Operating Instructions
for the WABCO Diagnostic Controller
with Program Card ECAS BUS - SAE
446 300 633 0
Operating Instructions

for the WABCO Diagnostic Controller
446 300 320 0 with
Program Card ECAS BUS-SAE
446 300 633 0

August 1998 Edition

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Fahrzeugbremsen

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**Abbreviations used:**

- AA: drive axle
- counts: unit of measurement for movement or pressure sensor values
- ECAS: Electronically Controlled Air Suspension
- ECU: Electronic Control Unit
- HA: rear axle
- k(Ω): kilo(ohm)
- KW: calendar week
- LA: lift axle
- SA: trailing axle
- VA: front axle
- V1: version 1
- 4x2: description code: 4 wheels, two of them driven
- 6x2: description code: 6 wheels, two of them driven
1. **BRIEF DESCRIPTION OF THE “ECAS” SYSTEM**

ECAS electronics 446 055 ... 0, combined with movement sensor 441 050 ... 0, solenoid valve 472 900 / 905 ... 0 and operating unit 446 056 ... 0, operates the automatic level regulation of commercial vehicles with air suspension. Distinctions are drawn between 4x2, 6x2 and bus systems with an appropriate range of equipment (eg., partial air, full air, trailing axle, lift axle).

The ECAS system regulates the specified level by continuous comparison between the actual heights measured (on an inductive basis) by the movement sensors, and the specified heights stored in the electronics. In the event of deviations between these values, solenoid valves are activated and the airbags pressurized or depressurized until the specified level is again achieved. The specified level can be the standard level (running level), but it can also be any other stored level.

All height adjustments take place within pre-selectable tolerance limits.

Adjustments to the level are introduced in a matter of seconds when the vehicle is at a standstill. In motion (recognized by a tachometer signal), they only take place after a delay of approximately 60 seconds.

The level can be deliberately altered using the ECAS operating unit (truck) or the operating switch (bus). After the change has been completed, it is then stored as the new specified level. Re-adjustment takes place automatically if there is a change in load.

The ECAS can fulfil other functions:

- automatic upper and lower height limitation
- correction of transverse stability
- level and pressure checks
- fault recognition and display
- raise/lower lift-axle
- load/unload trailing axle
- start-up assistance
- zero-point adjustment with raised lift-axle
- LSV control
- maintenance of residual pressure to avoid crushing the airbags
- kneeling (for buses), lowering over one wheel, or the whole side, to assist boarding at bus stops
- start-up lock (for buses)
- door release (for buses)
- storage and retrieval of freely selectable levels by means of the operating unit

When faults are recognized, the indicator lamp lights up, and the faults are permanently stored for diagnostic purposes in the control electronics.
2. DIAGNOSTIC COMPONENTS

1. Diagnostic controller 446 300 320 0
2. Program card 446 300 633 0
3. 35-pin measuring adaptor 446 300 314 0
4. Multimeter cable, black 894 604 354 2
5. Multimeter cable, red 894 604 355 2
6. Connecting cable (SAE, deutsch) 894 604 350 0
   Connecting cable (SAE, AMP) 894 604 351 0

The Diagnostic Controller Set 446 300 331 0
consists of Diagnostic Controller 446 300 320 0
and carrying case 446 300 022 2

Accessories
Keyboard 446 300 328 0
3 CONNECTION OF THE DIAGNOSTIC CONTROLLER

The allocation of PINs in the diagnostic socket must correspond to the SAE J 1587 standard as shown below. Connect Diagnostic Cable to diagnostic socket on vehicle.

Allocation of diagnostic socket:

- PIN A: diagnostic line A
- PIN B: diagnostic line B
- PIN C: battery positive
- PIN E: battery negative

Using the connecting adaptor, the pin allocation of the DB-9 "Diagnostic Input" plug on the front of the diagnostic controller is as follows:

1. Battery positive (terminal 30)
2. Battery negative (terminal 31)
6. Diagnostic cable (A)
7. Diagnostic cable (B)

Connect the 9-pin plug of the connecting cable or connecting adaptor to the diagnostic controller. This provides both the diagnostic connection and the power supply. Black bars appear on the display screen.

Push the program card into the special slot.

Plug in Card:
The contact side must face upwards

Removing Card:
Please do not pull hard. If a resistance is felt, push its end upwards lightly with your thumb whilst pressing downwards lightly with your index and middle fingers. This will make it very easy to remove.

