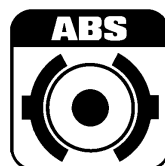


WABCO



Operating Instructions for the WABCO Diagnostic Controller with Program Card ABS-Hydraulic 446 300 782 0





Operating Instructions

for the WABCO
Diagnostic Controller
with Program Card ABS-Hydr.
446 300 782 0



Edition: March 1998



© Copyright WABCO 1998

WABCO
Fahrzeugbremsen

A Division of
WABCO Standard GmbH

The right of amendment is reserved

TABLE OF CONTENTS

	Page
1 Diagnostic Controller Set	3
1.1 General	4
1.2 Operation	4
2 What Systems Can Be Tested?	6
3 Connection of the Diagnostic Controller	6
4 Program Structure	7
4.1 Diagnosis	8
4.1.1 Error Memory	8
4.1.2 Component Actuate	8
4.1.3 Measured Values	9
4.1.4 Controller data	9
4.2 System Check	9
4.3 Multimeter	12
4.4 Options	13
4.4.1 Online Help	13
4.4.2 Version	13
4.4.3 ECUs for Testing	13
4.5 Special functions	13
5 Functional Fault in Diagnostic System	14
6 Pulse Program Sequence: Modulator Valves	17
7 Plug Pin Assignment	
ABS 446 044 07 . 0	18
8 Connection Diagrams	
ABS 446 044 07 . 0	19
9 Test Log	20

LIST OF ABBREVIATIONS USED:

ABS	Anti-Lock Braking System
ECU	Electronic Control Unit
el.	electrically
HA	rear axle
hyd	hydraulic
le	left
ri	right
VA	front axle

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 446 300 782 0
- 4. Connector Cable
- 5. Multimeter cable, black 894 604 301 2
- Multimeter cable, red 894 604 302 2
- 6. Keyboard 446 300 328 0

The DIAGNOSTIC-CONTROLLER

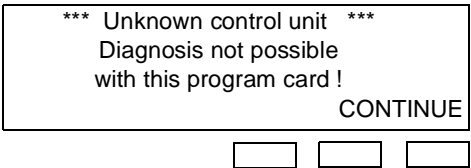
1.1 General

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. Thousands of transistors have been crammed into a very small space.

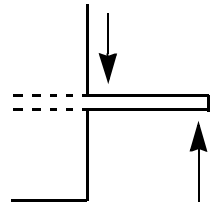
They form the memory which is similar to a large cupboard with thousands of drawers. Every drawer contains some information, and each one of these drawers has an "address". At the gilt contacts the address lines begin; it is via these lines that the Controller accesses the contents of the various "drawers". 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:

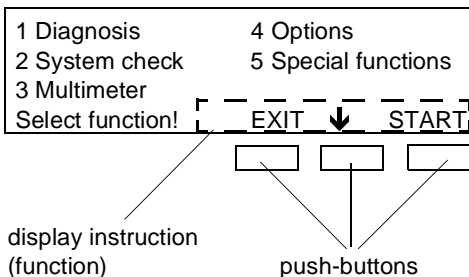
Please do not pull hard. If a resistance is felt, push its end upwards lightly with your thumb whilst pressing downwards lightly with your index and middle fingers. This will make it very easy to remove.



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.



display instruction
(function)

push-buttons

Here are some examples for different push-button functions:

push-buttons function

START Initiate program

RETURN 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.

CONTINUE

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

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.

COMPLETE




Confirms to the program that the process demanded by the operator has been completed.

Operating the External Keyboard 446 300 328 0







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

2. WHAT SYSTEMS CAN BE TESTED?

This program card can be used to test certain ABS-hydraulic systems which are identified by the part number of the ABS control unit.

*) As per November '97. Additional ECUs may be suitable for testing. The program card won't realize any test if it cannot identify the ECU.

system/plug	4-channel	6-channel
program card	446 300 782 0 	
ECUs which can be tested *)	446 044 071 0 446 044 072 0	

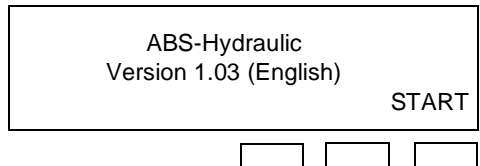
3. CONNECTING THE DIAGNOSTIC CONTROLLER

The Diagnostic Controller is connected to the vehicle with a special cable (from MERITOR WABCO):

Plug	SUB DB9 Socket
+12 V Pin ?	+ 12 V Pin 1
Ground Pin ?	Ground Pin 2
A-Line Pin ?	A-Line Pin 6
B-Line Pin ?	B-Line Pin 7

Connect the plug to the vehicle and the SUB DB9 socket to the Diagnostic Controller. This not only establishes the diagnostic connection but also provides the voltage supply. Black bars will appear in the display.

