



WABCO WHEEL SPEED SENSOR TROUBLESHOOTING INSTRUCTIONS

TP2303
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Only for Pneumatic ABS mBSP and E Version

Technical Bulletin

SAFETY INFORMATION Provisions for a safer work environment:

- Only trained and qualified automotive technicians should carry out work on the vehicles.
- Read this publication carefully.
- Follow all warnings, notices and instructions to help avoid personal injury and property damage.
- Always abide by the vehicle manufacturer's specifications and instructions.
- Observe all accident regulations of the respective company as well as regional and national regulations.
- The workplace should be dry, sufficiently lit and ventilated.
- Use personal protective equipment if required (safety shoes, protective goggles, respiratory protection and ear protectors).

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

This product can expose you to chemicals including Nickel, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

⚠ WARNING

Remove all pressure from the air system before you disconnect any component. Pressurized air can cause serious personal injury and damage to components.

⚠ CAUTION

When troubleshooting and testing the ABS system do not damage the connector terminals.

How to Obtain Additional Maintenance, Service and Product Information

If you have any questions about the material covered in this publication, or for more information about the WABCO product line, please contact ZF Customer Care Center at 855-228-3203, by email at nacustomer@zf.com or visit our website: www.zf.com/cv.

Visit our Literature Center at <https://zfcvliterature.com/> to access and download additional information.

WARRANTY INFORMATION FOR WARRANTY COVERAGE

The following test procedures must be performed BEFORE replacing any WABCO brand speed sensor (WSS). Please be sure to enter the proper problem code — as identified in this bulletin — on the warranty claim form

APPLICATION

Before testing the sensors, refer to the vehicle specification sheet to identify the type of pneumatic ABS installed on the vehicle: MBSP or E version pneumatic ABS.

The Pro-Link® 9000 or TOOLBOX™ Software may be used to identify the type of pneumatic ABS. TOOLBOX™ software cannot always be used to identify older versions of pneumatic ABS. For further assistance, contact WABCO Customer Care Center at 855-228-3203.

INSTRUCTIONS

The tables referenced in the following test procedures refer to pinout tables. Refer to Table A. If sensor replacement is necessary, refer to the appropriate maintenance manual. Use the following chart to determine which maintenance manual you should use.

WABCO

If the Type of ABS Installed on the Vehicle is:	USE	
	Table	Maintenance Manual
mBSP	A	MM1719
E Version Pneumatic ABS (Basic, Universal or Frame-mounted)	A	MM0112

NOTE

To access additional literature visit <https://zfcvliterature.com/>.

Test 1

Sensor resistance and short to ground test (Readings are only valid with an existing or active fault — sensor short or open) (Document Fault code for Warranty, specifically SPN or SID and FMI) (Reference Diagram A)

1. Turn ignition OFF. Apply the parking brakes. Chock the wheels by putting blocks under the front and rear tires to help prevent the vehicle from moving.
2. Reference the appropriate manual or Table A in this publication to identify the appropriate connector and pins for the sensor being tested. Then disconnect the appropriate harness connector from the ABS Electronic Control Unit (ECU).
3. Inspect the connectors and terminals for corrosion, physical damage, or loose connections. (Document inspection for warranty)
4. Use a Volt-Ohm meter to measure resistance (ohms) in two places:

Between the terminal pins identified in Step 2 — **specification must be between 900-2000 ohms**. Typical readings will be 1150 to 1250 ohms at room temperature.

From each terminal pin to the chassis ground— **resistance must be infinite (open circuit)**. (See electrical checks on pages 3-4.)

- A. If the proper ohm measurements are in specification, the sensor is not the cause of the fault. Reconnect the harness and clear the fault. If fault cannot be cleared, contact WABCO Customer Care Center at 855-228-3203.
- B. If the ohm readings are **not within** the proper specifications, repeat testing the harness at each additional connector until you reach the last sensor connector.
- C. If the sensor ohm readings are **not within** the proper specifications as measured at the sensor, record the readings and replace the sensor. Refer to

the appropriate maintenance manual for complete instructions.

- D. If the sensor ohms readings are not **within** the one ohm of the readings taken at the ECU, the OEM harness is at fault and must be repaired or replaced. Check sensor cable for broken wires or wear due to interference with moving components. Make necessary repairs. Refer to the appropriate maintenance manual for complete instructions.

