

## Troubleshooting in navigation system 2

Pin assignments, functions etc. apply to vehicles of the series E38 and E39 with navigation system 2 (as from production break PU 97)

### Introduction

The navigation system is a dynamic system which is mainly active while driving.

For this purpose, displays have been created on the on-board monitor of the navigation system 2 which make it possible to check the system while driving.

The test instructions have been set up as follows with the aim of effectively utilizing these functions:

- Fault symptoms with reference to the components to be tested
- Explanation of on-board monitor functions which are used for troubleshooting
- Tests and checks for the individual assemblies in the following sequence: Function test, speed sensor, GPS aerial and receiver, reverse signal, gyro, sound: NF, display: RGB, selection
- Notes on replacing the navigation computer

### Important

**Observe the installation notes (last chapter in these instructions) when installing or replacing the navigation computer.**

It is advisable to print out this document and keep it with you as a reference during troubleshooting.

### Fault symptoms

Fault symptom	Test to be carried out
No GPS reception	GPS
Faulty positioning	GPS, gyro
System does not respond to changes in direction	Gyro
Incorrect distance data in the turnoff instructions	Wheel speed sensor
Incorrect indication (colours, etc.) of navigation and selection menu on the on-board monitor	RGB lines
Display geometry not OK: e.g. image too wide or too flat for the monitor	RGB lines
Incorrect colours, display is white	RGB lines
No sound in navigation mode	AF lines
Navigation not indicated in selection menu	Selection
No selection menu	RGB lines

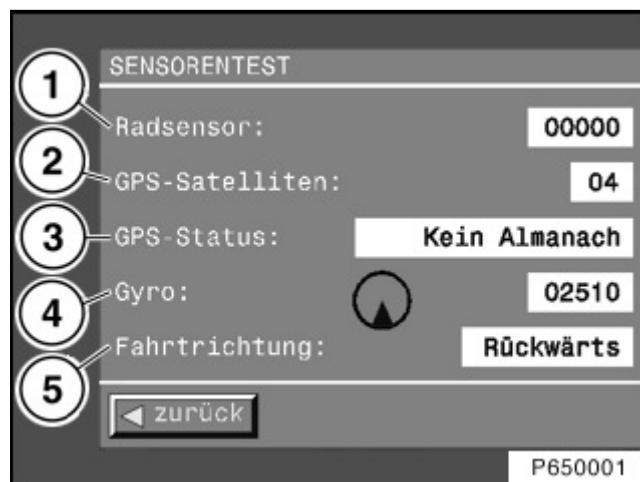
### Functions used

The sensor test indicated on the on-board monitor is assistance during troubleshooting.

The sensor test can be selected as follows:

- Selection, on-board monitor main menu
- Selection, "Settings" in on-board monitor main menu
- Press and hold the "MENU" button (longer than 8 s) in the settings mask
- Select "sensor test"

The following display then appears on the on-board monitor:



Significance of displays (for setpoints see table in "function test" in next chapter)

1	Wheel sensor	Number of pulses of speed sensor per minute
2	GPS satellites	Number of satellites currently received by GPS
3	GPS status	See test for displays and remedy: GPS
4	Gyro	Direction arrow; voltage supplied by gyro in mV
5	Driving direction	Reverse/forward

## Function test

### Procedure

- Select "sensor test" on on-board monitor
- Drive several small diameter circles with the vehicle outdoors
- Observe displays/indicators for sensor test

### Setpoints while driving in circles outdoors:

Display	Setpoint	If not OK, carry out following test
1	While driving (as from approx. 5 km/h): > 0	Wheel speed sensor
2	With unobstructed upward field of vision: > 3	GPS

3	Position known, searching for satellite contact/satellite contact/position known	GPS
4	When stationary/driving straight ahead: 2500 mV +/- 400 mV; while turning off: Outside above-specified range	Gyro
	Direction arrow clearly moves out of zero position when turning off	Gyro
5	Status of reverse gear is recognized correctly	Reverse

### Test: Wheel speed sensor

**Fault symptom:**

Incorrect distance data in the turnoff instructions

**Precondition**

No fault code stored for the speed sensors in ABS/ASC/DSC (warning lamp does not come on)

**Procedure**

**1st check**

Select sensor test on the on-board monitor, drive vehicle at speed > 5 km/h.

**Is a value > 0 indicated for the speed sensor pulses while driving?**

**If a value > 0 is indicated, then the part test for the speed sensors OK**

**If value = 0:**

**2nd check: Oscilloscope measurement of speed sensor signals**

- Connect test adapter 61 4 470 with 26-pin test box at plug connection X1312
- Raise vehicle (observe safety instructions).
- Select oscilloscope in <Measuring systems>.
- Connect test lead MFK1 between pin 1 (main vehicle wiring harness end) and terminal 31 (vehicle ground)
- Settings: Direct voltage, frequency: 20 Hz, measuring range: +/-20V
- Uniformly turn front left wheel by hand
- Replace the navigation computer if a **square-wave signal is indicated** but the navigation computer does not recognize it (0 indication in sensor test).
- If **no square-wave signal is indicated** check lines leading to ABS/ASC/DSC control unit and if lines are OK, continue troubleshooting in ABS

### Test: GPS aerial and receiver

**Precondition**

No covers on the GPS aerial.

