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097 4-speed automatic

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Transmission, preliminary diagnosis

Do not attempt repairs to the 097 4-speed automatic transmission until the following preliminary diagnostic steps have been performed.

Remedy each condition found as a result of the procedures described below. After each condition is corrected, road test the vehicle again before continuing to the next numbered step:

1 - Test drive vehicle

- test drive to verify customer complaints (if possible let customer drive)

2 - Basic setting

- reset transmission basic setting
- road test vehicle

3 - Check for leaks

- check vehicle for visible leakage of ATF from transmission and cooler lines, or hypoid oil from differential

4 - Check ATF level

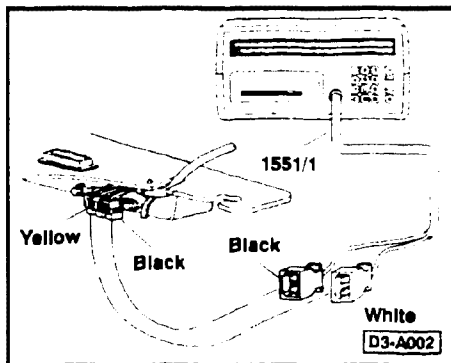
ATF must be at operating temperature (approx. 60°C or 140°F), and the ATF level at operating temperature must be within specifications. Connect **VAG 1551** Scan Tool to the yellow and black diagnosis terminals in the driver's footwell (see illustration).

The ATF temperature reading is accessed with diagnosis function **08**, group **05**, channel **01**, section D3-100. ATF temperature must be within stated range.

Note

ATF in the 097 transmission is reddish in color when new but soon discolors to a dark brown/black. A dark brown/black color is normal.

If repairs to the transmission are necessary, a complete printout of the **VAG 1551** On-Board Diagnostic (**OBD**) will be required. Switch the printer **ON** for all **OBD** functions performed and save the printout generated. The printout can then be attached to the repair order if necessary.



ATF contamination

If ATF is mixed with engine coolant or water it can have a milky appearance and be somewhat lighter in color. Causes for such fluid mixing can be due to leaks at the dipstick (water) or a malfunctioning transmission ATF cooler (high ATF level combined with low coolant level).

5 - Diagnostic Trouble Code (DTC) reading using VAG 1351

Refer to the sections which follow for complete instructions on recalling the Diagnostic Trouble Code (DTC) Memory with the **VAG 1551**.

- if malfunctions have been recorded, follow the directions in the **DTC** chart to locate the cause of the malfunction and make the necessary repairs

6 - Measuring value check with VAG 1551

- If no malfunctions are recorded or if the condition still exists after malfunctions have been corrected, use the **VAG 1551** Scan Tool (**ST**) to read measuring value block (**08**)

On-Board Diagnostic (OBD) of automatic transmission 097

Function

The Transmission Control Module (TCM) J 217 is equipped with a Diagnostic Trouble Code (DTC) Memory.

If malfunctions occur in the monitored sensors or components, these are stored in the **DTC** Memory with an indication of the type of malfunction.

Malfunctions which occur only occasionally are classified as "sporadic". Malfunctions occurring sporadically are identified as such. See Notes on malfunction recognition, which follow.

The control module for the automatic transmission distinguishes different malfunctions after analyzing the information (see **DTC** tables in section D3-60), and stores these until the contents of the **DTC** Memory are erased.

Electrical malfunctions which influence vehicle handling, can be diagnosed with the Scan Tool (ST) **VAG 1551**. Only the Scan Tool used in operating mode 1, "Rapid data transfer," can effectively access the vehicle's **OBD** capabilities.

Backup functions of Transmission Control Module (TCM)

If a critical failure relating to the transmission should occur during vehicle operation, the transmission will continue to operate, but only in the "limp home" i.e. backup mode. In the backup mode the transmission will automatically engage 3rd gear (**3GR**) hydraulically.

When the vehicle is re-started in the backup mode prior to malfunction elimination, the 2nd or 3rd (**3GR**) gear will be actuated hydraulically (with the gear selector in either the **D**, **3**, or **2** position).

If malfunctions that result in backup mode operation are eliminated, the transmission will remain in the backup mode until the ignition is switched **OFF**.

During backup mode operation, the **TCM** will not actuate the cruise control system.

Conditions that result in the backup mode:

- open or short circuits in wiring
- malfunctioning Transmission Control Module (TCM)
- malfunctioning solenoids

