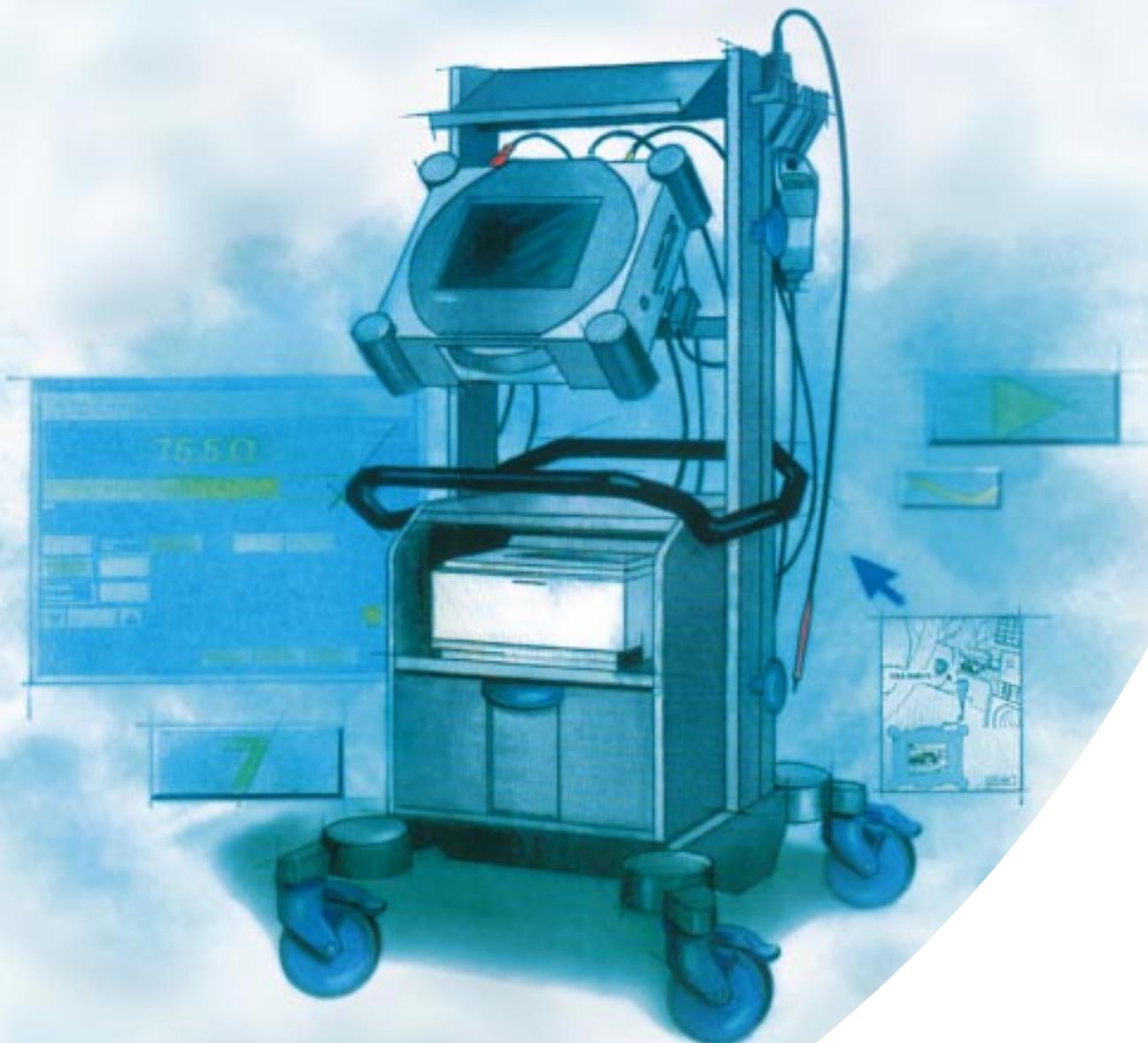




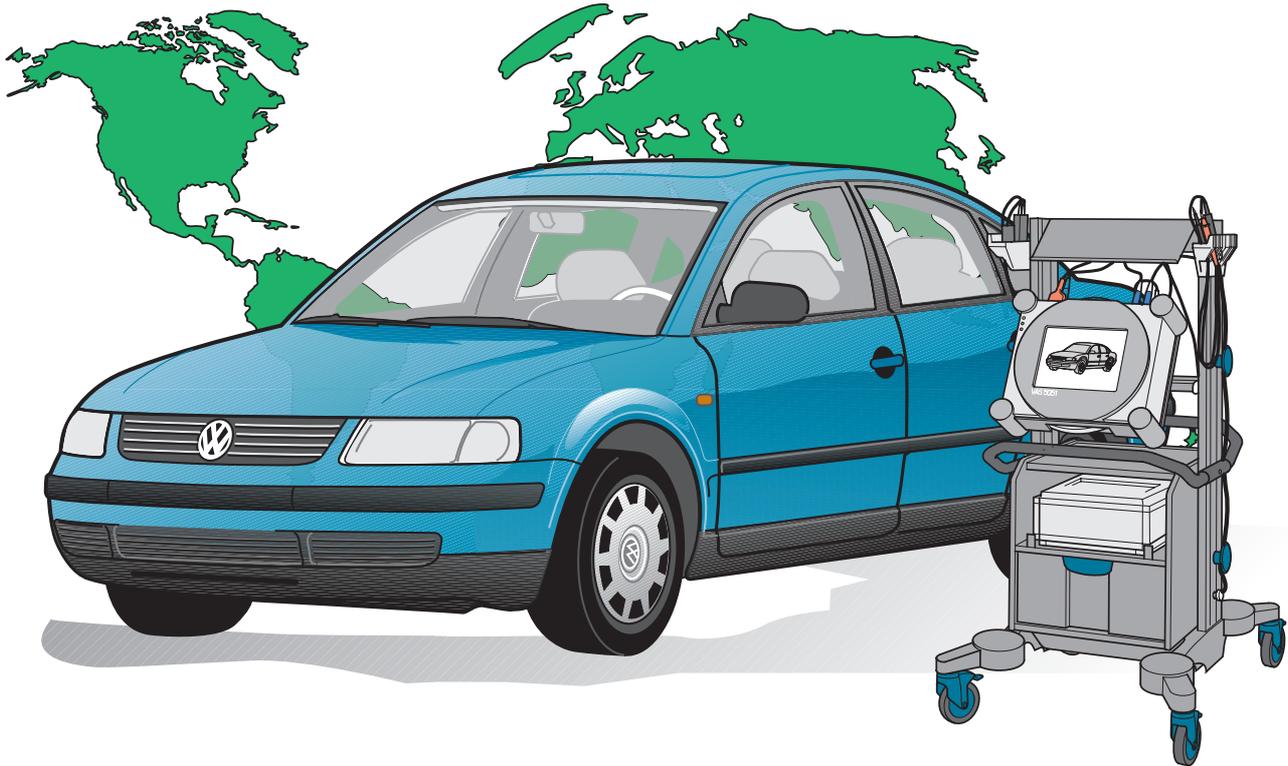
# Vehicle Diagnostic, Testing and Information System VAS 5051

Design and Functions

Self study program No. 202



## The Vehicle Diagnostic, Testing and Information System VAS 5051 ...



202/001

### **... for state-of-the-art fault finding!**

This innovative system provides mechanics with comprehensive support in concentrated form for finding faults in the electronic systems of vehicles.

The mechanic can be supported by the guided fault finding mode, or also carry out his own variable test sequences using the test instruments and self-diagnosis.

The system provides help for operation and fault detection.

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## Main components of the VAS 5051

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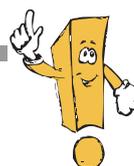
## Measurements and analysis with the VAS 5051

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Before switching on the diagnostic system, refer to the supplied Instruction Manual for information on how to use it and on special features.

**New!**



**Caution!  
Note!**



**The private study program  
is not a workshop manual!**

For test, adjustment and repair instructions, please refer to the provided servicing literature.

# Main components of the VAS 5051

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## Why another new diagnostic system?



Modern electronics makes our cars increasingly safe, comfortable and environment-friendly.

The associated increased networking of the electronic vehicle systems makes fault finding increasingly complex and time-intensive.

Since the previous vehicle system testers only indicate the path in which the fault is to be found, fault finding is sometimes delayed by lengthy measurements and studying of various workshop manuals.

The frequently used suspicion-based repairs result in unnecessary burdens on the customers and the mechanics as a result of multiple repairs.

The VAS 5051 vehicle diagnostic, testing and information system is now putting an end to this situation.

The new system combines the vehicle self-diagnosis, test instruments and technical documentation with state-of-the-art technology.

Use of the VAS 5051 enables fault finding on the vehicle to be carried out more rationally, precisely, clearly and economically:

- Because you receive exact instructions on what you have to do and where in all phases of the "Guided Fault Finding" on the touchscreen; operating faults are practically eliminated.
- Because the fault memories of the control units are read via the diagnostic interface to the vehicle, and an objective test plan is automatically derived from this.
- Because you can select hierarchically listed data from selection lists for vehicle identification, input of fault characteristics or selection of functions, groups of components and individual components.
- Because you can display associated documentation for selected functions, groups of components or individual components, and print this if required.

Because of its state-of-the-art technology and future-oriented capabilities, all workshops of the group worldwide will be equipped with the new VAS 5051.

The VAS 5051 can be used for all marques of the Volkswagen Group.

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## Fundamentals of system

The VAS 5051 is a knowledge-based system. The knowledge base is present on a CD-ROM and includes the latest knowledge on:

- Equipment
- Fault codes of control units
- Fault characteristics
- Vehicle design with respect to functions and components
- Function tests
- Technical documentation.

The data are combined in hierarchical architectures and linked to one another.

The knowledge base is generated using a diagnostic development system.

It can be easily supplemented and modified, thus permitting adaptation to new vehicles.

The incorporation of new documents is also possible, as is the utilization of workshop experience with e. g. new fault characteristics and their assignments.

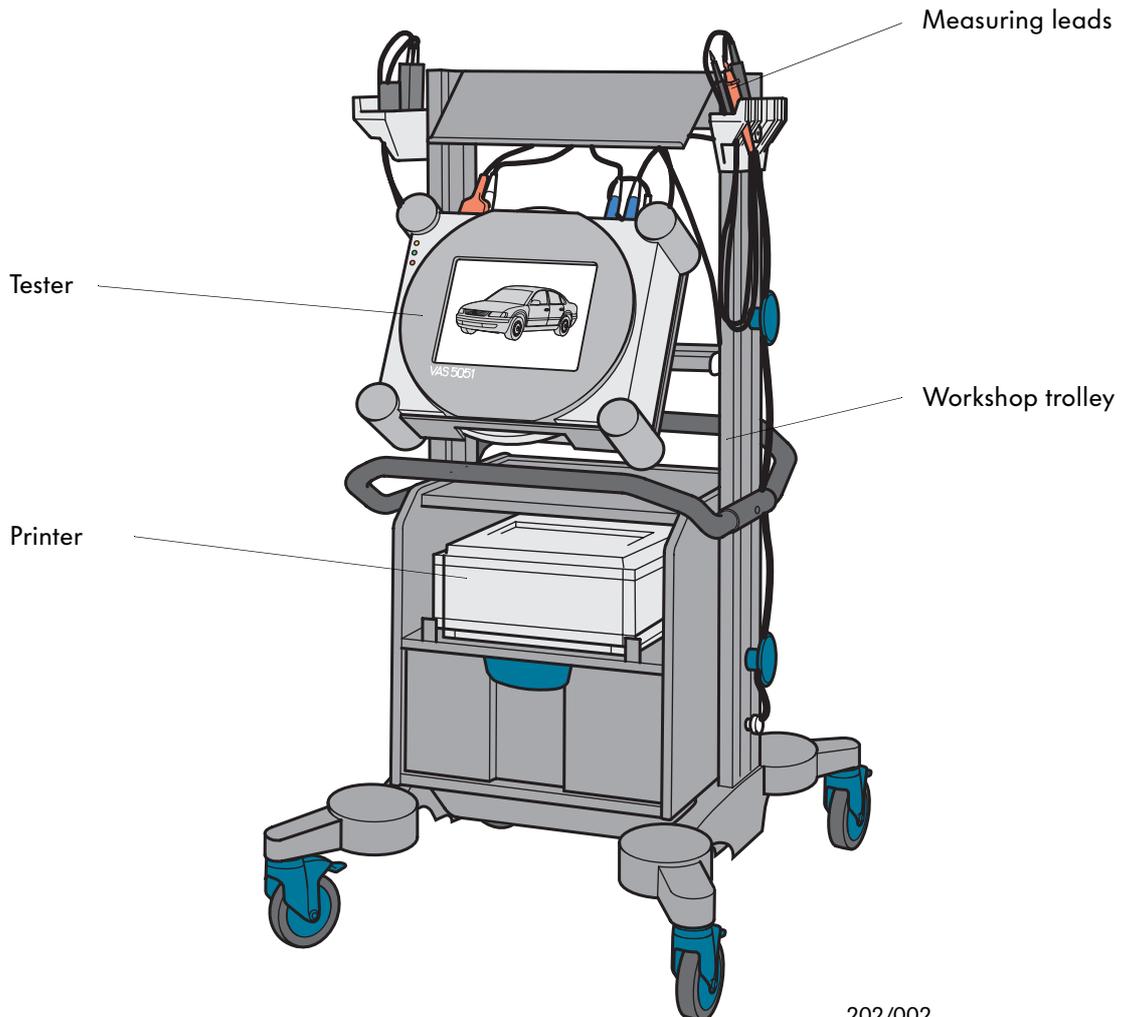
As a result of the knowledge base, the diagnostic system is able:

- To identify a vehicle and its standard/ optional equipment
- To carry out an automatic system test of the electronic systems fitted in the vehicle
- To carry out a "Guided fault finding" according to a test plan by selecting fault characteristics
- To use own knowledge by direct selection of tests
- To generate easy-to-use self-diagnosis functions
- To generate new test plans following automatic incorporation of a function test.



# Main components of the VAS 5051

## Design and features

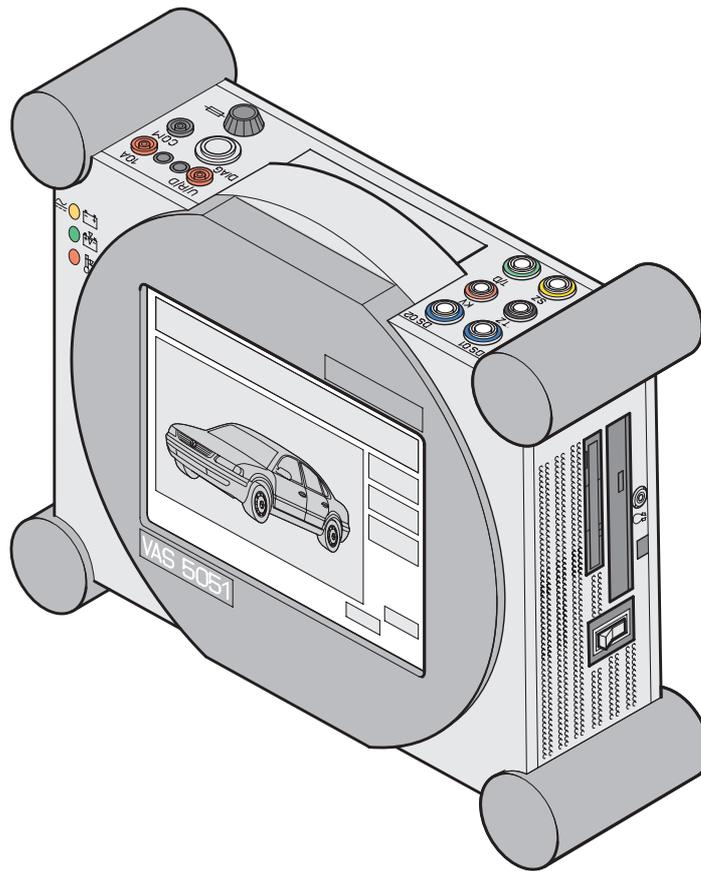


202/002

### VAS 5051 system features:

- Portable equipment powered via a mains connection or the diagnostic interface in the vehicle, an integrated battery provides a brief backup supply
- Operation using pressure-sensitive colour touchscreen
- Integrated diagnostic and test instrument module
- Integrated CD-ROM drive for CD-ROM with repair information in required language
- Infrared interface for control of printer
- VGA interface (video graphics adapter) for connection of an external monitor
- Prepared for remote diagnosis via retrofit ISDN connection

## Summary of tester



202/004

The functional centrepiece of the VAS 5051 is the tester with its LCD touchscreen.

When mounted on the workshop trolley, the complete system is mobile, and all equipment required for diagnosis is permanently within reach.

The tester can also be transported individually using the handle, e. g. into the vehicle interior.

The tester is controlled by touching corresponding text positions or navigation elements on the screen.

The tester is a combination of measuring instrument and computer.

The operating system and applications program are stored internally.

The vehicle-specific data, test programs and other technical documents are read in from replaceable CD-ROMs using the built-in CD-ROM drive, and saved on the hard disk in the tester.