Depending on the program card used, the following (or similar) will appear in the display. If not, refer to Section 7, Malfunctions.

![ECAS BUS SAE Version 1.00 (English)](https://example.com)

START

The first screen displays the System and version (1.00 in the example). Press the right-hand key.
4 OPERATING THE DIAGNOSTIC CONTROLLER

The diagnostic controller is operated by means of 3 operating keys on the front, or via the external keypad. The assignment of keys depends on the instructions which appear on the display directly above the keys.

<table>
<thead>
<tr>
<th>1 Diagnosis</th>
<th>2 Multimeter</th>
<th>3 Select function</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Options</td>
<td>4 Special functions</td>
<td></td>
</tr>
</tbody>
</table>

Here are some examples for different key functions:

- **Key**     **Function**
  - START      start the program.
  - EXIT       the display will return to the previous menu or programme item.
  -            selection of an item from the main menu. Every time the key is pressed, a new menu item will be suggested. The menu item selected will flash.

- **CONT**    The menu item selected previously is activated or actuated.
- **ABORT**   You have the option to abort the function in the event of an error.
- **END**     Ending the function you have been working on, i.e. setting parameters.
- **CHANGE**  Changing the parameters appearing in the display.
Operating the External Keyboard
446 300 328 0

The external keyboard permits you to enter numerical values. For the program card described in these operating instructions, an external keyboard is not required.

Functions are only assigned to the marked keys.

The keys can be used instead of the three push-buttons on the diagnostic controller.

**Exception:** if it is necessary to enter figures during the program, this function does not apply.

Using the ten-key block to it is possible either to enter numerical data (for example ISO addresses) or to select numbered items from the main menu.

Using the key, the menu item indicated is executed. The key has the same function as the controller key CONTINUE.

Using you can revert to the previous main menu displayed.

Using , when there is a series of data displayed (e.g., parameter, function test, calibration data), you can revert to the previous display.
5. PROGRAM STRUCTURE

Menu Selection ECAS BUS - SAE 446 300 633 0

1 Diagnosis
   1 Error memory
   2 Component actuate
      1 Raise/Lower
      2 Central 3/2 valve
      3 Lamp Test
      4 External controls
   3 Measured values
      1 Height sensor
      2 Tacho signal
      3 Switch test
      4 Voltages
   4 ECU data
      1 Parameters show / edit *
      2 WABCO data
      3 Read Fingerprint
      4 Print data
         1 Print errors
         2 Print parameters
      5 Transfer parameter *
         1 From ECAS-ECU to Controller
         2 From Controller to ECAS-ECU
      6 Compare parameter *
   5 Calibration
      1 Calibrate height sensor
      2 Show height sensor
      3 Key in data
   2 Multimeter
      1 DC voltage
      2 AC voltage
      3 Resistance
   3 Options
      1 Online help
      2 Version
      3 Supported ECU's
   4 Special functions

* only available after entering the PIN
5.1 DIAGNOSIS

When the diagnostic function is called up from Menu Item 1, the connection is made to the ECAS control unit.

Let the cursor flash on "1", and press the "CONT" key.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>4 Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Multimeter</td>
<td>5 Special functions</td>
</tr>
</tbody>
</table>

Select function! EXIT CONT

Let the cursor flash on "1", and press the "CONT" key.

ECU type : ECAS BUS
Part No. : 446 055 057 0
Prod. Date : KW35,1996
Software-No. : 7.3.0.1 / CONT

When this has been achieved, the data of the ECAS-ECU are shown in the display.

1 Error memory 4 ECU data
2 Component actuate 5 Calibration
3 Measured values
Select function! EXIT CONT

The following functions can be selected in diagnostic mode, and the indicator lamp flashes or lights up, depending on the system.

5.1.1 Error memory

If the ECAS control unit has detected an error in the system (indicator lamp lights up or flashes), this function will help to find the fault. Depending on the ECAS system in use, and the type of error, the following information will be displayed:

- Cause and location of fault displayed in clear, e.g. "Height sensor failure, rear right", "Broken cable or impedance too high".
- Indication of how frequently the fault has occurred.
- The display “The failure exists at present!” means that the fault was still present when the diagnostic mode was selected. There then arises a more detailed fault finding path with concrete instructions for fault correction. An example is given on page 14.

