



Operating Instructions

for WABCO's

Diagnostic Controller

446 300 320 0

with

Program Card ABS/ATC C (SAE)

446 300 514 0



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WABCO
Fahrzeugbremsen

A Division of
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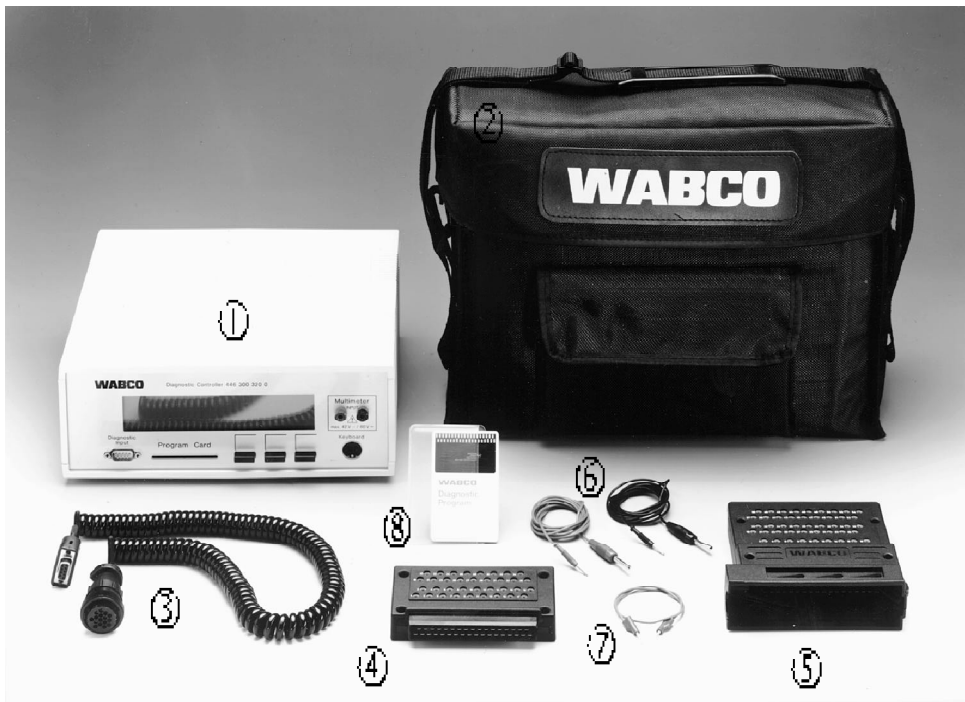
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LIST OF ABBREVIATIONS USED:

ABS	Anti-Lock Braking System
ATC	Automatic Traction Control
ECU	Electronic Control Unit
L1/L2	Wheels on steered axle (diagonals 1/2)
A1/A2	Wheels on driven axle (diagonals 1/2)
Z1/Z2	Wheels on third axle (diagonals 1/2)
MRV	Modulator valve (ATC)
Diff. valves	Differential brake valve (ATC)
IV	Inlet valve which when energized prevents further pressure increase at the wheel brake
OV	Outlet valve which when energized allows pressure at the wheel brake to be released
PIN	Individual connector in the ECU plug
MOT- valve	Engine valve with on/off control for ATC (also known as black / white valve)
PROP- valve	Engine valve with proportional control for ATC operation
>	greater than
<	less than
Ω	ohm
k Ω	kilo ohm
wheel A	Left Front (LF)
wheel B	Right Front (RF)
wheel C	Left Rear (LR)
wheel D	Right Rear (RR)