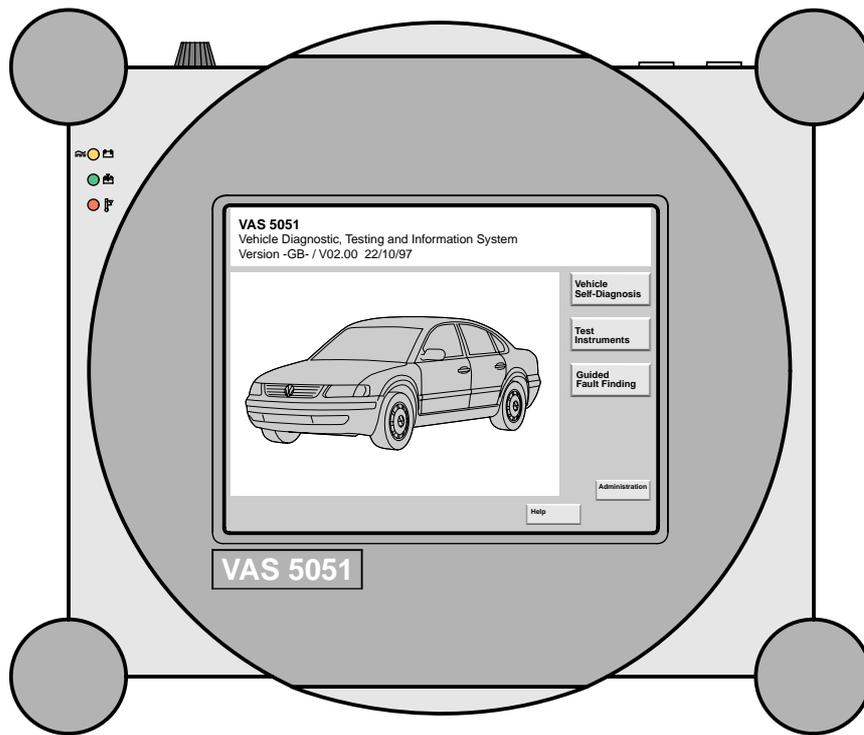
Updates are possible by simply using a new CD.

A laser printer is activated via an infrared interface without additional cabling.

This prints documents, and also hardcopies of the screen as required.

# Main components of the VAS 5051

## Front



202/003

The front of the tester is the screen which is used for information purposes and for communication with the mechanic.

The tester is operated using the touchscreen which covers the complete surface. This detects the pressure applied via your finger or other objects, and thus replaces a mouse and keyboard.

The graphic displays on the screen are referred to as "masks". They display all information and functions of the tester.

A text or navigation element provided for controlling the tester can be recognized by a change in colour.

The selected control element is only activated when the pressure produced by touching is removed.

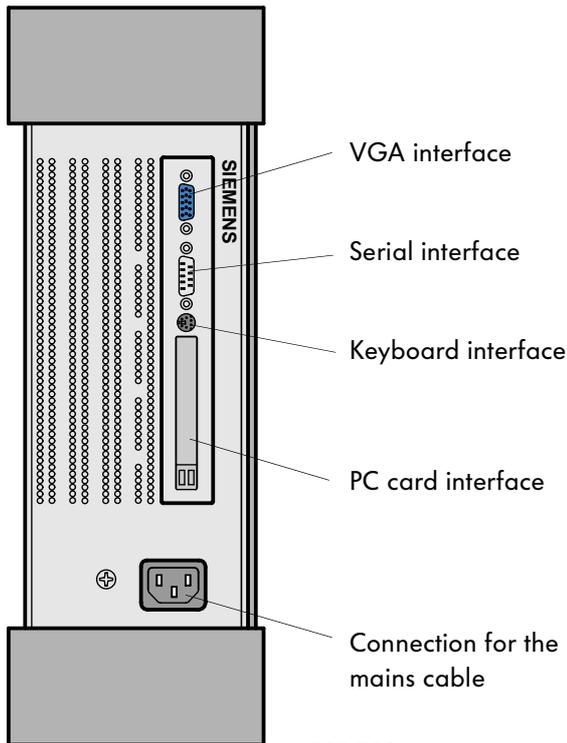


Do not use any pointed or hot objects to operate the screen, or any objects which leave colours behind. Such objects damage the screen.



The tester switches to power saving mode if it is not used for several minutes. When the screen is touched, the mask that was last accessed is displayed again.

## Left side



202/005

The connections are located behind a cover panel. Only the connection for the mains cable is required for workshop operation.

The other connections are required for servicing or repairs and for later extension of the tester's scope of functions.

An external monitor can be connected to the VGA interface.

The serial interface and the keyboard interface are only provided for servicing work on the tester.

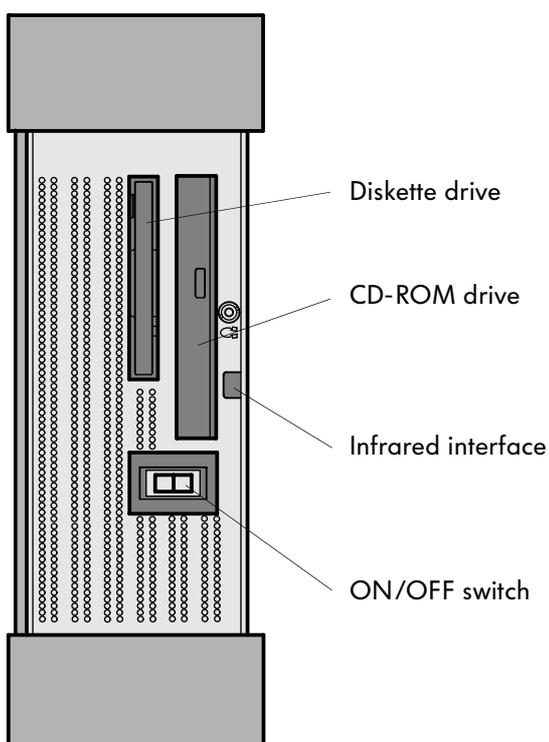
The PC card interface is used for subsequent extension of the tester, e. g. remote diagnosis.



No other interfaces may be used apart from the mains connection and the VGA interface.

Faults resulting from the use of other interfaces lead to cancellation of the guarantee.

## Right side



202/006

The CD-ROM drive is required to update the diagnostic system.

The tester loads the new program version from the CD-ROM onto the hard disk.



Be careful not to overwrite a newer program version, otherwise important data and functions could be lost.

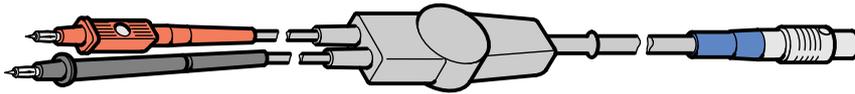
The diskette drive is not required for workshop operation.

The infrared interface permits data transmission to the printer without wiring.

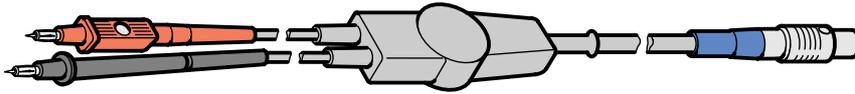


# Main components of the VAS 5051

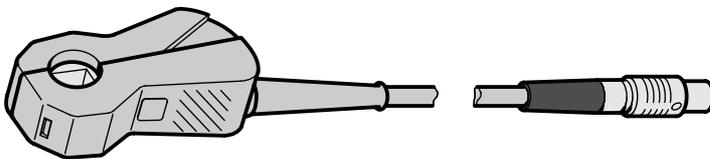
## Top



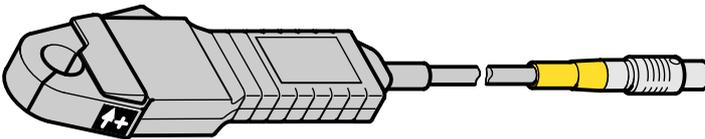
DSO measuring lead 2  
VAS 5051/8



DSO measuring lead 1  
VAS 5051/8



Trigger pick-up, option  
VAS 5051/18

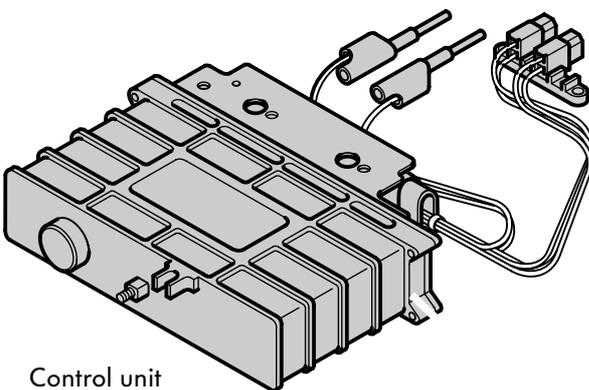


Current pick-up 50A  
VAS 5051/9

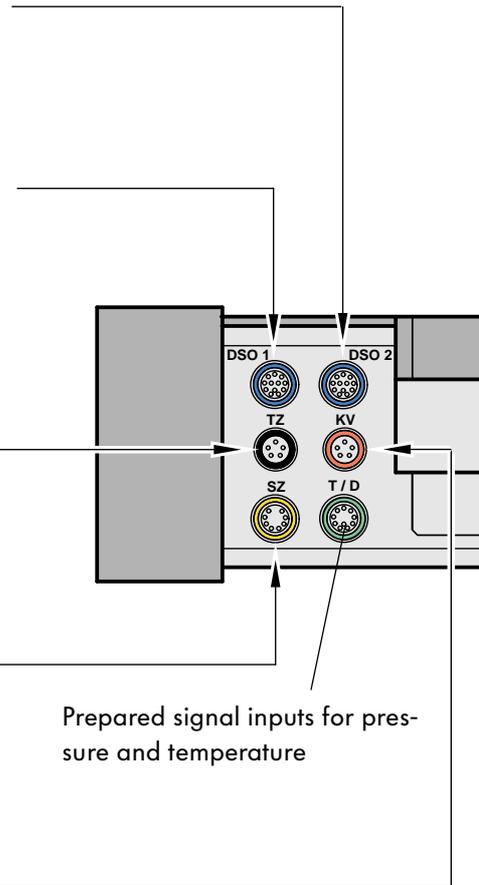
Current pick-up 500 A, option  
VAS 5051/19



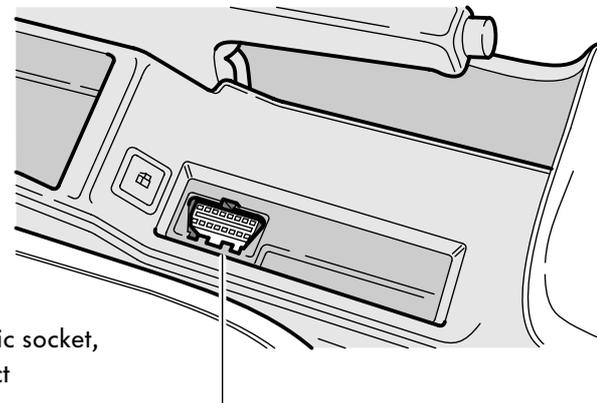
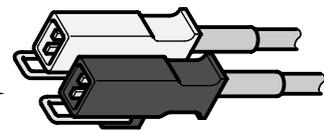
kV sensor, option  
VAS 5051/17



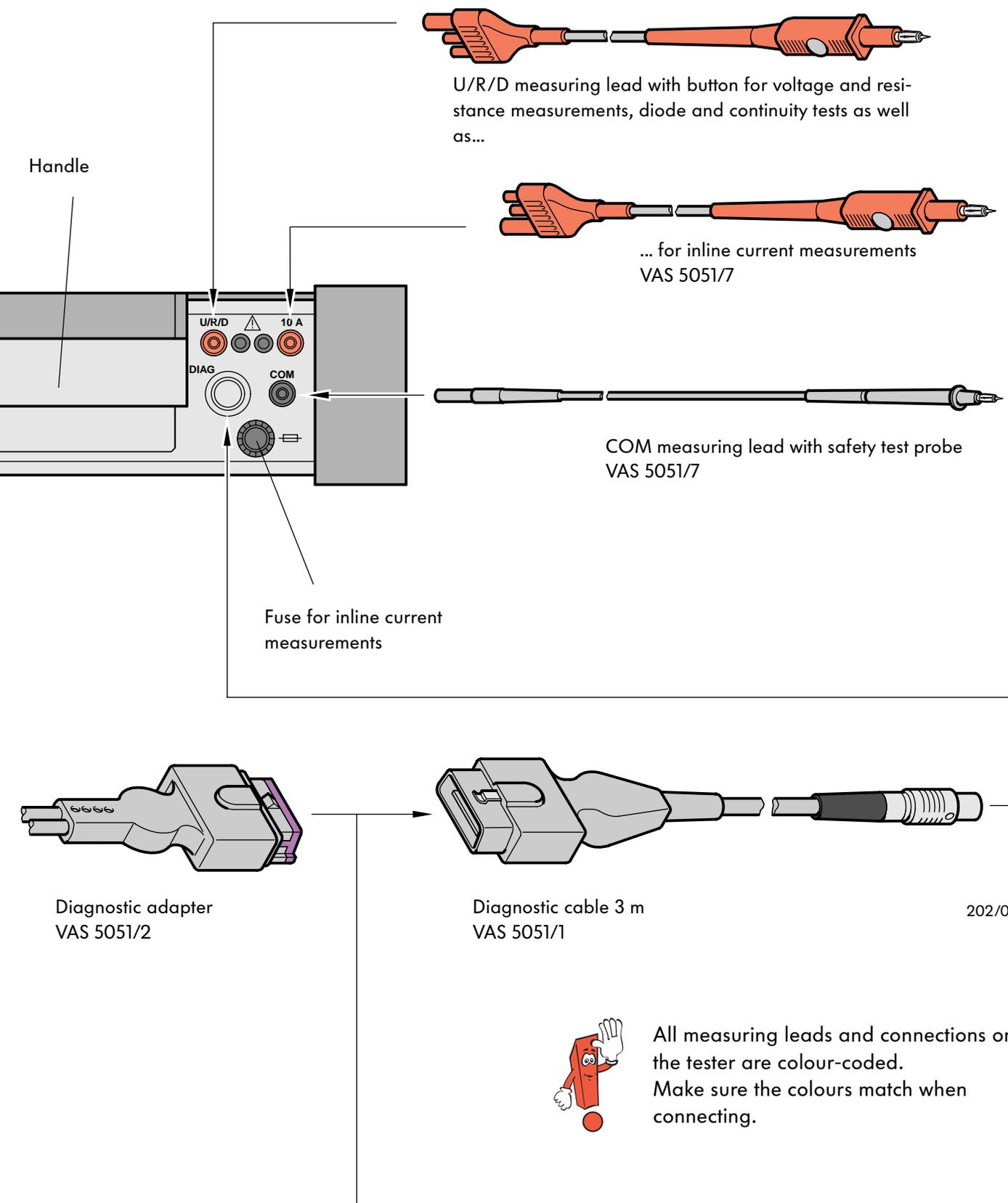
Control unit



Prepared signal inputs for pressure and temperature



Diagnostic socket,  
16-contact



U/R/D measuring lead with button for voltage and resistance measurements, diode and continuity tests as well as...

... for inline current measurements  
VAS 5051/7

COM measuring lead with safety test probe  
VAS 5051/7

Fuse for inline current measurements

Diagnostic adapter  
VAS 5051/2

Diagnostic cable 3 m  
VAS 5051/1

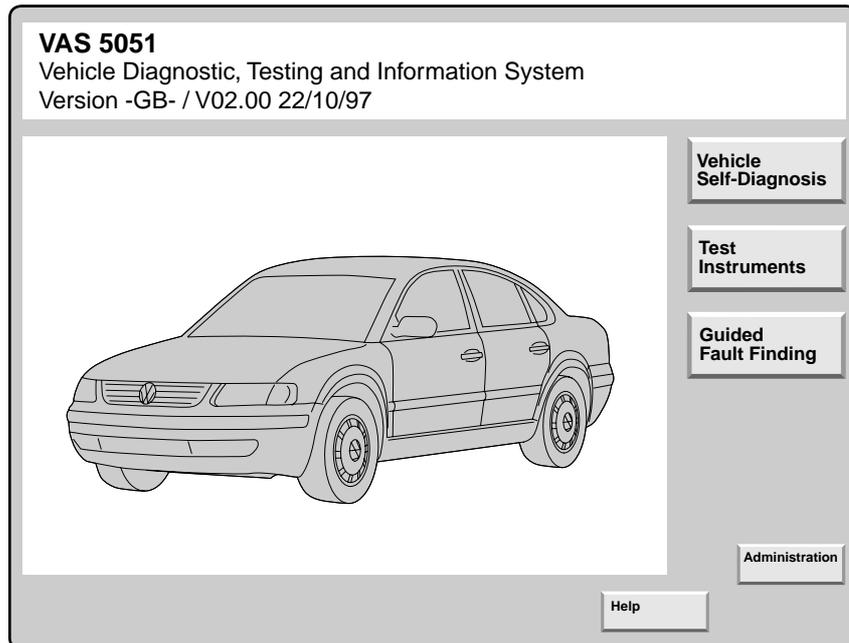
202/008



All measuring leads and connections on the tester are colour-coded. Make sure the colours match when connecting.