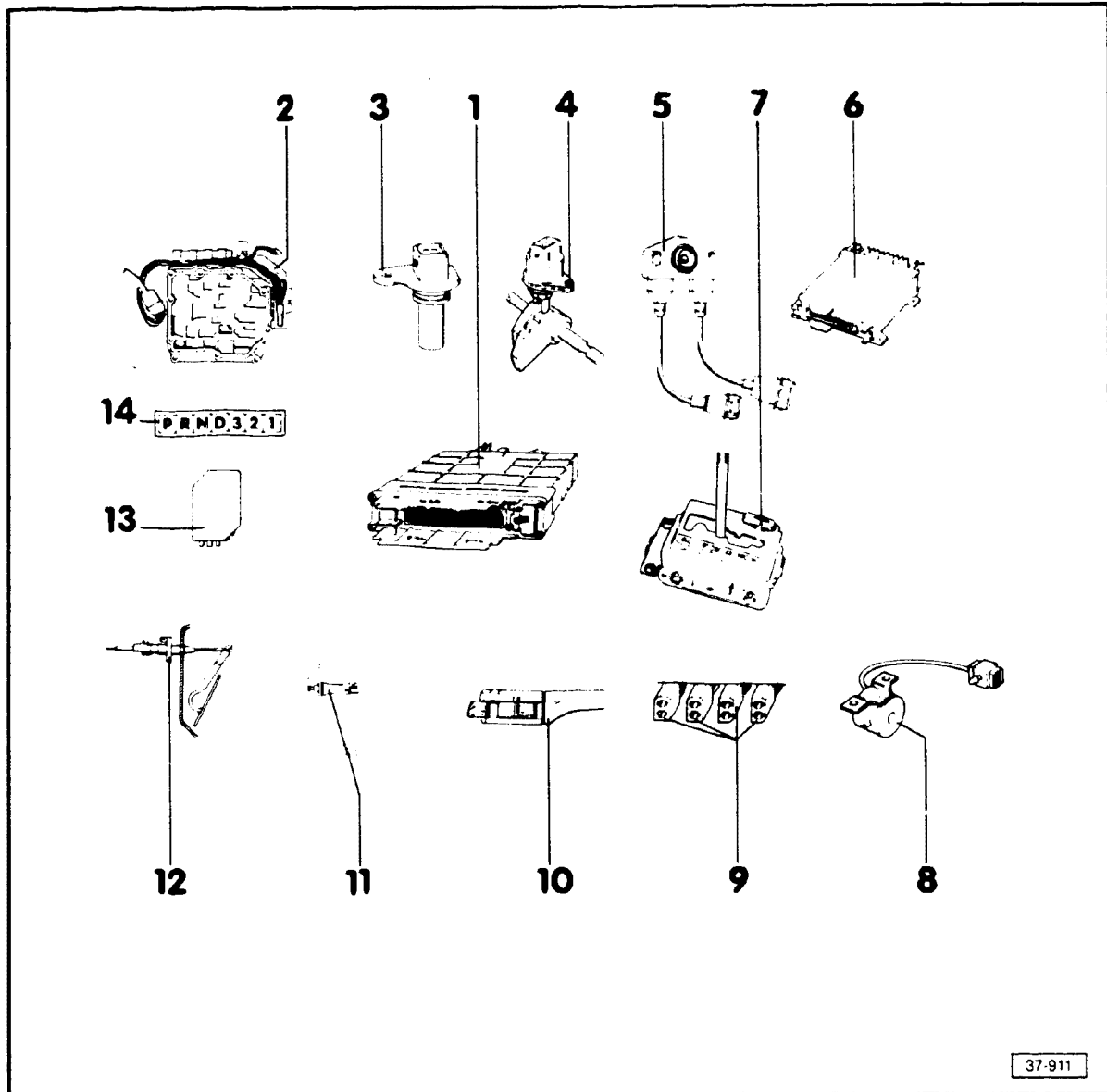
Notes on malfunction recognition:

- If a malfunction persists over a certain period of time, it is stored as a **static** malfunction. If the malfunction disappears for a certain time, it is then classified as "sporadic". If the malfunction no longer occurs during the next 20 engine starts, this sporadic malfunction is automatically erased.
- Sporadic malfunctions are indicated by "SP" on the right of the display of **VAG 1551** when interrogating the **DTC** Memory. "Sporadic fault" is also printed out on the log if the printer is switched **ON**.

Technical data of On-Board Diagnostic (OBD)

Memory • Permanent memory • Volatile memory	yes no
Data output • Rapid data transfer • Diagnostic Trouble Code (DTC) output	yes no
Output Diagnostic Test Mode (DTM)	no
Basic setting	yes
Coding control module	no
Reading measured value block	yes
Reading individual measured value	yes
Installed locations of components	Section D3-30

Electronic components, automatic transmission 097



CAUTION

If the Engine or Transmission Control Modules (ECM or TCM) are replaced, or if repairs are made to the Throttle Position (TP) sensor, the system must be returned to its basic setting — see section D3-80.

1 — Transmission Control Module (TCM) (J 217)

- location: left front floor above pedal bracket
- check using On-Board Diagnostic (OBD)

2 — Valve body

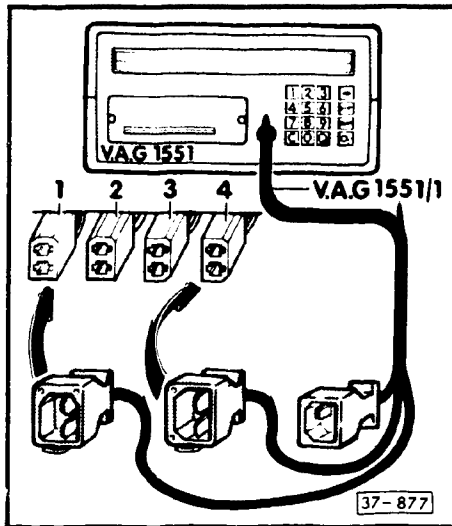
- location: under oil pan
- removing/installing, see Repair Group 38
- solenoids **N 88**, **N 89**, **N 90**, **N 91**, **N 92**, **N 93**, **N 94** and ATF temperature sender (**G 93**) are mounted on valve body
- solenoids are checked using On-Board Diagnostic (OBD)

- 3 — **Vehicle Speed Sensor (VSS) (G 68)**
 - location: on transmission housing
 - check using On-Board Diagnostic (OBD)
- 4 — **Multi-function switch (F 125)**
 - location: at rear of transmission case
 - check using On-Board Diagnostic (OBD)
- 5 — **Throttle Position (TP) sensor (G 69)**
 - location: on engine fuel distributor
 - removing/installing, see Repair Group 24
 - check using On-Board Diagnostic (OBD)
- 6 — **Engine Control Module (ECM)**
 - location: see engine repair group
- 7 — **Transmission Range (TR) program switch (E 122)**
 - location: on center console
 - check using On-Board Diagnostic (OBD)
- 8 — **Shiftlock solenoid (N 110)**
 - location: on selector lever mount
 - check using On-Board Diagnostic (OBD)
- 9 — **Data Link Connectors (DLC)**
 - location: front floor on driver's side
- 10 — **Cruise control switch (E 45)**
 - location: steering column
- 11 — **Brake light switch (F)**
 - location: on pedal cluster
 - check using On-Board Diagnostic (OBD)
- 12 — **Kickdown switch (F 8)**
 - location: integrated with accelerator cable in engine compartment
 - check using On-Board Diagnostic (OBD)
- 13 — **Relay for starter interlock and back-up light (J 226)**
 - location: relay panel (see wiring diagram)
- 14 — **Indicator for selector lever position (Y 5)**
 - location: in instrument cluster

VAG 1551 Scan Tool (ST), connecting

Requirements

- battery voltage **OK**
 - fuses **4, 12 and 21 OK**
 - Ground (**GND**) connections **OK**
 - selector lever in "P" position
 - parking brake on
- switch **OFF** ignition
 - connect diagnostic cable **VAG 1551/1** for Scan Tool **VAG 1551**:
 - black plug (voltage supply) on black Data Link Connector (**DLC**) **1** in vehicle
 - white plug on yellow **DLC 4**
 - blue plug not used
 - plug **3** is not available in some vehicles



VAG Self Diagnosis	HELP
1 Rapid data transfer	

VAG Self Diagnosis	HELP
Blink code output	

- **VAG 1551** displays will alternate as shown

and

Note

For additional operating instructions push the **HELP** key.