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 |

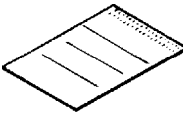
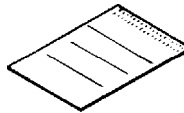
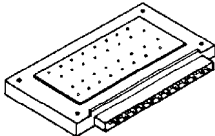
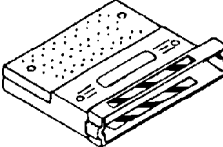
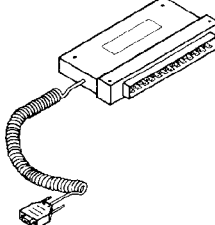
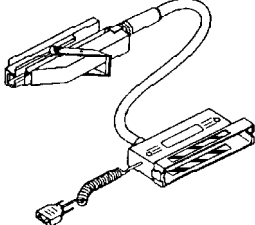
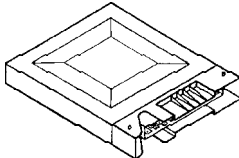
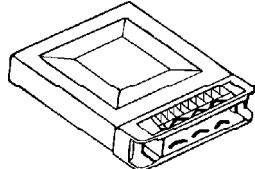
Additional Test Equipment

- | | |
|----------------------------------|---------------|
| 3. SAE Connector Cable (DEUTSCH) | 894 604 350 0 |
| SAE Connector Cable (AMP) | 894 604 351 0 |
| 4. Measuring-Adapter (35 pins) | 446 300 314 0 |
| 5. Measuring-Adapter (54 pins) | 446 300 309 0 |
| 6. Multimeter Cable (black) | 894 604 301 2 |
| Multimeter Cable (red) | 894 604 302 2 |
| 7. Bridging Cable | 894 604 300 2 |
| 8. Programme Card | 446 300 514 0 |

WHICH SYSTEMS CAN BE TESTED?

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

ABS/ATC C-Generation (SAE)

system/plug	4-channel/35 poles	6-channel/54 poles
programm card	446 300 514 0 	446 300 514 0 
measuring adapter application: fault search	446 300 314 0 	446 300 309 0 
inter-adapter application: if no diagnostic plug (to SAE J1587) on vehicle	446 300 325 0 	446 300 330 0 
ECUs which can be tested	446 004 038 0 039 0 040 0 	446 003 038 0 

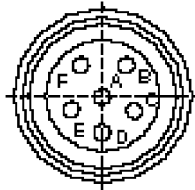
CONNECTING THE DIAGNOSTIC CONTROLLER

1a. Diagnostic socket to SAE J1587 available on vehicle

The allocation of PINs in the diagnostic socket must correspond to the SAE J1587 standard as shown below. Connect Diagnostic Cable to diagnostic socket on vehicle.

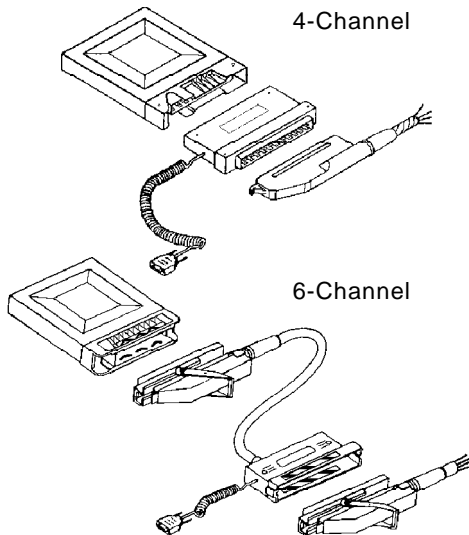
Allocation of diagnostic socket:

- PIN A diagnostic line (+)
- PIN B diagnostic line (-)
- PIN C battery positive
- PIN E battery negative



1b. No diagnostic socket to SAE J1587 available

If there is no diagnostic socket on the vehicle, an interadapter (accessories) can be fitted between the ECU and the vehicle harness connector (see diagram).



2. Connect the 9-pin plug of the connector cable (or the adapter cable) to the Diagnostic

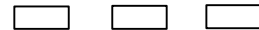
Controller, thus establishing both the diagnostic connection and voltage supply. Switch on ignition. The display will show black bars until a programme card is inserted. If an interadapter is used, the red toggle switch must be in position "1" to establish a voltage supply to the ECU.

3. Insert programme card, pushing it fully home (contact side first, black surface facing upwards). The display will now show which card has been inserted.

