

Diagnostic Controller

Operating Instructions



WABCO



Operating Instructions

for the WABCO
Diagnostic Controller
446 300 320 0 with
ABS Sensorcheck Probe
446 300 350 0 and
"ABS Sensorcheck" program card
446 300 604 0 (en)

for testing WABCO standard sensors and
mini sensors



2nd Edition



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WABCO

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An American Standard Company

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815 010 086 3

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1. GENERAL INFORMATION

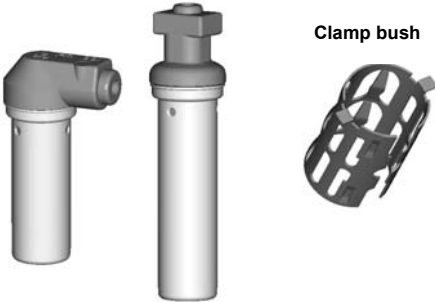
1.1 Abbreviations and explanation of terms

ASP	ABS Sensorcheck Probe
ECU	Electronic Control Unit
L1	Steering axle sensor right
L2	Steering axle sensor left
H1	Main axle sensor right
H2	Main axle sensor left
Z1	Additional axle sensor right
Z2	Additional axle sensor left

(Positions viewed in the direction of travel).

WABCO standard sensor

S Plus-Sensor



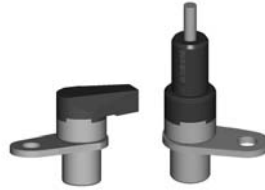
The WABCO standard sensor is installed together with a special clamp bush and during assembly is pressed up to the pole wheel. The ABS sensor air gap between the pole wheel and sensor is automatically set during operation.

The internal resistance at $R_t = + 20^\circ\text{C}$ is 1100 to 1250 Ohm.

The sensors have the following WABCO number ranges:

441 032 101 0 ... 441 032 249 0
441 032 400 0 ... 441 032 999 0

WABCO mini sensor



The WABCO mini sensor is securely screwed on in the vehicle. The ABS sensor air gap must lie between 0.1 and approx 0.7 mm.

The internal resistance at $R_t = + 20^\circ\text{C}$ is 1100 to 1250 Ohm.

The sensors have the following WABCO number range:

441 032 250 0 ... 441 032 299 0
441 037 001 0 ... 441 037 050 0

ABS sensor air gap

The ABS sensor air gap is the gap between the pole wheel and sensor. The larger the air gap the smaller the sensor signal.

Total tooth pitch error

The total tooth pitch error of a pole wheel results from the tolerance of the individual divisions (tooth + gap). In unfavourable cases it can lead to fluctuations in the signal frequency and therefore to faulty ECU speed processing. Therefore a relatively constant speed is required to check the total tooth pitch error (only in initial system check mode), e.g. as on a roller dynamometer.

Wobble

In the ideal case the air gap between the sensor and pole wheel is constant while a wheel is rotating. Bearing clearance, assembly and production tolerances produce a wobbling movement in the pole wheel, which causes a fluctuating signal strength. The maximum wobble should not exceed approx 0.2 mm.

Tooth profile deviation

Tooth profile deviations are caused by damage or flaws on the pole wheel in the area of the tooth geometry, which disrupt the sensor signal. These damaged areas or flaws are usually due to handling or assembly errors, but can also be caused by manufacturing errors.

1.2 Brief system description

The ABS Sensorcheck probe is used to test pole wheel - sensor combinations using the sensor signal. Both the WABCO standard sensor and the WABCO mini sensor can be checked. Damage or deformation of the pole wheel, the function of the sensor and the air gap between the sensor and pole wheel are checked.

The ASP is suitable for determining:

- Tooth profile deviations
- Wobble at the pole wheel
- over-large ABS sensor air gap, and in the mini sensor, possibly too small air gap
- Total tooth pitch error.

The program reads in the data measured by the ABS Sensorcheck Probe and analyses it

in order to make a statement about the condition of the pole wheel - sensor combination.

All WABCO standard and mini sensors used together with pole wheels which lie within the limit data given on pages 15 and 16 can be checked. If the number of teeth of a pole wheel is unknown the unit enables this to be determined (see Item 5.4 Tooth counter).

To perform the pole wheel test you must rotate the relevant wheel with a constant speed. The signal frequency of the sensor should lie within the range from 40 to 170 Hz. This roughly equates to a vehicle speed of 5 to 20 km/h. For reasons of measuring accuracy, if possible, it is advisable to perform the test with a higher speed than the minimum permissible speed.

The result of the test can be output on a printer as a log via the serial interface.



Caution when rotating the wheels, risk of injury!

Always use the test bench to rotate the wheels on the drive axles!