# Modes

## Start screen



202/047

The operating program is started automatically when you switch on the tester.

The tester is ready for use when the system start mask is displayed on the screen.

When switching on the tester for the first time, the mode buttons "Vehicle Self-Diagnosis", "Test Instruments" and "Guided Fault Finding" are not yet visible.

The complete system start mask appears when you enter the dealership identifier in the mode "Administration".

You can start the following modes from the system start mask:

- Vehicle self-diagnosis
- Test instruments
- Guided fault finding
- Administration.

The "Help" function can be selected in all modes and provides information on operation and on the functions of the individual navigation buttons.

## Administration

Administration	Equipment number: 12345
Administration	Importer number: 678
Select function	Dealership number: 98765 John Smith, Ltd.
Install update Self-test Change dealership identifier Signal generator Date/time Expanded functions Change language Select initial graphic CD contents list	
	<input type="button" value="Go to"/> <input type="button" value="Help"/>



202/025

The diagnostic system can be adjusted in mode "Administration".

The function "Install update" lets you download a newer program version from the CD-ROM onto the hard disk.

The language-specific setting of the system is carried out simultaneously from this CD-ROM.

The function "Self-test" permits internal checking of the test instrument unit and diagnostic unit of the tester.

The workshop code (VZ or importer number and dealership number) is entered once following starting-up of the tester.

It is subsequently only possible to change the dealership identifier (dealer's address).

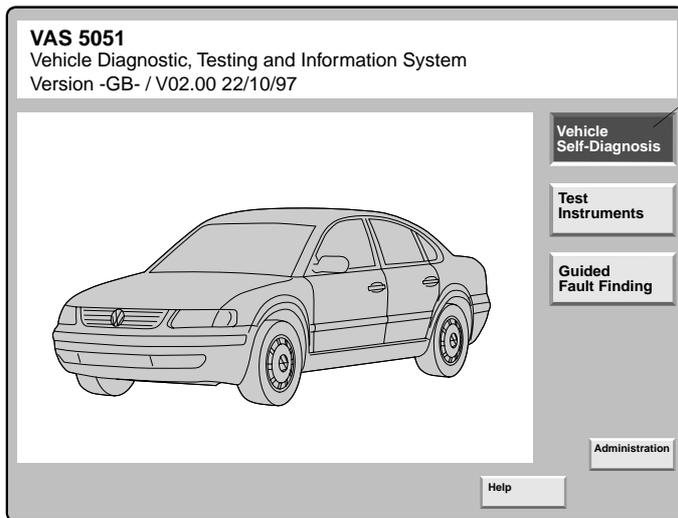
Further settings (such as date, time and signal pitch) can be individually adjusted according to requirements.

By selecting the initial graphic, it is possible to modify the marque-specific default setting of the vehicle display and the logo in the system start mask.

The expanded functions are not required for use in the workshop.

# Modes

## Vehicle self-diagnosis



The mode "Vehicle Self-Diagnosis" is activated by selecting the navigation element with this name in the system start mask.

202/049

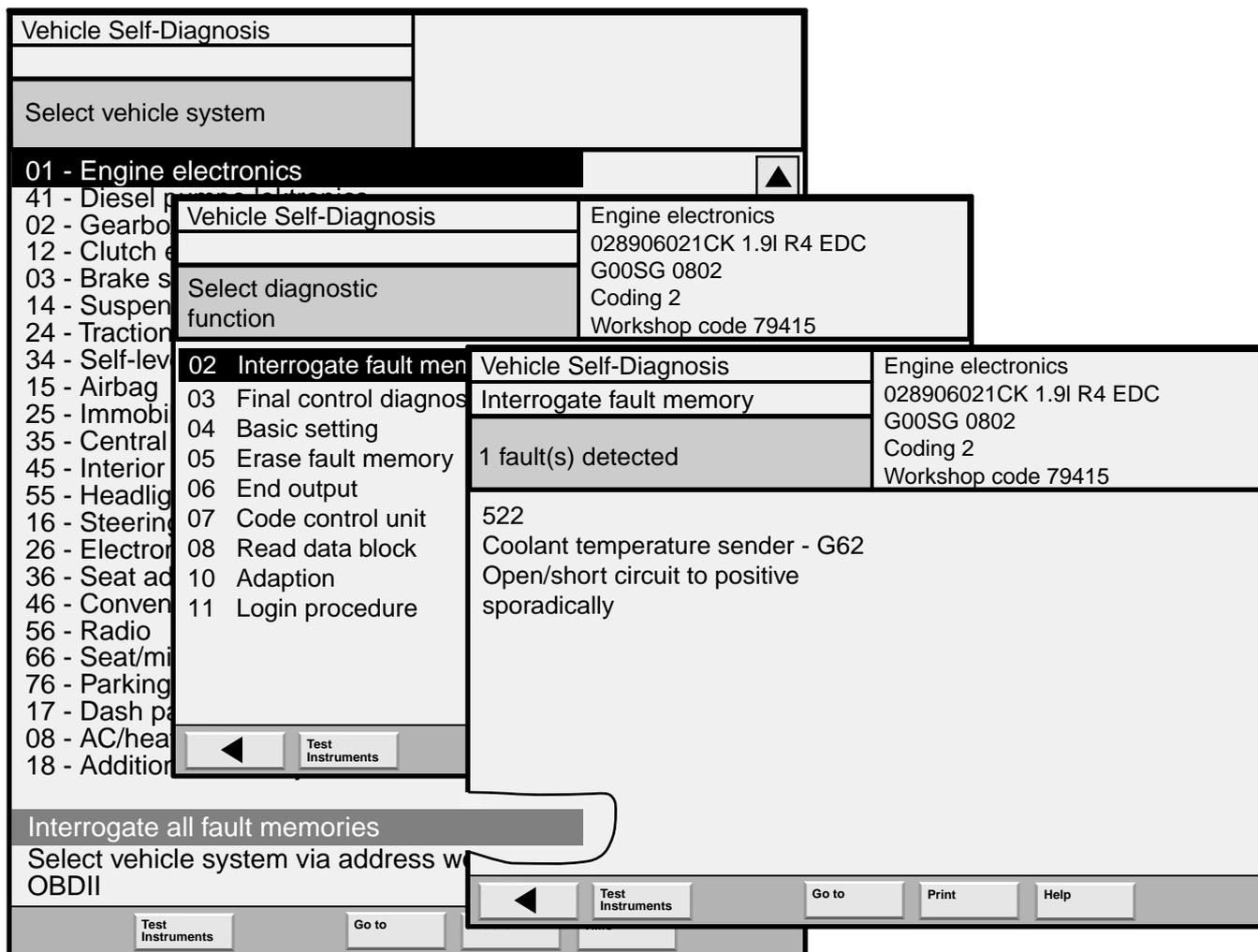
The mode "Vehicle Self-Diagnosis" provides the functions of the currently available V.A.G. 1551 and V.A.G. 1552 diagnostic testers.

Communication is carried out as usual via the diagnostic interface of the vehicle.

The vehicle self-diagnosis program helps the mechanic by guiding him through a dialog.

In addition, the tester is being developed further in order to be able to carry out the programming of control units (flash programming) in this mode in the future.

A requirement for use of the self-diagnosis mode is that the current workshop manual is available for the respective vehicle.



202/021

The vehicle systems or functions can be selected using the highlight bars.

When "Interrogate all fault memories" is selected, all control units present in the vehicle are interrogated and displayed.

The control unit identification is displayed following establishment of communication.

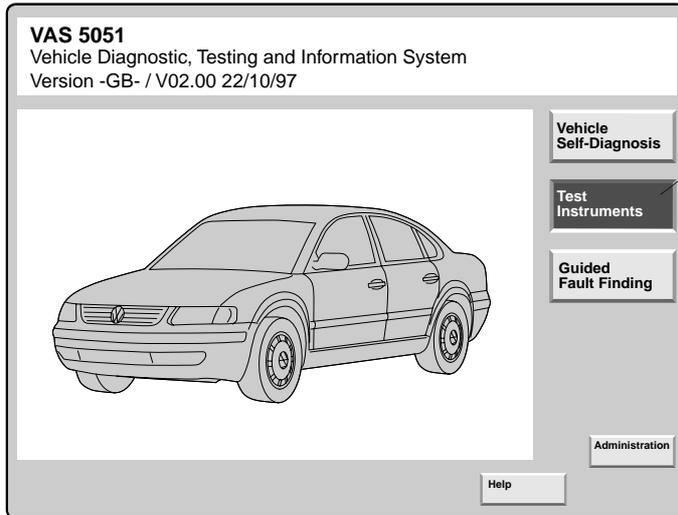
In the screen mask "Select diagnostic function" you can select the various functions which are to be carried out with the selected control unit.

With "Interrogate fault memory", a list of faults is displayed in the next screen mask.



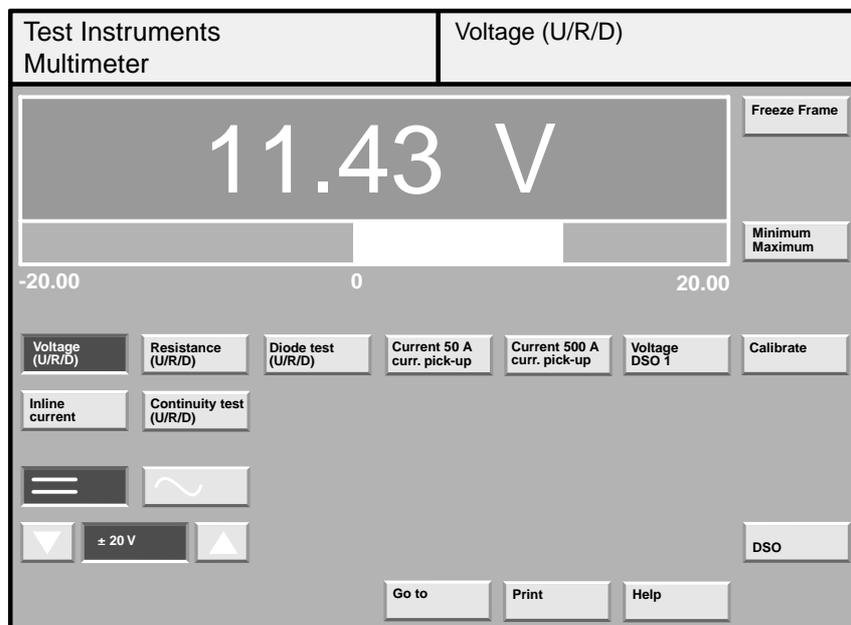
# Modes

## Test instruments - Multimeter



The mode "Test Instruments" is activated by selecting the navigation element with this name in the system start mask.

202/048



202/022

In mode "Test Instruments" it is possible to work with the "Multimeter" or the "Digital storage oscilloscope".

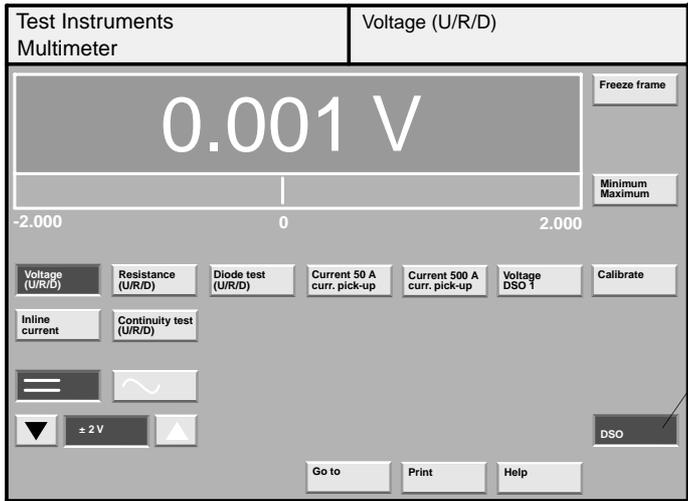
The multimeter can be used to measure all electrical variables present in the vehicle such as DC and AC voltages/currents and resistances.

The test instruments deliver data with a high accuracy.

Currents can be measured inline, i.e. by connection into the cable, or by using the current pick-up.

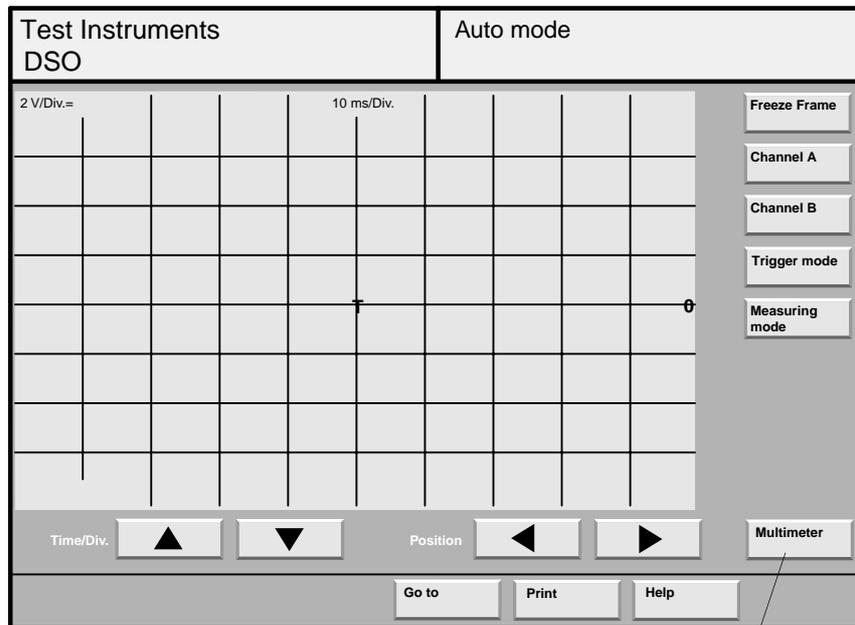
Continuity and diode tests can also be carried out.

## Digital storage oscilloscope



The measuring mode "Digital storage oscilloscope" is activated by selecting the navigation element with this name in the "Test Instruments" screen.

202/050



202/082

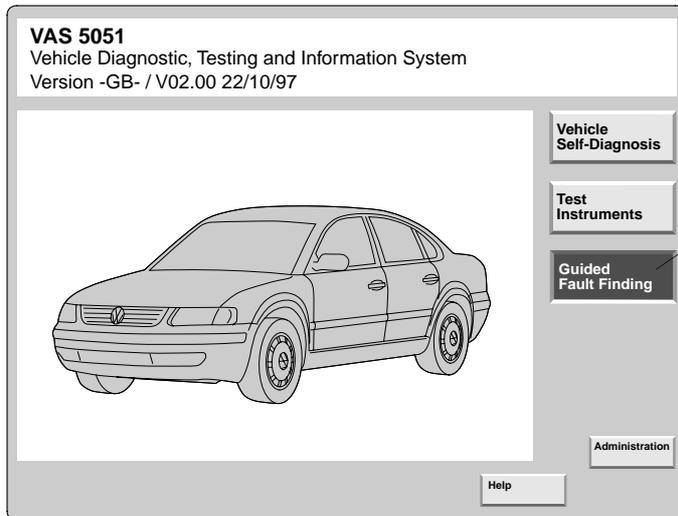
Return to multimeter

The digital storage oscilloscope (DSO) stores the current values of an analog signal using an adjustable time base. The stored values are displayed as a curve on the screen.

The DSO can be used to display the voltage waveshapes of two channels simultaneously. The required measuring leads are included in the equipment package.

# Modes

## Guided fault finding



The mode "Guided Fault Finding" is activated by selecting the navigation element with this name in the system start mask.

202/019

Guided fault finding is the actual innovation with which the VAS 5051 facilitates workshop operations and shortens the time required to find faults.