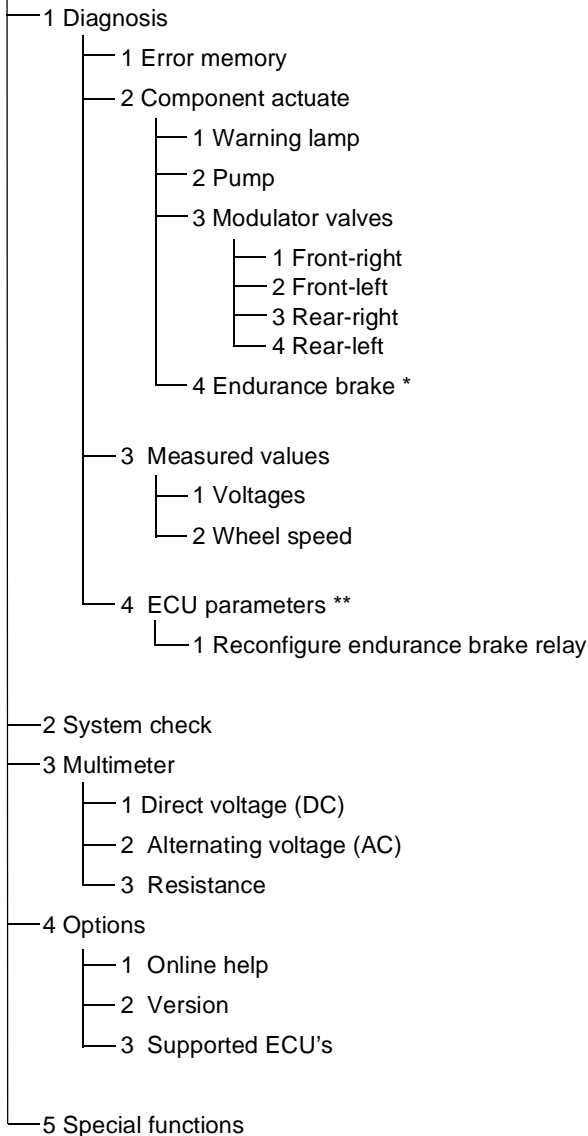
Now you push the program card into the slot provided. Make sure that the contacts on the card face upwards. You will now see something like this in the display:



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 1.03).

4. PROGRAME STRUCTURE

Menu Selection ABS Hydraulics



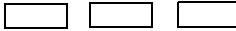
* only if fitted on the vehicle

** only available after entering the PIN

4.1. DIAGNOSIS

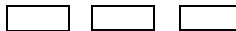
Let the cursor flash on "1", and press the "START" key.

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.

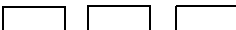
A	ECU type	: ABS-Hydraulic
WABCO	Part No.	: 446 044 071 0
S	Prod. date	: 32 / 1997
	Software No.:	V8551 CONTINUE



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 Error memory	3 Measured values
2 Component actuate	
Select function!	EXIT ↓ START



4.1.1 Error 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

Warning Lamp

The function of the warning lamp is tested. When entering the menu item, the warning lamp is switched on. You will be asked whether the warning lamp is on. If this is the case, it is switched off and you are once again asked to confirm that it is in proper working order. Finally the warning lamp is again switched on.

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.

Solenoid Valves

A pulse programme can be used to make sure the solenoid valves and their wiring (hydraulic and electrical) are in proper working order, and that the allocation to all four ABS valves is correct.

For the pressure curve, please refer to the diagram on Page 17.

Retarder Relay

The relay for switching off the retarder function in the event of ABS intervention during the braking process can be actuated. It is switched on for the length of time the push-button is depressed, i. e. the contacts will open. The moment the retarder relay is actuated, the braking force must fall since the retarder no longer affects the braking process. This menu item is displayed only if a retarder relay has been fitted.

4.1.3 Measuring Values

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

Voltages

The ignition voltage (X2_2) and the valve relay voltage (internal) are displayed.

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.

4.1.4 Control Unit Data

Reconfiguration of Retarder Relay

When it is first put into operation (commissioning), the ECU will check whether a retarder relay has been connected at its terminals. If this is the case, the relay is entered in the parameters as

having been fitted. If, at a later point in time, no relay is connected, the ECU will perceive an error. This menu item can be used to once again achieve automatic recognition (reconfiguration). This item is available only when a PIN has been entered.