2. DIAGNOSTIC COMPONENTS



Towing vehicle:

1*	Diagnostic Controller	446 300 320 0
2*	ABS Sensorcheck Probe	446 300 350 0
3*	Program card	446 300 601 0 (de)
		446 300 602 0 (fr)
		446 300 603 0 (it)
		446 300 604 0 (en)
		446 300 605 0 (es)
4	Connection adapter 35-pin for 4-channel systems**	446 300 315 0
	or	
	Connection adapter 54-pin for 6-channel systems**	446 300 319 0
	or	
	Connection cable (ISO 9141)	894 604 303 2
5	Measuring adapter 35-pin for 4-channel systems	446 300 314 0
	or	
	Measuring adapter 54-pin for 6-channel systems**	446 300 309 0
6	Multimeter cable black**	894 604 301 2
7	Multimeter cable red	894 604 302 2

Trailer:

1*	Diagnostic Controller	446 300 320 0
2*	ABS Sensorcheck Probe	446 300 350 0
3*	Program card	(see towing vehicle)
4	Connection adapter**	446 300 318 0
6	Multimeter cable black**	894 604 354 2
7	Multimeter cable red**	894 604 355 2

* Minimum number to test pole wheel-sensor combinations

** not illustrated

3. LINE PORT DESCRIPTION

3.1 Connection to the diagnostic controller

The connection is made via a 4-pin spiral cable permanently connected to the ABS Sensorcheck Probe with a 5-pin connector (DIN 41524) at the "Keyboard" socket of the Diagnostic Controller. It is not possible to reverse the polarity.

Please note! **Insert the program card 446 300 601 0 first and then connect the ASP** to the "Keyboard" **socket**. Only this program card can analyse the data constantly sent from the ASP. Remove the connector again if working with non-ASP program cards! Otherwise automatic program runs of the non-ASP program card are possible.


Diagnostic Controller power supply in the towing vehicle

Before switching on the ignition the Diagnostic Controller is connected to the central diagnostic link in the vehicle with a connection cable or by using a connection adapter between the vehicle's wiring and the measuring adapter.

Diagnostic Controller power supply in the trailer vehicle

After disconnecting the voltage supply the Diagnostic Controller is connected to the vehicle's wiring via the connection adapter 446 300 318 0.

The connection between the connection adapter and Vario-C-ECU must not be made as errors are entered in the ECU when the sensor connector is removed.

It is also possible to supply the power via the 12V-24V socket on the back of the Diagnostic Controller. Do not reverse the polarity (negative  positive).

3.2 Connection to the ABS sensor

The ASP measurement input (black and red socket) is connected with the sensor. After switching off the ignition, the ABS electronics are disconnected from the vehicle wiring in the towing vehicle and the measuring adapter (35 or 54-pin) is inserted. The following pins are connected using a multimeter cable 894 604 301 2 and 894 604 302 2 (same cables as for the trailer vehicle ABS diagnosis): (Circuit diagram 24 V ABS/ASR "C" - see enclosure)

	black	red
Sensor wheel A (L2)	32	15
Sensor wheel B (L1)	34	17
Sensor wheel C (A1)	35	18
Sensor wheel D (A2)	33	16
Sensor wheel E*(Z2)	53	54
Sensor wheel F* (Z1)	51	52

* only 6-channel "C"

The inputs can be polarised in any way. Accidental connection of the multimeter cable with the other pins (e.g. vehicle voltage) does not damage the ABS Sensorcheck Probe. Where ABS-Vario-C systems are installed in the trailer the coloured sensor connectors are disconnected from the open electronics.

Use multimeter cables 894 604 354 2 and 894 604 355 2 (same cables as for the ABS-Vario-C diagnosis) to connect the ASP with the sensor. The red and black cables can also be polarised in any way.

The connection can also be made directly at the sensors or their extension cables.

Here are a few examples of various pushbutton functions:

To avoid falsification of the check results, the connection between the ECU and the sensor whose pole wheel is being checked must be disconnected. The power supply to the electronics must also be disconnected to ensure the ECU does not make any entries in its error memory by disconnecting the sensor connection.

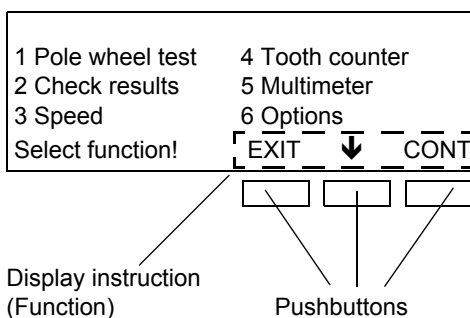
The ABS system can therefore not work during the test and the statutory provisions must be observed.

4. OPERATING THE DIAGNOSTIC CONTROLLER

The Diagnostic Controller is operated using the three pushbuttons on the front. The respective function is shown in the display above the relevant pushbutton.

