the ECU Connector and Pin B within the Continuous Sensor Harness Connector.	**Continuity Measurement Results** • Continuity is ***Present***: Open circuit not present in sensor power line. *Proceed to Step 6.* • Continuity is ***Not Present***: Open circuit present in sensor power line. o Check the entire run of the harness between the ECU Connector and the Continuous Sensor Harness Connector connected to the Faulted Wheel-end Brake. If damaged wiring is not found, proceed with replacing the ECU with a known good ECU. If the problem persists, further diagnostics is needed to locate the short. If the problem ceases, then proceed with replacing the ECU through warranty or aftermarket.
	6. Locate the iSense Pro ECU and disconnect the ECU Connector. Using a DMM in Continuity Check Mode and referring to *Figure 3* and *Table 2*, check the continuity between the Sensor Ground Pin corresponding to the axle on which the Faulted Wheel End resides and the Sensor Signal Pin corresponding to the Faulted Wheel End within the ECU Connector.	**Continuity Measurement Results** • Continuity is ***Present***: Short circuit in vehicle harness confirmed. Short must be found and repaired. • Continuity is ***Not Present***: Short not present between sensor ground and sensor signal. o Possible intermittent short. Check the entire run of the harness between the ECU Connector and the Continuous Sensor Harness Connector connected to the Faulted Wheel-end Brake. Additionally, check the entire run of the harness between the ECU Connector and where it is connected on the vehicle harness. If damaged wire insulation is not found, proceed with replacing the ECU with a known good ECU. If the problem persists, further diagnostics are needed to locate the short. If the problem ceases, then proceed with replacing the ECU through warranty or aftermarket.

Table 6 – Service Action Codes

TROUBLESHOOTING: ELECTRONIC CONTROL UNIT (ECU) WIRING HARNESS CONNECTORS

Bendix® Air Disc Brake (ADB) Wear-sensing Electronic Control Units (ECUs) are designed to interface with a Deutsch DTV connector *as referenced in Table 7*. Follow the connector manufacturer's specifications for creating or repairing wiring harnesses

IMPORTANT

All wiring harness connectors must be properly seated. The use of secondary locks is strongly advised.

WARNING

All unused ECU pins must be covered and receive proper environmental protection.

As a matter of good practice and to ensure maximum system robustness, always use the maximum size wire supported by the wire harness connectors for ignition and ground. All sensor and serial communications circuits (J1939) must use twisted pair wiring (one to two twists per inch). *Reference the appropriate SAE document for additional details.*

WARNING

All wires must be carefully routed to avoid contact with rotating elements. Wiring must be properly secured approximately every 6 to 12 inches using UV-stabilized, non-metallic hose clamps or bow-tie cable ties to prevent pinching, binding, or fraying.

It is recommended that wires be routed straight out of a connector for a minimum of three (3) inches before the wire is allowed to bend. Ignition power and ground wires should be kept to a minimum length. If convoluted tubing is used, its inner diameter must match the size of the wire bundle as closely as possible.

CAUTION

Wiring harness lengths must be carefully selected for the vehicle. Harnesses that are too long increase the possibility of electrical interference and wiring damage. Excess lengths of wire are not to be wound to form coils; instead, re-route, repair, or replace the wiring harness. Do not attempt to stretch harnesses that are too short, as mechanical strain can result in wire breakage.

Route sensor wiring coming out of the wheel-ends away from moving brake components. Sensor wiring needs to be secured to the axle to prevent excess cable length and wiring damage.

Following the axle, the sensor wires must be attached along the length of the service brake hoses using cable ties with ultraviolet protection and secured every 6 to 8 inches (152 to 203 mm). Sufficient – but not excessive – cable length must be provided to permit full suspension travel and steering axle movement. Install wires so that they cannot touch rotating elements such as wheels, brake discs, or drive shafts.

Bendix does not recommend using standard tie-wraps to secure wiring harnesses directly to rubber air lines. This may cause premature wiring failure from the pressure exerted on the wiring when air pressure is applied through the air line. Non-metallic hose clamps or bow-tie tie-wraps are preferred.

The use of grommets or other suitable protection is required whenever the cable must pass through metallic frame members.

All sensor wiring must utilize twisted pair wire, with approximately one to two twists per inch.

It is recommended that wires be routed straight out of a connector for a minimum of three inches before the wire is allowed to bend.