If no display appears, check the voltage supply to the Scan Tool.

The  key advances the program to the next display.

Reading Diagnostic Trouble Code (DTC) Memory using VAG 1551

After connecting the Scan Tool (ST), the following operating modes appear alternately:

1 Rapid data transfer

and

2 Blink code output

Note

Press the **PRINT** button for a complete printout of available diagnostic functions. See chart at end of this section.

- select operating mode 1, "Rapid data transfer"
- switch ignition **ON**
- read display:
- press keys **0** and **2** (this selects program **02** for "transmission electronics")
- read display:
- press **Q** key to enter input
- read display showing Transmission Control Module (TCM) identification:
- if display appears as shown:
- press **HELP** key to print out a list of possible malfunction causes (after eliminating cause, input **02** address word again)

Rapid data transfer	HELP
Insert address word XX	

Rapid data transfer	Q
02 transmission electronics	

095927731 R Digimat	0249
Code 127	WSC131071

Control unit does not respond! HELP	
-------------------------------------	--

Note

If "Control unit does not respond!" appears again:

- check for open circuits on Data Link Connectors (DLC) — see wiring diagram
- see **DTC** table under 5-digit code **65535** — control module malfunctioning
- press **➡** key

Rapid data transfer HELP
Select function XX

Rapid data transfer Q
02 Check fault memory

2 faults recognized!
(Example)

No fault recognized
(Example)

- read display:
- press 0 and 2 keys (to select program 02 for checking DTC Memory)

- read display
- press Q key to enter input
- read display showing number of malfunctions:

or

The stored malfunctions are displayed and printed out one after another.

- after last malfunction has been displayed, press  key
- eliminate malfunctions per DTC tables, section D3-60

List of possible diagnostic functions	Section
01 – Call up control module version	D3-50
02 – Read Diagnostic Trouble Code (DTC) Memory	D3-50
03 – Diagnose control module (currently unavailable)	–
04 – Initiate basic setting	D3-80
05 – Erase Diagnostic Trouble Code (DTC) Memory	D3-70
06 – End output	–
07 – Code control module (currently unavailable)	–
08 – Read measured value block	D3-90, D3-100
09 – Read individual measured values (not necessary if function 08 was previously selected)	D3-110

Diagnostic Trouble Code (DTC) charts

Listed below are all the possible transmission malfunctions that can be recognized by the Transmission Control Module (TCM) (J 217) and displayed by the Scan Tool **VAG 1551**.

If malfunctions occur only occasionally or if the **DTC Memory** was not canceled after elimination of the malfunction, those malfunctions will be displayed as sporadically occurring. Sporadic malfunctions are shown with an "SP/" at the right side of the display.

If malfunctioning components are found, also check the wiring to the components for short or open circuits using the wiring diagram.

On-Board Diagnostic (OBD) **D3**

VAG 1551 display	Possible causes	Repair
00000 4444 No fault recognized	If after a repair "no fault" appears, OBD has ended. If after repair transmission does not function properly, conduct repairs per repair manual.	
00258 1113 Solenoid valve 1 (N 88) open circuit short to ground	Open circuit or short circuit in wiring Solenoid valve 1 malfunctioning	Check wiring, connections and solenoid test step no. 6* Replace valve body
00260 1121 Solenoid valve 2 (N 89) open circuit short to ground	Open circuit or short circuit in wiring Solenoid valve 2 malfunctioning	Check wiring, connections and solenoid test step no. 7* Replace valve body
00262 1123 Solenoid valve 3 (N90) open circuit short to ground	Open circuit or short circuit in wiring Solenoid valve 3 malfunctioning	Check wiring, connections and solenoid test step no. 8* Replace valve body
00263 1124 Transmission	Mechanical/hydraulic malfunction Clutch or valve body malfunctioning	Read measured value block in whichever gear malfunction occurs Replace valve body or clutch
00264 1131 Solenoid valve 4 (N91) open circuit short to ground	Open circuit or short circuit in wiring Solenoid valve 4 malfunctioning	Check wiring, connections and solenoid test step no. 9* Replace valve body
00266 1133 Solenoid valve 5 (N 92) open circuit short to ground	Open circuit or short circuit in wiring Solenoid valve 5 malfunctioning	Check wiring, connections and solenoid test step no. 10* Replace valve body
00268 1141 Solenoid valve 6 (N 93) open circuit short to ground	Open circuit or short circuit in wiring Solenoid valve 6 malfunctioning	Check wiring, connections and solenoid Read individual measured value test step no. 11* Replace valve body

*See section D3-120, Electrical testing

On-Board Diagnostic (OBD) D3

VAG 1551 display	Possible causes	Repair
00270 1143 Solenoid valve 7 (N 94) open circuit short to ground	Open circuit or short circuit in wiring Solenoid valve 7 malfunctioning	Check wiring, connections and solenoid test step no. 12* Replace valve body
00281 1231 Vehicle speed sensor (G 68) No signal	Open circuit in wiring Vehicle Speed Sensor (VSS) malfunctioning	Check wiring, connections and speed sensor Read individual measured value test step no. 15* Replace Vehicle Speed Sensor
00293 1314 Multi-function switch (F 125)	Open circuit in wiring Multi-function switch malfunctioning	Check wiring and connections Read individual measured value test step no. 5* Replace multi-function switch
00296 1323 Kickdown switch (F 8)	Open circuit in wiring Throttle Position (TP) sensor malfunctioning Kickdown switch malfunctioning	Check wiring and connections Read measured value block test step no. 14* and check TP sensor test step no. 2* Replace accelerator cable
00299 1332 Trans-program switch (E 122) short circuit	Short circuit Transmission Range (TR) program switch malfunctioning	Check wiring and connections Read measured value block test step no. 16* Replace TR program switch
00300 1333 Trans oil temperature sender (G 93) No fault code recognized	Open circuit ATF temperature sender malfunctioning	Check wiring and connections Read individual measured value test step no. 17* Replace valve body
00518 2212 Throttle valve potentiometer (G 69) Signal outside tolerance	Open circuit or short circuit Throttle Position (TP) sensor malfunctioning	Check wiring and connections Read measured value block test step no. 2* Replace TP sensor

*See section D3-120, Electrical testing.