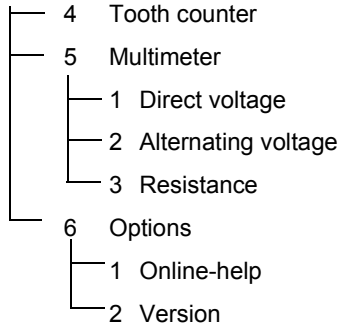
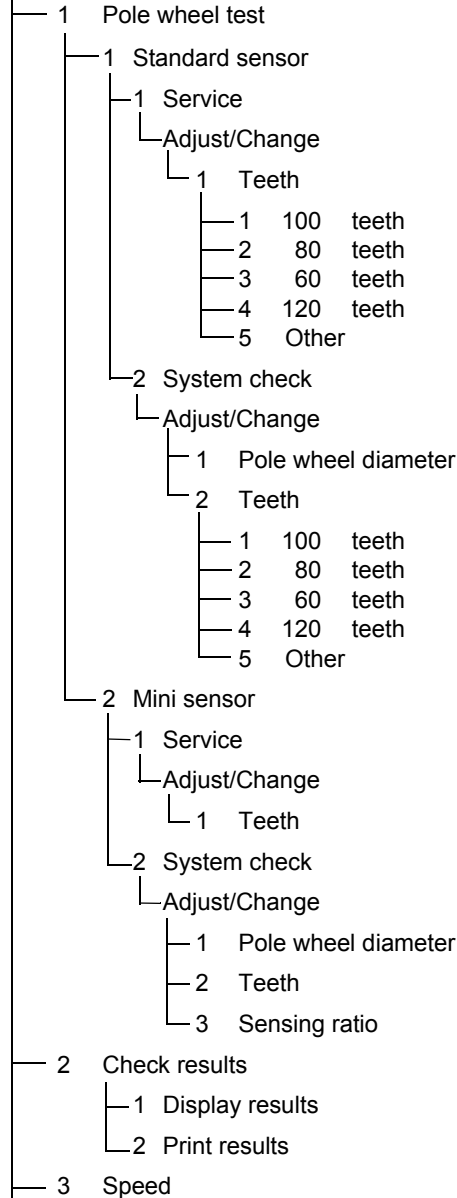
Pushbutton Function

START	Start the program (part).
EXIT	The display returns to the previous menu or program item.
↓	Select a menu item. With each press of the button skips from menu item to menu item. The menu item selected flashes.
CONT	The previously selected menu item is activated or triggered.
QUIT	You can cancel the respective function if an error occurs.

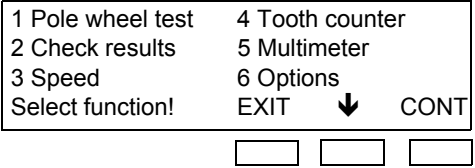


5. PROGRAM EXPLANATION

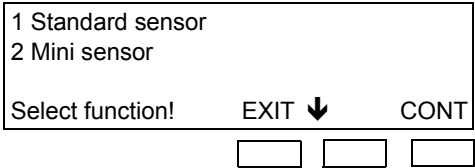
Menu selection ABS Sensorcheck
Probe Version 2.XX



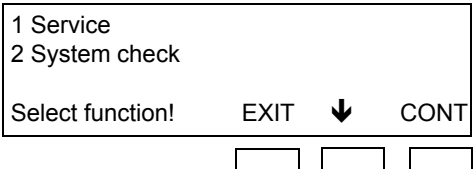
5.1 Pole wheel test



After selecting menu item 1 "Pole wheel test", the following menu appears:



After the sensor type has been selected the following menu appears:



When new vehicles are checked by the manufacturer or after repair work (adjusting the wheel bearing clearance + pressing the WABCO standard sensor back into place) select "System check" mode, in all other cases select "Service" mode.

More stringent test limits apply in "System check" mode than in "Service" mode. The total tooth pitch error is only checked in system check mode as this does not involve a suddenly occurring error. The test sequence does not differ in service and system check.

(Standard/mini sensor - Service)

Teeth	:	100
Parameters :	EXIT	CHANGE
	CONT	
	<input type="button" value=""/>	<input type="button" value=""/>

It is not necessary to enter the pole wheel diameter here.

(Standard sensor - system check)

Pole wheel diameter	:	170 mm
Number of teeth	:	100
Parameters:	EXIT	CHANGE
	CONT	
	<input type="button" value=""/>	<input type="button" value=""/>

It is necessary to enter the pole wheel diameter here because the test criteria are more stricter.

