

Workshop Manual OCTAVIA

**1.8-ltr./110 kW Engine,
Motronic Fuel Injection and Ignition
System**

List of Supplements for OCTAVIA Workshop Manual

Edition: 07.04

1.8 I/110 kW Engine, Motronic Fuel Injection and Ignition System

Replaces List of Supplements - Edition: 08.01

Supplement	Edition	Subject	Article Number
	07.98	Basic Edition of Workshop Manual	S00.5124.50.20
1	03.01	Supplement for Engines with Engine Codes ARZ, ARX, AUM	S00.5124.51.20
2	08.01	Modifications for Model Year 2002	S00.5124.52.20
3	07.04	Modifications in Repair Group 01 and 24	S00.5124.53.20
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Contents ⇒ next page.

Contents

01	Self-diagnosis	Page
	Self-diagnosis	01-1
	- Function	01-1
	- Technical data of self-diagnosis	01-2
	- Connecting vehicle system tester V.A.G 1552 and select engine electronics control unit	01-3
	- Interrogating and erasing fault memory	01-5
	- Actuator diagnosis	01-8
	Fault table	01-15
	- Fault table of fault codes 00282...17841	01-15
	- Fault table of fault codes 17842...18261	01-34
	- Readiness code	01-40
	- Reading readiness code	01-40
	- Generate readiness code	01-41
	Reading measured value block - Initiating basic setting of system	01-47
	List of display groups for engine identification characters AGU	01-49
	- Display groups 000...007	01-49
	- Display groups 008...099	01-63
	List of display groups for engine identification characters ARZ, ARX, AUM	01-82
	- Display groups 000...009	01-82
	- Display groups 010...041 and 099	01-91
	- Display groups 050...066	01-106
	- Display groups 113...118	01-115
	- Display groups 120...126	01-118
24	Fuel Formation/Injection	Page
	- Repairing the injection system	24-1
	Repairing the injection system	24-2
	Fitting locations - Overview	24-2
	Parts of injection system - Summary of components	24-4
	- Disassembling and assembling fuel distributor with injectors	24-7
	- Removing and installing air filter and air mass meter	24-8
	- Safety measures	24-9
	- Rules for cleanliness	24-9
	- Wiring and Component Test with Test Box	24-9
	Testing components and functions	24-12
	- Adapting idling speed	24-12
	- Testing Electronic Engine Power Control (Electronic throttle)	24-13
	- Testing throttle valve control unit	24-15
	- Testing accelerator pedal position sender	24-16
	- Testing altitude sender	24-17
	- Testing voltage supply for control unit	24-18
	- Procedure after voltage supply has been interrupted	24-19
	- Testing fuel pressure regulator and holding pressure (pressure in the system)	24-20
	- Testing injected quantity, leak tightness and spray pattern of injectors	24-22
	- Testing intake system for tightness (unmetered air)	24-25
	Inspecting lambda control	24-26
	- Incorrect driving behaviour after cold start	24-27
	- Testing lambda probe -G39 and lambda control upstream of catalytic converter	24-28
	- Testing lambda probe ageing upstream of catalytic converter	24-30
	- Testing lambda probe -G130 and lambda control downstream of catalytic converter	24-30
	- Testing exhaust emissions warning lamp (K83)	24-32

Replacing, coding and adapting the engine control unit	24-33
- Replacing engine control unit	24-33
- Coding control unit	24-34
- Adapting engine control unit to throttle valve unit	24-36
- Adjusting the kick-down function	24-39
Testing auxiliary signals	24-40
- Testing speed signal	24-40
- Testing CAN-Bus databus	24-41
- Activating or deactivating cruise control system (CCS)	24-42

28	Ignition system	Page
	Repairing the ignition system	28-1
	- Safety measures	28-1
	Parts of injection system - Summary of components	28-2
	Testing components and functions	28-3
	- Testing Hall sender (G40)	28-3

Self-diagnosis

Note:

The self-diagnosis monitors only a part of the injection and ignition system.

Function

The Motronic engine control unit -J220 for the injection and ignition system is equipped with a fault memory. The fault memory is designed as a permanent memory and as a volatile memory.

If malfunctions occur in the monitored sensors or components, they are stored in the fault memory with indication of the fault type ⇒ Fault table, page 01-15.

Faults which occur only occasionally (sporadically), are displayed as sporadically occurring faults with the suffix „SP“. Possible causes of sporadic faults are e.g. a loose contact or a momentary line interruption. If a sporadic fault no longer occurs within 40 warm-up phases (engine start at a temperature of 50 °C - engine stop at more than 72 °C), it is removed from the fault memory.

The stored faults can be read out with vehicle system tester V.A.G 1552 or V.A.G 1551 with fault read-out scan tool VAS 5051 ⇒ page 01-5.

After the fault(s) has(have) been removed the fault memory must be erased ⇒ page 01-6.

If the engine control unit is disconnected, perform work sequence for voltage interruption ⇒ page 24-19.

For engines with engine identification characters ARX and AUM

Whenever the fault memory is erased, it is necessary to generate a readiness code ⇒ page 01-41.

For all engines

Notes:

- ◆ *The following description only relates to vehicle system tester V.A.G 1552 using the current program card 5.0 or higher.*
- ◆ *The use of fault read-out scan tool V.A.G 1551 (with program card version 8.0) with integrated printer or VAS 5051 is similar, only the read-outs on the display may be slightly different. A minor deviation on the display read-out is possible.*

Technical data of self-diagnosis

Engine identification characters	AGU	ARZ	ARX	AUM
System designation	Motronic	Motronic	Motronic	Motronic
Exhaust limits conforming to	EU-2 (D3)	EU-2 (D4)	EU-3	EU-4
Lambda control	1 Lambda probe	2 Lambda probes	2 Lambda probes	2 Lambda probes
Knock control	2 Knock sensors	2 Knock sensors	2 Knock sensors	2 Knock sensors
Variable intake manifold length	no	no	no	no
Camshaft adjustment	no	no	no	no
Secondary air system	no	yes	yes	yes

Interrogating control unit version

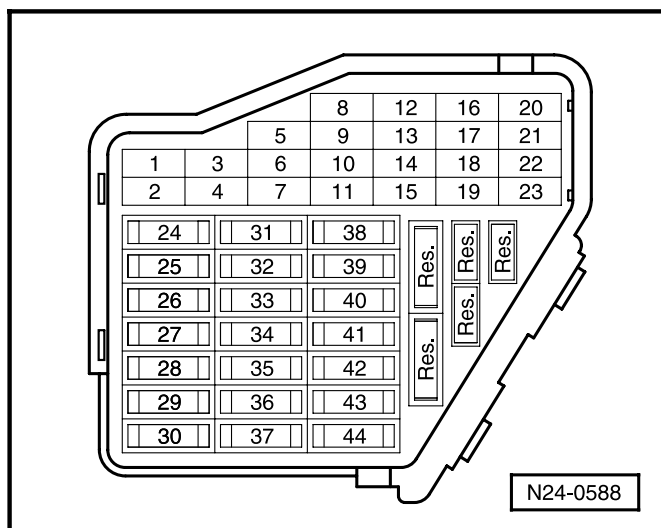
The control unit version is displayed once the vehicle system tester V.A.G 1552 is connected, and the engine electronics control unit selected ⇒ page 01-3.

Available functions when using vehicle system tester V.A.G 1552

The conditions under which the desired functions can be selected are given in the following table.

Function	Precondition		
	Engine not running, ignition switched on	Engine idling	Normal driving
01 Interrogating control unit	yes	yes	yes
02 Interrogating fault memory	yes ¹⁾	yes	yes
03 Actuator diagnosis	yes	no	no
04 Basic setting ²⁾	yes	yes	no ³⁾
05 Erasing fault memory	yes	yes	yes
06 Ending output	yes	yes	yes
07 Coding control unit	yes	no	no
08 Reading measured value block	yes	yes	yes
10 Adaptation ²⁾	yes	no	no
15 Readiness code	yes	yes	yes

- 1) Only perform when ignition switched on and if engine does not start (operate starter for at least 6 seconds).
- 2) To be carried out after the following operations:
replacing engine control unit, throttle valve control unit or engine, or disconnecting battery.
- 3) For engines with engine identification characters ARZ, ARX, AUM valid „yes“.



Connecting vehicle system tester V.A.G 1552 and selecting engine electronics control unit

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- Battery voltage at least 11.5 V.
- ◀ ● Fuses 10, 28, 29, 32, 34 and 43 o.k.
- Earth connections at gearbox and at left below battery o.k.

Procedure

- ◀ - Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

After the vehicle system tester has been connected:

- Depending on the desired function, switch the ignition on or start the engine ⇒ page 01-2, table of „Available Functions“.

If the readouts which appear in the display do not match the description in the procedure, refer to the following notes:

Notes:

- ♦ If „Error in data transfer“ is displayed because of an incorrect entry, unplug cable to vehicle system tester, plug in again and repeat the steps.
- ◀ ♦ If one of the following messages appears in the display, carry out fault finding as specified in the Fault Finding Programme diagnostic cable

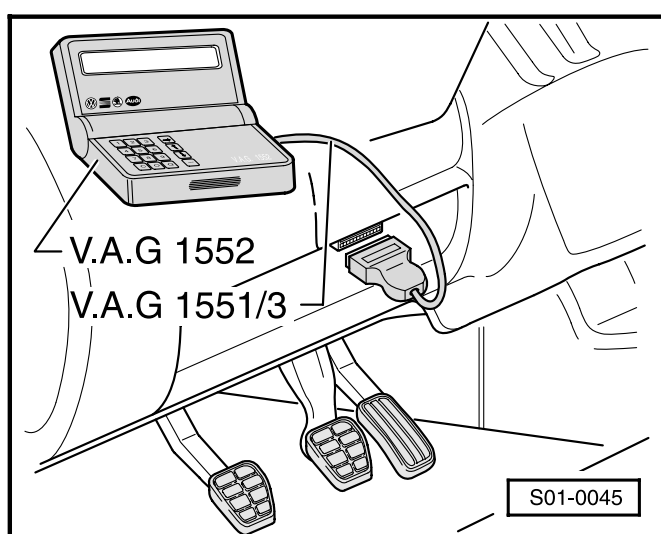
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder, or

⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder, or

⇒ Operating Instructions of vehicle system tester

Note:

Operate the vehicle system tester according to the readout in the display.



Test of vehicle systems
Control unit does not answer!

HELP

Test of vehicle systems
Fault in communication build-up

HELP

Test of vehicle systems
K wire not switching to earth

HELP

Test of vehicle systems
K wire not switching to positive

HELP

Vehicle system test
Enter address word XX

HELP

◀ Read-out on display:

- Enter address word 01 „Motor electronics“ and confirm entry with key Q.

06A906018CF 1.8 I R4/5VT MOTR HS D03 →
Coding 04000 WSC 06388

◀ The control unit identification number is shown on the display, e.g.:

- ♦ 06A906018CF = part no. of the control unit (for current control unit version - see Spare Parts Catalogue)
- ♦ 1.8 I = engine displacement
- ♦ R4/5VT = engine version (4cyl. in-line engine /5 Valve/Turbo)
- ♦ MOTR = system designation Motronic
- ♦ HS = manual gearbox
AT = automatic gearbox
G = vehicle with activated CCS
- ♦ D03 or 0004 = data status (software version) of control unit
- ♦ Coding 04000 = coding variant of control unit
- ♦ WSC 06388 = workshop code from V.A.G 1552, with which the last coding was performed

Notes:

- ◆ If the control unit version display does not match the vehicle, replace control unit ⇒ page 24-33.
- ◆ Incorrect coding of the engine control unit results in:
 - Drivability problems (jerky gearshifts, load change jolts, etc.)
 - Increased fuel consumption
 - Increased emission levels
 - Storage of non-existent faults in the fault memory
 - Functions not being performed (lambda control, actuation of activated charcoal filter system, etc.)
 - Reduction in life of automatic gearbox

If the coding does not match the corresponding version in the vehicle:

- Check coding of control unit ⇒ page 24-34, Coding engine control unit.
- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- For further procedure ⇒ Repair descriptions.

Interrogating and erasing fault memory

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Procedure

- Connect vehicle system tester V.A.G 1552. Start engine and select address word 01 „Engine electronics“ ⇒ page 01-3.

Only if engine does not start:

- Operate starter for at least 6 seconds; do not switch ignition off.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Enter 02 for the function “Interrogate fault memory” and confirm the entry with the key Q.

X faults recognized!

◀ The number of stored faults or "No fault recognized!" appears in the display.

If no fault is stored:

- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Enter 06 for the function „End output“ and confirm the entry with the key Q.

If one or several faults are stored:

Fault number: 00515

→

◀ Fault number appears in the display, e.g.

- Press → key.

Hall sender -G40-
Short to earth

→

◀ Fault source with fault type appears in the display, e.g.:

- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Enter 06 for the function „End output“ and confirm the entry with the key Q.
- Rectify the faults displayed by referring to the fault table ⇒ page 01-15.

Note:

When carrying out test and removal and installation operations, faults, such as connectors unplugged, may also be detected by other control units. That is why, in conclusion, it is always necessary to interrogate the fault memories of all the control units and to erase them. To do this:

- Enter 00 for the address word „Automatic test sequence“ and confirm the entry with the key Q. V.A.G 1552 thereupon sends all the known address words.
- Erase fault memory ⇒ page 01-6.

Erasing fault memory

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

Note for engines with engine code letters ARX and AUM:

Whenever the fault memory is erased, it is necessary to generate a readiness code ⇒ page 01-41.

- Repair carried out
- Once the fault has been removed, perform a test drive.

During this test drive the following conditions must be fulfilled:

- ◆ Coolant temperature must rise to more than 80 °C.
- ◆ Once this temperature is reached, the following operating states must be set several times:
 - Idle
 - Partial load
 - Enrichment
 - Trailing throttle (overrun fuel cut-off).
- ◆ In case of full load the speed should be increased beyond 3500 rpm.

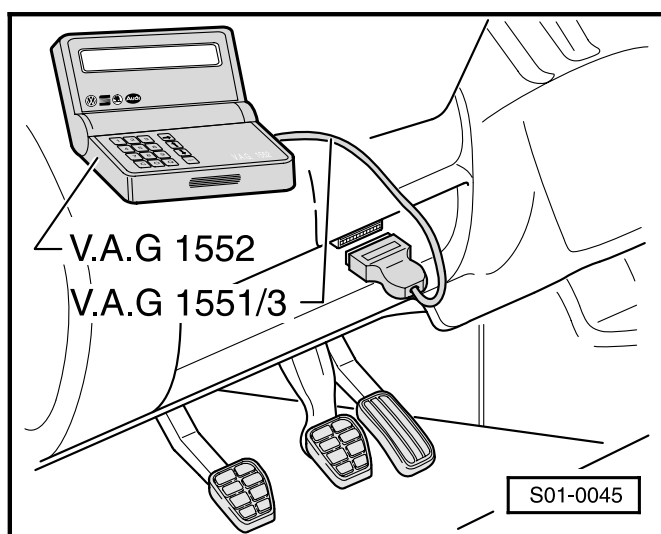
Procedure

- ◀ - Connect vehicle system tester V.A.G 1552 with the cable ⇒ page 01-3.
- Interrogate fault memory of control unit again (function 02) ⇒ page 01-5.
- ◀ Read-out on display:
 - If test and repair and installation work are only performed on the motor electronics, enter 02 for the function „interrogate the fault memory“ and confirm entry with key Q.

If the test and repair and installation operations have also affected other control units, interrogate and erase the fault memories of all control units upon completion.

For this you must proceed as follows:

- Enter 00 for the address word „automatic test sequence“ and confirm entry with key Q. The V.A.G 1552 sends all known address words in sequence.



Vehicle system test
Select function XX

HELP

No fault recognized!

- ◀ - The number of stored faults appears in the display.

If one or several faults are stored:

The stored faults are displayed one after the other.

- Rectify the faults displayed by referring to the fault table ⇒ page 01-15.
- Enter 05 for the function „Erase fault memory“ and confirm entry with the key Q.

Test of vehicle systems
Fault memory is erased!

→

- ◀ Readout in display:

Note:

The fault memory is not erased if ignition is switched off between „Interrogating fault memory“ and „Erasing fault memory“.

- Press → key.
- Enter 06 for the function „End output“ and confirm entry with the key Q.

Final control diagnosis

Test conditions

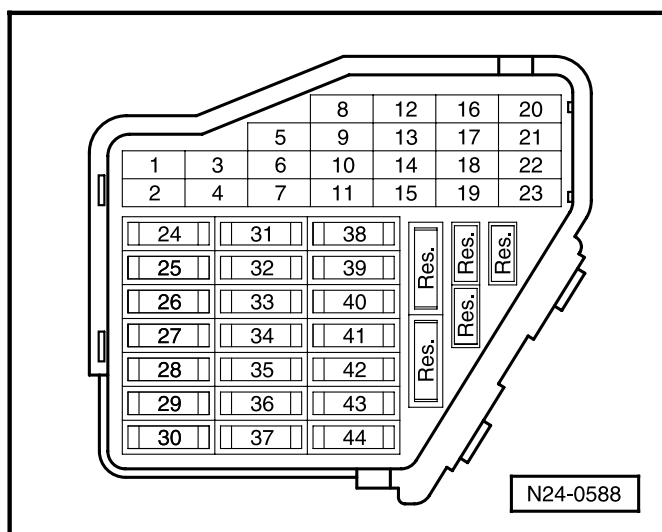
- ◀ ● Fuses 10, 28, 29, 32, 34 and 43 o.k.

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Notes:

- ♦ *Final control diagnosis can only be carried out when the engine is not running and the ignition is switched on.*
- ♦ *Final control diagnosis is aborted if the engine is started or if an engine speed pulse is detected.*
- ♦ *During final control diagnosis the individual control elements continue to be operated until the test programme is switched to the next control element by pressing the → key.*
- ♦ *The control elements are tested by listening or by touching.*



- ◆ *Before repeating final control diagnosis without briefly running the engine, the ignition must be switched off for about 2 seconds.*
- ◆ *The electric fuel pump runs during the entire final control diagnosis.*
- ◆ *Final control diagnosis is ended after 10 minutes.*
- ◆ *Idling speed switch must be in proper order.*

Engine code AGU

With the final control diagnosis the following components are actuated in the order stated:

1. Injector cylinder 1 -N30
2. Injector cylinder 2 -N31
3. Injector cylinder 3 -N32
4. Injector cylinder 4 -N33
5. Solenoid valve 1 for activated charcoal filter -N80
6. Charge pressure control solenoid valve -N75

Procedure

- Connect vehicle system tester V.A.G 1552. Start engine and select address word 01 „Engine electronics“ ⇒ page 01-3. The ignition must be switched on for this step.
- Enter 03 for the function „Final control diagnosis“.

Test of vehicle systems 03 - Final control diagnosis	Q
---	---

◀ Confirm entry with the key Q.

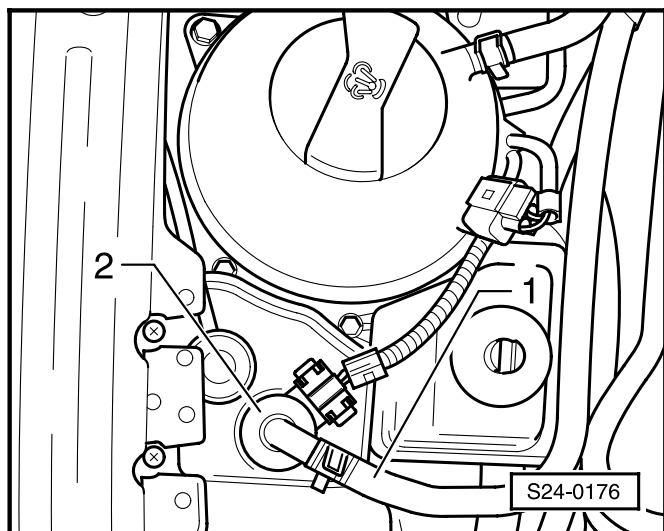
Injectors:

Final control diagnosis Injector cyl. 1 -N30	→
---	---

◀ Readout in display:

- Open throttle valve. As soon as the idling speed switch opens, the injector of cylinder 1 clicks five times.
- To switch to the next injector, press → key. (It is also possible to switch forward without testing the particular injector.)
- Repeat the procedure for testing all the injectors one after the other.

If one of the injectors is not actuated (does not click):



- Test resistance of the injector ⇒ page 24-7.
- Test wiring to the injector for short circuit or for open circuit
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

- Press → key.

Solenoid valve 1 for activated charcoal filter -N80

◀ Installation position of solenoid valve -2-.

Final control diagnosis →
Solenoid valve 1 for activated charcoal filter -N80

◀ This solenoid valve (located in front of coolant reservoir) must click.

If the valve is not actuated (does not click):

- Test resistance of valve ⇒ page 24-2.
- Test wiring to valve for short circuit and open circuit
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

If the solenoid valve clicks, opens and closes:

- Press → key.

Charge pressure control solenoid valve -N75:

Final control diagnosis →
Charge pressure control solenoid valve -N75

◀ This valve is operated continuously (clicks) until final control diagnosis is ended by pressing the → key.

If the valve is not actuated (does not click):

- Test resistance of valve ⇒ page 24-3.
- Test wiring to valve for short circuit and open circuit
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.
- End output and switch ignition off.

Note:

Before again selecting function 03 „Final control diagnosis“, it is necessary to switch the ignition off for about 20 seconds. If the ignition is not switched off before again starting the engine, the starter will crank the engine but the engine will not start as the injectors and ignition transformers are not actuated.

For engines with engine identification characters ARZ, ARX, AUM

With the actuator diagnosis the following parts are activated in the sequence indicated:

1. Tank vent valve -N80
2. Secondary air inlet valve -N112
3. Secondary air pump relay -J299
4. Solenoid valve for charge pressure control -N75
- 5.¹⁾ Camshaft adjustment
6. Turbocharger divert air valve -N249
- 7.²⁾ Brake vacuum pump
8. Injector cylinder 1 -N30
9. Injector cylinder 3 -N32
10. Injector cylinder 4 -N33
11. Injector cylinder 2 -N31
 - ¹⁾ For engines with engine identification characters ARX, AUM
 - ²⁾ For models with automatic gearbox. Designation of diagnosis can also be displayed as „Information in the literature“.

Procedure

- Connect vehicle system tester V.A.G 1552. Switch ignition on and enter address word 01 „Engine electronics“ ⇒ page 01-3.

Vehicle system test Select address word XX	HELP
---	------

◀ Enter 03 for the function „actuator diagnosis“.

Vehicle system test 03 - Actuator diagnosis	Q
--	---

◀ Confirm the entry with key Q.

Activated charcoal filter solenoid valve -N80

Actuator diagnosis Activated charcoal filter solenoid valve -N80	→
---	---

◀ This solenoid valve (in front of coolant expansion reservoir) must click.

If the injector is not actuated (does not click):

- Check resistance of the injector ⇒ page 24-2.
- Check wires to valve for open circuit or short-circuit
⇒ Binder Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Click, opens and closes the solenoid valve:

- Press key →.

Final control diagnosis
Secondary air injection valve -N112 →

Secondary air injection valve -N112:

◀ The secondary air injection valve -N112 must click until the → key is pressed.

If the valve is not actuated (does not click):

- Test voltage supply of valve.
- Test wiring to valve for short circuit and open circuit
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.
- Press → key.

Secondary air injection pump relay -J299:

Secondary air injection pump relay -J299 is installed in the holder in the protective housing next to brake servo unit.

- Test fuse of secondary air injection pump relay -J299.

Final control diagnosis
Secondary air injection pump relay -J299 →

◀ The secondary air injection pump relay -J299 is controlled by the secondary air injection pump motor. Motor operates at intervals until the → is pressed.

- If the secondary air injection pump motor does not run at intervals, test pump motor
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.
- Press → key.

Charge pressure control solenoid valve -N75:

Final control diagnosis
Charge pressure control solenoid valve -N75 →

◀ This valve continues to be operated (clicks) until the → key is pressed.

If the valve is not actuated (does not click):

- Test resistance of valve ⇒ page 24-3.
- Test wiring to valve for short circuit and open circuit
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.
- Press → key.

Actuator diagnosis
Camshaft adjustment →

Camshaft adjustment:

◀ This injector is actuated (clicks) until key → is pressed.

If the injector is not actuated (does not click):

- Check resistance of the injector ⇒ page 24-3.
- Check wires to valve for open circuit or short-circuit
⇒ Binder Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.
- Press key →.

Actuator diagnosis
Turbocharger divert air valve -N249 →

Turbocharger divert air valve -N249:

◀ This injector is actuated (clicks) until key → is pressed.

If the injector is not actuated (does not click):

- Inspect valve power supply.
- Check wires to valve for open circuit or short-circuit
⇒ Binder Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.
- Press key →.

Actuator diagnosis
Brake vacuum pump →

Activate the brake vacuum pump

(Only for vehicles with automatic gearbox)

◀ Brake servo unit vacuum pump does not run at intervals until the key → is pressed.

- If the brake servo unit vacuum pump does not run at intervals, check:
⇒ Chassis; Repair Group 47.
- Press key →.

Actuator diagnosis
Injector cylinder 1 -N30 →

Injectors:

◀ Click injector for cylinder 1 several times.

- If you want to switch to the next injector press key →. (Switching can also be performed without testing the relevant injector).
- Test all the injectors one after the other in this way.

If one of the injectors is not actuated (does not click):

- Check resistance of the injector ⇒ page 24-7.
- Check wires to valve for open circuit or short-circuit
⇒ Binder Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.
- Press key →.

Actuator diagnosis
END

→

◀ Read-out on display:

- End output and switch off ignition.

Fault table

Notes:

- ♦ The fault table is arranged in accordance with the 5-digit fault code which appears on the left.
Fault code 00282...17841 from page 01-15
Fault code 17842...18261 from page 01-34
- ♦ Explanations on fault types (e.g. open circuit or short to earth):
⇒ Operating instructions of vehicle system tester
- ♦ If components are shown as faulty:
First of all, test all the leads and plug connections to

these components as well as the earth cables of the system according to the current flow diagram. Replace the component only if these tests do not reveal any fault. This applies in particular to faults which are shown as sporadic (SP).

- ♦ When testing senders and other components of the fuel injection system, and when testing electric cables, proceed according to the appropriate current flow diagram
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Fault table of fault codes 00282...17841

Readout on V.A.G 1552	Rectifying fault
00282 Throttle valve positioner -V60¹⁾ implausible signal control limit exceeded	- Test -V60 ⇒ page 24-15, Testing throttle valve control unit
00515 Hall sender -G40 short to earth open/short to positive	- Test -G40 ⇒ page 28-3
00528 Altitude sender -F96 signal too large signal too small	- Test altitude sender -F96 ⇒ page 24-17
00532 Supply voltage signal too large signal too small	- Test supply voltage to engine control unit ⇒ page 24-18
00543 Maximum engine speed exceeded	- Rectify any mechanical damage

¹⁾ Part of throttle valve control unit -J338.

Notes on fault code 00532:

- ♦ If the fault is displayed as a sporadic fault, ignore fault readout! This fault may be stored if the engine runs for a lengthy period at idling speed with a large number of electrical components switched on and the battery is severely discharged.
- ♦ Fault type „signal too small“ is displayed as soon as the supply voltage is less than 10.8 V for more than 1 second (the control unit does not operate at a voltage of less than 6.0 V).
- ♦ No test is made for „signal too small“ during engine start (the voltage may drop to 10 V during engine start).

Readout on V.A.G 1552	Rectifying fault
00544 Maximum charge pressure exceeded	- Test -N75 ⇒ page 01-8, Final control diagnosis - Test charge pressure control in measured value block, display group 025 - Test charge pressure control system ⇒ 1.8 l/110 kW Engine - Mechanical Components; Repair Group 21 - Test altitude sender -F96 ⇒ page 24-17
00557 PAS pressure switch -F88 short to earth short to positive	- Test signal from PAS pressure switch in measured value block, display group 019
00561 Mixture adaptation above adaptation limit (add) above adaptation limit (mul) below adaptation limit (add) below adaptation limit (mul)	- Refuel vehicle, test fuel pressure regulator and holding pressure ⇒ page 24-20 - Test fuel pump ⇒ 1.8 l/110 kW Engine - Mechanical Components; Repair Group 20 - Test sender -G70 in measured value block, display group 002 - Test intake system for leaks (unmetered air) ⇒ page 24-25 - Test -N80 ⇒ page 01-8, Final control diagnosis - Test injected quantity ⇒ page 24-22
00575 Intake manifold pressure below control limit above control limit	- Test sender -G70 in measured value block, display group 002 - Test -N75 ⇒ page 01-8, final control diagnosis - Test charge pressure control in measured value block, display group 025 - Test charge pressure control system ⇒ 1.8 l/110 kW Engine - Mechanical Components; Repair Group 21
00670 Throttle valve positioner sender -G127¹⁾ signal too small signal too large implausible signal	- Adapt engine control unit to throttle valve control unit ⇒ page 24-36 - Test throttle valve control unit ⇒ page 24-15

¹⁾ Part of throttle valve control unit -J338.

The sender is a potentiometer which signals the position of the throttle valve positioner to the control unit.

Notes on fault code 00561:

♦ *add* = additive, means that the fault has an effect only in the idling speed range.

♦ *mul* = multiplicative, means that the fault has an effect over the entire engine speed and load range.

Readout on V.A.G 1552	Rectifying fault
00671 CCS switch -E45 implausible signal	- Test switch function in measured value block, display group 066 - Test wiring to switch for open circuit and short circuit
01119 Gear recognition signal open/short to positive short to earth	- Test cable connection to multifunction switch -F125 - Interrogate fault memory for automatic gearbox ⇒ Automatic Gearbox; Repair Group 01
01165 Throttle valve control unit -J338 below control limit above control limit control difference	- Test throttle valve control unit in measured value block, display group 023 - Test throttle valve control unit -J338 ⇒ page 24-15 - Adapt engine control unit to throttle valve control unit ⇒ page 24-36
01247 Solenoid valve 1 for activated charcoal filter -N80 short to earth short to positive output open	- Test valve -N80 ⇒ page 01-8, Final control diagnosis - Test valve -N80 in measured value block, display group 010
01249 Injector cyl. 1 -N30 short to earth short to positive output open	- Test injectors ⇒ page 01-8, Final control diagnosis
01250 Injector cyl. 2 -N31 short to earth short to positive output open	⇒ Cylinder 1, fault code 01249

Note on fault code 01165:

If fault „01165“ is stored in the fault memory, fault „17953“ is also stored when the engine is next started.

Read out on display of V.A.G 1552	Rectifying fault
01251 Injector cylinder 3 -N32 Short-circuit to earth Short-circuit to positive Outlet open	⇒ Cylinder 1, fault code 01249
01252 Injector cylinder 4 -N33 Short-circuit to earth Short-circuit to positive Outlet open	
01252 Injector cylinder 4 -N33 Short-circuit to earth Short-circuit to positive Outlet open	
01259 Fuel pump relay -J17 Line interruption/short-circuit to earth Short-circuit to positive	
01262 Solenoid valve for charge pressure control -N75 Short-circuit to earth Short-circuit to positive Outlet open	
01314 Engine control unit Control unit defective	
16394 Bank 1, Camshaft adjustment Malfunction	- Check camshaft adjustment ⇒ page 01-8, Actuator diagnosis
16395 Bank 1, Camshaft post-adjustment Nominal value is not reached	

Note for fault code 01259:

If the fault „01259“ is stored, the faults „01247 / 01249 / 01250 / 01251 / 01252 / 01262 and 16486“ can also be stored, because these components are supplied with voltage via the fuel pump relay.

Read out on display of V.A.G 1552	Rectifying fault
16396 Bank 1, Camshaft pre-adjustment Nominal value is not reached	- Check camshaft adjustment ⇒ page 01-8, Actuator diagnosis
16485 Air mass meter -G70 Implausible signal	- Check sender -G70 in measured value block, display group 002 - Check wiring to sender -G70 ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
16486 Air mass meter -G70 Signal too low	- Replace air filter element - Check sender -G70 in measured value block, display group 002 - Check wiring to sender -G70 ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
16487 Air mass meter -G70 Signal too great	
16490 Intake manifold pressure/air pressure ⇒ -G71/-F96 Implausible signal	- Check boost pressure sender -G31 in measured value block, display group 115 - Check altitude sender -F96 ⇒ page 24-17
16496 Intake manifold temperature -G42 Signal too low	- Check sender -G42 in measured value block, display group 003 if necessary 004 - Check resistance of sender -G42 ⇒ page 24-8
16497 Intake manifold temperature -G42 Signal too great	
16500 Coolant temperature sender -G62 Implausible signal	- Check sender -G62 in measured value block, display group 003 if necessary 004 - Check resistance of sender -G62 ⇒ page 24-8 - Check coolant ⇒ 1.8 l/110 kW Engine, Mechanics; Repair Group 19

Note for fault code 16496:

Fault „signal too low“ is stored after engine start after approx. 3 minutes idling.

Readout on V.A.G 1552	Rectifying fault
16501 Coolant temp. sender -G62 signal too small	- Test sender -G62 in measured value block, display group 003 and 004 - Test resistance of sender -G62 ⇒ page 24-8 - Test coolant thermostat ⇒ 1.8 l/110 kW Engine - Mechanical Components; Repair Group 19
16502 Coolant temp. sender -G62 signal too large	
16504 Throttle valve potentiometer -G69¹⁾ electr. fault in circuit	- Test cable connections to throttle valve potentiometer -G69 ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder - Test throttle valve potentiometer -G69 in measured value block, display group 098
16505 Throttle valve potentiometer -G69¹⁾ implausible signal	
16506 Throttle valve potentiometer -G69¹⁾ signal too small	
16507 Throttle valve potentiometer -G69¹⁾ signal too large	
16514 Bank 1 probe 1 electr. fault in circuit	- Test lambda probe -G39 and lambda control upstream of catalytic converter ⇒ page 24-28

¹⁾ Part of throttle valve control unit -J338.

Note on fault code 16500:

What is compared is the temperature curve in the range of 20 °C up to 60 °C with a model curve stored in the control unit. The model curve rises more slowly than the real curve. If the real values become too slow because of a fault, they will at some stage be aligned with the model values. This fault is detected by the engine control unit as being implausible.

Notes on fault codes 16500, 16501 and 16502:

As soon as one of the faults is detected, the engine control unit uses the intake air temperature as a substitute value for engine start. Then, the temperature rises in line with a model curve stored in the engine control unit (by 5.25 °C every 65 sec.). A fixed substitute value is displayed after a certain time for an engine at normal operating temperature. This fixed substitute value is, in turn, dependent on the intake air temperature.

Note on fault code 16505:

What is compared is the air flow (air mass) at the particular engine speed, with the throttle valve angle.

Notes on fault codes 16505, 16506 and 16507:

- ♦ As soon as one of the faults is detected, the control unit uses a substitute value formed from the engine speed and the inducted air mass.
- ♦ If a fault occurs simultaneously at the throttle valve potentiometer and at the air mass meter, no emergency running mode is possible. Consequence: the engine cuts out.

Readout on V.A.G 1552	Rectifying fault
16515 Bank 1 probe 1 voltage too small	- Test lambda probe -G39 and lambda control upstream of catalytic converter ⇒ page 24-28
16516 Bank 1 probe 1 voltage too large	
16517 Bank 1 probe 1 signal too slow	
16518 Bank 1 probe 1 no activity	
16519 Bank 1 probe 1, heating circuit electr. fault	
16520 Bank 1 probe 2 electr. fault in circuit	- Test lambda probe -G130 and lambda control downstream of catalytic converter ⇒ page 24-30
16521 Bank 1 probe 2 voltage too small	
16522 Bank 1 probe 2 voltage too large	
16523 Bank 1 probe 2 signal too slow	
16524 Bank 1 probe 2 no activity	

Readout on V.A.G 1552	Rectifying fault
16620 Charge pressure sender -G31 implausible signal	- Test charge pressure sender -G31 in measured value block, display group 115 - Test cable connections to charge pressure sender -G31 ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
16621 Charge pressure sender -G31 signal too small	
16622 Charge pressure sender -G31 signal too large	
16684 combustion misfiring detected	- Test combustion misfiring in measured value block, display group 014, 015 and 016 - Refuel vehicle and test fuel pressure ⇒ page 24-20 - Test injectors ⇒ page 01-8, Final control diagnosis - Test injected quantity and leaktightness ⇒ page 24-22 - Test ignition cables and spark plugs - Test ignition coils ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
16685 Cyl. 1 combustion misfiring detected	
16686 Cyl. 2 combustion misfiring detected	
16687 Cyl. 3 combustion misfiring detected	
16688 Cyl. 4 combustion misfiring detected	
16705 Engine speed sender -G28 implausible signal	- Test resistance of engine speed sender ⇒ page 24-3 - Test cable connections to sender -G28 ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
16706 Engine speed sender -G28 no signal	

Notes on fault code 16705:

- ♦ Metal swarf on sender body may produce additional signals.
- ♦ Fault „implausible signal“ is stored if the number of crankshaft signals (60) which the reference mark detects, does not match up.

Readout on V.A.G 1552	Rectifying fault
16709 Knock sensor 1 -G61 electr. fault in circuit	- Test knock sensor in measured value block, display groups 020, 022, 023 and 016 - Test resistance of knock sensor 1 -G61 ⇒ page 24-3 - Test cable connections to knock sensor 1 -G61 ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
16710 Knock sensor 1 -G61 implausible signal	
16711 Knock sensor 1 -G61 signal too small	- Test knock sensor in measured value block, display groups 020, 022, 023 and 016 - Test resistance of knock sensor 1 -G61 ⇒ page 24-3 - Test cable connections to knock sensor 1 -G61 ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Slacken knock sensor and tighten again to the specified torque of 20 Nm
16712 Knock sensor 1 -G61 signal too large	- Test knock sensor in measured value block, display groups 020, 022, 023 and 016 - Test resistance of knock sensor ⇒ page 24-3 - Test cable connections to knock sensor ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Slacken knock sensor and tighten again to the specified torque of 20 Nm
16716 Knock sensor 2 -G66 signal too small	
16717 Knock sensor 2 -G66 signal too large	
16725 Camshaft pos. sensor ⇒ sender -G40 implausible signal	- Test camshaft position sensor ⇒ page 28-3
16726 Camshaft pos. sensor ⇒ sender -G40 signal too small	- Test camshaft position sensor ⇒ page 28-3
16727 Camshaft pos. sensor ⇒ sender -G40 signal too large	

Notes:

- ♦ If the clearance between wheel rotor and sender is larger than specified, the signals may not be detected.
- ♦ If the sender rotor is loose, the signals may not be uniform.
- ♦ Spurious signals may result in additional signals being detected.

Readout on V.A.G 1552	Rectifying fault
16795 Secondary air injection system flow faulty	- Test injection valve -N112 ⇒ page 01-8, Final control diagnosis - Test intake air system for leaks (unmetered air) ⇒ page 24-25 - Test relay -J299 ⇒ page 01-8, Final control diagnosis - Test secondary air injection pump - Test combination valve - Inspect hoses and connection pipes to individual components, and between components ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 26
16804 Bank 1, catalyst system insufficient efficiency	- Generate readiness code ⇒ page 01-41 - If same faults are displayed, test emission levels ⇒ Inspection and Maintenance
16806 Bank 1, main catalyst insufficient efficiency	
16825 Tank vent system flow faulty	- Test -N80 ⇒ page 01-8, Final control diagnosis - Inspect connection of fuel system and throttle valve ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20
16885 Vehicle speed signal implausible signal	- Test vehicle speed signal in measured value block, display group 011 and 005 - Test vehicle speed signal ⇒ page 24-40
16890 Idling speed control speed below specification	- Test throttle valve control unit ⇒ page 24-15 - Test injection valve -N112 ⇒ page 01-8, Final control diagnosis - Inspect intake air system for leaks (unmetered air) ⇒ page 24-25
16891 Idling speed control speed above specification	- Test throttle valve control unit ⇒ page 24-15 - Test injection valve -N112 ⇒ page 01-8, Final control diagnosis - Inspect intake air system for leaks (unmetered air) ⇒ page 24-25

Note on fault codes 16795 and 16804:

- ♦ If this fault is displayed during three successive engine operating cycles (engine runs for at least 5 seconds), the engine control unit switches on the exhaust warning light in the dash panel insert.

Readout on V.A.G 1552	Rectifying fault
16944 Voltage supply implausible signal	- Test voltage supply to engine control unit ⇒ page 24-18
16946 Voltage supply voltage too small	
16947 Voltage supply voltage too large	
16955 Brake light switch -F implausible signal	- Test brake light switch and brake pedal switch in measured value block, display group 066
16985	- Replace engine control unit ⇒ page 24-33
16988	
16989	
16990 Control unit defective	
17069 Main relay ⇒ -J271 open circuit	- Test voltage supply relay -J271 for engine control unit ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
17070 Main relay ⇒ -J271 short to earth	
17071 Main relay ⇒ -J271 short to earth	
17072 Main relay ⇒ -J271 short to positive	

Note on fault codes 17069...17072:

- ♦ If this fault is displayed during three successive engine operating cycles (engine runs for at least 5 seconds), the engine control unit switches on the exhaust warning light in the dash panel insert.

Readout on V.A.G 1552	Rectifying fault
17510 Bank 1 probe 1, heating circuit short to positive	- Test lambda probe -G39 and lambda control upstream of catalytic converter ⇒ page 24-28
17511 Bank 1 probe 1, heating circuit insufficient power	
17513 Bank 1 probe 2, heating circuit short to positive	- Test lambda probe -G130 and lambda control downstream of catalytic converter ⇒ page 24-30
17519 Lambda control (bank 1) system too lean	- Test lambda probe -G39 and lambda control upstream of catalytic converter ⇒ page 24-28
17520 Lambda control (bank 1) system too rich	- Test lambda probe -G39 and lambda control upstream of catalytic converter ⇒ page 24-28
17521 Bank 1, probe 1 internal resistance too large	
17522 Bank 1, probe 2 internal resistance too large	- Test lambda probe -G130 and lambda control downstream of catalytic converter ⇒ page 24-30
17523 Bank 1 probe 1, heating circuit short to earth	- Test lambda probe -G39 and lambda control upstream of catalytic converter ⇒ page 24-28
17524 Bank 1 probe 1, heating circuit open circuit	
17525 Bank 1 probe 2, heating circuit short to earth	- Test lambda probe -G130 and lambda control downstream of catalytic converter ⇒ page 24-30

Readout on V.A.G 1552	Rectifying fault
17526 Bank 1 probe 2, heating circuit open circuit	- Test lambda probe -G130 and lambda control downstream of catalytic converter ⇒ page 24-30
17535 Bank 1, mixture adaptation (mult.) system too rich	- Test fuel pressure regulator and holding pressure ⇒ page 24-20 - Test injected quantity and leaktightness ⇒ page 24-22 - Test -N80 ⇒ page 01-8, Final control diagnosis
17536 Bank 1, mixture adaptation (mult.) system too lean	- Test injectors ⇒ page 01-8, Final control diagnosis - Test fuel pressure regulator and holding pressure ⇒ page 24-20 - Test injected quantity and leaktightness ⇒ page 24-22 - Inspect intake system for leaks ⇒ page 24-25 - Inspect exhaust system for leaks - Inspect secondary air injection system for leaks ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 26 - Inspect vacuum lines for leaks
17544 Bank 1, mixture adaptation (add.) system too lean	
17545 Bank 1, mixture adaptation (add.) system too rich	- Test fuel pressure regulator and holding pressure ⇒ page 24-20 - Test injected quantity and leaktightness ⇒ page 24-22 - Test -N80 ⇒ page 01-8, Final control diagnosis
17551 Load detection above limit	- Test sender -G70 in measured value block, display group 002 - Test throttle valve control unit ⇒ page 24-15
17557 Lambda control bank 1 implausible control value	- Test lambda probe -G39 and lambda control upstream of catalytic converter ⇒ page 24-28
17579 Angle sender 2 for TV drive -G188 implausible signal	- Test angle sender in measured value block, display groups 060, 062 and 063 - Test throttle valve control unit ⇒ page 24-15

Readout on display	Rectifying fault
17580 Angle sender 2 for TV drive -G188 signal too small	- Test angle sender in measured value block, display groups 060, 062 and 063 - Test throttle valve control unit ⇒ page 24-15
17581 Angle sender 2 for TV drive -G188 signal too large	
17584 Bank 1, lambda correction after cat control limit reached	- Inspect intake system for leaks ⇒ page 24-25 - Test lambda probe -G130 and lambda control downstream of catalytic converter ⇒ page 24-30
17606 Bank 1 probe 2, heating circuit electr. fault	- Test lambda probe -G130 and lambda control downstream of catalytic converter ⇒ page 24-30
17608 EGR solenoid valve -N249 mechanical fault	- Inspect valve for blockage - Inspect vacuum hoses for leaks and correct connection ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 21
17609 Injector cyl. 1 -N30 electr. fault in circuit	- Test injectors ⇒ page 01-8, Final control diagnosis
17610 Injector cyl. 2 -N31 electr. fault in circuit	
17611 Injector cyl. 3 -N32 electr. fault in circuit	
17612 Injector cyl. 4 -N33 electr. fault in circuit	
17621 Injector cyl. 1 -N30 short to positive	
17622 Injector cyl. 2 -N31 short to positive	

Readout on V.A.G 1552	Rectifying fault
17623 Injector cyl. 3 -N32 short to positive	- Test injectors ⇒ page 01-8, Final control diagnosis
17624 Injector cyl. 4 -N33 short to positive	
17633 Injector cyl. 1 -N30 short to earth	- Test injectors ⇒ page 01-8, Final control diagnosis
17634 Injector cyl. 2 -N31 short to earth	
17635 Injector cyl. 3 -N32 short to earth	
17636 Injector cyl. 4 -N33 short to earth	
17645 Injector cyl. 1 -N30 open circuit	
17646 Injector cyl. 2 -N31 open circuit	
17647 Injector cyl. 3 -N32 open circuit	
17648 Injector cyl. 4 -N33 open circuit	

Read out on display of V.A.G 1552	Rectifying fault
17658 Fuel level too low	- Top up with fuel, erase fault memory ⇒ page 01-5 - Read fault memory of dash panel insert ⇒ Electrical System; Repair Group 01
17695 Turbocharger divert air valve -N249 Line interruption	- Check turbocharger divert air valve -N249 ⇒ page 01-8, Actuator diagnosis
17696 Turbocharger divert air valve -N249 Short-circuit to positive	- Check turbocharger divert air valve -N249 ⇒ page 01-8, Actuator diagnosis
17697 Turbocharger divert air valve -N249 Short-circuit to earth	
17704 Fault in cooling system	- Check correct operation of the coolant regulator ⇒ 1.8 l/110 kW Engine, Mechanics; Repair Group 19 - Check coolant temperature sender ⇒ page 24-8
17705 Compressor - throttle valve connection Pressure drop	- Check hose connection ⇒ 1.8 l/110 kW Engine, Mechanics; Repair Group 21
17733 Knock sensor cyl. 1 Regulating limit reached	- Fill with fuel of minimum 95 RON. - Check knock sensor with measured value blocks 020, 022, 023 if necessary 014 and 015. - Check resistance of knock sensor ⇒ page 24-3 - Check wiring to knock sensor ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations - Tighten knock sensor to 20 Nm
17734 Knock sensor cyl. 2 Regulating limit reached	
17735 Knock sensor cyl. 3 Regulating limit reached	
17736 Knock sensor cyl. 4 Regulating limit reached	
17743 Engine torque monitoring Regulating limit exceeded	- Check hose connection ⇒ 1.8 l/110 kW Engine, Mechanics; Repair Group 21 - Check resistance of sender -G42 ⇒ page 24-8 - Check sender -G70 in measured value block, display group 002 - Check resistance of sender -G62 ⇒ page 24-8

Readout on V.A.G 1552	Rectifying fault
17744 Engine torque monitoring above control limit	- Inspect hose connection ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 21 - Test resistance of sender -G42 ⇒ page 24-8 - Test sender -G70 in measured value block, display group 002 - Test resistance of sender -G62 ⇒ page 24-8
17745 Bank 1, camshaft pos. sensor ⇒ -G163 short to earth	- Test Hall sender ⇒ page 28-3
17746 Bank 1, camshaft pos. sensor ⇒ -G163 open/short to positive	- Test Hall sender ⇒ page 28-3
17748 Camshaft pos./crankshaft pos. sens. incorrect assignment	
17763 Ignition actuation cyl. 1 open circuit	- Test ignition coil with power output stage ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
17764 Ignition actuation cyl. 1 short to positive	
17765 Ignition actuation cyl. 1 short to earth	
17766 Ignition actuation cyl. 2 open circuit	
17767 Ignition actuation cyl. 2 short to positive	
17768 Ignition actuation cyl. 2 short to earth	

Readout on V.A.G 1552	Rectifying fault
17769 Ignition actuation cyl. 3 open circuit	- Test ignition coil with power output stage ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
17770 Ignition actuation cyl. 3 short to positive	
17771 Ignition actuation cyl. 3 short to earth	
17772 Ignition actuation cyl. 4 open circuit	
17773 Ignition actuation cyl. 4 short to positive	
17774 Ignition actuation cyl. 4 short to earth	
17794	- Replace engine control unit ⇒ page 24-33
17795	
17796 Control unit defective	
17817 Tank vent valve -N80 electr. fault in circuit	- Test valve -N80 ⇒ page 01-8, Final control diagnosis
17818 Tank vent valve -N80 short to positive	
17828 Secondary air injection valve -N112 electr. fault in circuit	- Test valve -N112 ⇒ page 01-8, Final control diagnosis

Readout on V.A.G 1552	Rectifying fault
17829 Secondary air injection valve -N112 short to earth	- Test valve -N112 ⇒ page 01-8, Final control diagnosis
17830 Secondary air injection valve -N112 short to positive	- Test valve -N112 ⇒ page 01-8, Final control diagnosis
17832 Bank 1, secondary air system leak detected	- Inspect hose lines and components of secondary air injection system ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 26
17833 Tank vent valve -N80 short to earth	- Test valve -N80 ⇒ page 01-8, Final control diagnosis
17834 Tank vent valve -N80 open circuit	
17835 Actuate brake vacuum pump short to positive	- Test vacuum pump for brakes ⇒ Running Gear; Repair Group 47
17836 Actuate brake vacuum pump short to earth	
17837 Actuate brake vacuum pump open circuit	
17840 Secondary air injection valve -N112 open circuit	- Test valve -N112 ⇒ page 01-8, Final control diagnosis
17841 Secondary air pump relay -J299 open circuit	- Test relay -J299 ⇒ page 01-8, Final control diagnosis

Fault table of fault code 17842...18261

Read out on display of V.A.G 1552	Rectifying fault
17842 Secondary air pump relay -J299 Short-circuit to positive	- Check relay -299 ⇒ page 01-8, Actuator diagnosis
17843 Secondary air pump relay -J299 Short-circuit to earth	
17844 Secondary air pump relay -J299 Electrical fault in the circuit	
17908 Fuel pump relay -J17 Electrical fault in the circuit	- Check fuel pump relay -J17 ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17909 Fuel pump relay -J17 Short-circuit to earth	
17910 Fuel pump relay -J17 Short-circuit to positive	
17913 Idling switch -F60¹⁾ Does not close/line interruption	- Check idling switch in measured value block, display group 098, display field 3 - Check wiring to throttle valve control unit ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations - Adjust throttle control cable ⇒ 1.8 l/110 kW Engine, Mechanics; Repair Group 20
17914 Idling switch -F60¹⁾ Does not open/ short-circuit to earth	
17925 Power supply relay ⇒ -J217 Electrical fault in the circuit	- Check power supply relay -J217 according to Current Flow Diagram ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations

¹⁾ Component part of the throttle valve control unit -J338

Readout on display	Rectifying fault
17927 Bank 1, camshaft adjustment malfunction	- Test camshaft adjustment solenoid valve ⇒ page 01-8, Final control diagnosis
17931 Crash signal from airbag ECU implausible signal	- Test airbag ⇒ Body Fitting Work; Repair Group 01
17937 Camshaft adjustment short to positive	- Test camshaft adjustment solenoid valve ⇒ page 01-8, Final control diagnosis
17938 Camshaft adjustment short to earth	
17939 Camshaft adjustment open circuit	
17947 Clutch pedal switch -F36 implausible signal	- Test clutch pedal switch -F36 in measured value block, display group 066
17950 Angle sender for TV drive -G187 implausible signal	- Test throttle valve control unit -J338 in measured value block, display group 023 and 060, respectively - Test throttle valve control unit -J338 ⇒ page 24-15
17951 Angle sender for TV drive -G187 signal too small	
17952 Angle sender for TV drive -G187 signal too large	
17953 Throttle valve control malfunction	

Note on fault code 17953:

It is possible that several faults affecting the throttle valve control unit may occur, e.g. fault 00670. Fault 17953 may in fact be a consequential fault. In this case, begin fault finding at the relevant fault.