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:

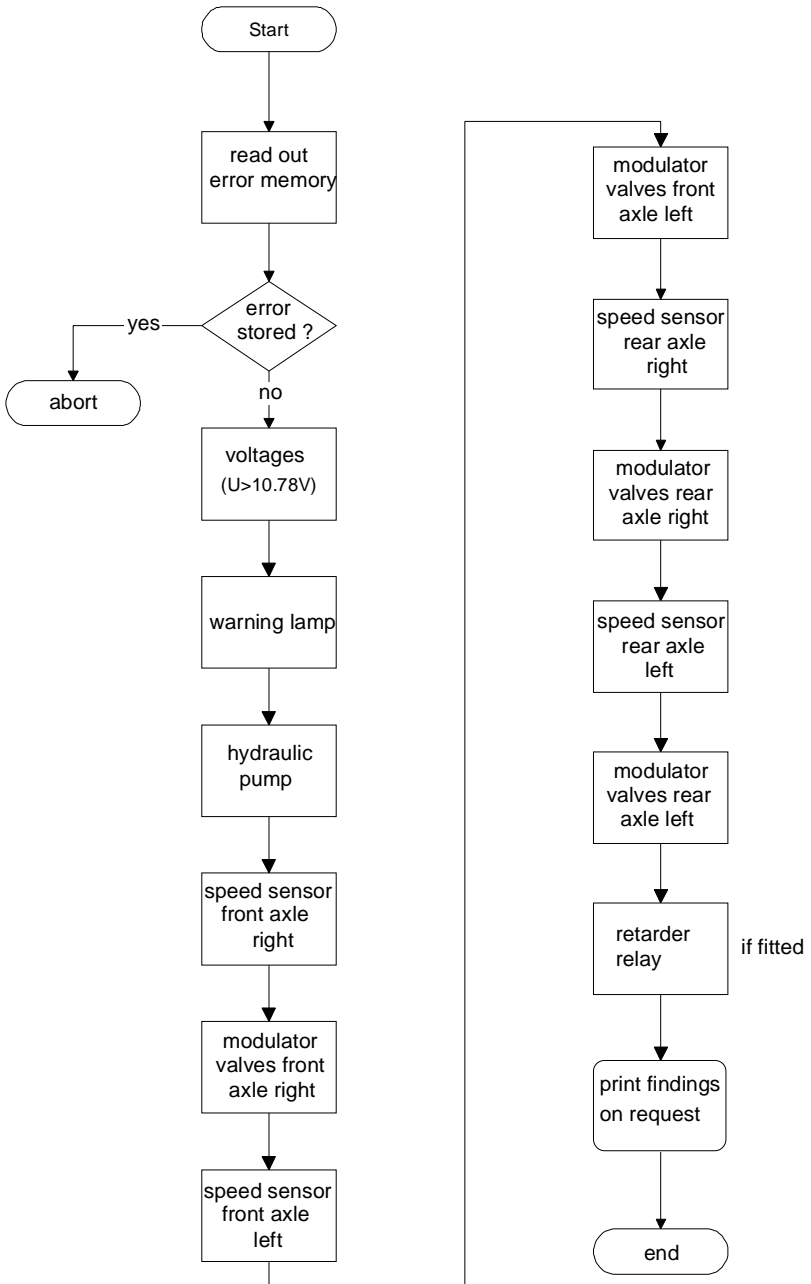
Once a test section has been initiated, this has to be processed step by step. It is neither possible to return to individual steps nor to leave them out.

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.

Procedure: Functional Test - Commissioning



Print System Check

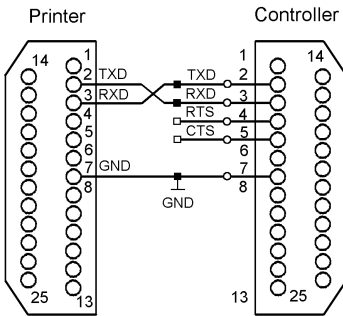
At the end of the test the results can be printed.

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-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



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	(19.06.1996)
Serial number	:	22435	CONTINUE

4.4.3 ECUs for Testing

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

4.5 SPECIAL FUNCTIONS

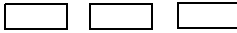
When a code (PIN) is entered in this menu, the ECU's specific parameters applying to that vehicle which normally cannot be altered may be adjusted and transmitted from one control unit to another.