(Mini sensor - system check)

Pole wheel diameter	:	140 mm
Teeth	:	100
Sensing ratio	:	0.55
Parameters :	EXIT	CHANGE
	CONT	
	<input type="button" value=""/>	<input type="button" value=""/>

In addition to entering the pole wheel diameter, it is also necessary to enter the sensing ratio of the pole wheel (gap to division). If the sensing ratio is unknown, enter an medium value of 0.55.

The number of teeth is always necessary for a correct test result!

If these test parameters are correct, press the <CONT> button to start or continue the pole wheel test, otherwise press the <CHANGE> button to open one of the following menus depending on whether you selected "Service" or "System check" mode:

1	100 teeth	4	120 teeth
2	80 teeth	5	Other
3	60 teeth		
Select function!	EXIT	↓	CONT
	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

1	Pole wheel diameter
2	Teeth
Select function!	EXIT
	↓
	CONT
	<input type="button" value=""/>

After selecting menu item 1 "Pole wheel diameter" the display may look e.g. like this:

Enter pole wheel diameter in millimeter		
Diameter : 142 mm		
↑	↓	CONT
<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

Press the left or middle button to change the diameter to your requirements (range: 50-280 mm for standard sensor and 100-200 mm for mini sensor). Press the <CONT> button to accept the displayed value.

Details of the pole wheel diameter can be obtained from the vehicle or axle manufacturer. If this is not possible, we recommend you use the following values:

Number of teeth	Pole wheel diameter
60	80 mm
80	110 mm
100	130 mm
120	160 mm

Use menu item 2 "Teeth" to adjust the number of pole wheel teeth.

The following menu appears:

1 100 teeth	4 120 teeth
2 80 teeth	5 Other
3 60 teeth	
Select function!	EXIT ↓ CONT

The items 1 to 4 are used to directly accept the respective displayed number of teeth. Item 5 is used to enter a number of teeth not listed under the first four items. (e.g. 45 teeth).

Enter the number of teeth!
Number : 45
↑ ↓ CONT

Proceed in exactly the same way as to enter the pole wheel diameter.

If you do not know how many teeth the pole wheel has, proceed as described in Item 5.4 "Tooth counter".

If you have entered the values for the pole wheel diameter and the number of teeth, press the <EXIT> button to start or continue the pole wheel test.

Follow each of the instructions that appear on the screen and then press the <CONT> button!

Connect ABS sensor check probe to the diagnostic controller and the ABS sensor to the ABS sensor check probe!
EXIT CONT

Start pole wheel check and Rotate wheel at constant speed!
CONT

After pressing the <START> button the bottom screen appears on the display, and a "countdown" of 5 seconds is started before the test begins.

Check starts in 5 seconds! Rotate wheel!

Checking pole wheel! Rotate wheel at constant speed! Wheel must not slow down!
--

In order to perform an optimum pole wheel test, where possible, the speed of the wheel should be kept constant. The measurement takes approx 2 to 6 seconds.

Collected data are being evaluated!
Please wait ...



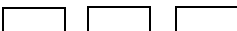
If this display appears you can stop turning the wheel. Analysis of the data takes a few seconds.

The result of the pole wheel test then appears in plain text.

Here are a few examples:

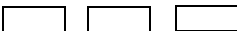
Sensor voltage too low!
Air gap between sensor and pole wheel probably too large!

CONT



Sensor voltage too high!
Air gap between sensor and pole wheel probably too small!

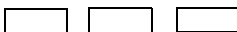
CONT



Only for "Mini sensor - System check".
The sensor is possibly touching the pole wheel. As mini sensors are screwed on, this can damage the sensor.

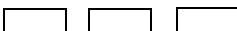
Pole wheel and sensor voltage
OK

EXIT CONT



Pole wheel failure detected!
Air gap between pole wheel and sensor varies too much!

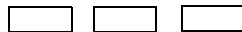
CONT



So-called "wobble" has occurred. The pole wheel or installation must be checked.

Pole wheel failure detected!
Check tooth shape!

CONT



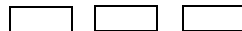
One or several tooth profile deviations have occurred. The pole wheel must be replaced.

5.2 Check results

The results of the pole wheel test can be displayed or printed out.

1 Display results
2 Print results

Select function! EXIT ↓ CONT



5.2.1 Display results

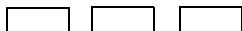
The following screens appear consecutively on the display. The result is repeated in plain text.