Readout on V.A.G 1552	Rectifying fault
17954 Charge pressure control solenoid valve -N75 short to positive	- Test valve -N75 ⇒ page 01-8, Final control diagnosis - Test charge pressure control system ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 21
17955 Charge pressure control solenoid valve -N75 short to earth	
17956 Charge pressure control solenoid valve -N75 open circuit	
17958 Charge pressure control difference	
17963 Maximum charge pressure exceeded	
17964 Charge pressure control below control limit	
17965 Charge pressure control above control limit	
17966 Throttle valve drive -G186 electr. fault in circuit	- Test throttle valve control unit ⇒ page 24-15
17967 Throttle valve control unit -J338 fault in basic setting	- Adapt engine control unit to throttle valve control unit ⇒ page 24-36
17968 Maximum engine speed exceeded	- Inspect engine for mechanical damage and erase fault memory ⇒ page 01-5 - Test resistance of engine speed sender ⇒ page 24-3

Readout on V.A.G 1552	Rectifying fault
17972 Throttle valve control unit -J338 undervoltage in basic setting	- Test battery voltage, charge if necessary - Adapt control unit to throttle valve control unit ⇒ page 24-36
17973 Throttle valve control unit -J338 lower stop is not reached	- Inspect throttle valve for damage and dirt
17976 Throttle valve control unit -J338 mechanical fault	- Test throttle valve control unit ⇒ page 24-15 - Inspect throttle valve for damage and dirt
17977 CCS switch -E45 implausible signal	- Test cruise control system (CCS), in measured value block, display group 066
17978 Engine control unit inhibited	- Adapt engine control unit to electronic immobiliser - Test electronic immobiliser ⇒ Electrical System; Repair Group 96
17987 Throttle valve control unit -J338 adaptation not started	- Adapt engine control unit to throttle valve control unit ⇒ page 24-36 - Test throttle valve control unit ⇒ page 24-15
18010 Voltage supply tml. 30 voltage too small	- Test supply voltage to engine control unit ⇒ page 24-18 - Carry out procedure in the case of interruption to supply voltage ⇒ page 24-19
18011 18012 Control unit defective	- Replace engine control unit ⇒ page 24-33
18017 Crash shutoff was activated	
	- Interrogate fault memory for airbag control unit and erase ⇒ Body Fitting Work; Repair Group 01

Note on fault code 17978:

If an attempt is made to start the engine with a non-adapted key, a static fault is stored. If the engine is subsequently started with an adapted key, the fault is converted into a sporadic fault.

Readout on V.A.G 1552	Rectifying fault
18018 Control unit defective	- Replace engine control unit ⇒ page 24-33
18020 Engine control unit incorrectly coded	- Code control unit for engine electronics ⇒ page 24-34
18032 Fault lamp on request active	- Interrogate fault memory of control unit for automatic gearbox 01M ⇒ Automatic Gearbox; Repair Group 01
18034 Drive databus no message from gearbox ECU	- Test databus between control units ⇒ page 24-41 - Test automatic gearbox control unit ⇒ Automatic Gearbox binder
18038 Accelerator pedal position sender -G79 signal too small	- Test accelerator pedal position in measured value block, display group 062 - Test accelerator pedal position sender ⇒ page 24-16
18039 Accelerator pedal position sender -G79 signal too large	
18041 Sender 2 for accelerator pedal position -G185 signal too small	
18042 Sender 2 for accelerator pedal position -G185 signal too large	
18044 Drive databus no message from airbag ECU	- Test databus ⇒ page 24-41 - Test airbag control unit ⇒ Body Fitting Work; Repair Group 01
18047 Sender 1/2 for accelerator pedal position -G79+G185 implausible signal	- Test accelerator pedal position sender in measured value block, display group 062 - Test accelerator pedal position sender ⇒ page 24-16

Readout on V.A.G 1552	Rectifying fault
18048 Control unit defective	- Replace engine control unit ⇒ page 24-33
18056 Drive databus defective	- Test databus ⇒ page 24-41 - Read out fault memories of all control units (Automatic test sequence) ⇒ page 01-5 - Test ABS control unit ⇒ Running Gear; Antilock Brake System; Repair Group 45
18057 Drive databus no message from ABS ECU	
18058 Drive databus no message from combiinstrument	- Test databus ⇒ page 24-41
18084 EPC fault light -K132 electr. fault in circuit	- Test EPC fault light ⇒ page 24-14
18085 EPC fault light -K132 short to positive	
18090 Drive databus no message from ABS control unit	- Test databus ⇒ page 24-41 - Test ABS control unit ⇒ Running Gear; Antilock Brake System; Repair Group 45
18091 Drive databus implausible message from airbag control unit	- Test databus ⇒ page 24-41
18259 Drive databus no message from ABS ECU	- Test databus ⇒ page 24-41 - Test ABS control unit ⇒ Running Gear; Antilock Brake System; Repair Group 45
18261 Drive databus implausible message from ABS ECU	
18262 Drive databus defective	- Test databus ⇒ page 24-41

Readiness code

Only engines with engine identification characters AUM, ARX

Function

The readiness code is a two 8-digit numerical code which indicates the status of the emission-relevant diagnoses.

If the diagnosis for a system was successfully performed (e.g. exhaust gas recirculation system), the relevant position of the numerical code is set from 1 to 0.

Readiness code 00000000 means that the individual diagnoses have been successfully performed.

This diagnosis is performed at regular intervals during normal driving. After repairs have been carried out to an emission-relevant system, it is recommended to generate the readiness code in order to thus ensure that the systems operate properly. If a fault is detected during diagnosis, it is then stored in the fault memory.

The readiness code is erased each time the fault memory is erased, or if there is an interruption to the voltage supply.

Reading readiness code

Special tools, aids and testers required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Procedure

- Connect vehicle system tester V.A.G 1552 and enter address word 01 „Engine electronics“, ignition switched on ⇒ page 01-3.
- Enter function 15 „Readiness code“ and confirm entry with key Q.

Reading measured value block
00000000 - Test complete

◀ After successfully completing all the diagnoses, the following readout must appear in the display:

Nominal value: 00000000 meaning ⇒ page 01-41.

If the nominal value is reached:

- Interrogating fault memory ⇒ page 01-5.

Readiness code
00101101 - Test not completed 00100000

◀ If the nominal value is not reached:

- Generating readiness code ⇒ page 01-41.

Meaning of 8-digit numerical block for readiness code

The Readiness code is only generated when all display positions are 0								Meaning	
1	2	3	4	5	6	7	8		
							0	Catalytic converter	
						0		Always „0“	
					0			Activated charcoal filter system (Tank ventilation system)	
				0				Secondary air injection system	
			0					Always „0“	
		0						Lambda probes	
	0							Lambda probe heater	
0								Always „0“	

Generating readiness code

Special tools, aids and testers required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- Vehicle stopped
- On vehicles with an automatic gearbox the selector lever must be in position „P“ or „N“
- All electrical consumers such as e.g. light and rear window heater must be switched off
- Air conditioning switched off
- Coolant temperature at least 80 °C display group 004, display field 3 ⇒ page 01-88

Procedure

- Connect vehicle system tester V.A.G 1552 and enter address word 01 „Engine electronics“, ignition switched on ⇒ page 01-3.

Note:

It is essential to carry out the individual steps in the correct order, otherwise the readiness code cannot be successfully generated.

Work step 1: Interrogating fault memory

- Enter function 02 „Interrogating fault memory“ and confirm entry with key Q.

X No fault detected

◀ The number of stored faults or „No fault detected“ appears in the display.

If a fault is stored:

- Rectify fault by referring to the fault table ⇒ page 01-15.

If no fault is stored:

- Press key →.

Work step 2: Erasing fault memory

- Enter function 05 „Erasing fault memory“ and confirm entry with key Q.

Note:

Readiness code is erased each time the fault memory is erased.

Vehicle system test
Fault memory is erased

→

◀ Read-out on display

Note:

If the ignition is switched off during „Interrogating fault memory“ and „Erasing Fault memory“, the fault memory is not erased.

- Press key →.

Work step 3: Adapting engine control unit to the throttle valve control unit

- Select function 04 „Initiate basic setting“ and display group number 060.

System in basic setting 60
14 % 85 % 8 ADP runs

→

◀ Check values in the display fields 3 and 4:
nominal value in display field 3: 0...8
nominal value in display field 4: ADP runs, ADP O.K

System in basic setting 63 →			
14 %	85 %	Kickdown	ADP o.k.

If the specifications are achieved:

- Press key C.

Step 4: Adapting kickdown function¹⁾

¹⁾ Vehicles fitted with automatic gearbox

- Enter display group number 063 and confirm entry with the key Q.

◀ Depress accelerator pedal fully and hold.

- Check readout in display field 4:
Specification: ADP o.k.

Note:

During adaptation „Kickdown ADP runs“ is displayed. After successful completion of adaptation, „ADP o.k.“ is displayed.

If the specification is achieved:

- Press key C.

Step 5: Testing operating states of lambda control

- Start engine and select address word 01 „Engine electronics“ ⇒ page 01-3.
- Select function 04 „Initiate basic setting“ and confirm entry with the key Q.

Models ► 04.01

- Increase engine speed to 1800...2000 rpm.

Models 05.01 ►

- Depress brake pedal and accelerator pedal at the same time. After the pedals are depressed, the engine speed is increased by the engine control unit to 1800...2200 rpm.

Continued for all models

- Enter display group number 030 and confirm entry with the key Q.

System in basic setting 30 →			
111	110		

- ◀ - Check operating state of lambda control in display fields 1 and 2:

Specification in display field 1: 111

Specification in display field 2: 110

Notes:

This procedure may take a few minutes.

- ◆ The first digit in the 3-digit numerical block changes temporarily between 0 and 1 (lambda probe heater OFF and ON).
- ◆ Lambda control of lambda probe downstream of catalytic converter is not active if no engine load and the third digit in display field 2 indicates 0.

If the specifications are not achieved:

- Interrogate fault memory ⇒ page 01-5.

If the specifications are achieved at least once:

- Press key C.

Step 6: Diagnosis of ageing of lambda probe upstream of catalytic converter

- Enter display group number 034 and confirm entry with the key Q.

System in basic setting 34	→
2000 rpm 350.0 °C 1.91 B1-S1 o.k.	

- ◀ - Continue running at increased speed, the readout in display field 4 changes first of all from „Test OFF“ to „Test ON“. The temperature of the catalytic converter in display field 2 must be at least 350 °C. The period shown in display field 3 must be greater than 0.5.

Note:

This procedure may also take several minutes.

- Run engine at increased speed until the specification „B1-S1 o.k.“ appears in display field 4.

If the specification is not achieved:

- Interrogate fault memory ⇒ page 01-5.

If the specification is achieved:

- Press key C.

Step 7: Testing preparation of lambda probe downstream of catalytic converter

- Enter display group number 036 and confirm entry with the key Q.

System in basic setting 36	→
0.640 V B1-S2 o.k.	

- ◀ - Continue running at increased speed until the readout in display field 2 changes first of all from „Test OFF“ to „Test ON“.
- Run engine at increased speed until the specification „B1-S2 o.k.“ appears in display field 2.

If the specification is not achieved:

- Interrogate fault memory ⇒ page 01-5.

If the specification is achieved:

- Press key C.

Step 8: Diagnosis of lambda control system

- Enter display group number 037 and confirm entry with the key Q.

System in basic setting 37			→
19.5 %	0.435 V	0.000	Syst. o.k.

◀ Continue running at increased speed, the readout in display field 4 changes first of all from „Test OFF“ to „Test ON“.

- Run engine at increased speed until the specification „Syst. o.k.“ appears in display field 4.

If the specification is not achieved:

- Interrogate fault memory ⇒ page 01-5.

If the specification is achieved:

- Press key C.

Step 9: Diagnosis of ageing of lambda probe downstream of catalytic converter

- Enter display group number 043 and confirm entry with the key Q.

System in basic setting 43			→
2000 rpm	450.0 °C	0.435 V	B1-S2 o.k.

◀ Continue running at increased speed until the readout in display field 4 changes first of all from „Test OFF“ to „Test ON“. The temperature of the catalytic converter in display field 2 must be at least 350 °C.

- Run engine at increased speed until the specification „B1-S2 o.k.“ appears in display field 4.

If the specification is not achieved:

- Interrogate fault memory ⇒ page 01-5.

If the specification is achieved:

- Press key C.

Step 10: Diagnosis of catalytic converter

- Enter display group number 046 and confirm entry with the key Q.

- Continue running engine at idling speed.

Notes concerning 4x4 models:

Engine speed for this test step:

► 04.01 2200...2600 rpm.

05.01 ► Depress brake pedal and accelerator pedal at the same time.

System in basic setting 46				→
2000 rpm	550.0 °C	0.07	CatB1 o.k.	

◀ Readout in display field 4 changes first of all from „Test OFF“ to „Test ON“. The temperature of the catalytic converter in display field 2 must be at least 440 °C.

Note:

This process may take several minutes.

- Continue running engine at idling speed until the specification „CatB1 o.k.“ appears in display field 4.

If the specification is not achieved:

- Interrogate fault memory ⇒ page 01-5.

If the specification is achieved:

- Press key C.

Step 11: Diagnosis of activated charcoal filter system (tank vent system)

- Enter display group number 070 and confirm entry with the key Q.

System in basic setting 70				→
0.0 %	-	0.0 %	TVV o.k.	

◀ Continue running at increased speed until the readout in display field 4 changes first of all from „Test OFF“ to „Test ON“.

- Run engine at idling speed until „TVV o.k.“ appears in display field 4.

Note:

If the test is not started or if the readout jumps from „Test ON“ to „Test OFF“, briefly blip throttle in order to repeat the test.

If the specification is not achieved:

- Interrogate fault memory ⇒ page 01-5.

If the specification is achieved:

- Press key C.

Work step 12: Diagnosis of secondary air injection system**Note:**

During diagnosis of the secondary air injection system the secondary air pump will run for a few seconds.

- Enter display group number 077 and confirm entry with key Q.
- Suddenly press and release (briefly accelerate to 2500 rpm)
- ◀ - Check value in display field 4, the message will then switch from „Test OFF“ to „Test ON“.
- Leave engine idling until „System O.K“ appears in display field 4:

System in basic setting 77			→
800 rpm	3.1 g/s	45.0 %	System OK

Note:

This diagnosis will last approximately 60 seconds.

If the nominal value is not reached:

- Interrogating fault memory ⇒ page 01-5.

Work step 13: Reading readiness code

- Reading readiness code ⇒ page 01-40.

Reading measured value block - Initiating basic setting of system

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- Coolant temperature at least 80 °C
- Electrical components switched off (radiator fan must not cut in during the test)
- Air conditioning system switched off
- No fault stored in the fault memory

Procedure

- Connect vehicle system tester V.A.G 1552. Start engine (or switch ignition on) and select address word 01 „Engine electronics“ ⇒ page 01-3.

According to the desired function, select:

- Enter 08 for the function „Read measured value block“ and confirm entry with the key Q.
- or
- Select 04 for the function „Initiate basic setting“ and confirm entry with the key Q.

Read measured value block
Enter display group number XXX

HELP

- ◀ - Readout in display:
- or

System in basic setting
Enter display group number XXX

→

- ◀ - Readout in display:

Note:

Display group number 001 is an example in order to present the sequence.

- Enter 001 for display group number „1“ and confirm entry with the key Q.

Read measured value block 1
1 2 3 4

→

- ◀ Readout in display,
e.g.: (1...4 = display fields)
- or

System in basic setting 1
1 2 3 4

→

- ◀ Readout in display:
- End output.

The measured values in the functions of reading measured value block and basic setting are described in the individual component tests.

Note:

Proceed as shown in the table below in order to switch to another display group:

Display group	V.A.G 1552	V.A.G 1551
higher	Press ↑ key	Press key 3
lower	Press ↓ key	Press key 1
skip	Press key C	Press key C

Survey of display groups for engine code AGU

Display groups 000...007

Display group 000, engine idling (engine warm, coolant temperature not less than +80 °C)

Display field	Specified readout	Equals measured value	Designation
1	170...204	80...105 °C	Coolant temperature (prerequisite for basic setting)
2	10...30	0.5...1.5 ms	Engine load (without components)
3	80...92	800...920 rpm	Engine speed (without components)
4	142...206	10...14.5 V	Battery voltage
5	0...12	0...5 °	Throttle valve angle
6	122...134	-3...+3 kg/h	Control value of idling air mass (idling speed controller)
7	120...136	-4...+4 kg/h	Learned value of idling air mass
8	78...178	-10...+10 %	Control value of mixture formation (lambda control value) (if not within tolerance, conduct test drive)
9	115...141	-0.64...+0.64 ms	Learned value of mixture formation (lambda learned value) additive (if not within tolerance, conduct test drive)
10	118...138	-8...+8 %	Learned value of mixture formation (lambda learned value) multiplicative (if not within tolerance, conduct test drive)

Notes on display fields 9 and 10:

- ◆ In the case of the additive learned value the injection time is altered by a fixed amount which is not dependent on the basic injection time.
- ◆ In the case of the multiplicative learned value this is a percentage change of the injection time which is dependent on the basic injection time.

Test table - display group 000

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1	greater 204	◆ Coolant temperature sender -G62 faulty ◆ Fault in cable connection to engine control unit	- Test coolant temperature sender -G62
	less than 170	◆ Coolant temperature sender -G62 faulty ◆ Fault in cable connection to engine control unit ◆ Coolant thermostat constantly open	- Test coolant temperature sender -G62 - Test coolant thermostat

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
2	greater than 30	◆ Air conditioning switched on ◆ Electrical components on ◆ Lambda control at rich or lean stop ◆ AC compressor also running although air conditioning switched off	- Switch air conditioning off - Switch electrical components off - Test lambda control ⇒ page 24-26 - Test AC compressor shutoff ⇒ page 01-74
	less than 10	◆ Unmetered air downstream of air mass meter ◆ Unmetered air downstream of throttle valve ◆ Vacuum hose disconnected ◆ Fuel pressure regulator	- Eliminate unmetered air
3	less than 80	◆ Gear engaged (automatic gearbox) ◆ Engine load because of ancillaries ◆ Throttle valve control unit -J338 jamming or faulty	- Move selector lever into P or N - Eliminate engine load (AC, power steering etc.) - Test throttle valve control unit -J338 ⇒ page 24-15
	greater than 92	◆ Idling speed switch -F60 not closed or faulty ◆ Large quantity of unmetered air (cannot be compensated by idling speed stabilisation) ◆ Throttle valve control unit -J338 jamming or faulty	- Interrogate fault memory, test idling speed switch -F60, adjust throttle cable if necessary - Eliminate unmetered air - Test throttle valve control unit -J338 ⇒ page 24-15
4	less than 142	◆ Alternator faulty, battery severely discharged ◆ Severe load on electrical system shortly after start because of high charge current and ancillaries ◆ Contact resistance in positive supply or earth connection for engine control unit ◆ Current drain with ignition off	- Test voltage, charge battery - Increase engine speed slightly for a few minutes and switch off ancillaries - Test supply voltage to engine control unit ⇒ page 24-18 - Eliminate current drain
	greater than 206	◆ Voltage regulator at alternator faulty ◆ Overvoltage because of jump-starting or quick-charger	- Test voltage, replace regulator if necessary - Interrogate fault memory ⇒ page 01-5

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
5	less than 0	♦ Not possible	
	greater than 12	♦ Basic setting of throttle valve control unit not performed ♦ Accelerator cable not correctly adjusted ♦ Throttle valve potentiometer in throttle valve control unit faulty ♦ Throttle valve mechanism jamming	- Perform basic setting of throttle valve control unit ⇒ page 24-36 - Interrogate fault memory ⇒ page 01-5 - Adjust throttle cable ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20 - Eliminate cause, replace if necessary
6	less than 122	♦ Unmetered air downstream of throttle valve	- Eliminate unmetered air
	greater than 134	♦ Increased engine load because of ancillaries	- Eliminate load, switch off ancillaries
7	less than 120	♦ Unmetered air downstream of throttle valve	- Eliminate unmetered air
	greater than 136	♦ Increased engine load because of ancillaries	- Eliminate load, switch off ancillaries
8	less than 78	♦ Mixture too rich, lambda control produces leaner mixture ♦ Large amount of fuel from activated charcoal filter (not in the case of basic setting) ♦ Leak in vacuum hose of fuel pressure regulator ♦ Lambda learned values at stop	- Depress accelerator every 20 seconds until learning process is performed - Replace vacuum hose - Check lambda learned values, display group 008

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
8	greater than 178	◆ Mixture too lean, lambda control produces richer mixture ◆ Unmetered air ◆ Injectors faulty ◆ Lambda learned values at stop	- Test fuel injected quantity ⇒ page 24-22 - Eliminate unmetered air - Test injectors - Check lambda learned values, display group 008
	Readout jumps or shows constant 128	◆ Fuel level too low ◆ Lambda closed-loop control is switched to open-loop	- Top up fuel to at least 10 litres
9	less than 115 or greater than 141		- Display group 008, display field 2 and 3
10	less than 118 or greater than 138		- Display group 008, display field 2 and 3

Display group 001 - Basic function:

Read measured value block 1 →				◀ Readout in display		
xxxx rpm	x.x ms	x ∠°	xx °BTDC			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle	9...15° BTDC	⇒ page 01-54
				Throttle valve angle. Readout when accelerator fully depressed is 75...95 ∠°	0...5 ∠°	⇒ page 01-54
				Engine load (injection time per crankshaft revolution)	0.5...1.5 ms	⇒ page 01-54
				Engine speed (idling speed)	800...920 rpm	⇒ page 01-53

Notes on display field 2:

- ♦ At very high ambient temperatures maximum engine load decreases by as much as 10 %.
- ♦ When driving at full throttle the following minimum values must be achieved:
at 4000 rpm approx. 6.5 ms
at 6000 rpm approx. 6.0 ms
- ♦ Maximum engine load decreases approximately 10 % for each 1000 m above mean sea level.

Test table - Display group 001

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1	less than 800 rpm	♦ Gear engaged (automatic gearbox) ♦ Engine load because of ancillaries ♦ Throttle valve control unit -J338 jamming or faulty ♦ Large quantity of unmetered air (cannot be compensated by idling speed stabilisation)	- Move selector lever into P or N - Eliminate load (AC, power steering etc.) - Test throttle valve control unit -J338 ⇒ page 24-15 - Inspect intake system for leaks ⇒ page 24-25
	greater than 920 rpm	♦ Idling speed switch -F60 not closed or faulty ♦ Large quantity of unmetered air (cannot be compensated by idling speed stabilisation) ♦ Throttle valve control unit -J338 jamming or faulty ♦ Air conditioning not switched off	- Interrogate fault memory ⇒ page 01-5 - Eliminate unmetered air - Test throttle valve control unit -J338 ⇒ page 24-15 - Switch air conditioning off

Test table - Display group 001

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
2	less than 0.5	◆ Smaller readouts can only occur when driving in overrun	
	greater than 1.5	◆ Poor idling (engine not running on all cylinders) ◆ Air mass meter -G70 faulty ◆ Throttle valve control unit -J338 faulty ◆ Electrical components on ◆ Steering wheel at full lock ◆ Gear engaged (automatic gearbox)	- Injectors or spark plugs faulty - Interrogate fault memory ⇒ page 01-5 - Test throttle valve control unit -J338 ⇒ page 24-15 - Switch components off - Move steering wheel into middle position - Move selector lever into P or N
3	less than 0 ∠°	◆ Not possible	
	greater than 5 ∠°	◆ Adaptation of throttle valve control unit -J338 not performed ◆ Throttle valve potentiometer in throttle valve control unit -J338 faulty ◆ Adjustment of throttle cable ◆ Throttle valve jamming	- Adapt throttle valve control unit -J338 ⇒ page 24-36 - Interrogate fault memory ⇒ page 01-5 - Test throttle valve control unit -J338 ⇒ page 24-15 - Adjust throttle cable ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20 - Release throttle valve
4	less than 9° BTDC	◆ Electrical components on ◆ Steering wheel at full lock ◆ Gear engaged (automatic gearbox)	- Switch components off - Turn steering wheel into middle position - Move selector lever into P or N
	less than 15° BTDC	◆ Unmetered air	- Eliminate unmetered air

Note on display field 3:

- ◆ When accelerator is fully depressed, the readout is between 75...95 ∠°.

Display group 002, basic function:

Read measured value block 2 →				◀ Readout in display		
xxxx rpm	x.x ms	x.x ms	x.x g/s			
1	2	3	4	◀ Display fields	Specification	Analysis
				Inducted air mass	1.8...4.0 g/s	⇒ page 01-55
				Injection time per power stroke	1.0...3.0 ms	⇒ page 01-55
				Engine load (injection time per crankshaft revolution)	0.5...1.5 ms	⇒ page 01-55
				Engine speed (idling speed)	—	⇒ page 01-53

Test table - Display group 002

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1		♦ ⇒ page 01-47, display group 001, display field 1	
2		♦ ⇒ page 01-47, display group 001, display field 2	
3	less than 1.0	♦ High quantity of fuel from activated charcoal filter system ♦ Incorrect injectors with larger flow installed	- Test activated charcoal filter solenoid valve - Test quantity of fuel injected ⇒ page 24-22
	greater than 3.0	♦ Increased engine load because of electrical components, AC, gear engaged or power steering at full lock	- Eliminate load
4	less than 1.8	♦ Large quantity of unmetered air between intake manifold and air mass meter	- Eliminate unmetered air
	greater than 4.0	♦ Gear engaged (automatic gearbox) ♦ Engine load because of ancillaries	- Move selector lever into P or N - Eliminate load (AC, power steering etc.)

Notes on display group 002:

- ◆ *What is shown in display field 2 is the injection time which corresponds to the inducted air mass and to the engine load in the idling speed range. This readout is in fact a mathematical, theoretical value which relates only to one revolution of the crankshaft. What is meant by engine load in idling speed range is the inherent friction of the engine to be overcome and the drive of the ancillaries. The inducted air mass is shown in display field 4.*
- ◆ *What is stated in display field 3 is the injection time which results from a complete power stroke, in other words two revolutions of the crankshaft.*
- ◆ *Despite this, what is shown in display field 3 is not approximately twice the value, but is a corrected, actual injection time. It is corrected by influencing parameters such as:*
 - *Lambda control*
 - *Fuel feed of activated charcoal filter*
 - *Air density, air temperature*
 - *Electrical system voltage (faster or slower opening of the injectors).*
- ◆ *If, for example, the engine inducts unmetered air, only the mathematical value in display field 2 (injection time per crankshaft revolution) should change. The actual injection time per power stroke is maintained at the specified value by the lambda control.*

Notes on display field 4:

- ◆ *What is displayed is the air mass measured by the air mass meter.*
- ◆ *In the emergency mode as a result of a fault at the throttle valve control unit, the engine runs without idling speed stabilisation at a fast idling speed (approx. 1100...1300 rpm) determined by the emergency running gap. The inducted air mass in this case is approx. 4.5...5.5 g/s.*
- ◆ *If the engine control unit detects a fault at the air mass meter, the substitute value of the throttle valve potentiometer in g/s is displayed.*

Display group 003, basic function: 1

Read measured value block 3 →				◀ Readout in display		
xxxx rpm	xx.x V	xxx °C	xxx °C			
1	2	3	4	◀ Display fields	Specification	Analysis
				Intake air temperature	xxx °C	⇒ page 01-57
				Coolant temperature	80...105 °C	⇒ page 01-57
				Battery voltage	10...14.5 V	⇒ page 01-57
				Engine speed (idling speed)	—	⇒ page 01-53

Notes on display field 3:

- ♦ As soon as the fault „Coolant temperature sender“ is stored in the fault memory, the engine control unit uses the intake air temperature as a substitute value for starting the engine. In this case, the temperature rises in accordance with the model curve stored in the control unit. A fixed substitute value is displayed after a certain time for the engine at normal operating temperature. This fixed substitute value in turn is dependent on the intake air temperature.
- ♦ In combination with fault code „16500“ the temperature curve in display field 3 is compared in the range from 20 °C up to 60 °C with a model curve stored in the control unit. The model curve rises more slowly than the real curve. If the real values become too slow because of a fault, they at some point are aligned with the model curves. The engine control unit detects this fault as implausible.

Notes on display field 4:

- ♦ The readout in the display must agree with the ambient temperature.
- ♦ If there is a fault at the intake air temperature sender -G42, or an open circuit in the wiring, the control unit operates with a substitute temperature of 19.5 °C.
- ♦ Only gold-plated contacts may be used for repairing contacts in the plug connection of the sender.

Test table - Display group 003

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1		♦ ⇒ page 01-47 display group 001, display field 1	
2	less than 10 V	♦ Alternator faulty, battery severely discharged ♦ Severe load on electrical system shortly after start because of high charge current and ancillaries ♦ Contact resistance in power supply or earth connection for engine control unit ♦ Current drain although ignition off	- Test voltage, charge battery - Increase engine speed slightly for a few minutes and switch off ancillaries - Test voltage supply to engine control unit ⇒ page 24-18 - Eliminate current drain
2	greater than 14.5 V	♦ Voltage regulator at alternator faulty ♦ Excess voltage caused by jump-starting or quick-charger	- Test voltage, replace regulator if necessary - Interrogate fault memory ⇒ page 01-5

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
3	less than 80 °C	♦ Engine too cold ♦ Coolant temperature sender or cable connection to engine control unit	- Conduct test drive if necessary - Test coolant temperature sender -G62-
	greater than 105 °C	♦ Radiator dirty ♦ Radiator fan not operating ♦ Coolant thermostat faulty ♦ Coolant temperature sender or cable connection to engine control unit faulty	- Clean radiator - Test operation - Test coolant thermostat - Test coolant temperature sender -G62-
4	constant 19.5 °C	♦ Fault detected at intake air temperature sender -G42	- Interrogate fault memory ⇒ page 01-5
		♦ Intake air temperature sender -G42 faulty	- Test sender -G42

Display group 004, idling speed setting:

Read measured value block 4 →				◀ Readout in display		
x ∠°	x.x g/s	x.x g/s	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Operating state (idling, part load, enrichment, overrun - release throttle)	Idling	—
				Learned value of idling air mass (automatic gearbox with gear engaged, manual gearbox in Neutral)	-1.1...+1.1 g/s	—
				Learned value of idling air mass (automatic gearbox without gear engaged)	-1.1...+1.1 g/s	⇒ page 01-59
				Throttle valve angle	0...5 ∠°	⇒ page 01-59

Test table - Display group 004

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1		♦ ⇒ page 01-47 display group 001, display field 3	
2	less than -1.1 g/s	♦ Unmetered air downstream of throttle valve	- Eliminate unmetered air
	higher than +1.1 g/s	♦ High load because of ancillaries ♦ Constriction or foreign body in intake area	- Switch off air conditioning and electrical components - Eliminate constriction or foreign body

Note on display field 1:

When accelerator is fully depressed, the readout is between 75...95 °.

Notes on display fields 2 and 3:

- ♦ What is displayed is the extent to which the idling speed stabilisation has „forgotten“ the fixed mean value. On a new engine the value is in the positive range because of the higher friction, in an engine which has been run in it is in the negative range. Values below the lower tolerance limit in combination with a readout in display group 005, display field 3 which is too low, indicate unmetered air.
- ♦ The readout is not measured by the air mass meter, but is calculated from the information supplied by the throttle valve potentiometer.
- ♦ On vehicles fitted with manual gearbox, 0 is always shown in display field 3.

Notes on display field 4:

What is displayed are the following operating states:

- ♦ Idling speed
- ♦ Part load
- ♦ Enrichment
- ♦ Overrun (throttle released)

Display group 005, idling speed stabilisation: (idling speed)

Read measured value block 5 →				◀ Readout in display		
xxxx rpm	xxxx rpm	xx %	x.x g/s			
1	2	3	4	◀ Display fields	Specification	Analysis
				Inducted air mass	1.8...4.0 g/s	—
				Idling speed controller	-10...+10 %	—
				Idling speed (specification) Manual gearbox: (AC off and on) Automatic gearbox: (AC off and on)	860 rpm	—
				Engine speed (idling speed)	—	⇒ page 01-53

Note on display group 005, display field 1:

- ♦ Engine speed is displayed in 10 steps.

Note on display group 005, display field 2:

- ♦ What is displayed is the specified engine speed fixed by the engine control unit (internal mathematical value of control unit). In exceptional cases, idling speed can be adapted ⇒ page 24-12. The idling speeds when a gear is engaged are then also adapted automatically.

Notes on display group 005, display field 3:

- ♦ If there is a change to the engine load conditions in the idling speed range, the idling air mass required also changes at a constant engine speed.
- ♦ What is displayed is the change to the idling air mass in %. As soon as this change is compensated by the learning process of the idling speed stabilisation, the mean value is re-established. The extent of the variation from the mean value depends on the magnitude of the load change (e.g. by switching electrical components on or off).
- ♦ The learning process is performed in small steps each time the idling speed switch is closed. If major variations exist, several steps are required. This necessitates briefly blipping the accelerator pedal every 20 seconds or so. Each time this is done, a further step of the learning process is performed.
- ♦ The „forgotten“ variation then appears in display group 04, display field 2. The values of the idling speed controller remain outside of the tolerance range if the learned values in display group 004, display field 2 have moved up against stop.
- ♦ Stop values: -1.1 and +1.1 g/s, respectively.

Notes on display group 005, display field 4:

- ♦ In the case of fault (00670) Throttle valve positioner: constant engine speed of 840 rpm and air flow of 2.8 g/s.
- ♦ In the case of faults (00670/16505/16506/16507) Throttle valve positioner and throttle valve potentiometer, the digital idling speed stabilisation (DIS) is switched off and a constant engine speed of approx. 1000 rpm and an air mass of 2.8 g/s are output.

Display group 006, idling speed stabilisation:

Read measured value block 6 →				◀ Readout in display		
xxxx rpm	xx %	xx %	xx° BTDC			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle	9...15° BTDC	⇒ page 01-61
				Lambda controller	-10...+10%	⇒ page 01-61
				Idling speed controller	-10...+10%	⇒ page 01-61
				Engine speed (idling speed)	—	⇒ page 01-53

Test table - Display group 006

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1		♦ ⇒ page 01-47 display group 001, display field 1	
2		♦ ⇒ page 01-47 display group 005, display field 3	
3	not to tolerance	♦ Negative readout, engine too rich, effect: lambda control produces leaner mixture ♦ Positive readout („+“ is not shown), engine too lean, effect: lambda control produces richer mixture ♦ Unmetered air ♦ Injector faulty ♦ Lambda learned value at stop	- Wait 30 seconds until readout has stabilised - Inspect intake system for leaks ⇒ page 24-25 - Test quantity injected ⇒ page 24-22 - Check lambda learned value, display group 008 ⇒ page 01-47
4		♦ ⇒ page 01-47 display group 001, display field 4	

Notes on display field 3:

- ♦ The readout must vary around zero. If a constant 0 is displayed, the lambda control has switched over from closed-loop to open-loop control because there is a fault in the lambda control. Interrogate fault memory ⇒ page 01-5.
- ♦ Operating state of lambda control: check display group 021, display field 4 ⇒ page 01-47.

Display group 007, lambda control and ACF system:

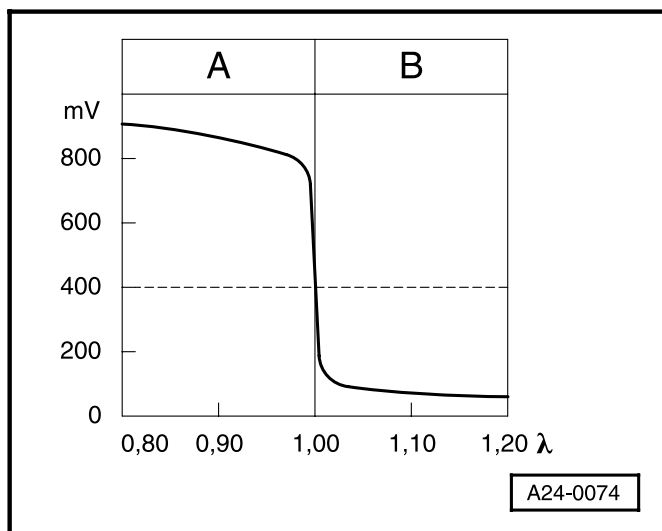
Read measured value block 7 →				◀ Readout in display		
xx %	xx V	xx %	x.xx			
1	2	3	4	◀ Display fields	Specification	Analysis
				Lambda correction factor when tank ventilation active	0.3...1.25	—
				On/off ratio of solenoid valve 1 for activated charcoal filter -N80. On/off ratio 0 means -N80 closed, on/off ratio 99 means -N80 fully open.	0...99 %	—
				Lambda probe voltage ⇒ display group 009	0...1 V	⇒ page 01-47
				Lambda controller ⇒ display group 006	-10...+10 %	⇒ page 01-47

Notes on display field 2:

- ◆ If the probe voltage changes only sluggishly, the following faults may exist ⇒ page 24-26, Testing lambda control.
- ◆ The voltage signal „rich mixture (low level of residual oxygen)“ is at approx. 0.7...1.0 V (related to reference earth).
- ◆ The voltage signal „lean mixture (large level of residual oxygen)“ is at approx. 0.0...+0.3 V (related to reference earth).
- ◆ A voltage jump from 0.7...1.0 V to 0.0...+0.3 V, and vice versa, takes place at the transition from „rich“ to „lean“ and vice versa ($\lambda = 1.0$).
- ◆ In view of the steep voltage jump, the lambda control is not able to maintain constant the ideal mixture composition which corresponds to $\lambda = 1.0$. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.
- ◆ The readout must occasionally drop below 0.3 V and rise above 0.6 V. Readouts below 0.45 V indicate a lean mixture, readouts above 0.45 V a rich mixture.

Notes on display field 4:

- ◆ If a readout of 0.3 is shown, the engine is supplied with a very rich mixture from the ACF system. The lambda control therefore has to reduce the injected quantity to 30 %.
- ◆ If a readout of 1.0 is shown, either an ideal mixture is supplied from the ACF system (it is not necessary to produce a leaner or richer mixture), or the ACF valve is closed (adaptation: display group 008, display field 4).
- ◆ If the readout is 1.01...1.2, the mixture from the ACF system is too lean. The lambda control therefore has to produce a richer mixture.

◀ **Voltage of 4-pin lambda probe U_λ in mV**

A: Lambda probe voltage high

- ◆ rich mixture (fuel excess or air deficiency)
- ◆ high CO concentration

B: Lambda probe voltage low

- ◆ lean mixture (fuel deficiency or air excess)
- ◆ low CO concentration

Display groups 008...099

Display group 008, lambda learned values:

Read measured value block 8 →				◀ Readout in display		
xx ms	xx %	xx %	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				„TV active“ means the activated charcoal filter solenoid valve is pulsed (6...16 min) „TV n. active“ means the activated charcoal filter solenoid valve is constantly closed (1 min) „λ adaptation“ means correction of the voltage curve shift caused by ageing of lambda probe	TV active or TV n. active or λ adaptation	—
			Lambda learned value at part load (multiplicative)		-8...+8 %	⇒ page 01-64
			Lambda learned value at idling (additive)		-10...+10 %	⇒ page 01-64
			Injection time		1.0...3.0 ms	⇒ page 01-64

Notes on display fields 2 and 3:

- ♦ *add = additive - The fault (e.g. unmetered air) has an increasingly lesser effect as engine speed rises. In the case of the additive learned value the injection time is altered by a fixed amount. The amount is not dependent on the basic injection time.*
- ♦ *mul = multiplicative - The fault (e.g. faulty injector) has a stronger effect as engine speed rises. In the case of the multiplicative learned value this is a percentage change of the injection time. This change is dependent on the basic injection time.*
- ♦ *Low values mean that the engine is running too rich and the lambda control therefore produces a leaner mixture.*
- ♦ *High values mean that the engine is running too lean and the lambda control therefore produces a richer mixture.*
- ♦ *All the learned values are reset if the control unit is not supplied with voltage.*

Test table - Display group 008

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1		◆ ⇒ page 01-47, display group 002, display field 3	
2 and 3	low lambda learned values	◆ Low lambda idling speed learned values with normal lambda part load learned values: oil dilution possible (high concentration of fuel in oil) ◆ Injector leaking ◆ Fuel pressure too high ◆ Activated charcoal filter solenoid valve -N80 constantly open ◆ Air mass meter -G70 faulty ◆ Lambda probe heater faulty or lambda probe dirty	- Disappears after driving on motorway or changing oil - ⇒ page 01-47, display group 007, display field 2 - Test injector - Test fuel pressure ⇒ page 24-20 - Test -N80 - Test -G70 - Test lambda probe heater ⇒ page 24-28
2 and 3	high lambda learned values	◆ Unmetered air possible in intake manifold area ◆ Injector clogged ◆ Air mass meter faulty -G70 ◆ Fuel pressure too low ◆ Unmetered air between air mass meter -G70 and throttle valve ◆ Unmetered air at manifold gasket ◆ Lambda probe heater faulty or lambda probe dirty	- ⇒ page 01-47, display group 007, display field 2 - Inspect intake system for leaks ⇒ page 01-24 - Test injected quantity ⇒ page 24-22 - Test -G70 - Test fuel pressure ⇒ page 24-20 - Eliminate cause - Eliminate cause - Test lambda probe heater ⇒ page 24-28

Display group 009, lambda learned values:

Read measured value block 9 →				◀ Readout in display		
xxxx rpm	xx %	x.x V	xx %			
1	2	3	4	◀ Display fields	Specification	Analysis
				Lambda learned value in idling (additive)	-10...+10 %	—
				Lambda probe voltage	0...1.0 V	⇒ page 01-66
				Lambda controller	-10...+10 %	—
				Engine speed (actual value)	800...920 rpm	—

Notes on display field 3:

- ◆ If the probe voltage changes only sluggishly, the following faults may exist ⇒ page 24-26, Testing lambda control.
- ◆ The voltage signal „rich mixture (low level of residual oxygen)“ is at approx. 0.7...1.0 V (related to reference earth).
- ◆ The voltage signal „lean mixture (large level of residual oxygen)“ is at approx. 0.0...+0.3 V (related to reference earth).
- ◆ A voltage jump from 0.7...1.0 V to 0.0...+0.3 V, and vice versa, takes place at the transition from „rich“ to „lean“ and vice versa ($\lambda = 1.0$).
- ◆ Lambda probe voltage does not vary within the respective range: conduct a test drive on open road and repeat test.
- ◆ In view of the steep voltage jump, the lambda control is not able to maintain constant the ideal mixture composition which corresponds to $\lambda = 1.0$. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.
- ◆ The readout must occasionally drop below 0.3 V and rise above 0.6 V. Readouts below 0.45 V indicate a lean mixture, readouts above 0.45 V a rich mixture.

Notes on display field 4:

- ◆ Low values mean that the engine is running too rich and the lambda control therefore produces a leaner mixture.
- ◆ High values mean that the engine is running too lean and the lambda control therefore produces a richer mixture.
- ◆ All the learned values are reset if the control unit is not supplied with voltage.

Test table - Display group 009

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
3	readout does not vary (constant 0...0.30 V or constant 0.70...1.00 V)	◆ Large quantity of unmetered air ◆ Spark plug faulty ◆ Fuel pressure too low or too high ◆ Injector faulty ◆ Coolant temperature sender -G62 faulty ◆ Activated charcoal filter solenoid valve faulty ◆ Lambda probe heater not operating ◆ Lambda probe faulty or dirty	- Inspect intake system for leaks ⇒ page 24-25 - Test spark plugs - Test fuel pressure regulator and holding pressure ⇒ page 24-20 - Test injectors - Test coolant temperature sender -G62- - Activated charcoal filter solenoid valve - Test lambda probe heater ⇒ page 24-28 - Test lambda probe ⇒ page 24-28 - Test lambda probe heater ⇒ page 24-28 - Test lambda probe signal cable and actuation ⇒ page 24-28
	constant 1.1 V	◆ Short circuit to positive caused by: lambda probe, lambda probe cable, earth cable, engine control unit	
	constant 0.40...0.50 V	◆ Open circuit in wiring caused by: lambda probe, lambda probe cable, earth cable, engine control unit	
	constant 0 V	◆ Short circuit to earth caused by: lambda probe, lambda probe cable, earth cable, engine control unit	

Display group 010, tank ventilation:

Read measured value block 10 →				◀ Readout in display		
xx %	x.xx	xx	x.xx			
1	2	3	4	◀ Display fields	Specification	Analysis
				Activated charcoal filter purging rate (ACF)	0...0.30	—
				Filling level of activated charcoal filter	-3...+32	—
				Lambda correction factor when tank ventilation active	0.3...1.25	—
				On/off ratio of solenoid valve 1 for activated charcoal filter (ACF)	0...99 %	—

Notes on display group 10:

- ♦ The engine control unit determines through the activated charcoal filter solenoid valve how much fuel is supplied to the engine from the activated charcoal filter system. If the filling level of the activated charcoal filter is high, and the solenoid valve remains closed in order to maintain the specified purging rate (lower on/off ratio), the reaction of the lambda control to this is shown by a change in the lambda correction factor. If this reaction is lower than expected (because in the meantime fuel vapours from the fuel tank have increased the filling level), the control unit thus calculates a higher filling level from this.
- ♦ Test fuel tank ventilation.

