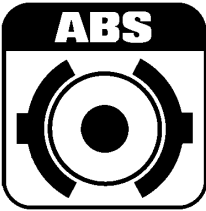


Hydraulic ABS D

Operating Instructions



WABCO

SAFETY DRIVES US



Operating Instructions

for the WABCO
Diagnostic Controller
with Program Card H-ABS D
446 300 783 0 since Version 1.30



Edition: June 2003



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WABCO

Vehicle Control Systems

An American Standard Company

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LIST OF ABBREVIATIONS USED:

ABS	Anti-Lock Braking System
ECU	Electronic Control Unit
ETC	Electronic Traction Control
el.	electrical
hy.	hydraulic

1. DIAGNOSTIC CONTROLLER SET 446 300 331 0



Contents of Diagnostic Controller Set:

- | | |
|--------------------------|---------------|
| 1. Diagnostic Controller | 446 300 320 0 |
| 2. Carrying Case | 446 300 022 2 |

Additional Test Equipment:

- | | |
|----------------------------|---------------|
| 3. Program Card | 446 300 783 0 |
| 4. Connector Cable | 446 300 329 2 |
| 5. Multimeter cable, black | 894 604 301 2 |
| Multimeter cable, red | 894 604 302 2 |
| 6. Keyboard | 446 300 328 0 |

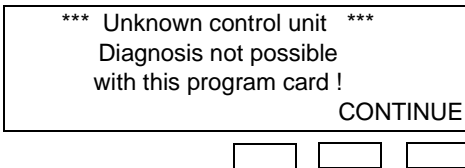
1.1 GENERAL

The Diagnostic Controller, referred to as the "Controller" below, is a computer which is capable of exchanging data with control units (which are computers, too). In this context, data mean the following:

- ❑ error messages stored in the ECU
- ❑ commands sent from the Controller to the ECU where they trigger certain processes.

In order to communicate with an ECU, a special program is required. This program is stored on the respective program card.

If an attempt is made to run an ECU with a program card which is **not** intended for it, the Controller will react by returning a message to this effect.



Any attempt to manipulate the connected ECU via the controller will be futile.

Program Card and ECU must match!

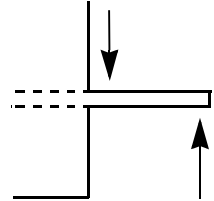
The **program card** is an electronic storage medium which contains both commands for the Controller and the message appearing in the display. For this reason the program card should be handled carefully because any damage, even if it is only on one contact or one line (scratch), can cause the whole of the card to fail.

Plug in Card:

The contact side must face upwards

Removing Card:

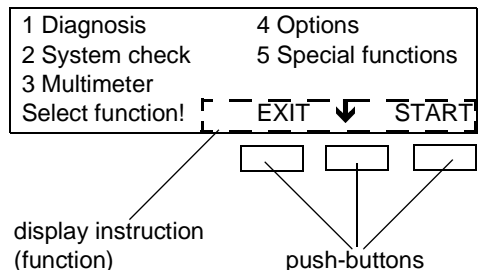
Please do not pull hard. If a resistance is felt, push its end upwards lightly with your thumb whilst pressing downwards lightly with your index and middle fingers. This will make it very easy to remove.



1.2 OPERATION

Operating Keys on the Unit

The Diagnostic Controller is operated by pressing the three operating push-buttons on its front, and by using an external keyboard. The function of the push-buttons depends on the instructions appearing in the display immediately above those push-buttons.



Here are some examples for different push-button functions:

Operating the External Keyboard 446 300 328 0

push-buttons function

START Initiate program

EXIT The display will return to the last main menu.

↓

Select an item from the main menu.

Scroll forward one item at a time by pressing the push-button. The item selected will flash.

CONT(INUE)

The menu item selected is triggered, i. e. activated.

ACTIVATE While prssing the push-button the component will be activated.

ON / OFF Pushing the push-button the component will be switched on/off.

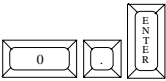
YES / NO Activating the push-button will be noticed as answering a question.

REPEAT Repeat a function once more.





