Foreword

The Multi-Tester plus/pro software cassette and the corresponding adapter are the components that give the diagnostic equipment its unique test characteristics.

All the data required to make the test system operate are stored on the software cassette.

The software cassette can easily be replaced enabling the Multi-Tester plus/pro to be a adapted to the trouble-shooting job at hand.

These Trouble-Shooting Instructions describe how to use the software for tracking faults in the Teves MK IV ABS system.

Multi-Tester plus/pro checks all signals that have bearing on the control system and can also diagnose a faulty control unit.

Contents

System Description - ABS Bosch 15/4

General ABS-system

The ABS brake system prevents the road wheel locking when braking so enchancing directional stability and steering performance while reducing the braking distance. Modern ABS systems are constructed using digital technology and precision hydraulics. ABS stands for German "Anti-Blockier-System" (Anti-Lock System).

Under normal conditions, when the wheels would not lock, the ABS system is not active - the brake system then operates as it would on a car not fitted with ABS. When the ABS system senses that a wheel is about to lock up the braking force is regulated in two stages. Stage 1 is pressure maintenance. In this phase the system prevents the pressure in the wheel cylinder from increasing by blocking the hydraulic pipe running between the brake master cylinder and the wheel cylinder in question. If that is insufficient to prevent the wheel locking up then stage 2 is initiated – pressure reduction. The pressure in the wheel cylinder is reduced in this phase by hydraulic fluid being withdrawn from the wheel cylinder.

Wheel sensors are used in systems, 2-4 to determine if a wheel is about to lock up. A sensor is sited at each front wheel and sometimes a further sensor is fitted at the differential on the final drive or at each rear wheel individually. Each wheel with a sensor is equipped with a sprocket whose rotational speed the sensor measures.

The ABS control unit regulates a number of solenoids and occasionally a pump to control the pressure in the hydraulic pipes.

If the ABS control unit detects a fault in the ABS system then the ABS warning light ignites and the ABS system is disengaged. In such cases the brake system operates as an ordinary system, that is without the effect of ABS.

Some ABS-systems are combined with TRACS, which is a so called anti-spin system'. The TRACS-system prevents the driving-wheels from spinning during acceleration. If a wheel starts spinning the wheel will be braked by the TRACS system using the hydraulic components of ABS and some TRACS-specific components. When the spinning wheel regains its correct speed the TRACS-system stops the braking. Some 'anti-spinn systems' may temporarily limit the power of the engine.

The Teves MK IV system

The system has 2, 3 or 4 pairs of valves. Each pair consists of one inlet valve and one outlet valve. An inlet valve is positioned between the main brake cylinder and a wheel cylinder. It is opened when the ABS-system is passive and closed during the pressure maintenance and reduction phases. An outlet valve is sited between a wheel cylinder and the brake fluid reservoir. This only opens during the pressure reduction phase.

Phase	*Inlet valve*	*Outlet valve*
Passive	open 12 V	closed 12 V
Pressure maintenance	closed 0 V	closed 12 V
Pressure reduction	closed 0 V	open 0 V

The hydraulic part of the system includes an electric pump, which provides high pressure brake-fluid for building up the pressure after the pressure reduction phase. When ABS is combined with TRACS an additional valve is included for this funktion. The system has two or four wheel speed sensors.

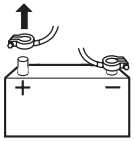
Users Guide

Connection of equipment

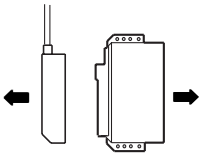
1 Preparations

Switch off ignition!

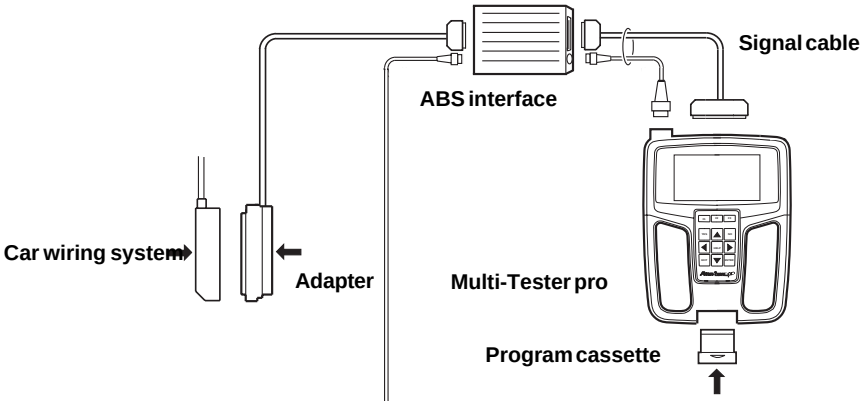
Disconnect positive battery terminal!



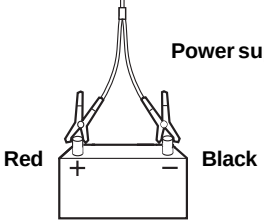
ABS-control unit disconnected



2 Connect system interface, adapter and program cassette



3 Connect power supply



Caution!
To prevent damaging the memory the Multi-Tester plus/pro must always be dis-connected from any power supply before it is opened and a new software cassette installed. Do not expose the tester to direct sunlight or extreme heat for a prolonged period as this may damage the display.

Starting the program

General

The program is re-started each time the power supply is interrupted and re-connected. When the supply is interrupted any faults and pre-sets recorded in memory are deleted.

At any particular moment, those keys which are not required are disabled. If such a key is pressed, the unit emits a long beep signal.

The program starts automatically when the Multi-Tester plus/pro is connected to the power supply. The unit executes steps 1 to 4 and pauses at step 5.

Working procedure

1. All fields in the display are tested (i.e. are illuminated),
Multi-Tester plus only
If no software cassette is installed or the cassette is incorrect, only the first and third row become illuminated.
At this point the display's contrast can be adjusted. Adjust the potentiometer to right of the switch inside the cassette opening (using a small screwdriver).

2. The Multi-Tester plus/pro performs a self-test....

SELF-TEST OK

3. ...and identifies the current versions of the hardware and software.

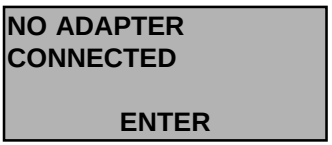
AUTODIAGNOS
MULTITESTER
XXXXXXXXXXXXXXXX
VER:XXXXXXXXXXXX

4. The adapter connected

The Multi-Tester plus/pro confirms which adapter is connected and displays this information. Is the information on row 2 correct? Respond by pressing ENTER.

This message is displayed if the adapter which is connected to the Multi-Tester plus/pro is of the incorrect type, i.e. not combined with the appropriate software cassette.

If the adapter is not connected to the unit, the message NO ADAPTER CONNECTED is displayed.



If the wrong ABS interface is connected, this is indicated in the display window.

5. Questions during initialization

The Multi-Tester plus/pro has to know certain things about the system that is going to be tested. Therefore you have to answer some questions concerning the number of sensors and pairs of valves, the number of cogs per sprocket and if the system includes TRACS (see the workshop manual if unsure).

Multi-Tester plus/pro asks how many wheel speed sensors that the current ABS-system has. The ↑/↓ keys move the cursor from one row to another. If you press ENTER you choose the alternative that the cursor indicates (see workshop manual).