On-Board Diagnostic (OBD) **D3**

VAG 1551 display	Possible causes	Repair
00526 2131 Brake light switch (F) No fault identified	Open circuit Brake light switch malfunctioning	Check wiring and connections Read measured value block test step no. 4* Replace brake light switch
00529 2122 Engine speed signal missing	Open circuit	Check wiring and connections Check Engine Control Module (ECM)
00532 2234 Supply voltage	Battery malfunctioning Voltage for valves too low	Check battery voltage, replace if necessary Read individual measured value Check supply voltage to Transmission Control Module (TCM) (J 217) test step no. 1*
00545 2314 Engine/transmission electrical connection open circuit short to ground	Open circuit or short circuit in wiring No connection between Engine and Transmission Control Modules	Check wiring and connections Read measured value If necessary, replace Engine Control Module (ECM) Return system to basic setting — section D3-80
00596 Short between valve wires	Open circuit or short circuit in wiring	Check wiring and connections test steps no. 6* to 12* and test step 17*
01236 4314 Selector lever lock solenoid (N 110) open circuit short to ground	Open circuit or short circuit in wiring Interlock solenoid switch malfunctioning	Check wiring, connections and solenoid test steps no. 3* and 13* Replace shift interlock solenoid switch

*See section D3-120, Electrical testing.

On-Board Diagnostic (OBD) **D3**

VAG 1551 display	Possible causes	Repair
65535 1111 Control unit (J 217)	Electrical interferences from outside sources or poor Ground (GND) connection Transmission Control Module (TCM) malfunctioning	Check wiring and connections test step no. 1* Replace TCM if necessary Return system to basic setting — section D3-80

*See section D3-120, Electrical testing.

Note

Replace the Transmission Control Module (TCM) and return system to basic setting only after determining and eliminating all possible mechanical, electrical, and hydraulic malfunctions.

Erasing Diagnostic Trouble Code (DTC) Memory using VAG 1551

Requirements

- DTC Memory is recalled and malfunctions eliminated

Rapid data transfer HELP
Select function xx

Rapid data transfer HELP
05 Erase Fault memory

Important!
Fault memory was not interrogated

Rapid data transfer ➡
Fault memory is erased

- read display:
- press 0 and 5 keys (to select the program 05 for clearing the DTC Memory)

- read display:
- enter input with Q key

Note

If the following display appears, the ignition was switched **OFF** or the engine allowed to run between **DTC** Memory reading and erasing or the **DTC** Memory was not recalled initially. Follow the work sequence exactly, otherwise no erasure of the memory will take place.

- read display; DTC Memory is now erased

Note

Wait approximately one minute before reading the DTC Memory again.

After erasing the DTC Memory:

- test drive vehicle and read DTC Memory again
 - following must be displayed:

No fault recognized

- press ➡ key

On-Board Diagnostic (OBD) **D3**

Returning to basic setting, automatic transmission 097

Return system to basic setting after the following repairs:

- engine replacement
- throttle replacement or cable adjustment
- Throttle Position (TP) sensor replacement or adjustment
- Transmission Control Module (TCM) replacement

Rapid data transfer	HELP
Select function XX	

Rapid data transfer	Q
04 Start basic setting	

Start basic setting	HELP
Input display group number XX	

System in basic setting	➡
-------------------------	---

Rapid data transfer	HELP
Select function XX	

- with system in program **02** for transmission electronics, read display:
- press **0** and **4** keys (to select program **04** for "basic setting")
 - Accelerator Pedal (AP) must not be depressed at this point

- read display
- press **Q** key to enter input

- read display (appears with program card /2 only)
- press keys **0** and **0**
- press **Q** key to enter input

- read display
 - system is now returned to basic setting

- push Accelerator Pedal to kickdown position and hold for three seconds
- press ➡ key

- read display

Function 08, measuring value block, reading (early version)

After connecting the Scan Tool **VAG 1551** and selecting the "Transmission electronics" program (see sections D3-40 and D3-50), the measuring value block function can be read as follows:

Rapid data transfer **HELP**
Select function **XX**

- read display
- press keys **0** and **8** (to select function **08** for reading measuring value block)
- press **Q** key to enter input

Rapid data transfer **Q**
08 Read measuring value block

- read display
- press **Q** key

Read measuring value block **HELP**
Input display group number **XX**

- read display
- press **0** key two times
- press **Q** key to enter input

Read measuring value block
0 1 0 0 17 0 242 250 19 3

- read display (EXAMPLE)

Note

The ten value readouts shown correspond, in order, to the ten **channel** numbers in the chart that follows this page.

If the display shows only **four** channel readouts see section D3-100.

When printer is switched **ON**, current display can be printed out.

Only the measuring value block shown in this section or the one in section D3-100 will be displayed, depending on the Transmission Control Module (**TCM**) version.

- observe values shown on tester and compare with values in chart
- if specified values for **TP** sensor (display segment 2) are not attained, first return system to basic setting, see section D3-80
- if specified values appear in all channels press  key
 - problem has not been found using this test sequence

On-Board Diagnostic (OBD) D3

- if specified values are not observed, return system to basic setting (see section D3-80) and follow instructions in chart for further testing to locate source of problem

Channel number	Designation	Conditions	Indicated on VAG 1551 (specified value)	If specified value NOT obtained
1	Road speed	transmission in D	driven speed in km/h	Speedometer and VAG 1551 readings may deviate slightly
2	Accelerator Pedal (AP)	Closed Throttle Position (CTP)	0 to 2	Check position of throttle
		Wide Open Throttle (WOT)	253 to 255	Return system to basic setting Adjust Throttle Position (TP) sensor or accelerator cable — replace if necessary
3	Transmission Range (TR)	vehicle stationary, selector in position:	N, P	Check multi-function switch (F 125) Note test step 5*
			D, 3, 2, 1	
			R	
		in driving mode, selector in position:	1	
			2	
			3	
			D	
4	Selector lever	selector in position:	1	Check multi-function switch (F 125) Note test step 5*
			2	
			3	
			D	
			R	
			N, P	
5	Coding of solenoid valves	not used		
6	Shift mode	not used		

*See section D3-120, electrical test steps.