OPERATING THE DIAGNOSTIC CONTROLLER

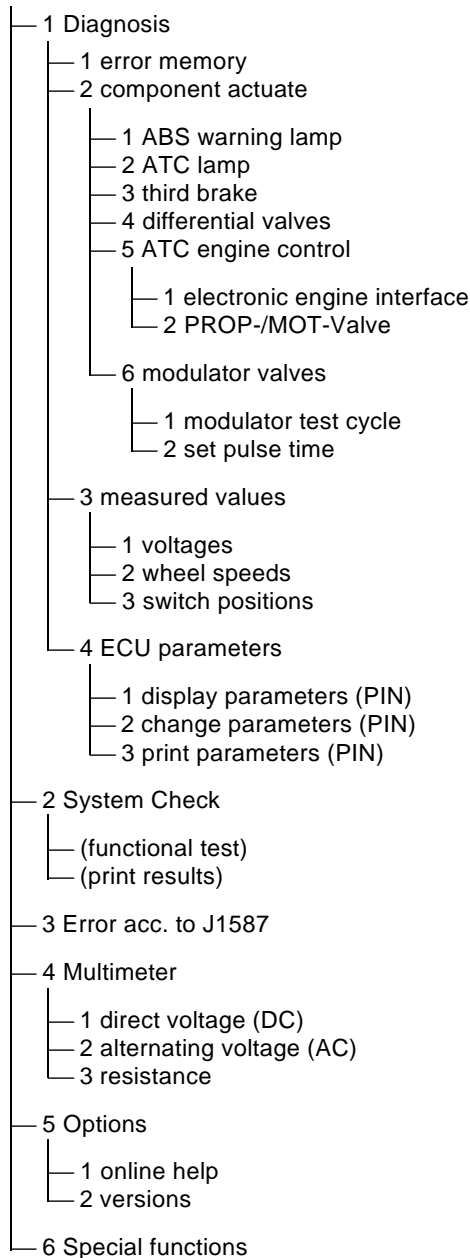
The Controller is operated by means of three push-buttons on its front panel. Their allocation is shown via the instructions appearing on the display directly above the respective push-button.

1 Diagnosis	4 Multimeter
2 System check	5 Options
3 Error acc. to J1587	6 Special function
Select function!	EXIT ↓ START



Push-button	Function
START :	Initiate programme.
RETURN :	The display will return to the last main menu.
(ARROW): ↓	Select an item from the main menu. Scroll forward one item at the time by pressing the push-button. The item selected will blink.
CONTINUE:	The item selected is activated or released.
REPAIR	This command will activate the failure search for the displayed error. However, by pressing CONTINUE you may display all errors first.

PROGRAMME STRUCTURE ABS/ATC C (SAE)



1. DIAGNOSIS

1 Diagnosis	4 Multimeter
2 System check	5 Options
3 Error acc. to J1587	6 Special functions
Select function!	EXIT ↓ START

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

A	ECU type:	ABS/ATC-C2
WABCO	Part No.:	446 004 039 4
S	Prod. date:	week / year
	Software No.:	3 CONTINUE

The WABCO data of the ABS ECU is displayed.

1 Error memory	3 Measured values
2 Component actuate	4 ECU parameters
Select function	EXIT START

In the Diagnosis mode, the following functions are available for selection:

- 1.1 Error memory
- 1.2 Component actuate
- 1.3 Measured values
- 1.4 ECU parameters

1.1 Error memory

If the ABS control unit has recognized a fault in the system (safety lamp on), this function helps locate the fault (example see Page 11). Depending on the type of ABS system used and the type of error encountered, the following advice will appear on the display.