The external keyboard is recommended because it makes operating the Controller very simple.


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  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 (eg., parameter, function test, calibration data), you can revert to the previous display.

2. WHAT SYSTEMS CAN BE TESTED?

The Diagnostic Program only enables hydraulic ABS systems with an ISO diagnostic interface (specifically KWP2000) to be checked. At the time of publication, the following ECUs with ABD* and without ABD are in production.

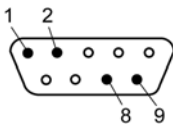
System / plug	
program card	446 300 783 0 
ECUs which can be tested	446 044 076 0 446 044 077 0 446 044 078 0 446 044 079 0* 446 044 080 0*

The Diagnostic Program automatically blocks the diagnosis if it does not recognise the control unit.

3. CONNECTING THE DIAGNOSTIC CONTROLLER

The Diagnostic Controller is connected to the vehicle with a special cable.

SUB DB9 socket of the controller



Pin assignment:

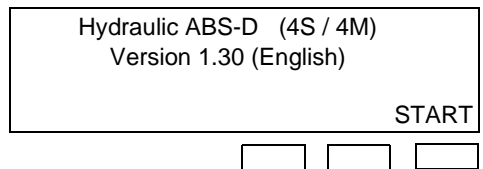
Pin 1	12 ... 24 V (red)
Pin 2	Earth (brown)
Pin 8	ISO K-line (yellow)
Pin 9	ISO L-line (green)

The controller and the ECU exchange data using the ISO 9141 protocol (specifically KWP 2000). The L-line is not required for this, although it must be connected as described above if it is present.

Connect the plug of the connection adapter (see page 3) into the vehicle's diagnostic socket and connect the connection adapter to the SUB DB9 socket of the controller. This provides both the diagnostic connection and the electrical power supply. Black bars appear on the display.

Then push the program card into the slot provided for it. Make sure you insert the card with the contacts facing upwards.

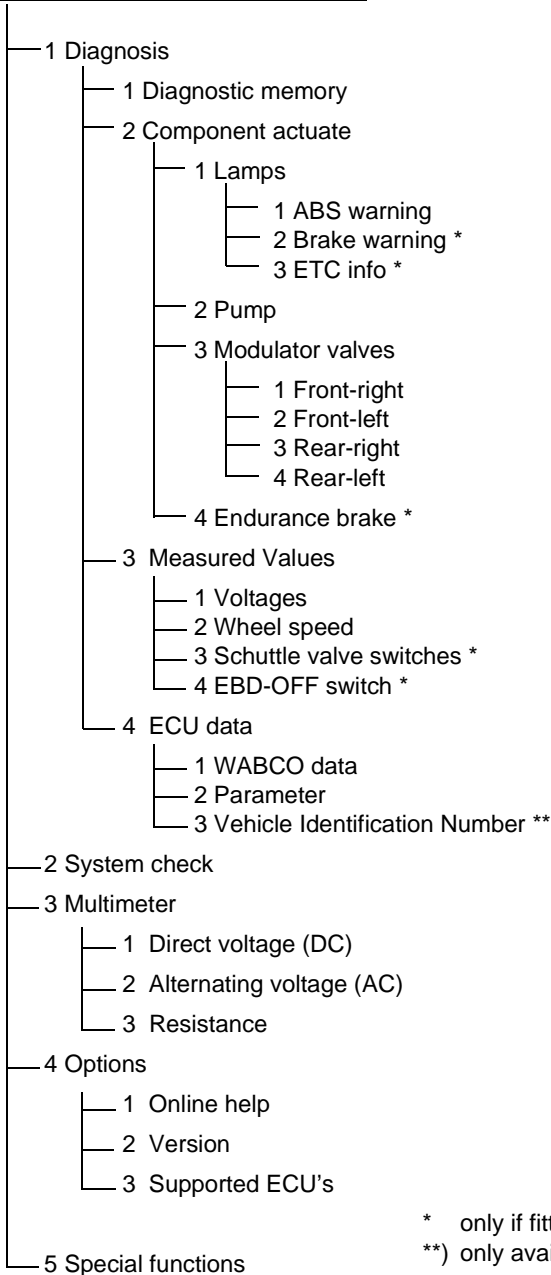
The following display (or similar) appears.