Pole wheel and sensor voltage.
OK

EXIT CONT



MINI SENSOR System check
Pole wheel diameter : 140 mm
Teeth : 100
Sensing ratio : 0.55 CONT



Medium speed : 60.2 rpm
 Frequency : 100.3 Hz
 MEASURED VALUES CONT

U max (standard at 100 Hz) : 0.24 Vrms
 U min (standard at 100 Hz) : 0,23 Vrms
 Ratio U max / U min : 1,04
 MEASURED VALUES CONT

U max (standard at 100 Hz) : <0.62 Vrms
 U min (standard at 100 Hz) : >0,16 Vrms
 Ratio U max / U min : <1,81
 LIMITING VALUES CONT

Maximum amplitude error : 2,4 %
 Maximum half-cycle error : 1,3 %
 Total tooth pitch error (deg) : 0,3
 MEASURED VALUES CONT

Amplitude error : <15,0 %
 Half-cycle error : <10,0 %
 Total tooth pitch error (deg) : < 1,5
 LIMITING VALUES CONT

The numerical values shown here are only an example.

Press the <CONT> button.

The voltages given are in Volt effective (Vrms) and are calibrated to a sensor signal frequency of 100 Hz. This means that if the test is repeated with a different speed the same voltage values will be displayed.

The ratio between the maximum voltage and the minimum voltage is a measurement of the change in the ABS sensor air gap during one rotation of the wheel.

If the air gap was constant this value would be exactly 1.0.

One of the two following screens (example) appears depending on whether tooth profile deviations were detected or not:

Number of detected tooth shape errors: 2
 CONT

Press the <CONT> button!

No tooth profile deviations found!
 CONT

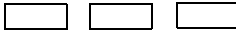
This screen only appears if it is useful to analyse the tooth profile deviations, i.e. not if the speed is too high or low or the air gap is too large.

5.2.2 Print results

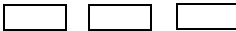
Follow the instructions on the display. The printer must be Epson-FX compatible, have a serial input, and the transmission format "1200 Baud", "8 Data bits", "1 Stop bit", "no parity bit" must be set (corresponds to the usual basic setting). When printing a differentiation is made between the original copy and any subsequent copies.

Disconnect ABS sensor check probe!
Connect printer to serial port!
Insert paper into printer!

EXIT CONT

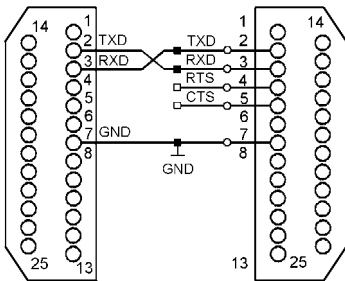


Results are being printed!
Please wait ...



Pin assignment:

Printer Diagnostic Controller



5.3. Speed

The speed of the pole wheel is displayed in revolutions per minute. This test is ideally suited for checking for correct connection of the ABS sensor. If the ABS sensor signal is **too weak** or **is not available**, the message "Sensor voltage < 50 mVrms; sensor possibly not connected!" appears. This can be for the following reasons:

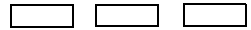
- ABS sensor is not connected to the ABS Sensorcheck Probe
- ABS sensor is not installed

- Pole wheel is not installed
- Wheel doesn't turn or turns too slowly
- Air gap between pole wheel and ABS sensor is too large
- ABS sensor is defective.

Example:

Wheel speed is being calculated!
Speed : rpm (100 teeth)

QUIT



To perform the pole wheel test you must rotate the relevant wheel with a constant speed. The signal frequency of the sensor should lie within the range from 40 to 170 Hz. This roughly equates to a vehicle speed of 5 to 20 km/h. If the rotational speed is too fast or slow this is displayed accordingly. In all other cases the speed determined and the set number of teeth are displayed.

5.4. Tooth counter

Select the menu item 4 "Tooth counter" (cf. page 8) with the wheel at a standstill. Rotate the wheel precisely once. To do this, you could for example put a mark on the tyre. While the wheel is turning the number of teeth counted is displayed. After one complete rotation the displayed number of teeth remains at the value for the number of pole wheel teeth.

Here are two examples:

Turn wheel exactly one revolution!
Teeth: 104

QUIT

Result: The wheel was probably turned beyond the marking. Rounding down to a "common" number of teeth value (60, 80, 100 or 120) gives: The pole wheel has 100 teeth.

Turn wheel exactly one revolution!
Teeth: 76

QUIT

Result: The pole wheel has 80 teeth. The wheel was probably not turned right up to

the aforementioned tyre mark.

You can also rotate the wheel several times and divide the value displayed by the number of revolutions. This increases the accuracy when determining the number of pole wheel teeth.

5.5 Multimeter

1 DC voltage	3 Resistance
2 AC voltage	
Select function!	EXIT ↓ CONT

IMPORTANT:

The measuring device is only designed for measurements within the vehicle-relevant range (low voltage). It may only be used within the measuring ranges given below.