- cause and location in plain writing, e.g. sensor error wheel A (steering axle S2), short circuit or broken wire.
- frequency at which the fault occurred.
Note: The ECU can recognize the error only **once** each time the ignition is switched on.
- “error exists at present” means that when the diagnosis mode was selected the error existed. This is followed by a detailed fault location routine with specific instructions on how to proceed in locating the error. If “error does not exist at present” appears on the display, this means that the fault did **not** exist at the time the diagnostic mode was selected, i.e. it cannot be located by way of electrical measurement.
- Integrated multimeter function. The tester is instructed to carry out electrical measurements (e.g. resistance measurements) with the aid of the measuring adapter (ref. page 4). Both prescribed and actual values appear on the display and can be compared.
- When correction of the fault is confirmed, that fault is deleted from the ECU.
- The fault location routine can be left only when all faults have been corrected.

1.2 Component Actuate

With “Component Actuate”, certain components within the ABS system can be actuated and tested. For this the respective components must, of course, have been fitted.

1.2.1 Warning lamp

The ABS warning lamp can be switched on or off at the push of a button.

1.2.2 ATC lamp

The ATC lamp can be switched on or off at the push of a button.

1.2.3 Third brake

The relay of the third brake (e.g. retarder) can be actuated at the push of a button (possible to hear the click sound of the relay on some installations).

1.2.4 Different valves

The differential brake valves of the ATC system can be individually actuated at the push of a button. By pressing the respective button, the valve is actuated briefly. If the button remains pushed, the valve is continuously actuated with short cycles.

1.2.5 ATC engine control

With this function, the electronic or pneumatic ASR engine control fitted in the vehicle can be actuated. Select the system fitted.

1.2.5.1 Electronic engine interfaces:

- J1922 data link

Test: start engine, increase engine speed and hold constant. Using the push-button, reduce engine speed, then increase to original level. When test is active an increase of engine torque should not be possible.

1.2.5.2 Pneumatic engine interfaces

- MOT Valve on/off characteristic (black / white)
- PROP Valve proportional characteristic

Test: start engine, increase engine speed and hold constant. Reduce speed via push-button “ON”. After releasing the button, engine speed is returned to its original level.

1.2.6 ABS modulator valves

1.2.6.2 Pulse programme

Both function and allocation of the ABS modulator valves can be individually checked by means of a pulse programme.

1.2.6.2 Time settings

The times for pressure build-up and pressure reduction are adjustable. For vehicles with large brake chambers, it may be of assistance to increase pulse times to ensure that sufficient (visible) pressurization and venting takes place. The value is preset at 51 milliseconds.

1.3 Measured values

This part of the programme is used to display values and switch positions.

1.3.1 Voltages

The actual voltages measured by the ECU are displayed. The valve relay voltages are slightly below the supply voltage.

1.3.2 Wheel speeds

The speeds of the ABS-controlled wheels are displayed. As soon as the wheel speed is more than 1.8 km/h, it will appear on the display.

When the wheel is stationary, the display will show < 1.8 km/h.

Note:

The diagnosis will be interrupted if all wheels are driven. When ATC-controlled wheels are turned at speeds in excess of approx. 3.5 km/h, ATC function is initiated, pressure is applied to the brakes on that wheel.

1.3.3 Switch positions

The positions of the ABS and ATC switches and the status of the ATC lamp are displayed.

1.4 Controller data

The following system-specific ECU parameters are displayed:

- WABCO ECU data
- ABS configuration
- ECU parameters
 - limiting speed: preset top speed
 - MIR definition: ABS bias factor on steering axle

2. SYSTEM CHECK

System check permits a complete ABS test including print-out of a test log (e.g. after initially fitting the system, 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 not possible to return to, or skip, individual steps.

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

Functional Testing

This test is carried out with the ECU connected. The Controller instructs the ECU to follow certain control instructions. The tester is confronted with individual yes/no inquiries.