The readout "4" indicates Transmission Range (TR**) 3 mechanical, readout "5" indicates Transmission Range (**TR**) 4 mechanical

CAUTION

A second person is needed to read specified values when in driving mode.

On-Board Diagnostic (OBD) **D3**

Channel number	Designation	Conditions	Indicated on VAG 1551 (specified value)	If specified value NOT obtained
7	Digital inputs	selector lever in D	original value: min. 240 max. 254	
		vehicle stationary brake pedal actuated	+ 1 from original value	Note test step 4*
		kickdown	-32 from original value	Note test step 14*
		push "S" switch	-16 from original value	Note test step 16*
8	Solenoid valve 6 (N 93)	not used	—	—
9	Throttle Position (TP) sensor (G 69)	vehicle stationary Closed Throttle Position (CTP)	min. 8	when accelerating, numerical value increases consistently.
		Wide Open Throttle (WOT)	max. 240 Note 0 to 255 corresponds to a range of 0 to 5 volts.	If numerical value decreases replace TP sensor Note test step 2*
10	Engine Speed (RPM)	vehicle stationary with engine running	28 (at idle) Note 28 corresponds to 840 rpm (where 1 = 30 rpm)	If necessary, adjust per Repair Manual

*See section D3-120, electrical test steps.

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Function 08, measuring value block, reading (late version)

Rapid data transfer HELP
Select function XX

Rapid data transfer Q
08 Read measuring value block

Read measuring value block HELP
Input display group number XX

Read measuring value block 1
P 0.37V 0% 00000111

- after selecting program **02** for transmission electronics, read display
- press keys **0** and **8** (to select program **08** for reading measuring value block)

- read display
- press **Q** key to enter input

- read display

Note

The measuring value block can only be read with the tester program card /2 installed.

- press keys **0** and **1** (to select group number **01** and display values corresponding to group **01** in following chart)
- press **Q** key to enter input

- read display (EXAMPLE)
- repeat group number entry for remaining groups (**02** through **05**)
 - when printer is switched **ON**, current display can be printed out
- see specified values on following pages
- if specified values for **TP** sensor (display segment 2) are not attained, first return system to basic setting, see section D3-80.
- if specified values appear on all channels press  key
 - problem has not been found using this test sequence
- if specified values are not observed, return system to basic setting (see section D3-80) and follow instructions in chart for further testing

On-Board Diagnostic (OBD) **D3**

Measuring value block, overview

Group number	Channel number	Designation
01	1	Selector lever position
	2	Throttle Position (TP) sensor voltage
	3	Accelerator Pedal (AP)
	4	Switch positions
02	1	Actual current of solenoid valve 6, (N 93)
	2	Specified current of solenoid valve 6, (N 93)
	3	Battery voltage
	4	Voltage at Vehicle Speed Sensor (VSS) (G 68)
03	1	Vehicle speed
	2	Engine RPM
	3	Drive range
	4	Accelerator Pedal (AP) value
04	1	Shift valves
	2	Drive range
	3	Selector lever position
	4	Vehicle speed
05	1	ATF temperature
	2	Switch openings
	3	Drive range
	4	Engine Speed (RPM)

On-Board Diagnostic (OBD) **D3**

Group number	Channel number	Test requirements		VAG 1551 display (specified value)	If test results NOT within specifications
01	1 Selector lever position	vehicle stationary, selector lever in:	P	P	Check multi-function switch (F 125) Note test step 5*
			R	R	
			N	N	
			D	D	
			3	3	
			2	2	
			1	1	
	2 Throttle Position (TP) sensor (G 69) voltage	vehicle stationary	Closed Throttle Position (CTP)	min. 0.156 Volts max. 0.8 Volt	When accelerating from CTP to WOT, the voltage value must increase Note test step 2* Return system to basic setting, see section D3-80
			Wide Open Throttle (WOT)	min. 3.5 Volts max. 4.680 Volts	
	3 Accelerator Pedal (AP) value	vehicle stationary	Closed Throttle Position (CTP)	0 to 1%	Check Throttle Position (TP) sensor (G 69) see Repair Group 24
			Wide Open Throttle (WOT)	99 to 100%	
	4 Switch position	1 Brake	activated	1	Note test step 4*
			not activated	0	
		2 Limited-slip control	activated	1	
			not activated	0	
		3 Program switch	activated	1	Note test step 16*
			not activated	0	
		4 Kickdown switch	activated	1	Note test step 14*
			not activated	0	
		5 Selector lever	R, N, D, 3, 2	1	Check multi-function switch (F 125)
			P, 1	0	
		6 Selector lever	P, R, 2, 1	1	Note test step 5*
			N, D, 3	0	
		7 Selector lever	P, R, N, D	1	
			3, 2, 1	0	
		8 Selector lever	P, R, N	1	
			D, 3, 2, 1	0	

* See section D3-120, Electrical test steps.