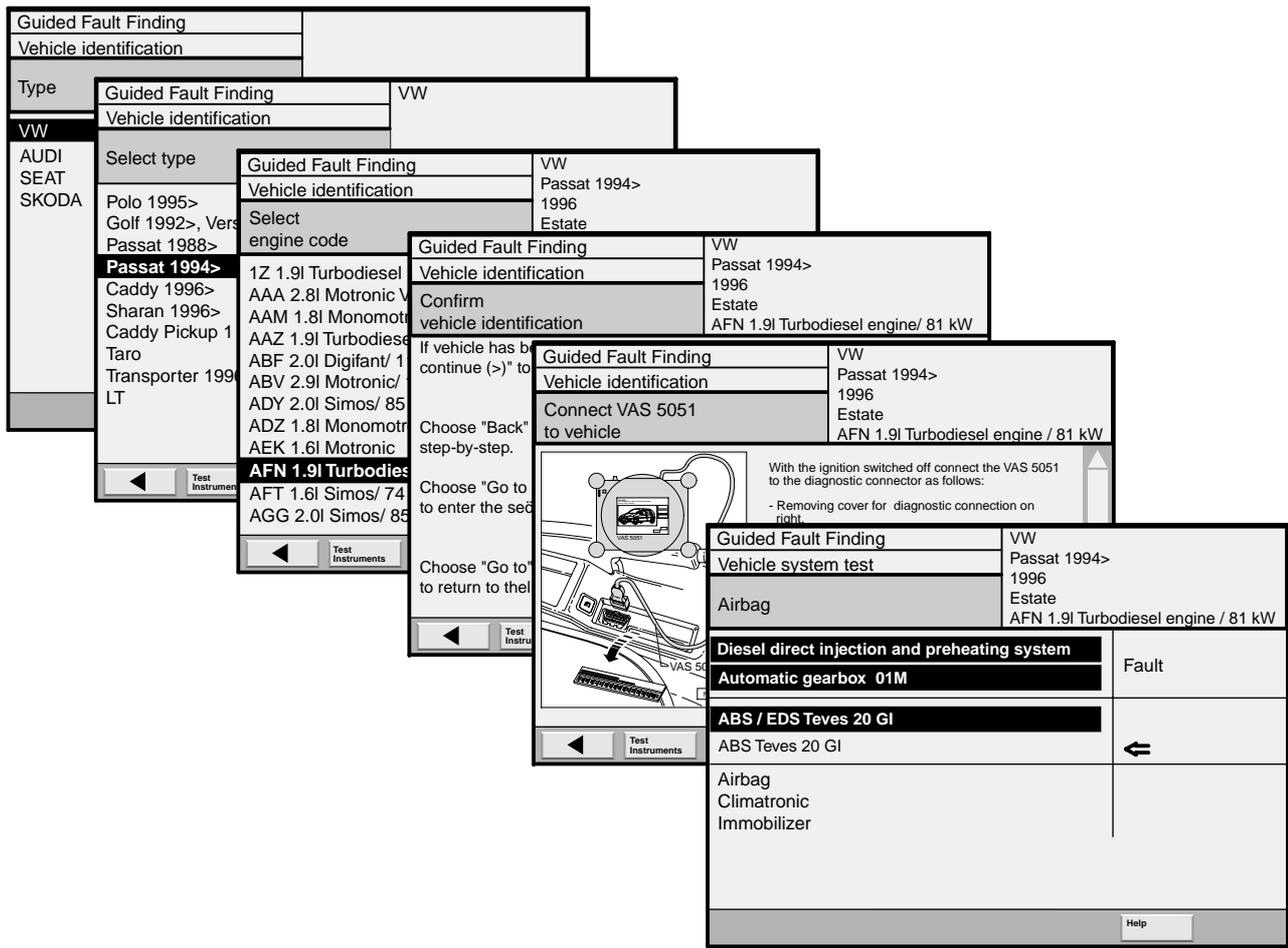
Starting from fault signals from the vehicle self-diagnosis, a brief description of the customer complaints, or assumptions concerning the cause of the fault, the mechanic is guided step-by-step through a fault finding program.

This fault finding program is permanently generated and optimized in the computer during the test.

The test instrument and self-diagnosis functions are implemented as necessary during guided fault finding.

All information from various workshop documents required for fault finding, e. g.:

- Workshop manuals
  - Fault finding programs
- are included in the programs of the mode "Guided fault finding".



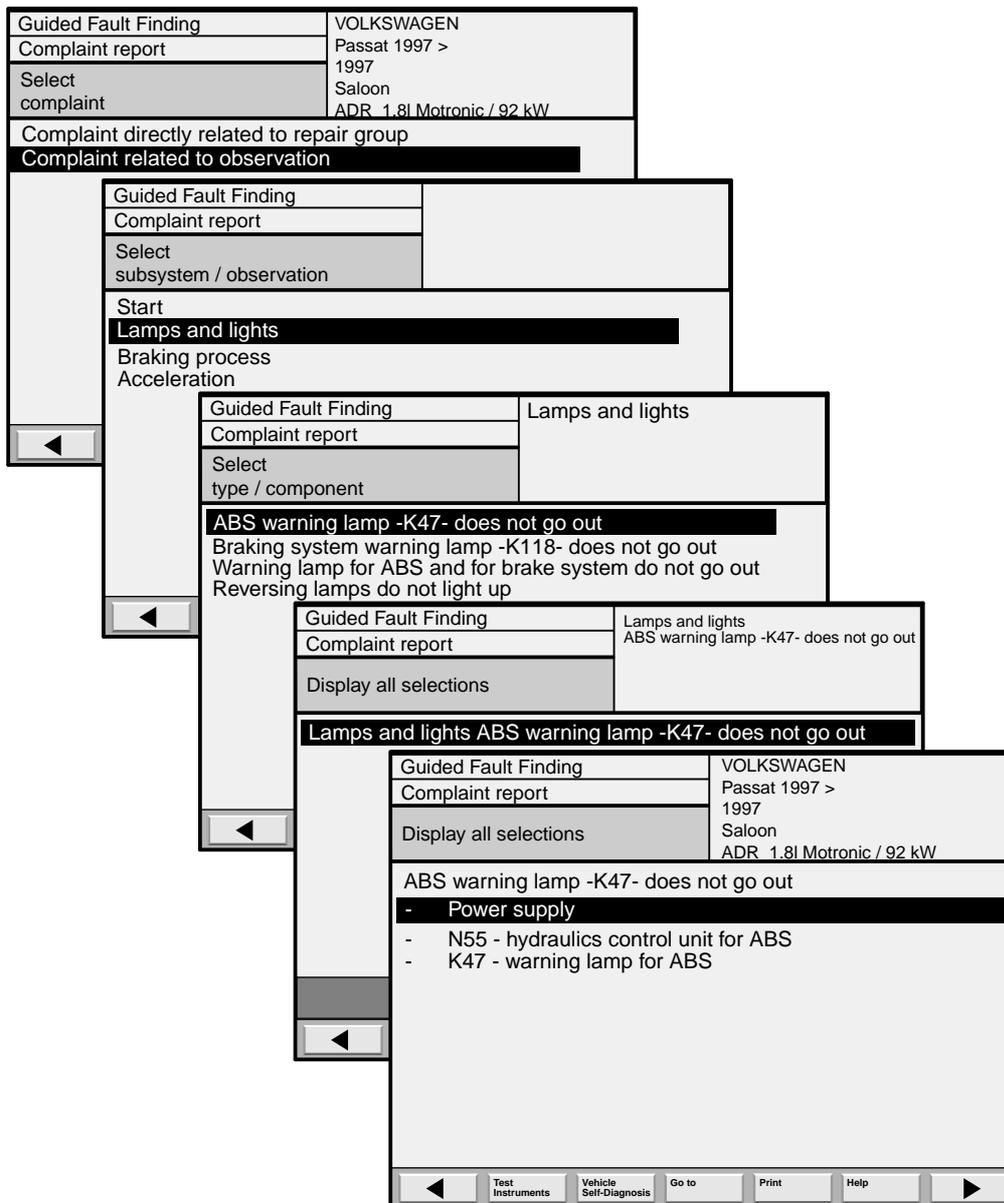
202/020

When starting the fault finding procedure, the vehicle must first be identified by a systematic interrogation algorithm. This guarantees unambiguous assignment of all documents and test values for the subsequent fault finding procedure.

The vehicle system test is started automatically. When interrogating the individual control units, all faults found are displayed in succession.

Faults can be selected individually and eliminated step-by-step according to the program specifications.

# Modes



202/052

If no faults have been detected during the vehicle system test, it is possible to select complaints according to observed fault characteristics when using the mode "Guided fault finding".

All test conditions and steps necessary up to elimination of the fault as well as the test equipment and activities required for the individual tests are defined.

Following input of the complaint, a special test plan is generated by the tester for the displayed fault characteristics.

The tester guides the mechanic through the test plan using a dialog.

**Guided Fault Finding**  
**Function test**  
 VOLKSWAGEN  
 Passat 1997 >  
 1997  
 Saloon  
 ADR 1.8l Motronic / 92 kW

**Test conditions**  
 Test conditions  
 - Fuse S20 OK  
 Yes   
 No

Are the conditions fulfilled?

**Guided Fault Finding**  
**Function test**  
 VOLKSWAGEN  
 Passat 1997 >  
 1997  
 Saloon  
 ADR 1.8l Motronic / 92 kW

**Check power supply**  
 The power supply will now be checked

- Switch off the ignition.  
 - Disconnect the plug of the ABS control unit -J104-. The control unit is located on the hydraulic unit on the left in the engine compartment.  
 - Connect the V.A.G. 1598 test box to the wiring harness using the V.A.G. 1598/27 adapter.  
 - Switch on the ignition.

**Guided Fault Finding**  
**Function test**  
 VOLKSWAGEN  
 Passat 1997 >  
 1997  
 Saloon  
 ADR 1.8l Motronic / 92 kW

**Check power supply**  
 Done

URD cable (+) to test box socket 15  
 COM cable (-) to test box socket 19  
 Check power supply!

**Guided Fault Finding**  
**Function test**  
 VOLKSWAGEN  
 Passat 1997 >  
 1997  
 Saloon  
 ADR 1.8l Motronic / 92 kW

**Check power supply**  
 Voltage measurement

URD cable (+) to test box socket 15  
 COM cable (-) to test box socket 19  
 Check power supply!  
 Target value OK: 10 ... 15 V

-20.00 10.00 15.00 20.00

**0.00 V**

**Guided Fault Finding**  
**Function test**  
 VOLKSWAGEN  
 Passat 1997 >  
 1997  
 Saloon  
 ADR 1.8l Motronic / 92 kW

**Check power supply**  
 There is no voltage on the control unit.  
 Electrical measurements will now be made on the wiring.  
 - Switch off the ignition!

**Testbox V.A.G 1598/27: Measuring equipment**

Print function  
 Screen  
 Diagnosis log  
 Document

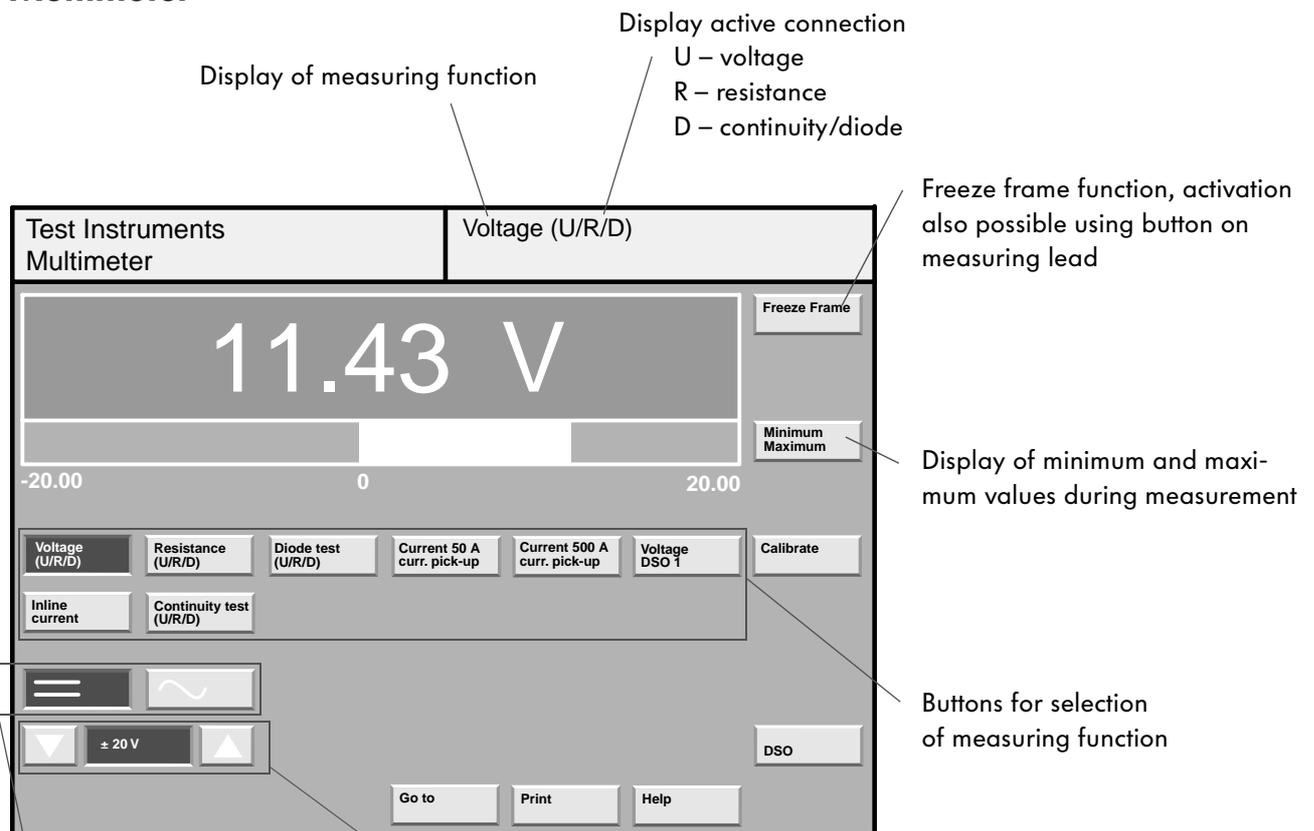


202/053

Following termination of the fault finding, you can print a report of the test steps using the function "Print/diagnosis log".

# Measurements and analysis with the VAS 5051

## Multimeter



Button for selection of measuring mode

- DC voltage
- AC voltage

Buttons for selection of measuring range setting

The display field for the measuring range is not selected in the above display, i.e. autoranging is activated in this case.

The selectable measuring functions in the mask "Multimeter" are divided into two function blocks:

### •Function block 1

(measurements using U/R/D measuring lead)

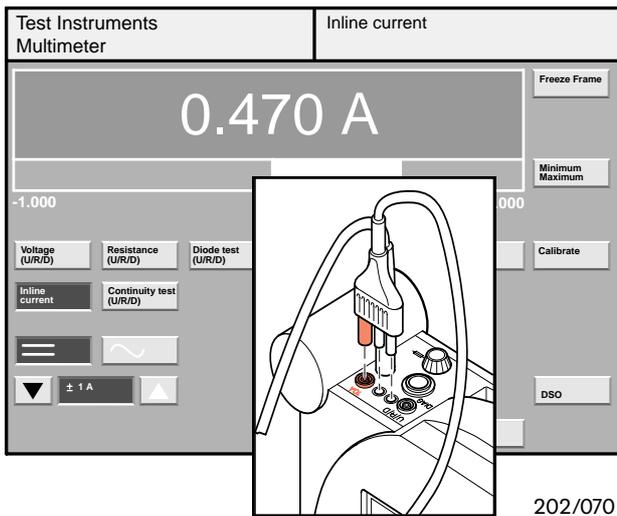
- Inline current
- Voltage
- Resistance
- Diode test
- Continuity test

### •Function block 2

(measurements using current pick-up, DSO 1)

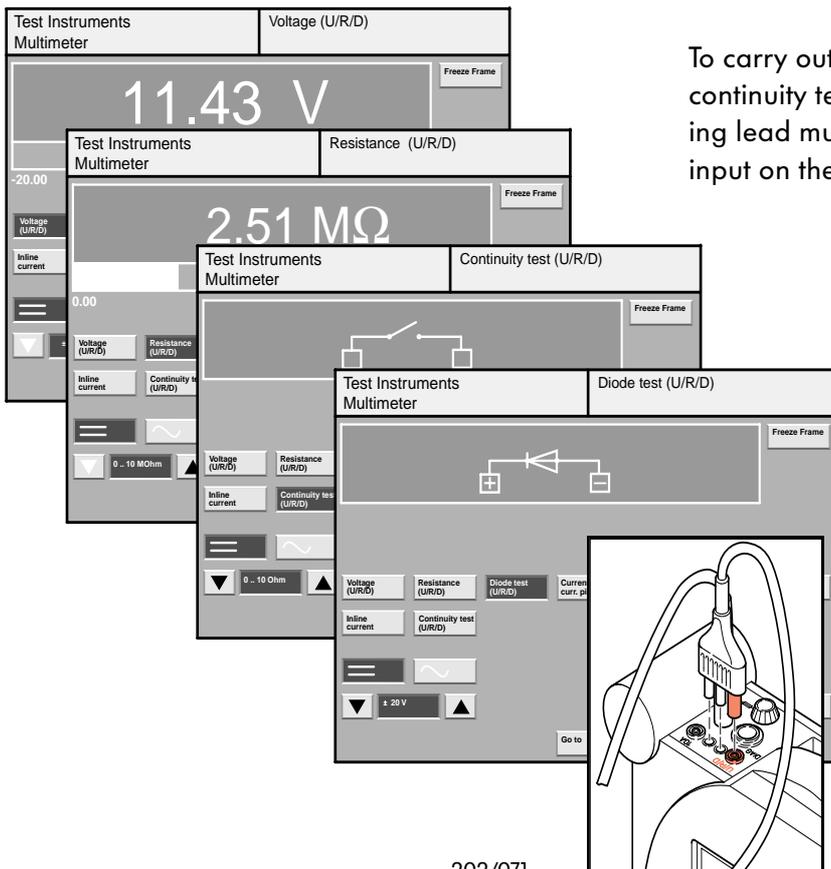
- Current 50 A, current pick-up
- Current 500 A, current pick-up
- Voltage, DSO 1

Use of the test instruments is possible without previous identification of the vehicle.