Procedure:

- actuate
warning lamp
ATC lamp
third brake
ABS/ATC switch
- pulse programme
This will not work on most SAE installations.
- actuate
diff. valves of ATC-controlled driving wheels
- actuate
pneumatic engine control (PROP- or MOT-valve) or alternatively electronical interface

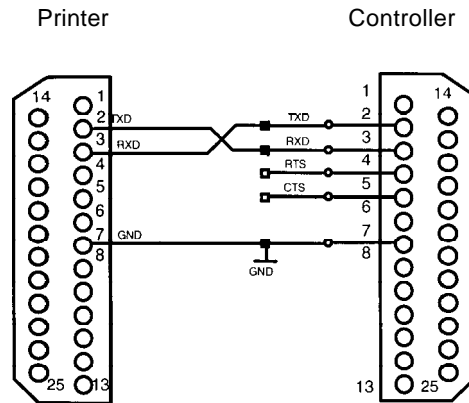
Print System Check

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

As mentioned above, the Controller has to be connected to the voltage supply at all times. 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 programme 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

3. ERROR ACC. TO J1587

4. MULTIMETER

The integrated multimeter function permits electrical 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.

Range	Display resolution	Accuracy of measuring range. Final Value at 20°C	
DC-voltage			
2.0 volts	0.1 volt	± 0.2 %	± 0.0 volt
20.0 volts	0.1 volt	± 0.2 %	± 0.1 volt
50.0 volts	0.1 volt	± 0.2 %	± 0.1 volt
AC-voltage			
2.0 volts	0.01 volt	± 0.6 %	± 0.02 volt
35.0 volts	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
2.0K Ω	1.0 Ω	± 0.2 %	± 1.0 Ω
20.0K Ω	10.0 Ω	± 0.1 %	± 10.0 Ω
95.0K Ω	100.0 Ω	± 0.2 %	± 100.0 Ω

Application:
 direct voltage: supply voltage on vehicle
 alternating voltage: sensor voltage
 resistance: valves, relays, sensors, wiring

NOTE: The measuring instrument is designed only for the vehicle range (low voltage). It must not be used outside the above measuring range.

5. OPTIONS

5.1 Online Help

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

5.2 Versions

This function will show the initial values of the test facilities:

- Controller hardware
- Controller operating system with creation date
- Multimeter
- Programme card with software creation date and check total

6. SPECIALFUNCTIONS

After inserting the P.I.N. qualified user can change the parameters.

EXAMPLE FOR LOCATING THE FAULT "SENSOR CABLE BREAK"

The ABS control unit has stored 1 error(s) in the error memory.

CONTINUE

Displays number of errors found.

Sensor error Wheel A (Steering S2)
(Short circuit or broken wire)

Error occurred 1x NEXT REPAIR

Display of **location** of fault (sensor wheel A, steering axle diagonal 2) and **type** of error encountered (parted or broken cable). The display also shows if the fault still existed at the time the diagnosis was initiated. Every time the ignition is switched on, the value is incremented by one. Start fault locating procedure by pressing REPAIR or display any other faults by pressing the CONTINUE button.

Check sensor Wheel A (Steering S2), connecting cable and connector for damage

Fault found NO YES

Visual check of the components for damage. If no errors found, continue to Step No. 4 by pressing "NO".

Switch ignition off!
THEN disconnect measuring pin adapter, connect ABS control unit and switch ignition on again. CONTINUE

NOTE: When using the inter-adapter, switch off ignition only using read toggle switch.
4-channel: measurementadapter 35 pins,
6-channel: measurementadapter 54 pins

Check resistance: PIN 15 / 32
SHOULD BE: 0.7–3.0 kΩ ACTUAL: 0.02 kΩ
Check actual value!
LOW CORRECT HIGH

Connect multimeter cable (red and black) to the multimeter sockets on the Controller. Push measuring pins into sockets 15 and 32 on the measurement adapter. Compare actual value measured with desired value. Using the respective button, indicate whether the actual reading is LOW, CORRECT (within the tolerance range) or HIGH (in this case: reading is LOW compared with desired value).

Disconnect sensor from connecting cable!
Check resistance: PIN 15 / 32
SHOULD BE: > 45 kΩ ACTUAL: 0.02 kΩ
Actual value O.K.? NO YES

To narrow down the fault, separate the sensor from the extension cable and again indicate whether reading is LOW, HIGH or CORRECT (in this case: reading is **LOW** again).

Sensor connecting cable
Wheel A (Steering S2) faulty.
Exchange faulty cable.
CONTINUE

Sensor connecting cable was isolated as the defective part.