WIRE REQUIREMENT	CONNECTOR	WIRE TERMINAL	LOCKING CLIP	WIRE PLUG	TERMINAL CRIMP TOOL
14 - 20 AWG* GXL or TXL copper stranded wire Min. Insulation OD: 0.088 mm Max. Insulation OD: 0.145 mm	 DTV06-18SB	 0462-201-16141	 WV-18S	 114017-ZZ	 HDT-48-00

Table 7 – ADB Wear-sensing ECU Component Connectors

NOTE: Bendix does not supply these parts.

** As a matter of good practice and to ensure maximum system robustness, always use the maximum size wire supported by the wire harness terminals and connectors for ignition & ground.*

TROUBLESHOOTING: BENDIX® AIR DISC BRAKE (ADB) WEAR-SENSING ELECTRONIC CONTROL UNIT (ECU) WIRING SCHEMATIC

4-AXLE/CONTINUOUS WEAR SENSOR

See Figure 7.

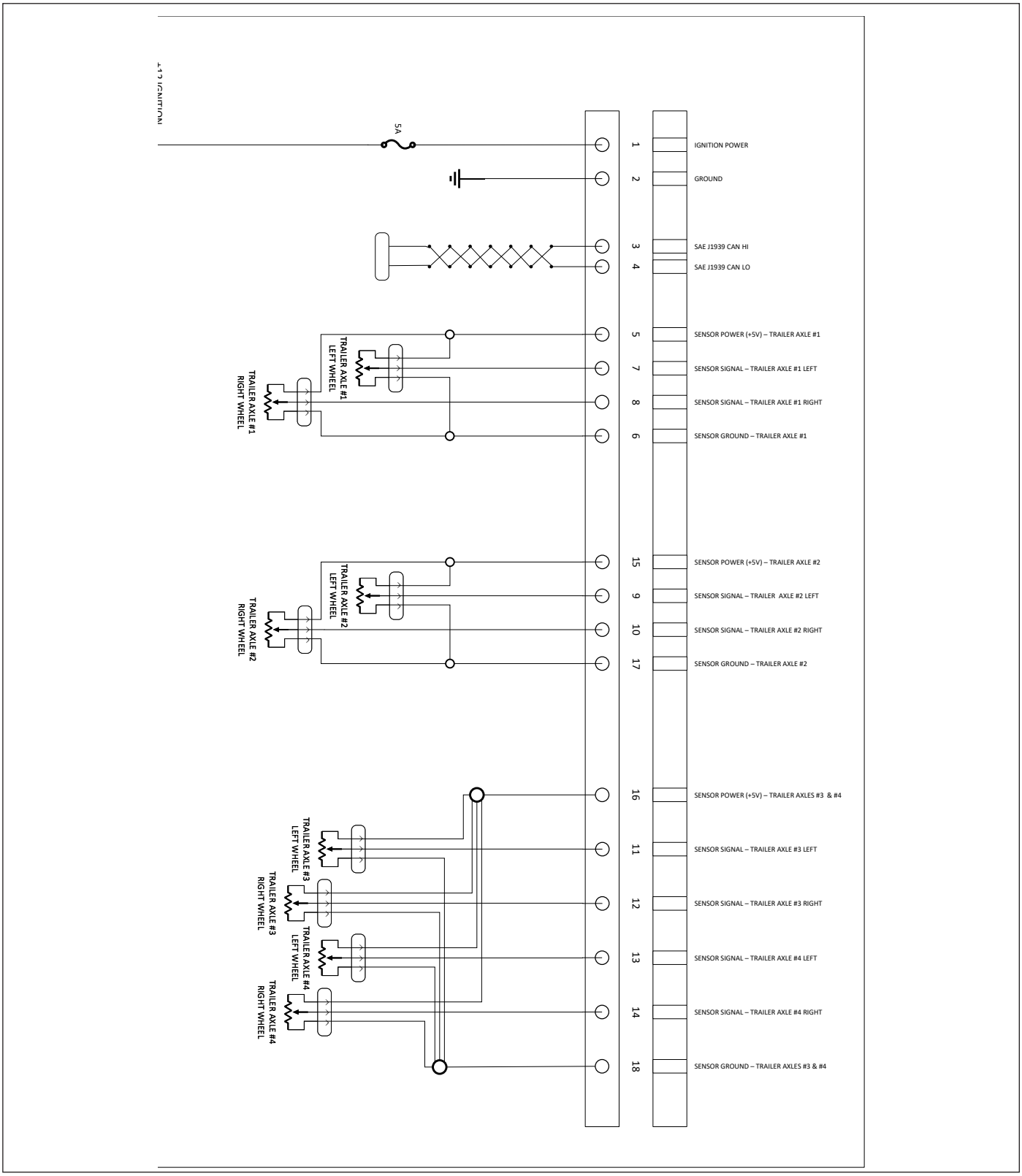


Figure 7 – 4-Axle/Continuous Schematic

TROUBLESHOOTING: BENDIX® AIR DISC BRAKE (ADB) WEAR-SENSING ELECTRONIC CONTROL UNIT (ECU) WIRING SCHEMATIC

3-AXLE/CONTINUOUS WEAR SENSOR

See Figure 8.

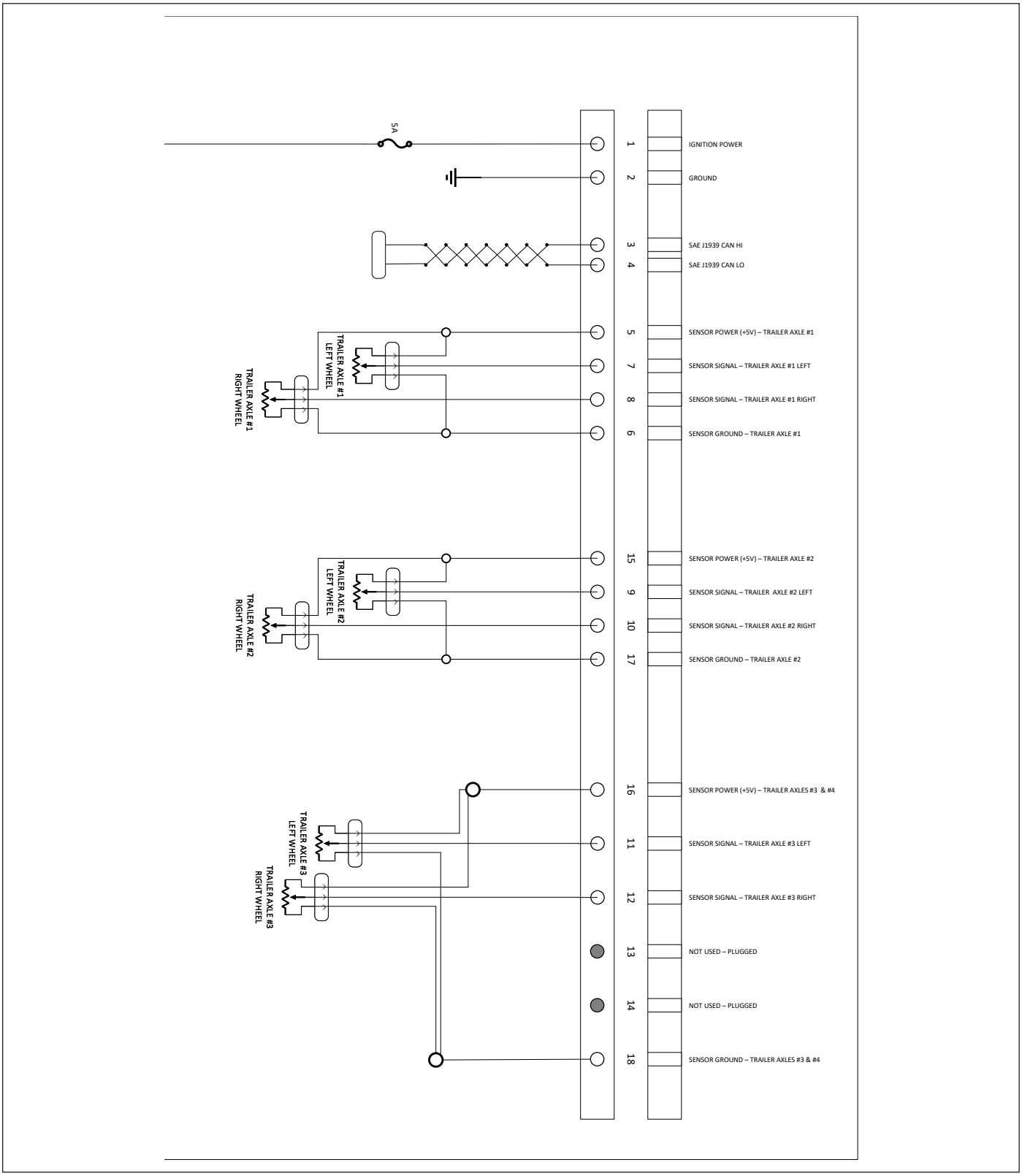


Figure 8 – 3-Axle/Continuous Schematic

TROUBLESHOOTING: BENDIX® AIR DISC BRAKE (ADB) WEAR-SENSING ELECTRONIC CONTROL UNIT (ECU) WIRING SCHEMATIC

2-AXLE/CONTINUOUS WEAR SENSOR

See Figure 9.