Notes on display field 1:

- ♦ When the lambda closed-loop control is active, the activated charcoal filter solenoid valve -N80 is pulsed. It remains opened at intervals of approx. 220 up to 900 seconds (tank ventilation is performed) and closed at intervals of about 70 seconds (no tank ventilation). During the intervals of about 70 seconds, the lambda control learns the operating conditions without any variation as a result of fuel vapours from the activated charcoal canister.
- ♦ On/off ratio 0 % means activated charcoal filter solenoid valve is closed. On/off ratio of 99 % means the solenoid valve is fully open.
- ♦ In the idling speed range the engine is able to process only a certain maximum quantity of fuel vapours from the activated charcoal filter system. For this reason, the opening of the activated charcoal filter solenoid valve is limited in the idling speed range. At part load, the on/off ratio may rise to as much as 99 %.
- ♦ It is possible to analyse the influence of the activated charcoal filter system by comparing the readout during „Basic setting“ (activated charcoal filter solenoid valve closed) and during „Read measured value block“ (solenoid valve open for about 220 up to 900 seconds, or closed for about 70 seconds).
- ♦ It is possible to switch between function 04 „Basic setting“ and function 08 „Read measured value block“ by alternately pressing keys 4 and 8 on V.A.G 1552 or V.A.G 1551.

Notes on display field 2:

- ♦ If a very rich mixture flows out of the activated charcoal filter system, the lambda control therefore has to produce a leaner mixture. This leaner mixture may be as much as 0.6. What this means in the particular case is that the lambda control has to reduce the injected quantity by 40 %.
- ♦ If the readout is 1.0 (lambda control without correction factor), either an ideal mixture is flowing from the activated charcoal filter system, or the activated charcoal filter solenoid valve is closed ⇒ display field 1.
- ♦ If the readout is 1.01 up to 1.25, the mixture from the activated charcoal filter system is too lean. The lambda control therefore has to produce a richer mixture.

Notes on display field 3:

- ◆ If the readout is -3, there are no fuel vapours in the activated charcoal filter.
- ◆ If the readout is +32, the activated charcoal filter is completely filled with fuel vapours.

Notes on display field 4:

- ◆ What is displayed is the volume concentration of the activated charcoal filter system related to the inducted total volume.
- ◆ If the readout is 0, no fuel vapours are supplied from the activated charcoal filter system.
- ◆ If the readout is 0.30, 30 % of the inducted air mass comes from the activated charcoal filter system.

Display group 011, fuel consumption:

Read measured value block 11 →				◀ Readout in display		
xxxx rpm	x.x ms	x km/h	x.x l/h			
1	2	3	4	◀ Display fields	Specification	Analysis
				Fuel consumption	0.5...1.5 l/h	—
				Vehicle speed	0 km/h	—
				Engine load ⇒ display group 001	0.5...1.5 ms	⇒ page 01-47
				Engine speed (idling speed)	—	⇒ page 01-53

Notes on display field 2:

- ◆ The maximum engine load decreases by about 10 % for each 1000 m above mean sea level.
- ◆ The maximum engine load likewise decreases by as much as 10 % at very high ambient temperatures.

Notes on display field 3:

- ◆ The vehicle speed signal is supplied by the speedometer sender -G22. The signal is further conditioned in the dash panel insert.
- ◆ The conditioned signal flows to the contact of the engine control unit and is used for the idling speed stabilisation and for minimising load change jolts during gearshifts.
- ◆ Conduct a test drive and observe vehicle speed. Specification: approx. vehicle speed.

Testing vehicle speed signal ⇒ page 24-40.

Notes on display field 4:

- ◆ The specification applies only to idling speed without any engine load as a result of ancillaries (e.g. automatic gearbox, air conditioning/heating system, alternator, power steering hydraulic pump).
- ◆ Not suitable for measuring fuel consumption in l/100 km.

Display group 012, fuel consumption:

Read measured value block 12 →				◀ Readout in display		
xxxx rpm	xx.x V	x.x l/h	xx °BTDC			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle ⇒ display group 001, display field 4	9...15° BTDC	⇒ page 01-47
				Fuel consumption ⇒ display group 011, display field 4	0.5...1.5 l/h	⇒ page 01-47
				Battery voltage ⇒ display group 003, display field 2	10...14.5 V	⇒ page 01-47
Engine speed (idling speed)					—	⇒ page 01-53

Display group 013, knock control:

Read measured value block 13 →				◀ Readout in display		
x °CA	x °CA	x °CA	x °CA			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle retardation of cylinder 4 by knock control	0...9 °CA	—
				Ignition angle retardation of cylinder 3 by knock control	0...9 °CA	—
				Ignition angle retardation of cylinder 2 by knock control	0...9 °CA	—
Ignition angle retardation of cylinder 1 by knock control					0...9 °CA	—

Notes on display group 013:

- ◆ The knock control is active from an engine load of 40 % or higher.
- ◆ If the engine load is greater than 40 %, the current ignition angle retardation values are displayed; if the engine load is less than 40 %, the values last used are displayed constantly.
- ◆ If knocking is audible without any detectable retardation of ignition angle, increase engine speed to more than 3500 rpm for 5 seconds in order to initiate knock sensor fault detection (diagnosis).
- ◆ If the ignition angle retardation value of one cylinder differs significantly from the others, the following faults are possible:
 - loose ancillaries
 - corrosion at plug connection of knock sensor
 - engine damage (e.g. oil consumption because of faulty piston)
- ◆ If the ignition timing point of all the cylinders is greatly retarded, the following faults are possible:
 - corrosion at the plug connection of the knock sensor
 - knock sensor not tightened to correct torque (20 Nm)
 - open circuit in wiring
 - knock sensor faulty
 - loose ancillaries
 - poor quality fuel (less than 95 RON)

Display group 014, knock control:

Read measured value block 14 →				◀ Readout in display		
xxxx rpm	xx.x ms	x °CA	x °CA			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle retardation of cylinder 2 by knock control	0...9 °CA	—
				Ignition angle retardation of cylinder 1 by knock control	0...9 °CA	—
				Engine load (injection time per revolution)	0...10,0 ms	—
				Engine speed	0...6800 rpm	—

Notes on display group 014:

- ◆ This display group can be used to check the ignition angle retardation of cylinders 1 and 2 at certain engine speeds and loads.
- ◆ Causes for ignition angle retardation ⇒ page 01-47, display group 13.

Display group 015, knock control:

Read measured value block 15 →				◀ Readout in display		
xxx	xxx	xxx	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle retardation of cylinder 4 by knock control	0...9 °CA	—
				Ignition angle retardation of cylinder 3 by knock control	0...9 °CA	—
				Engine load (injection time per revolution)	0...10,0 ms	—
				Engine speed	0...6800 rpm	—

Notes on display group 015:

- ◆ This display group can be used to check the ignition angle retardation of cylinders 3 and 4 at certain engine speeds and loads.
- ◆ Causes for ignition angle retardation ⇒ page 01-47, display group 13.

Display group 016, knock control: (idling speed)

Read measured value block 16 →				◀ Readout in display		
x.x V	x.x V	x.x V	x.x V			
1	2	3	4	◀ Display fields	Specification	Analysis
				Knock sensor signal cylinder 4	0.4...1.4 V	—
				Knock sensor signal cylinder 3	0.4...1.4 V	—
				Knock sensor signal cylinder 2	0.4...1.4 V	—
				Knock sensor signal cylinder 1	0.4...1.4 V	—

Notes on display group 016:

- ◆ If a difference of more than 50 % exists between the smallest and the largest knock sensor signal, the cause may be corrosion at the plug connection.
- ◆ If no fault is found during the electrical test of the knock sensor, of the wiring and of the plug connection, inspect the engine for loose ancillaries or engine damage: display group 013 ⇒ page 01-69.
- ◆ At higher engine speeds and loads the signal voltage displayed for the knock sensors may rise to as much as 5.1 V.

Display group 017, catalytic converter heating-up:

Read measured value block 17 →				◀ Readout in display		
xxxx rpm	x ms	xxx	xx °BTDC			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle: ignore	0...12° BTDC	—
				Energy balance for heating-up cat	0...100	—
				Engine load (injection time per revolution)	0...7 ms	—
				Engine speed	0...4000 rpm	—

Notes on display group 017:

- ◆ In order to warm up the catalytic converter as rapidly as possible to its operating temperature after a cold start, engine speed is increased in the idling speed range and the ignition angle is retarded. Only the retardation of the ignition angle is active in the part load range.
- ◆ This function for rapidly heating up the catalytic converter is active at start temperatures from -9 up to +39 °C.
- ◆ The function is terminated if the following criteria exist:
 - engine speed more than 4000 rpm
 - engine load greater than 7.0 ms
 - fault stored in fault memory relating to air mass meter and coolant temperature sender
 - energy balance more than 1.0
 - vehicle speed more than 55 km/h
 - altitude correction factor less than -20 % (display group 018)
- ◆ As soon as the function is terminated, the readout for the energy balance remains and is reset when the engine is next started.

Display group 018, altitude adaptation:

Read measured value block 18 →				◀ Readout in display		
xxxx rpm	x.x ms	x.x ms	xx %			
1	2	3	4	◀ Display fields	Specification	Analysis
				Altitude correction factor	-50...+10 %	⇒ page 01-72
				Engine load based on throttle valve angle	0.5...3.0 ms	—
				Engine load ⇒ display group 001, display field 2	0.5...1.5 ms	⇒ page 01-47
Engine speed					800...920 rpm	—

Notes on display field 4:

- ♦ The engine control unit compares the load signal of the air mass meter with a load value which is calculated from the throttle valve angle and engine speed. The difference of the two values results in the altitude correction factor.
- ♦ The altitude correction factor is dependent on the momentary atmospheric pressure and on the altitude above mean sea level of the workshop.
- ♦ The altitude adaptation influences the following factors:
 - Determining start quantity
 - Intake manifold pulsation compensation

Test table, display field 4:

Altitude above MSL	Atmospheric pressure	Specification
0 m	998 mbar	-1.5 %
500 m	954 mbar	-6.2 %
1000 m	902 mbar	-10.9 %
1500 m	853 mbar	-15.6 %
2000 m	805 mbar	-21.0 %
2500 m	756 mbar	-25.7 %
3000 m	704 mbar	-31.2 %
3500 m	655 mbar	-35.9 %
4000 m	607 mbar	-40.6 %

Display group 019, testing additional signals

Read measured value block 19 →				◀ Readout in display		
xxxx rpm xx.xx ms xxxx x xx° ATDC						
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle	20° ATDC 42° BTDC	—
				Operating state: 0xxx x = PAS pressure switch active xx0x x = Ignition angle retardation active xxx0 x = Clutch pedal switch active	xxxx x	—
				Engine load	0...10.00 ms	—
				Engine speed	0...6800 rpm	—

Notes on display group 019:

- ◆ This display group can be used to assess the different additional signals.
- ◆ Because of the short signal the ignition angle retardation is not always detected by V.A.G 1552.

Notes on display field 3:

- ◆ As a result of the signal from the gearbox control unit, the ignition angle is briefly retarded to a differing extent (torque reduction), depending on vehicle speed and engine speed, during a shift operation of the automatic gearbox in order to minimize the shift jolt.
- ◆ Conduct a test drive and observe readout in display field 3 (3rd digit from the left). The readout must always change for a short time during a gearshift.
- ◆ Because of the very short signal, observe field 3 (3rd digit from left) during the next gearshift until the readout jumps from 0 to 1.
- ◆ Turn steering wheel to full lock and observe readout (1st digit from left); specification: **0xxx x**.
- ◆ When the clutch pedal is depressed, the readout (4th digit from left) changes to **xxx0 x**.

Display group 020, operating states:

Read measured value block 20 →				◀ Readout in display		
xxxx rpm	Text	Text	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Operating state of AC compressor: ON/OFF	Compr. OFF Compr. ON	—
				Operating state of air conditioning High = high heating or cooling capacity Low = low heating or cooling capacity	A/C High A/C Low	—
				Selector lever position, Neutral, or gear engaged (for automatic gearbox)	Neutral, gear ENG	—
				Engine speed	800...920 rpm	—

Notes on display field 1:

- ◆ When the air conditioning is switched on, a positive signal is supplied to contact 10 at the engine control unit.
- ◆ This signal assures that the engine control unit maintains idling speed constant even if the power demand of the air conditioning system varies.
- ◆ After the air conditioning is switched on, idling speed must remain constant despite a short drop in engine speed (less than one second).

Notes on display field 2:

- ◆ Information flows from the automatic gearbox control unit into the engine control unit.
- ◆ Neutral = selector lever in P or N.
- ◆ Gear engaged = selector lever in 1/2/3/R/D.
- ◆ „Neutral“ is always displayed for vehicles fitted with manual gearbox.

Notes on display field 3:

- ◆ „A/C High“ = air conditioning requesting high heating or cooling capacity
- ◆ „A/C Low“ = air conditioning not switched on
- ◆ „A/C Low“ is always displayed for vehicles not fitted with air conditioning.

Notes on display field 4:

- ◆ If the accelerator is depressed rapidly, the readout in display field 4 must jump for a few seconds from „ON“ to „OFF“ (AC compressor switched off during vehicle acceleration).
- ◆ „Compr. OFF“ is always displayed for vehicles not fitted with air conditioning.

Display group 021, operating state of lambda control:

Read measured value block 21 →				◀ Readout in display		
xxxx rpm	x.x ms	xxx °C	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Lambda control: ON/OFF	λ ctrl. ON... λ ctrl. OFF.	—
				Coolant temperature	xxx °C	—
				Engine load	0.5...1.5 ms	—
				Engine speed	800...920 rpm	—

Notes on display group 021:

- ♦ The lambda control is switched on by the engine control unit as a function of the engine temperature and the intake air temperature.
- ♦ If the start temperature is below 15 °C (intake air temperature), the lambda control is not switched on by the engine control unit until the coolant temperature is 55 °C.
- ♦ At a start temperature of more than 15 °C (intake air temperature) the lambda control is active as soon as the lambda probe ready state is detected.
- ♦ If the lambda control is switched off, the engine runs map-controlled.

Display group 023, adaptation of throttle valve control unit

Read measured value block 23 →				◀ Readout in display		
xxxxxx	xx %	xx %	xx %			
1	2	3	4	◀ Display fields	Specification	Analysis
				Max. stop of throttle valve positioner -V60	18...54 %	—
				Emergency mode stop of throttle valve positioner -V60	60...91 %	—
				Min. stop of throttle valve positioner -V60	72...95 %	—
				Learning demand display ⇒ page 01-76, Table 1	100000	⇒ page 01-76

Note on display field 1:

If the specified readout is not achieved, adapt engine control unit to the throttle valve control unit -J338 ⇒ page 24-37.

Note on display fields 2, 3 and 4:

What is displayed are the stop values learned during the last basic setting.

Note on all display fields:

If the specified readout is again not achieved after carrying out basic setting, inspect cable connection for open circuit and short circuit as well as plug connections for dirt and corrosion before replacing the throttle valve control unit.

Analysis: Table 1; learning demand display

Meaning of the digits in the 6-digit numerical block for learning demand display: display field 1

X	X	X	X	X	X	Meaning of 6-digit readout
						1 = Learning process Min. stop of throttle valve positioner sender -G127 Readout „0“ = learning process performed, learning process o.k. Readout „1“ = learning process not performed, learning process n.o.k.
						2 = Learning process Max. stop of throttle valve positioner sender -G127 Readout „0“ = learning process performed, learning process o.k. Readout „1“ = learning process not performed, learning process n.o.k.
						3 = Learning process Min. stop, throttle valve potentiometer -G69 Readout „0“ = learning process performed, learning process o.k. Readout „1“ = learning process not performed, learning process n.o.k.
						4 = Learning process Max. stop, throttle valve potentiometer -G69 Readout „0“ = learning process performed, learning process o.k. Readout „1“ = learning process not performed, learning process n.o.k.
						5 = Ignore
						6 = Adjustment of throttle valve potentiometer -G69 with throttle valve positioner sender -G127 Readout „0“ = adjustment has to be performed Readout „1“ = adjustment performed, adjustment o.k.

Display group 024, knock control:

Read measured value block 24 →				◀ Readout in display		
xxxx rpm	xx.xx ms	xx °x.BTDC	xx.x °CA			
1	2	3	4	◀ Display fields	Specification	Analysis
				Total of ignition angle retardations cylinders 1...4	0...36.0 °CA	—
				Ignition angle	20° ATDC...42° BTDC	—
				Engine load	0...10.00 ms	—
				Engine speed	0...6800 rpm	—

Notes on display group 024:

- ♦ As soon as knocking is detected, the ignition angle must be retarded by the knock control in order to avoid any engine damage.
- ♦ When the ignition angle is retarded, however, the exhaust temperature is increased. There is a risk of the catalytic converter overheating.
- ♦ A retardation of the ignition angle of e.g. 3° at all cylinders has exactly the same effect as an ignition angle retardation of 12° CA at only one cylinder.
- ♦ In order to prevent such overheating, the mixture is enriched from a total retardation of approx. 10° at full load in order to reduce the exhaust temperature.

Display group 025, charge pressure control at full load (test drive in 3rd gear, coolant temperature not below +85 °C, engine speed 4000 rpm)**Notes:**

- ♦ Accelerate the vehicle in 3rd gear at full throttle from about 1500 rpm for the test.
- ♦ The measured values must be read off or printed out once an engine speed of 4000 rpm is reached (2nd person required).

Read measured value block 25 →				◀ Readout in display		
x.xx ms	x.xx ms	x.xx ms	xx %			
1	2	3	4	◀ Display fields	Specification	Analysis
				On/off ratio of charge pressure control solenoid valve	0...99 %	⇒ page 01-78
				Actual engine load (controlled to specified engine load by charge pressure) • must agree with display field 2 within tolerance of ± 0.30 ms	0.50...8.00 ms	⇒ page 01-78
				Engine load - specification after correction (reduced by knock control, altitude adaptation and coolant temperature)	0.00...8.00 ms	—
				Engine load - specified (map value based on accelerator pedal position)	3.00...8.00 ms	—

Test table - Display group 025

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
3	greater than 8.0	♦ Fault in charge pressure control	- Test charge pressure control
4	constant 5 %	♦ Charge pressure is not controlled	- Interrogate fault memory ⇒ page 01-5

Notes on display fields 2, 3, 4:

If the engine load is not within the tolerance, the following faults are possible:

- ♦ Charge pressure control solenoid valve -N75 not operating electrically or is clogged, hose of charge pressure control dropped off, leaking or clogged, leak between turbocharger and intake manifold, mechanism (linkage, shaft) of bypass valve stiff or tight, turbocharger faulty (turbine blocked by foreign bodies).

Display group 026, idling air demand:

Read measured value block 26 →				◀ Readout in display		
xx %	x.x g/s	xxx °C	xxxx rpm			
1	2	3	4	◀ Display fields	Specification	Analysis
				Engine speed	800...920 rpm	—
				Coolant temperature	80...105 °C	—
				Learned value of idling air mass (no gear engaged in automatic gearbox)	-1.1...+1.1 g/s	—
				Idling speed controller	-10...+10 %	—

Display group 027, load reduction by knock control at full load (test drive in 3rd gear, coolant temperature not below +85 °C, engine speed 4000 rpm)**Notes:**

- ♦ Accelerate vehicle at full throttle for the test.
- ♦ The measured values must be read off or printed out once an engine speed of 4000 rpm is reached (2nd person required).

Read measured value block 27 →				◀ Readout in display		
x ms	x.xx ms	xxxx rpm	xx %			
1	2	3	4	◀ Display fields	Specification	Analysis
				On/off ratio of charge pressure control solenoid valve	0...99 %	⇒ page 01-79
				Engine speed	xxx rpm	—
				Engine load after reduction	0.50...8.00 ms	—
				Load reduction by knock control	0...5 ms	—

Test table - Display group 027

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
4	constant 5 %	♦ Charge pressure is not controlled	- Interrogate fault memory ⇒ page 01-5

Display group 066, cruise control system:

Read measured value block 66 →				◀ Readout in display		
x km/h	xxxx	x km/h	xxxx			
1	2	3	4	◀ Display fields	Specification	Analysis
				Switch position of CCS operating switch	0000	⇒ page 01-79 ⇒ page 01-80
				Specified vehicle speed (value last stored by CCS)	0 km/h	—
				Switch position of CCS, brake and clutch	1000	—
				Vehicle speed	0 km/h	—

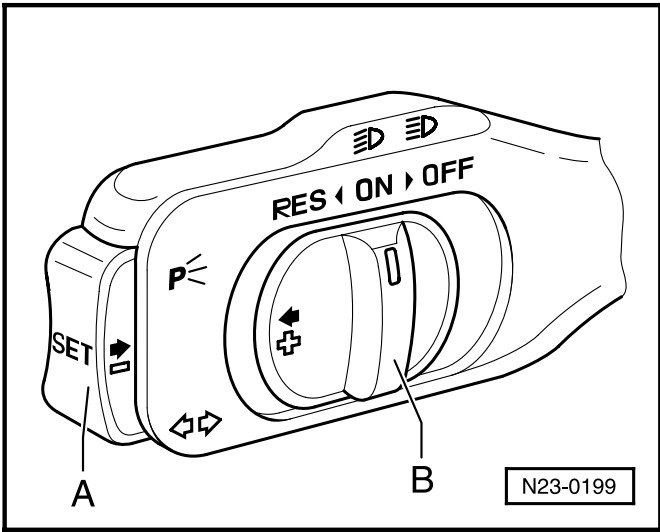
Note:

- ♦ With the exception of an operating switch, the CCS does not have any components of its own. All the functions are performed by the engine control unit. A minimum vehicle speed of 30 km/h is required for the CCS function.

Analysis of the digits in the 4-digit numerical block - Display group 066

Dis-play field	Readout on V.A.G 1552				Meaning of the digits in 4-digit numerical block
2	1	0	0	0	CCS switched off
	1	1	1	1	Brake pedal depressed (brake light switch)
	1	1	1	1	Brake pedal depressed (brake switch)
	1	1	1	0	Clutch pedal depressed

Analysis of the digits in the 4-digit numerical block - Display group 066



Dis- play field	Readout on V.A.G 1552				Meaning of the digits in 4-digit numerical block
4	0	0	0	0	CCS switch set to „ON“
	0	0	1	0	CCS switch set to „OFF“ (not locked)
	0	0	1	1	CCS switch set to „OFF“ (locked)
	0	1	0	0	„SET“ button pressed
	1	0	0	0	CCS switch set to „RES“

♦ CCS function ⇒ Owners Manual.

Display group 095, basic function:

Read measured value block 95				→ Readout in display		
xxxx rpm	x.xx ms	xx.x° BTDC	xxx °C			
1	2	3	4	Display fields	Specification	Analysis
				Coolant temperature	80...105 °C	—
				Ignition angle ¹⁾	12.0° BTDC	—
				Engine load	0.50...1.50 ms	—
				Engine speed	800...920 rpm	—

¹⁾ If display group 095 is selected in function 04 „Basic setting“ a fixed ignition timing point of approx. 12.0° BTDC is set in the idling speed range by the engine control unit.

Display group 098, adaptation of throttle valve control unit:

Read measured value block 98 →				◀ Readout in display		
x V	x V	Text	Text	◀ Display fields	Specification	Analysis
1	2	3	4	Adaptation status ADP = adaptation of throttle valve control unit	ADP runs ADP o.k. ADP ERROR	⇒ page 24-36
				Operating state ⇒ page 01-47, display group 004	Idling Part load	—
				Voltage of throttle valve positioner sender (G127)	0...5 V	—
				Voltage of throttle valve potentiometer (G69)	0...5 V	—

Note on display field 4:

When display group 098 is selected in function 04 „Basic setting“, the throttle valve control unit -J338 is adapted to the engine control unit.

Display group 099, lambda control:

Read measured value block 99 →				◀ Readout in display		
1	2	3	4	◀ Display fields	Specification	Analysis
				Lambda control: ON/OFF Basic setting 04: λ ctl. OFF Read measured value block 08: λ ctl. ON	λ ctl. OFF λ ctl. ON	—
				Lambda controller	-10...+10 %	—
				Coolant temperature	xxx °C	—
				Engine speed	0...6800 rpm	—

Notes on display group 099:

- ◆ For defined fault finding, the lambda control is switched off when display group 099 is selected in function 04 „Basic setting“, and switched on when selected in function 08 „Read measured value block“.
- ◆ It is possible to switch back and forward between function 04 „Basic setting“ and function 08 „Read measured value block“ by pressing keys 4 and 8 on vehicle system tester V.A.G 1552.

Survey of display groups for engine codes ARZ, ARX, AUM

Display groups 000...009

Display group 000, engine idling (coolant temperature not less than +80 °C)

Display field	Specified readout	Equals measured value	Designation
1	185...205 ¹⁾ 180...210	80...105 °C ¹⁾ 80...110 °C	Coolant temperature (prerequisite for basic setting)
2	21...39 ¹⁾ 14...39	15...30 % ¹⁾ 10...30	Engine load (without components)
3	70...82 ¹⁾ 70...84 64...76	700...820 rpm ¹⁾ 700...840 rpm 640...760 rpm	Engine speed (without components) • 4x4 models with manual gearbox • models with automatic gearbox
4	142...206	10...14.5 V	Battery voltage
5	1...7 ¹⁾ 1...10	0.4...2.75 % ¹⁾ 0.4...4.0 %	Throttle valve angle
6	106...189 ¹⁾ 106...189	-4.3...0 kg/h ¹⁾ -4.3...12.2 %	Control value of idling air mass (idling speed controller) ¹⁾ Load (torque) in idling speed range
7	113...143	-3...+3 %	Learned value of idling air mass
8	115...141	-10...+10 %	Control value of mixture formation (lambda control value) (if not within tolerance, conduct test drive)
9	78...178	-10...+10 %	Learned value of mixture formation (lambda learned value) additive (if not within tolerance, conduct test drive)
10	103...153	-10...+10 %	Learned value of mixture formation (lambda learned value) multiplicative (if not within tolerance, conduct test drive)

¹⁾ Figures for engine code ARZ.

Notes on display fields 9 and 10:

- ◆ In the case of the additive learned value the injection time is altered by a fixed amount which is not dependent on the basic injection time.
- ◆ In the case of the multiplicative learned value this is a percentage change of the injection time which is dependent on the basic injection time.

Test table - display group 000

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1	greater than 210 or 205	♦ Coolant temperature sender -G62 faulty ♦ Fault in cable connection to engine control unit	- Test coolant temperature sender -G62
	less than 180 or 185	♦ Coolant temperature sender -G62 faulty ♦ Fault in cable connection to engine control unit ♦ Coolant thermostat constantly open	- Test coolant temperature sender -G62 - Test coolant thermostat
2	greater than 39	♦ Air conditioning switched on ♦ Electrical components on ♦ Lambda control at rich or lean stop ♦ AC compressor also running although air conditioning switched off	- Switch air conditioning off - Switch electrical components off - Test lambda control ⇒ page 24-28 - Test AC compressor shutoff ⇒ page 01-107
	less than 14 or 21	♦ Unmetered air downstream of air mass meter ♦ Unmetered air downstream of throttle valve ♦ Vacuum hose disconnected ♦ Fuel pressure regulator	- Eliminate unmetered air
3	less than 70	♦ Gear engaged (automatic gearbox) ♦ Engine load because of ancillaries ♦ Throttle valve control unit -J338 jamming or faulty	- Move selector lever into P or N - Eliminate engine load (AC, power steering etc.) - Test throttle valve control unit -J338 ⇒ page 24-15
	greater than 84 or 82	♦ Large quantity of unmetered air (cannot be compensated by idling speed stabilisation) ♦ Throttle valve control unit -J338 jamming or faulty	- Eliminate unmetered air - Test throttle valve control unit -J338 ⇒ page 24-15

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
4	less than 142	♦ Alternator faulty, battery severely discharged ♦ Severe load on electrical system shortly after start because of high charge current and ancillaries ♦ Contact resistance in positive supply or earth connection for engine control unit ♦ Current drain with ignition off	- Test voltage, charge battery - Increase engine speed slightly for a few minutes and switch off ancillaries - Test supply voltage to engine control unit ⇒ page 24-18 - Eliminate current drain
	greater than 206	♦ Voltage regulator at alternator faulty ♦ Overvoltage because of jump-starting or quick-charger	- Test voltage, replace regulator if necessary - Interrogate fault memory ⇒ page 01-5
	less than 1	♦ Not possible	
5	greater than 10 or 7	♦ Basic setting of throttle valve control unit not performed ♦ Throttle valve potentiometer in throttle valve control unit faulty ♦ Throttle valve mechanism jamming	- Perform basic setting of throttle valve control unit ⇒ page 24-36 - Interrogate fault memory ⇒ page 01-5 - Eliminate cause, replace if necessary
6	less than 106	♦ Unmetered air downstream of throttle valve	- Eliminate unmetered air
	greater than 189	♦ Increased engine load because of ancillaries	- Eliminate load, switch off ancillaries
7	less than 113	♦ Unmetered air downstream of throttle valve	- Eliminate unmetered air
	greater than 143	♦ Increased engine load because of ancillaries	- Eliminate load, switch off ancillaries
8	less than 115	♦ Mixture too rich, lambda control produces leaner mixture ♦ Large amount of fuel from activated charcoal filter (not in the case of basic setting) ♦ Leak in vacuum hose of fuel pressure regulator ♦ Lambda learned values at stop	- Depress accelerator every 20 seconds until learning process is performed - Replace vacuum hose - Check lambda learned values, display group 008 ⇒ page 01-47

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
8	greater than 141	♦ Mixture too lean, lambda control produces richer mixture ♦ Unmetered air ♦ Injectors faulty ♦ Lambda learned values at stop	- Test fuel injected quantity ⇒ page 24-22 - Eliminate unmetered air - Test injectors - Check lambda learned values, display group 008 ⇒ page 01-47
	Readout jumps or shows constant 128	♦ Fuel level too low ♦ Lambda closed-loop control is switched to open-loop	- Top up fuel to at least 10 litres
9	less than 78 or greater than 178		- Display group 008, display fields 2 and 3 ⇒ page 01-47
10	less than 103 or greater than 153		- Display group 008, display fields 2 and 3 ⇒ page 01-47

Display group 001 - Basic function:

Engine code ARZ

• Engine idling						
Read measured value block 1 →				◀ Readout in display		
xxxx rpm	xxx °C	xx %	xxxxxxx			
1	2	3	4	◀ Display fields	Specification	Analysis
				Setting conditions for basic setting	1x111111	⇒ page 01-86
				Lambda control upstream of cat	-10...10 %	—
				Coolant temperature	80...110 °C	—
Idling speed manual gearbox automatic gearbox					700...820 rpm 640...760 rpm	⇒ page 01-86

Note on display fields 1 and 3:

- ♦ In connection with checking intake system for leaks (unmetered air), the display fields can also be used for engine codes ARX and AUM.

Analysis of 8-digit numerical block

Dis-play field	Readout on V.A.G 1552								Meaning if readout 1
4	1	2	3	4	5	6	7	8	Meaning
								1	Coolant temperature less than 80 °C
							1		Engine speed less than 2000 rpm
						1			Throttle valve closed
					1				Lambda control o.k.
				1					Idling speed switch closed
			1						AC compressor switched off
		1							Ignore
	1								No fault detected by self-diagnosis

Test table - Display group 001

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
1	less than 640 rpm or 700 rpm	♦ Throttle valve control unit -J338 jamming or faulty	- Test throttle valve control unit -J338 ⇒ page 24-15 - Test idling speed
	greater than 760 rpm or 820 rpm	♦ Large quantity of unmetered air (cannot be compensated by idling speed stabilisation) ♦ Throttle valve control unit -J338 jamming or faulty	- Interrogate fault memory ⇒ page 01-5 - Inspect intake system for leaks ⇒ page 24-25 - Test throttle valve control unit -J338 ⇒ page 24-15 - Test idling speed

Display group 002, basic function:**All engines**

• Engine idling						
Read measured value block 2 xxxx rpm xx.x % x.x ms x.x g/s				→	◀ Readout in display	
1	2	3	4	◀ Display fields	Specification	Analysis
				Inducted air mass	2...4.5 g/s	⇒ page 01-87
				Injection time per power stroke	2.0...4.0 ms	⇒ page 01-87
				Engine load	15.0...25.0 %	—
				Idling speed	—	⇒ page 01-85

Note on display field 4:

- ♦ What is displayed is the air mass measured by the air mass meter.

Test table - Display group 002

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
3	less than 2.0	♦ High quantity of fuel from activated charcoal filter system ♦ Incorrect injectors with larger flow installed	- Test activated charcoal filter solenoid valve - Test quantity of fuel injected ⇒ page 24-22
	greater than 4.0	♦ Increased engine load because of electrical components, AC, gear engaged or power steering at full lock	- Eliminate load
4	less than 2.0	♦ Large quantity of unmetered air between intake manifold and air mass meter	- Eliminate unmetered air
	greater than 4.5	♦ Gear engaged (automatic gearbox) ♦ Engine load because of ancillaries	- Move selector lever into P or N - Eliminate load (AC, power steering etc.)

Display group 003, basic function:**Engine code ARZ**

• Engine idling						
Read measured value block 3 →				◀ Readout in display		
xxxx rpm	x.x g/s	x.x %	xx° BTDC			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle	6...12° BTDC	—
				Throttle valve angle (potentiometer 1 -G187)	0.2...4.0 %	—
				Inducted air mass	2.0...4.5 g/s	—
Idling speed					—	⇒ page 01-85

Note on display field 3:

- ♦ Readout when accelerator fully depressed must be approx. 100 %.

Display group 004, basic function:**All engines**

• Engine idling						
Read measured value block 4 →				◀ Readout in display		
xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C			
1	2	3	4	◀ Display fields	Specification	Analysis
				Intake air temperature	-48...110 °C ¹⁾ -48...143.0 °C	⇒ page 01-89
				Coolant temperature	80.0...110.0 °C	⇒ page 01-89
				Supply voltage of engine control unit	12.000...15.000 V	⇒ page 01-89
Idling speed					—	⇒ page 01-85

¹⁾ Applies to engine code ARZ.

Note on display field 3:

- ♦ As soon as the fault „Coolant temperature sender“ is stored in the fault memory, the engine control unit uses the intake air temperature as a substitute value for starting the engine. In this case, the temperature rises in accordance with the model curve stored in the control unit. A fixed substitute value is displayed after a certain time for the engine at normal operating temperature. This fixed substitute value in turn is dependent on the intake air temperature.

Notes on display field 4:

- ♦ The readout in the display must agree with the ambient temperature.
- ♦ If there is a fault at the intake air temperature sender -G42, or an open circuit in the wiring, the control unit operates with a substitute temperature of 19.5 °C.
- ♦ Only gold-plated contacts may be used for repairing contacts in the plug connection of the sender.

Test table - Display group 004

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
2	less than 12.0 V	◆ Alternator faulty, battery severely discharged ◆ Severe load on electrical system shortly after start because of high charge current and ancillaries ◆ Contact resistance in power supply or earth connection for engine control unit ◆ Current drain although ignition off	- Test voltage, charge battery - Increase engine speed slightly for a few minutes and switch off ancillaries - Test voltage supply to engine control unit ⇒ page 24-18 - Eliminate current drain
	greater than 15.0 V	◆ Voltage regulator at alternator faulty ◆ Excess voltage caused by jump-starting or quick-charger	- Test voltage, replace regulator if necessary - Interrogate fault memory ⇒ page 01-5
3	less than 80 °C	◆ Engine too cold ◆ Coolant temperature sender or cable connection to engine control unit	- Conduct test drive if necessary - Test coolant temperature sender -G62
	greater than 110 °C	◆ Radiator dirty ◆ Radiator fan not operating ◆ Coolant thermostat faulty ◆ Coolant temperature sender or cable connection to engine control unit faulty	- Clean radiator - Test operation - Test coolant thermostat - Test coolant temperature sender -G62
	constant -48.0 °C	◆ Open circuit in wiring	- Test coolant temperature sender -G62
	constant 143 °C	◆ Short circuit between cables 3 and 4	- Test coolant temperature sender -G62
4	constant -48.0 °C	◆ Open circuit in wiring	- Interrogate fault memory ⇒ page 01-5
	constant 143 °C	◆ Short circuit between cables 1 and 2	- Test sender -G42

Display group 005, basic function:**All engines**

• Engine idling						
Read measured value block 5				→	◀ Readout in display	
xxxx rpm	xx %	x km/h	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Operating state (idling, part load, enrichment, overrun)	Idling	—
				Vehicle speed	0 km/h	—
				Engine load	15...25 %	—
Idling speed					—	⇒ page 01-85

Note on display field 3:

- ♦ Conduct test drive and observe vehicle speed. Specification: approx. vehicle speed.

Display group 006, basic function:**Engine code ARZ**

• Engine idling						
Read measured value block 6				→	◀ Readout in display	
xxxx rpm	xx %	xxx %	xx.x %			
1	2	3	4	◀ Display fields	Specification	Analysis
				Altitude correction factor	-50.0...20 %	—
				Intake air temperature	-48...110 %	—
				Engine load	15...25 %	⇒ page 01-46
Idling speed					—	⇒ page 01-85

Note on display field 3:

- ♦ The readout must be the same as the ambient temperature.

Display groups 010...041 and 099

Display group 010 - Ignition system:

Engine code ARZ

• Engine idling						
Read measured value block 10 →				◀ Readout in display		
xxxx rpm	xx %	x.x %	xx° BTDC			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle	6...12° BTDC	—
				Throttle valve angle	0.2...4.0 %	⇒ page 01-91
				Engine load	15...25 %	⇒ page 01-91
				Idling speed	—	⇒ page 01-85

Test table - Display group 010

Display field	Readout on V.A.G 1552	Cause of fault	Rectifying fault
2	less than 15 %	♦ Smaller readouts can only occur in overrun (throttle released)	
	greater than 25 %	♦ Poor idling (engine does not run on all cylinders) ♦ Electrical components on ♦ Steering wheel at full lock ♦ Gear engaged (automatic gearbox) ♦ Air mass meter -G70 faulty	- Injectors or spark plugs faulty - Switch off components - Move steering wheel into centre position - Move selector lever into P or N - Test air mass meter -G70
3	greater than 5 ∠°	♦ Adaptation of engine control unit to throttle valve control unit not performed ♦ Throttle valve potentiometer in throttle valve control unit faulty ♦ Throttle valve jamming	- Adapt engine control unit to throttle valve control unit ⇒ page 24-36 - Test throttle valve control unit ⇒ page 24-15 - Rectify fault

Display group 014, ignition - Misfiring detection

Engine codes ARX and AUM

• Engine idling						
Read measured value block 14				→ ◀ Readout in display		
xxxx rpm	xx.x %	x	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Status of misfiring detection (activated, deactivated)	activated	—
				Total of ignition misfirings	0	⇒ page 01-93
				Engine load	12.7...30.0 %	—
				Idling speed	—	⇒ page 01-85

Display group 015, ignition - Cylinder misfiring 1...3

Engine codes ARX and AUM

• Vehicle driven						
Read measured value block 15				→ ◀ Readout in display		
x	x	x	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Status of misfiring detection (activated, deactivated)	activated	—
				Ignition misfiring cylinder 3	0	⇒ page 01-93
				Ignition misfiring cylinder 2	0	⇒ page 01-93
				Ignition misfiring cylinder 1	0	⇒ page 01-93

Display group 016, ignition - Ignition misfiring 4

Engine codes ARX and AUM

• Vehicle driven						
Read measured value block 16 →				◀ Readout in display		
x	-	-	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Status of misfiring detection (activated, deactivated)	activated	—
Ignore					—	—
Ignore					—	—
Ignition misfiring cylinder 4					0	⇒ page 01-93

Analysis of display group 014, display field 3 and display groups 015 and 016, display fields 1, 2 and 3

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
greater than 0	♦ Spark plug faulty ♦ Ignition coil faulty ♦ Power output stages of ignition coil faulty	- Test spark plugs - Test ignition coil
	♦ Injector faulty	- Test injectors

Display group 020, ignition - Knock control

Engine codes ARX and AUM

• Vehicle driven						
Read measured value block 20 →				◀ Readout in display		
xx.x °CA	xx.x °CA	xx.x °CA	xx.x °CA			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle retardation cylinder 4 by knock control	0.0...12.0 °CA	⇒ page 01-94
				Ignition angle retardation cylinder 3 by knock control	0.0...12.0 °CA	⇒ page 01-94
				Ignition angle retardation cylinder 2 by knock control	0.0...12.0 °CA	⇒ page 01-94
				Ignition angle retardation cylinder 1 by knock control	0.0...12.0 °CA	⇒ page 01-94

Note on display fields 1...4:

- ♦ The readout in the idling speed range is 0.0 °CA.

Analysis of display group 020, display fields 1...4 - Ignition angle retardation

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
all cylinders more than 12.0 °CA	♦ Knock sensor faulty	- Test knock sensor
	♦ Plug connection corroded	
	♦ Knock sensor not correctly tightened	- Slacken knock sensor and tighten again to 20 Nm
	♦ Engine components loose	- Tighten loose components
	♦ Poor quality fuel	- Change grade of fuel
one cylinder differs significantly from the others	♦ Plug connection corroded	- Test knock sensor
	♦ Engine damaged	- Test compression: ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 15
	♦ Engine components loose	- Tighten loose components

Display group 022, ignition:
Engine code ARZ

• Vehicle driven						
Read measured value block 22 →				◀ Readout in display		
xxxx rpm	xxx %	xx.xx °CA	xx.xx °CA			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle retardation cylinder 2 by knock control	0...12.75 °CA	⇒ page 01-95
				Ignition angle retardation cylinder 1 by knock control	0...12.75 °CA	⇒ page 01-95
Engine load					15...175 %	—
Engine speed (vehicle driven) manual gearbox automatic gearbox					700...6800 rpm 640...6800 rpm	—

Note on display fields 3 and 4:

- ♦ The readout in the idling speed range is 0.0 °CA.

Display group 023, ignition:**Engine code ARZ**

• Vehicle driven						
Read measured value block 23 xxxx rpm xxx % xx.xx °CA xx.xx °CA				→ ◀ Readout in display		
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignition angle retardation cylinder 4 by knock control	0...12.75 °CA	⇒ page 01-95
				Ignition angle retardation cylinder 3 by knock control	0...12.75 °CA	⇒ page 01-95
Engine load					15...175 %	—
Engine speed, display group 022					—	⇒ page 01-94

Note on display fields 3 and 4:

- ♦ The readout in the idling speed range is 0.0 °CA.

Analysis of display groups 022 and 023, display fields 3 and 4 - Ignition angle retardation

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
all cylinders more than 12.75 °CA	♦ Knock sensor faulty	- Test knock sensor
	♦ Plug connection corroded	
	♦ Knock sensor not correctly tightened	- Slacken knock sensor and tighten again to 20 Nm
	♦ Engine components loose	- Tighten loose components
	♦ Poor quality fuel	- Change grade of fuel
one cylinder differs significantly from the others	♦ Plug connection corroded	- Test knock sensor
	♦ Engine damaged	- Test compression: ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 15
	♦ Engine components loose	- Tighten loose components

Display group 028, ignition:**Engine code ARZ**

• Vehicle driven						
System in basic setting 28 →				◀ Readout in display		
xxxx rpm	xxx %	xxx °C	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Result knock sensor test (Test ON/ Test OFF/Syst. o.k./Syst. n.o.k.)	Syst. o.k.	—
				Coolant temperature	40...110 °C	—
				Engine load	15...175 %	—
				Engine speed	2200...6800 rpm	—

Display group 030 - Lambda control**All engines**

• Engine code ARX, AUM: control unit in function 04 „Initiate basic setting“ • Engine code ARZ: control unit in function 08 „Read measured value block“						
Read measured value block 30 →				◀ Readout in display		
xxx	xxx	—	—			
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignore	—	—
				Ignore	—	—
				Status of lambda control after cat	110	⇒ page 01-96
				Status of lambda control before cat	111	⇒ page 01-96

Notes:

- ♦ Read out at catalytic converter temperature of at least 352 °C.
- ♦ First digit in 3-digit numerical block changes temporarily between 0 and 1 (lambda probe heater off and on).

Note on display field 2:

- ♦ The 3rd position in the display number changes under load to 1.

Meaning of 3-digit numerical block in display fields 1 and 2:

1	2	3	Meaning if readout positions = 1
		1	Lambda control active
	1		Lambda probe operational
1			Lambda probe heater switched on

Display group 032, lambda control (lambda learned values)**All engines**

Read measured value block 32 xx.x % xx.x %				→ ◀ Readout in display		
1	2	3	4	◀ Display fields	Specification	Analysis
				Ignore	—	—
				Ignore	—	—
				Lambda learned value at part load (multiplicative)	-10.0...10.0 %	⇒ page 01-98
				Lambda learned value at idling speed (additive)	-10...10 % ¹⁾ -6.0...6.0 % ²⁾	⇒ page 01-98

1) Applies to engine code ARZ.

2) Applies to engine codes ARX, AUM.

Notes on display fields 1 and 2:

- ◆ Low values mean that the engine is running too rich and the lambda control therefore produces a leaner mixture.
- ◆ High values mean that the engine is running too lean and the lambda control therefore produces a richer mixture.
- ◆ All the learned values are reset if the control unit is not supplied with voltage.
- ◆ add = additive - The fault (e.g. unmetered air) has an increasingly lesser effect as engine speed rises. In the case of the additive learned value the injection time is altered by a fixed amount. The amount is not dependent on the basic injection time.
- ◆ mul = multiplicative - The fault (e.g. faulty injector) has a stronger effect as engine speed rises. In the case of the multiplicative learned value this is a percentage change of the injection time. This change is dependent on the basic injection time.

Initiate learning process: control unit in basic setting (address word 04)

- ◆ Learning conditions for idling speed: engine idling, coolant temperature at least 75 °C, intake air temperature max. 90 °C.
- ◆ Learning conditions for part load: coolant temperature at least 75 °C, intake air temperature max. 90 °C.

Analysis of display group 032, display fields 1 and 2 - Lambda learned values

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
low learned values	◆ Low lambda idling speed learned values with normal lambda part load learned values: oil dilution (high concentration of fuel in oil) possible ◆ Injector leaking ◆ Fuel pressure too high ◆ Solenoid valve for activated charcoal filter constantly open ◆ Air mass meter faulty ◆ Lambda probe heater faulty or lambda probe dirty	- Disappears after driving on motorway or changing oil - Test injectors - Test fuel pressure regulator and holding pressure ⇒ page 24-20 - Test solenoid valve for activated charcoal filter ⇒ page 01-8, Final control diagnosis - Test air mass meter - Test lambda probe heater
high learned values	◆ High lambda idling speed learned values with less high lambda part load learned values: unmetered air in intake manifold area ◆ Injector leaking ◆ Display fields 1 and 2: air mass meter faulty ◆ Fuel pressure too low ◆ Unmetered air between air mass meter and throttle valve ◆ Unmetered air at manifold gasket ◆ Lambda probe heater faulty or lambda probe dirty	- Inspect intake system for leaks ⇒ page 24-25 - Test injected quantity ⇒ page 24-22 - Test air mass meter - Test fuel pressure regulator and holding pressure ⇒ page 24-20 - Eliminate unmetered air - Eliminate leakage - Test lambda probe heater ⇒ page 24-28

Display group 033, lambda control (lambda learned values)

All engines

• Engine idling • Engine code ARZ: control unit in function 08 „Read measured value block“						
Read measured value block 33 →				◀ Readout in display		
xx.x %		x.xxx V				
1	2	3	4	◀ Display fields	Specification	Analysis
					—	—
					—	—
					—	—
				Lambda probe voltage upstream of catalytic converter	0.000...1.000 V ¹⁾ 1.4...1.6 V	⇒ page 01-100
				Lambda controller upstream of catalytic converter	-10.0...10.0 %	⇒ page 01-100

1) Applies to engine code ARZ.

Note on display field 1:

- ♦ The readout must fluctuate by at least 2 % within the range -10.0...10.0 %.

Note on display field 1 for engine code ARZ:

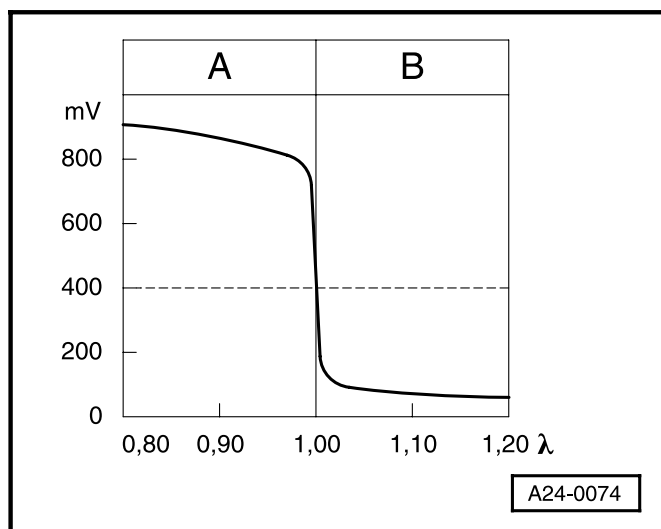
- ♦ The readout must fluctuate around zero. If 0 is always displayed, the lambda control has switched over from closed-loop to open-loop control because there is a fault in the lambda control. Interrogate fault memory ⇒ page 01-5.