If this is not the case, please refer to Chapter 5 on Functional Defects "DIAGNOSIS". The first display shows the system tested and the version (in this case 1.30).

4. PROGRAME STRUCTURE

Menue structure Hydraulic ABS D (4S/4M)



* only if fitted on the vehicle

** only available after entering the PIN

4.1. DIAGNOSIS

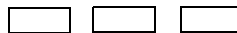
Let the cursor flash on “1”, and press the “START” key.

1 Diagnosis	4 Options
2 System check	5 Special Functions
3 Multimeter	
Select function!	EXIT ↓ START



When selecting the diagnostic function, communication with the ABS control is established.

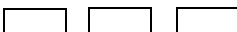
A	ECU type	: H-ABS D (4S/4M)
WABCO	Part No.	: 446 044 076 0
S	Prod. date	: 32 / 1998
	Software No.:	V56A1 CONT.



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

In the diagnostic mode, the following functions are now available for selection:

1 Diagnostic memory	3 Measured values
2 Component actuate	4 ECU data
Select function!	EXIT ↓ START



4.1.1 Diagnostic memory

If the ABS control unit has recognized a fault in the system, this function helps to locate the fault

The following will appear on the display:

- display of the error in plaintext
- information on whether the error currently exists or not. If not, the display shows how often it occurred.
- To assist in repairs, repair information is displayed at the push of a button

If the repair button has been pushed for all errors, the error memory is deleted automatically. Following this, the ignition has to be switched off and then on again to allow the ECU to perceive any errors now encountered. The error memory is read again and any errors still stored at this point are displayed.

4.1.2 Component Actuate

“Actuate” is used to make sure that certain components within the ABS system and their wiring are in good working order. For this to work, those components of course need to have been fitted

4.1.2.1 Warning Lamps

The function of the warning lamps is checked. When entering the menu point the warning lamps are on. After the selection of one lamp the buttons “ON” and “OFF” are available in order to switch this lamp. Finally the warning lamp is illuminated again.

4.1.2.2 Pump

The pump should only be activated after the system has been pressurized. Then switch on the hydraulic pump for no longer than 12 seconds. You should be able to hear the pump working. At the same time, the voltage at the return (Pin X2_8) is measured. If it is too low, the pump is switched off immediately (<10V after 30 milliseconds) and an error message will be returned.

4.1.2.3 Solenoid Valves

By means of a pulse program the function of all four ABS-valves can be tested for each wheel. Here the correct assignment as well as the hydraulic and electric connections are checked. The procedure of the pulse program is represented as a diagram on the pages 17.

4.1.2.4 Constant-Braking Relay

The relay for switching off the permanent brake can be controlled in case of ABS-brake actuations. For a period of pressing the button it is switched on, that means that the contacts open. At the moment the constant-braking relay is controlled the brake force must decrease since the permanent brake has no effect on the brake procedure anymore. This menu point is only displayed if a constant-braking relay is installed and recognized by the ECU.

In case the relay has been installed later it must be recognized by the ECU by "Reconfiguration of the Constant-Braking Relay".

4.1.3 Measuring Values

In this part of the program, various measuring values provided by the ECU can be displayed.

4.1.3.1 Voltages

The voltage on the reference ground pin (Pin X3_3) and the supply voltages of the ECU, U_{es} (Pin X2_2), and of the valves, U_{vent} (Pin X2_1), are displayed. The voltages are measured on the terminals of the ECU.

4.1.3.2 Wheel Speeds

All four wheel speeds picked up by the speed sensors (mph) are output in a

window. They will not be displayed until a speed of 1.1 mph has been reached.

4.1.3.3 Shuttle Valve Switches

(in case of installation only)

The functionality of the shuttle valve switches (SVS) can be checked. You are requested to apply the brake until both shuttle valve switches are actuated. The status of the shuttle valve switches is displayed as long as you are in this part of program.

4.1.3.4 ETC-OFF Switch

(in case of installation only)

The position of the switch is displayed until this part of program is left.