Upon instruction, the integrated multimeter, together with a measuring adapter, can be used to take electrical readings (e.g. resistance). Actual and preset values will both be displayed.

Once repair of the fault has been confirmed, it is deleted from the ECU. The fault tracing path can now be left once all faults have been repaired or the ignition switched off.

5.1.2 Component Actuate

1 Raise/Lower 3 Lamp Test
2 Central 3/2 valve 4 External controls
Select function! EXIT CONT
"Component actuate" permits certain components of the ECAS system to be activated to check that they are working properly.

If a fault is detected when the valves are activated, an error message will be returned and the activation remains ineffective (e.g. front axle valve interrupt).

Raising/Lowering
Depending on the type of system/parameters installed, this function can be used to activate the solenoid valves on the front and rear axles, or the individual bellows. The height sensor readings will appear on the display.

When pressing the "IN" key, the respective height sensor value will increase.

When pressing the "OUT" key, the respective height sensor value will decrease.

If no height sensor is connected, a value of "255" will appear instead. In the event of a short circuit, "---" will appear on the display.

The following maximum of combinations is possible (full configuration):
- front axle and driving axle right and left
- front axle only
- driving axle only
- driving axle left only
- driving axle right only

Pressurizing Valve
The "pressurizing valve" (also called the central 3/2-way valve) is arranged in line with the 2/2-way valves and determines whether "raising" or "lowering" is in operation. By pressing "ON" it is actuated independently from the 2/2-way valves. The height sensor readings must not change when that key is pushed; if they do this implies that a 2/2-way valve is leaking.

Lamp Testing
Depending on the system/parameters in use, different lamps can be switched on at the push of a button:
- Signal Lamp
- Kneeling Lamp
- Low Ride Lamp
- High Ride Lamp

When exiting from the routine, all lamps are switched off.

Actuate Exits
At the push of a key, different exits can be actuated. If any exits have not been connected due to the parameters set, the respective location will show "---" (actuation is then not possible).
- Exterior Sounder
- Dash Sounder
- Aux. Tank Control
- Wheel Chair Lift Inhibit

5.1.3 Testing and Measuring Values

<table>
<thead>
<tr>
<th>1 Height sensor</th>
<th>3 Switch test</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Tacho signal</td>
<td>5 Voltages</td>
</tr>
</tbody>
</table>

Select function! EXIT ↓ CONT
Height sensor Readings
The current readings of the height sensors will be displayed. If no height sensor has been connected, a value of “255” will be displaced, and if there is a short-circuit, “0” will appear in the display. If no height sensor has been fitted due to the parameters set, “---” will be displayed.

Tacho signal
This function can be used to verify the connection to the signal output of the speedometer. For this purpose the vehicle must be brought to a speed supplying the speedometer with a signal (faster than 1 k.p.h.), e.g. on a roller dynamometer.

Switch Positions
This function can be used to display the status of various switches. For this purpose, please actuate the respective switches on the vehicle.

- Park Brake Active
- Service Brake Active
- Input Door Position
- Shipping Level
- Transmission in Neutral
- Automatik Kneeling
- Manual Kneeling
- Recover to Normal
- High Ride
- Low Ride
- Stop

Voltage
The current operating voltage and the valve relay voltages are displayed.

5.1.4 Control Equipment Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Parameters</td>
<td>4 Print data</td>
</tr>
<tr>
<td>2 WABCO data</td>
<td>5 Transfer parameter</td>
</tr>
<tr>
<td>3 Read Fingerprint</td>
<td>6 Compare parameter</td>
</tr>
</tbody>
</table>

Select function! EXIT CONT

Parameter
Parameters are values set on the ECU for a specific system and can be displayed using the Diagnostic Controller. After entering the PIN under menu item “special functions”, the parameters can be changed and stored in the control unit.

WABCO Data
Display of the data stored in the ECAS control unit: Type of ECU, type of equipment, part number, manufacturing date and ECU software number.

Read Fingerprint
Here you can see who last entered or changed the parameters. Information is provided on:

- ID-Code
- Company code
- Serial number of the program card

Print Data
This is where the contents of the error memory and/or the parameters can be printed in a table.

Connection with the printer is established via the 25-pin socket on the rear and a serial printer cable. The cable must have a DB 25-
plug (not socket) at both ends.