On-Board Diagnostic (OBD) **D3**

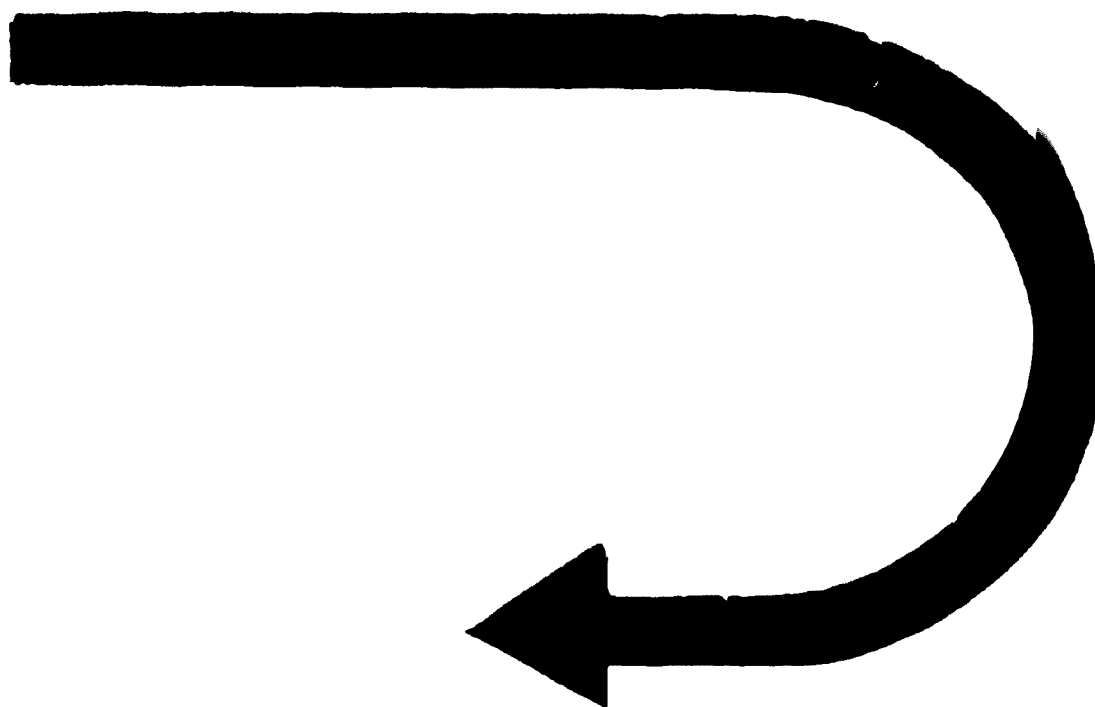
Group number	Channel number	Test requirements		VAG 1551 display (specified value)	If test results NOT within specifications
02	1 Solenoid valve 6 (N 93), actual current	vehicle stationary	Wide Open Throttle (WOT)	min. 0.0 Amps	Note test step 11*
			Closed Throttle Position (CTP)	max. 1.1 Amps	
	2 Solenoid valve 6 (N 93), specified current	vehicle stationary	Wide Open Throttle (WOT)	min. 0.0 Amps	
			Closed Throttle Position (CTP)	max. 1.1 Amps	
03	3 Battery voltage	vehicle stationary		min. 10.8 Volts max. 16.0 Volts	Check battery, replace if necessary
	4 Vehicle Speed Sensor (VSS) (G 68)	vehicle stationary		min. 2.20 Volts max. 2.52 Volts	Note test step 15*
	1 Speed	in driving mode**		driven speed in km/h	Speedometer and VAG 1551 readings may deviate slightly
	2 Engine Speed (RPM)	engine running		engine rpm	Adjust engine, see Repair Groups 24 or 25
	3 Gear engaged	in driving mode**	neutral	O	Check solenoid valves Note test steps 6 to 12*
			reverse	R	
			1 (hydraulic)	1	
			2 (hydraulic)	2	
			3 (hydraulic)	3H	
			3 (mechanical)	3M	
			4 (mechanical)	4	

*See section D3-120, Electrical test steps.

**CAUTION

In driving mode a second person is required to read displayed values.

CONTINUED IN THE
BEGINNING OF NEXT ROW



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Torque Converter 32 →

Group number	Channel number	Test requirements		VAG 1551 display (specified value)	If test results NOT within specifications
03 (Cont'd)	4 Accelerator Pedal (AP) value	in driving mode**	Closed Throttle Position (CTP)	0 to 1	Check Throttle Position (TP) sensor (G 69), see Repair Group 24 Check kickdown switch, see Repair Group 20 Return system to basic setting, see section D3-80
			Wide Open Throttle (WOT)	99 to 100	
04	1 Solenoid valves	in driving mode**	(N 88) switched	1	Individual solenoid valves will be switched depending on driving conditions Note test steps 6* to 10*, and 12*
			(N 88) not switched	0	
			(N 89) switched	1	
			(N 89) not switched	0	
			(N 90) switched	1	
			(N 90) not switched	0	
			(N 91) switched	1	
			(N 91) not switched	0	
	2 Gear engaged	in driving mode**	(N 92) switched	1	Check solenoid valves Note test steps 6* to 12*
			(N 92) not switched	0	
			(N 94) switched	1	
			(N 94) not switched	0	
			neutral	O	
			reverse	R	
			1 (hydraulic)	1	
			2 (hydraulic)	2	
			3 (hydraulic)	3H	
			3 (mechanical)	3M	
			4 (mechanical)	4	

*See section D3-120, Electrical test steps.

**CAUTION

In driving mode a second person is required to read displayed values.

Group number	Channel number	Test requirements	VAG 1551 display (specified value)	If test results NOT within specifications
04 (Cont'd)	3 Selector lever position	in driving mode**	P	Check multi-function switch (F 125) Note test step 5*
			R	
			N	
			3	
			2	
			1	
	4 Speed	in driving mode**	driven speed in km/h	Speedometer and VAG 1551 readings may deviate slightly
05	1 ATF temperature	vehicle stationary with engine running	°C (display becomes accurate at approximately 50°C)	Check ATF level at a temperature of 50° to 70°C Note test step 17*
	2 Shifting exits	in driving mode** Engine management		Check harness routing per wiring diagram Replace engine or transmission control modules (J 217)
			switched ON 1	
			switched OFF 0	
			switched ON 1	
			switched OFF 0	
	Shifting outlets	Solenoid for shiftlock (N 110)	switched ON 1	Check harness routing per wiring diagram Replace solenoid for shiftlock Note test step 3*
			switched OFF 0	
			switched ON 1	
			switched OFF 0	
		Cruise control	ON 1	Check cruise control wiring
			OFF 0	
		Air conditioning	switched OFF 1	Check harness routing per wiring diagram Check air conditioning per repair manual
			NOT switched OFF 0	
		Light in program switch	switched ON 1	Check harness routing per wiring diagram
			switched OFF 0	

*See section D3-120, Electrical test steps.

****CAUTION**

In driving mode a second person is required to read displayed values.

Group number	Channel number	Test requirements	VAG 1551 display (specified value)	If test results NOT within specifications
05 (Cont'd)	3 Gear engaged	neutral	O	Check solenoid valves.
		reverse	R	
		1 (hydraulic)	1	Note test steps 6 to 12*
		2 (hydraulic)	2	
		3 (hydraulic)	3H	If shifting does not occur, clutch or brake may be malfunctioning
		3 (mechanical)	3M	
		4 (mechanical)	4	Replace Transmission Control Module (TCM) (J 217)
	4 Engine Speed (RPM)	in driving mode**	Engine rpm	Adjust per engine repair group

*See section D3-120, Electrical test steps.