4.1.4 Control Unit Data

4.1.4.1 WABCO-Data

The ECU-data including the series numbers are displayed.

4.1.4.2 Parameters

At this place the automatic recognition for endurance brake switch-off relay can be activated (self learning function).

4.1.4.3 Vehicle Identification Number

(If foreseen, only)

Shows the VIN if they are established for the vehicle. If there is no write protection set for the number in the ECU, you can enter the number with "Enter". The number can be stored in the ECU after it has been entered. At this point, you can decide whether or not to set the write protection.

CAUTION:

Once the write protection has been set, the number can only be changed subsequently at the WABCO factory.

4.2. SYSTEM CHECK

System check permits a complete ABS test including print-out of a test log (e.g. after first installation or after extensive repairs).

System check is divided into 2 sections:

- functional test
- print results

Important notes:

Once a test section has been initiated, this has to be processed step by step. It is neither possible to return to individual steps nor to leave them out.

If the supply voltage to the Diagnostic Controller is interrupted, all data measured and stored for the print log up to that point of time are destroyed. Thus it is important that the supply to the Diagnostic Controller is not interrupted if a print log is required.

Functional Test

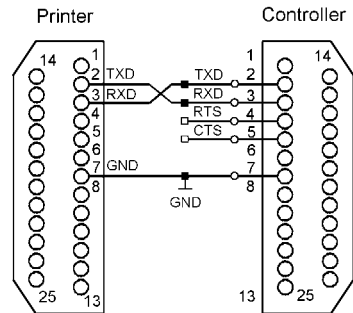
The functional test can be used only while the vehicle is stationary (in current ignition-on phase, its wheels may not simultaneously have exceeded a speed of 4.35 mph), and if no errors have been stored.

Print System Check

At the end of the test the results can be printed.

As mentioned above, the Controller has to be permanently connected to the voltage supply. Any interruption will destroy all data stored.

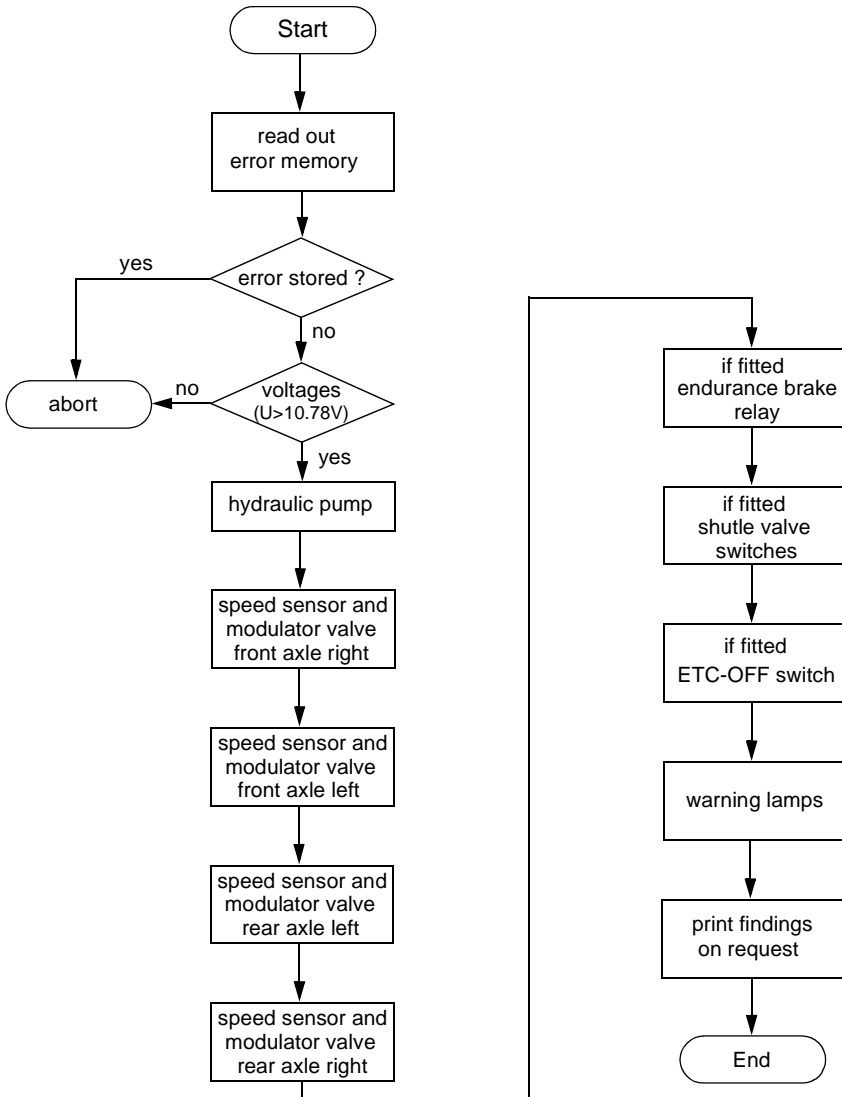
Connection with the printer is established via the 25-pin socket on the rear and a serial printer cable. The cable must have a DB 25-pin (not socket !) **at both ends**.



