Test table

Display group 001

Display zones Explanations

1 ... rpm NoteNote Engine speed (from the TD signal -pin 19- directly from the engine control unit). A second mechanic is required to read the values whilst driving \rightarrow Chapter

"Safety precautions"

• Minimum value = 90 rpm

If the ignition is switched on (engine off) a value of 90 rpm is displayed. This is not a faultIf no value is displayed:

Interrogate engine control unit fault memory

2 ... rpm Gearbox speed (from gearbox speed sender -G38-). A second mechanic is required to read the values whilst driving \rightarrow Chapter

"Safety precautions"

• Minimum value = 60 rpm

If the ignition is switched on (engine off) or vehicle is stationary with engine running, a value of 60 rpm is displayed. This is not a faultIf no value is displayed:

Check sender, to do this perform electrical test \rightarrow Chapter

3 ... %

4

- Accelerator pedal position (CAN bus signal from engine control unit)
- Specified value if accelerator pedal is not pressed: Less than 4%

• Specified value if accelerator pedal is fully pressed: greater than 96% When accelerating from idling to full throttle the % value is continually increasedIf the values are not reached:

Interrogate engine control unit fault memory if necessary

If the value remains at 0 % when accelerating, but after releasing the accelerator pedal and pressing again it increases in steps (e.g. 30, 60, 90 ...), this points to a faulty brake light switch -F-:

Check brake light switch -F- in measured value block 004, display zone 2 \rightarrow Anchor

Gear engaged in gearbox whilst driving. A second mechanic is required to read the values \rightarrow <u>Chapter</u>

"Safety precautions"

1st GEAR 5th GEAR	 1st GEAR 5th GEAR = display changes with a change in gear
R-GEAR	 R-GEAR = reverse gear is engaged
LG 1-2	 LG 1-2 = idling gate 1-2 gear (in gearbox)
LG 3-4	 LG 3-4 = idling gate 3-4 gear (in gearbox)
SYNC	 SYNC = during synchronisation phase
FAULT	 FAULT = invalid position If readings do not match specifications or with the display "FAULT":

Check potentiometer 1 for gear recognition -G239-, potentiometer 2 for gear recognition -G240-

and potentiometer for selector lever, forwards/backwards -G272- in measured value block 015 $\underline{\rightarrow}$ Anchor and 016 $\underline{\rightarrow}$ Anchor

Check non-positive connection of clutch: To check, the vehicle must not be in ECO mode while driving. This is the only way to ensure that the clutch is engaged at the end of a gear shift. Engine and gearbox speed must not then differ by more than 120 rpm from one other while driving. If the difference is greater than this, the clutch is slipping and will have to be replaced. The vehicle is always in ECO mode after the engine is started (green warning lamp in dash panel insert lights up). If ECO mode has to be switched off for a test, press the switch for Start/Stop mode -E262- in the centre console, the green warning lamp in the dash panel insert goes out.

Display group 002

Display Explanations

zones

- 1 ... V Load signal (CAN bus signal from engine control unit)
 - Specified value when idling: approx. 0.00 V
 - Specified value for full throttle: approx. 5.00 V
- 2 ... V Signal from clutch travel sender -G162-

Switch on ignition, selector lever in "STOP" or do not press brake pedal and selector lever in "R", "N", "D" or tiptronic gate (condition for engaged clutch):

• Specified value for engaged clutch: 1.85 ... 1.95 V

Switch on ignition, press brake pedal and selector lever in "R", "N", "D" or tiptronic gate (condition for disengaged clutch):

• Specified value for disengaged clutch: 3.7 ... 4.1 V

• The difference between the two values for engaged and disengaged clutch must be greater than 2 V If reading does not match specification:

Perform basic setting \rightarrow Chapter

3 ... V Voltage of terminal 15

• A minimum voltage of 11.3 V is required to perform the final control diagnosis of the hydraulic control unit and the final control diagnosis of the gear actuator in the "Guided fault-finding"

• A minimum voltage of 12.4 V is required to perform the basic setting

If reading does not match specification:

Check battery, renew if necessary

Check supply voltage of electronic manual gearbox control unit -J514- , to do this perform electrical test $\underline{\rightarrow}$ Chapter

- 4 ... °C Coolant temperature (CAN bus signal from engine control unit)
 - Measured value may differ from measured value of engine control unit by up to 5 °C

Display group 003

Display	Explanations

zones

- 1 ... rpm Engine speed \rightarrow Anchor, measured value block 001, display zone 1
- $2 \ \dots \text{rpm} \qquad \text{Gearbox speed} \xrightarrow{} \text{Anchor}, \text{ measured value block 001, display zone 2}$
- 3 … % Actual clutch position. The voltage values from the clutch travel sender -G162- (→ Anchor, measured value block 002, display zone 2) are converted in the control unit and output as %-values