The program works with EPSON FX-compatible printers with a serial interface (RS 232). The transmission parameters of the printer must be set to the configuration shown below:

- **Speed**: 1200 Baud
- **Data bits**: 8
- **Stop bit**: 1
- **Parity bit**: X ON / X OFF

**Transfer Parameters**
Parameters can be transferred from the ECU and the Diagnostic Controller, and vice-versa. Thus it is possible to copy the parameters from one ECU into another. This function requires entry of the PIN under the menu item "special functions".

**Compare Parameters**
This allows the parameters stored in the Diagnostic Controller to be compared with those in the ECU.

**5.1.5 Calibration**

<table>
<thead>
<tr>
<th>1 Cal. height sen.</th>
<th>3 Key in data</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Show height sen.</td>
<td></td>
</tr>
</tbody>
</table>

Select function! EXIT ↓ CONT

The purpose of system calibration is to eliminate to the largest possible extent any installation and equipment tolerances resulting from ECAS installation. Calibration also has to be repeated when sensors or ECU have been replaced.

**How is the calibration made?**
Using the "ACTUATE" key, the vehicle is brought to the desired normal level (running level). By operating the keys, the actual level is stored as the normal level. Depending on the system, further levels (upper and lower level) are calibrated in the same way.

**Note:**
- at least the normal level must be known, for instance as a distance between the frame and the axle, in accordance with the vehicle manufacturer’s data. It should also be known whether the upper and lower level are the buffer stops, for instance, or whether other levels must be calibrated.

**Error Recognition During System Calibration**
If faulty calibration is suspected, the calibration data can be read via menu item "Show height sensor". The calibration levels must show a clear allocation.

Calibration must meet the following requirements:

1. The height sensor values must be > 4 counts, and
2. < 255 counts.
3. The upper stop level must be larger than the normal level (in counts) plus triple tolerance of the index level plus 3 counts.
4. The lower stop level must be smaller than the normal level minus double tolerance of the index level.

Please note:
The index level tolerances front/rear are determined by Parameters 8/9.

Display Calibration Values
The calibration data stored in the ECAS control unit for all three levels are displayed.

Enter Calibration Values
After entering the PIN under "special functions", it is possible to manually enter the calibration data for all three levels.

5.2 MULTIMETER

The integrated multimeter function permits electric measurements on the vehicle. Only the desired measuring function (direct voltage, alternating voltage or resistance) needs to be selected. The measuring range is automatically set by the unit.

Application:
Direct voltage: supply voltage on vehicle
Alternating voltage: sensor voltage
Resistance: valves, relays, sensors, wiring

NOTE:
The measuring instrument is designed only for measurements within the vehicle-specific range (low voltage). It must not be used beyond the above-mentioned measuring range.

<table>
<thead>
<tr>
<th>Range</th>
<th>Display resolution</th>
<th>Accuracy of measuring range. Final value at 20°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC-voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 volt</td>
<td>0.1 volt</td>
<td>± 0.2 %</td>
</tr>
<tr>
<td>20.0 volt</td>
<td>0.1 volt</td>
<td>± 0.2 %</td>
</tr>
<tr>
<td>50.0 volt</td>
<td>0.1 volt</td>
<td>± 0.2 %</td>
</tr>
<tr>
<td>AV-Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 volt</td>
<td>0.01 volt</td>
<td>± 0.6 %</td>
</tr>
<tr>
<td>35.0 volt</td>
<td>0.1 volt</td>
<td>± 0.6 %</td>
</tr>
<tr>
<td>Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.0 Ω</td>
<td>0.1 Ω</td>
<td>± 0.3 %</td>
</tr>
<tr>
<td>200.0 Ω</td>
<td>0.1 Ω</td>
<td>± 0.2 %</td>
</tr>
<tr>
<td>2.0 kΩ</td>
<td>1.0 Ω</td>
<td>± 0.2 %</td>
</tr>
<tr>
<td>20.0 kΩ</td>
<td>10.0 Ω</td>
<td>± 0.1 %</td>
</tr>
<tr>
<td>95.0 kΩ</td>
<td>100.0 Ω</td>
<td>± 0.2 %</td>
</tr>
</tbody>
</table>
5.3 OPTIONS

<table>
<thead>
<tr>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Online help</td>
</tr>
<tr>
<td>2 Version</td>
</tr>
<tr>
<td>3 Support ECU’s</td>
</tr>
</tbody>
</table>

Select function! EXIT CONT

Help Texts

This function permits the operator to obtain additional operating information. If this function has been activated, more detailed information on the programme will appear at suitable times between the programme’s steps.