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:	XON / XOFF

Procedure: Functional Test - Commissioning



4.3 MULTIMETER

1 DC voltage	3 Resistance
2 AC voltage	
Select function!	EXIT ↓ START
<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

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.

Range	Display resolution	Accuracy of measuring range. Final value at 20°C	
DC-voltage			
2.0 volt	0.1 volt	± 0.2 %	± 0.0 volt
20.0 volt	0.1 volt	± 0.2 %	± 0.1 volt
50.0 volt	0.1volt	± 0.2 %	± 0.1 volt
AV-Voltage			
2.0 volt	0.01 volt	± 0.6 %	± 0.02 volt
35.0 volt	0.1 volt	± 0.6 %	± 0.4 volt
Resistance			
20.0 Ω	0.1 Ω	± 0.3 %	± 0.1 Ω
200.0 Ω	0.1 Ω	± 0.2 %	± 0.1 Ω
2.0 kΩ	1.0 Ω	± 0.2 %	± 1.0 Ω
20.0 kΩ	10.0 Ω	± 0.1 %	± 10.0 Ω
95.0 kΩ	100.0 Ω	± 0.2 %	± 100.0 Ω

4.4 OPTIONS

4.4.1 Online Help

This function enables the user to obtain additional information on the program. When the function is switched on, more detailed information will appear where suitable places. When the card is used for the first time the function will be switched on.

4.4.2 Version

This operation shows the version of the components used (Controller and program card).

Hardware	:	V1	Multimeter: V1
Operating system	:	V3.1	(07.03.1991)
Program	:	V1.00	(19.11.1998)
Serial number	:	22435	CONT.

4.4.3 ECUs for Testing

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

4.5 SPECIAL FUNCTIONS

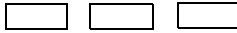
When a code (PIN) is entered in this menu, the ECU's specific parameters applying to that vehicle which normally cannot be altered may be adjusted and transmitted from one control unit to another.

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

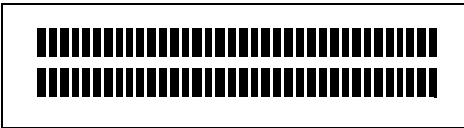
5. FUNCTIONAL FAULT IN DIAGNOSTIC SYSTEM



no display



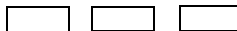
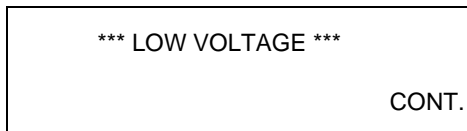
Cause	Remedy
<ul style="list-style-type: none"> - no voltage supply - undervoltage (less than about 7 volts) 	<ul style="list-style-type: none"> - check all plugged connections - check supply voltage



black „bars“



Cause	Remedy
<ul style="list-style-type: none"> - program card not inserted 	<ul style="list-style-type: none"> - push program card in as far as the stop (Contacts overhead).



Cause	Remedy
<ul style="list-style-type: none"> - Supply voltage too low (only during diagnostic operation) 	<ul style="list-style-type: none"> - check battery load capacity, and ensure adequate supply.