5. The code for a sensor resistance problem is SENS1. Record or note this code to provide to warranty.

Test 2

Sensor voltage output test (Normally associated with a stored fault — excessive air gap or erratic speed signal) (Reference Diagram A)

1. Turn ignition OFF. Apply the parking brakes. Raise the vehicle off the ground. Chock the wheels that are still on the ground by putting blocks under the front and rear tires to help prevent the vehicle from moving.
2. Reference the appropriate manual or Table A in this publication to identify the appropriate connector and pins for the sensor being tested. Then disconnect the appropriate harness connector from the ABS Electronic Control Unit (ECU).
3. Inspect the connectors and terminals for corrosion, physical damage or loose connections. Make the necessary repairs.
4. Release the parking brakes.
5. Rotate the wheel by hand at 30 rpm (1/2 revolution per second).
6. Use a Volt-Ohm meter to measure the AC voltage across the terminal pins, identified in step 2, on the connector listed in the table while spinning the appropriate wheel at 30 rpm (1/2 revolution per second). **Minimum output voltage required — 0.2 volts AC.**
If voltage is below minimum, readjust the sensor by pushing sensor in holder until it contacts the tooth wheel. Repeat AC voltage measurement. If voltage is still low, call WABCO Customer Care at 855-228-3203.
If voltage is greater than 0.2 volts AC, and if signal failures continue to occur when the vehicle is driven, inspect the wheel bearing hub (refer to axle manufacturer's recommendations) and tooth wheel condition.
7. The code for a sensor voltage problem is SENS2. Record or note this code to provide to warranty.

Table A: Pneumatic ABS — ECU Connector and Terminal Check Pins

ABS ECU	Sensor	Connector	Pins
mBSP (see next pages)	LF, 1 or A	X1	1 and 2
	RF, 2 or B	X1	10 and 11
	LR, 3 or C	X1	19 and 20
	RR, 4 or D	X1	28 and 29
	LR 3rd, 5 or E	X3	1 and 2
	RR 3rd 6 or F	X3	10 and 11
PABS E Frame Mount With ESC	LF	X2 - 18 PIN	12 and 15
	RF	X2 - 18 PIN	10 and 13
	LR	X2 - 18 PIN	11 and 14
	RR	X2 - 18 PIN	17 and 18
PABS E Frame Mount Non-ESC	LF	X2-Black	7 and 8
	RF	X2-Black	5 and 6
	LR	X3-Green	1 and 2
	RR	X3-Green	3 and 4
	LR (3rd Axle)	X4-Brown	3 and 4
	RR (3rd Axle)	X4-Brown	5 and 6
PABS E Universal Cab Mount	LF	X2 - 18 PIN	12 and 15
	RF	X2 - 18 PIN	10 and 13
	LR	X2 - 18 PIN	11 and 14
	RR	X2 - 18 PIN	17 and 18
	LR (3rd Axle)	X3 - 15 PIN	2 and 5
	RR (3rd Axle)	X3 - 15 PIN	11 and 14

Connect TOOLBOX™ Software for fault codes, maintenance manual and other related information.

The electrical checks below are for Pneumatic ABS Version mBSP. For Pneumatic ABS E-Version Change out connector and pin locations for the tests from the Table A. *** Please, document all fault codes and any electrical checks as described below for warranty submission or to provide when contacting the ZF Customer Care Center at 855-228-3203.

SPN 789 FMI ** - Roadside(left) steer axle sensor (position A or position 1) (Reference Diagram A)

Turn key off, go to ECU, and unplug the x1 connector and on the harness side

1. Measure the resistance from pin 1 to pin 2 =
 2. Measure the resistance from pin 1 to ground =
 3. Measure the resistance from pin 2 to ground =
- Unplug the sensor.**
4. Measure the resistance from pin 1 to pin 2 again =

At the sensor itself:

5. Measure the resistance of the sensor across both pins =
6. Measure the resistance of each pin on sensor to ground =

KEY ON:

7. Measure voltage from pin 1 to ground =
8. Measure voltage from pin 2 to ground =

SPN 790 FMI ** - Curbside(right) steer axle sensor (position B or position 2) (Reference Diagram A)

Turn key off, go to ECU, and unplug the x1 connector and on the harness side

1. Measure the resistance from pin 10 to pin 11 =
2. Measure the resistance from pin 10 to ground =
3. Measure the resistance from pin 11 to ground =

Unplug the sensor.

4. Measure the resistance from pin 10 to pin 11 again =

At the sensor itself:

5. Measure the resistance of the sensor across both pins =
6. Measure the resistance of each pin on sensor to ground =

KEY ON:

7. Measure voltage from pin 10 to ground =
8. Measure voltage from pin 11 to ground =

** See FMI Chart in Table B on pages 5-6

SPN 791 FMI ** - Roadside(left) drive axle sensor (position C or position 3) (Reference Diagram A)

Turn key off, go to ECU, and unplug the x1 connector and on the harness side

1. Measure the resistance from pin 19 to pin 20 =
2. Measure the resistance from pin 19 to ground =
3. Measure the resistance from pin 20 to ground =

Unplug the sensor.