2 SENSORS
4 SENSORS

↑/↓/ENTER/EXIT

The Multi-Tester plus/pro here asks how many pairs of inlet- and outlet valves that the current ABS-system has. Two pairs means two inlet valves and two outlet valves, that is a total number of four valves. If the number of valves is odd it is likely that the car is equipped with TRACS (see workshop manual).

2 PAIRS OF VALV.
3 PAIRS OF VALV.
4 PAIRS OF VALV.

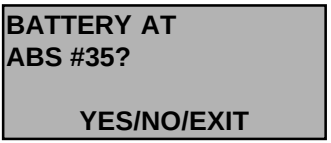
↑/↓/ENTER/EXIT

Here you should state whether pin no. 19 in the 55-pole connector is connected to ground or not. An easy way of finding that out is to look if there if there is a connection at position 19 in the 55-pole connector. If that is the case reply YES.

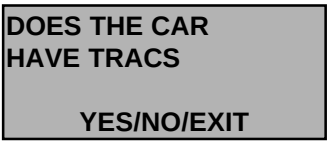
GROUND PIN AT ABS #19?

YES/NO/EXIT

Here you should state whether pin no. 35 in the 55-pole connector is connected to the battery plus pole or not. An easy way of finding that out is to look if there is a connection at position 35 in the 55-pole connector. If that is the case reply YES.

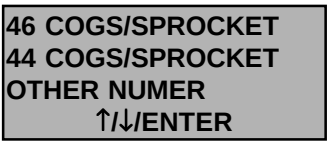


If the car has TRACS and this function is carried out by the ABS-ECU you should answer YES to this question. Cars equipped with TRACS often have high engine power, and there is an indicator at the dashboard.

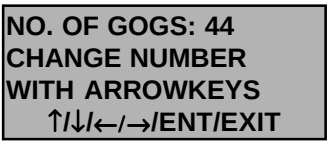


Multi-Tester plus/pro asks how many cogs that the sensor sprockets have (see workshop manual).

If you cannot get that piece of information you can guess. If you state the wrong number this only results in wrong values in the Monitor tests 'Eccentricity' and 'wheel speed'.

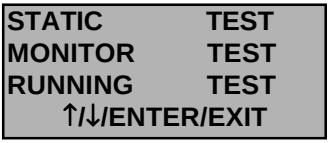


If you have anwered OTHER NUMBER to the question above, you will get this question. In the upper right corner of the display a number is shown. You can change this number with the arrow-keys. ↑/↓ arrows change the ten and ←/→ arrows the unit. When this number corresponds to the number of cogs for the current system you press ENTER.



6. Choice of test

This is the entry point for the Monitor test and Running test. Select the desired test with the aid of the arrow keys. Press ENTER.

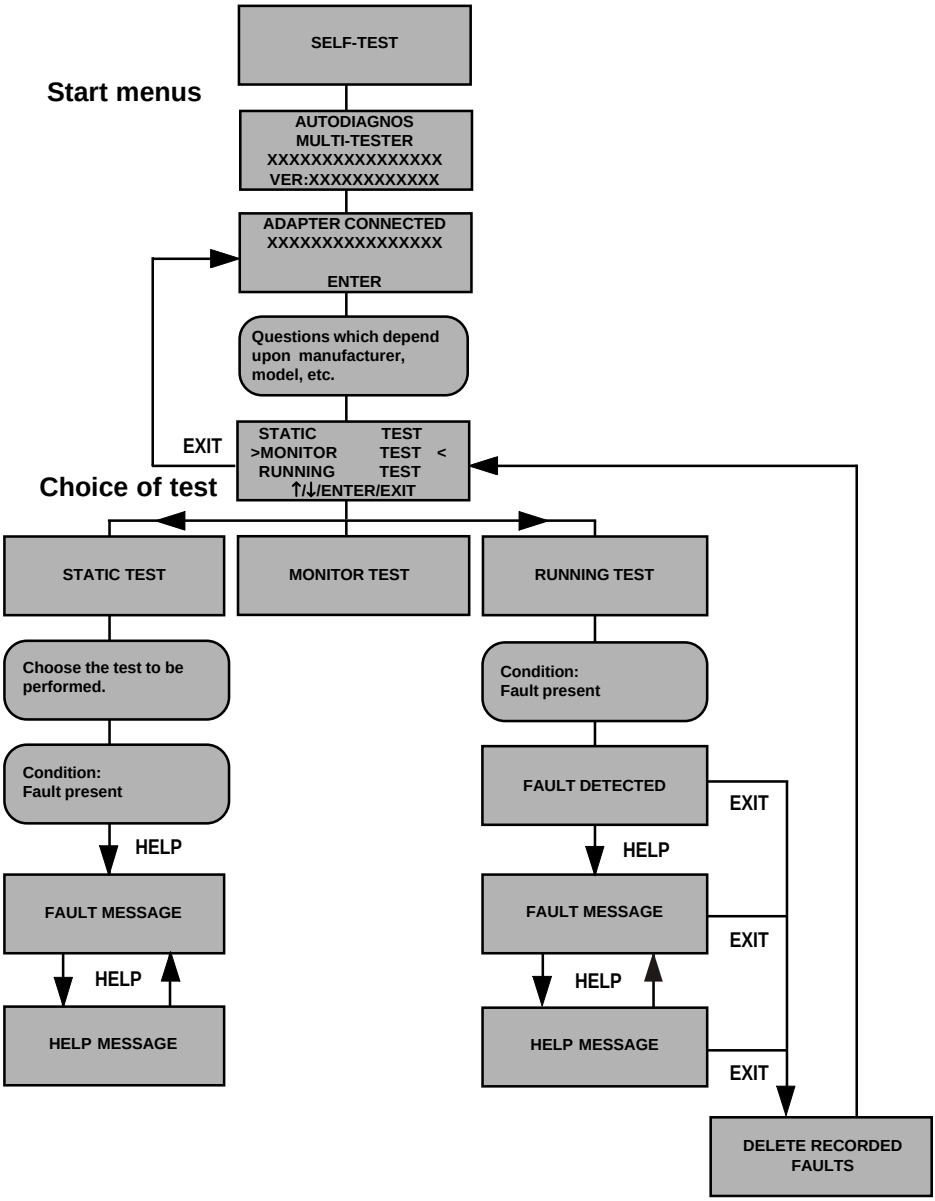


7. Cancel

To cancel work with the Multi-Tester plus/pro:

- Switch off engine.
- Disconnect the power cable from the unit.
- Disconnect the battery's positive terminal.
- Remove the adapter and re-connect the car's wiring harness to the control unit.
- Re-connect the battery's positive terminal.

Program structure



Programs and tests

Summary

The following types of tests are available:

Static test - shows measurement signals and faults
In the Static test, certain components in the ABS system of the car are activated by Multi-Tester plus/pro. For reasons of safety the car should therefore be stationary during the test. No signals or fault messages are stored in the memory.

Monitor test - displays measurement signals
Multi-Tester plus/pro displays the signals continuously. It displays different signals, depending on which control system is connected. No signals are stored in the memory.

Running test - registers and stores faults
When the signal has been scanned, the microprocessor in the instrument compares the input signals to the control system with pre-programmed standard values.

Any deviation, i.e. a fault, is read and stored by the instrument. The interval between two readings depends on the type of signals being registered.