*** Initialization error ***
 Switch ignition on!
 Check diagnostic connection!
 CONTINUE

Cause	Remedy
<ul style="list-style-type: none"> – Insufficient supply voltage (< 8 volts) – No supply voltage (ignition off) – Diagnostic lines switched or disconnected 	<ul style="list-style-type: none"> – Ensure supply – Switch on ignition – Check lines and connections for function and proper allocation

*** Wrong key word ***
 Diagnosis impossible!
 CONTINUE

Cause	Remedy
<ul style="list-style-type: none"> – Wrong ECU connected – Wrong „WABCO Data“ in ECU or defective ECU 	<ul style="list-style-type: none"> – Check ECU part number – Change ECU and check ECU part number

*** Communication Breakdown ***
 check diagnostic connection
 and diagnostic lines.
 Restart diagnostic procedure. CONT.

Cause	Remedy
<ul style="list-style-type: none"> – Data transmission discontinued during – Diagnostic Line or voltage disconnection during diagnosis – critical error in diagnostic operation 	<ul style="list-style-type: none"> – Check all connections – switch on ignition

*** Unknown control unit ***
Diagnosis not possible
with this program card!

CONTINUE

Cause

- ECU cannot be tested with this program card

Remedy

- Use right program card

*** Error during self-test ***
EEPROM of Diagnostic Controller
faulty

CONTINUE

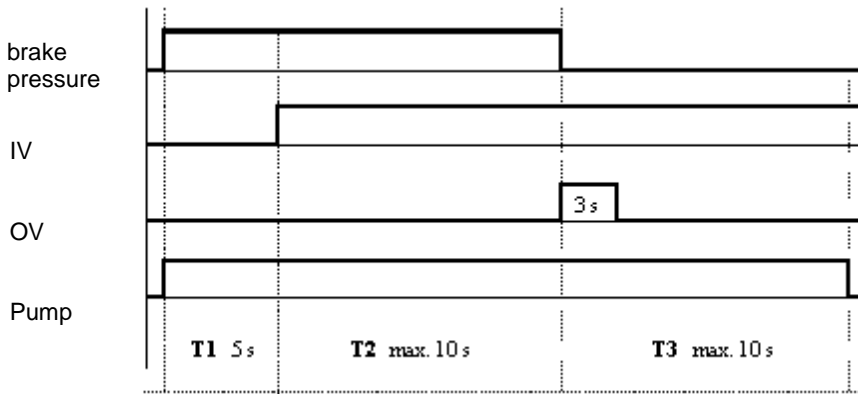
Cause

- EEPROM (Diagnostic Controller's) non-volatile memory of DC defective

Remedy

- Repair Diagnostic Controller

6. TEST SEQUENCE: MODULATOR VALVES



How to test:

- Use a brake test rig with individual wheel control
- Apply and hold the brake on or release it when prompted to do so
- If a brake switch is fitted, the program detects when the brake has been applied
- Turn the wheel when prompted, the program detects the rotation speed.

Sequence:

T1: The pump is started after the brake is applied.