Notes on display field 2 for engine codes ARZ and AUM:

- ♦ Readout of 1.500 V equals approximately lambda 1.
- ♦ Voltage signal „rich mixture“ (low level of residual oxygen) is at approx. 0.130...1.500 V.
- ♦ Voltage signal „lean mixture“ (large level of residual oxygen) is at approx. 1.500...4.800 V.

Notes on display field 2 for engine code ARZ:

- ♦ Voltage signal „rich mixture“ (low level of residual oxygen) is at approx. 0.7...1.0 V.
- ♦ Voltage signal „lean mixture“ (large level of residual oxygen) is at approx. 0.0...0.3 V.
- ♦ A voltage jump from 0.7...1.0 V to 0.0...+0.3 V, and vice versa, takes place at the transition from „rich“ to „lean“ and vice versa ($\lambda = 1.0$).
- ♦ In view of the steep voltage jump, the lambda control is not able to maintain constant the ideal mixture composition which corresponds to $\lambda = 1.0$. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.
- ♦ If the specifications are not achieved: conduct a test drive in order to eliminate any residues on the lambda probe, and repeat the test.

**◀ Voltage of 4-pin lambda probe U_λ in mV**

A: Lambda probe voltage high

- ♦ rich mixture (fuel excess or air deficiency)
- ♦ high CO concentration

B: Lambda probe voltage low

- ♦ lean mixture (fuel deficiency or air excess)
- ♦ low CO concentration

Analysis of display group 033, display field 1 - Lambda control - Sender upstream of catalytic converter

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
not within tolerance range	◆ Negative range: engine too rich, lambda control produces leaner mixture ◆ Positive range: engine too lean, lambda control produces richer mixture ◆ Unmetered air ◆ Injector faulty ◆ Lambda learned values at stop	- Wait 30 seconds until the readout has stabilised - Inspect intake system for leaks ⇒ page 24-25 - Test injected quantity ⇒ page 24-22 - Check lambda learned values in display group 032

Analysis of display group 033 for engine code ARZ, display field 2 - Voltage of lambda probe upstream of catalytic converter

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
constant 1.100 V	◆ Short circuit to positive caused by: lambda probe, lambda probe cable, earth cable, engine control unit	- Test lambda probe cable
constant 0.400...0.500 V	◆ Open circuit caused by: lambda probe, lambda probe cable, earth cable, engine control unit	
constant 0.000 V	◆ Short circuit to earth caused by: lambda probe, lambda probe cable, earth cable, engine control unit	

Note on display field 2:

- ◆ Voltage signal is conditioned and smoothed by engine control unit.

Analysis of display group 033, display field 2 - Voltage of lambda probe upstream of catalytic converter

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
greater than 4.800 V	◆ Short to positive in cable from engine control unit to lambda probe ◆ Lambda probe faulty	- Test cable of lambda probe upstream of catalytic converter - Replace lambda probe upstream of catalytic converter
less than 0.130 V	◆ Short to earth in cable from engine control unit to lambda probe ◆ Lambda probe faulty	

Display group 034, lambda control - Diagnosis of lambda probe ageing

Engine codes ARX and AUM

- Vehicle stationary, engine running at fast idling speed - Control unit in function 04 „Initiate basic setting“						
System in basic setting 34 →				◀ Readout in display		
xxxx rpm	xxx.x °C	x.xx	Text	◀ Display fields	Specification	Analysis
1	2	3	4	Result of test of lambda probe ageing before cat (Test OFF/ Test ON/B1-S1 o.k./B1-S1 n.o.k.)	B1-S1 o.k.	—
				Duration of period of lambda probe upstream of catalytic converter	0.50...2.50	—
				Catalytic converter temperature	greater than 350 °C	—
				Engine speed	2000 rpm	—

Note on display field 2:

- ♦ Value calculated from engine speed and engine load.

Note on display fields 3 and 4:

- ♦ The duration of the period indicates the time between two jumps (e.g. mixture rich - lean - rich) and is thus a measure of the lambda probe ageing. If the specified time is exceeded, this is shown in display field 4 = B1-S1 n.o.k.

Display group 036, lambda control - Preparation downstream of catalytic converter

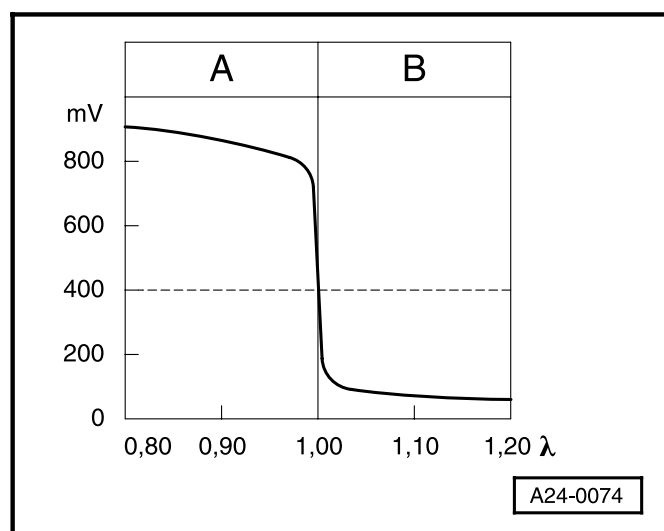
- Vehicle stationary, engine running at increased rpm - Control unit in function 04 „Initiate basic setting“						
System in basic setting 36 →				◀ Readout in display		
x.xxx V	Text			◀ Display fields	Specification	Analysis
1	2	3	4		—	—
					—	—
				Test lambda probe after cat (Test OFF/Test ON/B1-S2 o.k./ B1-S2 n.o.k.)	B1-S2 o.k.	—
				Voltage of lambda probe downstream of catalytic converter	0.000...1.000 V	⇒ page 01-102

Note:

- ♦ If the specifications are not achieved: conduct a test drive in order to eliminate any residues on the lambda probe, and repeat the test.

Notes on display field 1:

- ◆ Voltage signal „rich mixture (low level of residual oxygen)“ is at approx. 0.700...0.900 V.
- ◆ Voltage signal „lean mixture (large level of residual oxygen)“ is at approx. 0.000...0.300 V.
- ◆ A voltage jump from 0.700...0.900 V to 0.000...0.300 V and vice versa takes place at transition from „rich“ to „lean“ and vice versa ($\lambda = 1.0$).
- ◆ In view of the steep voltage jump, the lambda control is not able to maintain constant the ideal mixture composition which corresponds to $\lambda = 1.0$.
The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.



◀ **Voltage of 4-pin lambda probe U_λ in mV**

A: Lambda probe voltage high

- ◆ rich mixture (fuel excess or air deficiency)
- ◆ high CO level

B: Lambda probe voltage low

- ◆ lean mixture (fuel deficiency or air excess)
- ◆ low CO level

Analysis of display group 036, display field 1 - Voltage of lambda probe downstream of catalytic converter

Display field: 1	Possible cause of fault	Rectifying fault
constant 1.085 V	◆ Short circuit to positive caused by: Lambda probe Lambda probe cable Earth cable Engine control unit	- Test basic voltage of lambda probe downstream of catalytic converter ⇒ page 24-30 - Test cable to lambda probe downstream of catalytic converter
constant 0.400...0.500 V	◆ Open circuit caused by: Lambda probe Lambda probe cable Earth cable Engine control unit	
constant 0.000 V	◆ Short circuit to earth caused by: Lambda probe Lambda probe cable Earth cable Engine control unit	

Display group 037, diagnosis of lambda control system

Engine codes ARX and AUM

- Vehicle stationary, engine running at increased rpm - Control unit in function 04 „Initiate basic setting“						
System in basic setting 37 →				◀ Readout in display		
xx.x %	x.xxx V	x.xxx	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Test lambda probe (Test ON/Test OFF, Syst. o.k./Syst. n.o.k.)	Syst. o.k.	—
				Correction value between lambda probe upstream and downstream cat	less than 0.02	—
				Voltage of lambda probe downstream of cat	0.000...1.000 V	⇒ page 01-102
Engine load					13.0...40.0 %	

Notes:

- ♦ Maintain engine speed at approx. 2000 rpm for the test.
- ♦ If the specifications are not achieved: conduct test drive in order to eliminate any residues in the lambda probe, and repeat test.
- ♦ If the voltage of the lambda probe is o.k. also after the test drive and the correction value between lambda probe upstream and downstream of catalytic converter is more than 0.02, this means that the lambda probe upstream of the catalytic converter has aged.

Note on display field 2:

- ♦ Voltage of lambda probe downstream of catalytic converter may remain constant.

Analysis of display group 037, display field 2

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
constant 0.450 V	♦ Open circuit in cable 4 from engine control unit to lambda probe ♦ Open circuit in cable 3 from engine control unit to lambda probe	- Test basic voltage ⇒ page 24-30
greater than 0.950 V	♦ Short to positive in cable 4 from engine control unit to lambda probe	- Test cable to lambda probe downstream of catalytic converter
less than 0.100 V	♦ Short to earth in cable 4 from engine control unit to lambda probe	

Display group 041, lambda control (resistance of lambda probe heater)**All engines**

Read measured value block 41 →				◀ Readout in display		
Text		Text				
1	2	3	4	◀ Display fields	Specification	Analysis
				Lambda probe heater after cat	Htg. aC. OFF Htg. aC. ON	—
						—
				Lambda probe heater before cat	Htg. bC. OFF Htg. bC. ON	—
						—

Note:

Depending on the operating state of the engine, the lambda probe heaters are switched on or off, i. e. the readouts in display fields 2 and 4 may show either Htg.b(a)CON or alternately Htg.b(a)C ON or OFF.

Display group 043, diagnosis of ageing of lambda probe downstream of catalytic converter**Engine codes ARX and AUM**

- Vehicle stationary, engine running at increased rpm - Control unit in function 04 „Initiate basic setting“						
System in basic setting 43 →				◀ Readout in display		
xxxx rpm	xxx.x °C	x.xxx V	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Test lambda probe (Test OFF/ Test ON/B1-S2 o.k./B1-S2 n.o.k.)	B1-S2 o.k.	—
				Voltage of lambda probe downstream of catalytic converter	0.000...1.000 V	—
				Catalytic converter temperature	greater than 350 °C	—
				Engine speed	2000 rpm	—

Display group 046, lambda control - Diagnosis of catalytic converter**Engine codes ARX and AUM**

- Vehicle stationary, engine running at increased rpm - Control unit in function 04 „Initiate basic setting“			
System in basic setting 46 →			
xxxx rpm	xxx.x °C	x.xx	Text
1	2	3	4
◀ Readout in display			
◀ Display fields			
Result of cat conversion test (Test OFF/Test ON/Cat B1 o.k./Cat B1 n.o.k.)			
Specification			
Cat B1 o.k.			
Analysis			
—			
Learning step counter			
more than 1			
Catalytic converter temperature			
at least 440.0 °C			
Engine speed			
2000 rpm			

Display group 099, lambda control**Engine code ARZ**

Read measured value block 99 →			
xxxx rpm	xxx °C	xx %	Text
1	2	3	4
◀ Readout in display			
◀ Display fields			
Lambda control: ON/OFF Basic setting 04: λ ctl. OFF Read measured value block 08: λ ctl. ON			
Specification			
λ ctl. OFF λ ctl. ON			
Analysis			
—			
Lambda controller			
-10...+10 %			
Coolant temperature			
80...100 °C			
Engine speed			
640...820 rpm			

Notes on display group 099:

- ♦ For defined fault finding, the lambda control is switched off when display group 099 is selected in function 04 „Basic setting“, and switched on in function 08 „Read measured value block“.
- ♦ It is possible to switch back and forward between function 04 „Basic setting“ and function 08 „Read measured value block“ by pressing the keys 4 and 8 on vehicle system tester V.A.G 1552.

Display groups 050...066

All engines

Display group 050, engine speed control (operating states)

Read measured value block 50 →				◀ Readout in display		
xxxx rpm	xxx rpm	Text	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Operating state AC compressor ON/OFF	Compr. ON or Compr. OFF	—
				Operating state of air conditioning	A/C High or A/C Low	—
				Engine speed (idling speed specification) manual gearbox automatic gearbox	760 rpm 700 rpm	—
				Idling speed	—	⇒ page 01-85

Note on display field 2:

- ♦ What is displayed is the specification for the engine speed which is fixed by the engine control unit (internal calculated value of control unit). In exceptional cases the idling speed can be adapted. The idling speed with gear engaged is then also changed automatically.

Notes on display field 3:

- ♦ A/C High = air conditioning requesting high heating or cooling capacity
- ♦ A/C Low = air conditioning not switched on

Notes on display field 4:

- ♦ If the accelerator is depressed rapidly, the readout in display field 4 must jump for a few seconds from „ON“ to „OFF“ (AC compressor switched off during vehicle acceleration).
- ♦ „Compr. OFF“ is always displayed for vehicles not fitted with air conditioning.
- ♦ Test signal from AC compressor and to AC compressor.

Display group 054, engine speed control - Operating states

Engine code ARZ

Read measured value block 54 →				◀ Readout in display		
xxxx rpm	Text	xxx %	xxx %			
1	2	3	4	◀ Display fields	Specification	Analysis
				Throttle valve positioner angle	0...100 %	—
				Sender 1 for accelerator pedal position -G79	0...100 %	—
				Operating state (idling, part load, enr., overrun)	Text	—
				Engine speed (idling speed) manual gearbox automatic gearbox	700...2520 rpm 640...2520 rpm	—

Display group 055, engine speed control (idling speed stabilisation)**Engine code ARZ**

Read measured value block 55 →				◀ Readout in display		
xxxx rpm	xx.xx %	x.x %	xxxxx			
1	2	3	4	◀ Display fields	Specification	Analysis
				Operating states	xxxxx	⇒ page 01-107
				Learned value of idling speed controller air conditioning ON (A/C High) air conditioning OFF (A/C Low)	-6.0...6.0 % -3.0...3.0 %	—
				Idling speed controller	-4.30...12.20 %	—
Idling speed					—	⇒ page 01-85

Note on display field 3:

- ♦ In the case of a new engine the readout is in the positive range because of the higher friction, in the case of an engine which has been run in it is in the negative range.

Meaning of the 5-digit numerical block in display field 4

Meaning if display positions = 1					
1	2	3	4	5	Meaning
				1	AC compressor switched on
			1		Gear engaged
		1			Air conditioning switched on
	1				Ignore
1					PAS pressure switch switched on

Display group 056, engine speed control (idling speed stabilisation)**All engines**

Read measured value block 56 →				◀ Readout in display		
xxxx rpm	xxxx rpm	x.xx %	xxxxx			
1	2	3	4	◀ Display fields	Specification	Analysis
				Operating states	00000	—
				Idling speed controller	-4.30...12.20 %	—
				Idling speed - specification: ⇒ page 01-106; display group 050 ¹⁾ • 4x4 models with manual gearbox • models with automatic gearbox	— 770 rpm 700 rpm	—
Idling speed					—	⇒ page 01-85

¹⁾ Applies only to engine code ARZ.

Note on display field 2:

- ♦ What is displayed is the specified value of the engine speed which is fixed by the engine control unit (internal mathematical value in control unit).

Note on display field 4:

- ♦ Information flows from the automatic gearbox control unit into the engine control unit.

Meaning of the 5-digit numerical block in display field 4

Meaning if display positions = 1					
1	2	3	4	5	Meaning
				1	AC compressor: 1 = on, 0 = off
			1		Manual gearbox: always „0“ Automatic gearbox (position of selector lever): 0 = P or N; 1 = 1/2/3/D/R
		0			Always „0“
	0				Always „0“
0					Steering wheel position: 0 = straightahead, turned slightly to full lock; 1 = at full lock, when making U-turn

Display group 060, engine speed control (adapting throttle valve control unit¹⁾)**All engines**

• Ignition on, engine off						
System in basic setting 60 →				◀ Readout in display		
xx %	xx %	x	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Adaptation state (ADP runs, ADP o.k. or ADP ERROR)	ADP o.k.	—
				Learning step counter	0...8	—
				Throttle valve angle (potentiometer 2 -G188)	97...3 %	—
				Throttle valve angle (potentiometer 1 -G187)	3...93 %	—

¹⁾ Adapting engine control unit to throttle valve control unit ⇒ page 24-36.

Notes on display group 060:

- ♦ Carry out adaptation of throttle valve control unit when ignition switched on.
- ♦ When display group 060 is selected in function 04 „Initiate basic setting“, the throttle valve control unit is adapted to the engine control unit. This adaptation has to be performed if a different throttle valve control unit (or complete engine), or also a different engine control unit, has been installed.
- ♦ During adaptation the learning step counter in display group 3 counts up to 8.

Note on display field 4:

- ♦ If „ERROR“ appears in the display, interrogate fault memory ⇒ page 01-5.

Display group 061, engine speed control (adapting throttle valve control unit)**Engine code ARZ**

• Ignition on, engine off						
Read measured value block 61 →				◀ Readout in display		
xxxx rpm	xx.x V	xxx %	xxxxx			
1	2	3	4	◀ Display fields	Specification	Analysis
				Operating states	xxxxx	—
				Throttle valve angle (potentiometer 1 -G187)	0...100 %	—
				Supply voltage of engine control unit	12.0...15.0 V	—
Engine speed, display group 022					—	⇒ page 01-94

Display group 062, electronic throttle system**All engines**

• Ignition on, engine off						
Read measured value block 62 →				◀ Readout in display		
xx %	xx %	xx %	xx %			
1	2	3	4	◀ Display fields	Specification	Analysis
				Sender 2 for accelerator pedal position -G185	4...49 %	—
				Sender 1 for accelerator pedal position -G79	12...97 %	—
				Throttle valve angle (potentiometer 2 -G188)	97...3 %	—
				Throttle valve angle (potentiometer 1 -G187)	3...93 %	—

Notes:

- ♦ The percentage readout in display field 1 must rise evenly. The tolerance range 3...93 % is not fully utilised in this case.
- ♦ The percentage readout in display field 2 must drop evenly. The tolerance range 97...3 % is not fully utilised in this case.
- ♦ The percentage readout in display field 3 must rise evenly. The tolerance range 12...97 % is not fully utilised in this case.
- ♦ The percentage readout in display field 4 must also rise evenly. The tolerance range 4...49 % is not fully utilised in this case.
- ♦ The readout displayed in display field 3 must always be approximately twice as much as the readout in display field 4.

Models fitted with automatic gearbox

Display group 063, engine speed control

Note on display group 063:

- ♦ Applies to vehicles fitted with automatic gearbox.

- Ignition on, engine off - Control unit in function 04 „Initiate basic setting“			
System in basic setting 63 →			
xx %	xx %	Text	Text
1	2	3	4
◀ Readout in display			
◀ Display fields			
Operating state (<i>pedal; after, ERROR, ADP. runs, ADP o.k.</i>)			
Accelerator pedal position			
Throttle valve angle (potentiometer 2 -G188) ¹⁾			
Kickdown learned values sender 1 for accelerator pedal position -G79			
Throttle valve angle (potentiometer 1 -G187) ¹⁾			
Sender 1 for accelerator pedal position -G79			
		Specification	
		Analysis	
		ADP o.k.	—
		Kickdown	—
		-25...25 % ¹⁾	—
		79...94 %	—
		-25...25 % ¹⁾	—
		79...94 %	—

¹⁾ Readouts apply only to engine code ARZ.

Notes on display field 4:

- ♦ If „ERROR“ appears in the display, interrogate fault memory ⇒ page 01-5.
- ♦ „ERROR“ may be displayed if, in the case of readout „Pedal; after“ the accelerator pedal is not depressed immediately or is released as soon as adaptation has been performed. In both cases, adaptation must be repeated.

Display group 066, cruise control system

All engines

Read measured value block 66 →			
xxx km/h	xxxxxxx	xxx km/h	xxxxxxx
1	2	3	4
◀ Readout in display			
◀ Display fields			
CCS switch position			
Specified vehicle speed (speed last stored by CCS)			
Switch position of CCS, brake and clutch			
Vehicle speed			
		Specification	
		Analysis	
		0000 ¹⁾ xxxxxxx	⇒ page 01-111 ¹⁾ , 01-112
		—	—
		1000 ¹⁾ xxxx1000	⇒ page 01-111 ¹⁾ , 01-112
		0 km/h	—

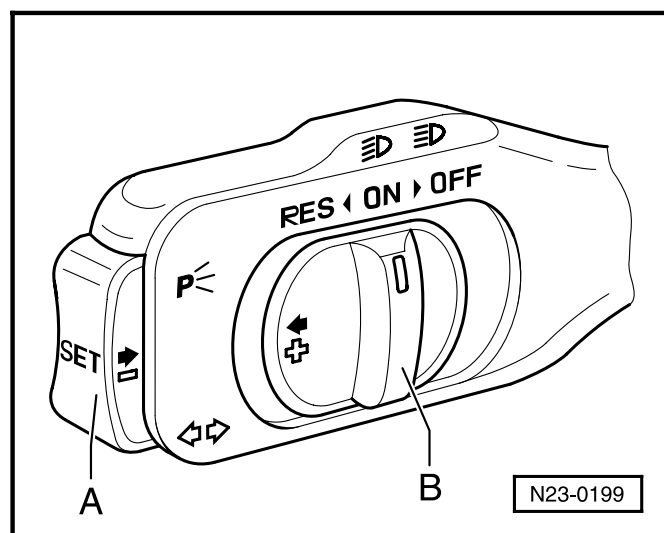
¹⁾ Applies only to engine code ARZ.

Note:

- ♦ With the exception of an operating switch, the CCS does not have any components of its own. All the functions are performed by the engine control unit. A minimum vehicle speed of 30 km/h is required for the CCS function.

Analysis of the 4-digit numerical block for engine code ARZ - Display field 066, display field 2

Meaning of the digits in the 4-digit numerical block				
1	2	3	4	Meaning
			1	Brake pedal depressed (brake light switch)
		1		Brake pedal depressed (brake switch)
	1			Clutch depressed, or brake pedal depressed if automatic gearbox
1				CCS actuated

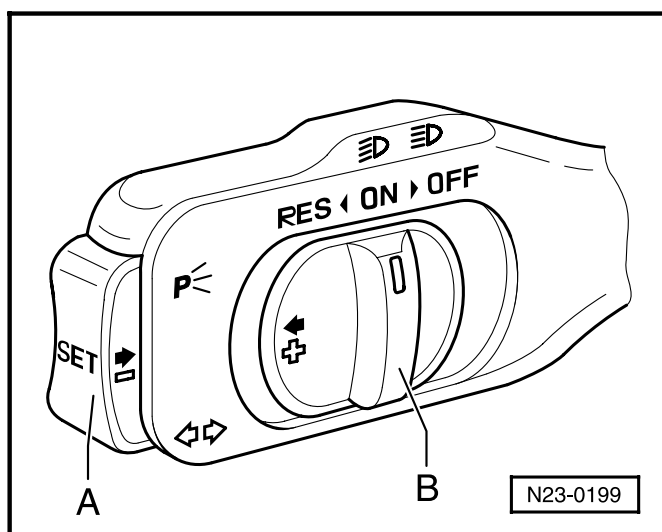
Analysis of 4-digit numerical block for engine code ARZ - Display group 066, display field 4

Meaning of the digits in the 4-digit numerical block				
1	2	3	4	Meaning
			1	CCS switch set to „OFF“ (only if closed)
		1		CCS switch set to „OFF“ (when closing or closed)
	1			„SET“ button pressed
1				CCS switch to „RES“

- ♦ CCS function ⇒ Owners Manual.

Analysis of the 8-digit numerical block - Display group 066, display field 2

Meaning of the digits in 8-digit numerical block								Meaning
1	2	3	4	5	6	7	8	
							1	• Brake pedal depressed (brake light switch)
						1		• Brake pedal depressed (brake pedal switch)
					1			• Clutch pedal depressed
				1				• CCS actuated
			x					Ignore
		x						Ignore
	x							Ignore
x								Ignore



Analysis of the 8-digit numerical block - Display group 066, display field 4

Meaning of the digits in 8-digit numerical block								Meaning
1	2	3	4	5	6	7	8	
				0	0	1	1	• Switch B to „ON“
				1	0	1	1	• Switch B to „RES“
				0	1	1	1	• Switch A operated
				0	0	0	1	• Switch B to „OFF“ before operating point
				0	0	0	0	• Switch B locked in position „OFF“
			0					Ignore
		0						Ignore
	0							Ignore
0								Ignore

Display group 070, exhaust reduction - Diagnosis of activated charcoal filter system

Engine codes ARX and AUM

• Engine idling • Coolant temperature at least 80 °C • Control unit in function 04 „Initiate basic setting“						
System in basic setting 70 →				◀ Readout in display		
xx %	xx.x %	-	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Result of diagnosis (Test ON/Test OFF/TVV o.k./TVV n.o.k. or Abort)	TVV o.k.	—
						—
Lambda controller variation with TVV diagnosis					-7.0 %...7.0 %	—
On/off ratio of activated charcoal filter solenoid valve					0...100 %	—

Note on display group 070:

- ♦ TVV means tank vent valve (activated charcoal filter solenoid valve). Diagnosis can be initiated only once each time engine is started.

Note on display field 2:

- ♦ During the diagnosis the readout must be less than -7.0 % or greater than 7.0 %.

Display group 077, diagnosis of secondary air injection system

Engine codes ARX and AUM

• Engine idling • Control unit in function 04 „Initiate basic setting“						
System in basic setting 77 →				◀ Readout in display		
xxxx rpm	x.x g/s	xx.x %	Text			
1	2	3	4	◀ Display fields	Specification	Analysis
				Result of test: Test ON/Test OFF/Syst. o.k./Syst. n.o.k./Abort)	Syst. o.k.	—
Air mass ratio, secondary air injection system				➤ 04.01 05.01 ➤	greater than -20.0 % -100...100 %	—
Air mass				➤ 04.01 05.01 ➤	2.0...5.0 g/s 1...10 g/s	—
Engine speed (idling speed)					—	⇒ page 01-85

Note on display field 4:

- ♦ If „Syst. n.o.k.“ appears in the display, interrogate fault memory ⇒ page 01-5.

Display group 086 - Readiness code

For engine with engine identification characters ARX and AUM

• Ignition switched on, engine switched off						
Reading measured value block 86 →				◀ Read-out in display		
00000000 xxxxxxxx xxxxxxxx -						
1	2	3	4	◀ Display field	Nominal value	Evaluation
					—	—
Diagnosis status					xxxxxxx	—
Diagnosis status					xxxxxxx	—
Readiness code (text completed)					00000000	⇒ page 01-114

Note on display field 1:

- ♦ Display field 1 indicates systems on which a test must be performed if the display indicates „1“ instead of „0“.

Evaluation of 8-digit numerical block for readiness code - display group 086, display field 1

Readiness code is only generated if a 0 is shown at all places								
1	2	3	4	5	6	7	8	Checked system
							0	Catalytic converter
						0		Always „0“
					0			Activated charcoal filter system (Tank ventilation system)
				0				Secondary air injection system
			0					Always „0“
		0						Lambda probes
	0							Lambda probe heater
0								Always „0“

Display groups 113...118

Display group 113, charge pressure control

• Vehicle driven						
Read measured value block 113 xxxx rpm xxx % xxx % xxxx mbar				→ ◀ Readout in display		
1	2	3	4	◀ Display fields	Specification	Analysis
				Atmospheric pressure	500...1200 mbar	⇒ page 01-115
				Throttle valve angle (potentiometer 1 -G187)	0...100 %	—
				Engine load	15...175 % ¹⁾ 10...150 %	—
				Engine speed	640...6800 rpm ¹⁾ 700...6800 rpm	—

¹⁾ Applies only to engine code ARZ.

Analysis of display group 113, display field 4 - Atmospheric pressure

Altitude above MSL	Atmospheric pressure
0 m	998 mbar
500 m	954 mbar
1000 m	902 mbar
1500 m	853 mbar
2000 m	805 mbar
2500 m	756 mbar
3000 m	704 mbar
3500 m	655 mbar
4000 m	607 mbar

Note:

The readout may differ depending on atmospheric conditions.

Display group 114, charge pressure control

• Vehicle driven						
Read measured value block 114 →				◀ Readout in display		
xxx %	xxx %	xxx %	xxx %			
1	2	3	4	◀ Display fields	Specification	Analysis
				On/off ratio (actuation) of charge pressure control solenoid valve	0...100 %	—
				Momentary engine load (controlled to specified engine load by charge pressure)	15...175 % ¹⁾ 10...150 %	—
				Specified engine load depending on repairs (reduced by knock control, altitude adaptation and coolant temperature)	max. 175 % ¹⁾ 10...150 %	—
				Specified engine load (readout in display depending on accelerator pedal position)	max. 175 % ¹⁾ 10...150 %	—

¹⁾ Applies only to engine code ARZ.

Display group 115, charge pressure control

• Vehicle driven						
Read measured value block 115 →				◀ Readout in display		
xxxx rpm	xxx %	xxxx mbar	xxxx mbar			
1	2	3	4	◀ Display fields	Specification	Analysis
				Charge pressure - momentary value	max. 2000 mbar ¹⁾ 990...2200 mbar	—
				Charge pressure - specification	990...2000 mbar ¹⁾ 990...2200 mbar	—
				Engine load	15...175 % ¹⁾ 10...150 %	—
				Engine speed	640...6800 rpm ¹⁾ 700...6800 rpm	—

¹⁾ Applies only to engine code ARZ.

Display group 117, charge pressure control

• Vehicle driven						
Read measured value block 117 →				◀ Readout in display		
xxxx rpm	xxx %	xxx %	xxxx mbar			
1	2	3	4	◀ Display fields	Specification	Analysis
				Charge pressure - specification	990...2000 mbar ¹⁾ 990...2200 mbar	—
				Throttle valve angle (potentiometer 1 -G187)	0...100 %	—
				Sender 1 for accelerator pedal position -G79	0...100 %	—
Engine speed					640...6800 rpm ¹⁾ 700...6800 rpm	—

¹⁾ Applies only to engine code ARZ.

Display group 118, charge pressure control

• Vehicle driven						
Read measured value block 118 →				◀ Readout in display		
xxxx rpm	xxx °C	xxx %	xxxx mbar			
1	2	3	4	◀ Display fields	Specification	Analysis
				Charge pressure - momentary value	max. 2000 mbar ¹⁾ max. 2200 mbar	—
				On/off ratio (actuation) of charge pressure control solenoid valve	0...100 % ¹⁾ 0...95 %	—
				Intake air temperature	max. 110 °C	—
Engine speed					640...6800 rpm ¹⁾ 700...6800 rpm	—

¹⁾ Applies only to engine code ARZ.

Display groups 120...126

Display group 120, traction control system -TCS-

• Vehicle driven						
Read measured value block 120 xxxx rpm xxx Nm xxx Nm Text				→ ◀ Readout in display		
1	2	3	4	◀ Display fields	Specification	Analysis
				Status (TCS active/TCS n. active)	Text	—
				Actual engine load	0...260 Nm	—
				Specified engine load	0...399 Nm ¹⁾ 0...440 Nm	—
Engine speed					640...6800 rpm ¹⁾ 700...6800 rpm	—

¹⁾ Applies only to engine code ARZ.

Display group 122, gearbox (only automatic gearbox)

• Vehicle driven						
Read measured value block 122 xxxx rpm xxx Nm xxx Nm Text				→ ◀ Readout in display		
1	2	3	4	◀ Display fields	Specification	Analysis
				Status (engine ctrl./no ctrl.)	Text	—
				Actual engine load	0...260 Nm	—
				Specified engine load	0...399 Nm ¹⁾ 0...440 Nm	—
Engine speed					640...6800 rpm ¹⁾ 700...6800 rpm	—

¹⁾ Applies only to engine code ARZ.

Display group 125, communication - databus messages

Engine codes ARX and AUM

• Engine idling						
Read measured value block 125 →				◀ Readout in display		
—	Text	Text	—			
1	2	3	4	◀ Display fields	Specification	Analysis
					—	—
Instrument cluster status					Combi 1	⇒ page 01-119
ABS status					ABS 1	⇒ page 01-119
					—	—

Display group 126, communication - databus messages

Engine codes ARX and AUM

• Engine idling						
Read measured value block 126 →				◀ Readout in display		
—	—	Text	—			
1	2	3	4	◀ Display fields	Specification	Analysis
					—	—
Airbag status					Airbag 1	⇒ page 01-119
					—	—
					—	—

Analysis of display groups 125 and 126

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
0 instead of 1	◆ Fault in CAN databus cable ◆ CAN databus not used - control unit ◆ CAN databus faulty - control unit	- Perform automatic test sequence of all fault memories

Repairing the injection system

Repairing the ignition part

⇒ Repair Group 28

Notes:

- ◆ *The control unit for the injection and ignition system is equipped with a fault memory. Before repairs, setting operations and fault finding interrogate the fault memory and inspect the vacuum connections (unmetered air).*
- ◆ *Do not use sealants containing silicone. Traces of silicone elements drawn in by the engine are not burnt in the engine and damage the lambda probe.*
- ◆ *Components marked with an * are checked by self-diagnosis ⇒ page 01-5, interrogating fault memory.*
- ◆ *Components marked with an ** are checked by actuator diagnosis ⇒ page 01-8.*
- ◆ *A minimum voltage of 11.5 V is required for perfect functioning of the electrical components.*
- ◆ *If after fault finding, repair or inspection of components the engine starts briefly and then stops, it is possible that the immobiliser blocks the engine control unit. Then interrogate the fault memory and if necessary adapt the control unit ⇒ page 24-36.*
- ◆ *Certain inspections may cause the control unit to detect and store a fault. It is therefore necessary to interrogate the fault memory after having completed all inspections and repairs, and if necessary delete ⇒ page 01-5, interrogate and erase fault memory.*

Safety measures ⇒ page 24-9.

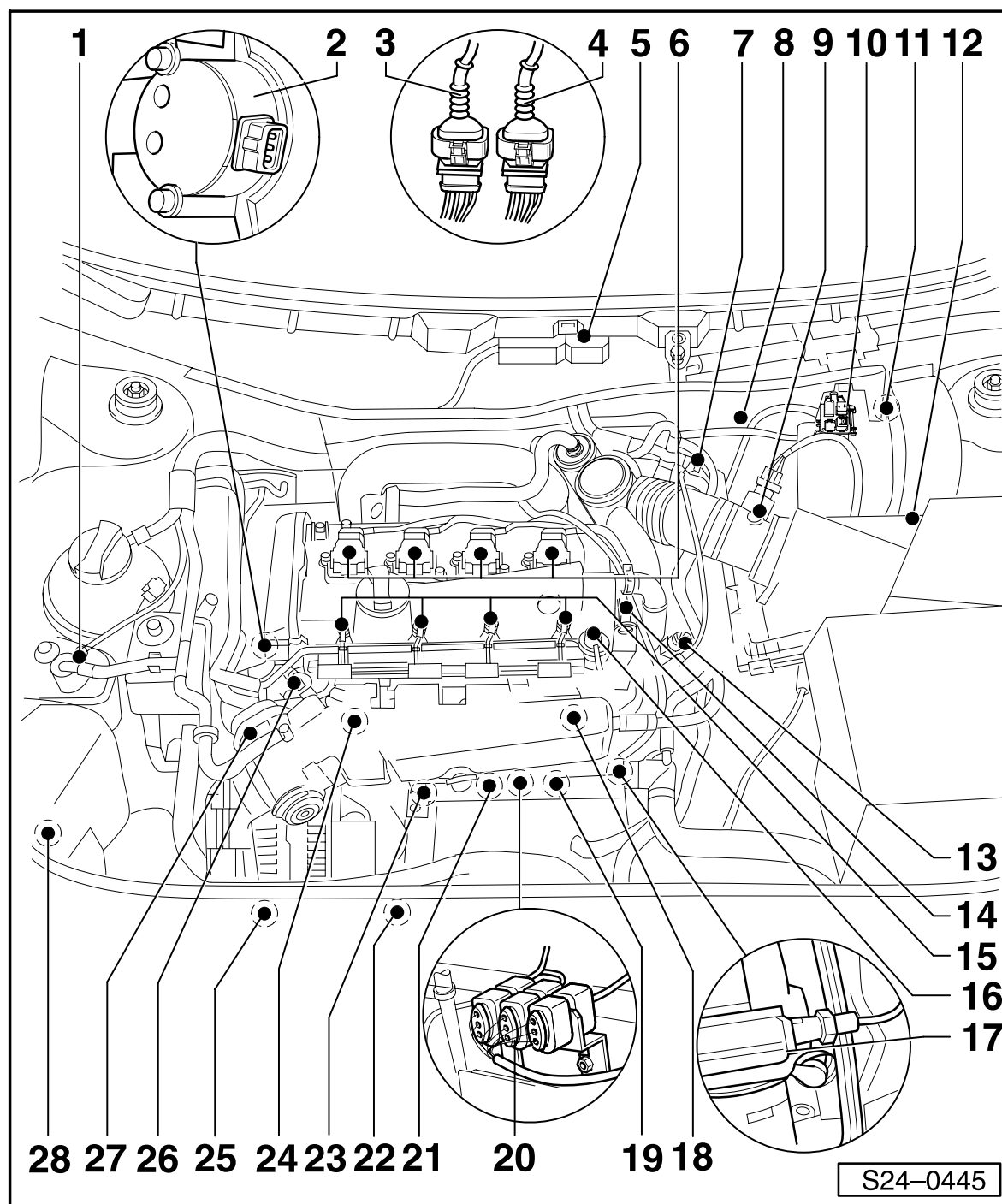
Rules of cleanliness ⇒ page 24-9.

Testing intake system for tightness (unmetered air) ⇒ page 24-25.

Whenever the fault memory is erased, it is necessary to generate a readiness code ⇒ page 01-41.

Servicing fuel injection system

Survey of fitting locations



S24-0445

1 - Solenoid valve 1 for activated charcoal filter -N80

- ◆ activated charcoal filter system
- ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20
- ◆ desired resistance 22...30 Ω

2 - Hall sender -G40

- ◆ ⇒ page 28-3, item 20

3 - Connector

- ◆ black for lambda probe 1 upstream of catalytic converter -G39 and lambda probe heater -Z19
- ◆ on underside of vehicle on right below a cover

4 - 4-pin plug connection

- ◆ for engine codes ARZ, ARX, AUM
- ◆ brown for lambda probe 2 downstream of catalytic converter -G130 and lambda probe heater -Z29
- ◆ on underside of vehicle below a cover

5 - Engine control unit -J220**6 - Ignition coils with power output stage -N70, -N127, -N291 and -N292**

- ◆ for engine code AGU, ignition coils -N, -N128, -N158 and -N163
- ◆ ⇒ page 28-2, item 10

7 - Charge pressure control solenoid valve -N75

- ◆ specified resistance 25...35 Ω

8 - Altitude sender -F96

- ◆ for engine code AGU

9 - Air mass meter -G70**10 - Secondary air injection pump relay -J299**

- ◆ for engine codes ARZ, ARX, AUM

11 - Clutch pedal switch -F36, brake light switch -F and brake pedal switch -F47**12 - Power output stage -N122**

- ◆ for engine code AGU
- ◆ ⇒ page 28-2, item 2
- ◆ at air filter housing

13 - Coolant temperature sender -G62**14 - Camshaft adjustment solenoid valve**

- ◆ for engine code ARX, AUM
- ◆ specified resistance 12...18 Ω

15 - Injector -N30...-N33**16 - Fuel pressure regulator****17 - Engine speed sender -G28**

- ◆ inductive sensor
- ◆ specified resistance between contacts 2 + 3:
engine code AGU: 480...1000 Ω
engine codes ARZ, ARX, AUM:
730...1000 Ω

18 - Knock sensor 2 -G66

- ◆ ⇒ page 28-2, item 16
- ◆ specified resistance between contacts 1 + 2, 1 + 3 and 2 + 3: ∞ Ω
- ◆ resistance cannot be measured at 2-pin connector

19 - Turbocharger solenoid valve -N249

- ◆ for engine codes ARZ, ARX, AUM

20 - 3-pin plug connection

- ◆ for engine codes AGU, ARZ
- ◆ brown for knock sensor 1 -G61
- ◆ black for knock sensor 2 -G66
- ◆ grey for engine speed sender -G28

21 - 3-pin plug connection

- ◆ for engine codes ARX, AUM
- ◆ grey for engine speed sender -G28
- ◆ inductive sensor

22 - Secondary air injection pump -V101

- ◆ for engine codes ARZ, ARX, AUM

23 - Secondary air injection valve -N112

- ◆ for engine codes ARZ, ARX, AUM

24 - Knock sensor 1 -G61

- ◆ ⇒ page 28-2, item 15
- ◆ specified resistance between contacts 1 + 2, 1 + 3 and 2 + 3: ∞ Ω
- ◆ resistance cannot be measured at 2-pin connector

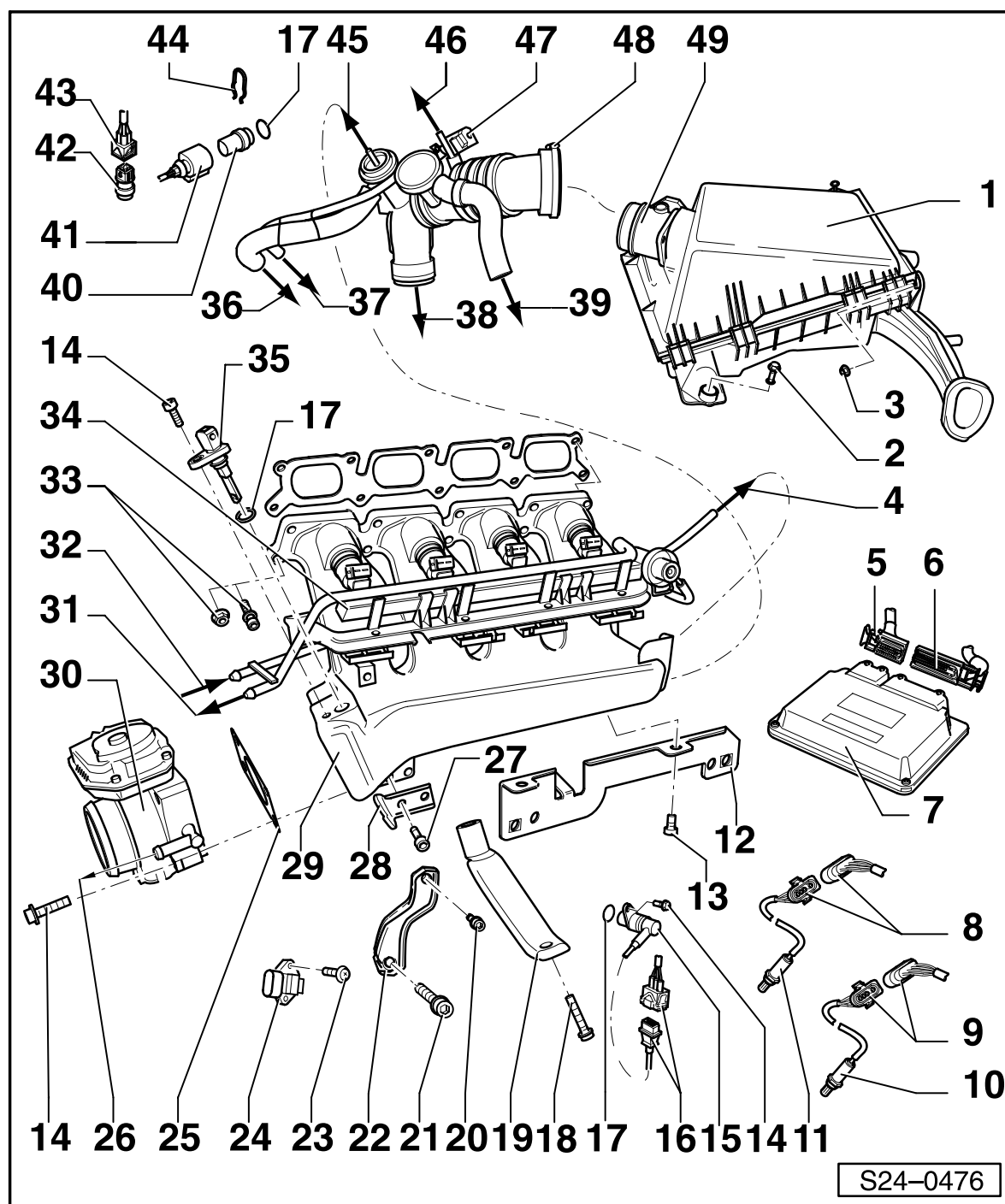
25 - PAS pressure switch -F88

- ◆ specified resistance ∞ Ω
- ◆ steering at full lock 0 Ω

26 - Intake air temperature sender -G42**27 - Throttle valve control unit -J338****28 - Charge pressure sender -G31**

- ◆ for engine codes ARZ, ARX, AUM

Parts of fuel injection system - assembly overview



S24-0476

1 - Air filter

- ♦ removing and installing ⇒ page 24-8

2 - 10 Nm

3 - 6 Nm

4 - Vacuum hose

- ♦ to intake manifold

5 - Connector

- ♦ for engine code AGU: 28-pin

- ♦ for engine codes ARX, ARX, AUM: 40-pin

- ♦ switch ignition off before unplugging or plugging in connector

- ♦ release to unplug

6 - Connector

- ♦ for engine code AGU: 52-pin

- ♦ for engine codes ARX, ARX, AUM: 81-pin

- ♦ switch ignition off before unplugging or plugging in connector

- ♦ release to unplug

7 - Motronic control unit -J220*

- ◆ fitting location: in middle of plenum chamber
- ◆ testing voltage supply ⇒ page 24-18
- ◆ procedure in the case of interruption to voltage supply ⇒ page 24-19
- ◆ after replacing, perform basic setting ⇒ page 24-36
- ◆ replacing ⇒ page 24-33

8 - 4-pin plug connection

- ◆ for engine codes ARZ, ARX, AUM
- ◆ brown for lambda probe downstream of catalytic converter -G130 and lambda probe heater -Z29
- ◆ fitting location ⇒ page 24-2, Survey of fitting locations

9 - Connector

- ◆ for engine codes AGU, ARZ: 4-pin
- ◆ for engine codes ARX, AUM: 6-pin
- ◆ black for lambda probe 1 upstream of catalytic converter -G39 and lambda probe heater -Z19
- ◆ fitting location ⇒ page 24-2, Survey of fitting locations

10 - Lambda probe 1 upstream of catalytic converter -G39*, 50 Nm

- ◆ fitting location: in front exhaust pipe
- ◆ coat only thread with high-temperature bolt paste „G 052 112 A3“; high-temperature bolt paste must not get into the slots of the probe body
- ◆ testing lambda probe and lambda control ⇒ page 24-28
- ◆ voltage for probe heater supplied through fuel pump relay -J17

11 - Lambda probe 2 downstream of catalytic converter -G130*, 50 Nm

- ◆ for engine codes ARZ, ARX, AUM
- ◆ fitting location: downstream of catalytic converter
- ◆ coat only thread with high-temperature bolt paste „G 052 112 A3“; high-temperature bolt paste must not get into the slots of the probe body
- ◆ testing lambda probe and lambda control ⇒ page 24-30
- ◆ voltage for probe heater supplied through fuel pump relay -J17

12 - Bracket**13 - 10 Nm****14 - 10 Nm****15 - Engine speed sender -G28*****16 - 3-pin plug connection**

- ◆ grey
- ◆ for engine speed sender
- ◆ fitting location ⇒ page 24-2, Survey of fitting locations

17 - O-ring

- ◆ replace if damaged

18 - 20 Nm

- ◆ for engine code AGU

19 - Support

- ◆ for engine code AGU
- ◆ between intake manifold and engine block

20 - 20 Nm

- ◆ for engine codes ARZ, ARX, AUM

21 - 45 Nm

- ◆ for engine codes ARZ, ARX, AUM

22 - Support

- ◆ for engine codes ARZ, ARX, AUM
- ◆ between intake manifold and engine block

23 - 6 Nm**24 - Charge pressure sender -G31****25 - Gasket**

- ◆ replace

26 - From activated charcoal filter solenoid valve -N80

- ◆ connecting activated charcoal filter:
⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20