Up to five faults can be stored every time a Running test is performed. If a fault is detected and stored, the letter **"F"** appears on the display. If you wish, Multi-Tester plus/pro will display a brief description of the fault. Help messages and status messages provide further information.

Priority

General
A primary fault may generate secondary faults. Multi-Tester plus/pro compares primary and secondary faults and shows only the primary, essential fault.

Order of priority

- Voltage supply
- Ground connections to the control system
- Other signals

Static test -

measurements which to be performed whith the car stationary

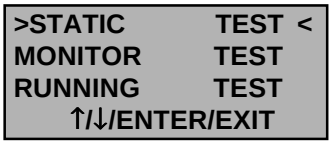
General

The Static Test can be regarded as a development of the Monitor Test. The main difference between the two is that in the Static Test the Multi-Tester plus/pro activates some of the components in the car's ABS system, while in the Monitor Test the Multi-Tester plus/pro has a purely passive role.

- In the Static test, neither the readings nor any error messages that may appear are stored.
- At any particular moment, those keys which are not required are disabled. If such a key is depressed, the unit emits a long beep signal.

The following measurements are made:

SENSOR RESISTANCE:	Resistance of the sensors (kΩ)
VALVE RESISTANCE:	Resistance of the valves (Ω)
VALVE/PUMP RELAY TEST:	The ABS interface attempts to energize the relay (certain cars only)
BRAKE PEDAL TEST:	Checks whether the stop lamp switch is working (certain cars only)



Working procedure

1. Starting Static test

The entry point is the “Choice of test” menu. In order to display this menu, follow steps 1–6 in the “Starting the program” section.

Select STATIC TEST (using the arrow keys) then press ENTER.

2. Static test menu

Here you can choose which measurements to do. The measurements that can be chosen in this menu depend on which system is being tested and which program version is running in Multi-Tester plus/pro. You choose the measurement function with the arrow keys ENTER.

3. Start/stop engine

For some of the measurements in the Static test the engine must be running. If one of these has been chosen and the engine is not running, a message appears on the display.

4. Measurements in Static test

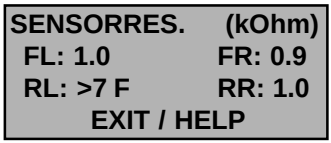
In certain case, when you choose a measurement function from the menu, several tests may be done automatically by Multi-Tester plus/ pro. The test sequence performed depends on the system being tested.

When analog measurements are done, a message like the one on the right usually appears. The first line states which measurement has been done. The second and third lines show the readings. The fourth line shows which keys are available for use.

If there is an **"F"** after the reading, the reading is incorrect. To see fault and help texts, press HELP.

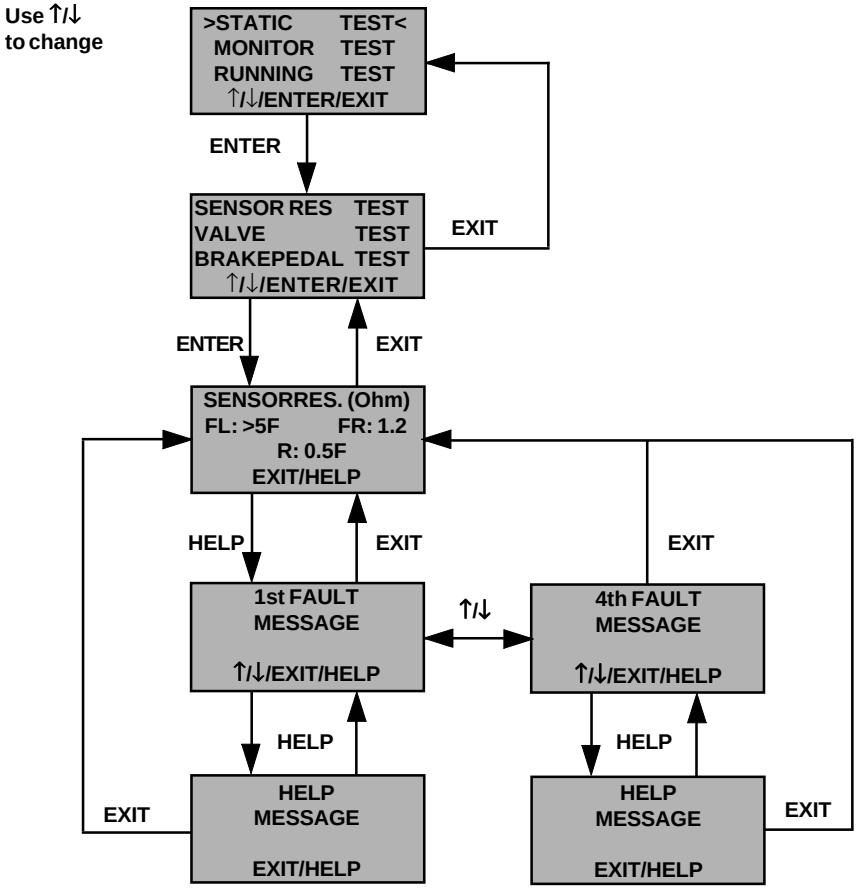
5. Ending the test

If you press EXIT at any time during a Static test, you are returned to the "Static test" menu. There you can choose to make a new measurement or press EXIT to return to the "Choice of test" menu.



FL = front left
FR = front right
RL = rear left
RR = rear right
R = back

Static test


Use ↑/↓
to change
>STATIC TEST<
MONITOR TEST
RUNNING TEST
↑/↓/ENTER/EXIT
ENTER
SENSOR RES TEST
VALVE TEST
BRAKEPEDAL TEST
↑/↓/ENTER/EXIT
EXIT
ENTER
EXIT
SENSORRES. (Ohm)
FL: >5F FR: 1.2
R: 0.5F
EXIT/HELP
HELP
EXIT
EXIT
1st FAULT
MESSAGE
↑/↓/EXIT/HELP
↑/↓
4th FAULT
MESSAGE
↑/↓/EXIT/HELP
HELP
HELP
EXIT
HELP
MESSAGE
EXIT/HELP
HELP
MESSAGE
EXIT/HELP
EXIT

Monitor test – display measured values

General

- In Monitor test the values are continously displayed and are not recorded.
- At any particular moment, those keys which are not required are disabled. If such a key is depressed, the unit emits a long beep signal. See even Static test.

Measurements based on sensor signals.

WHEEL SPEED: Rotation speed of wheels in rev/s.

AMPLITUDE: Mean of peak values of the sine waves that are the sensor signals in volts.

ECCENTRICITY: A measure of the difference in amplitude between different sections of the toothed wheel as a percentage of the mean value of the amplitudes.

VOLTAGES: For example, terminal 15 and alternator voltage in volts (battery voltage, alternator signal and supply from main relay are about 0 V if the motor is not running).

Caution! If the display is to be read whilst driving the test should be performed by two people.

```
 STATIC        TEST
>MONITOR       TEST <
 RUNNING       TEST
    ↑/↓/ENTER/EXIT
```

Working procedure

1. Starting Monitor test

The entry point is the “Choice of test” menu. In order to display this menu, follow steps 1–6 in the “Starting the program” section.