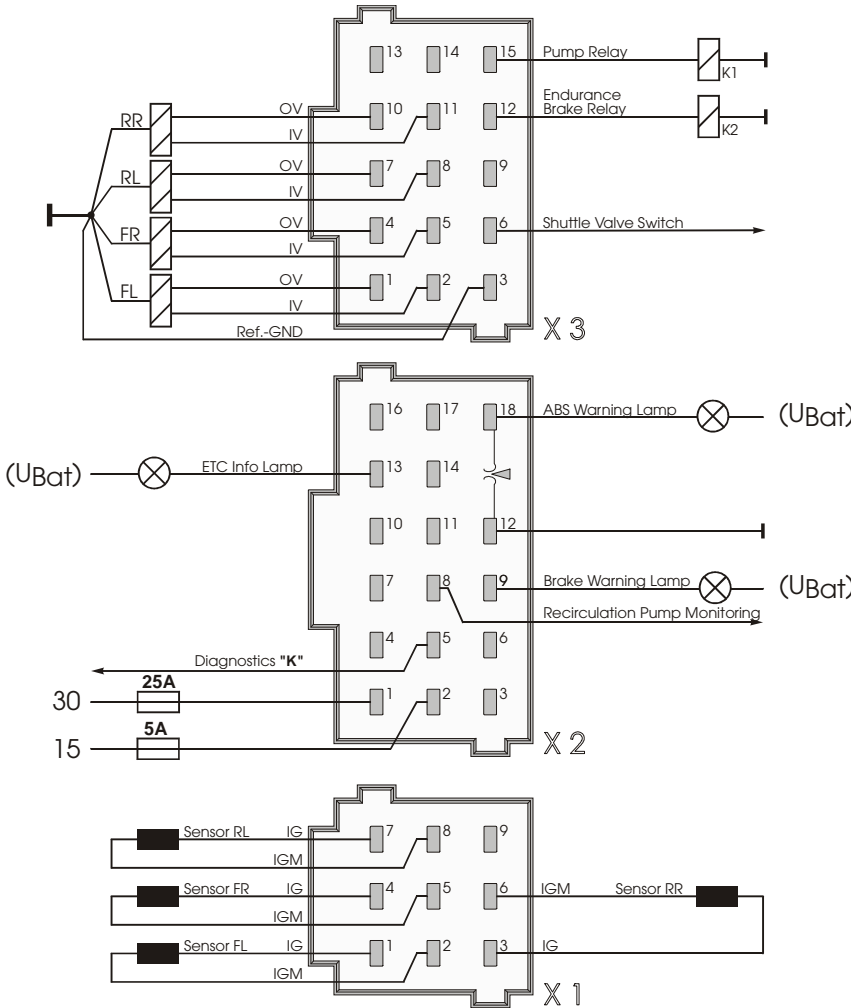
T2: The inlet valve is closed 5 seconds later and the user is prompted to turn the wheel. It should be blocked. The program cancels the test if the user does not confirm this within 10 seconds.

T3: In the following test step, the outlet valve is opened and the user is prompted to turn the wheel. It should be free. The program cancels the test if the user does not confirm this within 10 seconds.

The test result is a fail if no speed > 1.9 km/h was detected at the wheel being tested during test step T3.

possible errors	possible causes
<ul style="list-style-type: none"> – Activation has no effect on the activated ABS valve – deviations from pulse program 	<ul style="list-style-type: none"> – electrical Wrong connection of two ABS valves. Wrong connection of cables for inlet valve and outlet valve of an ABS valve. – hydraulic Wrong connections Defective ABS valve