Switch on ignition, selector lever in "STOP" or do not press brake pedal and selector lever in "R", "N", "D" or tiptronic gate (condition for engaged clutch):

Specified value for engaged clutch: 0 ... 1 %

Switch on ignition, press brake pedal and selector lever in "R", "N", "D" or tiptronic gate (condition for disengaged clutch):

- Specified value for disengaged clutch: 99 ... 100 %
- 4 0 ... 100 Specified clutch position % Note

Switch on ignition and do not press brake pedal (condition for engaged clutch):

• Specified value for engaged clutch: 0 %

Switch on ignition and do not press brake pedal (condition for disengaged clutch):

• Specified value for disengaged clutch: 99 ... 100 %

In all clutch control procedures, values must not differ from each other by more than 5 % for longer than 1 second. With greater deviations: Perform basic setting \rightarrow Chapter and check clutch travel sender -G162-, to do this perform electrical test \rightarrow Chapter.

Display group 004

Display zones Explanations

- 1 XXXXXXXX Input information 1, 8-digit display (e.g. 00101101), description \rightarrow Anchor
- 2 XXXXXXXX Input information 2, 8-digit display (e.g. 00010010), description \rightarrow Anchor
- 3 XXXXXXXX Output information 1, 8-digit display (e.g. 01111110), description \rightarrow Anchor
- 4 XXXXXXXX Output information 2, 8-digit display (e.g. 11111101), description → Anchor

Input information 1 in display zone 1 of display group 004

Display zone 1					1			Explanations
1	2	3	4	5	6	7	8	
0								Display is always "0"
	0							Display is always "0"
		Х						 "0" = driver's door open "1" = driver's door closed With deviations:
								Interrogate convenience system fault memory
								Check wiring between electronic manual gearbox control unit -J514- (pin 16) and central control unit for convenience system -J393-
			1					Display is always "1"
				х				• "0" = no starting procedure
								• "1" = start prompt by ignition lock
					Х			 "0" = selector lever in "STOP", "R", "N" or "D"
								 "1" = selector lever into tiptronic gate With deviations:
								Check selector lever position in measured value block 005, display zone 3 \rightarrow Anchor
						х		 "0" = gearbox hydraulic pump relay -J510- actuated by sender for gearbox hydraulic pressure -G270-, hydraulic pump running (audible) "1" = gearbox hydraulic pump relay -J510- not actuated by sender for gearbox hydraulic
								pressure -G270-, hydraulic pump not running
							Х	 "0" = switch for Start/Stop mode -E262- in the centre console pressed and held "1" = switch for Start/Stop mode -E262- not pressed

Input information 2 in display zone 2 of display group 004

Display zone 2					2			Explanations
1	2	3	4	5	6	7	8	
0								Ignore
	0							Ignore
		0						Ignore
			1					Ignore
				0				Ignore
					0			 "0" = reverse gear not engaged "1" = reverse gear engaged In selector lever position "STOP" the reverse gear may also be indicated as engaged if this was the last gear engaged. With deviations:
								Check selector lever position in measured value block 005, display zone 3 \rightarrow Anchor
						1		 "1" = voltage from terminal 30 is applied This display must always be "1". With deviations:
								Check voltage supply in measured value block 020, display zone 2 \rightarrow Anchor
							х	 "0" = brake pedal not operated "1" = brake pedal operated Signal is required for starting the engine Note. With deviations:
								Interrogate engine control unit fault memory, if necessary check brake light switch -F- /brake pedal switch -F47-

The signal of the brake light switch -F- /brake pedal switch -F47- is depicted here (CAN bus signal from engine control unit). For the Start/Stop mode function, however, the signal of the brake pressure switch -F270- is required; this can be checked in the electrical test \rightarrow Chapter.

Output information 1 in display zone 3 of display group 004

Display zone 3					Explanations			
1	2	3	4	5	6	7	8	
0								Ignore
	0							Ignore
		0						Ignore
			0					 "0" = engine is shut off in ECO mode Note, e.g. when stopping at traffic lights "1" = ECO mode is switched off or engine is not shut off in ECO mode (running) In ECO mode, the switching from "0" to "1" and vice versa takes place in some cases very slowly and is displayed by the tester after a long time delay when shutting off and starting the engine
				Х				Ignore
					х			 "0" = gearbox hydraulic pump relay -J510- is actuated "1" = gearbox hydraulic pump relay -J510- is not actuated Display must respond in the same way as for the 7th item in display zone 1 (in some cases with a slight time delay)
						Х		 "0" = starter inhibitor and reversing light relay -J226- is actuated Note "1" = starter inhibitor and reversing light relay -J226- is not actuated Display must be "0" when starting normally with the ignition key and when starting in ECO mode Note by releasing the brake pedal
							0	Ignore
The	e ve	ehio	cle	is a	alwa	avs	in	ECO mode after the engine is started (green warning lamp in dash panel insert lights up). If

The vehicle is always in ECO mode after the engine is started (green warning lamp in dash panel insert lights up). If ECO mode has to be switched off for a test, press the switch for Start/Stop mode -E262- in the centre console, the green warning lamp in the dash panel insert goes out. Terminal 30 is switched through via the relay downstream of terminal 50, this supplies power to the starter which must start the engine.