Range	Display resolution	Accuracy of the measuring range end value at 20°C	
DC voltage	2.0 V	± 0,2 %	± 0.0 V
	20.0 V	± 0,2 %	± 0.1 V
	50.0 V	± 0,2 %	± 0.1 V
AC voltage	2.0 V	± 0,6 %	± 0.02 V
	35.0 V	± 0,6 %	± 0.4 V
Resistance	20.0 Ω	± 0,3 %	± 0.1 Ω
	200.0 Ω	± 0,2 %	± 0.1 Ω
	2.0 kΩ	± 0,2 %	± 1.0 Ω
	20.0 kΩ	± 0,1 %	± 10.0 Ω
	95.0 kΩ	± 0,2 %	± 100.0 Ω

The integrated multimeter function can be used to take electrical measurements on the vehicle. You only need to select the required measuring function

- 1 DC voltage
- 2 AC voltage
- 3 Resistance

The measuring range is automatically set by the unit.

5.6 Options

1 ONLINE-Help			
2 Version			
Select function!	EXIT	↓	CONT
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

"Options" contains the following sub-items:

5.6.1 Online-help

This function enables the operator to receive additional explanations about operating the system. If this function is switched on, more detailed explanations of the program appear at a suitable position between the program steps.

5.6.2 Version

Hardware	: V1 Multimeter: V1	
Operating system	: V3.1 of 07.03.1991	
Program	: V2.00 of 22.08.2002	
Checksum	: BC 99 (hex)	CONT
	<input type="text"/>	<input type="text"/>

This function displays the delivered status of the controller and program card used:

5.7 Limit data for the test

System check mode (I), Service (S)

WABCO standard sensor:

- Permissible frequency range : 30 - 200 Hz
- Permissible teeth : 40 - 120
- Permissible pole wheel diameter : 50 -280 mm
- Umin (I) : is calculated in Vrms (standard at 100 Hz)
- Umin (S) : 0.2 Vrms (standard at 100 Hz)
- Umax/Umin (I) : 2.0 -2.2 (depending on the level of the measured sensor voltage)
- Umax/Umin (S) : 2.2 - 2,5 (depending on the level of the measured sensor voltage)
- Amplitude error (I) : < 15% permissible
- Amplitude error (S) : 1 15 - 30% error permissible*
- Half-cycle error (I) : < 10 % permissible
- Half-cycle error (S) : 1 10 -15 % error permissible*
- Total tooth pitch error (I) : < 1.5 degree

* (see following page)

WABCO mini sensor:

Permissible frequency range	: 30 - 200 Hz
Permissible teeth	: 80 - 120
Permissible pole wheel diameter	: 100 -200 mm
Sensing ratio (I)	: 0,45 - 0,65
Umax (I)	: is calculated (standard at 100 Hz)
Umin (I)	: is calculated (standard at 100 Hz)
Umin (S)	: 0,11 Vrms (standard at 100 Hz)
Umax/Umin (I)	: 1.65 - 2.1
Umax/Umin (S)	: 1.75 - 2.2
Amplitude error (I)	: < 15 %
Amplitude error (S)	: 1 15 - 30% error*
Half-cycle error (I)	: < 10 %
Half-cycle error (S)	: 1 10 -15 % error*

- * If an amplitude error of 15 - 30% and a half-cycle error of 10 - 15% occurs at the same tooth during service, this is evaluated as 1 tooth profile deviation, i.e. pole wheel OK.
If an amplitude error of 15 - 30% and a half-cycle error of 10 - 15% occurs at different teeth during service, this is evaluated as 2 tooth profile deviations, i.e. pole wheel not ok.

6. TECHNICAL PARAMETERS

The ASP is supplied with an operating voltage of 5 V (IB approx 60 mA) via the Diagnostic Controller's power supply unit.

Storage temperature: - 40°C ... 70°C

Operating temperature: 0°C ... 70°C

Degree of protection to DIN 40050: IP20

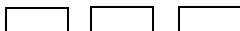
The clock and data output and the internal operating voltage of the ASP are to be electrically separated from the power supply and the vehicle earth.

The ASP is installed in a plastic housing (BxHxD in mm 90x50x24).

Malfunctions and their causes:



No display

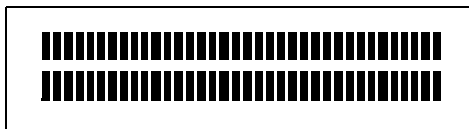


Cause

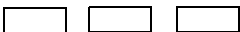
Remedy

- No voltage
- Undervoltage (smaller than approx 7 V)
- If, after inserting the program card the display disappears, the program card is defective

- Check all plug-in connections
- Check power supply
- Replace program card



Black "bar"



Cause

Remedy

- Program card not inserted

- Push in program card up to the limit stop (contacts facing upwards).

7. LOG PRINTOUT

If it is not possible to printout the log with the Diagnostic Controller, the log on page 20 "Mini sensor test" or page 21 "Standard sensor test" can be used and copies made on a photocopier.