4. Measure the resistance from pin 19 to pin 20 again =

At the sensor itself:

5. Measure the resistance of the sensor across both pins =
6. Measure the resistance of each pin on sensor to ground =

KEY ON:

7. Measure voltage from pin 19 to ground =
8. Measure voltage from pin 20 to ground =

SPN 792 FMI ** - Curbside(right) drive axle sensor (position D or position 4) (Reference Diagram A)

Turn key off, go to ECU, and unplug the x1 connector and on the harness side

1. Measure the resistance from pin 28 to pin 29 =
2. Measure the resistance from pin 28 to ground =
3. Measure the resistance from pin 29 to ground =

Unplug the sensor.

4. Measure the resistance from pin 28 to pin 29 again =

At the sensor itself:

5. Measure the resistance of the sensor across both pins =
6. Measure the resistance of each pin on sensor to ground =

KEY ON:

7. Measure voltage from pin 28 to ground =
8. Measure voltage from pin 29 to ground =

SPN 793 FMI ** - Roadside(left) intermediate axle sensor (position E or position 5) (Reference Diagram A)

Turn key off, go to ECU, and unplug the x3 connector and on the harness side

1. Measure the resistance from pin 1 to pin 2
2. Measure the resistance from pin 1 to ground =
3. Measure the resistance from pin 2 to ground =

Unplug the sensor.

4. Measure the resistance from pin 1 to pin 2 again =

At the sensor itself:

5. Measure the resistance of the sensor across both pins =
6. Measure the resistance of each pin on sensor to ground =

KEY ON:

7. Measure voltage from pin 1 to ground =
8. Measure voltage from pin 2 to ground =

SPN 794 FMI ** - Curbside(right) intermediate axle sensor (position F or position 6) (Reference Diagram A)

If the fault is active proceed with the following checks and record exact values.

Turn key off, go to ECU, and unplug the x3 connector and on the harness side

1. Measure the resistance from pin 10 to pin 11 =
2. Measure the resistance from pin 10 to ground =
3. Measure the resistance from pin 11 to ground =

Unplug the sensor.

4. Measure the resistance from pin 10 to pin 11 again =

At the sensor itself:

5. Measure the resistance of the sensor across both pins =
6. Measure the resistance of each pin on sensor to ground =

KEY ON:

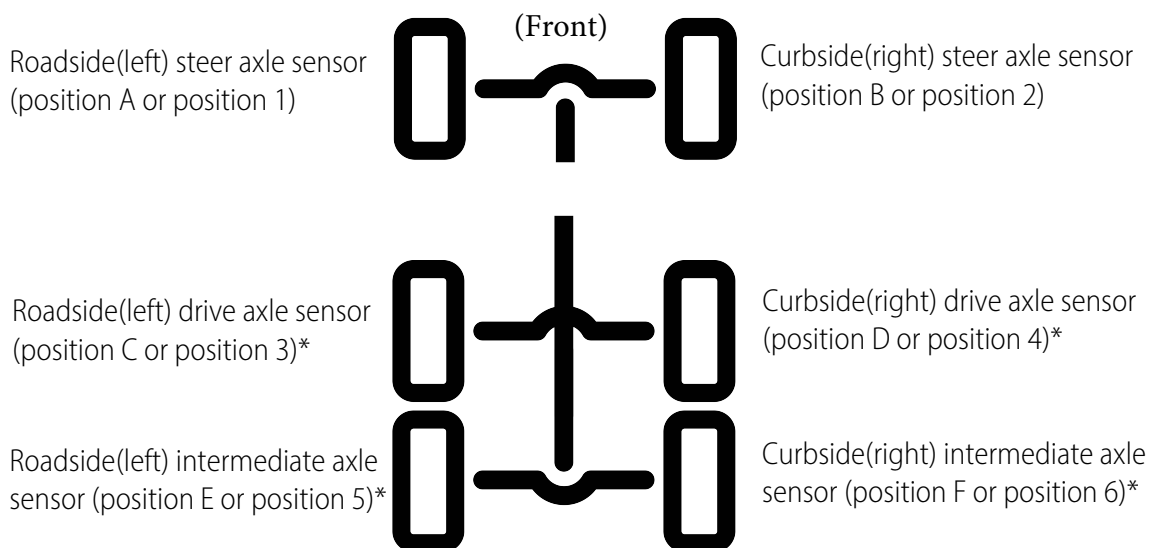
7. Measure voltage from pin 10 to ground =
8. Measure voltage from pin 11 to ground =