****CAUTION**

In driving mode a second person is required to read displayed values.

Function 09, individual measuring values, reading

After connecting the tester **VAG 1551** and selecting the "Transmission electronics" program (see sections D3-40 and D3-50) the individual measuring values can be read as follows:

Rapid data transfer **HELP**
Select function **XX**

- read display
- press keys **0** and **9** (to select function **09** for reading individual measuring values)

Rapid data transfer **Q**
09 Read individual measuring value

- read display
- press **Q** key to enter input

Read individual measuring value
Enter channel number **XX**

- read display
- press keys to input channel number of desired readout:

00 Test opening for solenoid valves (**N 88**), (**N 89**), (**N 90**)

01 Test opening for solenoid valves (**N 91**), (**N 92**), (**N 93**)

02 Voltage for Vehicle Speed Sensor (**VSS**) (**G 68**)

03 ATF temperature

04 Test opening for solenoid valve (**N 93**)

05 Battery voltage

06 (not used)

07 Voltage of Throttle Position (**TP**) sensor

Read individual measuring value
Channel **03** Measuring value **2**

- read display
- when printer is switched **ON**, current display can be printed out
- observe values shown on tester and compare with values in charts which follow, for each corresponding channel
- if specified values appear in all channels, press  key
- if specified values are not observed, follow instructions in chart for further testing (see section D3-120 for electrical test steps)

On-Board Diagnostic (OBD) **D3**

Note

When proceeding to the next channel during this check, it is necessary to select the **09** function again before selecting the channel number.

Channel number	Designation	Conditions	Indicated on VAG 1551 (specified value)	If specified value not obtained
00	Test opening for solenoid valves (N 88), (N 89), (N 90)	not used	—	—
01	Test opening for solenoid valves (N 91), (N 92), (N 94)	not used	—	—
02	Vehicle Speed Sensor (VSS) (G 68)	vehicle stationary	minimum 112 maximum 133	Note test step 15*
03	ATF temperature	vehicle stationary with engine running		The ATF temperature must be 50-70°C when checking the ATF level
		approximately 20°C	2	Note test step 17*
		approximately 60°C	12	
		approximately 80°C	24	
04	Solenoid valve 6 (N 93)	vehicle stationary	Wide Open Throttle (WOT) minimum 0 maximum 10	Note test step 11*
			Closed Throttle Position (CTP) minimum 220 maximum 240	
05	Battery voltage	vehicle stationary	maximum 16V	Check battery and replace if necessary
			minimum 10.8V	
06	Not used	—	—	—
07	Voltage of Throttle Position (TP) sensor (G 69)	vehicle stationary	Wide Open Throttle (WOT) maximum 240	Note test step 2*
			Closed Throttle Position (CTP) minimum 8	

*See section D3-120, Electrical test steps.

Electrical test steps for troubleshooting automatic transmission 097

Testing equipment

- **VAG 1598**, Test box
- **VAG 1598/9**, adaptor
- **VW 1594** adaptor wires
- **US 1119**, multi-meter

Testing

Perform only those recommended test steps from the Diagnostic Trouble Code (DTC) charts, section D3-60 (indicated *)

Requirements

- battery voltage **OK**
- fuses **4, 12, and 21 OK**
- Ground (**GND**) connection at left of relay plate **OK**
- **GND** cable connections at battery and transmission **OK**
- switch **OFF** ignition for all test steps
- disconnect multi-point connections from Transmission Control Module (**TCM**)
- connect test box **VAG 1598** and adaptor **VAG 1598/9** to the harness connector and **TCM (J 217)**:
 - voltage test** — connect adaptor **VAG 1598/9** to **TCM**
 - resistance test** — disconnect adaptor **VAG 1598/9** from **TCM**
- **TCM GND** connections **OK**

CAUTION

Switch to appropriate test area on multi-meter **before** connecting. When checking for infinity (∞) Ohms (Ω), switch multi-meter to highest measuring range.

Note

The sockets on the test box **VAG 1598** are identical with the pin designations on the **TCM (J 217)**.

If the test readings vary from the specifications shown, perform the malfunction elimination procedures on the right side of the chart. However, if the readings obtained differ only slightly from the specified values, first clean sockets and connectors of the testers and test leads and repeat test. Before

replacing the particular components, test wiring and connections and, particularly if specified values are below 10 Ohms, repeat the resistance measurement on the component.

Specified test values are verified for **US 1119** only and are not necessarily applicable to other testing equipment.

Specified test values are valid for ambient temperatures of 0° to 40°C (32° to 104°F).

38-point connector on Transmission Control Module (TCM), terminal identification

- 1 - Ground (**GND**) (terminal 31)
- 2 - Solenoid valve 4, (**N 91**)
- 3 - Solenoid valve 3, (**N 90**)
- 4 - not used
- 5 - Bulb for Transmission Range (**TR**) program switch, (**E 122**)
- 6 - K-wire of diagnosis
- 7 - limited slip control
- 8 - Kickdown for A/C
- 9 - Throttle Position (**TP**) sensor, (**G 69**) signal voltage
- 10 - Throttle Position (**TP**) sensor, (**G 69**) voltage supply, 5 volt
- 11 - not used
- 12 - Selector lever display (**Y 5**)
- 13 - Vehicle Speed Sensor (**VSS**), (**G 68**), shielding
- 14 - L-wire of diagnosis
- 15 - Multi-function switch, (**F 125**)
- 16 - Multi-function switch, (**F 125**)
- 17 - Kickdown switch, (**F 8**)
- 18 - Supply voltage for solenoid valve
- 19 - Supply voltage (terminal 15)
- 20 - Shift lock solenoid, (**N 110**)
- 21 - Solenoid valve 7, (**N 94**)
- 22 - Solenoid valve 1, (**N 88**)
- 23 - Solenoid valve 2, (**N 89**)
- 24 - Solenoid valve 5, (**N 92**)