27 - 10 Nm

- ◆ for engine code AGU

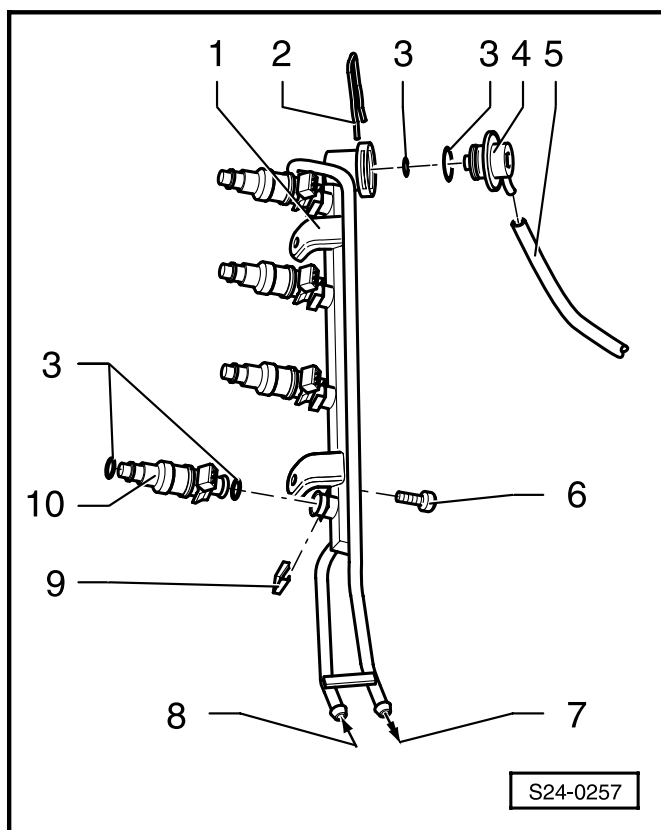
28 - Support

- ◆ for engine code AGU
- ◆ for throttle cable

29 - Intake manifold

- 30 - Throttle valve control unit -J338***
- ◆ testing ⇒ page 24-15
 - ◆ if replaced, adapt engine control unit ⇒ page 24-36
 - ◆ for engine code AGU, with pulley for throttle cable
- 31 - Return-flow line**
- ◆ secure with spring strap clips
 - ◆ ensure tightly installed
 - ◆ to fuel delivery unit:
- ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20
- 32 - Feed line**
- ◆ secure with spring strap clips
 - ◆ from fuel filter:
- ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20
- 33 - 10 Nm**
- 34 - Fuel rail with injectors**
- ◆ disassembling and assembling ⇒ page 24-7
- 35 - Intake air temperature sender -G42**
- 36 - To pipe between turbocharger and charge air cooler**
- 37 - To pipe between turbocharger and charge air cooler**
- 38 - To turbocharger**
- 39 - To crankcase ventilation**
- 40 - Coolant temperature sender -G62***
- ◆ for engine codes ARZ, ARX, AUM
 - ◆ blue
 - ◆ with coolant temperature gauge sender -G2
 - ◆ before removing, release pressure in cooling system
 - ◆ specified resistances ⇒ page 24-8
- 41 - 4-pin plug connection**
- ◆ for engine codes ARZ, ARX, AUM
 - ◆ black
 - ◆ for coolant temperature sender -G62
- 42 - Coolant temperature sender -G62***
- ◆ for engine code AGU
 - ◆ blue
 - ◆ with coolant temperature gauge sender -G2
 - ◆ before removing, release pressure in cooling system
 - ◆ specified resistances ⇒ page 24-8
- 43 - 4-pin plug connection**
- ◆ for engine code AGU
 - ◆ black
 - ◆ for coolant temperature sender -G62
- 44 - Retaining clamp**
- ◆ ensure tightly fitted
- 45 - To turbocharger solenoid valve -N249**
- 46 - To turbocharger pressure unit**
- ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 21
- 47 - Charge pressure control solenoid valve -N75*/****
- 48 - Intake hose**
- ⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 21
- 49 - Air mass meter -G70***
- ◆ 5-pin connector

Disassembling and assembling fuel rail with injectors



1 - Fuel rail

2 - Retaining clamp

- ◆ ensure tightly installed

3 - O-ring

- ◆ replace if damaged

4 - Fuel pressure regulator

- ◆ testing fuel pressure regulator and holding pressure ⇒ page 24-20

5 - Vacuum hose

6 - 10 Nm

7 - Return-flow line connection

8 - Feed line connection

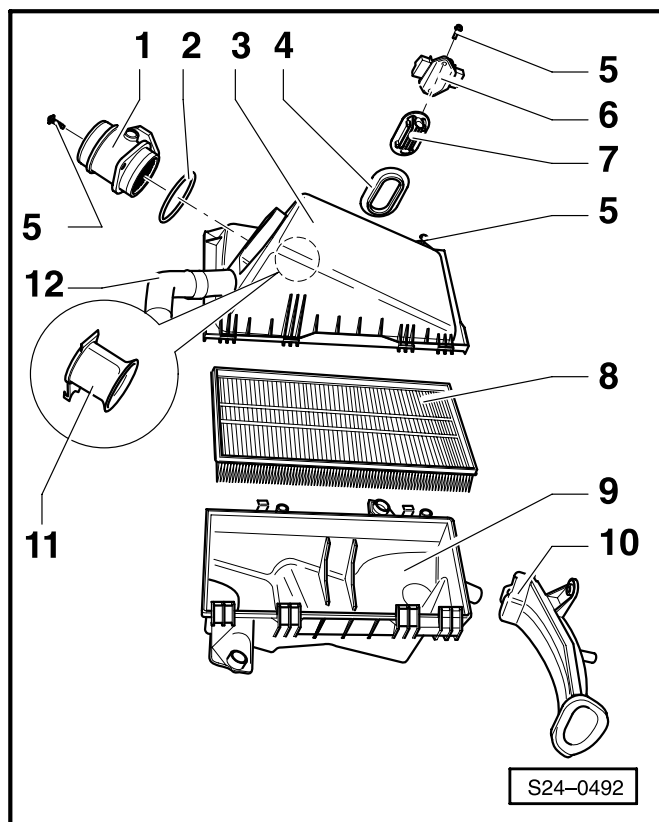
9 - Retaining clamp

- ◆ ensure injectors tightly installed in rail

10 - Injector -N30...-N33*/**

- ◆ specified resistance 12...17 Ω (at approx. 20 °C)
- ◆ resistance increases by 4...6 Ω when engine warm

Removing and installing air filter and air mass meter



1 - Air mass meter -G70*

2 - Seal

3 - Top part of air filter

4 - Rubber ring
♦ for engine code AGU

5 - 6 Nm

6 - Power output stage -N122
♦ for engine code AGU
♦ ⇒ page 28-2, item 2

7 - Heat sink
♦ for engine code AGU
♦ ensure tightly installed

8 - Filter element

9 - Bottom part of air filter

10 - Air guide
♦ to lock carrier

11 - Air guide
♦ in top part of air filter

12 - Pipe to secondary air injection pump

Resistances for coolant temperature sender -G62 and intake air temperature sender -G42

Chart is split into two temperature ranges:

A - 0...50 °C

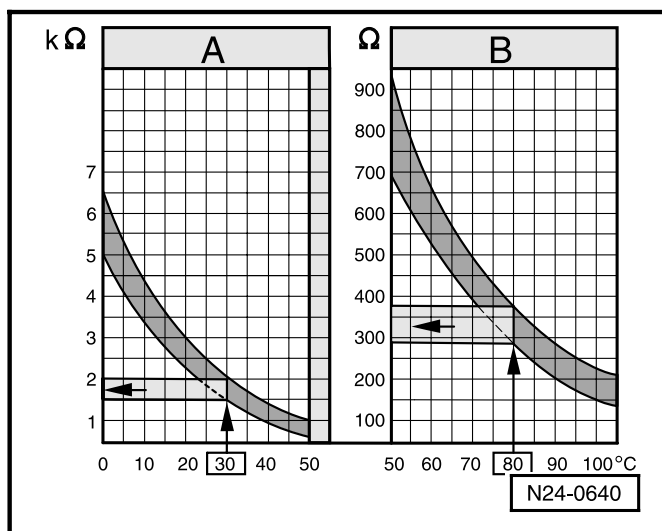
B - 50...105 °C

Example:

♦ at a temperature of 30 °C the specification in range A is 1.5...2.0 kΩ

♦ at a temperature of 80 °C the specification in range B is 290...375 Ω

♦ Contacts for measuring resistance of sender -G62: engine code AGU: 1 + 3
engine codes ARZ, ARX, AUM: 3 + 4



Safety precautions

Warning!

Fuel system is pressurized! Place cleaning cloths around the connection point before slackening hose connections. Then, release pressure by carefully detaching the connection point.

⇒ Safety precautions, ignition system, Repair Group 28.

Rules for cleanliness

Pay careful attention to the following „5 rules“ for cleanliness when working on the fuel supply and injection system:

- ◆ Thoroughly clean connection points and surrounding area before disconnecting.
- ◆ Place removed parts down on a clean base and cover over. Do not use fluffing cloths!
- ◆ Carefully cover over or seal opened components if repairs are not performed immediately.
- ◆ Install only clean parts:
Do not remove replacement parts from their wrapping until just before installing.
Do not use parts which have been stored unwrapped (e.g. in tool boxes etc.).
- ◆ If the system is opened:
Avoid working with compressed air, if possible.
Avoid moving the vehicle, if possible.

Testing cables and components test box

Engine code AGU

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/22 or V.A.G 1598/31

Notes:

- ◆ *For testing, use e.g. hand-held multimeter V.A.G 1526 A, or voltage tester e.g. V.A.G 1527 B.*
- ◆ *For connecting the testers to the test box, use adapter cables from adapter cable set, e.g. V.A.G 1594 A.*

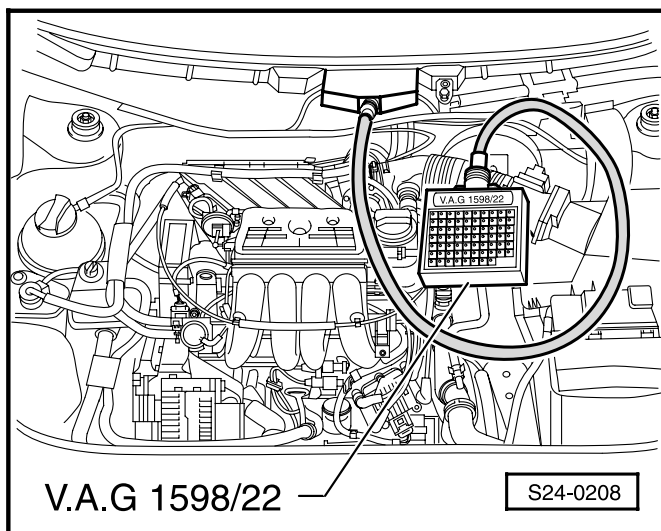
- ♦ The contact numbers of the connector of the control unit and the socket numbers of the test box are identical.

- Detach the windscreen wiper arms and remove the cover from the plenum chamber
⇒ Body Fitting Work; Repair Group 66; Trim Panels.

- Switch off ignition (if not already off) and unplug connector from control unit.

- ◀ Connect test box V.A.G 1598/22 to the connector of the wiring loom.

- Carry out test as described in the particular repair procedures.



Warning!

In order to avoid destroying the electronic components, switch on the particular measuring range before connecting the test cables, and pay attention to the test conditions.

Note:

After re-connecting the engine control unit, it is necessary to adapt the engine control unit to the throttle valve control unit ⇒ page 24-36.

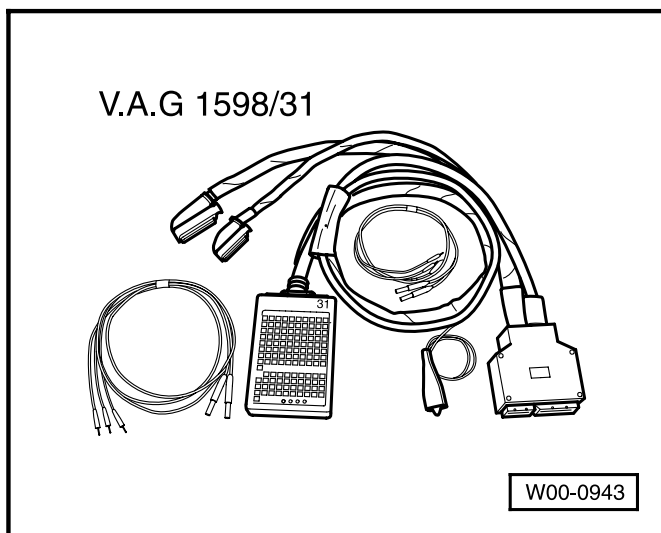
Engine codes ARZ, ARX, AUM

Special tools, testers and aids required

- ◀ ♦ Test box V.A.G 1598/31

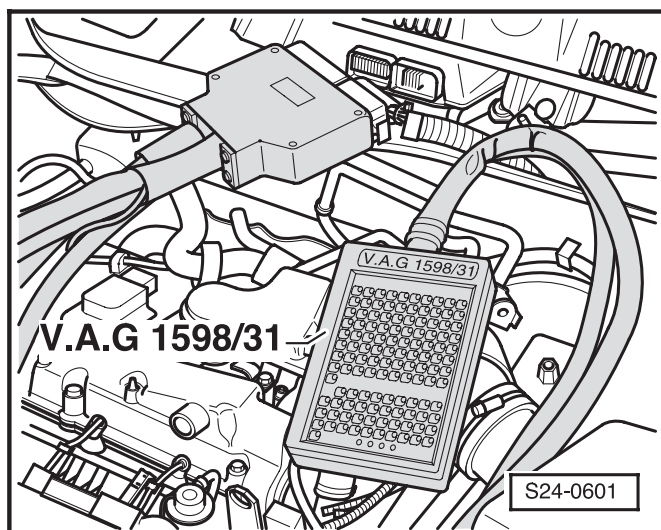
Notes:

- ♦ Test box V.A.G 1598/31 is designed in such a way that it can be connected at the same time to the wiring loom to the engine control unit, and to the engine control unit itself.
- ♦ The advantage which this offers is that the electronic engine management system remains fully operational when the test box is connected (e.g. measuring signals when engine running).
- ♦ Whether the control unit remains connected to the test box or not, is specified in the particular test procedures.
- ♦ For connecting test equipment (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A etc.), always use the adapter cable set V.A.G 1594 A.
- ♦ The contact numbers of the connector of the control unit and the socket numbers of the test box are identical.



Attention!

To avoid damaging the electronic components, switch on the relevant measuring range before connecting the measuring cables and comply with the test conditions.



- Switch off ignition.
- Unscrew windscreen wiper arms and remove cover of plenum chamber
⇒ Body Work, Repair Group 66, trim strips
- Release the plug locks and unplug the plug connector of the engine control unit.
- ◀ - Connect test box V.A.G 1598/31 to connector of wiring loom. Clamp the earth clip to the battery. Whether the engine control unit remains connected to the test box or not, is described in the relevant test procedures.
- Perform test as described in the relevant repair sequences.

Notes:

After re-connecting the engine control unit perform the following:

- Adapting engine control unit to throttle valve control unit ⇒ page 24-36.
- Adjust the kick-down function for vehicles with an automatic gearbox ⇒ page 24-39.
- Interrogate and if necessary erase fault memory ⇒ page 01-5, Interrogate and erase fault memory.

For engines with engine identification characters ARX and AUM

- Whenever the fault memory is erased, it is necessary to generate a readiness code ⇒ page 01-41.

Testing components and functions

Adapting idling speed

In exceptional cases, for example in the case of customer complaints regarding rumbling noises, vibrations in idle speed range, it is permissible to slightly modify the idling speed. If this is done, ensure that the specified speed for the exhaust emissions test is maintained (otherwise there is a risk of the exhaust limits being exceeded at the occasion of the next exhaust test).

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- Coolant temperature at least 85 °C.
- No fault stored in the fault memory.

Test procedure

- Connect vehicle system tester V.A.G 1552 and switch on ignition ⇒ page 01-3.

Engine code AGU

- Enter function 11 „Login procedure“ and confirm with the key Q.

Login procedure Enter code number XXXXX	HELP
--	------

- ◀ Enter Login code number 01283 and confirm with the key Q.

Test of vehicle systems Select function XX	HELP
---	------

- ◀ Readout in display:

Continued for all engines

- Enter function 10 „Adaption“ and confirm entry with the key Q.

Test of vehicle systems 10 - Adaption	Q
--	---

- ◀ Readout in display:

Adaption Enter channel number XX	
-------------------------------------	--

- ◀ Enter 01 for channel 1 and confirm entry with the key Q.

Channel 1 860 rpm	Adaption 860 rpm	-2.3 %	128	→ 2.5 g/s
----------------------	----------------------------	--------	-----	--------------

- ◀ Readout in display:

Engine codes ARZ, ARX, AUM

Channel 1 720 rpm	Adaption 730 rpm	A/C Low	125	→ Compr.OFF
----------------------	----------------------------	---------	-----	----------------

- ◀ Readout in display:

Continued for all engines

- Enter the desired engine speed in display field 2 with the ↑ or ↓ keys in steps of 10 rpm.

Note:

Idling speed must not be altered beyond the permissible engine speed range. Current specification for idling speed:

⇒ Inspection and Maintenance binder, Emission test.

- Confirm entry by pressing the key Q.

Channel 1	Adaption	131	Q
Store changed value?			
Channel 1	Adaption	131	→
Changed value is stored			

◀ Confirm entry with the key Q.

◀ Press → key.

- End output and switch ignition off.

Testing Electronic Power Control (EPC) (electronic throttle)

Function of the EPC system

The position of the accelerator pedal is transmitted to the engine control unit by means of two accelerator pedal position senders (potentiometers housed in a common housing), which are linked to the accelerator pedal.

The throttle valve is operated by means of an electric motor (throttle valve positioner) in the throttle valve control unit, this being possible over the entire engine speed and load range.

The electronic throttle consists not only of one or two components, rather, the EPC is a system which embraces all the components which contribute to determining, controlling and monitoring the position of the throttle valve (e.g. the accelerator pedal position senders, the throttle valve control unit, the EPC warning light, the engine control unit, ...).

Meaning of the EPC warning light (electronic throttle fault light) in the dash panel insert

„EPC“ is an abbreviation which means **E**lectronic **P**ower **C**ontrol (electronic throttle).

After the ignition is switched on, the engine control unit checks all the components which are essential for the operation of the EPC system.

Testing EPC fault light -K132**Note:**

The electronic power control fault lamp -K132 is also known by the abbreviated designation EPC warning lamp.

Special tools, testers and aids required

- ◆ Adapter cable set, e.g. V.A.G 1594 A
- ◆ Test box V.A.G 1598/31

Operational check of warning light

- Switch ignition on.

The EPC warning light must come on.

- Start engine and run at idling speed.

The EPC warning light must go out if no fault relating to the EPC is stored in the fault memory.

If the EPC warning light does not go out, test the wiring

⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

If the EPC warning light does not come on at all, test dash panel insert and also wiring

⇒ Electrical System; Repair Group 90.

⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

Testing throttle valve control unit

Testing operation

The throttle valve housing includes the throttle valve drive (throttle valve positioner) -G186/-V60, angle sender 1 for throttle valve drive -G187/-G127, angle sender 2 for throttle valve drive -G188, throttle valve potentiometer -G69 and idling speed switch -F60.

Notes:

- ◆ If the throttle valve control unit is replaced, it is then essential to adapt the new control unit to the engine control unit ⇒ page 24-36.
 - ◆ On vehicles fitted with automatic gearbox, it is additionally necessary to adapt the gearbox control unit.
- ⇒ Automatic Gearbox; Self-Diagnosis; Repair Group 01; Performing self-diagnosis; Basic setting.

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A

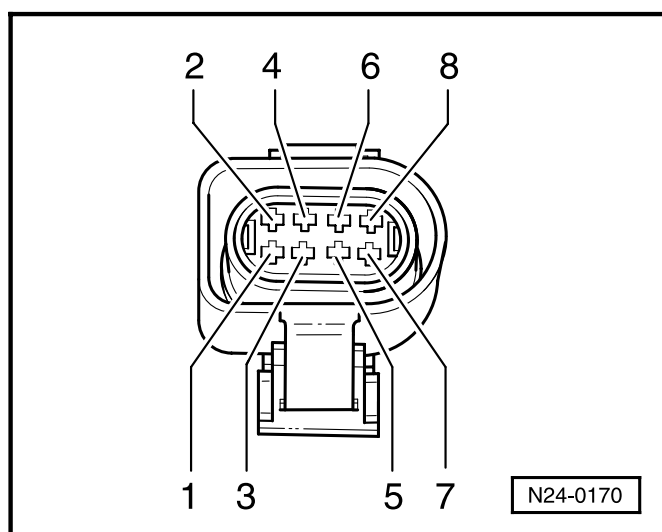
Test condition

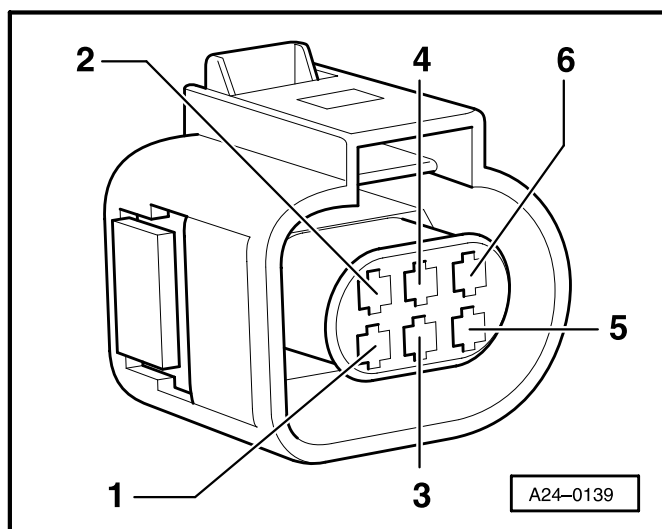
- Throttle valve must neither be damaged nor dirty.

Testing throttle valve drive (throttle valve positioner) -G186/-V60

Engine code AGU

- Measure the resistance of the throttle valve positioner between the following contacts:
- ◀ - Connect multimeter and measure the resistance of the throttle valve positioner between the following contacts:
 - Vehicles fitted with CCS - contacts 7 + 8
 - Vehicles not fitted with CCS - contacts 1 + 2





Engine codes ARZ, ARX, AUM

- ◀ - Measure the resistance of the throttle valve drive between contacts 3 + 5:

Continued for all engines

Specification: 1...5 Ω (at 20 °C).

If the specification is not achieved:

- Replace throttle valve control unit -J338.

If the specification is achieved:

- Test voltage supply of throttle valve control unit and wiring to engine control unit.

If the voltage supply and the cable connection are o.k.:

- Replace engine control unit $\Rightarrow$ page 24-33.

Testing accelerator pedal position senders

Special tools, testers and aids required

- ♦ Hand-held multimeter, e.g. V.A.G 1526 A
- ♦ Adapter cable set, e.g. V.A.G 1594 A

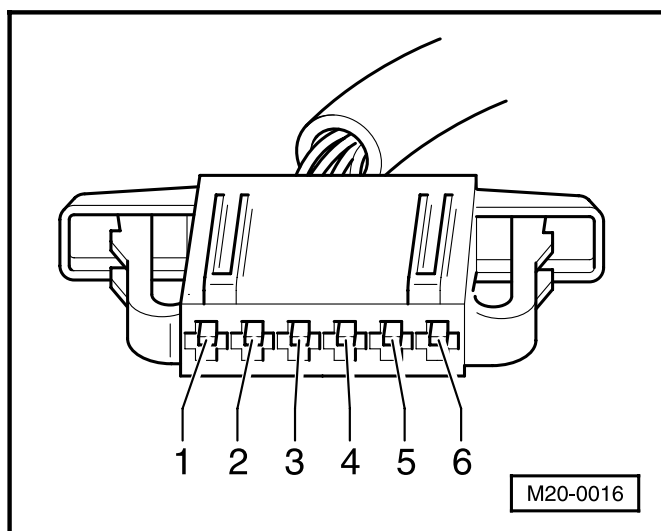
The accelerator pedal position senders -G79 and -G185 are located at the accelerator pedal and transmit the driver's request (when accelerator depressed) to the engine control unit completely independently of each other. Both senders are combined in a housing.

Test procedure

- Check measured value block, display group 062 $\Rightarrow$ page 01-109.

If the readout in the display does not match the specifications:

- Remove bottom part of dash panel
 $\Rightarrow$ Body Fitting Work; Repair Group 70.
- Separate plug connection of the accelerator pedal position senders.



- Switch ignition on.
- ◀ - Connect multimeter for voltage measurement as follows:

Contact at plug connection	Specification
1 + earth	approx. 5 V
1 + 5	approx. 5 V
2 + earth	approx. 5 V
2 + 3	approx. 5 V

If the specifications are not achieved:

- Test the cable connections from the engine control unit to the accelerator pedal position senders
- ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

Testing altitude sender

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Test procedure

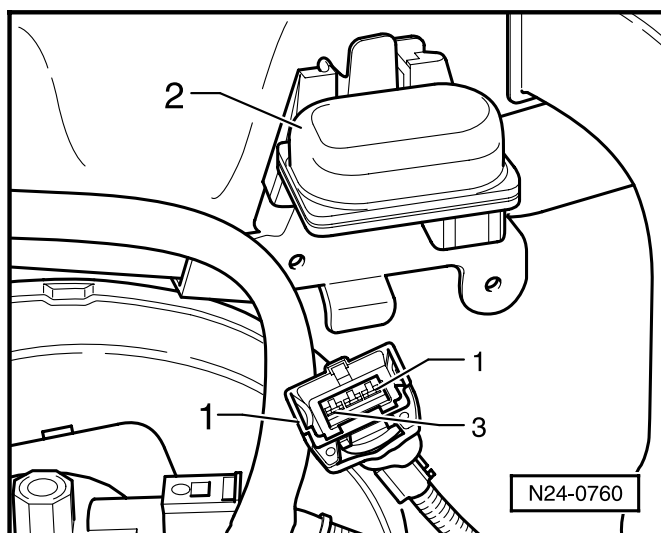
- Check measured value block, display group 018 ⇒ page 01-72.

If the specification is not achieved:

- ◀ - Unplug the 3-pin connector -1- from the altitude sender -2-.
- Switch ignition on.
- Connect multimeter and measure voltage between the following contacts of the connector of sender:
 - Contacts 1 + 3
 - Contacts 2 + 3

Specification: 4.5...5.5 V.

If the specification is achieved:



- Replace altitude sender -F96
⇒ page 24-3, item 8.

If the specification is not achieved:

- Test wiring between connector of sender and engine control unit
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder

Testing voltage supply of control unit

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A
- ◆ Test box V.A.G 1598/22 or V.A.G 1598/31

Test conditions:

- Fuses 10 and 29 of engine control unit o.k.
- Battery voltage at least 11.5 V
- Alternator o.k.

Test procedure

- Read measured value block and display group.
for engine code AGU: 003 ⇒ page 01-57
for engine codes ARZ, ARX, AUM: 004
⇒ page 01-88

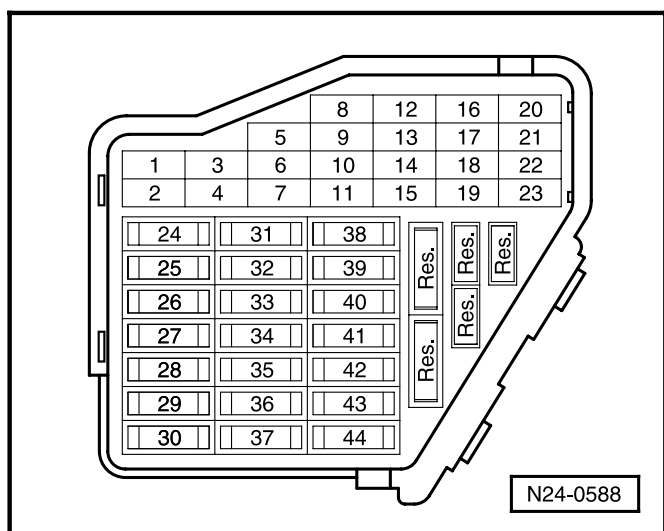
If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 24-9.

Testing voltage of terminal 30

Engine code AGU

- Connect multimeter and measure voltage between sockets 2 and 3 of test box.



Engine codes ARZ, ARX; AUM

- Connect multimeter and measure voltage between sockets 1 and 62 of test box.

Continued for all engines

Specification: at least 11.5 V.

If the specification is not achieved:

- Test cable connections to relay plate according to current flow diagram, and repair if necessary
- ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Testing voltage of terminal 15**Engine code AGU**

- Connect multimeter and measure voltage between sockets 1 and 2 of test box.

Engine codes ARZ, ARX; AUM

- Connect multimeter and measure voltage between sockets 2 and 3 of test box.

Continued for all engines

- Switch ignition on.

Specification: at least 11.5 V.

If the specification is not achieved:

- Test cable connections to relay plate according to current flow diagram, and repair if necessary
- ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Procedure after interruption to voltage supply

If the voltage supply is interrupted, the engine control unit „forgets“ all the learned basic values. As this results in the control unit operating in a different mode, various driving modes may occur when driving.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Procedure

Carry out the following steps after the voltage has been interrupted:

- Switch ignition on for at least 10 seconds.
- Switch ignition off.
- Adapt engine control unit to throttle valve control unit ⇒ page 24-36.
- Check idling speed.

Note:

During the check of idling speed, the activated charcoal filter solenoid valve is switched off and the learning process of the lambda control initiated.

- Conduct a lengthy test drive during which the relevant values are learned and rectify any drivability faults which exist.

The following conditions must be met during this test drive:

- ◆ Coolant temperature must rise to more than 85 °C.
- ◆ Once this operating temperature is reached, the following operating states must be repeated several times:
 - Idling speed
 - Part load
 - Full load
 - Enrichment
 - Overrun
- ◆ At full load engine speed must increase to more than 3500 rpm.

Testing fuel pressure regulator and holding pressure (pressure in system)**Special tools, testers and aids required**

- ◆ Pressure measuring device, e.g. V.A.G 1318
- ◆ Pressure hose with connections, e.g. V.A.G 1318/8
- ◆ Adapter V.A.G e.g. 1318/9
- ◆ Adapter V.A.G e.g. 1318/17

Test conditions

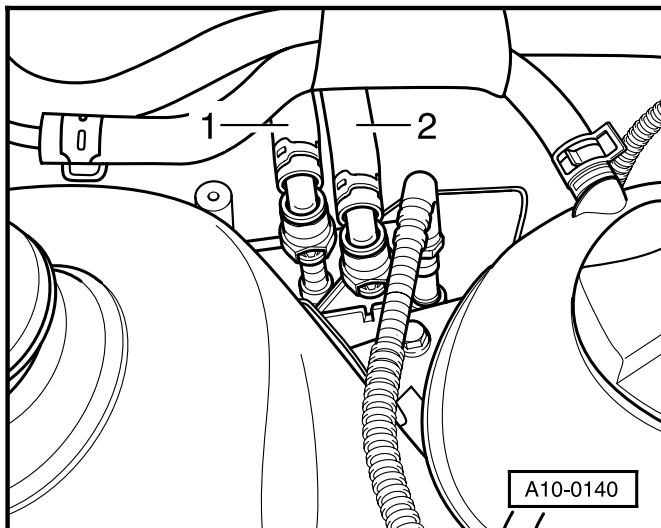
- Fuel delivery o.k., testing:
⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20
- Fuel pump relay o.k.
- Fuel filter o.k.
- Battery voltage o.k.

Test procedure**Note:**

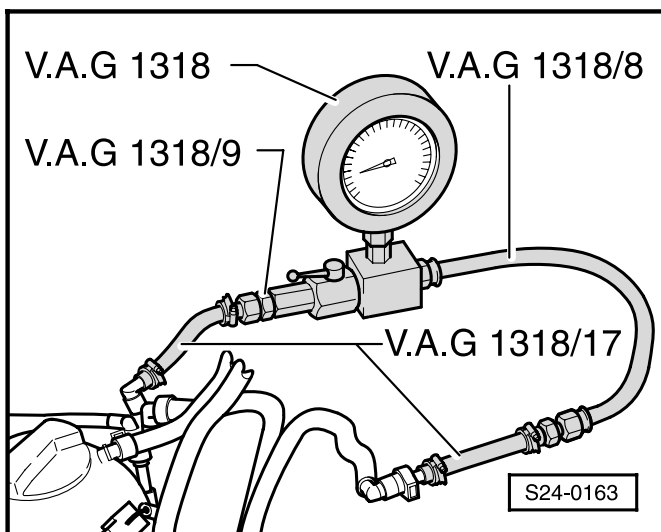
The fuel pressure regulator regulates the fuel pressure in line with the intake manifold pressure.

Warning!

Fuel system is pressurized! Before slackening hose connections or opening test connections, place cleaning cloths around the connection point. Then, release pressure by detaching carefully.

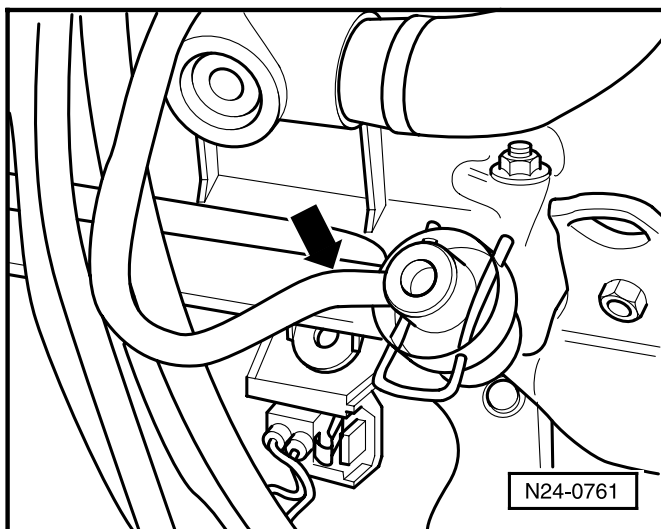


- ◀ - Detach fuel feed hose -1- from the feed line.



- ◀ - Connect pressure measuring device with adapters to the feed line.
- Open shut-off cock of pressure measuring device. Lever points in direction of flow.
- Start engine and run at idling speed.
- Measure fuel pressure.

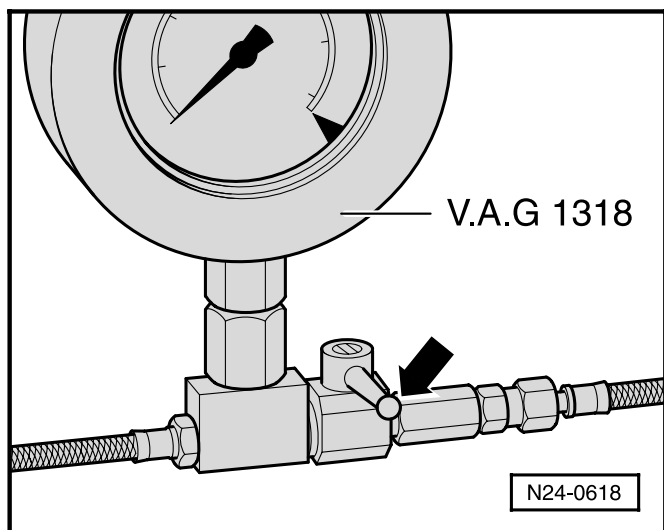
Specification: pressure approx. 0.25 MPa (2.5 bar)



- ◀ - Detach vacuum hose -arrow- from fuel pressure regulator. The fuel pressure must rise to approx. 0.3 MPa (3 bar).
- Switch ignition off.

If the specification is not achieved:

- Test leaktightness and holding pressure by observing the pressure drop at the gauge. After 10 minutes, a pressure of at least 0.20 MPa (2 bar) must still be indicated.



If the pressure drops below 0.20 MPa (2 bar):

- Inspect line connections for leaks, O-rings at fuel rail and at injectors for leaks.
- Inspect non-return valve of fuel pump
⇒ 1.8 l/110 kW Engine, Mechanical Components; Repair Group 20
- Start engine and run at idling speed.
- ◀ - After the pressure has built up, switch ignition off. At the same time, close shut-off cock at pressure measuring device -arrow- (lever at right angles to direction of flow).
- Observe pressure drop at gauge.

If the pressure again drops:

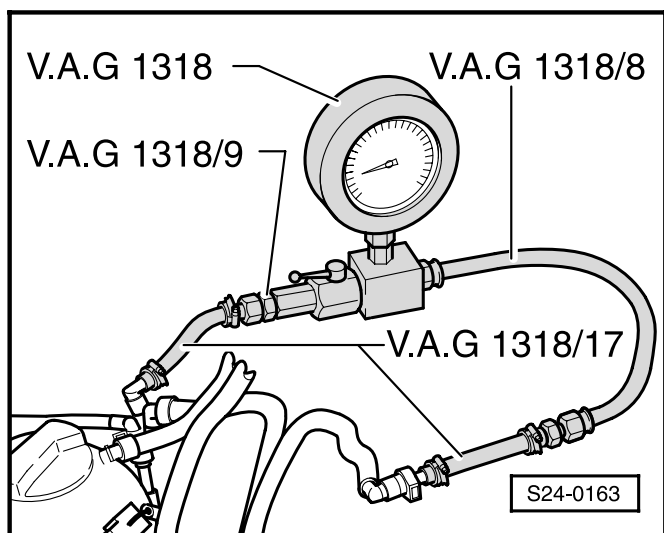
- Replace fuel pressure regulator.
- ◀ - Open shut-off cock of pressure measuring device (lever points in direction of flow).
- Start engine and run at idling speed.
- After the pressure has built up, pinch off return-flow hose tight and at the same time switch the ignition off. Release return-flow hose again.

If the pressure does not drop:

- Replace fuel pressure regulator.

Note:

Before disconnecting the pressure measuring device, release pressure by opening the shut-off cock. Hold a vessel in front of the connection for this step.



Testing injected quantity, leaktightness and spray pattern of injectors

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

- ◆ Measuring tool set
e.g. V.A.G 1594 A, B or C
- ◆ Remote control V.A.G 1348/3A with adapter
cable V.A.G 1348/3-2
- ◆ Measuring glasses, e.g. V.A.G 1602

Test condition

- Check fuel pressure O.K ⇒ page 24-20
- Fuel pump relay O.K
⇒ Binder: Current Flow Diagrams, Electrical
Fault Finding and Fitting Locations
- Fuel temperature 15...20 °C, fuel must conform to the valid standards

Test sequence

- Unplug connectors at all the injectors.
- Remove the complete fuel rail.
- Detach vacuum hose from fuel pressure regulator.
- Remove fuel rail together with injectors from intake manifold and support.

Inspect for tightness

- Connect vehicle system tester V.A.G 1552. Switch on ignition and enter address word 01 „Engine electronics“ ⇒ page 01-3.
- Initiate actuator diagnosis and actuate injector of cylinder 1, the fuel pump must run.

Note:

This sequence is intended to ensure that the fuel pump runs when the engine is switched off. The idling speed limit switch must be in closed position as otherwise the selected injector will spray five times.

- Test the tightness of the injectors (visual inspection). With the fuel pump running, only 1 to 2 drops a minute should drip out at each valve.
- If the fuel loss is greater adjust the fuel pump (end actuator diagnosis) and replace defective injector.

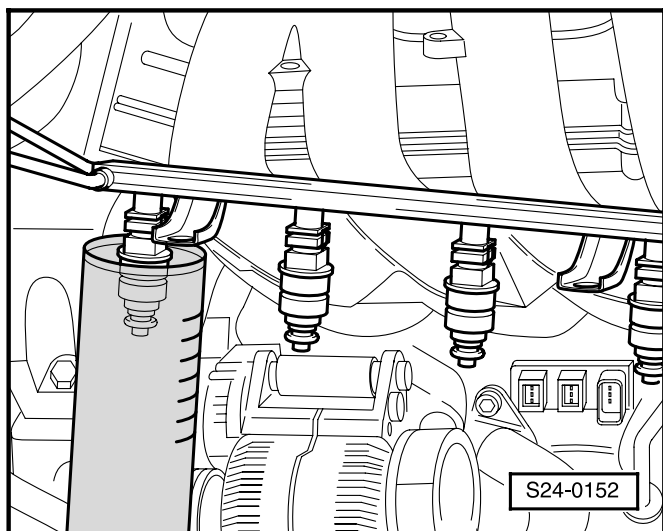
Note:

Replace seals at the same time.

- If necessary repeat actuator diagnosis.

Note:

The actuator diagnosis can only be initiated again once the ignition has been briefly switched off.

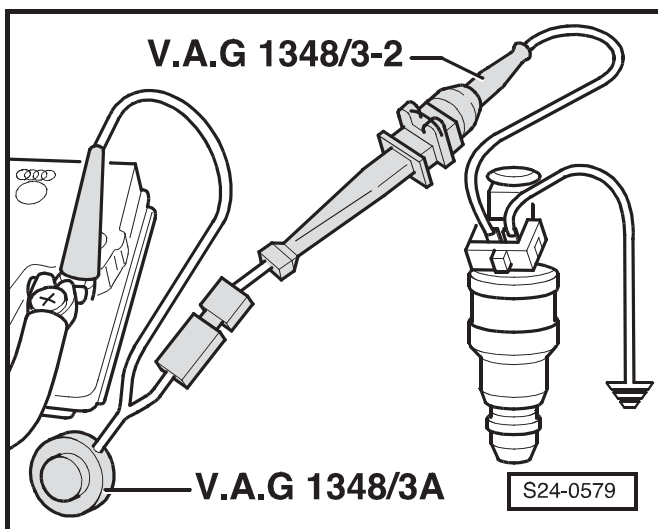


Test injected quantity

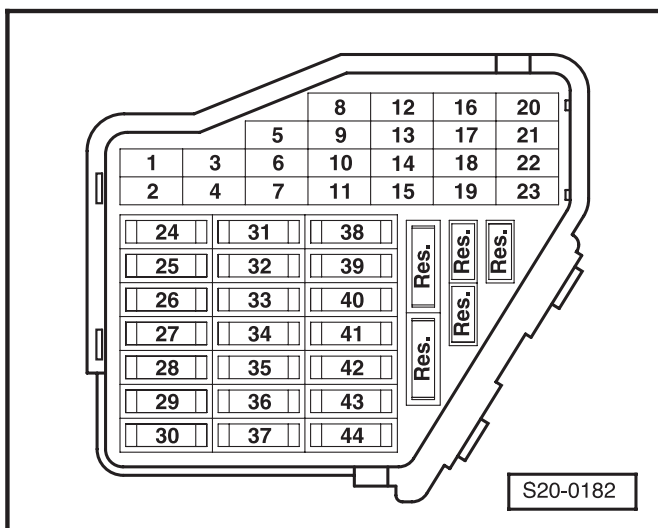
Note:

When testing the injection rate also check the jet formation. The jet must be the same for all valves.

- ◀ Place the injector to be tested in a graduated measuring glass.
- Connect one contact of the injector to the engine mass.



- ◀ Connect the second contact of the injector to the remote control.
- Connect terminal to battery positive terminal.



- ◀ Connect via V.A.G 1348/3-2 battering positive terminal and fuse holder no. 28.

The fuel pump must run.

- Operate remote control for 30 seconds.
- Perform the measurement on all injectors.
- Once all four injectors have been driven, position the graduated measuring glasses on an even base.
- Disconnect voltage supply for fuel pump.
- Compare the individual quantities.

For engines with engine identification characters AGU

Nominal value: 124...134 ml

For engines with engine identification characters ARZ, ARX, AUM

Nominal value: 139...150 ml

For all engines

- If the measurement obtained for one or several injection valves is below or above the specification, replace defective injector
⇒ page 24-7.

Pay attention to the following points before installing the injectors:

- Install new O-rings at all the opened connections (the plastic cap must on no account be pulled off the head of the injector for replacing the front O-ring - lift O-ring over plastic cap).
- Moisten O-ring with clean engine oil.
- Ensure the injectors are installed in the correct position.
- Ensure the retaining clamps are properly located.
- Installation is carried out in the reverse order.

Testing intake system for leaks (unmetered air)

Special tools, testers and aids required

- ◆ Engine leak detection spray G 001 800 A1

Test procedure

Notes:

- ◆ *As a result of the vacuum in intake system the leak detection spray is inducted with the unmetered air. The leak detection spray reduces the ignition performance of the mixture. This causes a drop in the engine speed and also a change in the lambda probe value.*
- ◆ *It is essential to comply with the safety precautions stated on the can.*
- Check measured value block, display group:
Engine code AGU: 009 ⇒ page 01-65
Engine codes ARZ, ARX, AUM: 001 ⇒ page 01-85.
- Systematically spray the parts of the intake system with engine leak detection spray.

If engine speed drops and there is a change to the lambda probe value:

- End output and switch ignition off.
- Inspect the sprayed point of the intake system for leaks and rectify the fault.

Testing lambda control

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Diode test lamp, e.g. V.A.G 1527 B
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Notes:

The lambda probe compares the oxygen content of the air with the residual oxygen in the exhaust and supplies a voltage signal to the engine control unit.

A so-called reference voltage of approx. 0.4 to 0.5 V is preprogrammed in the engine control unit for analysing the signal supplied by the lambda probe. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.

When the engine is idling and at normal operating temperature, the control cycle must be performed at least 30 times a minute.

If there is no change to the voltage, or only a sluggish change, the following faults may exist:

- ◆ *The slots or holes in the head of the lambda probe are clogged.*
- ◆ *The vent hole at the probe -in the area of the connection cable- is sealed off.*
- ◆ *Probe has been subjected to excessive thermal stresses.*
- ◆ *Probe has been damaged by leaded fuel.*
- ◆ *Contact resistance in signal cable.*
- ◆ *Probe too cold, probe heater not operating.*
- ◆ *Lambda control switched off (engine control unit has detected fault at fuel injection system ⇒ Interrogate fault memory and also Read measured value block, display group 021).*
- ◆ *Probe damaged by contact spray or similar products (contact spray is drawn into the probe as a result of the thermal variations and the capillary effect caused by the fine cavities in the electric cables).*
- ◆ *Probe damaged by silicone vapours. (If sealants containing silicone are used, traces of silicone elements are inducted by the engine. These silicone elements are not combusted and damage the lambda probe).*

- ◆ *Probe damaged by oil elements escaping from the crankcase ventilation or by leaks in the engine.*

Drivability problems after cold start

Engine code AGU

Test condition

- No fault relating to lambda control stored in fault memory. Rectify possible faults and erase fault memory.

The time until the lambda control is activated (required probe temperature approx. 300 °C) is determined primarily by the following factors:

- ◆ Ambient temperature (summer/winter)
- ◆ Operating conditions after start
- ◆ Operation of probe heater

If faults occur after a cold start, it is then necessary to determine whether the problem occurs before or after the lambda control is activated.

Test vehicle under cold start conditions:

- Read measured value block and display group 009 ⇒ page 01-65.
- Conduct a test drive and observe lambda probe voltage in display field 3.

Specified voltage when vehicle cold, if lambda control not operating
0.45...0.50 V.

Once the lambda control is activated, the voltage signal in display field 3 must vary between 0.0...1.0 V.

- If the problems occur before the lambda control is activated, the lambda control is then not the cause.
- If the problems occur only after the lambda control has been activated, test the operation of the lambda control ⇒ page 24-28.

Testing lambda probe -G39 and lambda control upstream of catalytic converter

Engine codes AGU, ARZ

Test conditions

- Engine control unit must be adapted to throttle valve control unit ⇒ page 24-36.
- Coolant temperature at least 80 °C.
- No leak in exhaust system between catalytic converter and cylinder head.
- Connect vehicle system tester V.A.G 1552. Start engine and select address word 01 „Engine electronics“ ⇒ page 01-3.

Engine code AGU

- Check display groups 007, 008 and 009 ⇒ pages 01-61 to 01-65.

Engine code ARZ

- Check display groups 030, 032, 033 and 041 ⇒ pages 01-96 to 01-104.

Engine codes AGU, ARZ

If the specifications are not achieved:

- Test resistance of heating element between contacts 1 + 2, voltage for heating and also cables to -Z19
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

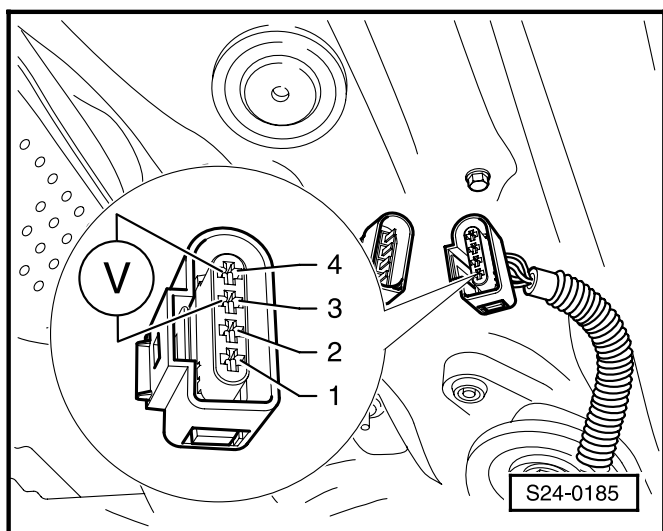
Note:

Resistance of heating element approx. 1...5 Ω at 20 °C.

If the specified resistance is achieved and the voltage supply for the heater and the cables to -Z19 are o.k.:

- Switch ignition on.
- ◀ Use hand-held multimeter to measure voltage between contacts 3 and 4 of connector at wiring loom.

Specification: 0.40...0.50 V



- Switch ignition off.

If the specifications are achieved:

- Replace lambda probe -G39.

If the specifications are not achieved:

- Test wiring between engine control unit and connector of lambda probe
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

If no fault is found in the wiring:

- Replace engine control unit ⇒ page 24-33.

Engine codes ARX, AUM

Test conditions

- Fuse 43 o.k.
- Fuel pump relay o.k.
- No leak in exhaust system between catalytic converter and cylinder head.
- Coolant temperature at least 80 °C ⇒ page 01-8, display group 004, display field 3.