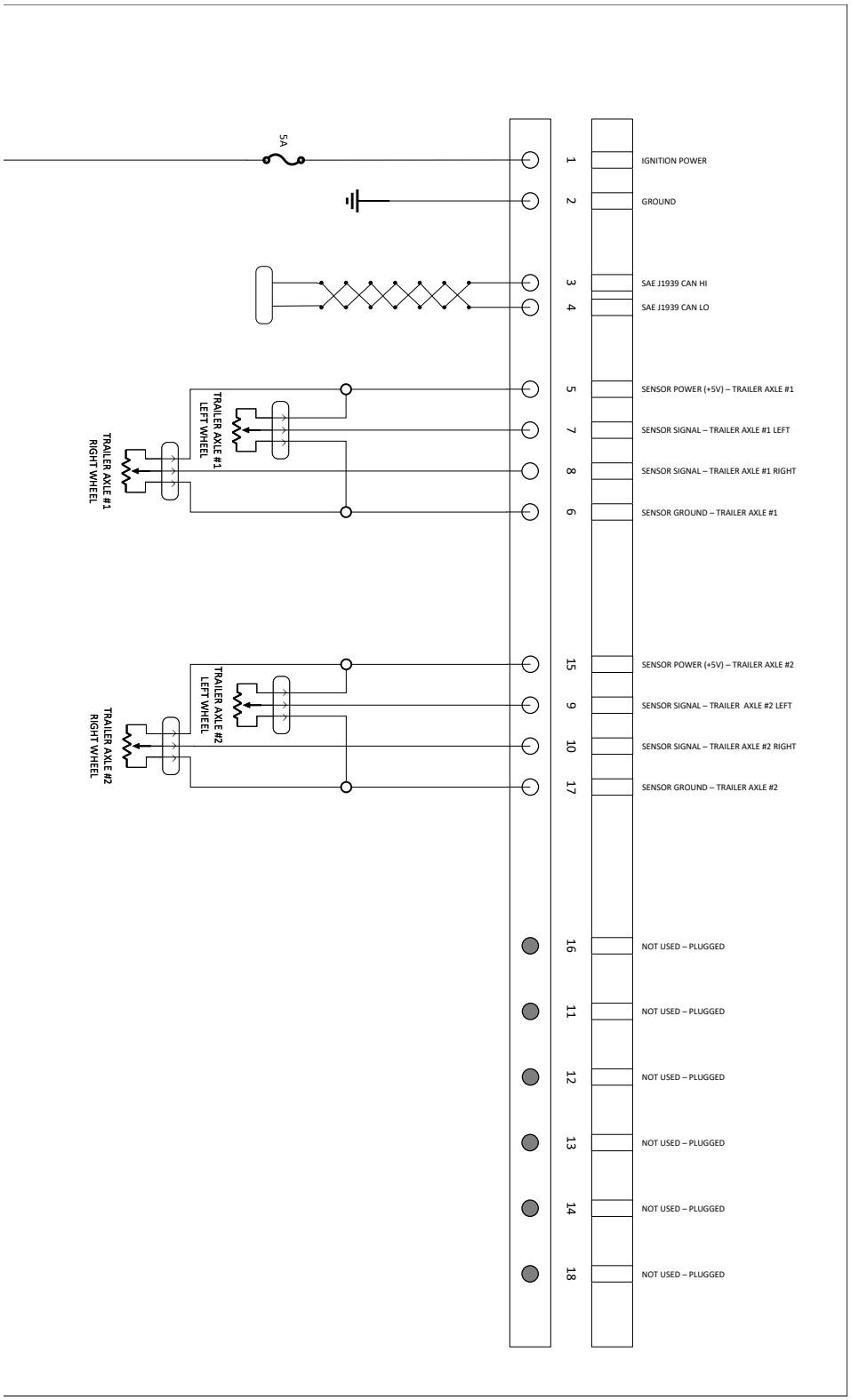


Figure 9 – 2-Axle/Continuous Schematic

TROUBLESHOOTING: BENDIX® AIR DISC BRAKE (ADB) WEAR-SENSING ELECTRONIC CONTROL UNIT (ECU) WIRING SCHEMATIC

1-AXLE/CONTINUOUS WEAR SENSOR

See Figure 10.