If necessary the form can be enlarged to A4 format before completing.

Examples of a mini sensor system check and a standard sensor service test record:

```

***      WABCO ABS sensor check      ***
*** electrical sensor pole wheel test ***
***      TEST RECORD      ***
    
```

=====

SELECTED SETTINGS

```

! Mode                      System check
! Sensor type               Mini sensor
! Pole wheel diameter       140 mm
! Teeth                     100
! Sensing ratio             00.55
    
```

=====

MEASURED VALUES

```

! Speed                     60.2 rpm
! Frequency                 100.3 Hz
! Umax (standard at 100 Hz) 0.24 Vrms
! Umin (standard at 100 Hz) 0.23 Vrms
! Ratio Umax / Umin         1.04
! max. amplitude error      2.4%
! max. half-cycle error     1.3%
! max. total tooth pitch error 0.3 degrees
! Number of tooth shape errors 0
    
```

=====

LIMITING VALUES

```

! Umax (standard at 100 Hz) < 0.62 Vrms
! Umin (standard at 100 Hz) > 0.16 Vrms
! Ratio Umax / Umin         < 1.81 (variable: 1.65 - 2.1)
! max. amplitude error      < 15.0 %
! Half-cycle error          < 10.0 %
! Total tooth pitch error    < 1.5 degrees
    
```

=====

RESULT

```

! Pole wheel and sensor voltage OK
    
```

```

! Vehicle/Axle: _____ Manufacturer: _____
! Date: _____ Tested: _____
    
```

```

=====
!
!
!
!           ***   WABCO ABS sensor check   ***
!           *** electrical sensor pole wheel test ***
!           ***   TEST RECORD   ***
!
=====

```

=====

! SELECTED SETTINGS

```

! Mode                               Service
! Sensor type                         Standard sensor
! Pole wheel diameter                 --- mm
! Teeth                               120
=====

```

=====

! MEASURED VALUES

```

! Speed                               50.1 rpm
! Frequency                           100.3 Hz
! Umin (standard at 100 Hz)          0.48 Vrms
! Ratio Umax / Umin                  1.02
! max. amplitude error                2.0%
! max. half-cycle error              0.6 %
! Number of tooth shape errors        0
=====

```

=====

! LIMITING VALUES

```

! Umin (standard at 100 Hz)          > 0.20 Vrms
! Ratio Umax / Umin                  < 2.38 (variable: 2.2 - 2.5)
! max. amplitude error                < 30.0 %
! Half-cycle error                    < 15.0 %
=====

```

=====

! RESULT

```

! Pole wheel and sensor voltage      OK
=====

```

```

! Vehicle/Axle: _____ Manufacturer: _____
! Date: _____ Tested: _____
=====

```

"Mini sensor test"

*** WABCO ABS sensor check ***
 *** electrical sensor pole wheel test ***
 *** TEST RECORD ***

SELECTED SETTINGS

! Mode _____
 ! Sensor type _____
 ! Pole wheel diameter _____
 ! Teeth _____
 ! Sensing ratio _____

MEASURED VALUES

! Speed _____ rpm
 ! Frequency _____ Hz
 ! Umax (standard at 100 Hz) _____ Vrms
 ! Umin (standard at 100 Hz) _____ Vrms
 ! Ratio Umax / Umin _____
 ! max. amplitude error _____ %
 ! max. half-cycle error _____ %
 ! max. total tooth pitch error _____ degrees
 ! Number of tooth shape errors _____

LIMITING VALUES

! Umax (standard at 100 Hz) < _____ Vrms
 ! Umin (standard at 100 Hz) > _____ Vrms
 ! Ratio Umax / Umin < _____ (variable: 1.65 - 2.2)
 ! max. amplitude error < _____ %
 ! Half-cycle error < _____ %
 ! Total tooth pitch error < _____ degrees

RESULT

! Vehicle/Axle: _____ Manufacturer: _____
 ! Date: _____ Tested: _____

"Standard sensor test"

```

***      WABCO ABS sensor check      ***
***      electrical sensor pole wheel test      ***
***      TEST RECORD      ***
    
```

SELECTED SETTINGS

```

! Mode _____
! Sensor type _____
! Pole wheel diameter _____
! Teeth _____
    
```

MEASURED VALUES

```

! Speed _____ rpm
! Frequency _____ Hz
! Umin (standard at 100 Hz) _____ Vrms
! Ratio Umax / Umin _____
! max. amplitude error _____ %
! max. half-cycle error _____ %
! max. total tooth pitch error _____ degrees
! Number of tooth shape errors _____
    
```