To carry out a current measurement (inline), the U/R/D measuring lead must be plugged into the 10-A signal input on the tester.

202/070

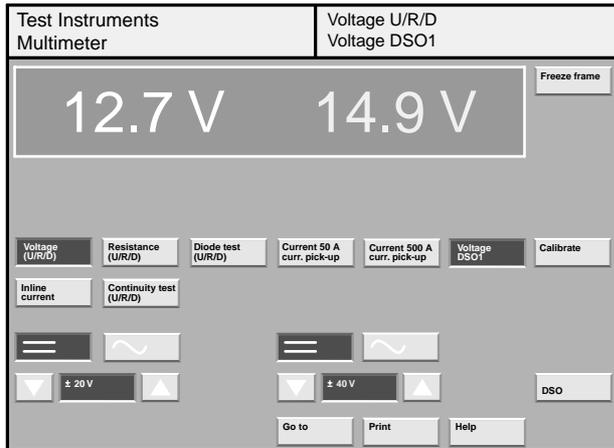


To carry out a voltage, resistance, diode test or continuity test measurement, the U/R/D measuring lead must be plugged into the U/R/D signal input on the tester.

202/071

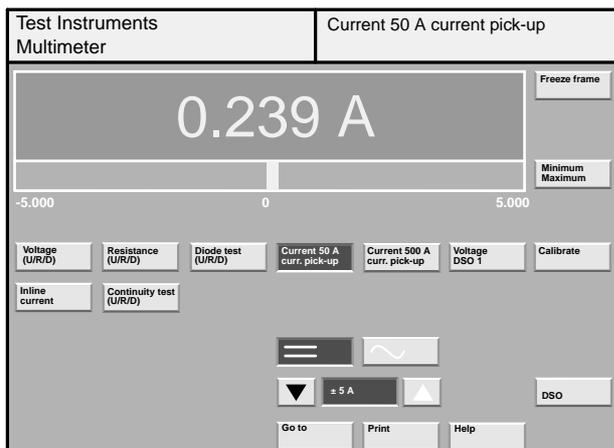


# Measurements and analysis with the VAS 5051



It is possible to simultaneously measure different voltages via the connections U/R/D and DSO 1, and to compare them on the display. The U/R/D voltage and the buttons for selection of the measuring range are located on the left. Everything on the right applies analogously to the DSO 1 connection.

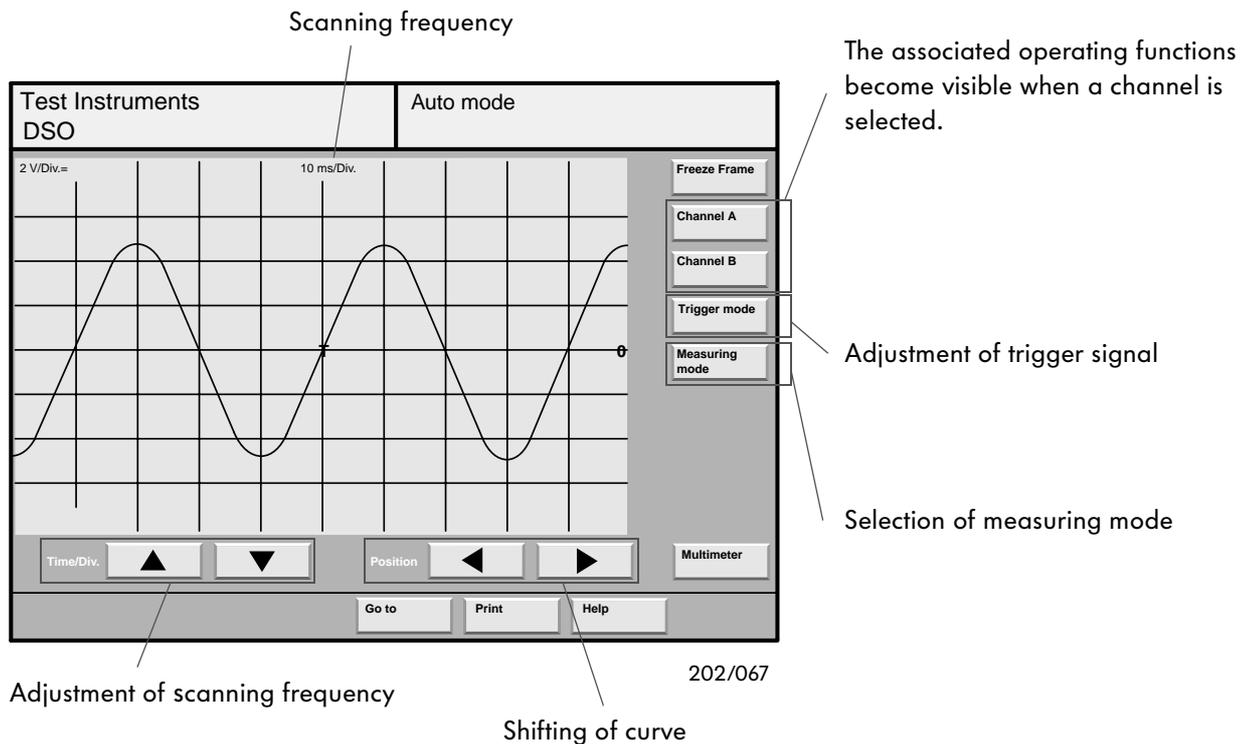
202/054



The current measurement is made using a current pick-up (current pick-up 50 A included in equipment package). The current following through the cable is measured when the pick-up is closed. Measurements are possible on wires with a diameter up to 20 mm.

202/068

## Digital storage oscilloscope



The graphic waveshapes of the curves can be displayed in the mask "DSO" and compared with one another.

Parameters can be set, measurements triggered, and the measured values of individual curves read.

Scanning frequencies and amplitudes are set using the various arrow buttons in the masks.

The signals present in channels A or B can be selected using the buttons "Channel A" and "Channel B" and set individually.

The measurements should preferably be made in "Auto setup mode" of the measuring mode.

Recorded curves can be compared with a defined curve for correctness using the function "Preset measurement".

The trigger channel is selected and set using the button "Trigger mode".

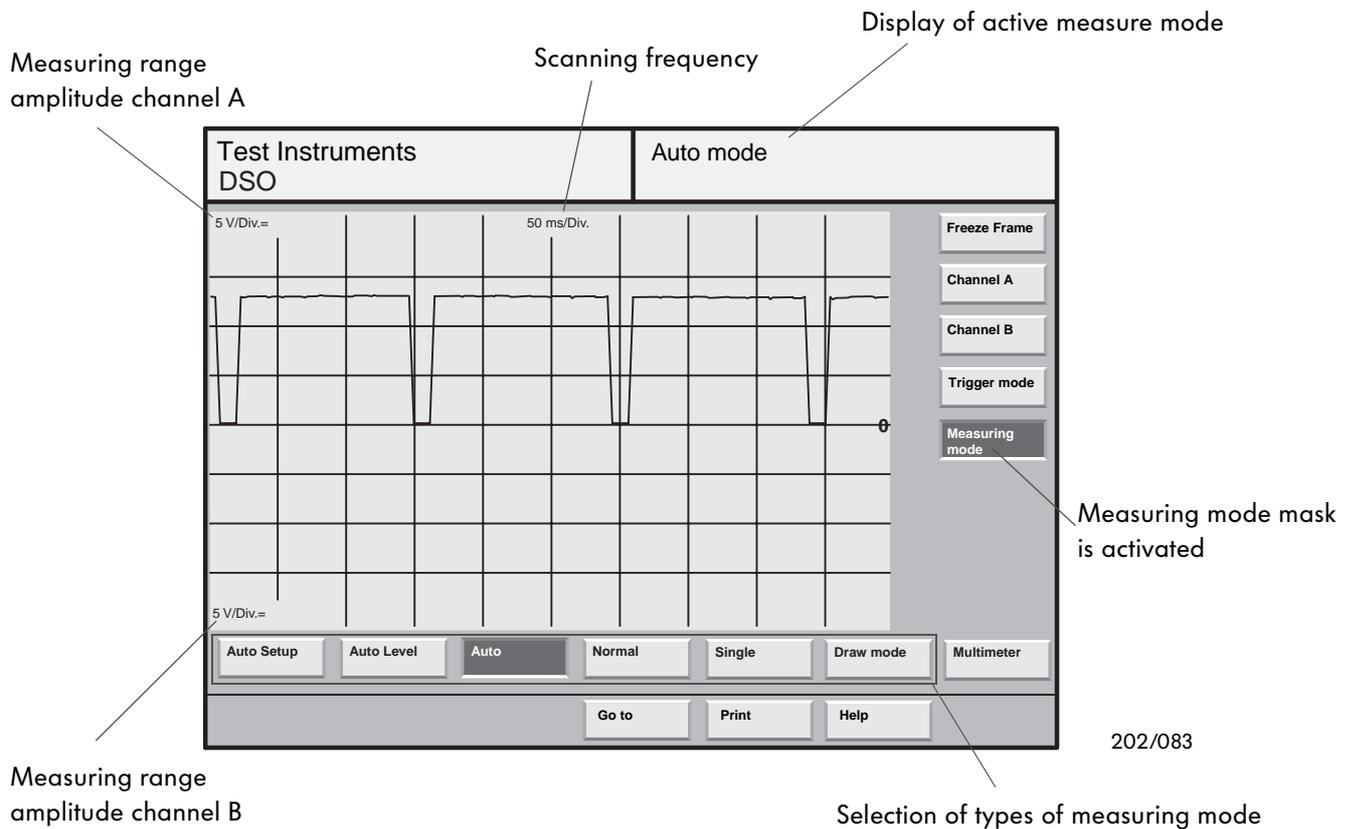
The objective of triggering is to establish a fixed relationship between the measured voltage and the sweep generated in the equipment. The result can be stationary oscillograms for single signals and for signals repeated at irregular intervals.

The trigger point is the point of the curve which corresponds to the beginning of the measurement.

The signal response prior to the trigger point is also displayed depending on the position of the trigger point on the screen.



# Measurements and analysis with the VAS 5051



The button "Measuring mode" can be used to set the following methods of data measurement:

- Auto setup
- Auto level
- Auto
- Normal
- Single
- Draw mode

If an unknown signal is present, the measure mode "Auto setup" presents advantages. In auto setup mode, the amplitudes of channels A and B, the scanning frequency, and the trigger threshold are set automatically.

A change is then made automatically to the mode "Auto level", and the measurement continued independent of the signal amplitude.

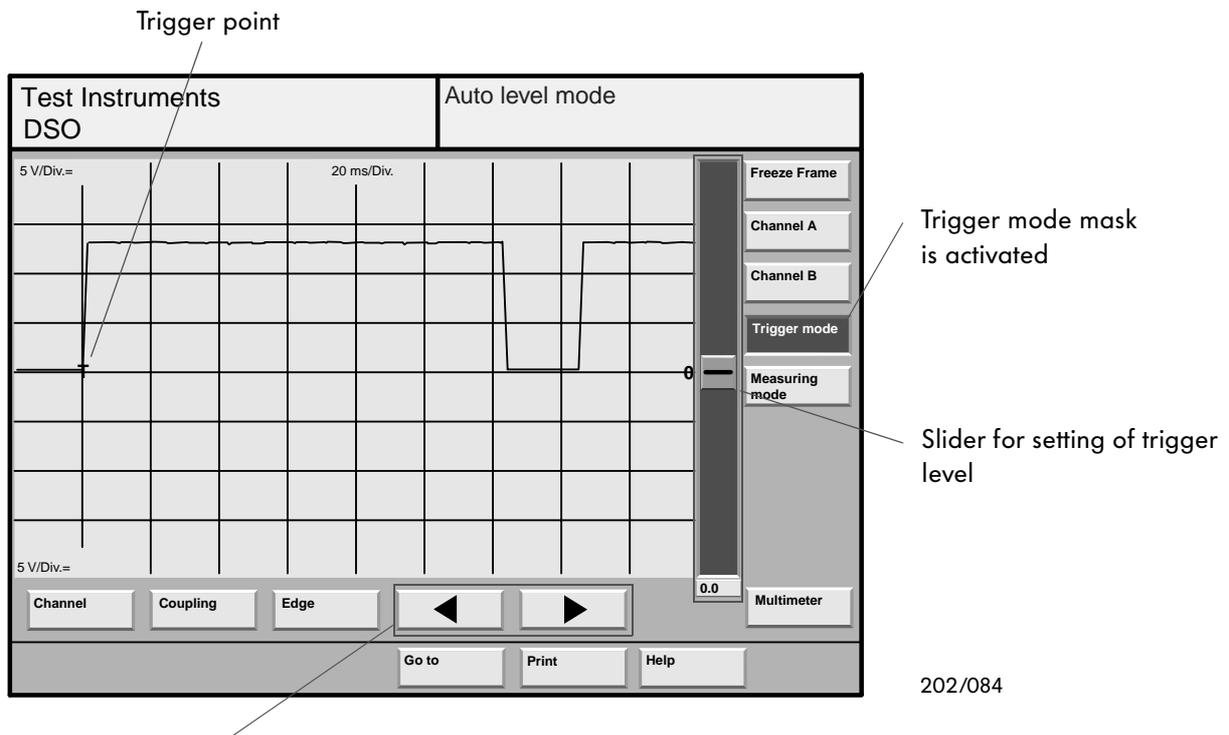
Measuring is carried out automatically and free-running if the measure mode "Auto" is selected. The signal is displayed either following a valid trigger event or following expiry of the wait time determined by the scanning frequency.

A trigger event is present if the entered input signal has been triggered, i.e. a time and phase reference has been produced.

A signal is only displayed on the screen in measuring mode "Normal" if a trigger signal is present and the trigger level is correctly set to the input signal.

A measurement is only carried out once in measuring mode "Single" following a valid trigger event. A new single recording is carried out each time the button is pressed.

The measure mode "Draw mode" should be set for signals which only change slowly, e. g. lambda probe or temperature sender. Recording of the measured value is untriggered, the curve is displayed continuously from left to right.



Arrow buttons for shifting of trigger point

The button "Trigger mode" is used to activate the input functions for setting the trigger signal.

The signal connection (e. g. DSO 1, DSO 2, pick-up, kV) for the trigger signal can be selected by pressing the button "Channel".

When pressing the button "Coupling", a selection menu appears depending on the selection of channel A or B.

High-frequency or low-frequency filtering of the trigger signal can be carried out in this menu.

The button "Edge" opens a further menu with the possible selections "neg." or "pos.". The falling edge of the trigger signal or input signal is used when selecting "neg.", the rising edge when selecting "pos.".



When connecting the measuring leads of the DSO, check that the polarity and the respective connection points are correct. The signal shape is largely determined by the connection points. Both signal cables should preferably be connected to the sensor or actuator.

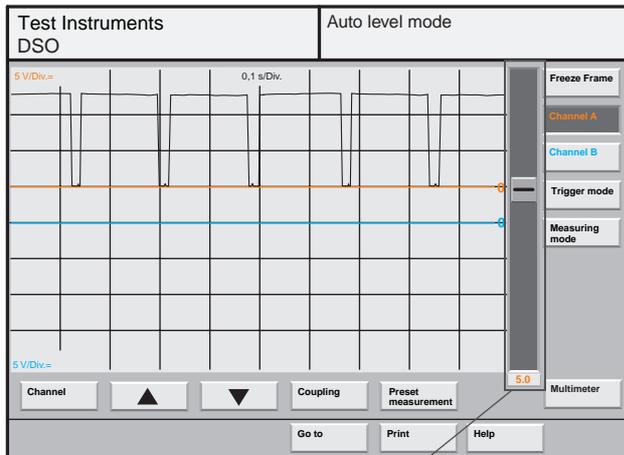
The trigger level can be changed by moving the slider.

Shift upwards to select positive voltage values, and downwards to select negative values.

The buttons "Coupling" and "Edge" are omitted if the signal connection "Pick-up" is selected.



# Measurements and analysis with the VAS 5051



202/085

A slider enables you to shift the curve vertically, separately for each channel.

The operating functions for channel A are displayed by pressing the button "Channel A".

The button "Channel" activates the signal connection (e. g. DSO 1, DSO 2, kV) for the selected channel.

The amplitude setting of the measured signal is made separately for each channel using the arrow buttons.

A pullup menu appears when you press the button "Coupling".

The possible selections have an influence on the display of the curve, e. g. reference potential (GND), DC and AC voltage components.

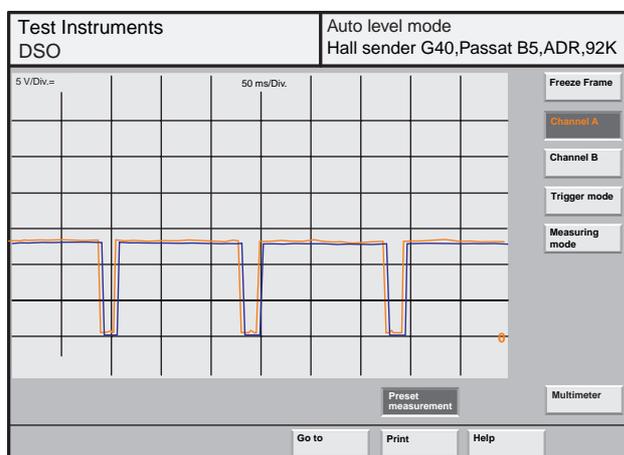


202/086

Following pressing of the button "Preset measurement", a list of preset curves appears.