No FURTHER errors stored in the
ABS control unit.
CONTINUE

No **FURTHER** errors have been stored.

Switch ignition off!
THEN disconnect ABS control unit,
connect measuring adapter and switch
ignition on again. CONTINUE

Proceed as described in Step No. 4 but in reverse sequence.

All RECTIFIED errors
are cleared in the ABS control unit!
CONTINUE

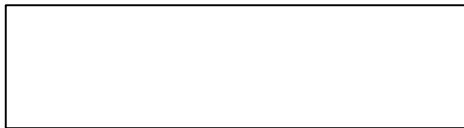
Switch ignition off and on again!
CONTINUE

After switching the ignition off and then on, the ECU will check the wiring once again. When using the inter-adapter the ignition must be switched off using the red toggle switch.

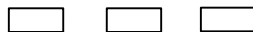
No FURTHER errors stored in the
ABS control unit.
CONTINUE

Error memory was read again. The display shows that no errors are stored in the ECU. If this is not the case, the fault locating procedure will commence again. To leave the fault locating procedure, press "CONTINUE".

FUNCTIONAL FAULT IN DIAGNOSTIC SYSTEM



no display



Cause

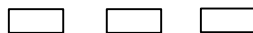
- no voltage supply
- undervoltage (less than about 7 volts)

Remedy

- a) SAE diagnostic plug:
 - Check plug allocation
 - Voltage between PIN1 and PIN2 = supply voltage on vehicle
- b) Inter-adapter:
 - Switch on ignition at adapter
 - Check all plug-in connections



black "bars"

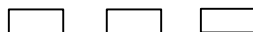
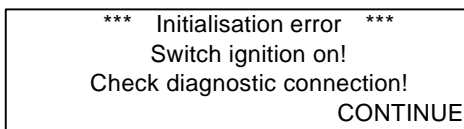


Cause

- programme card not inserted

Remedy

- Insert programme card, pushing it fully home



Cause

- insufficient supply voltage (only during diagnosis)

Remedy

- Check condition of battery and ensure sufficient supply

*** LOW VOLTAGE ***

CONTINUE

Cause	Remedy
<ul style="list-style-type: none"> - insufficient supply voltage (< 10.8 volts) - no supply voltage (ignition off) - no ECU or wrong ECU connected - Diagnostic lines switched or disconnected 	<ul style="list-style-type: none"> - Ensure supply - Switch on ignition - Check ECU and connection - Check lines and connections for function and proper allocation

*** Wrong key word ***

Diagnosis impossible!

CONTINUE

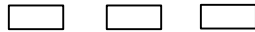
Cause	Remedy
<ul style="list-style-type: none"> - wrong ECU connected - wrong "WABCO Data" in ECU or defective ECU 	<ul style="list-style-type: none"> - Check ECU part number - Change ECU and check ECU part number

Defective Programme Card !

CONTINUE

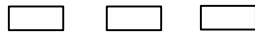
Cause	Remedy
<ul style="list-style-type: none"> - defective programme card - wrong programme card 	<ul style="list-style-type: none"> - Change programme card

*** COMMUNICATION
BREAKDOWN ***
Restart diagnosis procedure!
CONTINUE



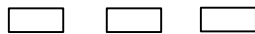
Cause	Remedy
<ul style="list-style-type: none"> - Data transmission aborted during diagnosis Line or voltage disconnection during diagnosis 	<ul style="list-style-type: none"> - Check all connections a) SAE socket on vehicle: <ul style="list-style-type: none"> - switch on ignition b) inter-adapter: <ul style="list-style-type: none"> - move red toggle - switch to "1" position

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



Cause	Remedy
<ul style="list-style-type: none"> - ECU cannot be tested with this programme card 	<ul style="list-style-type: none"> - Use right programme card

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



Cause	Remedy
<ul style="list-style-type: none"> - EEPROM (Diagnostic Controller's non-volatile memory defective) 	<ul style="list-style-type: none"> - Repair Diagnostic Controller

SYSTEM CHECK PROTOCOL
Motor vehicle ABS/ATC-C (SAE)

.....
Vehicle No.