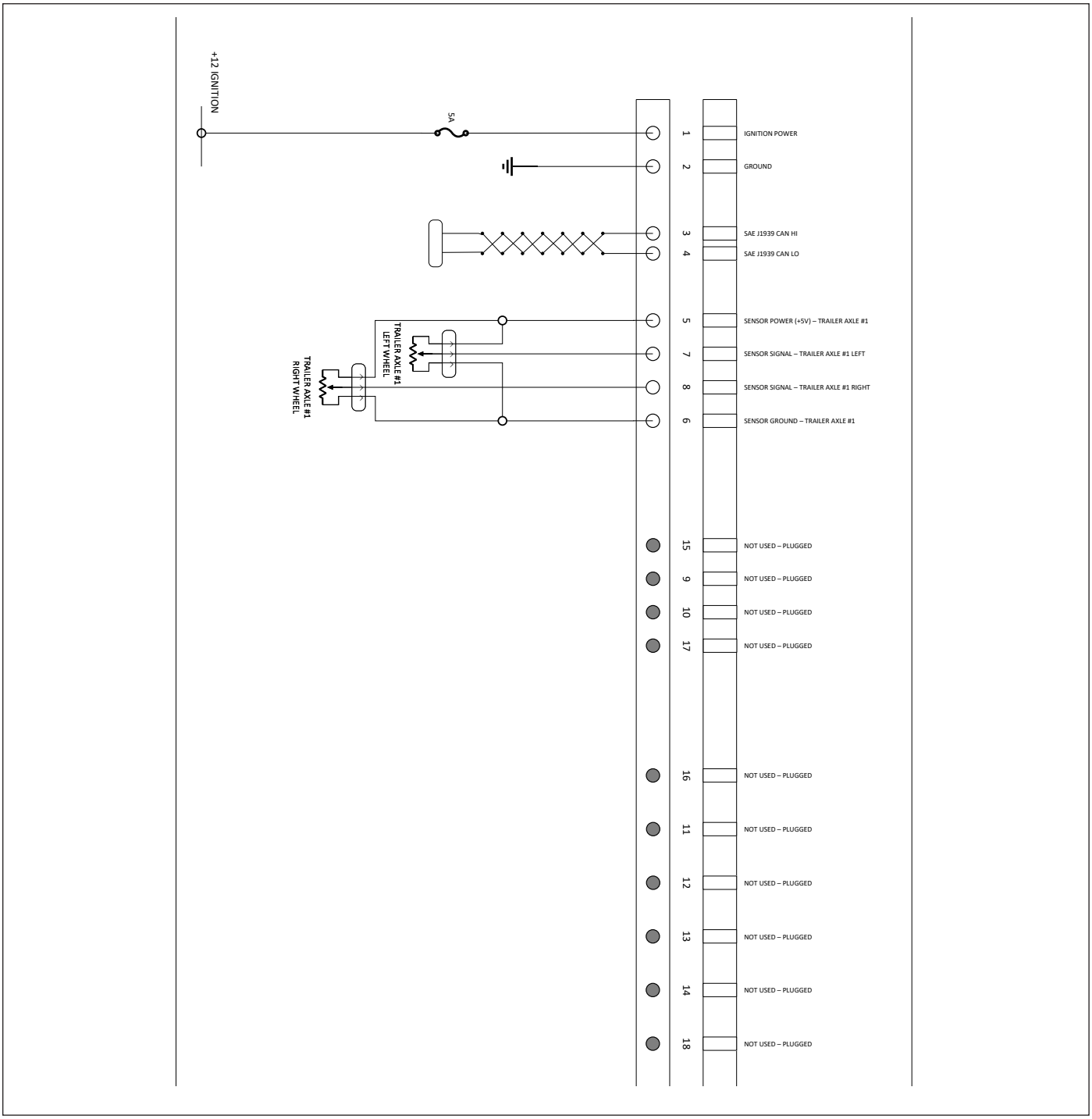


Figure 10 – 1-Axle/Continuous Schematic

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