- 25 - Solenoid valve **6**, (**N 93**)
- 26 - Brake light switch, (**F**)
- 27 - Diesel engine - Engine Speed (**RPM**) sensor
Gas engine - TDC signal
- 28 - Diesel engine - Engine Speed (**RPM**)
Gas engine - ignition timing adjustment
- 29 - Throttle Position (**TP**) sensor, (**G 69**), Ground (**GND**)
- 30 - ATF temperature
- 31 - not used
- 32 - Vehicle Speed Sensor (**VSS**), (**G 68**)
- 33 - Vehicle Speed Sensor (**VSS**), (**G 68**)
- 34 - Multi-function switch, (**F 125**)
- 35 - Multi-function switch, (**F 125**)
- 36 - Program switch, (**E 122**)
- 37 - Idle switch
- 38 - Cruise control

Voltage tests

Test step	VAG 1598 terminals	Component to be tested	•Test conditions and additional steps	Specified value or results	If test results NOT within specs
1	19 + 1	Transmission Control Module (TCM) (J 217) voltage supply	• switch ignition ON	Battery voltage (approx.)	Check wire from terminal 1 to Ground (GND) Check wire for continuity from terminal 19. to terminal 15 in relay panel
2	10 + 29	Throttle Position (TP) sensor (G 69)	• switch ignition ON • disconnect Throttle Position (TP) sensor	4.6 to 5 Volts	Replace TCM Return system to basic setting
	9 + 29		Closed Throttle Position (CTP) min. max. Wide Open Throttle (WOT) min. max.	0.156 Volts 0.8 Volts 3.5 Volts 4.68 Volts	When accelerating from CTP to WOT , voltage value increases consistently Calibrate TP sensor; replace if necessary (see engine section) Return system to basic setting
3	19 + 20	Solenoid switch (N 110) for shift interlock*	• switch ignition ON • selector lever in P or N	Battery voltage (approx.)	Replace TCM Return system to basic setting
			brakes applied	0 Volts	Check signal from brake light switch (F) — see test step no. 4. Replace TCM if necessary Return system to basic setting
4	26 + 1	Signal from brake light switch (F)	• switch ignition ON do NOT apply brakes	0 Volts	Check brake light switch and wiring per wiring diagram
			brakes applied	Battery voltage (approx.)	

*Only for VW vehicles.

Voltage tests/Resistance Tests

Test step	VAG 1598 terminals	Component to be tested	•Test conditions and additional steps	Specified value or results	If test results NOT within specs
5	34 + 1	Multi-function switch (F 125)	• switch ignition ON move selector lever to positions N, D, 2 and 3 move selector lever to position P and 1 move selector lever to position R	4.5 to 5 Volts	Check wire routing per wiring diagram Replace multi-function switch
				0 to 0.8 Volts	
				approx. battery voltage	
	15 + 1		move selector lever to position P, R, 2 and 1 move selector lever to position N, D and 3	4.5 to 5 Volts	
				0 to 0.8 Volts	
	35 + 1		move selector lever to position P, R, N and D move selector lever to position 3, 2, and 1	4.5 to 5 Volts	
				0 to 0.8 Volts	
	16 + 1		move selector lever to position P, R, and N move selector lever to position D, 3, 2, and 1	approx. battery voltage	
				0 to 0.8 Volts	
6	22 + 18	Solenoid valve 1 (N 88)	• switch ignition OFF Transmission Control Module (TCM) (J 217) disconnected	55-65 Ohms	Check harness per wiring diagram
	22 + 1			∞ Ohms	Replace valve body
7	23 + 18	Solenoid valve 2 (N 89)	• switch ignition OFF Transmission Control Module (TCM) (J 217) disconnected	55-65 Ohms	Check harness per wiring diagram
	23 + 1			∞ Ohms	Replace valve body

Resistance test

Test step	VAG 1598 terminals	Component to be tested	•Test conditions and additional steps	Specified value or results	If test results NOT within specs
8	3 + 18	Solenoid valve 3 (N 90)	• switch ignition OFF	55-65 Ohms	Check harness routing per wiring diagram
	3 + 1		TCM (J 217) disconnected*	∞ Ohms	Replace valve body
9	2 + 18	Solenoid valve 4 (N 91)	• switch ignition OFF	55-65 Ohms	Check harness routing per wiring diagram
	2 + 1		TCM (J 217) disconnected*	∞ Ohms	Replace valve body
10	24 + 18	Solenoid valve 5 (N 92)	• switch ignition OFF	55-65 Ohms	Check harness routing per wiring diagram
	24 + 1		TCM (J 217) disconnected*	∞ Ohms	Replace valve body
11	25 + 18	Solenoid valve 6 (N 93)	• switch ignition OFF	4.5-6.5 Ohms	Check harness routing per wiring diagram
	25 + 1		TCM (J 217) disconnected*	∞ Ohms	Replace valve body
12	21 + 18	Solenoid valve 7 (N 94)	• switch ignition OFF	55-65 Ohms	Check harness routing per wiring diagram
	21 + 1		TCM (J 217) disconnected	∞ Ohms	Replace valve body
13	19 + 20	Solenoid switch (N 110) for shift interlock*	• switch ignition OFF TCM (J 217) disconnected	14-25 Ohms	Check harness routing per wiring diagram Replace magnet for shift interlock
14	1 + 17	Kickdown switch (F 8)	• switch ignition OFF • TCM (J 217) disconnected do NOT press Accelerator Pedal (AP) depress AP fully	∞ Ohms	Check harness routing per wiring diagram Adjust or replace accelerator cable
				less than 1.5 Ohms	

*Only for VW vehicles.

Resistance test

Test step	VAG 1598 terminals	Component to be tested	•Test conditions and additional steps	Specified value or results	If test results NOT within specs
15	32 + 33	Vehicle Speed Sensor (VSS) (G 68)	• switch ignition OFF • TCM (J 217) disconnected	800 to 830 Ohms	Check harness routing per wiring diagram Replace VSS
16	36 + 1	Transmission Range (TR) program switch (E 122)	• switch ignition OFF • TCM (J 217) disconnected - TR program switch not activated - TR program switch activated	∞ Ohms less than 1.5 Ohms	Check harness routing per wiring diagram Replace TR program switch
17	30 + 18	ATF temperature sensor (G 93)	• switch ignition OFF • TCM (J 217) disconnected - ATF temperature (approx.) 20°C (68°F) - ATF temperature 60°C (140°F) - ATF temperature 120°C (216°F)	0.247 Meg Ohm approx. 48.8 kOhm approx. 7.4 kOhm	Check harness routing per wiring diagram Replace ATF temperature sensor