**Procedure**

Read GPS status in sensor test on the on-board monitor (display line 3).

**Display: GPS fault**

Cause: There is no communication between the navigation computer and the GPS receiver.

Troubleshooting procedure:

- Check voltage supply of GPS receiver and repair if necessary: Plug connector X1958, terminal R: Pin 7, terminal 31: Pin 1, terminal 30: Pin 8
- If voltage supply is OK: Check wires between navigation computer and GPS receiver and repair if necessary
- If wires are OK: Replace GPS receiver

### Display: Reception fault

Cause: Communication between the navigation computer and GPS receiver is OK, however, there is no satellite information

Troubleshooting procedure:

- Make sure that the GPS aerial is not covered.
- If the GPS aerial is NOT covered by objects protruding beyond the rear window shelf: Measure aerial voltage:  
Disconnect aerial plug connector X81008 from GPS receiver.  
Use test adapter No. 65 5 012  
Terminal R ON  
Measure voltage at aerial plug connector (GPS receiver end) between pin 1 and pin 2  
Setpoint: 5 V +/- 0.3 V
- **If the measured value is in the set range:** Replace GPS aerial
- **If the measured value is NOT in the set range:** Replace GPS receiver

### Display: No almanac

Troubleshooting procedure:

- If the **battery was recently disconnected**/the battery supply of the GPS receiver interrupted:  
Place vehicle outdoors for 15 minutes with terminal R switched on and unobstructed upward view
- **If the voltage supply was NOT interrupted:**  
Check voltage supply of GPS receiver and repair if necessary:  
If the voltage supply is OK: Replace GPS receiver.

### Display: Searching for satellites

Cause: Satellite contact is interrupted. This always occurs when visual contact to the sky is restricted, e.g. in a closed room, tunnel or in the cover of high buildings or trees

The system is OK if the display "searching for satellites" only comes on under the above conditions.

Proceed as described below if "searching for satellites" is also indicated under the conditions: The vehicle is outdoors under an open sky with unrestricted upward view, terminal R is on for longer than 3 minutes:

- Make sure that the GPS aerial is not covered.
- If the GPS aerial is NOT covered by objects protruding beyond the rear window shelf: Measure aerial voltage:  
Disconnect aerial plug connector X81008 from GPS receiver.  
Use test adapter No. 65 5 012  
Terminal R ON  
Measure voltage at aerial plug connector (GPS receiver end) between pin 1 and pin 2  
Setpoint: 5 V +/- 0.3 V
- **If the measured value is in the set range:** Replace GPS aerial
- **If the measured value is NOT in the set range:** Replace GPS receiver

### Display: Satellite contact

The GPS system is OK.

### Display: Position known

The GPS system is OK.

## Test: Reverse

### Procedure

#### 1st check:

Alternately engage reverse and forward gears. Is the status shown correctly on the on-board monitor (sensor test)?

**If status is shown correctly: Reverse is recognized correctly. Subsystem is OK.**

**If the status is NOT shown correctly:**

**2nd check: Navigation computer input**

- Connect test adapter 61 4 470 to plug connection X 1312
- Measure voltage between pin 1 and terminal 31 (vehicle ground)  
Setpoints:  
Engage reverse gear: U > approx. 5 V  
Reverse NOT engaged: U approx. 0 V
- **If the measured value is in the set range:** Replace navigation computer
- **If the measured value is NOT in the set range:** Check line from light module to navigation computer plug connector X1312 pin 1; if line is OK: Continue troubleshooting in the light module

## Test: Gyro

### Procedure

Select sensor test, evaluate display 1 with vehicle stationary: Is the voltage in the range of 2500 mV +/- 400 mV?

**If value is not OK:** Replace navigation computer. Refer to notes on replacing the navigation computer

**If value is OK:**

- Drive in circles with small diameters in a car park.
- Observe indication in line 4 while driving in circles
- **Setpoint:** While driving in circles, the arrow indicator in line 4 must move distinctly out of the zero position, i.e. the indicated value must deviate distinctly from 2500 mV

**If the indication is within the setpoints: System OK**

**If the indication is NOT within the setpoints: Replace navigation computer, refer to installation instructions for navigation computer (last chapter of this document).**

## Test: Sound, AF

### On-board monitor system with video module

Work through the corresponding test modules in the diagnostic program for the video module in order to check the AF lines: "Sound"

### System without video module

**1st check: Is the sound radio/cassette mode OK?**

**Sound in radio/cassette mode not OK:** Continue troubleshooting in the radio

**Sound in radio/cassette mode OK:**

**2nd check:**

- Disconnect plug connection X18805 at navigation computer
- Connect V-adaptor lead 61 4 470 with 26-pin test box to plug connection X1313
- Select oscilloscope in measuring systems.
- Test lead MFK1 to pin 9 (+) and pin 18 (-)
- Setting:  
Alternating voltage, frequency: 200 Hz, measuring range: +/- 5 V
- Select <Information>< volume matching> in navigation system
- Activate voice output/test tone under volume matching with rotary knob/push button
- **Check:**  
Is the signal visible on the oscilloscope for the duration of the test tone/voice output?
- **Signal visible:**  
Check lines between navigation computer and radio and repair if necessary. If OK: Continue troubleshooting in the radio
- **Signal not visible:**  
Replace navigation computer.