Versions

This function shows the data on the Controller and the Programme Card supplied: e.g.:

<table>
<thead>
<tr>
<th>Hardware</th>
<th>V1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimeter</td>
<td>V1</td>
</tr>
<tr>
<td>Operating system</td>
<td>V3.1</td>
</tr>
<tr>
<td></td>
<td>(07.03.1991)</td>
</tr>
<tr>
<td>Program</td>
<td>V1.00</td>
</tr>
<tr>
<td></td>
<td>(09.09.1997)</td>
</tr>
<tr>
<td>Serial number</td>
<td>22435</td>
</tr>
</tbody>
</table>

ECUs for Testing

Indicates the WABCO numbers of the control units supported by the program.

5.4 SPECIAL FUNCTIONS

When a code (PIN) is entered in this menu, the ECU’s specific parameters applying to that vehicle which normally cannot be altered may be adjusted and transmitted from one control unit to another.

Authorization to modify these parameters requires attending a WABCO training course.

6 EXAMPLE OF FAULT FINDING “MOVEMENT SENSOR CABLE BREAK”

The fault finding is explained in this section, using an example.

The ECAS-ECU has stored 3 error(s) in the error memory

Fault location (2/2 valve rear axle left) and type (Broken wire or impedance too high) are displayed. In addition, there is an indication of whether the fault was actually present when the diagnosis started. If the fault occurs several times (e.g., an intermittent contact) the frequency is indicated.

The fault search is started with the "REPAIR" key.

Any further faults present are then revealed by using "CONT" key.
Please note:
When using the separate keyboard 446 300 328 0, this key can be used to return to the previous error display.

Press "REPAIR" to initiate the fault finding path.

Disconnect the sensor from the cable and measure again. After once again comparing the specified value with the actual value, use the respective button to indicate whether the specified value has been achieved (YES) or not (NO). In this example it has been achieved.

Check height sensor, connecting cable and connector for damage. Fault found? NO YES

Check components visually for damage. If fault has been found, confirm with "YES". If not, answer "NO" to go on to the next step.

Disconnect sensor from connecting cable. Check resistance: PIN 25 / 27

SHOULD BE > 45 kΩ ACTUAL: >100 kΩ
Actual value OK? NO YES

No further errors are stored.

The error memory in the ECAS-ECU has now been cleared!

The fault memory is read again for checking purposes. The display indicates that no fault is stored in the ECU. Otherwise the fault search would recommence.

To quit the fault search path press "CONT".
## 7. MALFUNCTIONS

### No Display

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• no voltage supply</td>
<td>• check all plugged connections</td>
</tr>
<tr>
<td>• undervoltage (less than about 7 volts)</td>
<td>• check supply voltage</td>
</tr>
</tbody>
</table>

### Black "Bars"

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• program card not inserted</td>
<td>• push program card in as far as the stop (Contacts overhead).</td>
</tr>
</tbody>
</table>

### Low Voltage

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Supply voltage too low (only during diagnostic operation)</td>
<td>• check battery load capacity, and ensure adequate supply.</td>
</tr>
</tbody>
</table>
### Initialization error

**Switch ignition on!**

**Check diagnostic connection!**

### Unknown control unit

**Diagnosis not possible with this program card!**

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Insufficient supply voltage (&lt; 18 volts)</td>
<td>• Ensure supply</td>
</tr>
<tr>
<td>• No supply voltage (ignition off)</td>
<td>• Switch on ignition</td>
</tr>
<tr>
<td>• Diagnostic lines switched or disconnected</td>
<td>• Check lines and connections for function and proper allocation</td>
</tr>
</tbody>
</table>

### Communication Breakdown

**Check diagnostic connection and diagnostic lines. Restart diagnostic procedure.**

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Data transmission discontinued during diagnosis</td>
<td>• Check all connections</td>
</tr>
<tr>
<td>• Diagnostic Line or voltage disconnection during diagnosis</td>
<td>• switch on ignition</td>
</tr>
<tr>
<td>• critical error in diagnostic operation</td>
<td></td>
</tr>
</tbody>
</table>
### Error during self-test

**EEPROM of Diagnostic Controller faulty**

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• EEPROM (Diagnostic Controller’s) non-volatile memory of DC defective</td>
<td>• Repair Diagnostic Controller</td>
</tr>
</tbody>
</table>