.....
ECU No.

Component test

Component		Should be	Actual	Unit	Value
!ECU power-supply voltage		10.8- 16.0	_____	volts	_____
!ABS-relay 1 and SILA-relay		13 - 54	_____	volts	_____
!ABS-relay 2		25 - 108	_____	ohms	_____
!3.Brake-relay		25 - 108	_____	ohms	_____
! INLET valve	Wheel A (S2)	4.3 - 6.1	_____	ohms	_____
!OUTLET valve	Wheel A (S2)	4.3 - 6.1	_____	ohms	_____
! INLET valve	Wheel B (S1)	4.3 - 6.1	_____	ohms	_____
!OUTLET valve	Wheel B (S1)	4.3 - 6.1	_____	ohms	_____
! INLET valve	Wheel C (D1)	4.3 - 6.1	_____	ohms	_____
!OUTLET valve	Wheel C (D1)	4.3 - 6.1	_____	ohms	_____
! INLET valve	Wheel D (D2)	4.3 - 6.1	_____	ohms	_____
!OUTLET valve	Wheel D (D2)	4.3 - 6.1	_____	ohms	_____
!Sensor resistance	Wheel A (S2)	1.4 - 2.0	_____	kohms	_____
!Sensor to ground	Wheel A (S2)	> 45	_____	kohms	_____
!Sensor voltage	Wheel A (S2)	> 0.10	_____	volts	_____
!Sensor resistance	Wheel B (S1)	1.4 - 2.0	_____	kohms	_____
!Sensor to ground	Wheel B (S1)	> 45	_____	kohms	_____
!Sensor voltage	Wheel B (S1)	> 0.10	_____	volts	_____
!Sensor resistance	Wheel C (D1)	1.4 - 2.0	_____	kohms	_____
!Sensor to ground	Wheel C (D1)	> 45	_____	kohms	_____
!Sensor voltage	Wheel C (D1)	> 0.10	_____	volts	_____
!Sensor resistance	Wheel D (D2)	1.4 - 2.0	_____	kohms	_____
!Sensor to ground	Wheel D (D2)	> 45	_____	kohms	_____
!Sensor voltage	Wheel D (D2)	> 0.10	_____	volts	_____
!DIFF valve	Wheel C (D1)	7.7 -11.3	_____	ohms	_____
!DIFF valve	Wheel D (D2)	7.7 -11.3	_____	ohms	_____
!PROP/MOT valve		15.2-22.6	_____	ohms	_____