Table B - FMI Chart

FMI	FAULT DESCRIPTION	FAULT INDICATION	REPAIR INFORMATION
FMI 1	Air gap (not a electrical issue)	An airgap failure is detected, if the voltage amplitude is too low (depends on signal frequency)	Check the relevant wheel speed sensor and its mounting. Is the distance between pole wheel and sensor (airgap) too wide)
FMI 2	Incorrect Tire	System has detected a significant difference in the proportion of tire diameter to numb of tone ring teeth between wheel ends. 10% (+/-2%)	<ul style="list-style-type: none"> + Check for tire size mismatch. + Check for correct number of tone ring teeth. + Verify that ECU is programmed for the correct vehicle
FMI 3	Short to Voltage (high voltage)	A short circuit to UB at the wheel speed sensor (IG-H or IG-L) is detected after 150 ms.	<ul style="list-style-type: none"> + Check wiring of relevant sensor (short circuit?) + Check relevant sensor (internal short-circuit ?)
FMI 4	Short to ground	A short circuit to GND at the wheel speed sensor (IG-H or IG-L) is detected 150 ms.	<ul style="list-style-type: none"> + Check wiring of relevant sensor (short circuit ?) + Check relevant sensor (internal short-circuit ?)
FMI 5	Open circuit	An interruption (open load) at the wheel speed sensor (IG-H or IG-L) is detected after 140 ms.	<ul style="list-style-type: none"> + Check correct parameter settings (relevant sensor assembled ?) + Check wiring to relevant sensor (interruption ?)
FMI 6	Short to circuit	A shorted coil of the wheel speed sensor (< 300 Ohm) is detected after 150 ms.	<ul style="list-style-type: none"> + Check wiring of relevant sensor (short circuit ?) + Check relevant sensor (internal short-circuit ?)
FMI 7	Tooth wheel / airgap (not a electrical issue)	The wheel speed detection will be able to detect insufficient and/or missing teeth defined within 3000 counts of teeth.	+ Check the relevant pole-wheel (is it damaged? dirty?)
FMI 8	Abnormal frequency	A failure is detected, if the wheel speed signal frequency is >3500 Hz	+ Check whether there are in admissible oscillation-effects at the relevant foundation brake
FMI 9	Wires mismatched (not an electrical issue)	ABS Warning Lamp	<ul style="list-style-type: none"> + Check for mismatch fault of another sensor. + Verify correct harness location and wiring for sensor. + Check for corroded or damaged wiring between the ECU and the ABS wheel speed sensor.

FMI	FAULT DESCRIPTION	FAULT INDICATION	REPAIR INFORMATION
FMI 10	Speed Drop-Out (not an electrical issue)	ABS Warning Lamp	<ul style="list-style-type: none"> + Adjust wheel speed sensor until it touches the tone ring. + Check for loose wheel bearings or excessive hub runout. + Check sensor wiring and connectors for intermittent contact. + Check condition of ABS sensor head. + Check mounting of tone ring and condition of teeth. + Check condition and retention of ABS sensor spring clip. + Check ABS sensor cable routing and clipping. + Check for corroded or damaged wiring between the ECU and the ABS wheel speed sensor. + Turn the wheel at half a revolution per second and verify 0.2 AC volt sensor output voltage
FMI 11	Plausibility check of wheel speed sensor	The wheel speed detection will monitor analog input and digital input of WABA ASIC and compare both signals whether or not they are consistency (plausibility check).	<ul style="list-style-type: none"> + Check whether there are inadmissible oscillation-effects at the mounting of the relevant wheel speed sensor
FMI 13	Failure detection 'Over Equipped' of wheel speed sensor	A failure is detected, if the relevant component is not activated in the parameter setting, but it is nevertheless connected to the ECU.	<ul style="list-style-type: none"> + Check the isolation of the wheel speed sensor wiring (high frequencies might be induced)
FMI 14	RunOut failure of wheel speed sensor (not an electrical issue)	A RunOut failure will be detected if the ration of min/max amplitudes is too high.	<ul style="list-style-type: none"> + Check the relevant pole wheel (is it damaged?) + Check the relevant wheel bearing (is it loosened?)

Diagram A: Wheel Speed Sensor locations



**Note: Sensor position may differ from unit to unit. Ensure the proper wheel end is being tested or inspected before proceeding. Disconnect the opposite side sensor on the affected axle to ensure the correct sensor testing location. While using Toolbox check what fault becomes active.*

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