Select MONITOR TEST (using the arrow keys) then press ENTER.

```
WHEELSPEED
AMPLITUDE
ECCENTRICITY
    ↑/↓/ENTER/EXIT
```

2. Monitor menu

Here you can choose which parameters you want to look at. The parameters that can be chosen in this menu depend on which system is being tested and which program version is being run in Multi-Tester plus/pro. Use the arrow keys and ENTER to choose parameters.

```
WHEELSPEED (RPS)
FL:  10   FR:  10
RL:  10   RR:  10
      ↑/↓/EXIT
```

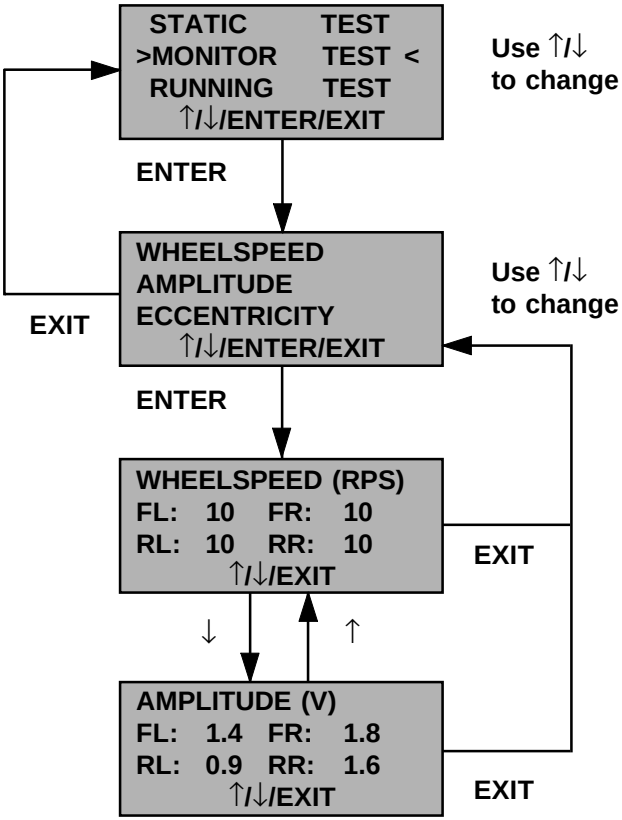
3. Parameters

The first line shows which parameter is being displayed. The second and third lines show the values. The fourth line shows which keys can be used. When you have chosen a parameter you can change to another parameter with the arrow keys. There is no need to go back to the Monitor menu to choose a new parameter.

4. Terminating tests

If you press EXIT when a signal group is displayed, you are returned to the Monitor menu. There you can choose to look at any signal group or press EXIT to return to the ”Choice of test” menu.

Monitor test



Running test – recording faults

General
This test is used to detect incorrect input signals to the various ABS-systems. An fault is recorded if a signal deviates from its pre-programmed standard value. The fault is recorded until it is deleted manually or the power supply is interrupted.

- Up to five faults can be recorded each time Running is executed.
- Each primary fault can lead to a number of secondary faults.
- The Multi-Tester plus/pro stores all faults (primary and secondary) temporarily and offers an assessment of which is the primary fault. This is important in order to carry out repair work. Fault information is saved and displayed.
- The same fault cannot be recorded twice in succession.
- At any particular moment, those keys which are not required are disabled. If such a key is depressed, the unit emits a long beep signal.
- Running can be executed either in the workshop or under driving conditions (to obtain a complete test, the test must be done when running on the road.
- The test of the sensor signals in Running test only starts once the car has reached a set speed. The speed depends on the number of teeth per wheel and the circumference of the tire. A speed of just over 5 mph (7 km/h) is sufficient for a system with 96 teeth per wheel, while a 24-tooth system needs just over 20 mph (30 km/h). In this respect it does not matter what number of teeth you have stated to the tester. It is the actual number of teeth per wheel that determines the speed limit. Diagnosis of the wheel sensors is based on frequency. When the frequency from one wheel sensor differs significantly from the other sensors, a fault is registered. This means that faults may be registered even if one wheel slips, even though the sensor is OK.

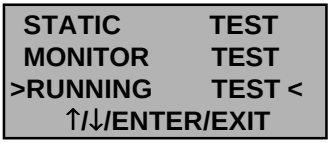
Caution! If the display is to be read whilst driving the test should be performed by two people.

An fault can be recorded the moment Running starts. The Multi-Tester plus/pro emits a beep and the letter **F** is displayed when an fault is detected. Instructions for retrieving the fault from memory together with a description of fault, help and status messages are described in the “Fault messages” section.

Working procedure

1. To start Running test

The entry point is the “Choice of test” menu. To display this menu, follow steps 1–6 in the “Starting the program” section. Select RUNNING TEST (using the arrow keys). Press ENTER.



2. Start the engine

If the engine is already running the message is not displayed. Instead the next menu is displayed.

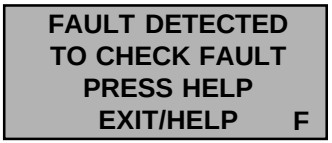
Comment

If the engine is not started within 20 seconds, and fault is registered (i.e. NO SUPPLY FROM IGNITION SWITCH is displayed).

3. No faults detected

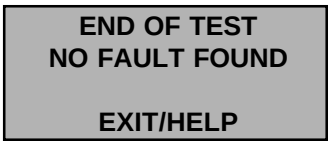
The Multi-Tester plus continues to compare the signals from the control system with the pre-programmed tolerance levels and records any faults which occur. The test continues until EXIT is pressed or the power supply is interrupted.

Testing under driving conditions can now begin.



4. Fault detected

When an fault is detected the unit emits a beep and the letter **F** is displayed. Instructions for retrieving the fault from memory together with a description of fault, help and status messages are included in the "Fault messages" section.

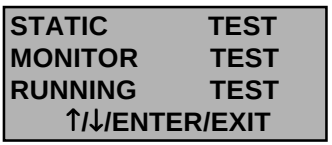


5. If the engine is switched off

If the engine is switched off, the message END OF TEST is displayed.

FAULT EXISTS is displayed if an fault has been recorded. The test continues if the engine is re-started.

NO FAULT FOUND appears when the system is functioning normally.



6. Terminating the test

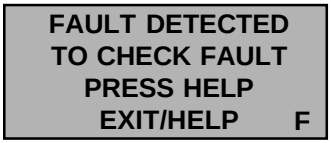
The test is cancelled by pressing EXIT, when the "Choice of test" menu is displayed. Recorded faults are retained in memory until they are either deleted manually or the power supply is interrupted.

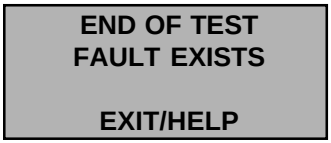
Fault messages

1. Fault detected

The letter **F** is displayed, or, if the engine is switched off, the text FAULT DETECTED.

Interrupt the test by pressing EXIT. The unit returns to the "Choice of test" menus. Otherwise proceed to display the number of faults by pressing HELP.