LIMITING VALUES

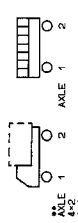
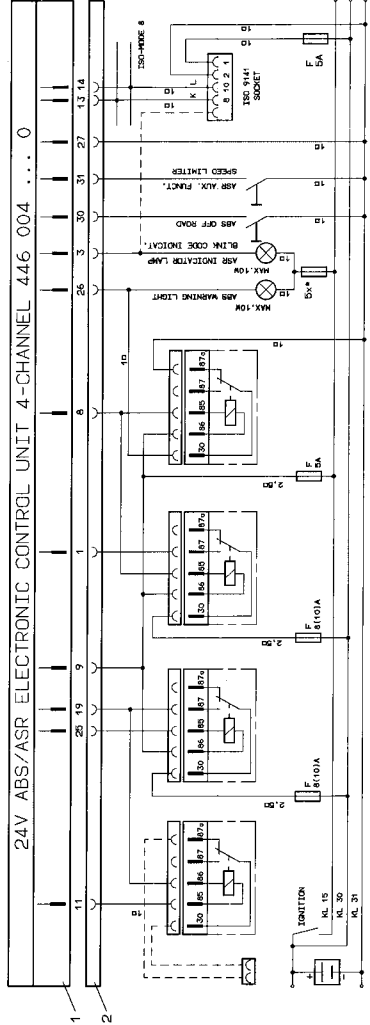
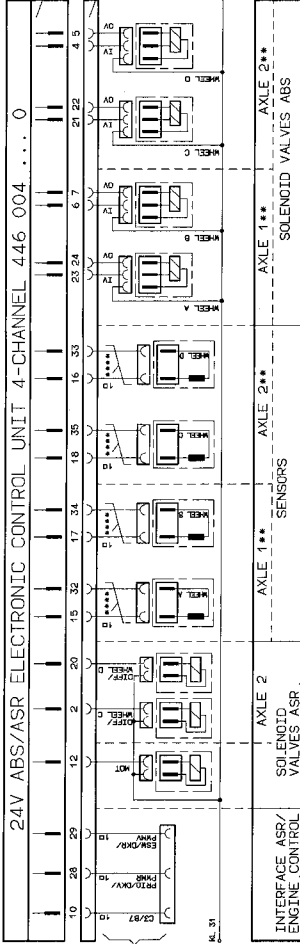
```

! Umin (standard at 100 Hz) > _____ Vrms
! Ratio Umax / Umin < _____ (variable: 2.0 - 2.5)
! max. amplitude error < _____ %
! Half-cycle error < _____ %
! Total tooth pitch error < _____ degrees
    
```

RESULT

```

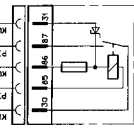
! Vehicle/Axle: _____ Manufacturer: _____
! Date: _____ Tested: _____
    
```

WIRE	LEFT	RIGHT
1. STOPPING	L (L3)	R (R3)
2. DRIVING	C (L4)	D (R2)

- SOLENOID CABLE: WABCO 894 601 0.. 2
- GROUND BY BROWN
- GREEN YELLOW AV BLUE
- EV-INLET VALVE
- AV-OUTLET VALVE
- CROSS SECTION OF NON-INDICATED WIRES: 1.0mm² / 17 AWG
- FUSES SPECIFIED BY THE VEHICLE MANUFACTURER (VIN 72081)
- *** - ASR-OPTION
- **** - TWISTED WIRE
- 5+ - COMMON FUSE OF THE VEHICLE E.T.C. HEAD LAMPS
- 6+ - NON-CONNECTED WIRES MAX. 1m

DATE		2000-09-10	WABCO
DESIGNED BY		WABCO	
CHECKED BY		WABCO	
DRAWN BY		WABCO	
SCALE		1:1	
PROJECT NO.		841 801 161 0	
DRAWING NO.		0301	
CONTRACT NO.			
JOB NO.			
SHEET NO.		611	03



OVERVOLTAGE PROTECTION
RELAY 446 036 00.. 0
AS OPTION. PLEASE SEE PRODUCT SPEC.
ECU 446 004 ... 0 / PARAGRAPH 8



WABCO, the vehicle control systems business of American Standard Companies, is the world's leading producer of electronic braking, stability, suspension and transmission control systems for heavy duty commercial vehicles. WABCO products are also increasingly used in luxury cars and sport utility vehicles (SUVs). Customers include the world's leading commercial truck, trailer, bus and passenger car manufacturers.

Founded in the US 136 years ago as Westinghouse Air Brake Company, WABCO was acquired by American Standard in 1968. Headquartered in Brussels, Belgium, the business today employs nearly 6700 people in 30 office and production facilities worldwide. In 2004, WABCO contributed US\$1.72 billion to American Standard's total sales of US\$9.50 billion.

Website: www.wabco-auto.com



WABCO

Vehicle Control Systems
An American Standard Company