Testing operation

- Check display groups 030, 032, 033 and 041
⇒ pages 01-96 to 01-104.

If the specifications are not achieved:

- Test resistance of heating element between contacts 3 + 4, voltage for heating and also cables to -Z19
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

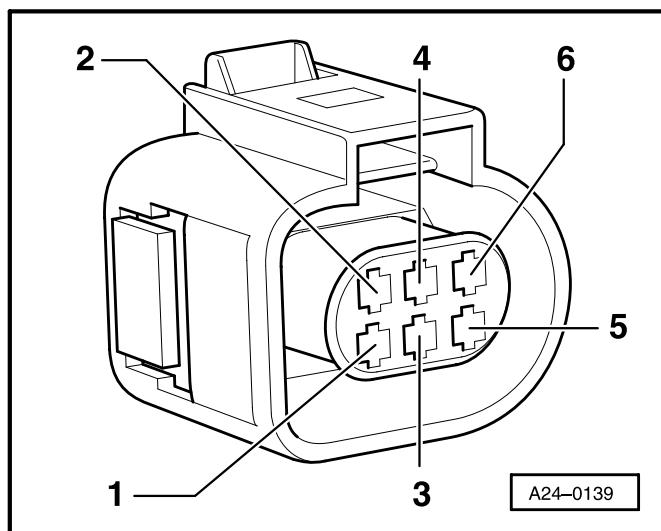
Note:

Resistance of heating element approx. 2.5...10 Ω at 20 °C.

If the specified resistance is achieved and the voltage supply for the heater and the cables to -Z19 are o.k.:

- Switch ignition on.
- ◀ - Use hand-held multimeter to measure voltage between contacts 3 and 4 of connector at wiring loom.

Specification: 0.40...0.50 V



- Switch ignition off.

If the specifications are achieved:

- Replace lambda probe -G39.

If the specifications are not achieved:

- Test cable of lambda probe -G39
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.
- If the cable connection is o.k., replace engine control unit ⇒ page 24-33.

Testing ageing of lambda probe upstream of catalytic converter

Test condition

- Coolant temperature at least 80 °C.

Testing operation

- Check display group 034 ⇒ page 01-101.

If the specifications are not achieved:

- Conduct a test drive in order to eliminate any residues on the lambda probe, and repeat the test.

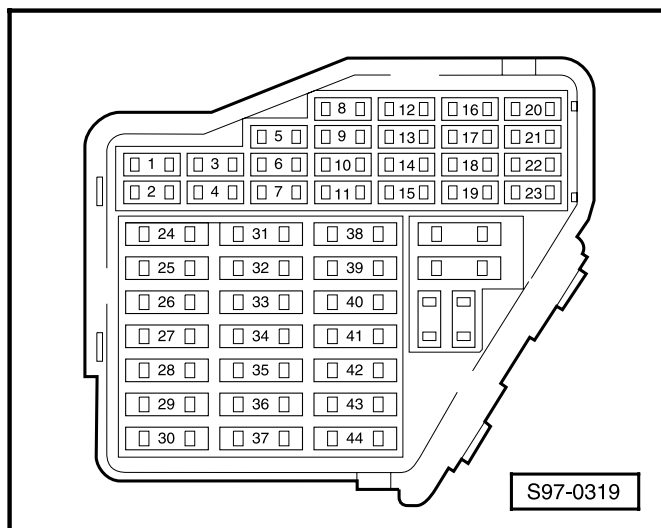
If the specifications are again not achieved:

- Test heater of lambda probe upstream of catalytic converter -G39 ⇒ page 24-28.

Testing lambda probe -G130 and lambda control downstream of catalytic converter

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A



Test conditions

- No leak in exhaust system between catalytic converter and cylinder head.
- Coolant temperature at least 85 °C ⇒ page 01-88, display group 004, display field 3.
- ◀ ● Fuse 43 o.k.
- Battery voltage at least 11.5 V.
- Fuel pump relay o.k.

Testing operation

- Check display groups 030, 036, 037 and 041 ⇒ pages 01-96 to 01-104.

If the specifications are not achieved:

- Test resistance of heating element between contacts 1 + 2, voltage supply for heating and cables to -Z29
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

Note:

Resistance of heating element approx. 1...5 Ω at 20 °C.

If the specified resistance is achieved and the voltage supply for the heater and the cables to -Z19 are o.k.:

- ◀ - Connect multimeter for voltage measurement to contacts 3 and 4 (connector to engine control unit).
- Start engine and measure basic voltage
Specification: 0.400...0.500 V.
- Switch ignition off.

If the specification is achieved:

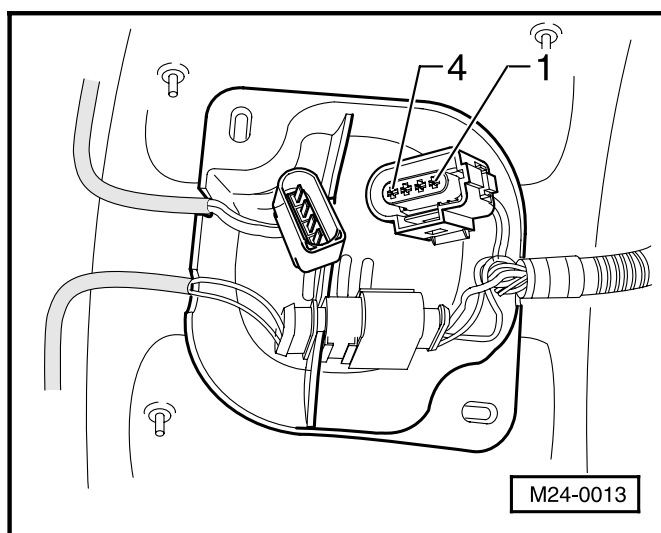
- Replace lambda probe downstream of catalytic converter -G130.

If the specification is not achieved:

- Test lambda probe cable -G130
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

If no fault is found in the wiring:

- Replace engine control unit ⇒ page 24-33.



Test exhaust emissions warning lamp (K83)

For engines complying with exhaust emission standard EU-4

Function

If the control unit detects a fault with a major incidence on the emission level the exhaust emissions warning lamp will light up or start flashing.

The exhaust emissions warning lamp may either flash or remain lit. In any case the fault memory must be interrogated ⇒ page 01-5.

- ◆ Exhaust emissions warning lamp flashes: there is a fault on the vehicle that may damage the catalytic converter. Drive on under reduced engine power!
- ◆ Exhaust emissions warning lamp flashes: there is a fault on the vehicle that no longer guarantees low exhaust gas emissions. Interrogate fault memory of the engine control unit or of the automatic gearbox control unit.
- ◆ If there is incorrect driving behaviour, or if the customer complains and the exhaust emissions warning lamp is not lit, interrogate the fault memory, as a fault may have been stored that does not immediately cause the exhaust emission warning lamp to light up.

Functional test of the exhaust emissions warning lamp

- Switch on ignition.

The exhaust emissions warning lamp must light up.

- Start engine and run in idle.

The exhaust emissions warning lamp must go out if no fault was stored in the fault memory.

Note:

The switching signal for the exhaust emissions warning lamp is transmitted from the engine control unit to the dash panel control unit via the CAN databus. Check data transmission between engine control unit and other control units ⇒ page 24-41.

Replacing, coding and adapting engine control unit

Replacing engine control unit

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Note:

When the connectors are unplugged from the control unit, the learned values are erased although the contents of the fault memory are retained.

- Connect vehicle system tester V.A.G 1552. Switch ignition on and enter address word 01 „Engine electronics“ ⇒ page 01-3.

06A906018CF 1.8l R4/5VT MOTR HS D03 →
Coding 04000 WSC 06388

◀ The control unit identification appears in the display (example):

- Note Part No. of control unit and code.
- End output.

Removing

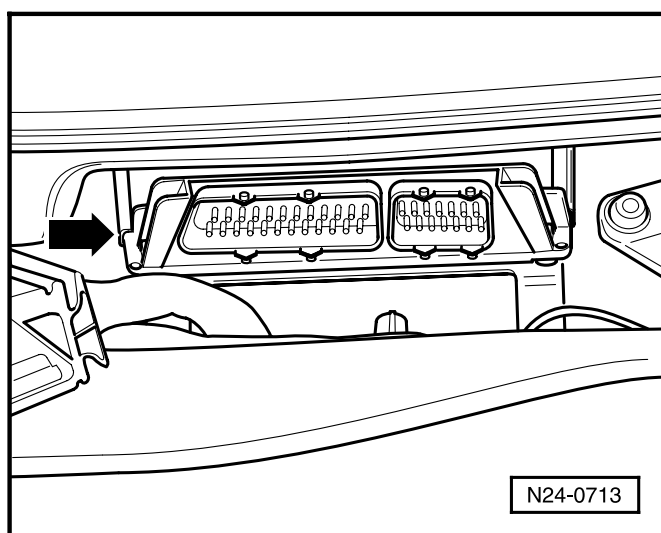
- Switch ignition off.
- Remove cover of plenum chamber
⇒ Body Fitting Work; Repair Group 66; Trim Panels.
- Release locks of connectors and unplug control unit connectors.
- ◀ - Push engine control unit to the right and pull forward.

Installing

Installation is carried out in the reverse order.

Notes:

- ♦ *In the initial learning phase during engine basic setting slightly irregular idling as well as slight jerking when driving are possible.*
- ♦ *After installing the engine control unit, it is necessary to carry out the following steps:*
- *Interrogate fault memory, rectify any faults and erase fault memory ⇒ page 01-5.*



- Perform coding on new engine control unit
⇒ page 24-34.
- Adapting the engine control unit to the throttle valve unit (J338) ⇒ page 24-36.
- Adapting the engine control unit to the electronic immobiliser
⇒ Electrical system; Repair Group 96.
- Perform idling check.
- Perform CCS test ⇒ page 01-110.
- Adjust the kick-down function for vehicles with an automatic gearbox ⇒ page 24-39.

For engines with engine identification characters ARX and AUM

- Whenever the fault memory is erased, it is necessary to generate a readiness code
⇒ page 01-41.

Coding engine control unit

Special tools, aids and testers required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

If the specific vehicle coding is not displayed or if the control unit was replaced, the control unit must be coded as follows.

- Connect vehicle system tester V.A.G 1552. Switch on ignition and enter address word 01 „Engine electronics“ ⇒ page 01-3.
- Enter 07 for the function „coding control unit“ and confirm entry with key Q.

Coding control unit Enter code number xxxxx (0-32000)	Q
--	---

◀ Read-out on display:

- Enter the correct code number for this vehicle and confirm with the key Q.

For engines with engine identification characters AGU

Code number	Equipment
04030	Automatic gearbox
04000	Manual gearbox

06A906018CF 1.8 I R4/5VT MOTR HS D03 →
Coding 04000 WSC 06388

◀ The read-out on vehicle system tester V.A.G 1552 is e.g.:

For engines with engine identification characters ARZ, ARX and AUM

Engine identification characters	Designation of control units	Equipment	Code number
ARZ	06A906032BA	-	05500
ARX	06A906032FC 06A906032SG	Manual gearbox + Four-wheel drive (4x4) + ABS + EDL	10600
ARX	06A906032FC 06A906032SG	Manual gearbox + Four-wheel drive (4x4) + ESP	10700
ARX	06A906032HJ 06A906032SG	Manual gearbox + Four-wheel drive (4x4) + TCS + ABS + EDL /ESP	10700
AUM	06A906032DJ	Automatic gearbox + ABS	11430
AUM	06A906032DJ 06A906032HL	Automatic gearbox + TCS + ABS + EDL /ESP	11530
AUM	06A906032DK 06A906032FC 06A906032SG	Manual gearbox + ABS	11400
AUM	06A906032DK 06A906032HJ 06A906032FC 06A906032SG	Manual gearbox + TCS + ABS + EDL /ESP	11500

06A906032BA 1.8 I R4/5VT G01 0004 →
Coding 05500 WSC 12345

◀ The read-out on vehicle system tester V.A.G 1552 is e.g.:

For all engines

- End output

Note:

When the ignition is switched on again the basic setting is automatically performed again.

Adapting engine control unit to throttle valve control unit

Engine code AGU

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Adaption allows the engine control unit to learn the stop positions of the throttle valve and a comparative characteristic curve between throttle valve potentiometer and throttle valve positioner sender with the ignition switched on and the engine off.

Adaption has to be carried out in the following cases:

- ◆ if the voltage supply of the engine control unit has been interrupted (e.g. after disconnecting the battery)
- ◆ if the throttle valve control unit -J338 has been removed and installed
- ◆ if the throttle valve control unit -J338 has been replaced.

Test conditions

- No fault stored in the fault memory ⇒ page 01-5, Interrogating fault memory.
- Battery voltage at least 11.5 V.
- All electrical components, such as lights and rear window heater, must be switched off.
- Throttle valve control unit must be in idling position.
- If the vehicle is equipped with CCS, the system must be correctly set.

Test procedure

- Connect vehicle system tester V.A.G 1552 and select „Engine electronics“ (address word 01) ⇒ page 01-3. Ignition must be switched on for this step.
- Select function 04 „Initiate basic setting“ and then display group 098.

System in basic setting	98	→
2.20 V 2.80 V Idling	ADP. runs	

◀ After pressing the key Q, the throttle valve positioner is moved into the Min., Max. and into five intermediate positions, and the control unit stores the relevant throttle valve angle in the permanent memory. This process takes not more than 10 seconds.

System in basic setting			98	→
2.20 V	2.80 V	Idling	ADP. o.k.	

◀ Readout in display:

Basic setting			98	→
2.20 V	2.80 V	Idling	ADP ERROR	

◀ If one of the following messages appears in the display, adaption has been aborted.

Note:

If the basic setting is aborted by the control unit, the reason may be:

- ◆ *The throttle valve does not reach the mechanical idling speed stop because of dirt, e.g. oil carbon deposits, or a throttle cable which is incorrectly set.*
- ◆ *The battery voltage is too low.*
- ◆ *The throttle valve control unit or the cable connection is faulty.*

If basic setting is aborted, fault „17967“ or „17973“ is entered in the fault memory. The basic setting is automatically repeated the next time the ignition is switched on.

- Adaption is concluded by pressing the → key.
- Check specifications of throttle valve control unit in measured value block, display group 023 ⇒ page 01-47. If the specifications are not achieved, repeat adaption of control unit.
- Interrogate fault memory (function 02) ⇒ page 01-5.
- If no fault is detected, check whether the idling speed switch opens and closes when the accelerator is operated; test idling speed switch.
- End output.

Engine codes ARZ, ARX, AUM

Adaption of engine control unit to throttle valve control unit on vehicles fitted with EPC system

When adaption is performed, the engine control unit learns the various positions of the throttle valve with the ignition switched on and the engine off. These positions are stored in the engine control unit. The feedback relating to the position of the throttle valve is provided by the two angle senders of the throttle valve drive.

Note:

The engine does not start during automatic adaption.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Requirements:

- No fault is stored in the fault memory; interrogate fault memory ⇒ page 01-5.
- Engine off, ignition on.
- Accelerator not depressed.
- Coolant temperature greater than 5 °C, but less than 95 °C.
- Intake air temperature less than 100 °C.
- Battery voltage at least 11.5 V.

Procedure

- Connect vehicle system tester V.A.G 1552. Switch ignition on and enter address word 01 „Engine electronics“ ⇒ page 01-3.
- Select 04 for the function „Initiate basic setting“ and display group 060.

After the key Q is pressed, the throttle valve positioner is operated.

System in basic setting 60			→
5.4 %	85 %	8	ADP. o.k.

- ◀ Check the specifications for the throttle valve control unit in display fields 3 and 4.

Specification for display field 3: **8**

Specification for display field 4:

ADP runs
ADP o.k.

Note:

The abbreviation „ADP“ in display field 4 means „Adaption“.

Note:

If adaption is aborted by the control unit, the reason may be:

- ◆ *The throttle valve is not able to close fully (e.g. because of dirt).*
- ◆ *The battery voltage is too low.*
- ◆ *The throttle valve control unit or the cable connection is faulty.*
- ◆ *The engine is started during adaption or the accelerator is depressed.*
- ◆ *Housing of throttle valve control unit is installed twisted (stressed) (check screw connections).*

After adaption has been aborted „Function is unknown or cannot be performed at the moment“ appears in the vehicle system tester. Adaption is automatically repeated the next time the ignition is switched on (a few seconds).

- End the basic setting of engine by pressing the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display (function selection):

Adapting kickdown function

If the EPC or engine control unit is replaced, it is necessary to adapt the kickdown function on vehicles fitted with automatic gearbox ⇒ page 01-43, Generating readiness code, Adaption of kickdown function.

Testing additional signals

Testing vehicle speed signal

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/22 or V.A.G 1598/31
- ◆ Diode test lamp, e.g. V.A.G 1527 B
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Test conditions

- Battery voltage at least 11.5 V.
- Speedometer o.k.

Test procedure

- Connect test box to wiring loom to engine control unit ⇒ page 24-9.

Engine code AGU

- Connect diode test lamp between socket 3 (positive) and socket 20 (signal).

Engine codes ARZ, ARX, AUM

- Connect diode test lamp between socket 3 (positive) and socket 54 (signal).

Continued for all engines

- Switch ignition on.
- Rotate front wheel and observe voltage.

Note:

The right front wheel must not be rotated; hold tight if necessary.

Diode test lamp must flash (very short flashing signal).

If the diode test lamp does not flash:

- Test wiring to speedometer and to vehicle speed sender
- ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

Testing CAN databus

- Determine by referring to the appropriate current flow diagrams which control units are connected to the drive CAN databus (CAN = Controller Area Network).
- Inspect the plug connections of all the connected control units to ensure they are tight.
- Connect vehicle system tester V.A.G 1552 and enter function 00 „Automatic test sequence“.

Before testing the communication line, determine whether there is any operational fault present at the control units connected.

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/31 or V.A.G 1598/21
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Test condition

- A fault has been detected at the CAN databus by the self-diagnosis.

Test procedure

- Switch ignition off.

Engine codes ARZ, ARX, AUM

- Unlock connector and unplug it from engine control unit.
- Connect test box V.A.G 1598/31 to engine control unit. Do not connect cables to engine control unit.
- Test middle terminating resistor in engine control unit between sockets of test box:

Socket at test box 1598/31	Socket at test box 1598/31
58	60

Specification: 60...72 Ω .

Engine code AGU

- Separate plug connections from the control units with CAN databus
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.
- Connect test box V.A.G 1598/21 to the ABS wiring loom.
- Test middle terminating resistor in engine control unit between sockets of test box.

Socket at test box 1598/21	Socket at test box 1598/21
10	11

Specification: 115...135 Ω.

Continued for all engines

If the measurement is not within the specified range:

- Replace engine control unit ⇒ page 24-33.

If the measurement is within the specified range:

- Test databus
⇒ Electrical System; Repair Group 90.

Activating and deactivating cruise control system (CCS)**Models fitted with EPC****Special tools, testers and aids required**

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- There must not be any fault stored in the fault memory; interrogate fault memory ⇒ page 01-5.

Test sequence

- Connect vehicle system tester V.A.G 1552. Switch ignition on and enter address word 01 „Engine electronics“ ⇒ page 01-3.

06A906032HJ 1.8l R4/5VT G
Coding 11500

0001 →
WSC XXXXX

◀ Readout in display (example):

06A906032HJ 1.8l R4/5VT
Coding 00001

0001 →
WSC XXXXX

If „1.8 l R4/5VT G“ is displayed, CCS is activated.

◀ Readout in display (example):

If „1.8 l R4/5VT“ is displayed, CCS is not activated.

Login procedure
Enter code number XXXXX

◀ - Press → key and select function 11 „Login procedure“.

Enter code number as specified in the table below and confirm entry with the key Q.

Code number	Cruise control system (CCS)
11463	Cruise control system (CCS) is activated
16167	Cruise control system (CCS) is deactivated

- Select function 06 „End output“ and switch the ignition off.

After activating the CCS, conduct a road test as an operational check of the system.

Procedure after interruption to voltage supply

If the voltage supply has been interrupted, the engine control unit „forgets” all the learned values and basic setting values. This may result in considerable drivability problems, depending on the mileage of the vehicle.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Procedure

After the voltage supply has been interrupted, carry out the following operations:

- Switch on the ignition for at least 10 seconds.
- Switch off the ignition.
- Adapt the engine control unit to the throttle valve control unit ⇒ page 24-72.
- Perform the idling speed test ⇒ page 24-13.

Note:

During the idling speed test the activated charcoal filter solenoid valve and the air conditioning are switched off and the learning process of the lambda control is initiated.

- Conduct a lengthy road test until the drivability problems have been eliminated.

During this road test, the following operating conditions must be met:

- ◆ The coolant temperature must rise to more than 85 °C.
- ◆ Once this temperature has been reached, the following operating states
 - Idling
 - Part throttle
 - Full throttle enrichment
 - Fuel shut-off on overrunmust be achieved several times.
- ◆ Engine speed must have risen to more than 3500 rpm at full throttle.

Testing fuel pressure regulator and holding pressure

Special tools, testers and aids required

- ◆ Pressure measuring device e.g. V.A.G 1318
- ◆ Pressure hose with connections e.g. V.A.G 1318/8
- ◆ Adapter e.g. V.A.G 1318/9
- ◆ Adapter e.g. V.A.G 1318/17

Test conditions

- Delivery of fuel pump o.k.; testing:
⇒ 1.8-ltr./110 kW Engine, Mechanical Components; Repair Group 20, Testing fuel pump
- Fuel pump relay o.k.; testing ⇒ page 24-52.
- Fuel filter o.k.
- Battery voltage o.k.

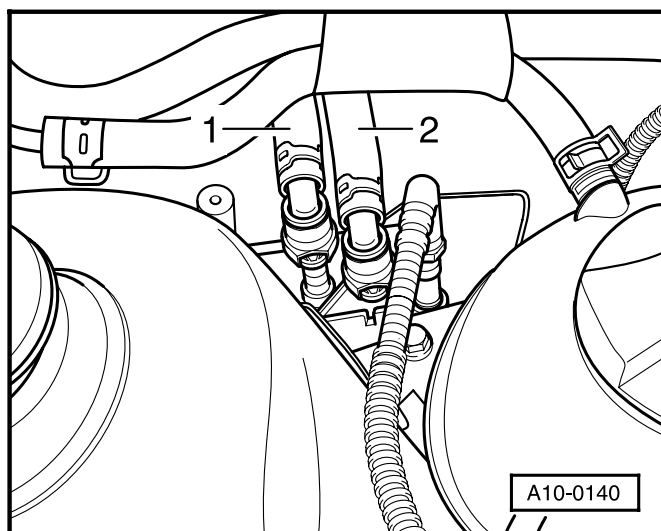
Test procedure

Note:

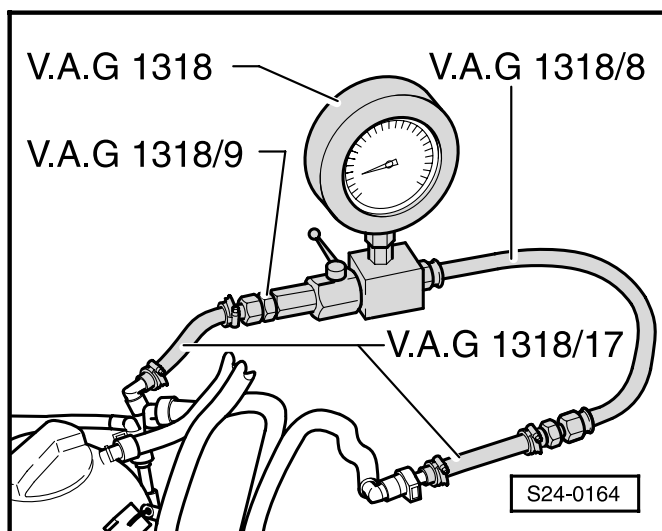
The fuel pressure regulator regulates the fuel pressure in line with the intake manifold pressure.

Warning!

Fuel system is pressurized! Place cleaning rags around the connection point before opening the system and then release the pressure by carefully detaching the connection point.

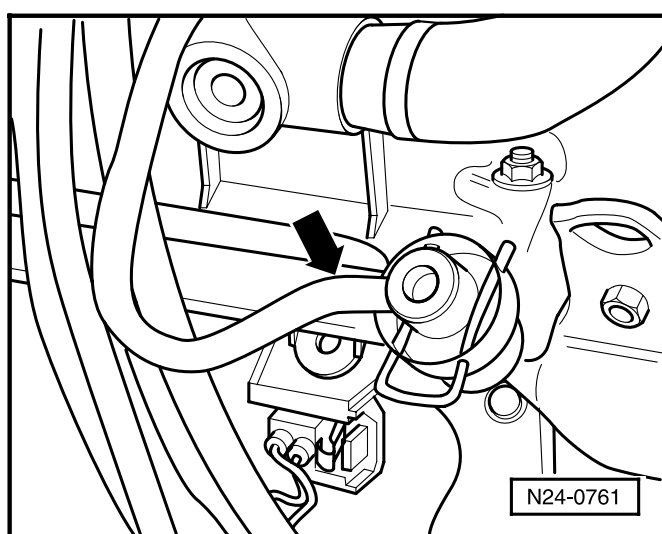


◀ - Detach the fuel feed hose -1- at the feed line.



- ◀ - Connect the pressure measuring device V.A.G 1318 to the feed line using the adapters 1318/8, 1318/9 and 1318/17.
- Open the shut-off cock of the pressure measuring device. The lever points in the direction of flow.
- Start the engine and run at idling speed.
- Measure the fuel pressure.

Specification: approx. 0.25 MPa.



- ◀ - Detach the vacuum hose from the fuel pressure regulator. The fuel pressure must rise to approx. 0.3 MPa.

If the specification is not achieved:

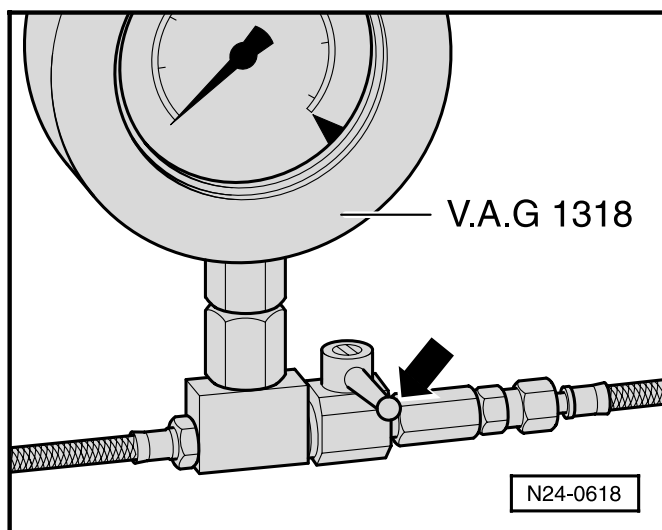
- Test delivery of the fuel pump.
- ⇒ 1.8-ltr./110 kW Engine, Mechanical Components; Repair Group 20, Testing fuel pump

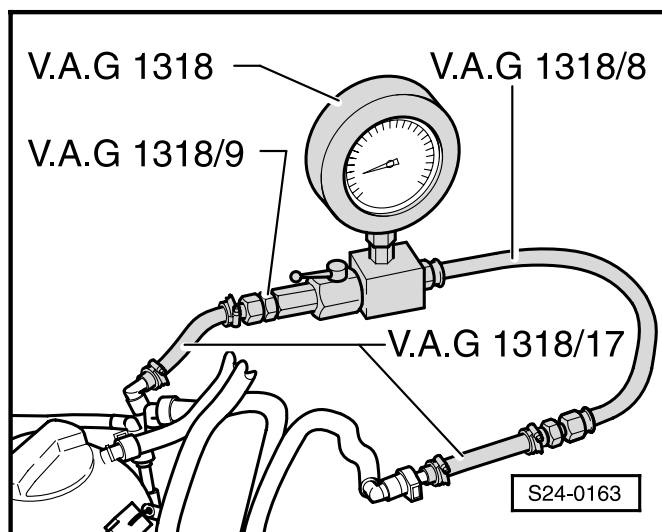
If the specification is achieved:

- Switch off the ignition.
- Test the leaktightness and the holding pressure by checking the pressure drop at the gauge. There must still be a pressure of at least 0.20 MPa present after 10 minutes.

If the holding pressure drops below 0.20 MPa:

- Start the engine and run at idling speed.
- ◀ - After pressure has been built up, switch off the ignition and at the same time close the shut-off cock of pressure measuring device V.A.G 1318 (lever at right angles to direction of flow).
- Check the pressure drop at the gauge.





If the pressure does not drop:

- Test the check valve of the fuel pump.
- ⇒ 1.8-ltr./110 kW Engine, Mechanical Components; Repair Group 20, Testing fuel pump

If the pressure again drops:

- ◀ - Open the shut-off cock of the pressure measuring device V.A.G 1318 (lever in direction of flow).
- Start the engine and run at idling speed.
- Once the pressure has built up, switch off the ignition and at the same time clamp the return-flow hose together until tight and then again open the passage in the return-flow hose.

If the pressure does not drop:

- Replace the fuel pressure regulator.

If the pressure again drops:

- Inspect the line connections, O-rings at the fuel rail and injectors for leaks.
- Inspect the pressure measuring device for leaks.

Note:

Before disconnecting the pressure measuring device, release the fuel pressure by opening the shut-off cock. Hold a vessel in front of the connection for this step.

Testing injected quantity, leaktightness and spray pattern of the injectors

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Remote control V.A.G 1348/3A with adapter cable V.A.G 1348/3-2
- ◆ Tester for injected quantity e.g. V.A.G 1602

Test condition

- Fuel pressure o.k.; testing ⇒ page 24-45.

Test procedure:

- Unplug the connectors at all the injectors.
- Then, remove the fuel rail complete.
- Detach vacuum hose from the fuel pressure regulator.
- Lift off fuel rail and injectors at the intake manifold and support.

Testing for leaks

- Initiate final control diagnosis and operate injector of cyl. 1 (N30) ⇒ page 01-33; the fuel pump should run.

Note:

This step is intended merely to operate the fuel pump when the engine is not running. The idling speed switch must remain closed during this test otherwise the injector selected will eject five times.

- Inspect injectors for leaks (visual inspection). When the fuel pump is running, only 1...2 drips a minute should flow out of each injector.
- If the fuel loss is greater, switch off fuel pump (end final control diagnosis) and replace the faulty injector.

Note:

Always replace the seals.

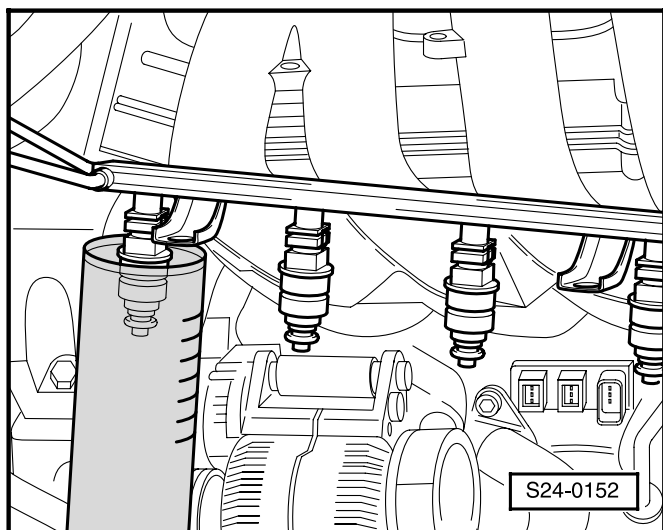
- Once again initiate final control diagnosis, if necessary.

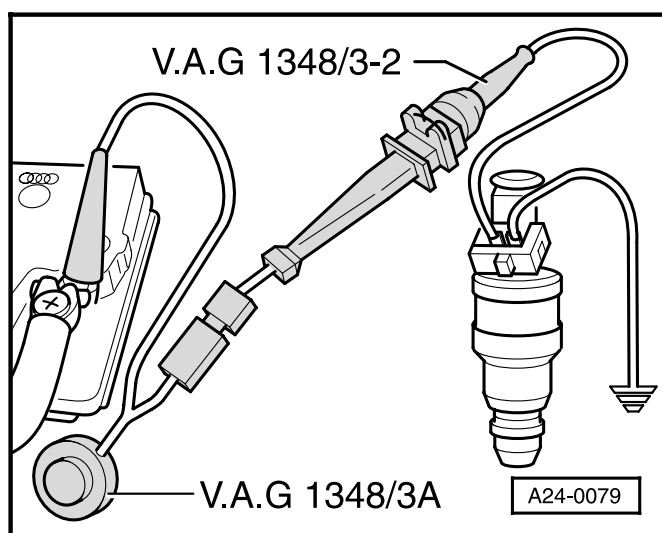
Note:

The final control diagnosis cannot be repeated until the ignition has been switched off for a short moment.

Testing injected quantity

- ◀ Insert the injector to be tested in a measuring glass of the injected quantity tester e.g. V.A.G 1602.





- ◀ - Connect one contact of the injector to engine earth using the test cable and crocodile clamp from V.A.G 1594.
- Connect the second contact of injector to positive using remote control V.A.G 1348/3 A, adapter cable V.A.G 1348/3-2 and auxiliary cable.
- Initiate final control diagnosis (function 03) ⇒ page 01-33. The fuel pump should run.
- Operate the remote control V.A.G 1348/3 A for 30 seconds.
- Carry out the measurement at all the injectors.
- After all four injectors have been operated, place the measuring glasses on a flat surface.

Specification: 110...130 ml

- If the measurement obtained from one or several injectors is not within the tolerance range, switch off fuel pump (end final control diagnosis) and replace the faulty injector.
- If the measurements obtained from all the injectors are not within the tolerance range, test fuel pressure ⇒ page 24-45.

Note:

When testing the injected quantity, also test the spray pattern. The spray ejected should be the same at all the injectors.

Before installing, pay attention to the following points regarding the injectors:

- Replace the O-rings at all the opened connection points. (The plastic cap must not be removed from the injector head to replace the front O-ring; lift the O-ring over the plastic cap).
- Moisten O-rings with clean engine oil.
- Ensure the injectors are properly installed.
- Ensure the retaining clips are correctly installed.
- Installation is carried out in the reverse order to removing.

Testing injectors

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Engine speed sender o.k.
- Fuel pump relay o.k.
- ◀ ● Fuse 32 for injectors o.k.

Test procedure

- Initiate final control diagnosis ⇒ page 01-33.

If one or several injectors do not click:

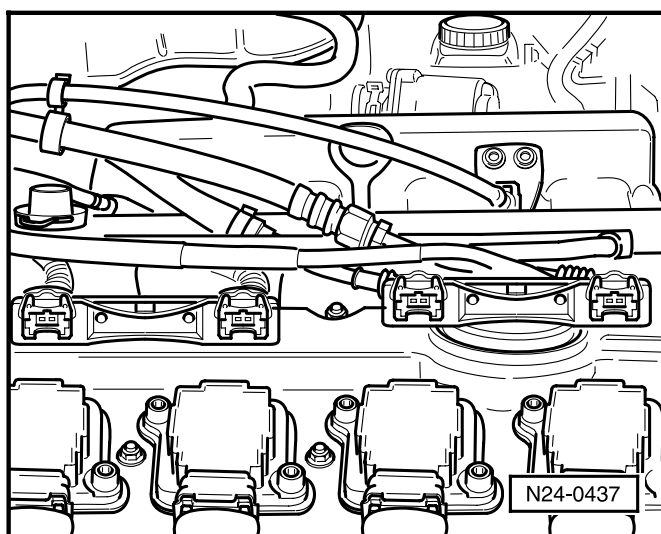
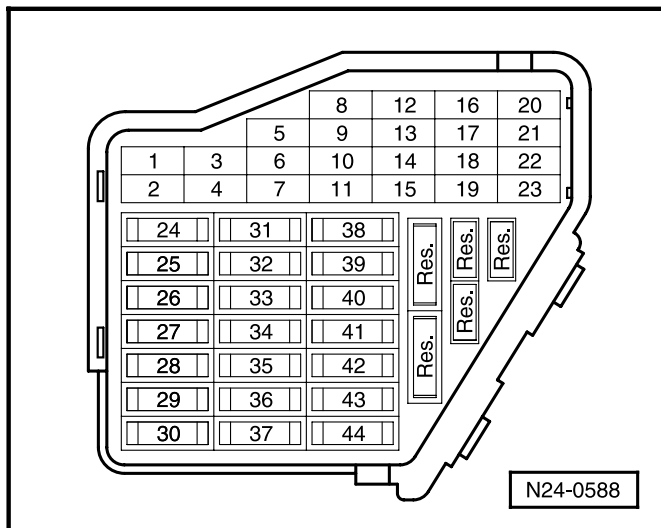
Testing actuation of voltage supply

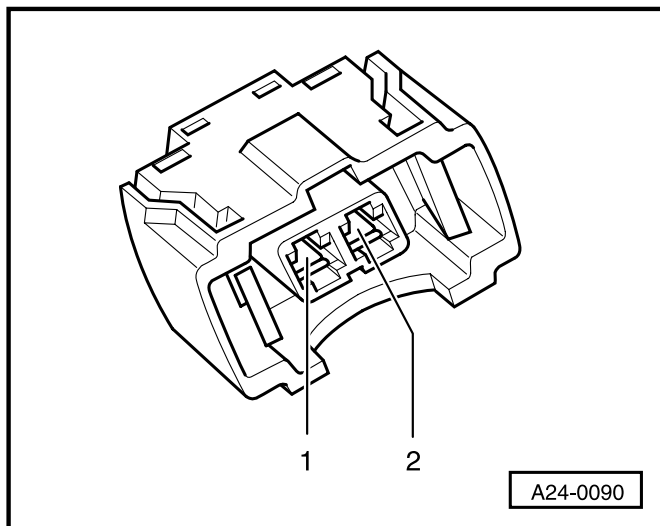
- ◀ - Unplug connector at the injector to be tested.
- Connect the diode test lamp to the contacts of the connector of cylinder 1.
- Initiate final control diagnosis and actuate injector of cylinder 1 (N30) ⇒ page 01-33; the fuel pump must run.

Diode test lamp must flash.

Note:

Diode test lamps with a low current consumption do not go out fully between the flash pulses but continue glowing a little and become brighter during a flash pulse.





- Repeat the test at the connectors of injectors cylinders 2...4.
- Switch off the ignition.

If the LED does not flash at any of the cylinders:

- ◀ - Connect diode test lamp to the connector of cylinder 1, contact 1 and earth.
- Initiate final control diagnosis and actuate injector of cylinder 1 (N30) ⇒ page 01-33.

The LED must come on:

- Repeat the test at the connectors of the injectors of cylinders 2...4.

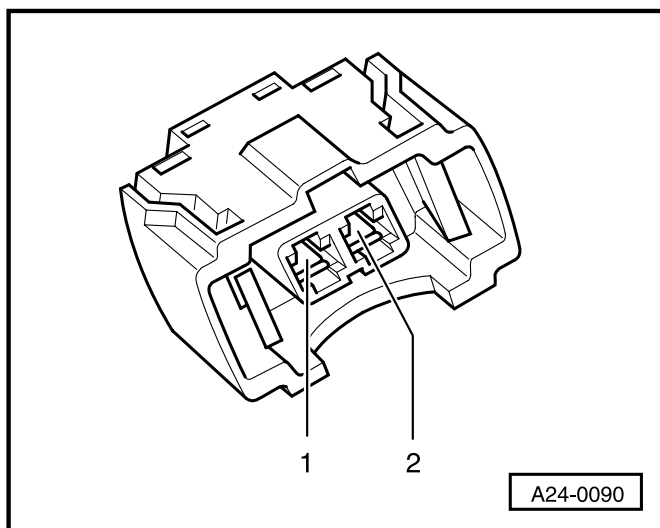
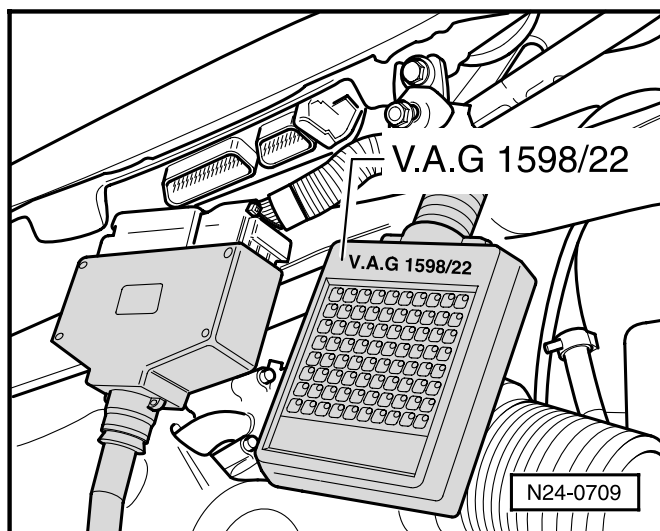
If the LED does not come on:

- Switch off the ignition.
- Test cable between 2-pin connector contact 1 and fuel pump relay (J17) for open circuit according to the current flow diagram.

Specification: max. 1.5 Ω

If the LED does not flash at one or several cylinders:

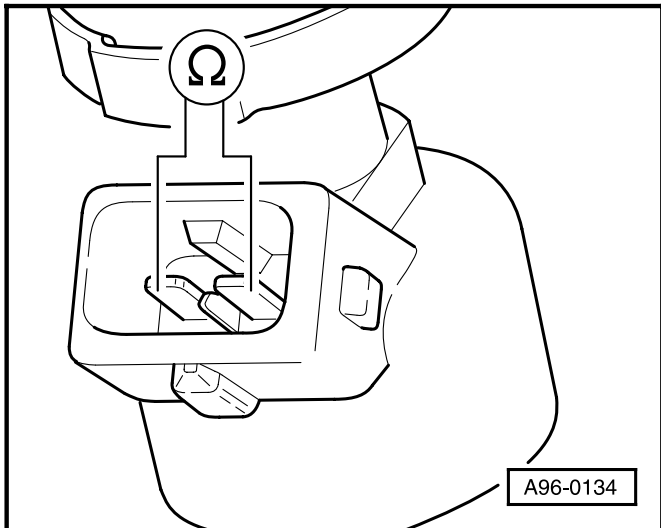
- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.



- ◀ - Test cable connection between contact 2 of the connector of the relevant injector and engine control unit for continuity and for short circuit to positive.

Contact 2 at connector of injector	Test box V.A.G 1598/22, socket
1	73
2	80
3	58
4	65

- In addition, test the cables for short circuit to each other
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder.



- Rectify any open circuit in the wiring or short circuit.
- If the cable connection is o.k., replace engine control unit ⇒ page 24-69.
- If no fault can be found in the actuation and voltage supply, test the resistances of the injectors.

Testing resistances of the injectors

- Unplug the connector at the injector to be tested.
- ◀ - Perform a resistance measurement between the contacts of the injector.

Specification: 12...15 Ω.

The resistance is increased by about 4...6 Ω if the engine is at operating temperature.

If the specification is not achieved:

- Replace the faulty injector.

Testing fuel pump relay and actuation

Special tools, testers and aids required

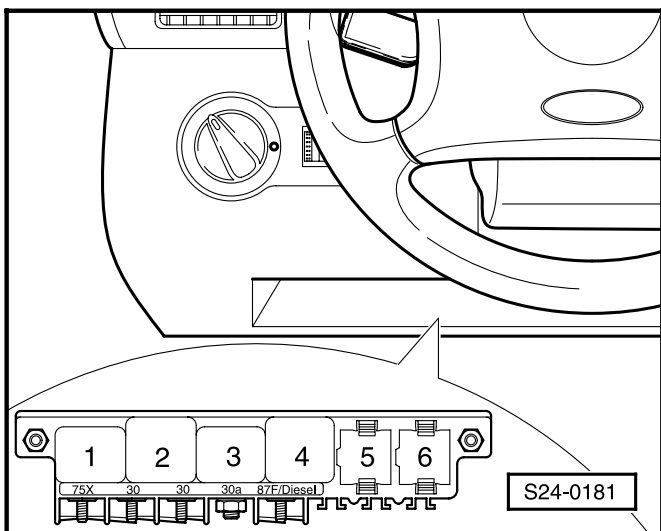
- ♦ Test box V.A.G 1598/22
- ♦ Hand-held multimeter e.g. V.A.G 1526 A
- ♦ Diode test lamp e.g. V.A.G 1527
- ♦ Adapter cable set e.g. V.A.G 1594 A
- ♦ Current flow diagram

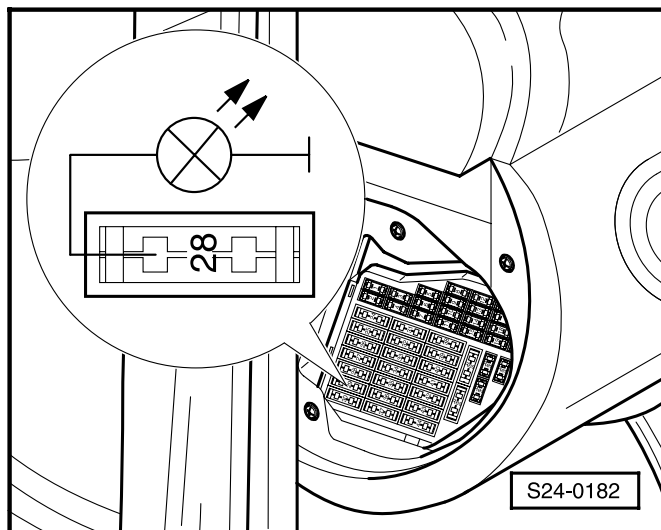
Note:

- ◀ *The fuel pump relay is located in the electrical centre in the interior of the vehicle behind the driver footwell storage compartment, relay position 4.*

A - Testing fuel pump relay -J17

- Remove the storage compartment in the front left footwell.



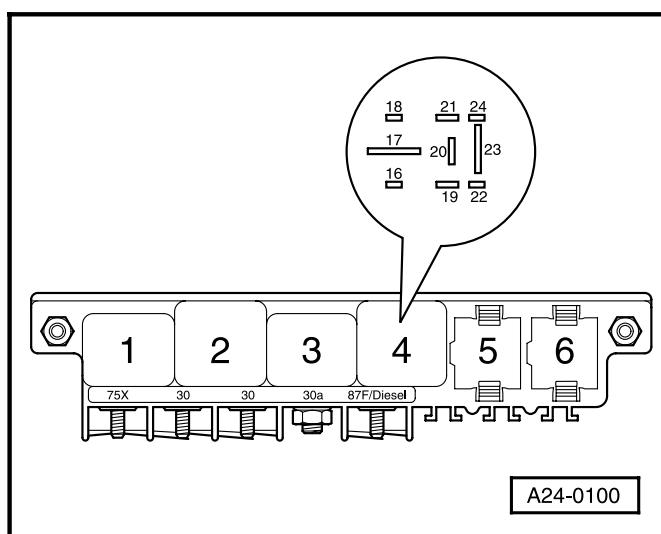


Take out fuse 28 at fuse holder and connect diode test lamp between earth and one of the two contacts of fuse 28.

Briefly operate the starter.

The fuel pump relay must operate (can be felt and heard), the diode test lamp must come on.

If the diode test lamp does not come on although the fuel pump relay operates, repeat the test at the other contact.



If the diode test lamp again does not come on, test cable connection between contact 23 at relay position 4 and fuse 28 for continuity and rectify any open circuit.

⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

If no open circuit is found, replace fuel pump relay.

If the fuel pump relay does not operate, test actuation ⇒ page 24-53.

If the voltage supply and the actuation are o.k., replace fuel pump relay.

B - Testing voltage supply and actuation of fuel pump relay

Remove fuel pump relay J17 from the electrical centre, relay position 4.

Testing voltage supply

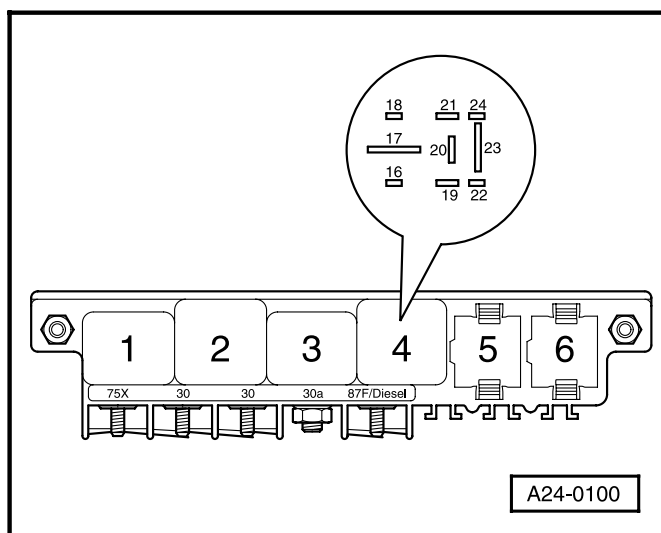
Switch on the ignition.