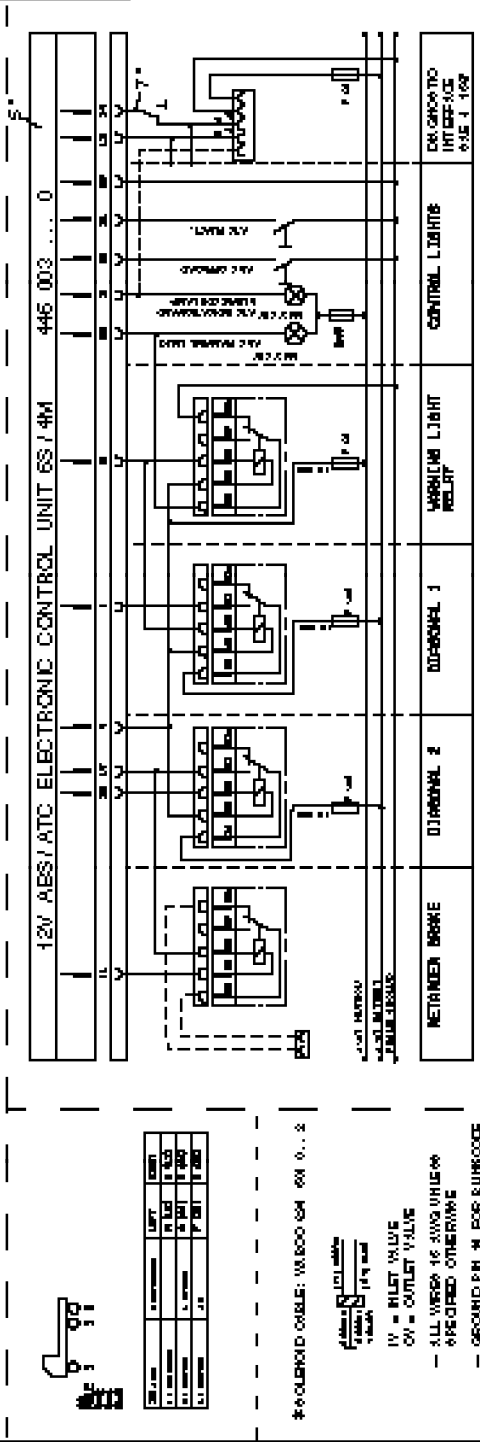
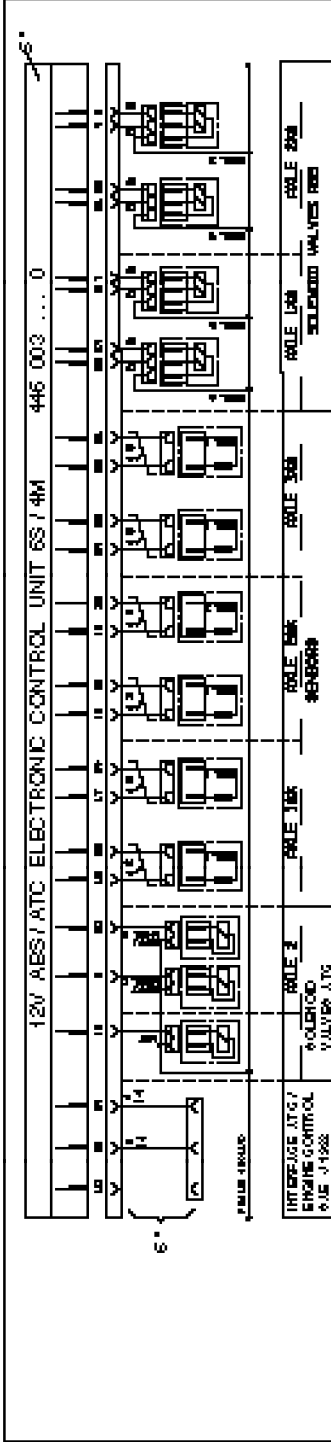
Function test

!No errors stored in the electronic control unit (ECU)					
!ABS warning light			_____		
!ATC light			_____		
!ABS offroad switch			_____		
!ATC function switch			_____		
!Modulator	Wheel A (S2)		_____		
!Modulator	Wheel B (S1)		_____		
!Modulator	Wheel C (D1)		_____		
!Modulator	Wheel D (D2)		_____		
!DIFF valve	Wheel C (D1)		_____		
!DIFF valve	Wheel D (D2)		_____		
!PROP/MOT Engine control			_____		

.....
Place

.....
Date

.....
Sign



WIRE	COLOR
1	RED
2	BLACK
3	GREEN
4	YELLOW
5	PURPLE
6	BROWN
7	PINK
8	WHITE
9	GRAY
10	BLUE
11	ORANGE
12	SLATE
13	TEAL
14	RED/BLACK

- WATER METER: W1000 6M 0...2
- 1 - TWISTED WIRE
 - 2 - 20 TURNS PER LETTER
 - 3 - WIRE COIL E.O.I.
 - 4 - 14S 02 02 0 PAWH 12V 14W 40E
 - 5 - HOT CONTROLLED WIRE
 - 6 - WIRE LENGTH = 4m
 - 7 - UPON CUSTOMER REQUEST

ABS/ATC		6S74M	
01	8-41	8-01	273 0
02	8-48	8-01	273 0
03	8-48	8-01	273 0