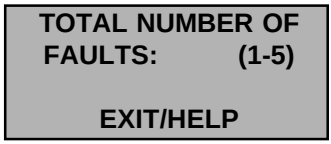




2. Number of faults

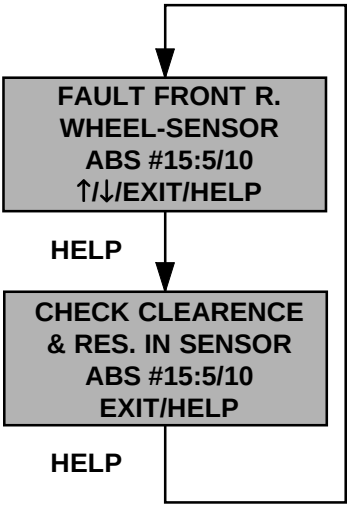
The number of faults detected appears on the display. A maximum of 5 faults can be recorded each time Running test is executed. Each fault has the following information associated with it:

- Fault message
- Help message

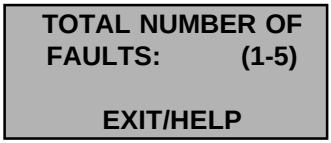


3. Fault messages

Press HELP to display the fault message. Use EXIT to return to the TOTAL NUMBER OF FAULTS menu.

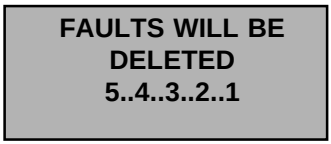


To delete recorded faults

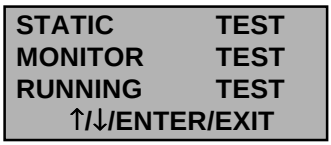


1. Start
To delete faults, start from this point.

2. To delete faults
Depress the EXIT key for at least 5 seconds. If EXIT is not pressed within 3 seconds the unit returns to the TEST OK STILL RUNNING message automatically.