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

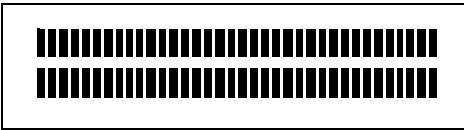
5. FUNCTIONAL FAULT IN DIAGNOSTIC SYSTEM



no display



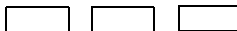
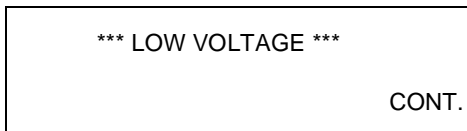
Cause	Remedy
<ul style="list-style-type: none"> – no voltage supply – undervoltage (less than about 7 volts) 	<ul style="list-style-type: none"> – check all plugged connections – check supply voltage



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 (Kontakte nach oben).



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 (-xx) ***
 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

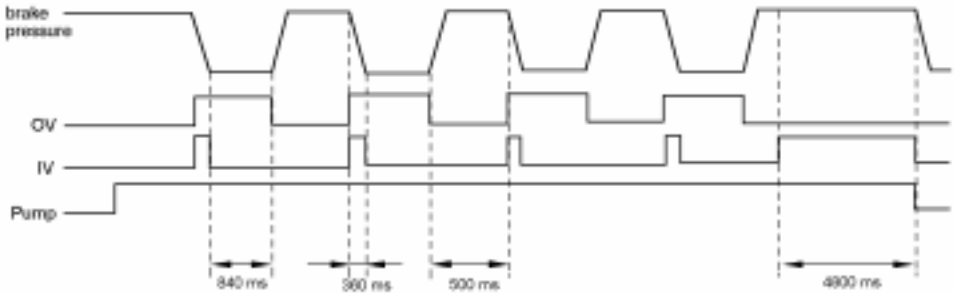
Cause

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

Remedy

- Repair Diagnostic Controller

6 PULSE PROGRAM SEQUENCE: MODULATOR VALVES



How to test:

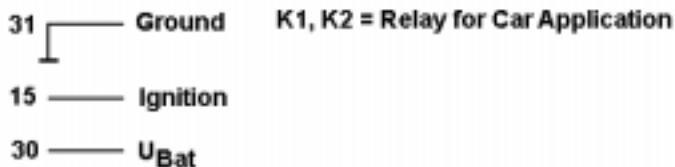
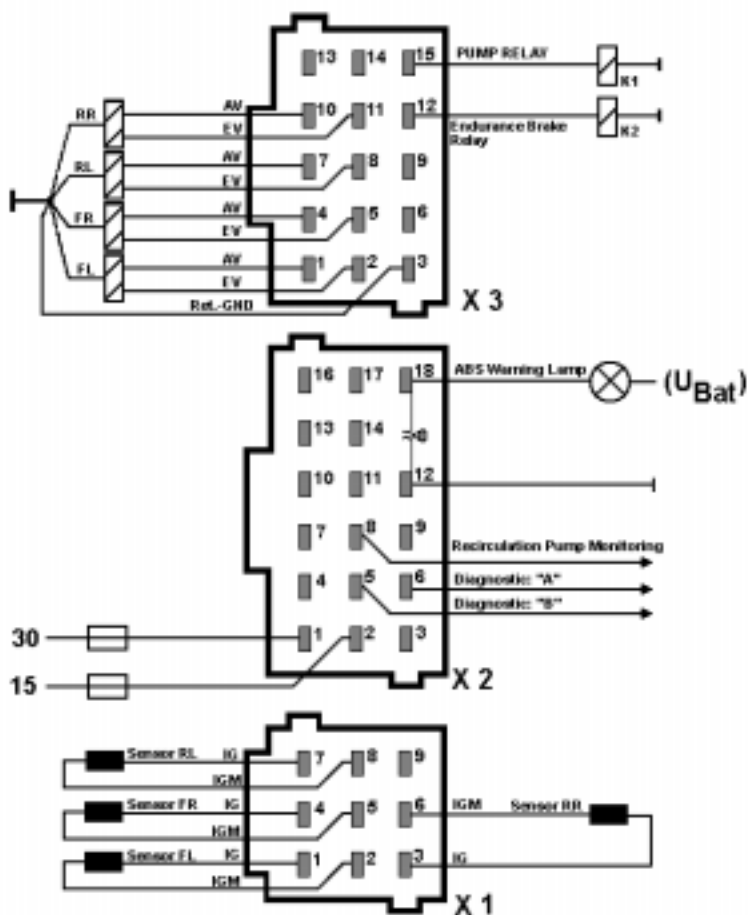
- Connect gauge to brake cylinders or use brake test bench with individual wheel facility.
- Actuate brakes and keep actuated!
- Start pulse program and watch pressure reaction.