## Test: Image, RGB

### On-board monitor system with video module

Work through the corresponding test modules in the diagnostic program for the video module in order to check the AF lines: "RGB lines navigation computer - video module", "Image"

### On-board monitor system without video module

**Symptoms:** Faults in menu display AND navigation; no menu display, incorrect colours, image/picture geometry not OK.

#### Instructions:

- Disconnect plug connection X1313
- Measure resistance at disconnected plug connection (vehicle wiring harness end):  
Between pin 7 and pin 16, setpoint: approx. 50 Ohm  
Between pin 7 and pin 17, setpoint: approx. 50 Ohm  
Between pin 7 and pin 18, setpoint: approx. 50 Ohm  
**If at least one of the measured values is NOT in the specified range:** Check lines from navigation computer to on-board computer and repair if necessary. If wires are OK: Replace on-board monitor

#### If measured values are in specified range:

- Select multimeter in measuring systems.  
Settings: **Direct voltage**, measuring range +/- 1 V
- Connect test adapter 61 4 470 with 26-pin test box to plug connector X1313.  
**Navigation computer AND on-board monitor must be connected!**
- Switch off radio, switch on on-board monitor, display main menu (if possible)
- Measure voltage  
Between pin 5 and terminal 31 (vehicle ground)  
Between pin 6 and terminal 31 (vehicle ground)  
Between pin 7 and terminal 31 (vehicle ground)

#### Evaluating results

If on **at least** one of the 3 lines:

**U = 0 V:** Replace navigation computer.

**U >= 1.4 V:** Replace on-board monitor

If on **all** 3 lines:

**1.0 V > U >= 0.2 V:** carry out the 3rd check as described in the following

#### 3rd check

- Test adapter 61 4 470 with 26-pin test box connected, navigation computer and on-board monitor plugged in.
- Select "menu" on on-board monitor
- Light must NOT be switched on
- Multimeter selected  
Setting: **Alternating voltage**, measuring range: +/- 1 V
- Measure voltage  
Between pin 5 and terminal 31 (vehicle ground)  
Between pin 6 and terminal 31 (vehicle ground)  
Between pin 7 and terminal 31 (vehicle ground)

#### Evaluating results

**All 3 lines U > 100 mV:** If one of the above symptoms applies, replace on-board monitor.

**On at least 1 line U < 100 mV:** Replace navigation computer.

## Test: Selection of GPS navigation in menu

### On-board monitor system without video module

### GPS navigation is black in selection menu

Switch off ignition, close all doors and flaps, wait approx. 2 minutes. The navigation must then be shown white and be selectable in the menu.

### On-board monitor system with video module

#### GPS navigation missing in selection menu

If the point "GPS navigation" is not shown at all in the selection menu in the on-board monitor system with video module: Try to select navigation via diagnosis. If this is not possible, work through instructions provided in DIS for reestablishing diagnosis.

#### GPS navigation is black in selection menu

Switch off ignition, close all doors and flaps, wait approx. 2 minutes. The navigation must then be shown white and be selectable in the menu.

## Notes on replacing the navigation computer

### Installation

Proceed as described below to install the navigation computer:

- Ignition lock in position 0
- Connect navigation computer to vehicle wiring harness
- Insert navigation computer in retaining fixture
- Ignition lock still set to 0 position
- Close all doors and flaps on the vehicle.
- Wait approx. 2 minutes (I/K-bus reset)

**The vehicle must not be moved or be subject to vibration during this waiting period.**

#### Reason:

The navigation computer recalibrates its gyro every time it is restarted. The gyro reacts to any movement. As a result, initial calibration which took place while the computer was inserted in the retaining fixture provides faulty values.

For this reason, the navigation computer must be induced to perform a new gyro calibration before the vehicle is driven. This is achieved by resetting the I/K-bus as described in the above.

### Encoding

After replacement, the navigation computer must be encoded with "Coding ZCS".

### Test drive

In contrast to the navigation system of the 1st generation, an intricate calibration driving procedure is not necessary but rather only a test drive of approx. 15 minutes after replacing the navigation computer.

Observe the following points:

- The I/K-bus was reset as described under "installation".
- Drive for approx. 15 minutes in different directions in an area in which GPS reception is not permanently restricted by tunnels, high buildings or trees.

#### Reason:

The navigation computer must carry out its automatic wheel calibration procedure. This takes approx. 15 minutes under conditions of uninterrupted GPS reception.