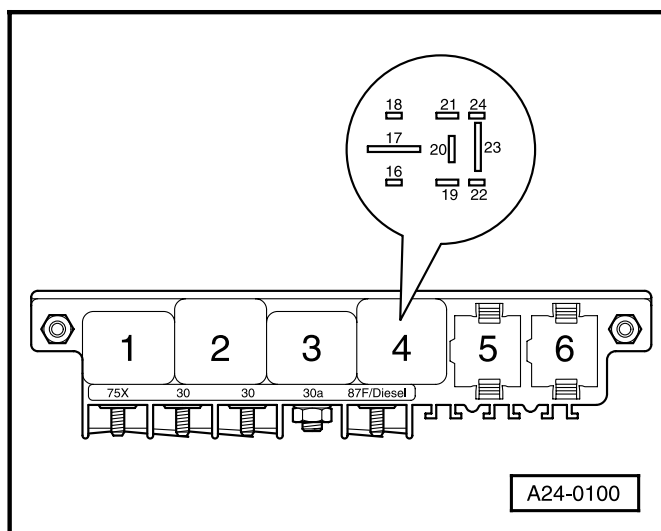
Warning!

Switch on the relevant measuring range and pay attention to the test conditions before connecting the test cables in order to avoid damaging the electronic components.

Connect the hand-held multimeter in turn to contacts 19 (positive) and earth as well as to 17 (positive) and earth of the relay base.

Specification in each case: approx. battery voltage





- If the specifications are not achieved, rectify open circuit in wiring.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

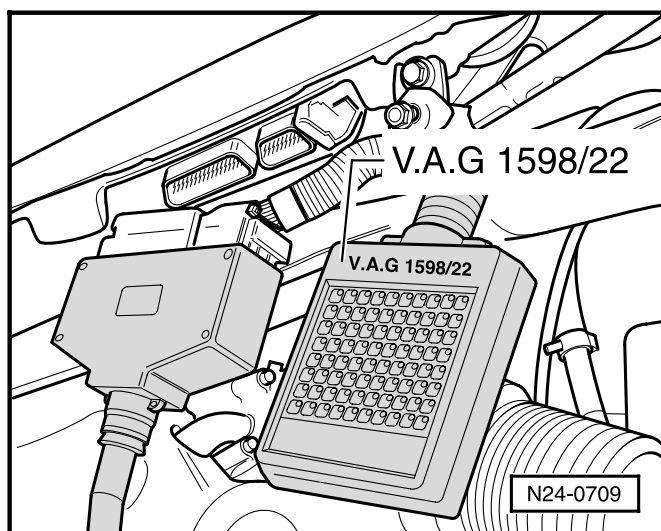
Testing actuation

- ◀ - Connect the diode test lamp to contact 16 (earth) and to positive.
- When the starter is operated, the diode test lamp must come on and remain on.

Note:

Diode test lamps with a low current consumption do not go out fully but glow weakly until the starter is operated.

If the diode test lamp does not come on, test the cable as follows:



- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
- Connect the hand-held multimeter between contact 16 of the relay base and socket 4 of the test box and test the cable connection for continuity.
- Rectify any open circuit in the wiring.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If no open circuit is present and the diode test lamp does not come on, replace engine control unit ⇒ page 24-69.
- If actuation of the fuel pump relay and the cable connection are o.k., replace fuel pump relay.
- Re-insert fuse 28.

Testing air mass meter

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Fuse 43 is o.k.
- The coolant temperature is at least 85 °C.
- All electrical components are switched off.
- Air conditioning system, if fitted to vehicle, is switched off.
- Selector lever of automatic gearbox, if fitted to vehicle, is in position „P” or „N”.

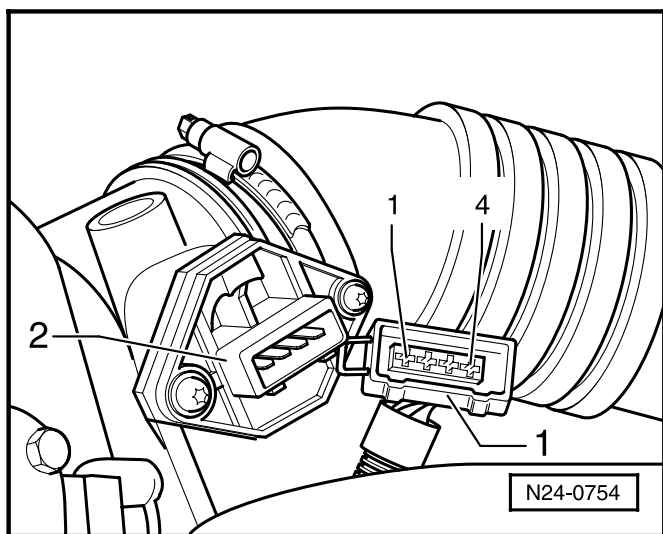
Testing operation

- Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3 ⇒ page 01-3; engine is idling during this step.
- Read measured value block (function 08) and select display group 003 ⇒ page 01-45.
- Check in display block 3 whether the coolant temperature is more than 85 °C.
- Select display group 002.
- Check the inducted air mass in display block 4.

Specification: 1.8...4.0 g/s

Read measured value block 3				→
860 rpm	14 V	90 °C		40 °C

Read measured value block 2				→
860 rpm	1.2 ms	1.7 ms		2 g/s



- If the specifications are not achieved or if a fault regarding the air mass meter is stored in the fault memory:
- Test the voltage supply of the air mass meter ⇒ page 24-56.

Testing voltage supply of air mass meter (G70)

- Test fuse for air mass meter.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- Unplug the 4-pin connector -1- at the air mass meter -2-.
- ◀ - If the fuse is o.k., connect the multimeter for a voltage measurement to contact 3 of the connector and to engine earth.

Warning!

Switch on the relevant measuring range and pay attention to the test conditions before connecting the test cables in order to avoid damaging the electronic components.

- Briefly operate the starter (engine may also start for a short time); the diode test lamp should come on.

Specification: 11...15 V

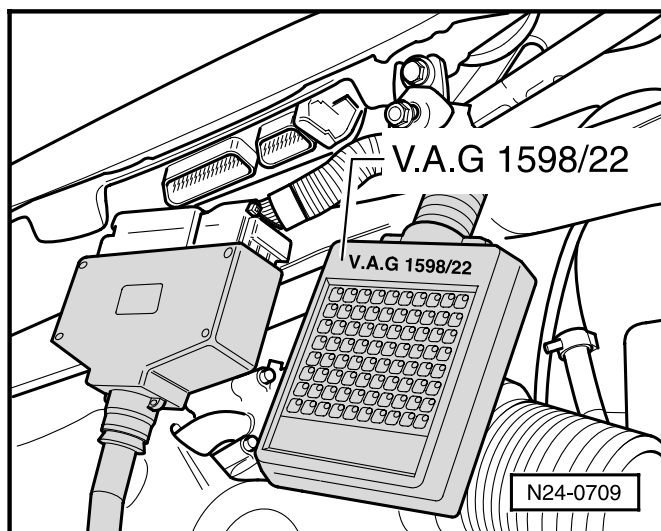
- Switch off the ignition.

If the specification is not achieved:

- Test the cable connection from contact 3 of the connector to the fuse for open circuit and for short circuit to earth and rectify if necessary.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If the fuse and cable connection are o.k., test fuel pump relay ⇒ page 24-52.

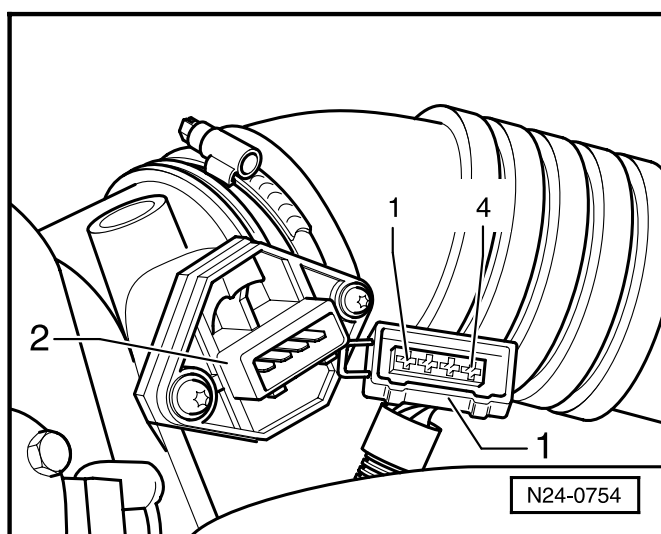
If the voltage supply is o.k.:

- Test the signal wires ⇒ page 24-57.



Testing signal wire of air mass meter

- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.



- ◀ - Test cable connection from the connector at the air mass meter to the engine control unit for open circuit and for short circuit to positive and to earth, and repair if necessary:

Contact at 4-pin connector of air mass meter G70	Test box V.A.G 1598/22, socket
1	2
2	12
4	13

- If the cable connection is o.k., replace the air mass meter (G70).

Testing intake system for leaks (unmetered air)

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Engine leak detection spray G 001 800 A1

Test procedure

Notes:

- ◆ *As a result of the vacuum in the intake system, the leak detection spray is inducted together with the unmetered air. The leak detection spray reduces the ignition performance of the fuel mixture which in turn results in a drop in engine speed and a change in the lambda probe readout.*
- ◆ *It is essential to observe the safety instructions stated on the can.*
- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit (address word 01) ⇒ page 01-3; engine is idling for this step.
- Press keys 0 and 8 for the function „Read measured value block” and confirm the entry with the key Q.
- Press keys 0, 0 and 9 for „Display group number 9” and confirm the entry with the key Q.

Read measured value block 9			→
860 rpm	-8%	0.9 V	+8%

◀ Readout in display:
(1...4 = display blocks)

- Note the engine speed shown in display block 1.
- Note the lambda probe voltage shown in display block 3 and the range within which it varies.
- Spray the parts of the intake system systematically with engine leak detection spray.

If there is no change to the engine speed or to the lambda probe voltage:

- Press the → key.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.

If engine speed drops or if there is a change to the lambda probe voltage:

- Press the → key.
- Press keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.
- Inspect the sprayed point of the intake system for leaks and rectify the fault.

Testing lambda control

The lambda probe compares the oxygen concentration of the air with the residual oxygen in the exhaust and supplies a voltage signal to the control unit.

The voltage signal „rich mixture (low level of residual oxygen)“ is at approx. 0.7...1.0 V (related to reference earth).

The voltage signal „lean mixture (high level of residual oxygen)“ is at approx. 0.0...0.3 V (related to reference earth).

A voltage jump from 0.7...1.0 V to 0.0...0.3 V and vice versa takes place at the transition from „rich mixture“ to „lean mixture“ and vice versa.

In view of the sharp voltage jump, the lambda control is not able to hold constant the ideal mixture composition which corresponds to $\lambda = 1.0$.

A so-called reference voltage of approx. 0.4...0.5 V is programmed in the engine control unit for analysing the signal supplied by the lambda probe. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.

The control must operate at least 30 times a minute when an engine at normal operating temperature is running at idling speed.

If the voltage does not change, or only sluggishly, the following faults may exist:

- ◆ *Slots or holes in probe head blocked.*
- ◆ *The vent hole at the probe in the area of connection cable is sealed off.*
- ◆ *Probe has been subjected to excessive thermal stresses.*
- ◆ *The probe has been damaged by leaded fuel.*

- ◆ *Contact resistance in the signal wire.*
- ◆ *Probe too cold, probe heater not operating.*
- ◆ *Lambda control switched off (engine control unit has detected fault at the injection system ⇒ Interrogate fault memory and also Read measured value block, display group 021).*
- ◆ *Probe damaged by contact spray or similar products. (The contact spray is drawn into the probe through the fine cavities in the electric cables as a result of the thermal variations and the capillary effect).*
- ◆ *Probe damaged by silicone vapours. (If sealants containing silicone are used, traces of silicone elements are inducted by the engine. These silicone elements are not combusted and damage the lambda probe).*
- ◆ *The lambda probe has been damaged by oil elements escaping from the crankcase ventilation or as a result of leaks in the engine.*

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Current flow diagram

Testing drivability problems after cold start

Test condition

- No fault regarding lambda control stored; rectify any fault and erase fault memory.

The time which elapses until the control is activated (probe temperature required approx. 300 °C) is determined primarily by the following factors:

- ◆ Ambient temperature (summer/winter)
- ◆ Operating conditions after start
- ◆ Operation of probe heater

If faults occur after a cold start, it is necessary to first of all determine whether the problem occurs prior to or only after the control system has been activated.

Test vehicle under cold start conditions:

- Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3 ⇒ page 01-3.
- Select the function Read measured value block (function 08) and display group 009 ⇒ page 01-53.
- ◀ - Now, conduct a road test and check the probe voltage shown in display block 3.

Read measured value block 9	→
860 rpm -8% 0.5 V	-8%

Warning!

Have a 2nd person operate V.A.G 1552.

When the vehicle is cold or when the lambda control is not operated, the voltage must be 0.45...0.50 V.

Read measured value block 9	→
1860 rpm -8% 0.750 V	-8%

- ◀ Once the lambda control is activated, the voltage signal in display block 3 should vary between 0.0...1.0 V.

Notes:

- ◆ Voltage readouts of more than 0.7 V indicate a rich mixture composition (low level of oxygen in exhaust).
- ◆ Voltage readouts below 0.3 V indicate a lean mixture composition (high level of oxygen in exhaust).

- If the drivability problem occurs before the lambda control has been activated, the lambda control is not the cause of the problem.
- If the drivability problem does not occur until after the lambda control has been activated, test operation of lambda probe ⇒ page 24-62.

Notes:

- ♦ *If a problem is not as bad after the lambda control has been activated, the cause of the problem (e.g. unmetered air, faulty injector, etc.) is counteracted by activation of the lambda control. This can be recognized by reading the lambda learned values.*
- *Read measured value block (function 08) and select display group 008 ⇒ page 01-51. If the specifications are not achieved, rectify fault.*
- *In addition, read the measured value block in function 04 (Basic setting). In this function the solenoid valve of the activated charcoal filter -N80 is closed.*
- ♦ *It is possible to specifically switch the lambda control off and on using display group 099. It is possible to switch back and forward between „Basic setting” (lambda control off) and „Read measured value block” (lambda control on) by pressing the keys 4 and 8, respectively.*

Testing operation of lambda control

Test conditions

- Engine control unit adapted to throttle valve control unit ⇒ page 24-72.
- Coolant temperature at least 85 °C.
- No leak in exhaust system between catalytic converter and cylinder head.
- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit ⇒ page 01-3; engine is idling for this step.
- Select function 08 „Read measured value block” and display group 003 ⇒ page 01-45.

Read measured value block 3	→
860 rpm 14 V 90°C	40°C

◀ Readout in display:

Do not continue the test until the coolant temperature in display block 3 is at least 80 °C.

- Press key C.
- Press keys 0, 0 and 9 for „Display group number 009” and confirm the entry with the key Q.

Read measured value block 9			
860 rpm	-8%	0.5 V	-8%

→

◀ Readout in display:

- Check the lambda probe voltage in display block 3. The voltage should vary at least 30 times a minute within the range from 0...1.0 V.

If the lambda control does not vary within the stated range:

- Clear lambda probe using a road test and repeat the test.

If the specification is again not achieved:

- Test lambda probe heater ⇒ page 24-65.
- Analyse the measured value blocks 007 to 009 ⇒ page 01-50.
- If the voltage change takes place more slowly, the following faults are possible:
 - ◆ The slots or holes in the probe head are blocked.
 - ◆ The vent hole at the probe in the area of the connection cable is sealed off.
 - ◆ The probe has been subjected to excessive thermal stresses (glazed).
 - ◆ The probe has been damaged by leaded fuel.

- If the lambda probe voltage remains constant, the following faults are possible:

Readout	Cause	Continue test
between 0.4...0.5 V	Open circuit	⇒ page 24-67, Test base voltage
1.1 V	Short circuit to positive	⇒ page 24-68, Test lambda probe cable
0.00 V	Short circuit to earth	
0.0...0.3 V	Mixture too lean Mixture control moved against control stop in direction of „richer mixture”, but lambda probe still detects ”mixture too lean”	
0.7...1.0 V	Mixture too rich Mixture control has moved against control stop in direction of „leaner mixture”, but lambda probe still detects „mixture too rich”	

- Press the key C.
- If the lambda probe is operating properly, check lambda learned values.
- Select display group 008 and confirm the entry with the key Q.

Read measured value block 8	→
2 ms -0.7 % -0.5 % TB active	

◀ Readout in display:

The mixture adaptation is adaptive, in other words it is able to „learn” differences between engine cylinders (nozzle flow, compression, fuel pressure, etc.) through the lambda control and to compensate for these by adapting the basic injection times programmed in the map. The injection times are extended or shortened until a mixture of $\lambda = 1$ is achieved. The variation of the actual injection time from the basic injection time programmed in the map is stated in %.

- ◆ Positive learned value (+...%): Programmed basic injection time too short, actual injection time extended by ...% so that $\lambda = 1$ is achieved.

- ◆ Negative learned value (-...%): Programmed basic injection time too long, actual injection time shortened by ...% so that $\lambda = 1$ is achieved.

Specifications: ⇒ page 01-51.

Testing lambda probe heater

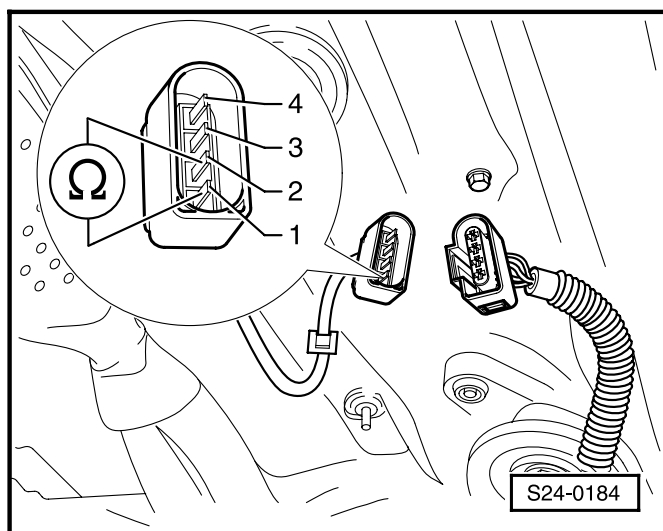
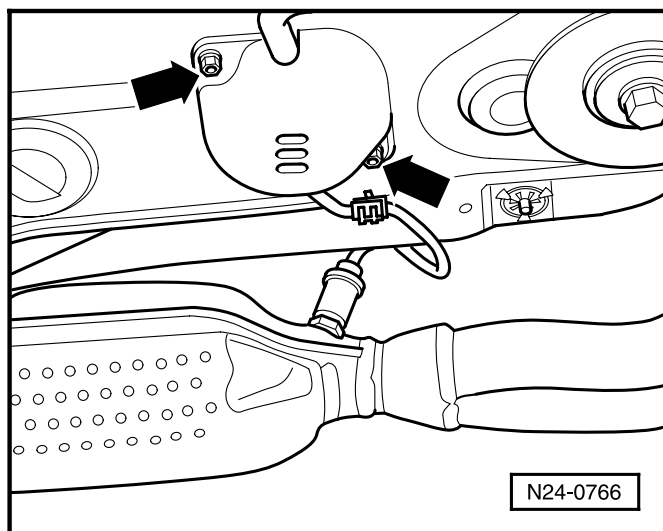
- The heating circuit of the lambda probe is monitored by the self-diagnosis.
- Interrogate fault memory ⇒ page 01-5.

Test conditions

- Fuse 43 is o.k.
- Battery voltage is at least 11.5 V.
- Fuel pump relay is o.k.

Test procedure

- ◀ - Unscrew the protective cover -arrows- and separate the 4-pin plug connection (black) to the lambda probe upstream of the catalytic converter (G39).



- ◀ - Conduct a continuity test (resistance measurement) between contacts 1 and 2 of the probe connector.

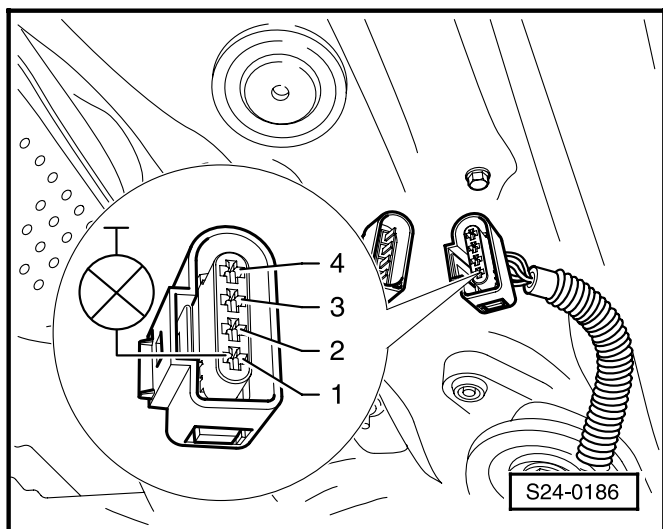
Warning!

Switch on the relevant measuring range before connecting the test cables and pay attention to the test conditions in order to avoid damaging the electronic components.

Note:

At room temperature the resistance of the heating element is approx. 1...5 Ω . The resistance rises sharply as soon as there is a slight rise in temperature.

- If an open circuit is found, replace lambda probe (G39).

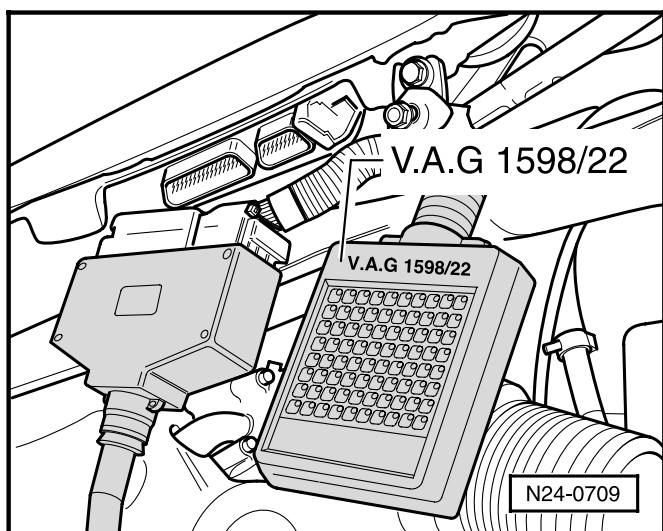


If the heating element has continuity, test voltage supply for lambda probe heater as follows:

- ◀ - Set the multimeter to voltage measurement and connect it to contacts 1 + 2 of the connector to the control unit.
- Briefly operate the starter (engine may also start for a short time).

Specification: 11...15 V

If the specification is not achieved:

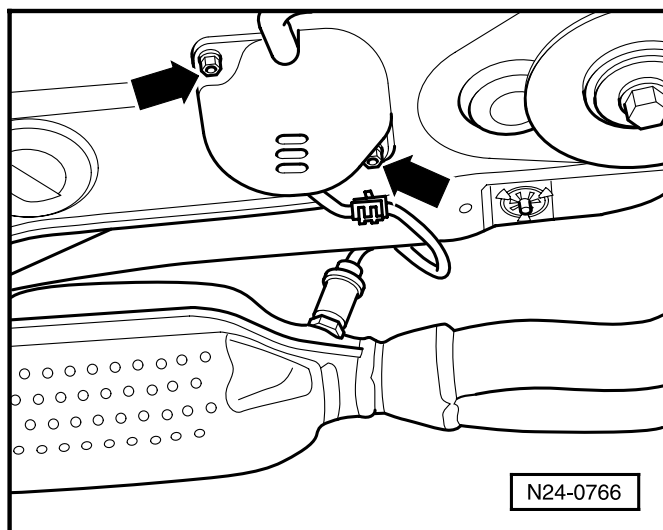


- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.

- Test the cable connection from contact 2 of the connector at the wiring loom (earth cable) to contact 27 at engine control unit for continuity and rectify any open circuit.
- Test the cable connection from contact 1 of the connector at the wiring loom to the fuse for open circuit and for short circuit to earth, and repair if necessary.

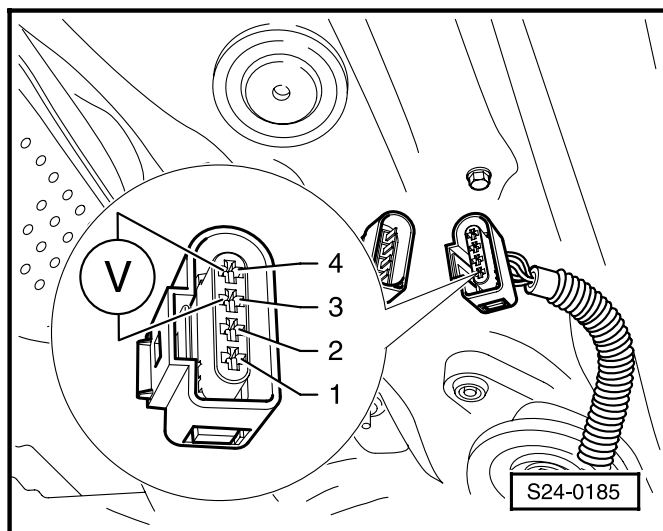
If the cable connections are o.k.:

- Test the cable connection from contact 1 to the fuel pump relay (J17) according to the current flow diagram.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- Test fuel pump relay ⇒ page 24-52.



Testing basic voltage

- ◀ - Unscrew protective cover -arrows- and separate the 4-pin plug connection (black) to the lambda probe upstream of the catalytic converter (G39).
- Switch on the ignition.



- ◀ - Conduct a voltage measurement between contacts 3 and 4 of the connector at the wiring loom.

Specification: 0.40...0.50 V

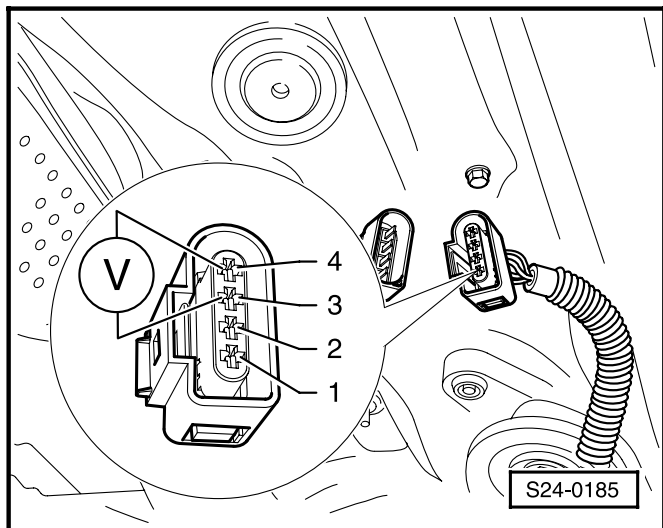
- Switch off the ignition.

If the specification is not achieved:

- Test the lambda probe cables ⇒ page 24-68.

If the specification is achieved:

- Replace the lambda probe (G39).



Testing lambda probe cables

- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
- ◀ - Test the following cable connections for open circuit, short circuit to positive and to earth, and repair if necessary:

Connector at wiring loom, contact	Test box V.A.G 1598/22, socket
3	25
4	26

- If no fault is found in the wiring, replace engine control unit ⇒ page 24-69.

Removing and installing lambda probe

Special tools, testers and aids required

- ♦ Wrench for lambda probe e.g. 3337
- ♦ Assembly paste e.g. G 052 112 A3

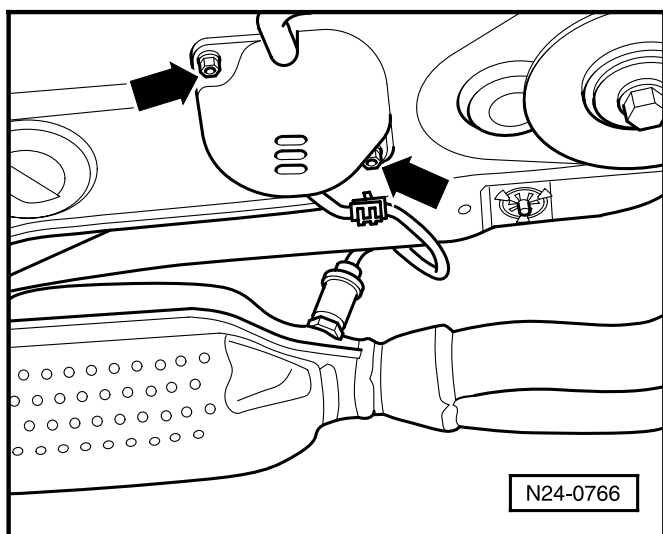
Removing

- ◀ - Unscrew the protective cover -arrows- and separate the 4-pin plug connection (black) to the lambda probe upstream of the catalytic converter.
- Unscrew the lambda probe, using e.g. 3337.

When installing, pay attention to the following points:

Notes:

- ♦ Tightening torque 50 Nm.
- ♦ Coat the thread of the lambda probe with assembly paste e.g. G 052 112 A3. This paste must not get into the openings of the probe.



Replacing, coding and adapting engine control unit

Replacing engine control unit

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Note:

When the connectors are unplugged from the engine control unit, the learned values are erased but the contents of the fault memory are retained.

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit ⇒ page 01-3.
- Enter control unit identification.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.

Removing

- Switch off the ignition.
- Unscrew the windscreen wiper arms and remove the cover of the plenum chamber.

Notes:

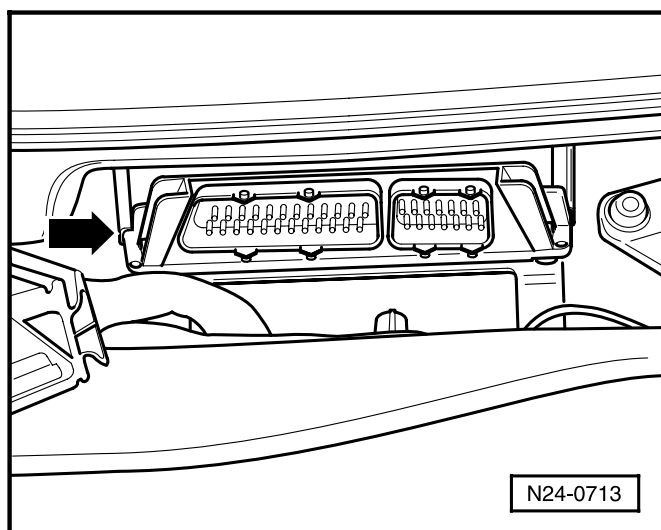
- ♦ *When removing the cover, detach the hose and the connector for the spray nozzles.*
- ♦ *In order to connect test box V.A.G 1598/22 which is required for testing the components, release the connector catches and unplug the control unit connectors.*

- Release the connector catches and unplug the control unit connectors.

- ◀ - Use a screwdriver to push the catch of the fixture to the side and pull the engine control unit forward.

Installing

Installation is carried out in the reverse order.



Notes:

- ◆ *During the initial learning phase of engine basic setting, slightly irregular idling as well as slight jerking when driving are possible.*
- ◆ *The following steps must be carried out after installing the engine control unit:*
 - *After completing the work, interrogate the fault memory of the new engine control unit and erase the fault memory if necessary.*
 - *Perform coding of the new engine control unit ⇒ page 24-70.*
 - *Adapt engine control unit to the throttle valve control unit (J338) ⇒ page 24-72.*
 - *Adapt engine control unit to the electronic immobiliser ⇒ page 24-71.*
 - *Perform the idling speed test ⇒ page 24-13.*

Coding engine control unit**Special tools, testers and aids required**

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

If the code which is displayed does not correspond to the vehicle or if the control unit has been replaced, it is then necessary to code the control unit as follows:

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit ⇒ page 01-3; the engine should be switched on for this step.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Select function 07 „Code control unit” and confirm the entry with the key Q.

Code control unit
Enter code number xxxxx (0-32000)

Q

◀ Readout in display:

- Enter the relevant code number for this vehicle and confirm the entry with the key Q.

Code number	For models with
04030	Automatic gearbox
04000	Manual gearbox

06A906018CF 1.8l R4/5VT MOTR HS D03 →
Coding 04000 WSC 06388

◀ The control unit identification appears in the display of the vehicle system tester V.A.G 1552, e.g.:

- Switch off the ignition and switch it on again.

Note:

The coding entered is activated when the ignition is next switched on.

- Press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press the keys 0 and 6 for the function „End output” and confirm the entry with the key Q.

Adapting engine control unit to electronic immobiliser

Special tools, testers and aids required

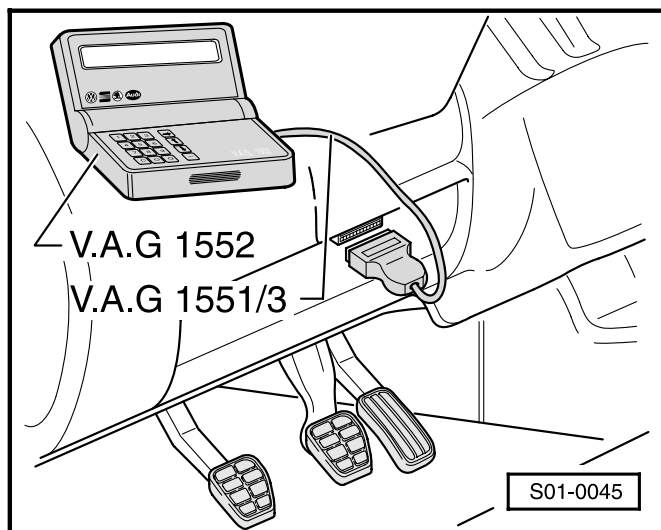
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Test condition

- Authorized car key available

Procedure

- ◀ - Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3 ⇒ page 01-3.
- Switch on the ignition.
- Press keys 1 and 7 for the address word „Dash panel insert” and confirm the entry with the key Q.
- Press the → key.



8L0919860. AB-KOMBIINSTR. VDO... →
Coding XXXXX WSC 12345

◀ Readout in display:

- Press the → key.

IMMO-IDENTNR: AUZXXXXXXXXXX →

◀ Readout in display:

- Press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press keys 1 and 0 for the function „Adaptation” and confirm the entry with the key Q.

Adaptation
Enter channel number XX

◀ Readout in display:

- Press the key 0 twice for „Channel number 0” and confirm the entry with the key Q.

Adaptation
Erase learned values?

Q

◀ Readout in display:

- Confirm the entry with the key Q.

Adaptation
Learned values are erased

→

◀ Readout in display:

- Complete adaptation by pressing the → key.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.
- Switch off the ignition.

Note:

When the ignition is next switched on, the identification of the engine control unit is entered in the immobiliser control unit.

Adapting engine control unit to throttle valve control unit

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

When adaptation is performed, with the ignition switched on and the engine not running, the engine control unit learns the stop positions of the throttle valve control unit and a comparative curve between throttle valve potentiometer and throttle valve positioner sender.

Adaptation must be performed if:

- ♦ the supply voltage has been interrupted
- ♦ the throttle valve control unit (J338) has been removed and installed
- ♦ the throttle valve control unit (J338) has been replaced.

Test conditions

- No fault stored in fault memory
⇒ page 01-5, Interrogating fault memory
- Battery voltage is at least 11.5 V
- All electrical components such as lights and rear window heater are switched off
- The throttle valve is in the idling position
- The setting of the cruise control system, if fitted, is correct

Procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit with the address word 01 ⇒ page 01-3; the ignition should be switched on for this step.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press key 0 and 4 for the function „Initiate basic setting” and confirm the entry with the key Q.

Basic setting
Enter display group number XXX

HELP

◀ Readout in display:

- Press the keys 0, 9 and 8 for „Display group number 98” and confirm the entry with the key Q.

System in basic setting	98	→
2.20 V 2.80 V	Idling	ADP. runs

◀ Readout in display:

After the key Q is pressed, the throttle valve positioner moves to the Min., Max. and to five intermediate positions and the control unit stores the particular throttle valve angle in the permanent memory. This procedure takes not more than 10 seconds. After this, the throttle valve remains in the start position for a short time and then closes.

System in basic setting	98	→
2.20 V 2.80 V	Idling	ADP. O.K.

◀ Readout in display:

System in basic setting	98	→
2.20 V 2.80 V	Idling	ADP ERROR

◀ If one of the following messages appears in the display, adaptation has been aborted.

Notes:

If the basic setting has been aborted by the control unit, this may be caused by one of the following points:

- ◆ *The throttle valve does not reach the mechanical idling speed stop because of dirt, e.g. oil carbon deposits or an incorrectly set throttle cable.*
- ◆ *The battery voltage is too low.*
- ◆ *The throttle valve control unit or a cable connection is faulty.*

After the basic setting has been aborted, fault „17967 or 17973“ is entered in the fault memory. The next time the ignition is switched on, the basic setting is once again performed automatically.

- End adaptation by pressing the → key.
- Check the specifications of the throttle valve control unit in display group 023 ⇒ page 01-62, Analysing measured value blocks. If the specifications are not achieved, repeat adaptation.
- Interrogate fault memory (function 02) ⇒ page 01-5.
- If no fault is detected, check whether the idling speed switch opens and closes when the accelerator is operated ⇒ page 24-22, Testing idling speed switch.
- Press keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.

Performing basic setting of engine control unit

The following operation can be carried out with the basic setting when the engine is not running:

- ◆ Adaptation of throttle valve control unit to engine control unit ⇒ page 01-66, Display group 098.

The following operations can be carried out with the basic setting when the engine is running:

- ◆ Learning process of lambda control
⇒ any display group
- ◆ Fault finding by specifically switching lambda control on and off ⇒ page 01-67, Display group 099

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Test conditions for operations when engine running

- Coolant temperature at least 80 °C.
- Electrical components switched off (radiator fan must not run during the test).
- Air conditioning switched off.
- Selector lever in position P or N.
- No fault stored in fault memory.
- Connect vehicle system tester V.A.G 1552 and select the engine electronics control unit with address word 01 ⇒ page 01-3. The ignition should be switched on for this step.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press keys 0 and 4 for the function „Basic setting” and confirm the entry with the key Q.

Basic setting
Enter display group number XXX

HELP

◀ Readout in display:

- Select the desired display group number from the list of display groups in „Reading measured value block”.

Note:

Display group number 001 is an example for presenting the sequence.

- Enter 001 for the function „Display group number 01”.
- Confirm the entry with the key Q.

System in basic setting 1

1

2

3

→

4

◀ Readout in display:

Notes:

- ◆ *In the case of display group number 000, the measured values are shown in decimal form.*
- ◆ *Each time the PRINT key is pressed (on V.A.G 1551), the current readout in the display is printed out.*
- ◆ *Press key C before selecting further display groups.*
- If the specifications are achieved in all the display blocks, press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.

Testing additional signals

Testing signals from to air conditioning

AC compressor signal:

Voltage is supplied to the engine control unit just before the AC compressor switches on. The effect of the signal is that the engine control unit maintains a constant idling speed even if the power demanded by the air conditioning system varies.

AC compressor cut-off:

The AC compressor is switched off by the engine control unit for about 6 seconds when accelerating from a standing start and from a low speed (1st gear) to ensure that full engine power is available for accelerating. If the accelerator pedal is released before this time, the time is reduced to at least 3 seconds. The AC compressor is switched off by the gearbox control unit (kickdown switch) at full throttle.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Air conditioning operating properly
- Air conditioning is switched off
- No fault stored in fault memory of engine control unit
- Interior temperature higher than +15 °C
- Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3 ⇒ page 01-3; engine should be idling for this step.

Read measured value block 20 →
860 rpm Neutral A/C-High **Compr. OFF**

◀ Readout in display:

Specification in display block 4: Compr. OFF

- Switch on the air conditioning.
- Set the lowest temperature and the highest blower speed.

Specification in display block 3: A/C-High

Specification in display block 4: Compr. ON

The compressor should run.

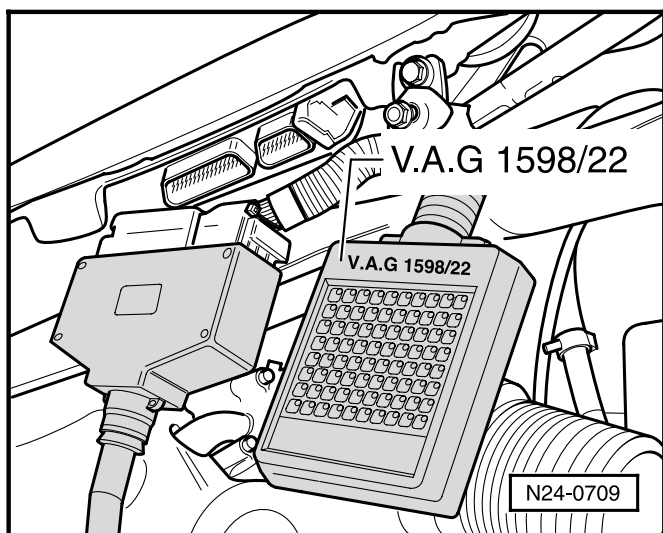
- Depress the accelerator suddenly and release it again (brief blip of throttle).

When the accelerator is depressed rapidly, the readout in display block 4 must jump from „ON“ to „OFF“ for a few seconds (compressor switched off when vehicle accelerated).

- Press the → key.
- Press keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.
- Switch off the ignition.

If the readout does not change:

- ◀ Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
- Test the cable connection from contact 8 of engine control unit to contact 3 at the radiator fan control unit (J293) for short circuit to earth and to positive and also for open circuit according to the current flow diagram.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If there is no fault in the cable connection, replace the radiator fan control unit (J293).
⇒ Heating and Air Conditioning; Repair Group 87.



Testing engine speed adaptation by switching on air conditioning

Notes:

- ◆ *When the air conditioning is switched on, a positive signal is supplied to contact 10 of the engine control unit.*
- ◆ *The effect of this signal is that the engine control unit maintains a constant idling speed even if the power demanded by the air conditioning system varies.*

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Engine warmed up to operating temperature
- Air conditioning operating properly
- No fault stored in fault memory of the air conditioning
- Interior temperature higher than +15 °C
- All electrical components switched off
- Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3 ⇒ page 01-3; engine should be idling for this step.
- Read measured value block (function 08) and select display group 020.

Read measured value block 20 →			
860 rpm	Neutral	A/C-High	Compr. OFF

◀ Readout in display:

Display block 1: idling speed

Display block 3: signal from air conditioning

Display block 4: signal from AC compressor

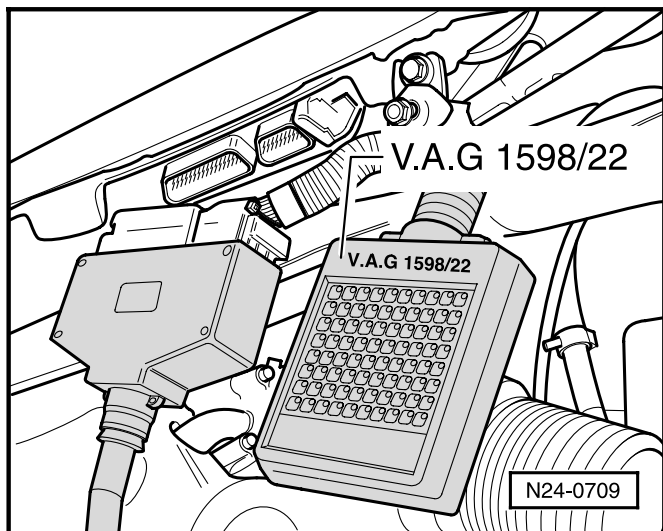
- Switch on the air conditioning with the „Auto“ button. The compressor should run.

Specification in display block 4: Compr. ON

Specification in display block 3: A/C-High

Apart from a short drop in engine speed (less than one second) idling speed should remain at a constant level.

If idling speed is not maintained at a constant level, test whether the signal from the air conditioning system is received at the engine control unit.



- If the signal is not received, switch off the engine and connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
- Test the cable connection from contact 8 of the engine control unit to contact 3 at the radiator fan control unit (J293) for short circuit to earth and to positive and also for open circuit on the basis of the current flow diagram.
- If there is no fault in the cable connection, replace the radiator fan control unit (J293).
⇒ Heating and Air Conditioning; Repair Group 87.

Testing selector lever position of automatic gearbox

The engine control unit is supplied with the following information from the gearbox control unit:

- gear engaged (selector lever in 2/3/4/R/D)
- or
- no gear engaged (selector lever in P or N)

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter V.A.G 1526 A
- ◆ Diode test lamp V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram
- Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3 ⇒ page 01-3.
- Switch on the ignition.
- Read measured value block (function 08) and select display group 020 ⇒ page 01-61.

Read measured value block 20 →			
860 rpm	Neutral	A/C-High	Compr. OFF

◀ Readout in display:

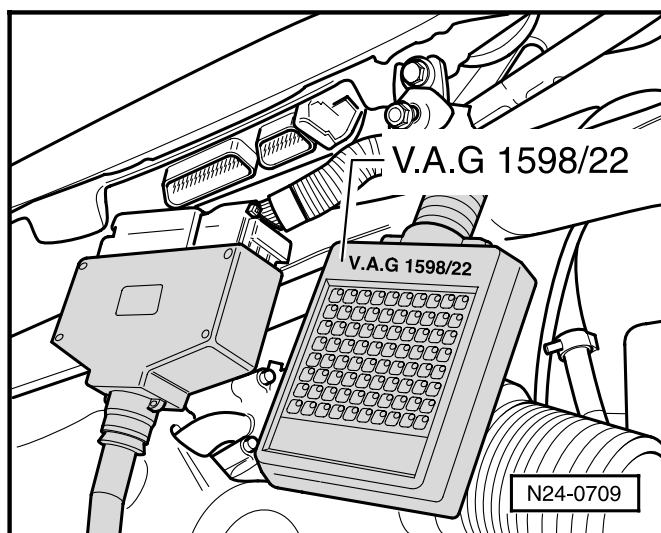
Specification in display block 2: „Neutral“ (selector lever in P or N)

- Press the brake pedal and engage a gear.

Specification: „Gear ENG“

If the readout does not change:

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
 - Test the cables between test box sockets 29 + 41 and the automatic gearbox for open circuit according to the current flow diagram.
 - If no fault is found in the cable connection, test multifunction switch
- ⇒ Automatic Gearbox; Repair Group 01; Gearbox: Electrical Test.



Testing engine speed signal

Note:

The engine speed signal is output at contact 6 of the engine control unit. This signal is necessary for various systems including the rev counter indication in the dash panel insert and the operation of other control units.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Current flow diagram
- Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3 ⇒ page 01-3.
- Read measured value block display group 001 ⇒ page 01-41; engine should be idling for this step.

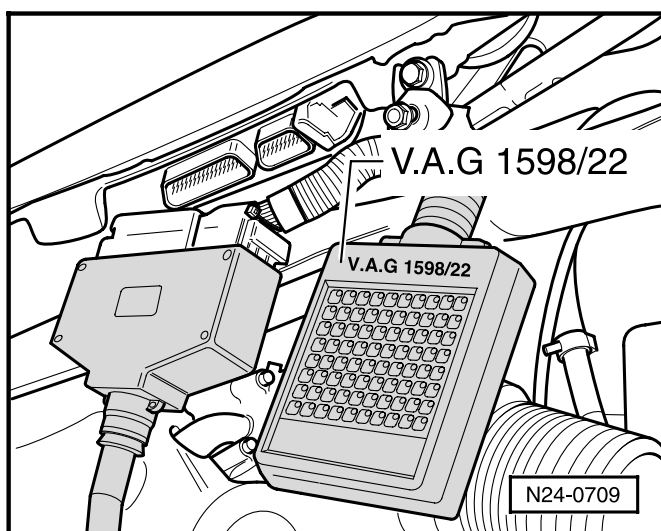
Read measured value block	1	→
900 rpm	1.5 ms	5 ∠°
		12° BTDC

- ◀ - Check readout in display block 1.
- Briefly blip throttle.

Specification: The current engine speed must be displayed (even over entire engine range). This readout must agree with the speed indicated at the rev counter.

If the specification is not achieved:

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
- Test cable connection from contact 6 of the test box to the dash panel insert for open circuit according to the current flow diagram.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



Testing cruise control system (CCS)

The CCS does not have any separate components - with the exception of the operating switch. All the functions are performed by the engine control unit.

Minimum vehicle speed for operation of the CCS is 30 km/h.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Test box V.A.G 1598/22
- ◆ Current flow diagram

Test procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit ⇒ page 01-3. The engine should be idling for this step.
- Select function 08 „Read measured value block” and confirm the entry with the key Q.
- Select display group 066 ⇒ page 01-65.

Read measured value block				66	→
0 km/h	1000	0 km/h		0000	

- ◀ - Readout in display:
- Check the readout in display block 2.

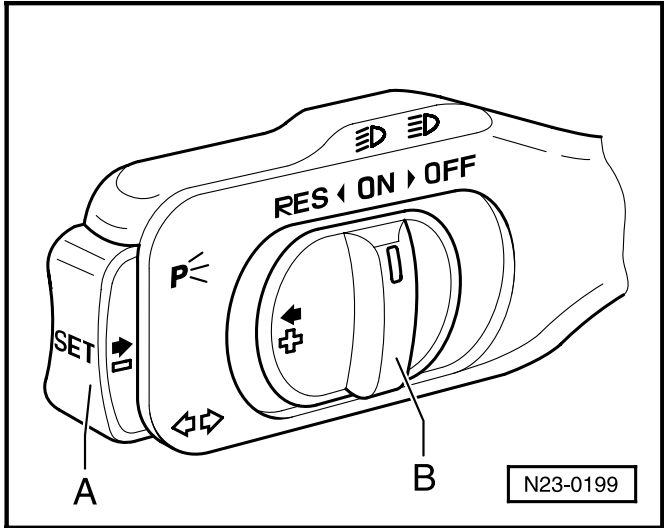
Specification: **1xxx**

If the specification in display block 2 is not achieved with „CCS activated”:

- Replace engine control unit ⇒ page 24-69.