Output information 2 in display zone 4 of display group 004

Display zone 4	Explanations
X	Switching status of gear selector valve 3 -N286 This display must always be the same as the display at item 5 $$
	Operate the selector lever when the vehicle is stationary with the ignition on and brake pedal pressed.
	Selector lever in tiptronic and 3rd or 4th / 5th gear Note selected:
	• "0" = gear selector valve 3 -N286- is on (energised)
	Selector lever in "R" or selector lever in tiptronic and 1st / 2nd gear Note selected:
	 "1" = gear selector valve 3 -N286- is off (disconnected from voltage) With deviations:
	Perform electrical test \rightarrow Chapter
0 0 0 X X	Ignore Ignore Ignore This display must always be the same as the display at item 1 Switching status of gear selector valve 4 -N287 This display must always be the same as
	the display at item 8
	pressed.
	Selector lever in "R"; selector lever in tiptronic and 3rd / 4th gear Note selected:
	• "0" = gear selector valve 4 -N287- is on (energised)
	Selector lever in tiptronic and 1st or 2nd / 5th gear Note selected:
	 "1" = gear selector valve 4 -N287- is off (disconnected from voltage) With deviations:
	Perform electrical test \rightarrow Chapter
1 X The display in the dash	Ignore This display must always be the same as the display at item 6 panel insert indicates the gear currently engaged.

Display group 005

Display zones		Explanations		
1	rpm	Engine speed \rightarrow Anchor, measured value block 001, display zone 1		
2	V	Voltage of terminal 15 \rightarrow Anchor, measured value block 002, display zone 3		
3		Selector lever position		
	A-STOP	 A-STOP = automatic operation gate Stop position 		
	A-R	 A-R = automatic operation gate R position 		

A-N A-E T-0 T-MI T-PL ???	 A-N = automatic operation gate N position A-E = automatic operation gate D position (is identical to E position) T-0 = tiptronic gate Middle position T-MI = tiptronic gate Minus position T-PL = tiptronic gate Plus position ??? = fault, invalid position With deviations and with display "???": Check values in measured value block 022 → Anchor
	Perform basic setting \rightarrow Chapter
4 A	Valve for clutch actuator -N255- (in small tolerance range a changing, "jumping" display is not a fault)
	Switch on ignition and do not press brake pedal (condition for engaged clutch):
	• Specified value for engaged clutch: 0.030 0.730 A
	Switch on ignition and do not press brake pedal (condition for disengaged clutch):
	 Specified value for disengaged clutch: 0.800 … 0.900 A With deviations:
	Check valve for clutch actuator -N255- , to do this perform electrical test $ ightarrow$ Chapter

Display group 007

Display zones	Explanations
1 rpm	Engine speed <u>\rightarrow Anchor</u> , measured value block 001, display zone 1
2 rpm	Gearbox speed \rightarrow Anchor, measured value block 001, display zone 2
3 rpm	 Calculated gearbox speed calculated from vehicle speed and engaged gear Minimum value = 60 rpm If the ignition is switched on (engine off) or vehicle is stationary with engine running, a value of 60 rpm is displayed. This is not a fault.
4 km/h	 Vehicle speed signal from dash panel insert Minimum value = 3 km/h Can be up to 7 km/h below the display on the speedometer in the dash panel insert. If the ignition is switched on (engine off) or vehicle is stationary with engine running, a value of 3 km/h is displayed. This is not a faultWith deviations:
	Interrogate dash-panel insert fault memory
	Check speedometer and wiring according to current flow diagram

Display group 008

Display zones Explanations

1	%	Actual clutch position \rightarrow Anchor, measured value block 003, display zone 3
2		Gear engaged in gearbox \rightarrow Anchor, measured value block 001, display zone 4
3	rpm	Engine speed \rightarrow Anchor, measured value block 001, display zone 1
4	rpm	Gearbox speed \rightarrow Anchor, measured value block 001, display zone 2