Sequence:

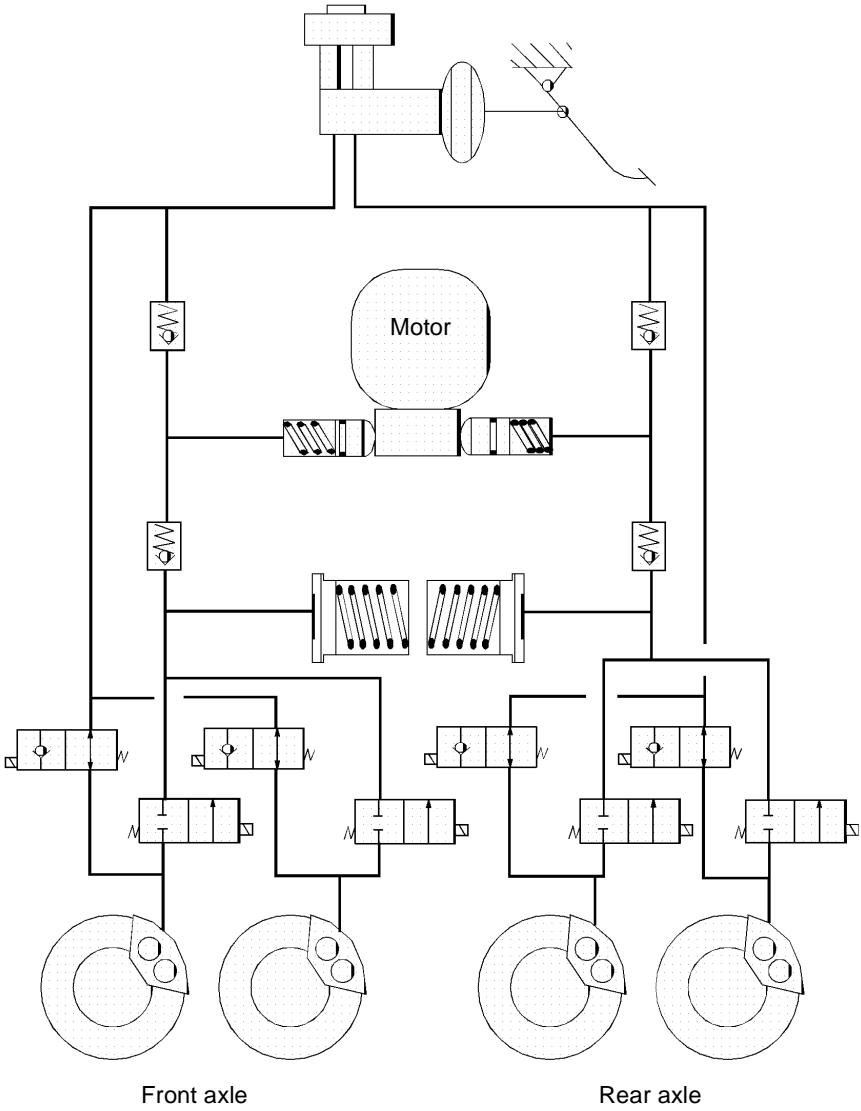
1. Pressure buildup to max. brake pressure and holding phase
2. Pressure reduction for 360 milliseconds
3. Holding phase 840 milliseconds
4. Pressure buildup to max. brake pressure and holding phase
5. Hold brake pressure 4.8 secs while inlet valve (IV) is energized

possible errors	possible causes
<ul style="list-style-type: none"> - pulse program has no effect on actuated 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 PLUG PIN ASSIGNMENT



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 ***
Motor vehicle ABS-Hydraulic

.....
VehicleNo.

.....
ECUNo.

Component	rated value	act. value	judgement
! ABS relay supply	>10.78Volt	_____	_____
! UES	>10.78Volt	_____	_____
! ABS warning light			_____
! 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 relay			_____

.....
Place

.....
Date

.....
Sign

WABCO

WABCO
Fahrzeugbremsen

A Division of
WABCO Standard GmbH

Am Lindener Hafen 21
30453 Hannover
Telefon (05 11) 9 22-0
Telefax (05 11) 2 10 23 57