With the preset measurements, there will be a "Document" button in the future for the display of additional information (e. g. adaptation of measuring leads, recording conditions such as engine speed or temperature).

The curve selected from the list is displayed in a different colour in the mask "DSO" by pressing the button "Display".



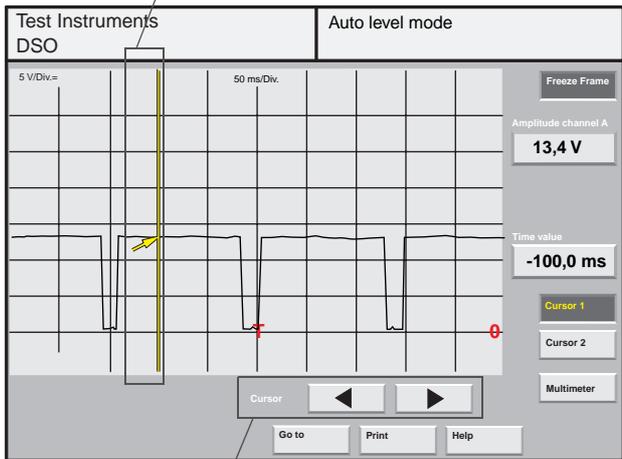
202/087

The current curve (red) can then be compared with the fixed curve.

The current curve is permanently updated as long as "Freeze Frame" has not been selected.

The test parameters of the selected channel are set to the values with which the "Preset measurement" was saved. The parameters of the selected channel can then no longer be set freely.

Cursor 1 with measuring line



202/081

Shifting of cursor 1  
(fine adjustment)

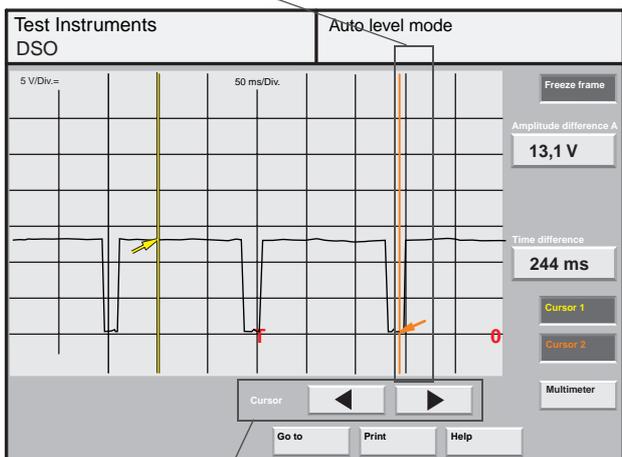
By pressing the button "Freeze frame", the cyclic repetition of the measurement can be stopped or continued.

The buttons "Cursor 1" and "Cursor 2" are displayed in the freeze frame function. The voltage values of the curves can then be displayed separately for each channel.

The associated voltage value of each curve can be determined by shifting the cursor position.

The time value represents the distance from the trigger point "T".

Cursor 2 with measuring line



202/023

Shifting of cursor 2  
(fine adjustment)

The difference in amplitude is displayed automatically if both "Cursor" buttons are selected.

The difference in amplitude results from the difference between the voltage value of the curve at the position of cursor 1 and the voltage value at the position of cursor 2.

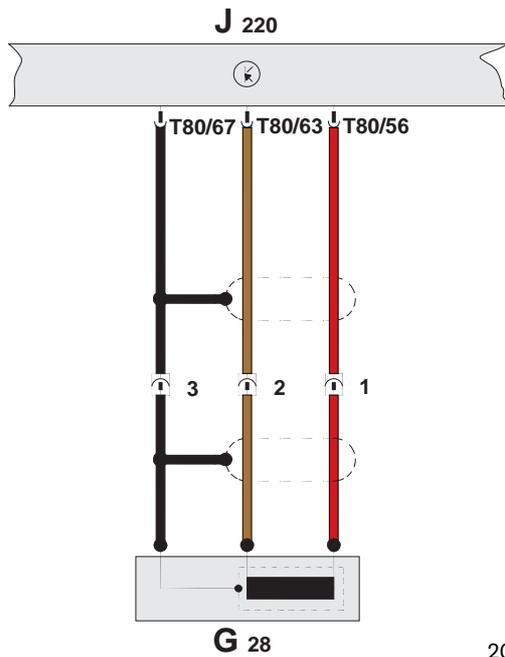
The difference in time is the interval from cursor 1 to cursor 2.

If both cursors are selected, only cursor 2 can be shifted on the curve.



# Measurements and analysis with the VAS 5051

## Sensor analysis with the DSO



202/038

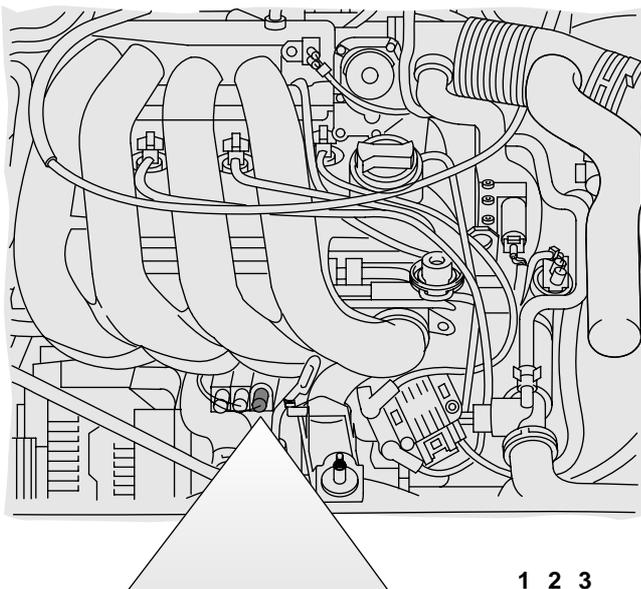
### Engine speed sender G28

The engine speed sender is a speed and reference marker sender. The engine does not run without this signal.

The adjacent circuit diagram shows the electrical connections on the engine speed sender G28 of the 1.8 l/92 kW petrol engine.

The signal for analysis by the DSO is measured at the following contacts:

- DSO 1 (+) → Contact 1 (signal)
- DSO 1 (-) → Contact 2 (ground)



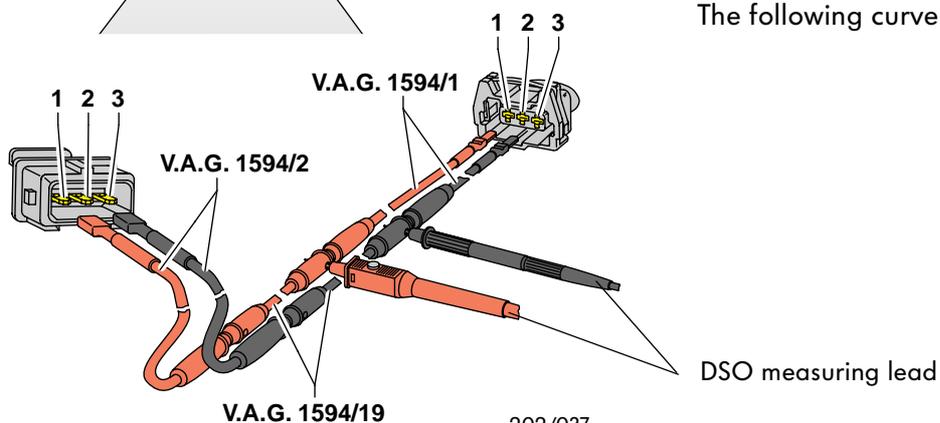
Remove the connector from the engine speed sender G28 and connect again using the measuring leads

- V.A.G. 1594/1
- V.A.G. 1594/2 and
- V.A.G. 1594/19

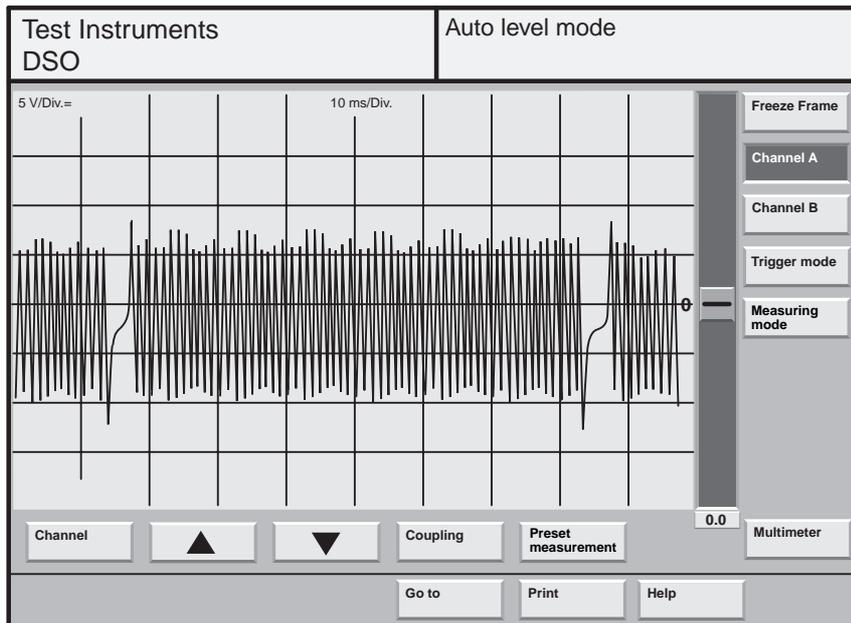
from the V.A.G. 1594A test set.

The speed signal between contacts 1 and 2 can then be displayed as a curve on the DSO.

The following curve is obtained:



202/037

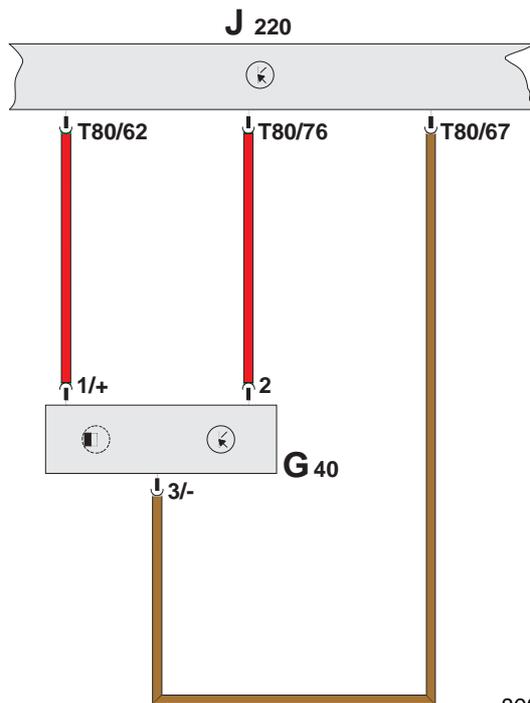


202/059

The crankshaft signal wheel has 60 teeth with two gaps of 2 teeth for synchronization. The two gaps can be clearly seen in the above diagram.



# Measurements and analysis with the VAS 5051



202/044

## Hall sender G40

The Hall sender signal enables the engine control unit to recognize the ignition position for cylinder 1 with ignition systems without a distributor.

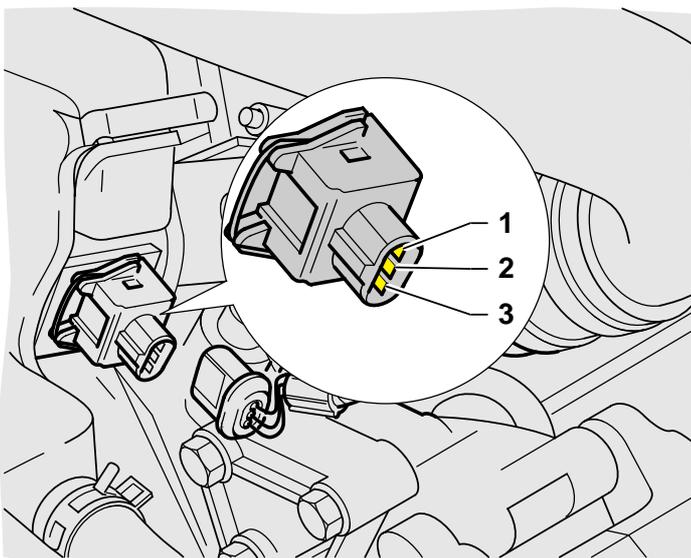
The ignition point for the other cylinders and the commencement of injection are calculated from this.

The adjacent circuit diagram shows the electrical connections on the Hall sender G40 of the 1.8 l/92 kW petrol engine.

The electric signal of the Hall sender for subsequent analysis by the DSO is measured at the following contacts:

- DSO 1 (+) → Contact 2 (signal)
- DSO 1 (-) → Contact 3 (ground)

The connection to the control unit must not be interrupted in the process, otherwise the engine will stop.

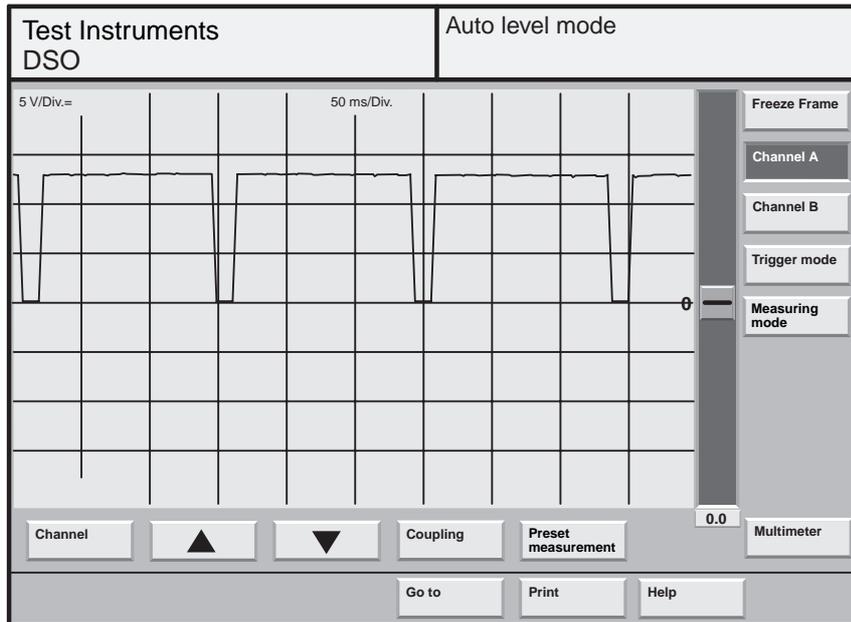


The Hall sender signal between contacts 2 and 3 can be displayed as a curve on the DSO by intermediate connection of an adapter lead from the V.A.G. 1594A test set which permits parallel connection of the DSO measuring lead of the VAS 5051 tester on the Hall sender.

The individual adapter leads are described on page 30.

The following curve is obtained:

202/075

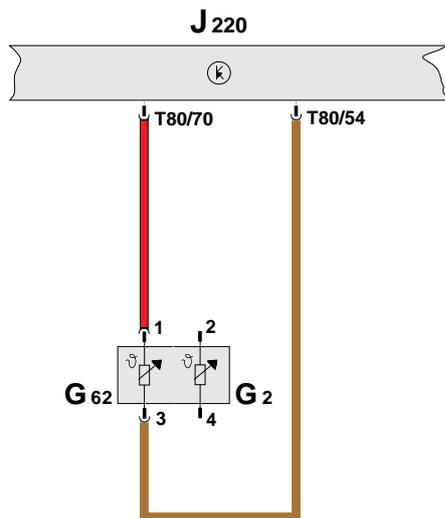


202/058

The Hall sender is OK if the curve is uniform and periodic.



# Measurements and analysis with the VAS 5051



202/039

## Coolant temperature sender G62

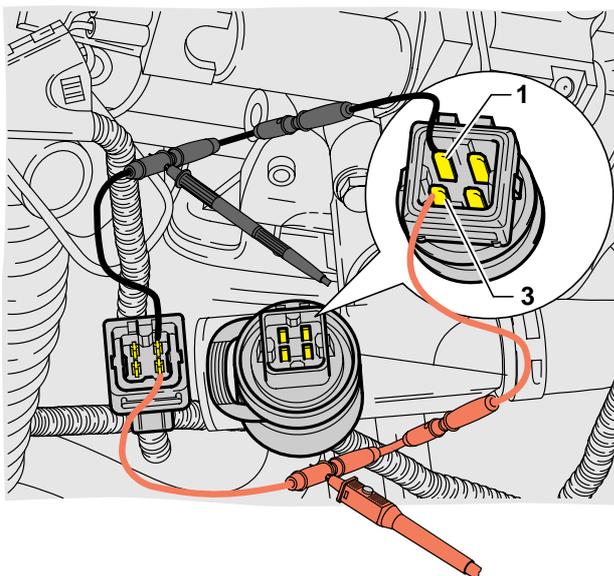
The signal from the coolant temperature sender G62 is used by the engine control unit as a correction factor for the basic injection timing depending on the engine temperature (warm-up period).