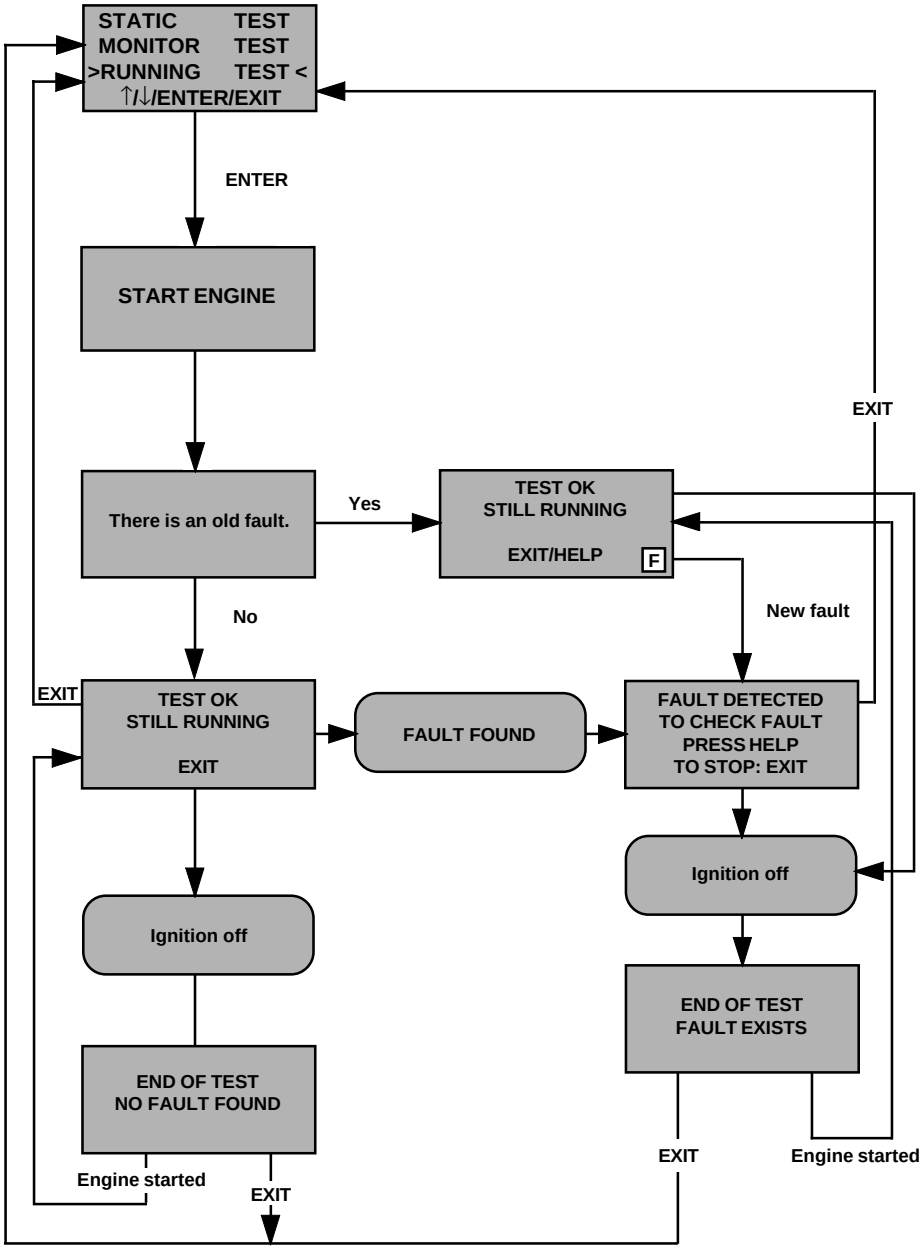


3. Delete faults.
All faults are deleted simultaneously.

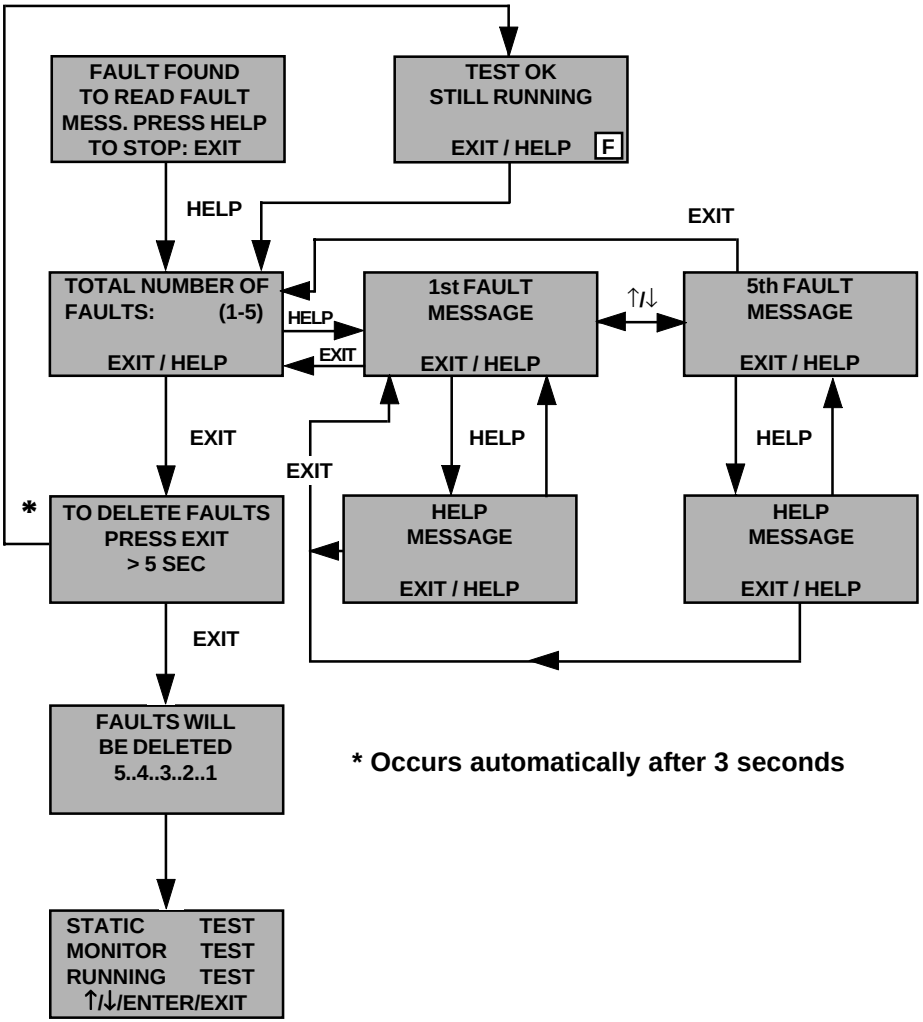


4. Exit delete
When all faults have been deleted, the instrument returns to the “Choice of test” menu.

Running test



Fault detected



*** Occurs automatically after 3 seconds**

Fault Tracing

Pin 1 Ground

MONITOR	STATIC	RUNNING
”#1 GND” (OK/ERROR)	Not tested.	Continuous check of ground level. Desired value: approx. 0 V See chapter Locating Faults ➧4

Pin 2 Valve outlet front left (OFL)

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 3-5 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 7.0 Ω	Not tested. See chapter Locating Faults ➧6

Pin 3/33, 34 Control of and power supply from main relay

MONITOR	STATIC	RUNNING
Not displayed.	The relay control (pin 34) is activated and the voltage levels at pin 3 and 22 are measured. Desired value: >11 V A fault is registered for levels less than 7 Volts.	Not tested. See chapter Locating Faults ➧3

Pin 13/26 Pressure switch for TRACS

MONITOR	STATIC	RUNNING
"#13/26 PRS" (CLOSED/OPEN)	Not tested.	Not tested.

Pin 15 Pump relay control

MONITOR	STATIC	RUNNING
Not displayed.	The pump relay is activated (pin 15) and the amplitude and the frequency of the sensor signal are measured. If the amplitude is lower than 0.5 V a fault will be registered.	Not tested.

See chapter Locating Faults ➧9

Pin 16/41 Pedal position sensor

MONITOR	STATIC	RUNNING
"#16/41 PED." (kΩ)	The brake pedal should be depressed and released on instruction.	Not tested.

See chapter Locating Faults ➧8

Pin 18 Valve outlet rear right (ORR) or front right (OFR)

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 3–5 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 7.0 Ω	Not tested.

See chapter Locating Faults ➧6

Pin 19 Ground

MONITOR	STATIC	RUNNING
”#19 GND” (OK/ERROR)	Not tested.	Continuous check of ground level. Desired value: approx. 0 V

See chapter Locating Faults ➧4

Pin 20 Valve inlet front left (IFL)

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 6-8 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 9.0 Ω	Not tested.

See chapter Locating Faults ➧6

Pin 21 Valve outlet front right (OFL)

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 3-5 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 7.0 Ω	Not tested.

See chapter Locating Faults ➧6

Pin 23 Diagnosis

MONITOR	STATIC	RUNNING
Not displayed.	Not tested.	Not tested.

Pin 25 Switch for TRACS

MONITOR	STATIC	RUNNING
"#25 TRACS" (ON/OFF)	Not tested.	Not tested.

Pin 27/45 Rear right wheel sensor

MONITOR	STATIC	RUNNING
Wheel speed (revs/secs.) Amplitude (V) Eccentricity (%)	Check of resistance. Desired value: approx. 1 kΩ Min: 0.5 kΩ Max: 2.0 kΩ	Pulse control at speeds higher than approx. 30 km/h. Depending on no. of cogs/sprocket and the circumference of the tire.

See chapter Locating Faults ➧7

Pin 28/46 Rear left wheel sensor

MONITOR	STATIC	RUNNING
Wheel speed (revs/secs.) Amplitude (V) Eccentricity (%)	Check of resistance. Desired value: approx. 1 kΩ Min: 0.5 kΩ Max: 2.0 kΩ	Pulse control at speeds higher than approx. 30 km/h. Depending on no. of cogs/sprocket and the circumference of the tire.

See chapter Locating Faults ➧7

Pin 29/47 Front right wheel sensor

MONITOR	STATIC	RUNNING
Wheel speed (revs/secs.) Amplitude (V) Eccentricity (%)	Check of resistance. Desired value: approx. 1 kΩ Min: 0.5 kΩ Max: 2.0 kΩ	Pulse control at speeds higher than approx. 30 km/h. Depending on no. of cogs/sprocket and the circumference of the tire.

See chapter Locating Faults ➧7

Pin 30/48 Front left wheel sensor

MONITOR	STATIC	RUNNING
Wheel speed (revs/secs.) Amplitude (V) Eccentricity (%)	Check of resistance. Desired value: approx. 1 kΩ Min: 0.5 kΩ Max: 2.0 kΩ	Pulse control at speeds higher than approx. 30 km/h. Depending on no. of cogs/sprocket and the circumference of the tire.

See chapter Locating Faults ➧7

Pin 31, 49 Pump sensor signal

MONITOR	STATIC	RUNNING
Not displayed.	The pump relay is activated (pin 15) and the amplitude and the frequency of the sensor signal are measured. If the amplitude is lower than 0.5 V a fault will be registered.	Not tested. See chapter Locating Faults ➧9

Pin 32 Brake light switch

MONITOR	STATIC	RUNNING
"# 32 BRAKEL." (ON/OFF)	Brake pedal test.	Not tested. See chapter Locating Faults ➧5

Pin 35 Battery voltage

MONITOR	STATIC	RUNNING
"#35 BATT" (OK/ERROR)	Not tested.	Continuous test of voltage level. Desired value: >11 V See chapter Locating Faults ➧1

Pin 36 Valve outlet rear (OR), rear left (ORL) or rear right (ORR)

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 3–5 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 7.0 Ω	Not tested. See chapter Locating Faults ➧6

Pin 37 Valve TRACS

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 6–8 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 9.0 Ω	Not tested. See chapter Locating Faults 6

Pin 38 Valve inlet front right (IFR)

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 6–8 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 9.0 Ω	Not tested. See chapter Locating Faults 6

Pin 44 TRACS-light

MONITOR	STATIC	RUNNING
"#44 T-LIGHT" (ON/OFF)	Not tested.	Not tested. See chapter Locating Faults 10

Pin 52 ABS-light

MONITOR	STATIC	RUNNING
"#52 A-LIGHT" (ON/OFF)	Not tested.	Not tested. See chapter Locating Faults 10

Pin 53 Power from ignition switch (terminal 15)

MONITOR	STATIC	RUNNING
"#53 BATT" (V)	Not tested.	Continuous test of voltage level. Voltage below 7.0 V for 300 ms max. is interpreted as an intermittent fault. Lower voltage over a longer period is interpreted as ignition off. Desired value: >11 V See chapter Locating Faults ➧2

Pin 54 Valve inlet rear (IR), rear left (IRL) or front left (IFR)

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 6–8 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 9.0 Ω	Not tested. See chapter Locating Faults ➧6

Pin 55 Valve inlet right rear (IRR), or right front (IFR)

MONITOR	STATIC	RUNNING
Not displayed.	Check of resistance. Desired value: 6–8 Ω The limits for fault-registration are: Min: 2.0 Ω Max: 9.0 Ω	Not tested. See chapter Locating Faults ➧6

Locating Faults

1

Check of voltage feed from battery, ABS pin 35

1. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
2. Measure the voltage between the ABS control unit pin 35 and ground. Desired value: > 11 V

   Possible cause of fault: Fuse.
3. Measure the resistance of the cable between the ABS unit pin 35, and the fuse-holder. Desired value: 0–1 Ω
4. Measure the resistance of the cable between the fuse-holder and the battery plus pole. Desired value: 0–1 Ω

2

Check of power supply from ignition switch (terminal 15), ABS pin 53

1. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
2. Start engine.
3. Measure the voltage between pin 53 and ground. Desired value: > 11 V
4. Turn off engine.
5. Measure the resistance of the cable between the ABS unit pin 53, and the ignition switch. Desired value: 0–1 Ω

3

Check of main relay control signal, ABS pin 34, and feed from main relay, ABS pin 3 and 33.