Read measured value block			66 →
0 km/h	1000	0 km/h	0000

◀ - Check the readout in display block 4:



Test conditions	Display block 2	Display block 4
CCS activated	1000	-
Clutch pedal depressed	1110	-
Brake pedal depressed (brake pedal switch)	1111	-
Brake pedal depressed (brake light switch)	1111	-
Switch B to „ON”	-	0000
Switch B to „RES”	-	1000
Switch A pressed	-	0100
Switch B to „OFF”, before switch-on point	-	0010
Switch B to „OFF”, locked	-	0011

If the specification in display block 4 is not achieved although switch B is set to „ON”:

- Press the → key.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.
- Switch off the ignition.
- Connect test box V.A.G 1598/22 to the wiring loom of the control unit.

- Test the cable connection from the engine control unit to the operating switch of the CCS for open circuit and short circuit to earth.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

If no fault is found in the wiring:

- Replace the operating switch of the CCS
- ⇒ Electrical System.

Testing vehicle speed signal

Notes:

- ◆ *The vehicle speed signal is produced by the vehicle speed sender -G68 and is processed in the dash panel insert.*
- ◆ *The processed signal passes to contact 20 of the engine control unit and is used for idling speed stabilisation and for minimising load change jolts during gearshifts.*

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Battery voltage is at least 11.5 V.
- The speedometer is operated properly.

Test procedure

- Connect fault reader ⇒ page 01-3 and select the engine control unit. Engine should be idling for this step.

- Read measured value block (function 08) and select display group 011 ⇒ page 01-56.

Warning!

Have a second person operate V.A.G 1552.

Read measured value block 11				→
1860 rpm	1.5 ms	72 km/h	1.5 l/h	

- ◀ - Conduct a road test and check the vehicle speed signal in display block 3.
Specification: approx. vehicle speed

- Press the → key.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.
- Switch off the ignition.
- If the vehicle speed is not displayed, raise front left of vehicle until the wheel is clear of the ground.

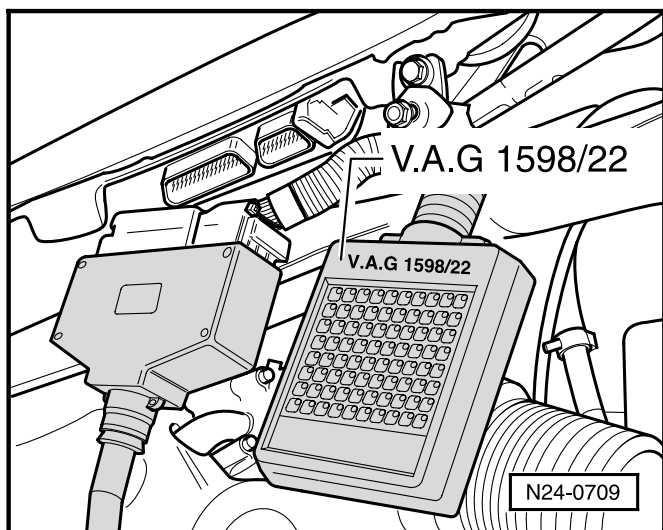
- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.

- Connect the diode test lamp between socket 3 (positive) and socket 20 (signal).
- Switch on the ignition.
- Rotate the left front wheel by hand.

Note:

The right front wheel must not rotate; hold tight if necessary.

- The diode test lamp should flash (very short flashing signal).
- If the diode test lamp does not flash, test the cable connection from contact 20 at the connector of the engine control unit to the dash panel insert for open circuit and short circuit.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



Testing ignition angle retardation during gearshift

Only for models with automatic gearbox

Notes:

- ◆ When this signal is supplied by the gearbox control unit, the ignition angle is retarded to a varying extent during a gearshift of the automatic gearbox (torque reduction), depending on vehicle speed and engine speed, in order to minimise the gear change jolt.
- ◆ In view of the very brief signal, V.A.G 1552 does not always detect the request to retard the ignition angle.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Current flow diagram
- Connect fault reader ⇒ page 01-3 and select the engine control unit. Engine should be idling for this step.
- Read measured value block (function 08) and select display group 019 ⇒ page 01-60.
- ◀ - Check the readout in display block 3 (3rd position from the left). Specification: **xx1x__x**.
- Conduct a road test and check the readout in display block 3 (3rd position from the left). During a gearshift the following readout should be briefly displayed: Specification: **xx0x__x**.

Read measured value block 19				→
860 rpm	8.5 ms	xx1x__x	5° BTDC	

Warning!

Have a second person operate V.A.G 1552.

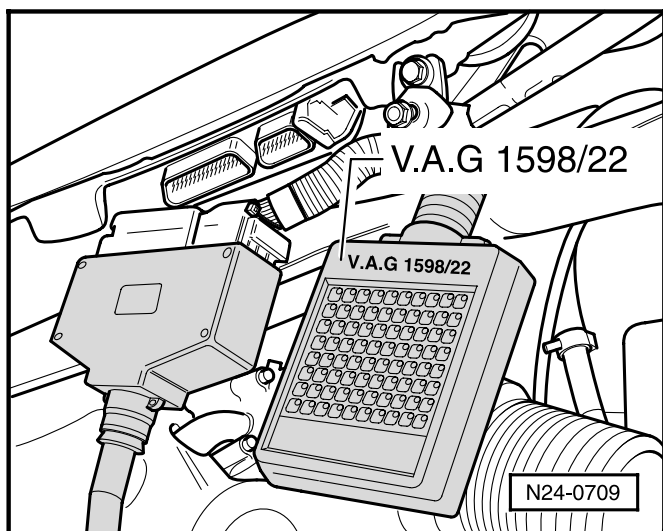
Note:

In view of the fact that the signal supplied by the automatic gearbox is very short, it may be necessary to observe the signal during several gear changes until the readout in display block 3 jumps from 1 to 0.

- Press the → key.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.
- Switch off the ignition.

If the readout does not change:

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
- Test the cables between test box sockets 29 and 41 and the automatic gearbox for open circuit and short circuit according to the current flow diagram.

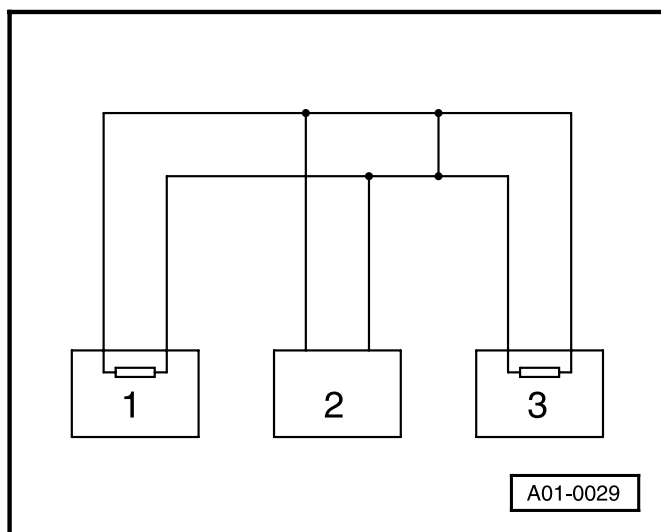
**Testing a „two-line bus system”**

- Refer to the appropriate current flow diagram to determine how many control units are connected to the CAN (Controller Area Network) bus.
- Check the multi-pin connectors of the control units to ensure they are properly connected.
- Connect fault reader V.A.G 1552 and press key 0 twice for the function „Automatic test sequence”.

Before examining the bus lines, ensure that there is no operational fault at any of the control units connected to the bus.

If an operational fault exists, repair this first of all.

- Note the faults and erase the fault memories of all the control units.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.



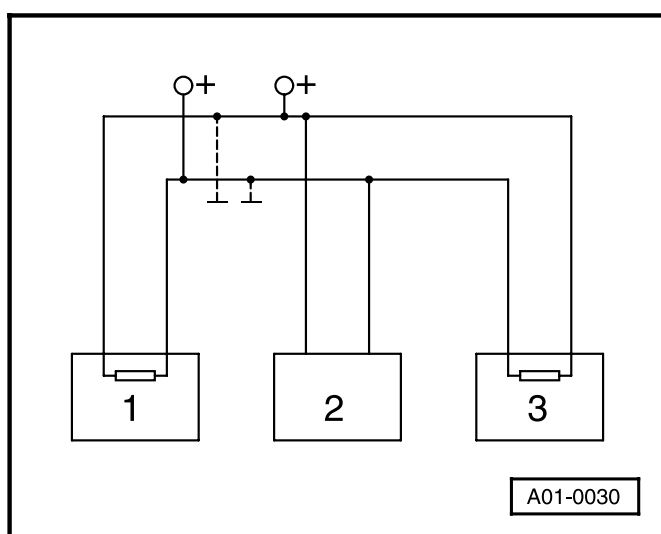
- Repair the operational faults by referring to the fault table in the appropriate workshop manuals.

If all the operational faults have been rectified and there is still a problem with communication of control units, it is then necessary to inspect the bus wires.

- Switch off the ignition.

- ◀ - Unplug the connectors of the control units linked by the bus wires and examine the bus wires to determine whether a short circuit is present.

⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



- ◀ - Examine the bus wires to determine whether there is a short circuit to positive or to earth.

If it is not possible to determine any cause for the fault „Hardware defect“ in the bus wires, examine the control units to determine whether one of these is responsible for this fault.

At this stage, plug connections of the control units which use the CAN bus for communication, are still disconnected. The ignition is switched off.

- Connect one of the control units.
- Connect fault reader V.A.G 1552.
- Switch on the ignition and erase the fault memory of the control unit you have just connected.
- Press keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.
- Switch off the ignition and on again.
- Leave the ignition switched on for 10 seconds. After this, read the fault memory of the control unit you have just connected with the fault reader V.A.G 1552.
- If the fault „Hardware defect“ is present, replace the control unit you have just connected.
- If the fault „Hardware defect“ is not present, connect the next control unit and repeat the test procedure.

Testing signal from power steering pressure switch

Special tools, testers and aids required

- ◆ Fault reader V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Current flow diagram

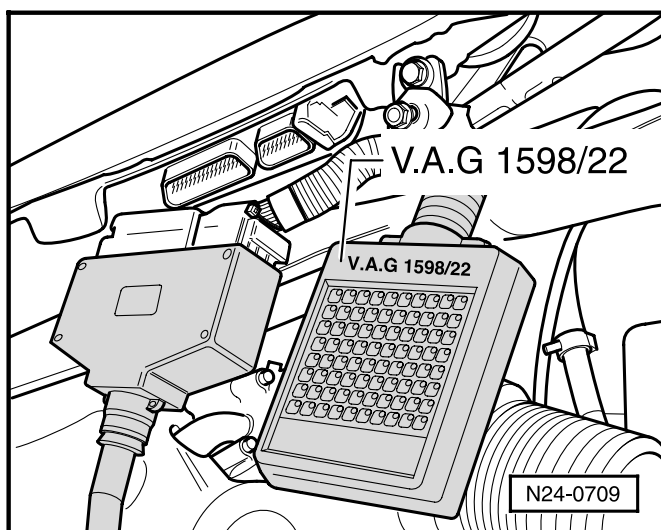
- Connect fault reader ⇒ page 01-3 and select the engine control unit. Engine should be idling for this step.
- Read measured value block (function 08) and select display group 019 ⇒ page 01-60.

Read measured value block 19 →			
860 rpm	8.5 ms	1xxx__x	5° BTDC

- ◀ - Check the readout in display block 3 (1st position from the left).
Specification: **1xxx__x**.
- Turn the steering wheel to full lock and check the readout in display block 3 (1st position from the left).
Specification: **0xxx__x**.
- Press the → key.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.
- Switch off the ignition.

If the specification is not achieved:

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
- Separate 2-pin connector from the power steering pressure switch.



- Test the following cable connections for open circuit and for short circuit to earth or positive, and repair if necessary.

Connector at cable connection, contact	Test box, sockets
1	49
2	14

- If no fault is found in the wiring, connect the multimeter to the contacts of the pressure switch.
- Leave engine running at idling speed.
- Test the pressure switch for continuity.
Specification: $\infty \Omega$
- Turn the steering wheel to full lock.
Specification: Pressure switch should switch to continuity.

If the specification is not achieved:

- Replace pressure switch.

If the specification is achieved:

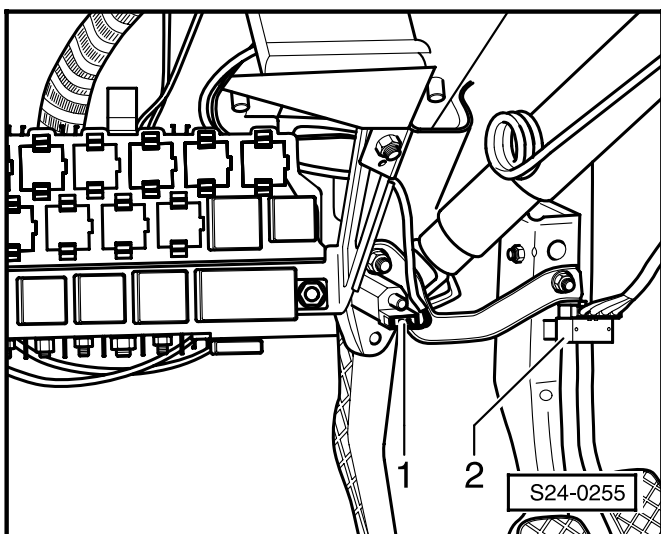
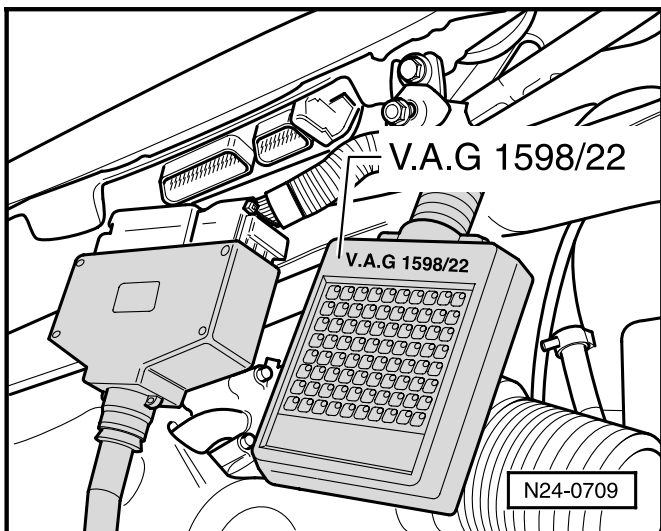
- Replace engine control unit $\Rightarrow$ page 24-69.

Testing signal from clutch pedal switch

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Current flow diagram
- Connect the fault reader. Then, switch on the ignition and select the engine control unit with the address word 01 $\Rightarrow$ page 01-3.

Read measured value block 19 →
 860 rpm 8.5 ms xxx1__x 5° BTDC



- Read measured value block (function 08) and select display group 019 ⇒ page 01-60.

- ◀ - Check the readout in display block 3 (4th position from the left).
 Specification: **xxx1__x**.

- Depress clutch pedal fully and check the readout in display block 3 (4th position from the left).
 Specification: **xxx0__x**.

- Press the → key.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.
- Switch off the ignition.

If the specification is not achieved:

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.

- ◀ - Separate the connector from the clutch pedal -1-.
- Test the following cable connections for open circuit and for short circuit to earth or positive, and repair if necessary.

Connector at cable connection, contact	Test box, socket
2	9

If the specification is not achieved:

- Test the cable between contact 1 of the 2-pin connector and the fuel pump relay according to the current flow diagram.
 ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Testing signal from brake pedal switch and brake light switch

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Current flow diagram

Only for models with cruise control system (4-pin switch)

- Connect the fault reader. Then, switch on the ignition and select the engine control unit with the address word 01 ⇒ page 01-3.
- Read measured value block (function 08) and select display group 066 ⇒ page 01-65, and confirm the entry with the key Q.

Read measured value block	66	→
0 km/h	1110	0 km/h
		0000

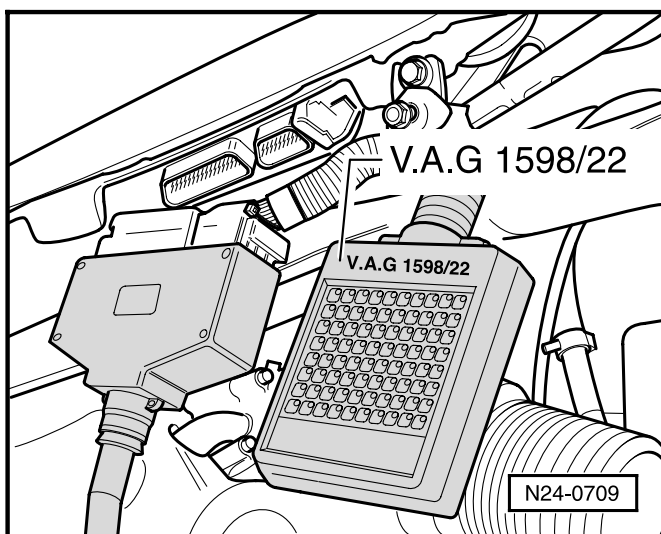
- ◀ - Check the readout in display block 2 (4th position from the left).
Specification: **1110**.

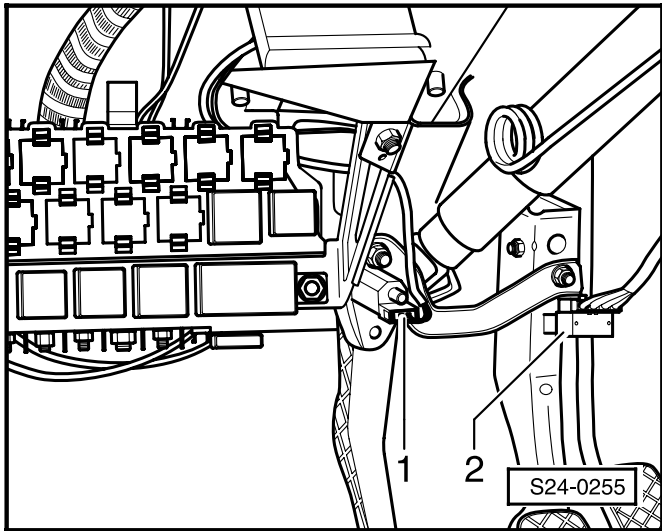
- Depress the brake pedal and check the readout in display block 2 (4th position from the left).
Specification: **1111**.

- Press the → key.
- Press keys 0 and 6 for the function „End output” and confirm the entry with the key Q.
- Switch off the ignition.

If the specification is not achieved:

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.





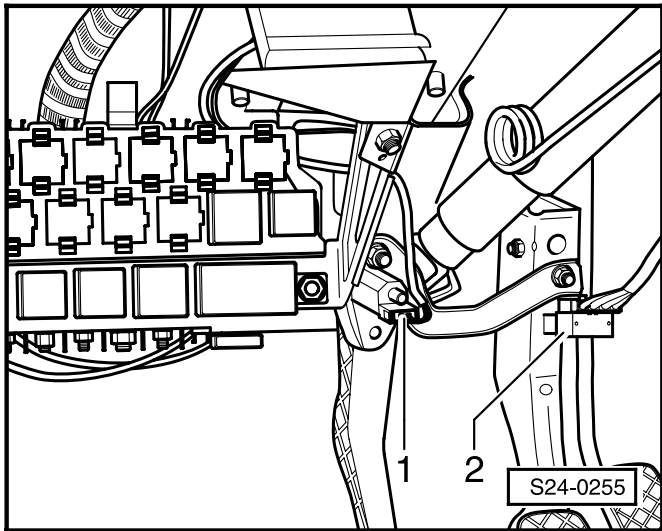
- ◀ - Unplug connector from the brake pedal -2-.
- Test the following cable connections for open circuit and for short circuit to earth or positive, and repair if necessary.

Connector at cable connection, contact	Test box, sockets
3	48
2	47

If the specification is achieved:

- Test contacts 1+2 between the 4-pin connector and the fuel pump relay according to the current flow diagram.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Only for models without cruise control system (2-pin switch)



- ◀ - Unplug connector from brake pedal -2-.
- Test the cable between contact 1 of the connector (red/brown cable) and fuse 13 for open circuit according to the current flow diagram.
- Test the cable between contact 2 of the connector (red/black cable) and the brake lights for short circuit and for open circuit according to the current flow diagram.
- Repair any faults in the wiring or replace brake pedal switch, respectively.

If no fault is found in the wiring:

- Test the operation of the brake pedal switch with the multimeter.
- Replace a faulty brake pedal switch.

Servicing ignition system

Safety precautions

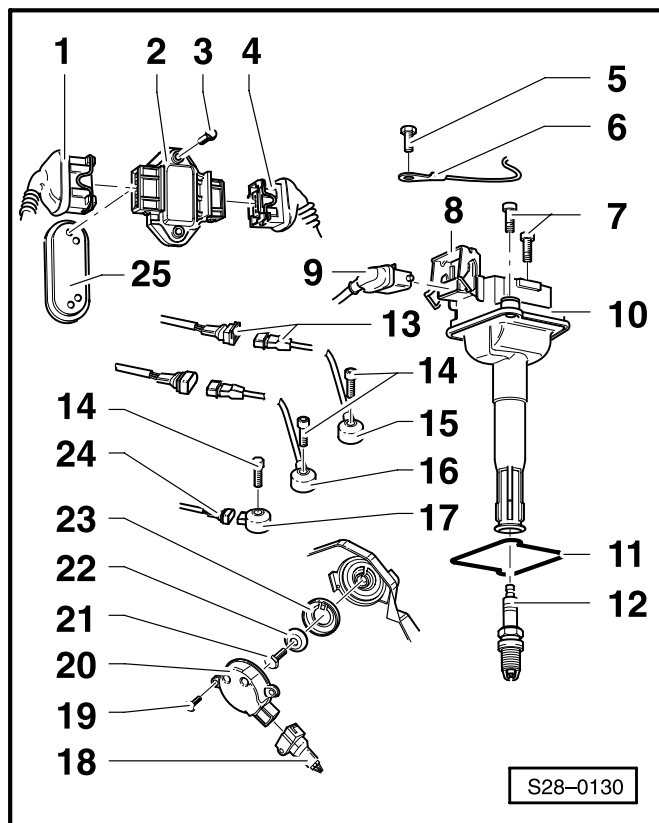
In order to avoid injuries to persons and/or damage to the fuel injection and ignition system, pay attention to the following points:

- ◆ Do not disconnect and connect cables of the fuel injection and ignition system, or of test equipment, unless the ignition is switched off.
- ◆ To operate the engine at starter speed without it actually starting (e.g. compression test), unplug the connector from the power output stage of the ignition coils and the connectors or the injectors. After completing the work, interrogate fault memory.
- ◆ The ignition must be switched off if carrying out an engine wash.
- ◆ The battery must not be disconnected and connected unless the ignition is switched off otherwise the engine control unit may be damaged.

Notes:

- ◆ *This section deals specifically with the components relating to the ignition system. For other components of the fuel injection and ignition system ⇒ Repair Group 24.*
- ◆ *The control unit for the fuel injection and ignition system is equipped with self-diagnosis.*
- ◆ *Components marked with * are tested by self-diagnosis ⇒ page 01-5, Interrogating and erasing fault memory.*
- ◆ *Components marked with ** can be tested by final control diagnosis ⇒ page 01-8.*
- ◆ *A voltage of at least 11.5 V is required for proper operation of the electrical components.*
- ◆ *When conducting certain tests it is possible that a fault is detected and stored by the control unit. or this reason, after completing all the tests and repairs, interrogate the fault memory and erase it if necessar.
⇒ page 01-5, Interrogating fault memory
⇒ page 01-6, Erasing fault memory.*

Parts of ignition system - Assembly overview



1 - Connector

- ◆ for engine code AGU
- ◆ black, 5-pin

2 - Power output stage -N122

- ◆ for engine code AGU
- ◆ at air filter housing
- ◆ coat underside (to heat sink) with heat conducting paste G 052 170 A2 to ensure good heat transfer

3 - 6 Nm

- ◆ for engine code AGU

4 - Connector

- ◆ for engine code AGU
- ◆ black, 4-pin

5 - 10 Nm

- ◆ switch ignition off before slackening and tightening

6 - Earth cable

- ◆ switch ignition off before removing and installing

7 - 9 Nm

- ◆ for engine codes AGU, ARZ
- ◆ oil slightly before installing

8 - Lock

- ◆ for engine code AGU
- ◆ connector

9 - Connector

- ◆ for engine code AGU: black 3-pin
- ◆ for engine codes ARZ, ARX, AUM: black, 4-pin

10 - Ignition coil

- ◆ for engine code AGU: -N, -N128, -N158 and -N163
- ◆ for engine codes ARZ, ARX, AUM: with power output stages -N70, -N127, -N291 and -N292
- ◆ for engine codes ARX, AUM: no screw mounting
- ◆ with detachable plug connection

11 - Gasket

- ◆ for engine codes AGU, ARZ
- ◆ replace if damaged

12 - Spark plug, 20 - 30 Nm

- ◆ use special spark plug wrench (e.g. 3122 B) for removing and installing
- ◆ type and change interval ⇒ Inspection and Maintenance

13 - Plug connection

- ◆ for engine codes AGU, ARZ: 3-pin
- ◆ contacts of plug connection gold-plated
- ◆ brown - for knock sensor 1 -G61
- ◆ blue - for knock sensor 2 -G66

14 - 20 Nm

- ◆ correct tightening torque is important for proper operation of knock sensor.
- ◆ contacts of sensor and of connector gold-plated

15 - Knock sensor 1 -G61*

- ◆ for engine codes AGU, ARZ
- ◆ contacts of sensor and of connector gold-plated

16 - Knock sensor 2 -G66*

- ◆ for engine codes AGU, ARZ
- ◆ contacts of sensor and of connector gold-plated

17 - Knock sensor 1 -G61* and 2 -G66*

- ◆ for engine codes ARX, AUM
- ◆ contacts of sensor and of connector gold-plated

18 - Connector

- ◆ black, 3-pin
- ◆ for Hall sender -G40

19 - 10 Nm**20 - Hall sender -G40***

- ◆ testing ⇒ page 28-3

21 - 25 Nm**22 - Washer**

- ◆ conical

23 - Orifice plate for Hall sender

- ◆ pay attention to installation position

24 - Connector

- ◆ for engine codes ARX, AUM: 2-pin
- ◆ contacts of connector gold-plated

25 - Heat sink

- ◆ for engine code AGU

Testing components and functions

Testing Hall sender (G40)

Special tools, testers and aids required

- ◆ Diode test lamp, e.g. V.A.G 1527 B
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A

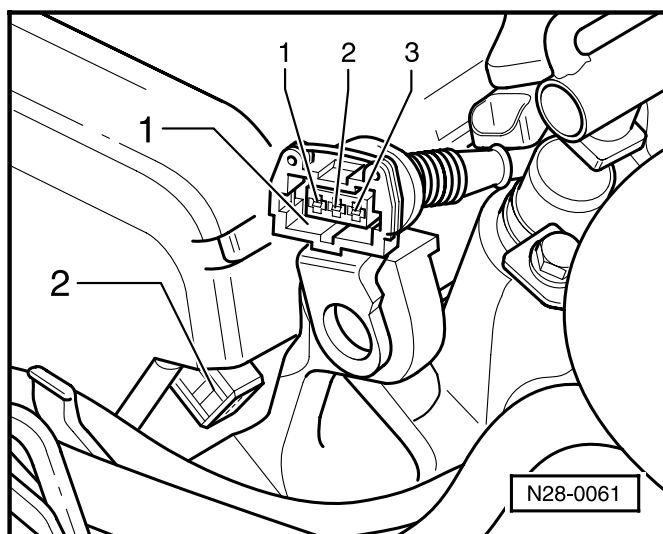
Test condition

- Battery voltage at least 11.5 V

Test procedure

Notes:

- ◆ *In normal operation the engine control unit detects the ignition position of cylinder 1 from the Hall sender signal.*
- ◆ *In view of the fact that it is no longer possible to properly assign the knock sensor cylinders to the signals if the Hall sender signal is not received, the knock control is switched off and the ignition angle is retarded slightly to reliably avoid knocking.*
- ◆ *If the Hall sender signal is not received, the engine continues running and can also be re-started for the following reasons:*
 - ◆ The offset by one engine revolution does not have any perceptible effect on fuel injection. Fuel injection no longer takes place with the inlet valve opened but „advanced“ (before the closing of the inlet valve). Consequently, there is only a minor effect on the quality of the mixture formation.



- ◀ - Unplug the 3-pin connector -1- from the Hall sender -2-.

- Connect the hand-held multimeter and measure the voltage at contacts 1 (positive) and 3 (earth) of the connector of the Hall sender.

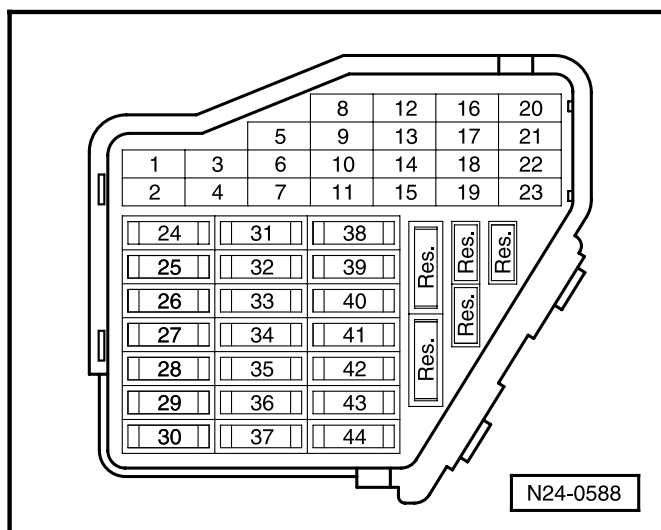
- Switch ignition on:

Specification: at least 4.5 V

- Switch ignition off.

- Test the cable connection from the Hall sender.

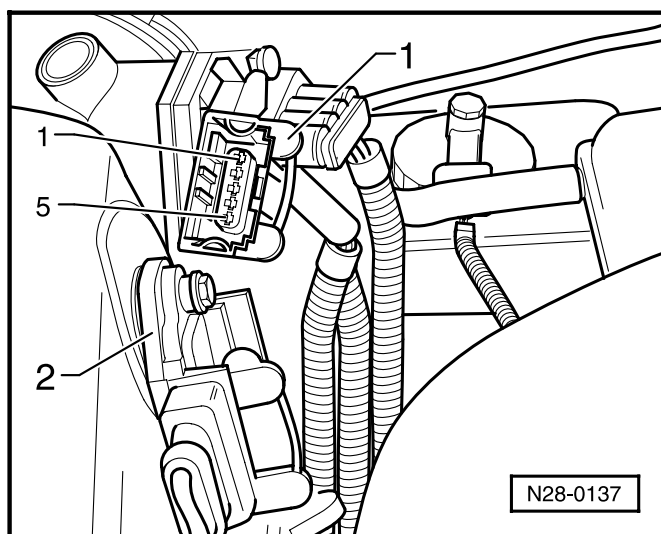
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.



Test conditions

- Battery voltage at least 11.5 V
- Engine speed sender o.k.; testing ⇒ page 24-34
- Hall sender o.k.; testing ⇒ page 28-10
- Fuse 29 o.k.
- Earth connection o.k. ⇒ page 28-2, item 6.

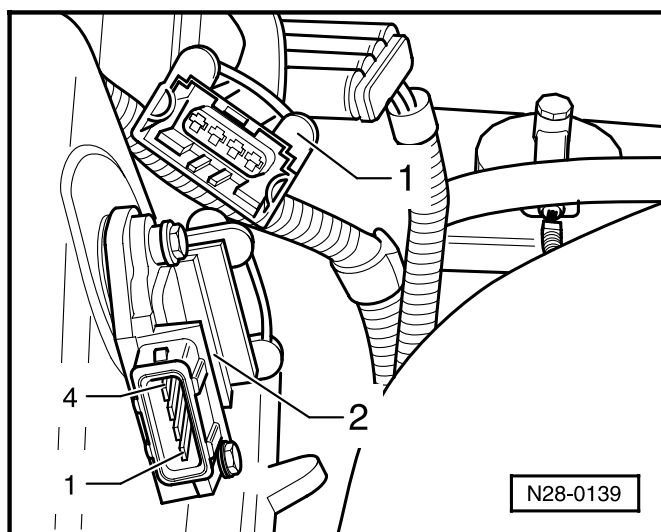
Testing actuation of power output stage



- Unplug the connectors from the injectors.
- ◀ - Unplug the 5-pin connector -1- from the power output stage for the ignition coils -2-.
- Connect the diode test lamp to contacts 1 + 3 using auxiliary cables from V.A.G 1594.
- Operate the starter and test the ignition signal from the engine control unit.
The LED should flicker.
- Repeat the test between contacts 2, 4, 5 + contact 3 (earth).

If the LED does not flicker:

- Test the wiring to the engine control unit ⇒ page 28-6.



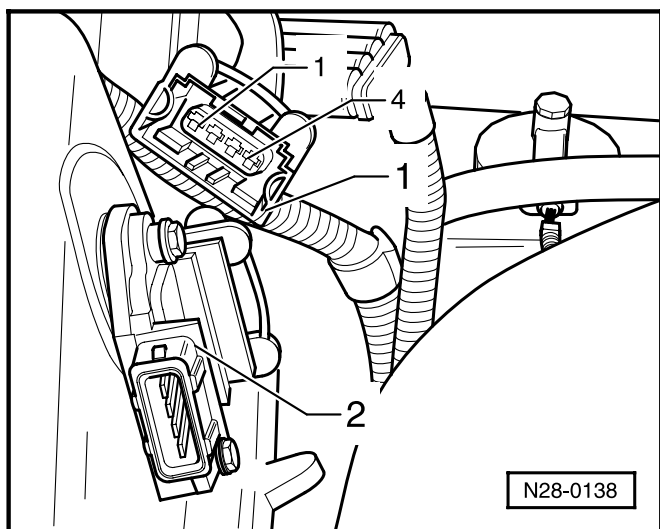
Testing power output stage

- Plug in the 5-pin connector again at the power output stage.
- ◀ - Unplug the 4-pin connector -1- from the output stage for the ignition coils -2-.

- Connect the diode test lamp to contact 1 of the output stage and to battery + using auxiliary cables from V.A.G 1594.
- Operate the starter.
The LED should flicker.
- Repeat the test at contacts 2, 3 and 4.

If the LED does not flicker:

- Replace the power output stage ⇒ page 28-2, item 2.



Testing ignition coils

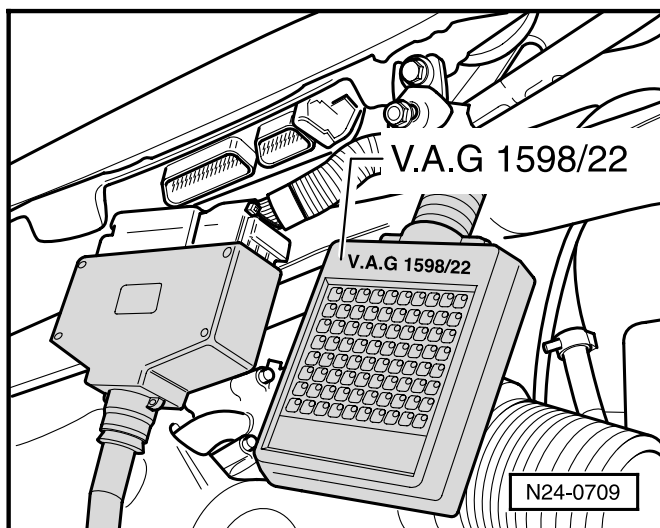
- Switch on the ignition.
- ◀ - Connect the diode test lamp to contact 1 of the 4-pin connector and to battery + using auxiliary cables from V.A.G 1594.
The LED should come on.
- Repeat the test at contacts 2, 3 and 4.

If the LED does not come on at one of the contacts:

- Test the cable between the 4-pin connector and the corresponding connector (contact 1) of the ignition coil for open circuit according to the current flow diagram.
Cable resistance: max. 1.5 Ω

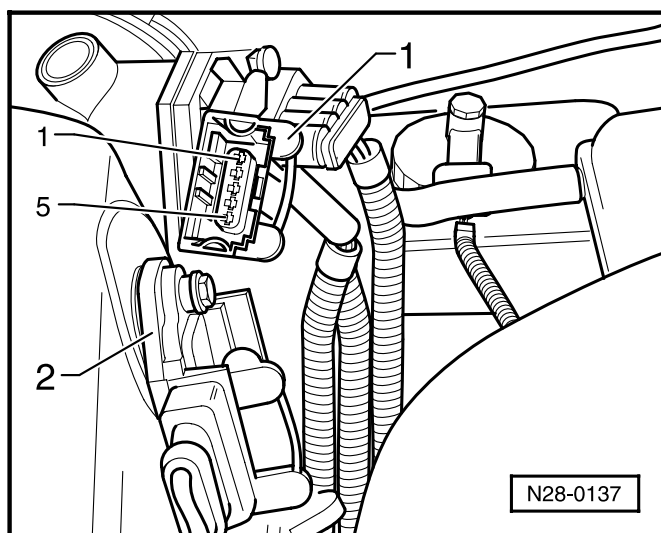
If no fault is found in the cable:

- Replace the appropriate ignition coil.



Testing wiring

- Switch on the ignition.
- ◀ - Connect the test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.



- Test the cables between test box and 5-pin connector for open circuit according to the current flow diagram.

Contact at 5-pin connector of power output stage	Test box V.A.G 1598/22, socket
1	77
2	70
3	2
4	78
5	71

Specification: max. 1.5 Ω

- Rectify any open circuit in the wiring or short circuit.

If no fault is found in the wiring:

- Replace engine control unit $\Rightarrow$ page 24-69.

Testing knock sensors

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Current flow diagram

Notes:

- ◆ *For testing the operation of the knock sensors, read measured value block, display groups 013, 014, 015 and 024.*
- ◆ *The knock sensors themselves can be tested electrically (interrogate fault memory $\Rightarrow$ page 01-5).*
- ◆ *It is essential to exactly adhere to the tightening torque of 20 Nm to ensure proper operation of the knock sensors.*
- ◆ *Inspect plug connection for corrosion.*
- ◆ *Only gold-plated contacts may be used for repairing the contacts in the plug connection of the knock sensors.*

Test condition

- A fault at one or both knock sensors must have been detected by the self-diagnosis.

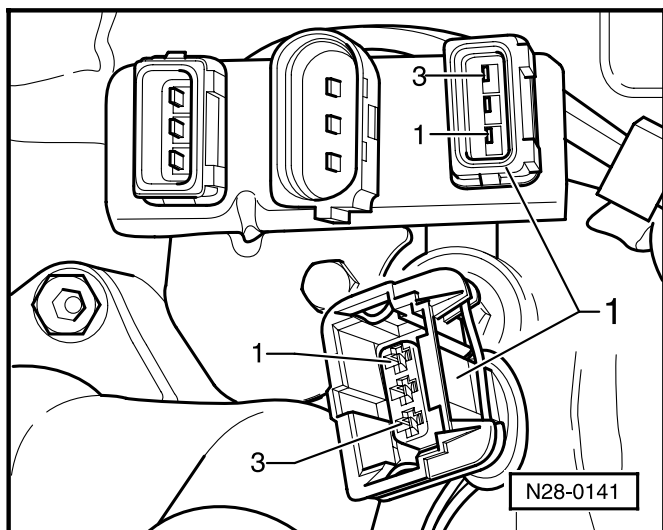
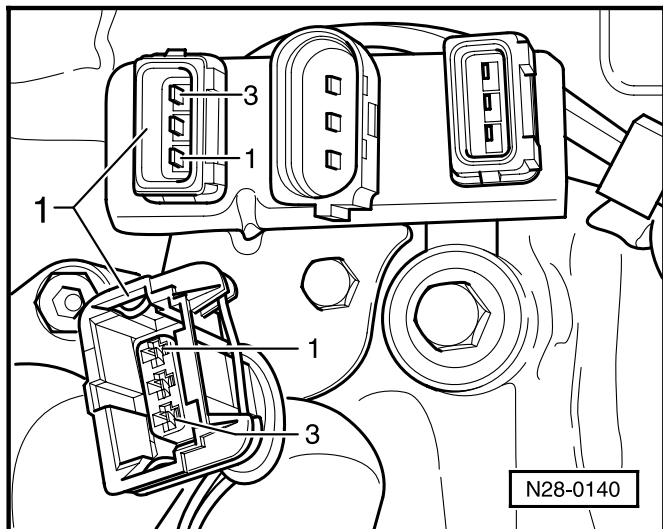
Testing operation

- Operational test of the knock control system and of the knock sensors $\Rightarrow$ page 01-57, Reading measured value block, display groups 013 to 016 and 24.

Testing resistance and wiring

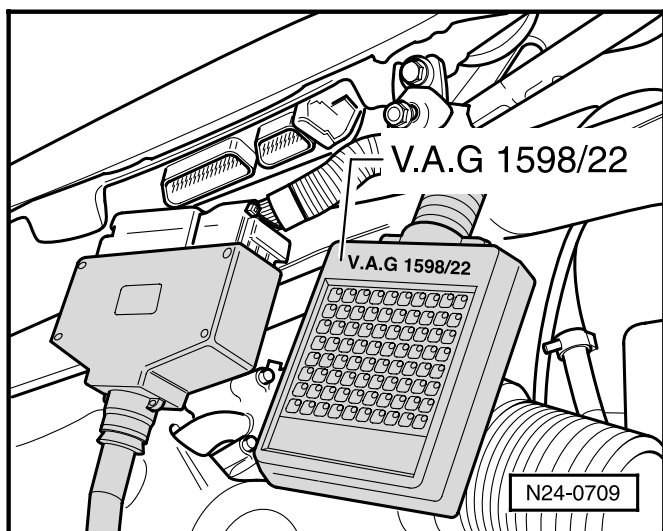
- ◀ - Unplug the 3-pin connector to the knock sensor 1 (G61) -1-.
- Measure the resistance between contacts 1+2, 1+3 and 2+3 at the connections to the knock sensors and test for short circuit to each other.

Specification: $\infty \Omega$



- ◀ - Unplug the 3-pin connector to the knock sensor 2 (G66) -1-.
- Measure the resistance between contacts 1+2, 1+3 and 2+3 at the connections to the knock sensors and test for short circuit to each other.

Specification: $\infty \Omega$



- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit $\Rightarrow$ page 24-69, Replacing engine control unit.

- Test the wiring between test box and 3-pin connector for open circuit according to current flow diagram.

Knock sensor 1

Contact at 3-pin connector of knock sensor 1	Test box V.A.G 1598/22, socket
1 (signal)	68
2 (earth)	67
3 (screening)	67

Knock sensor 2

Contact at 3-pin connector of knock sensor 2	Test box V.A.G 1598/22, socket
1 (signal)	60
2 (earth)	67
3 (screening)	67

- In addition, test wiring at socket 67 for short circuit to sockets 60 and 68.

Specification: $\infty \Omega$

If no fault is found in the wiring:

- Slacken the knock sensor and tighten it again to 20 Nm.
- Conduct a road test.

The following operating conditions must be met during this road test:

- Coolant temperature must rise to more than 80 °C.
- Once the temperature is reached, the following operating states must be achieved several times
 - idling speed
 - part throttle
 - full throttle enrichment
 - fuel shut-off on overrun.
- Engine speed must have increased to more than 3500 rpm at full throttle.

Once again interrogate the fault memory of the control unit. If the fault is still present:

- Replace the knock sensor(s).

Testing Hall sender

Special tools, testers and aids required

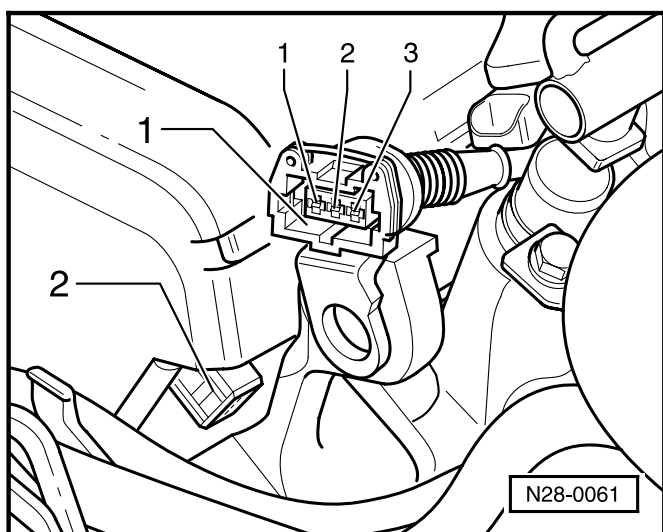
- ◆ Test box V.A.G 1598/22
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Hand-held multimeter e.g. V.A.G 1526 A
- ◆ Adapter cable set e.g. V.A.G 1594 A
- ◆ Current flow diagram

Test condition

- Battery voltage is at least 11.5 V.

Notes:

- ◆ *In normal operation, the engine control unit detects the ignition position of cylinder 1 from the Hall sender signal.*
- ◆ *Because it is no longer possible to determine the cylinder assignment of the knock sensor signals if no signal is received from the Hall sender, the knock control system is switched off and the ignition angle is retarded slightly to reliably avoid any knocking.*
- ◆ *If no signal is received from the Hall sender, the engine continues running and can also be started again for the following reasons:*
 - ◆ Ignition offset by one engine revolution does not have any perceptible effect on fuel injection. Fuel injection takes place „advanced“ (upstream of the closed inlet valve) when the inlet valve opens. As a result there is only a slight effect on the quality of the mixture formation.



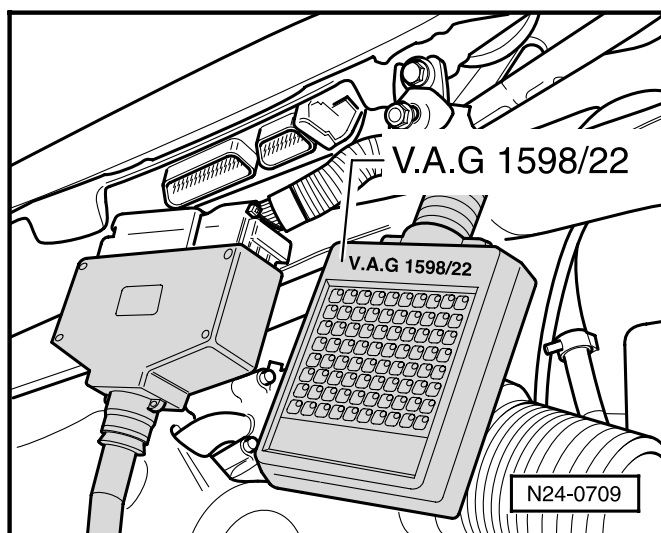
◀ - Unplug the 3-pin connector -1- of the Hall sender -2-.

- Connect the hand-held multimeter to contact 1 (positive) and 3 (earth) of the connector of the Hall sender.

- Switch on the ignition.

Specification: min. 4.5 V

- Switch off the ignition.



- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-69, Replacing engine control unit.
- Test the wiring between test box and 3-pin connector for open circuit according to current flow diagram.

Contact at 3-pin connector of Hall sender	Test box V.A.G 1598/22, socket
1 (signal)	62
2 (earth)	76
3 (screening)	67

Specification: max. 1.5 Ω

- In addition, test the cables for short circuit to each other.

Specification: $\infty \Omega$

If no fault is found in the wiring and if voltage was present between contacts 1+3:

- Erase fault memory ⇒ page 01-5.
 - If a fault relating to the camshaft sensor (Hall sender) is again displayed after erasing the fault memory as a check, although all the previous tests were o.k., the following fault is possible:
 - Rotor orifice plate for Hall sender twisted.
 - Unbolt Hall sender and inspect whether the rotor orifice plate to camshaft is correctly installed (if incorrectly installed, the detent lug is flattened when the bolt is tightened).
 - If the installation of the rotor orifice plate is o.k., check assignment of crankshaft/camshaft.
- ⇒ 1.8-ltr./110 kW Engine, Mechanical Components; Repair Group 15, Removing and installing cylinder head

Note for signal test with oscilloscope:

The middle of the Hall window must be positioned on the third descending slope of the engine speed signal after the reference mark gap.

If the specification is not achieved:

- Replace the Hall sender.
- If the specification is achieved and a fault relating to the Hall sender is again displayed in the fault memory:
- Replace engine control unit ⇒ page 24-69.

If no fault is found in the wiring and if voltage was present between contacts 1+3:

- Replace engine control unit ⇒ page 24-69.