The adjacent circuit diagram shows the electrical connections on the coolant temperature sender G62 of the 1.8 l/92 kW petrol engine.

The electric signal for subsequent analysis by the DSO is measured at the following contacts:

- DSO 1 (+) → Contact 1 (signal)
- DSO 1 (-) → Contact 3 (ground)

The coolant temperature sender G62 controls the coolant temperature gauge in the dash panel insert.

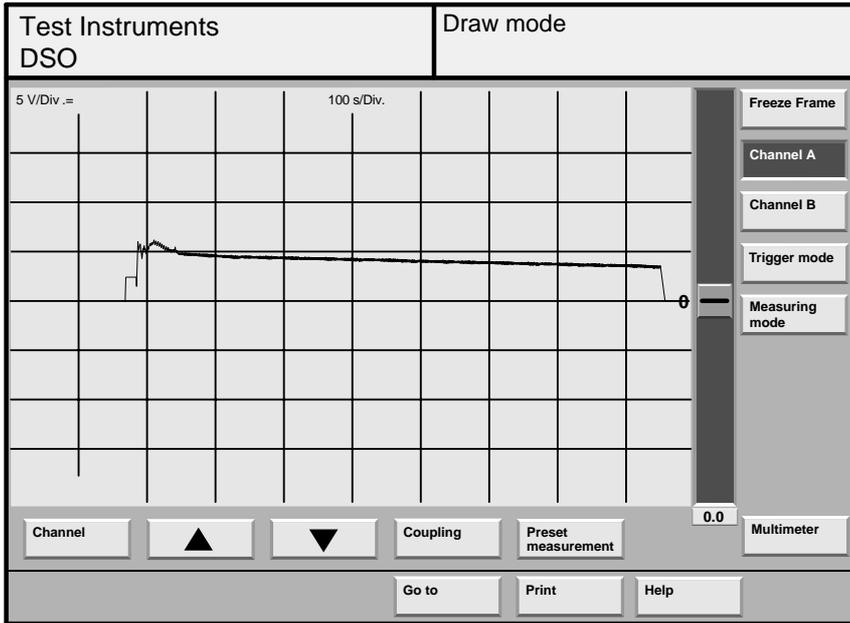


202/074

The temperature signal between contacts 1 and 3 can be displayed as a curve by intermediate connection of an adapter lead from the V.A.G. 1594A test set.

The individual adapter leads are described on page 30.

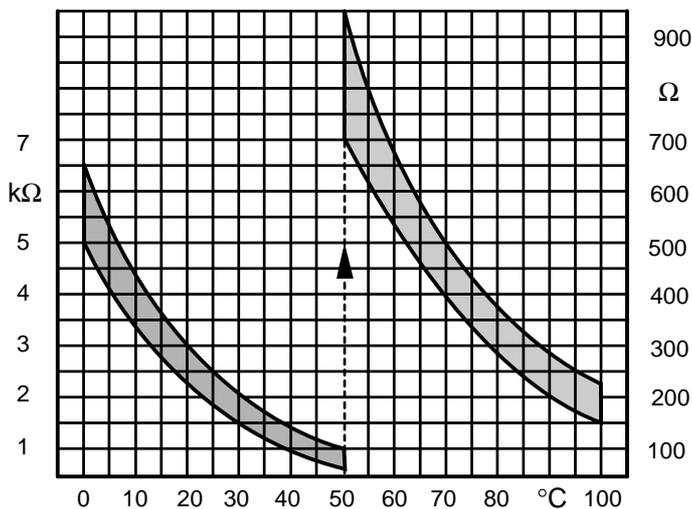
The following curve is obtained:



202/060

This signal via the adapter leads is slightly falsified by interfering fields, e. g. the ignition cables. However, the falling trend on warming-up of the engine can be recognized.

The voltage curve shows the change in temperature of the engine or coolant from approx. 10 °C up to 90 °C.



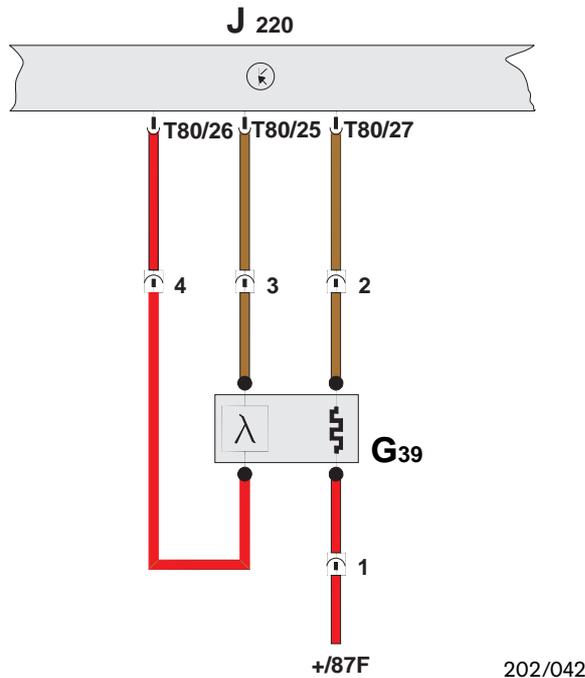
202/089

Exact judgement of the engine temperature sender is possible using the resistance characteristic from the corresponding workshop manual.

The characteristic shows the corresponding resistance value of the sender depending on the temperature.

The sender is OK if the resistance value is within the shaded area.

# Measurements and analysis with the VAS 5051



## Lambda probe G39

The lambda probe is located in the exhaust pipe upstream of the catalytic converter. The engine control unit receives a voltage signal from the lambda probe on the composition of the exhaust gas. The engine control unit controls the injectors such that the quantity of injected fuel results in an air/fuel ratio of approx.  $\lambda = 1.0$ .

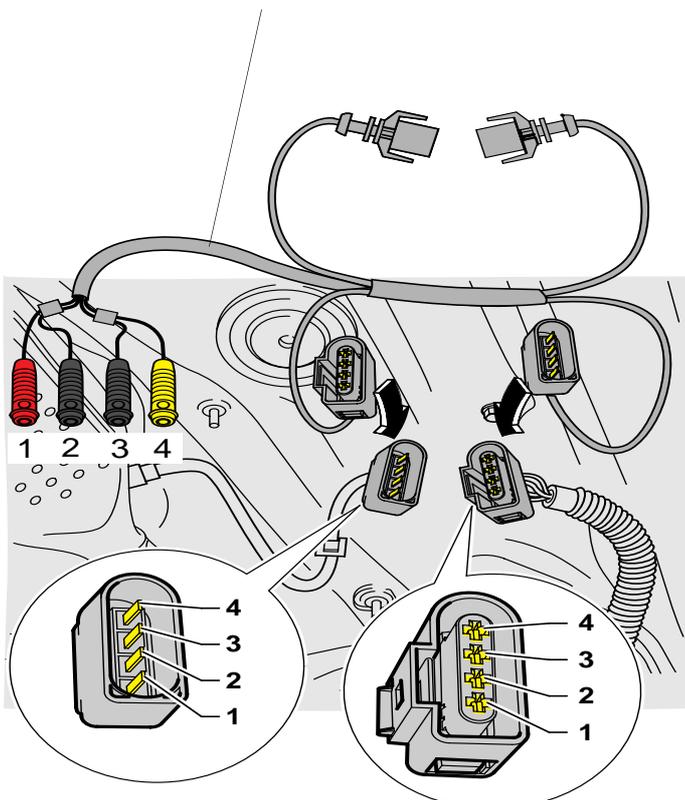
The adjacent circuit diagram shows the electrical connections on the lambda probe G39 of the 1.8 l/92 kW petrol engine.

The electric signal for subsequent analysis by the DSO is measured at the following contacts:

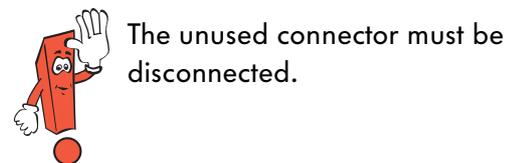
- DSO 1 (+) → Contact 4 (signal)
- DSO 1 (-) → Contact 3 (ground)



Lambda probe adapter VAS 5103

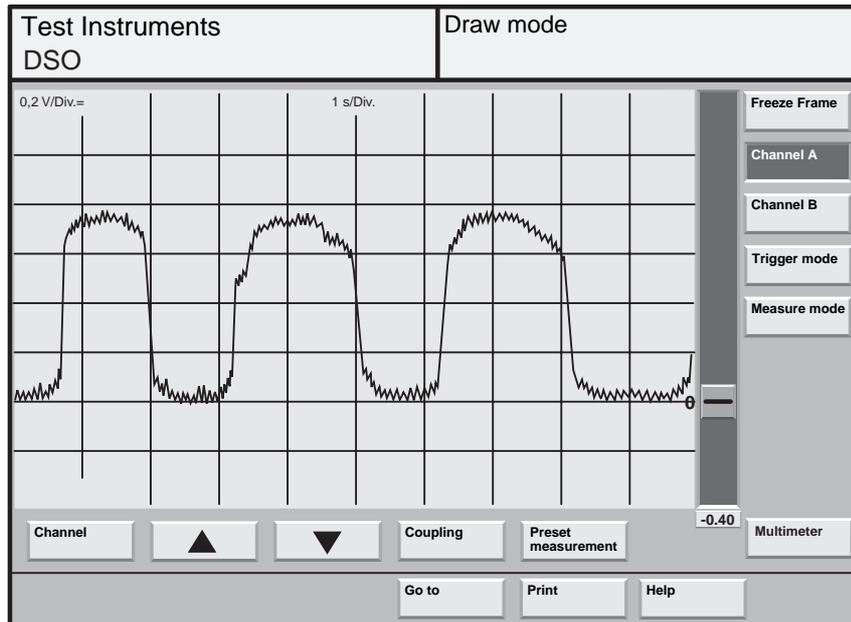


The lambda probe adapter VAS 5103 is used to connect the tester measuring leads to the lambda probe connector. The adapter lead is designed for two different versions of lambda probe connectors.



The lambda probe heating signal between contacts 1 and 2 and the lambda probe signal between contacts 3 and 4 can be displayed as a curve by intermediate connection of the adapter lead which permits parallel connection of the DSO measuring lead of the VAS 5051 tester to the connector for the lambda probe.

The following curve is approximately obtained for the lambda probe signal at idling speed:



202/061

The visible deviations (peaks) are not faults in the lambda probe signal, they are interferences from the ignition system. They are "received" via the adapter leads and the DSO lead.

The voltage signal for a rich mixture with little residual oxygen is approx. 0.7 ... 1.1 V.  
The voltage signal for a lean mixture with a lot of residual oxygen is approx. 0.1 ... 0.3 V.

The transition from rich to lean and vice versa is accompanied by a voltage jump from 0.7 ... 1.1 V to 0.1 ... 0.3 V or vice versa.

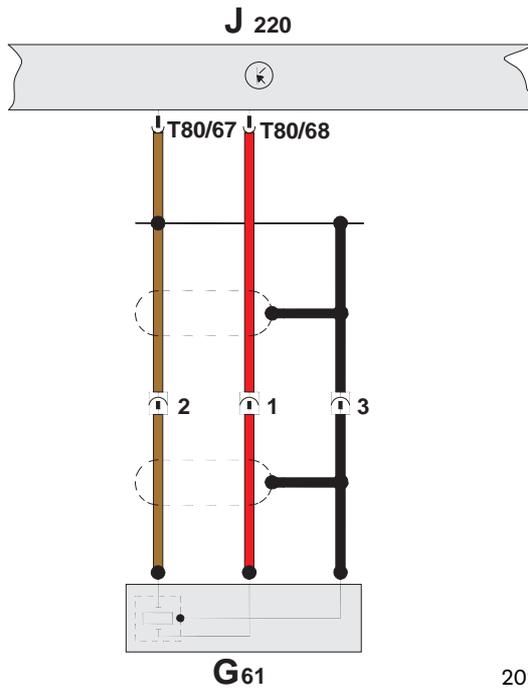
The control continuously oscillates between the statuses "slightly too lean" and "slightly too rich".

The following faults may be present if the change in voltage does not take place or is sluggish:

- Holes in probe head blocked
- Excessive thermal stress
- Probe too cold, probe heating not functioning
- Lambda control switched off, engine control unit has recognized fault in injection system -> interrogate fault memory.



# Measurements and analysis with the VAS 5051



202/043

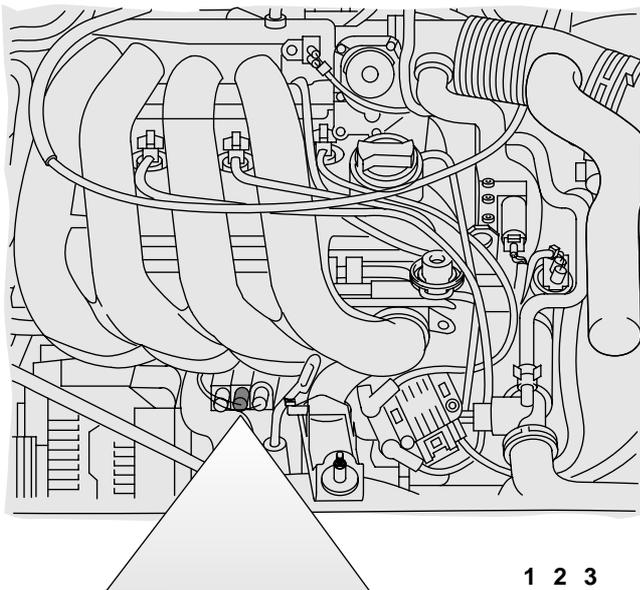
## Knock sensor G61

The knock sensor records the vibrations of the engine during knocking combustion, and passes a signal on to the engine control unit. The engine control unit then sets the ignition point to "Retard". This allows the engine to be driven with different fuel qualities.

The function diagram for the knock sensor is shown on the left.

The electric signal for subsequent analysis by the DSO is measured at the following contacts:

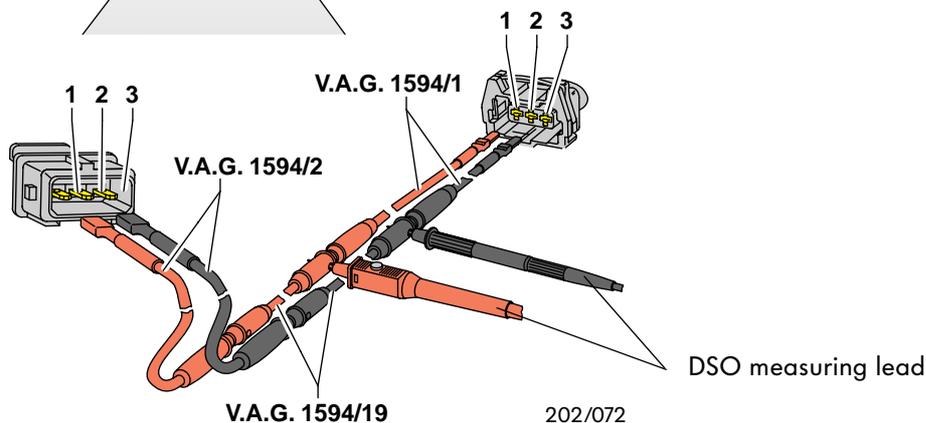
- DSO 1 (+) → Contact 1 (signal)
- DSO 1 (-) → Contact 2 (ground)



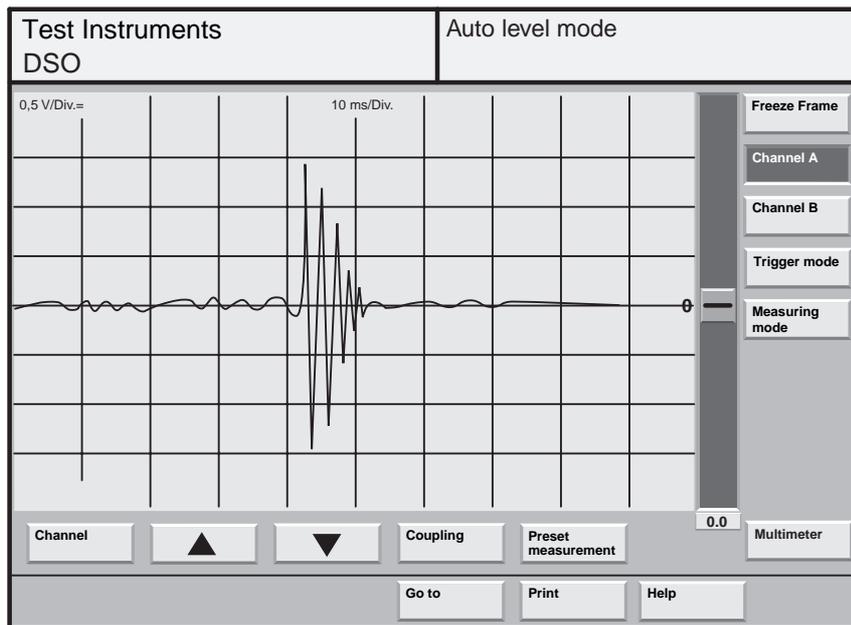
The function of the knock sensor can be checked from the curve by intermediate connection of an adapter lead from the V.A.G. 1594A test set.