No feed from main relay to neither ABS pin 3 nor 33:

1. Check main relay fuse.
2. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
3. Measure the resistance of the cable between ABS control unit pin 3, 33 and 34 and the main relay. Desired value: 0–1 Ω
4. Measure the resistance of the cable between the main relay and the fuse-holder, and between the fuse-holder and the ignition switch and the battery. The correct reading is: 0–1 Ω

   If the reading is correct: replace the relay and repeat the test with Multi-Tester plus/pro.

No feed from main relay at ABS pin 3 or pin 33:

1. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
2. Measure the resistance between the ABS control unit pin 3 and 33. Desired value: 0–1 Ω
3. Check the wiring to the ABS control unit pin 3 and 33 and from the main relay.

4

Check of ground connection, ABS pin 1 and 19

1. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
2. Measure the resistance between the ABS control unit pin 1 and ground. Desired value: 0–1 Ω
3. If there is a ground connection at ABS pin 19: Measure the resistance in the wiring between ABS pin 19 and ground. Desired value: 0–1 Ω

   Possible cause of fault: Wiring or connectors.

5

Check of brake light switch, ABS pin 32

1. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
2. Turn on ignition, depress brake pedal and measure the voltage between ABS pin 32 and ground.

   The voltage should be higher than 11 V approx. with the pedal depressed. The voltage should be 0 V approx. with the pedal released.

   Incorrect reading: check the the brake light switch and wiring between the switch and the ABS control unit.

6

Check of valves and their wiring, ABS pin 2, 18, 20, 21, 36, 37, 38, 54 and 55

The braking pressure is regulated in the Teves MK IV ABS system using an inlet valve and an outlet valve for each brake circuit. The system has 2, 3 or 4 brake circuits. Thus it has 4, 6 or 8 valves for ABS-regulation. If the ABS-system is combined with TRACS it also contains a TRACS-valve. All valves are controlled by the ABS control unit through separate outputs.

1. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
2. If a fault is indicated for all valves, measure the resistance between the main relay (see workshop manual) and ABS control unit pin 3.
   Desired value: 0–1 Ω
3. If the error text shows a fault in one individual valve, measure the resistance across the valve block (see relevant workshop manual for the pin no. of the car you are working on).
   Desired value: 3–5 Ω (outlet valves)
   Desired value: 6–8 Ω (TRACS- and inlet valves)

   Possible cause of fault: Valve block.
4. Measure the resistance of the cable connecting the valve reported incorrect and the ABS control unit. (see relevant workshop manual for the pin no. of the car you are working on). Desired value: 0–1 Ω

7

Check of wheel sensors and their wiring, ABS pin 27, 28, 29, 30, 45, 46, 47 and 48

The wheel sensors record the rotational speed of the wheels through a sprocket. The signal is passed on to the ABS control unit which uses the data to determine if any of the wheels are about to lock up while braking is under way. The ABS system is then activated.

Resistance too high:

1. Measure the resistance directly across the wheel sensors in question. Desired value: 0.7–1.5 kΩ

   Possible cause of fault: Wheel sensor.

2. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
3. Take a measurement in the wiring between the ABS control unit and the sensors in question. Desired value: 0–1 Ω

Resistance too low:

1. Measure the resistance directly across the wheel sensors in question. Desired value: 0.7–1.5 kΩ

   Possible cause of fault: Wheel sensor.

2. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
3. Disconnect the sensor from its extension cable and measure the resistance between the signal and ground wires for each respective sensor (eg. pin 27 and 45 for sensor rear right). Desired value: 100 kΩ

   Possible cause of fault: Extension cable, connectors and the 55-pin harness for short circuits.

No sensor signal:

1. Check the sprocket for mechanical damage or if a cog has become blocked with dirt.
2. Measure the clearance between the sensor and the sprocket throughout one complete revolution and compare with the data in the workshop manual. Adjust if necessary. (See workshop manual).
3. Go through the checklist under 'Resistance too high' and 'Resistance too low'.

8

Check of the pedal sensor and its wiring, ABS pin 16 and 41

1. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
2. Connect an ohm meter between ABS pin 16 and 41.
3. Release the brake pedal. Desired value: 250 ±25 Ω

   Possible cause of fault: Wiring between the pedal sensor and the harness.
4. Turn off ignition and shortcircuit ABS pin 1, 2, 18, 21, 34 and 36 with banana plugs.
5. Turn on ignition and depress the brakepedal completely. Then turn off ignition. The ignition must not be turned on more than 20 seconds.
6. Release the brakepedal slowly and check the ohm meter. Seven distinct resistance values should be read. They are:

Position	Resistance (Ω)	
7	infinite	(completely depressed)
6	1030 ±100	
5	820 ± 80	
4	690 ± 70	
3	560 ± 60	
2	440 ± 45	
1	250 ± 25	(completely released)

If any of the readings is incorrect: Replace the pedal sensor.

9

Check of pump sensor signal, ABS pin 31 and 49

1. Check the pump relay fuse.
2. Disconnect the ABS adapter from the wiring harness. Connect the Autodiagnos Break-out Box (A0201/A0202) and the 55-pin adapter (A020209) to the car's wiring harness only. Do not reconnect the control unit.
3. Measure the resistance between ABS pin 31 and 49 (the pump sensor). The correct reading is between 10–40 Ω. Incorrect reading: Measure the resistance in the pumpsensor at the hydraulic unit. The correct reading is between 10–40 Ω.

   Incorrect reading: Replace the hydraulic unit.

   Correct reading: Check the wiring between the pump sensor and the 55-pole harness.
4. Turn on ignition and short ciruit ABS pin 1, 15 and 34. The pump should start. Turn off ignition and disconnect the short circuits.

   If the pump started: The pumpsensor signal is incorrect. Check once more the wiring between the pump sensor and the harness. If the wiring is correct: Replace the hydraulic unit.

   If the pump did not start: Turn on ignition and short circuit ABS pin 1 and 34. Measure the voltage at ABS pin 15. The correct reading is more than 11 V approx.

   Incorrect reading: Check the wiring between the relay and the 55-pole harness. Also check the wiring between the relay and the fuse holder.
5. Replace the relay and repeat the test with Multi-Tester plus/pro.

10

Check of ABS-light and TRACS-light and their wiring

If Multi-Tester plus/pro indicates that that the lights are on they should be on.