7. CABLING DIAGRAM FOR MAXIMUM SYSTEM CONFIGURATION



31 — Ground

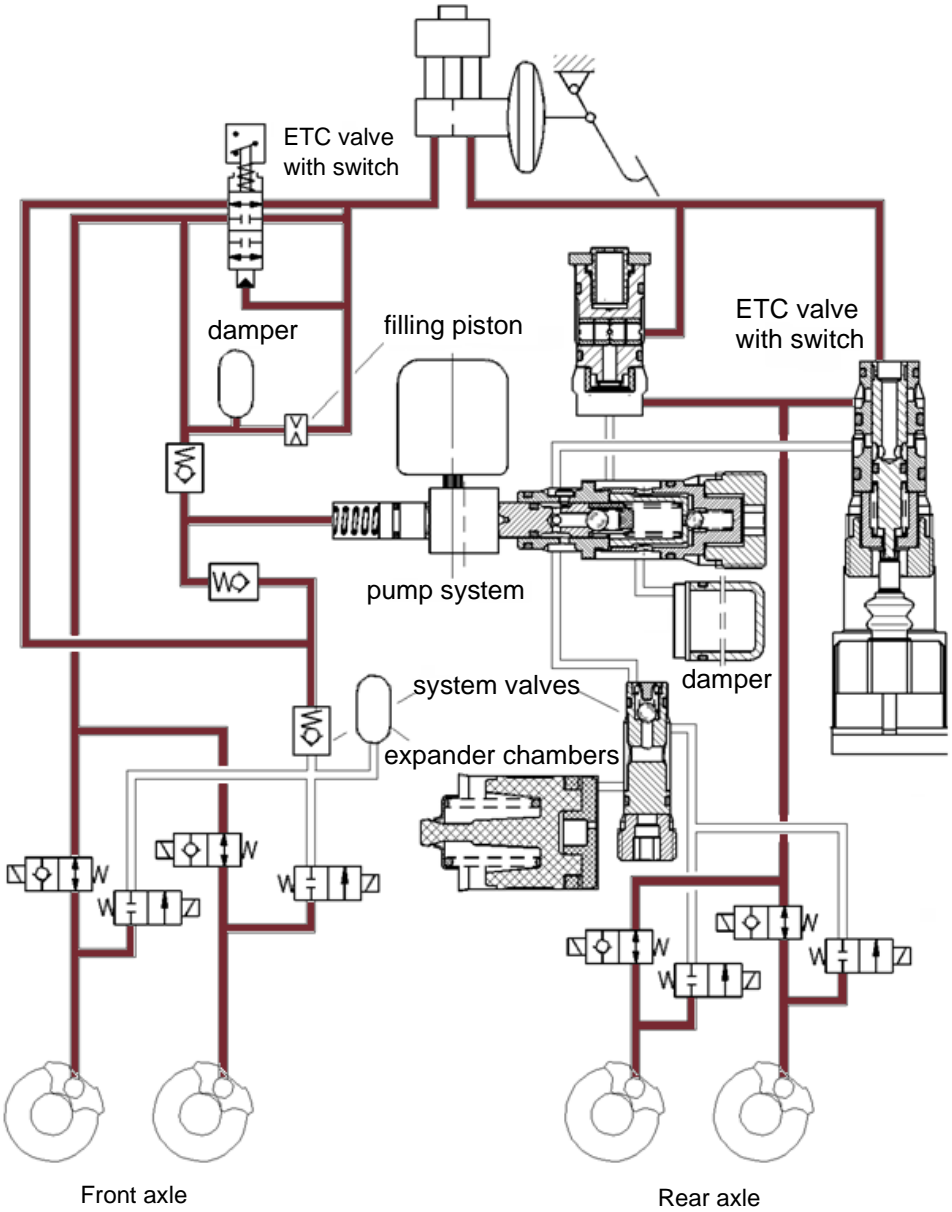
K1, K2 = Relay for Car Application

15 — Ignition

30 — U_{Bat}

Cabling for internal brake switch, ABS light, brake warning light and endurance brake relay is optional depending on the system configuration.

8. CONNECTION DIAGRAMS



9. TEST LOG

The printed commissioning log shows a maximum version to be copied for operation where there is no printer available. The corresponding findings of the various steps within the testing procedure are entered from the commissioning run.

*** SYSTEM CHECK PROTOCOL ***
Hydraulic-ABS-D (4S / 4M)

.....
Vehicle No.

.....
ECU No.

Component	rated value	act. value	judgement
UES ABS-relay supply		_____ _____	_____ _____
Pump and pump relay			_____
Modulator wheel front right			_____
Modulator wheel front left			_____
Modulator wheel rear right			_____
Modulator wheel rear left			_____
Sensor wheel front right			_____
Sensor wheel front left			_____
Sensor wheel rear right			_____
Sensor wheel rear left			_____
Endurance brake			_____
ETC-off switch			_____
Shuttle valve switches			_____
Speedometer needle deflection			_____
ABS warning light			_____
ATC info light			_____
Brake warning light			_____

.....
Place

.....
Date

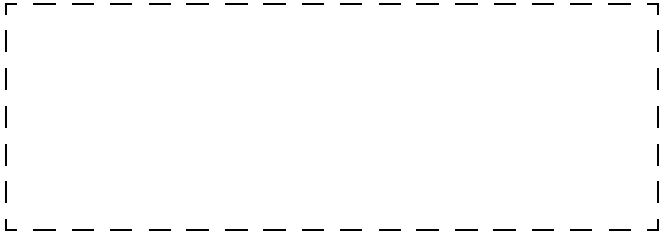
.....
Sign



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