The DSO measuring lead is connected parallel to the contacts 1 and 2 of the knock sensor.

The following curve is obtained:



202/072



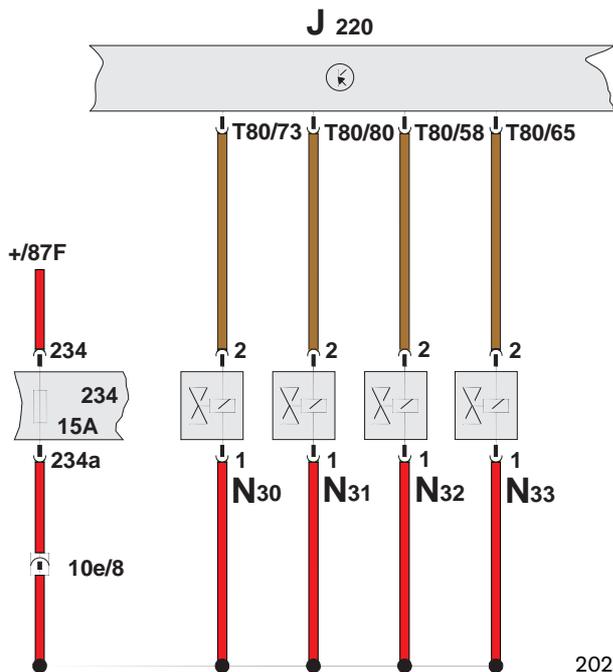
202/062

The curve shown above can be obtained  
 e. g. by gently knocking on the mounting screw of  
 the knock sensor.



# Measurements and analysis with the VAS 5051

## Actuator analysis with the DSO



202/040

## Injectors N30 ... N33

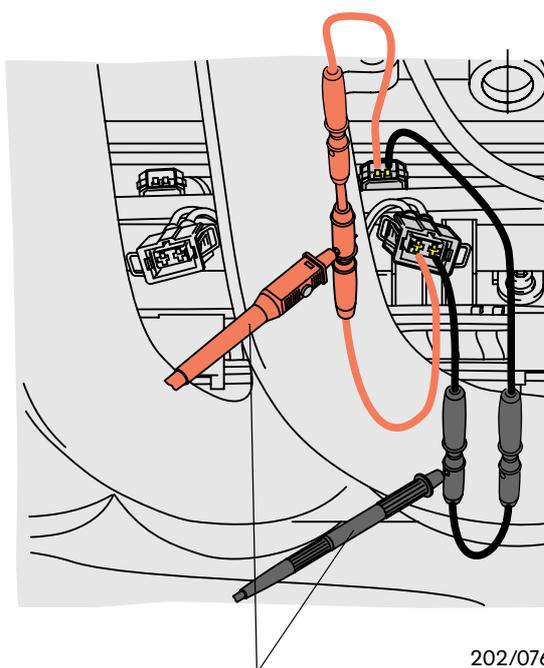
The injectors are located in the manifold upstream of the associated inlet valve.

The injectors are controlled by the engine control unit by means of electric pulses. The injection quantity is controlled by the engine control unit by means of the injection period since the cross-section of the opening and the difference in pressure are constant.

The adjacent circuit diagram shows the electrical connections of the individual injectors of the 1.8 l/92 kW petrol engine.

The electric signal for subsequent analysis of an individual injector by the DSO is measured at the following contacts:

- DSO 1 (+) → Contact 2 (signal)
- DSO 1 (-) → Contact 1 (positive)



202/076

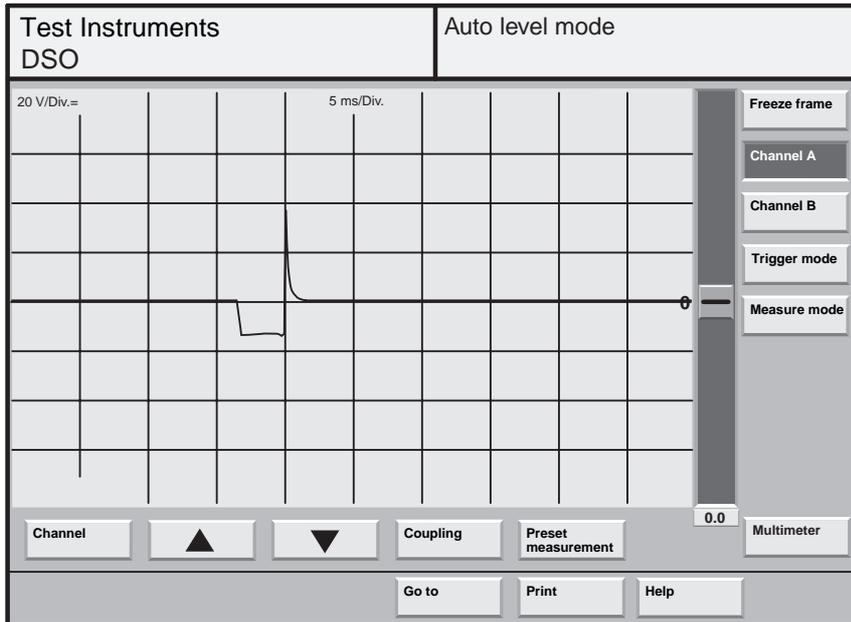
DSO measuring lead

The injection signal can be displayed as a curve by intermediate connection of an adapter lead from the V.A.G. 1594A test set into the wire to an injector with the DSO measuring lead of the VAS 5051 tester connected.

The individual adapter leads are described on page 30.

Faults can be detected compared to a defined curve.

The following curve is obtained:



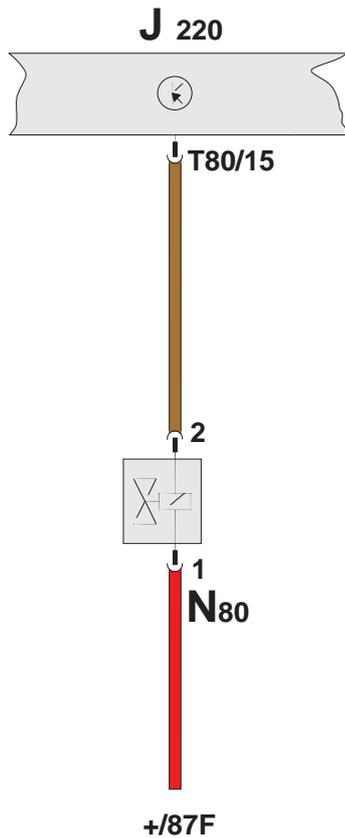
202/063

The curve shows the voltage response on the injector. The voltage peak results from discharging of the magnetic field.

The injection period is proportional to the injection quantity.



# Measurements and analysis with the VAS 5051



## Activated charcoal filter solenoid valve N80

The activated charcoal filter solenoid valve is a valve in the tank venting system. The solenoid valve closes the tank venting system downstream of the activated charcoal filter and is only opened electrically by the engine control unit.

The solenoid valve is activated periodically by the engine control unit according to evaluation of the lambda probe, the throttle valve sender and the coolant temperature sender.

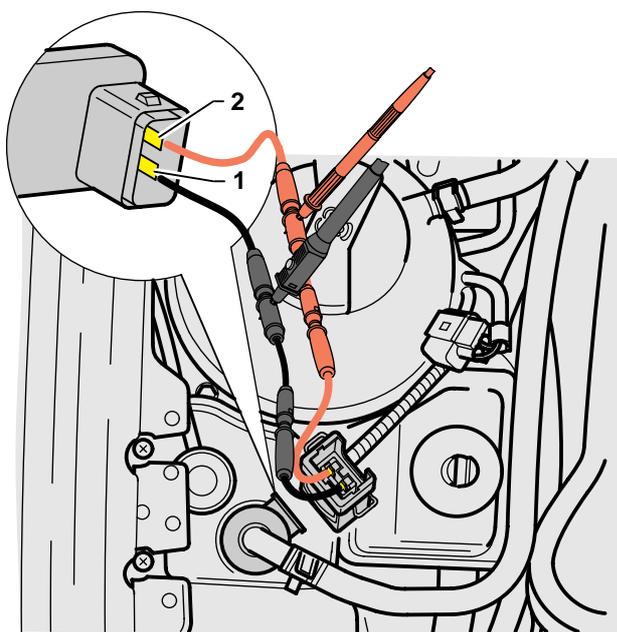
The adjacent circuit diagram shows the electrical connections of the activated charcoal filter solenoid valve on the 1.8 l/92 kW petrol engine.

The electric signal for subsequent analysis by the DSO is measured at the following contacts:

- DSO 1 (+) → Contact 2 (signal)
- DSO 1 (-) → Contact 1 (positive)



202/051



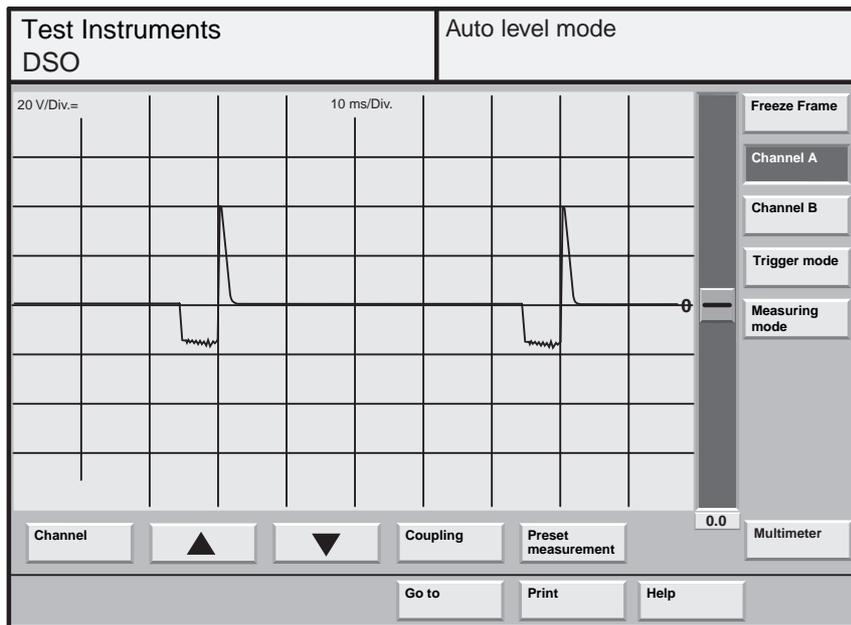
The solenoid valve control signal can be displayed as a curve by intermediate connection of an adapter lead from the V.A.G. 1594A test set into the lead to the activated charcoal filter solenoid valve with the DSO measuring lead of the VAS 5051 tester connected.

The individual adapter leads are described on page 30.

Faults can be detected compared to a defined, preset measurement.

The following curve is obtained:

202/077



202/066

The opening duration and the switching frequency of the activated charcoal filter solenoid valve can be recognized from the displayed curve.



# Measurements and analysis with the VAS 5051

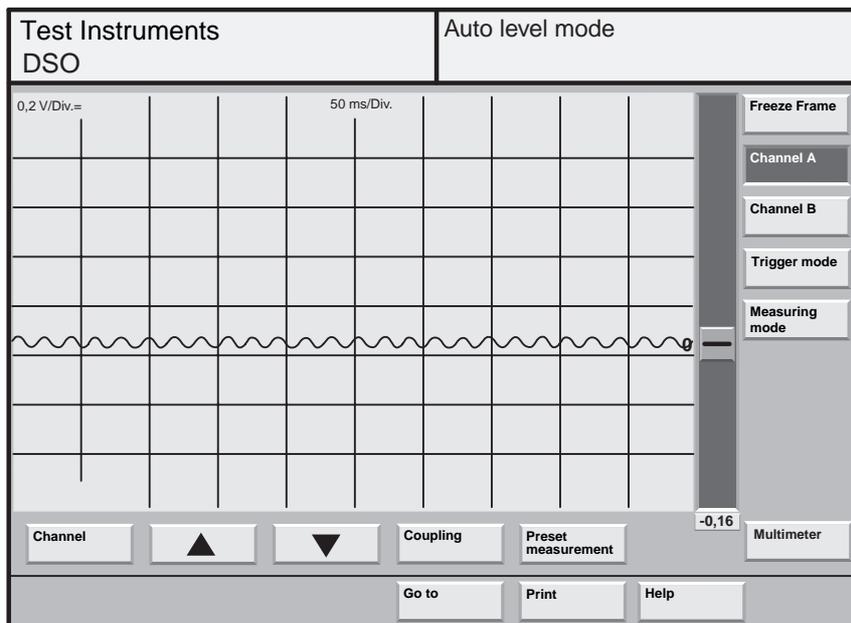
Your attention must finally be drawn to the following points for evaluation of displayed curves which deviate greatly from one of the preset curves:

- Only curves recorded under the same conditions or prerequisites can be compared with one another
- Fluorescent lamps may produce interfering signals
- The ignition transformer and leads emit interfering signals which may be superimposed on the actual curve or falsify it.

The curves shown here are examples which cannot be used as correct curves for fault finding.



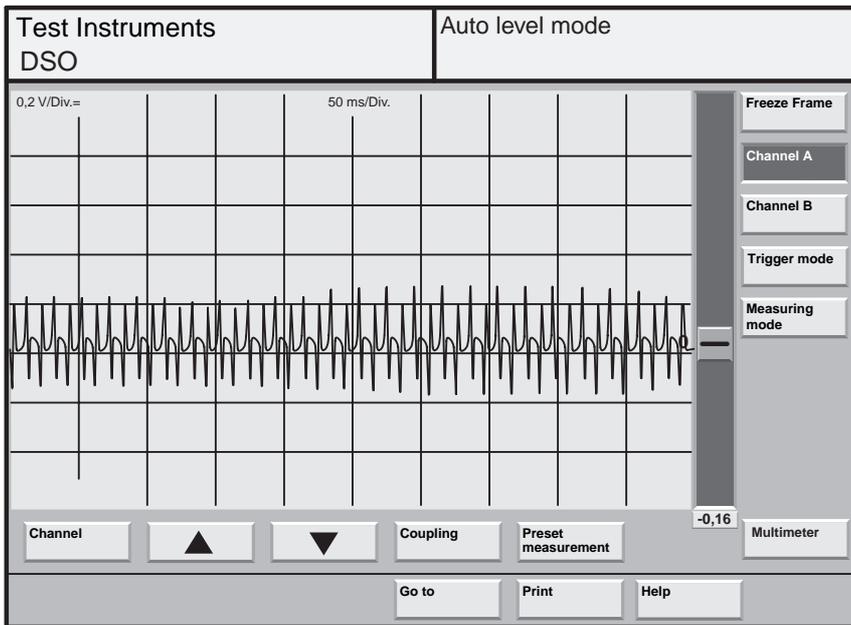
If the DSO test probes are not connected correctly, it may occur that interfering signals from the ignition system are displayed, and not the expected sender or actuator signal.



202/078

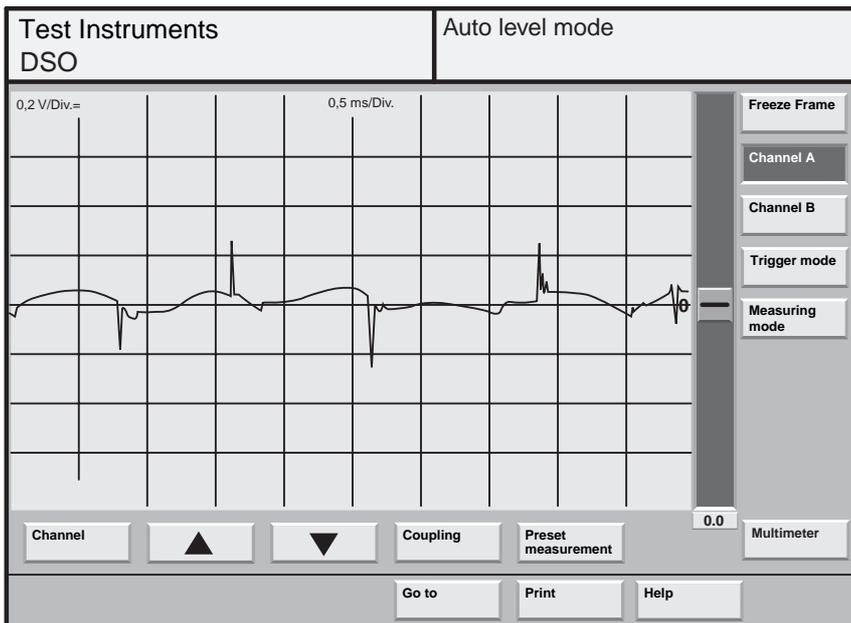
The displayed curve shows the typical wave-shape of interference from illumination by fluorescent lamps.

The interfering curve is superimposed on the measured curve, and changes the overall curve.



202/079

The displayed curve shows the typical wave-  
shape of interference from the use of a portable  
lamp on the vehicle in the immediate vicinity of  
the measuring leads.



202/080

The displayed curve shows the typical wave-  
shape of interference from incorrectly connected  
probes of the DSO measuring lead.

# Notes

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740.2810.21.20 Corresponds to technical state 11/97

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