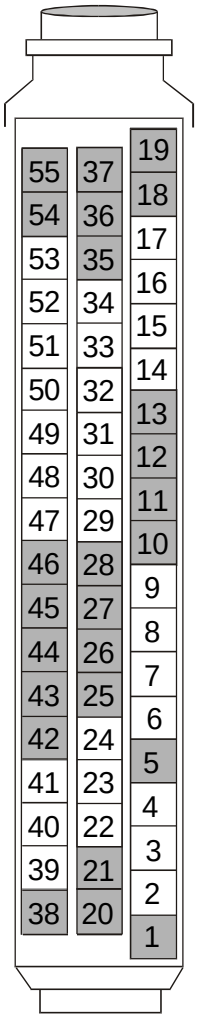
1. Check the buld and the wiring.

Index

Interface - Signal Locations

Note: Interface viewed from below

Wiring

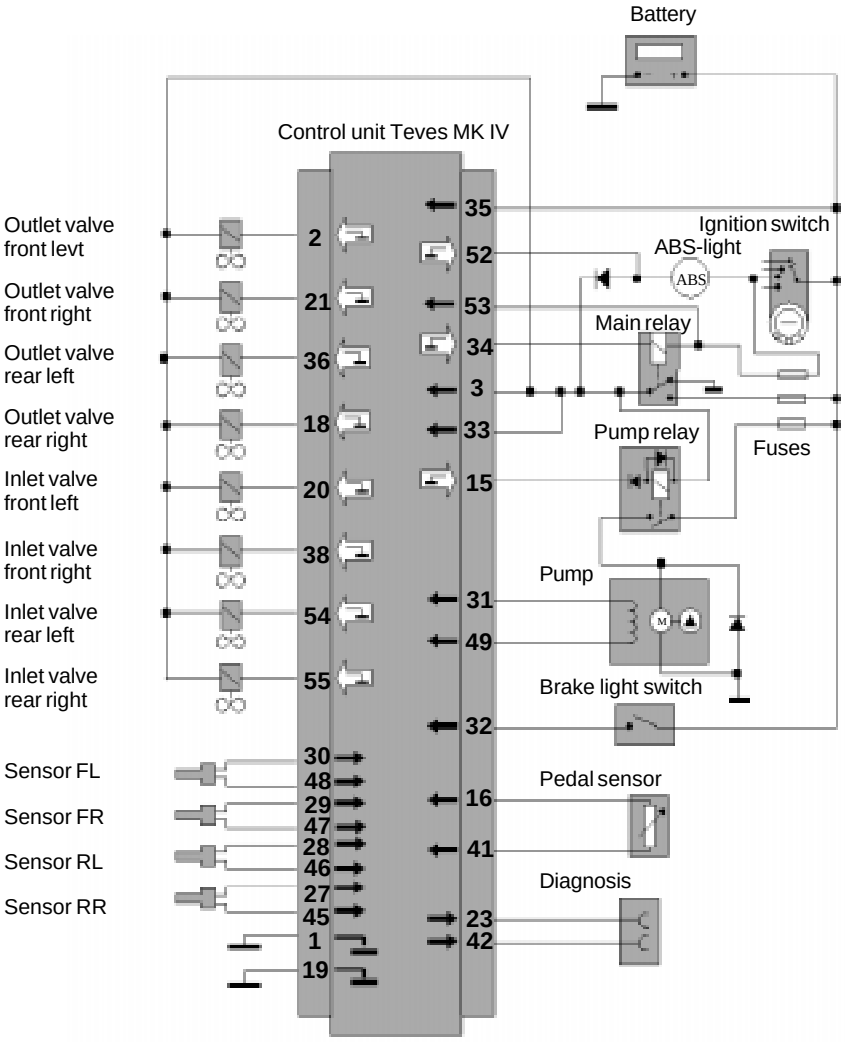


1. Ground
2. Valve outlet front left
3. Control of and power su pply from main relay
13. Pressure switch for TRACS
15. Pump relay control
16. Pedal position sensor
18. Valve outlet rear right or front right
19. Ground
20. Valve inlet front left
21. Valve outlet front right
23. Diagnosis
25. Switch for TRACS
26. Pressure switch TRACS
27. Wheel sensor rear right
28. Wheel sensor rear left
29. Wheel sensor front right
30. Wheel sensor front left
31. Pump sensor signal
32. Brake light switch
33. Feed from main relay
34. Main relay control signal
35. Battery voltage
36. Valve outlet rear, rear left or front left
37. Valve TRACS
38. Valve inlet front right
44. TRACS-light
45. Wheel sensor rear right
46. Wheel sensor rear left
47. Wheel sensor front right
48. Wheel sensor front left
49. Pump sensor
52. ABS-light
53. Power from ignition switch (terminal 15)
54. Valve inlet rear, rear left or front left
55. Valve inlet rear right or front right

Shaded areas indicate signals that can vary depending on car model.

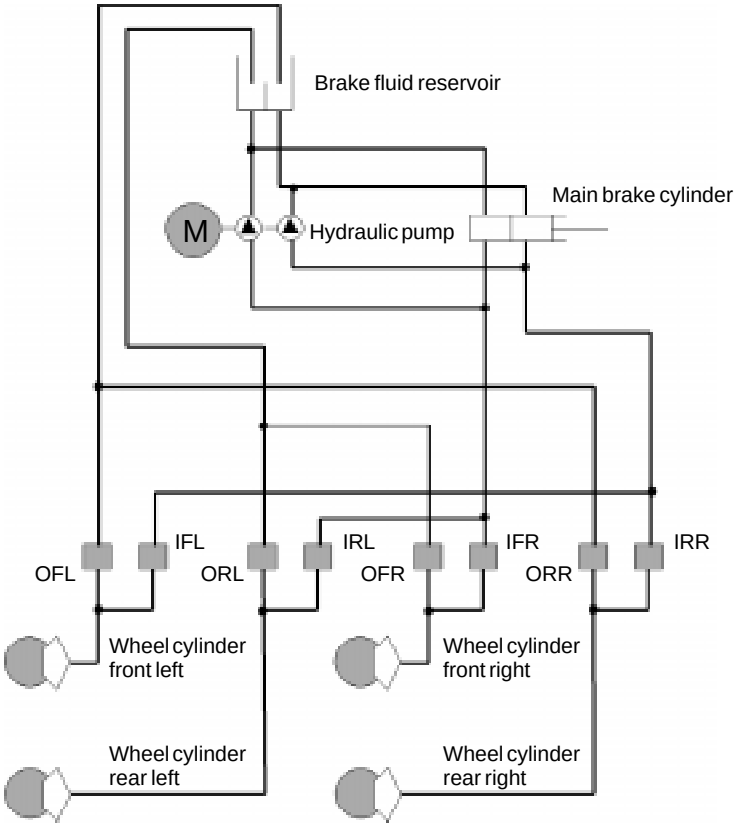
Wiring Diagram

Note: This is an example of a wiring diagram for a Teves MK IV. Check in the relevant workshop manual for the wiring diagram of the car you are working on.



Hydraulic Diagram

Note: This is an example of a hydraulic diagram for a Teves MK IV. Check in the relevant workshop manual for the hydraulic diagram of the car you are working on.



IFL-inlet valve	front left	OFL-outlet valve	front left
IFR-inlet valve	front right	OFR-outlet valve	front right
IRL-inlet valve	rear left	ORL-outlet valve	rear left
IRR-inlet valve	rear right	ORR-outlet valve	rear right
(IR-inlet valve rear)		(OR-outlet valve rear)	