Display group 013

Display zones Explanations

1	V	Voltage of terminal 15 \rightarrow Anchor, measured value block 002, display zone 3
2	A	Valve for clutch actuator -N255- \rightarrow Anchor, measured value block 005, display zone 4
3	%	Actual clutch position \rightarrow Anchor, measured value block 003, display zone 3
4	%	Specified clutch position \rightarrow Anchor, measured value block 003, display zone 4

Display group 015

Display Explanations zones

1 ... V Specified voltage of potentiometer for selector lever, forwards/backwards -G272-

Selector lever in "STOP":

• Specified value: approx. 4.10 V

Selector lever in "R":

• Specified value: approx. 3.14 V

Selector lever in "N":

• Specified value: approx. 2.75 V

Selector lever to tiptronic "+":

• Specified value: approx. 2.50 V

Selector lever in "D":

• Specified value: approx. 2.20 V

Selector lever to tiptronic "–":

• Specified value: approx. 1.70 V

Deviations of up to 0.4 V are possible. It is not the absolute voltage value that is decisive, but rather the fact that in "STOP" the highest and in tiptronic "–" the lowest voltage is displayed. With deviations:

Check values in measured value block 022 $\underline{\rightarrow}$ Anchor

Perform basic setting \rightarrow Chapter

Perform electrical test \rightarrow Chapter

- 2 ... V Not used
- 3 ... V Actual voltage of the potentiometer 1 for gear recognition -G239- by shifting the selector lever Note when the vehicle is stationary with ignition on

Selector lever in "R" or selector lever in tiptronic and 1st / 3rd or 5th gear selected:

• Specified value: 3.8 ± 0.4 V

Selector lever in tiptronic and 2nd / 4th gear selected:

• Specified value: 1.6 ± 0.4 V With deviations:

Check values in measured value block 022 \rightarrow Anchor

Perform basic setting \rightarrow Chapter

4 ... V Actual voltage of the potentiometer 2 for gear recognition -G240- (gate recognition) by shifting the selector lever Note when the vehicle is stationary with ignition on

Selector lever in "R":

• Specified value: 3.8 ± 0.4 V

Selector lever in tiptronic and 1st / 2nd gear selected:

• Specified value: 3.0 ± 0.4 V

Selector lever in tiptronic and 3rd / 4th gear selected:

• Specified value: 2.0 ± 0.4 V

Selector lever in tiptronic and 5th gear selected:

• Specified value: 1.2 ± 0.4 V With deviations:

Check values in measured value block 022 $\underline{\rightarrow}$ Anchor

Perform basic setting \rightarrow Chapter

The display in the dash panel insert indicates the gear currently engaged.

Note

The voltage must remain constant whilst driving with every gear engaged (not while shifting). If the voltage value changes (increase or decrease), at the same time check the voltage value of the sender for gearbox hydraulic pressure -G270- in measured value block 020 → Anchor. If the voltage value there drops continuously, check the system for leaks (oil loss), if necessary seal the system.

Display group 016

```
Display Explanations zones
```

1 ... % Specified position of potentiometer for selector lever, forwards/backwards -G272- , converted into %

Selector lever in "STOP":

• Specified value: approx. 100 %

Selector lever in "R":

Specified value: approx. 77 %

Selector lever in "N":

• Specified value: approx. 55 %

Selector lever to tiptronic "+":

• Specified value: approx. 39 %

Selector lever in "D":

• Specified value: approx. 19 %

Selector lever to tiptronic "-":

• Specified value: approx. 0 % Deviations of up to 10 % are possible. It is not the absolute percentage value that is decisive, but rather the fact that in "STOP" the highest and in tiptronic "–" the lowest percentage value is displayed. With deviations:

Check values in measured value block 022 \rightarrow Anchor

Perform basic setting \rightarrow Chapter

2 Not used

3 ... % Actual position of potentiometer 1 for gear recognition -G239- , converted into % Note

Selector lever in "R" or selector lever in tiptronic and 1st / 3rd or 5th gear selected:

• Specified value: 0 ... 10 %

Selector lever in tiptronic and 2nd / 4th gear selected:

• Specified value: 90 ... 100 % With deviations:

Check values in measured value block 022 $\underline{\rightarrow}$ Anchor

Perform basic setting \rightarrow Chapter

4 ... % Actual position of potentiometer 2 for gear recognition -G240- , converted into % Note

Selector lever in "R":

• Specified value: 90 ... 100 %

Selector lever in tiptronic and 1st / 2nd gear selected:

• Specified value: 60 ... 65 %

Selector lever in tiptronic and 3rd / 4th gear selected:

• Specified value: 30 ... 35 %

Selector lever in tiptronic and 5th gear selected:

• Specified value: 0 ... 10 %

With deviations:

Check values in measured value block 022 $\underline{\rightarrow}$ Anchor

Perform basic setting \rightarrow Chapter

The display in the dash panel insert indicates the gear currently engaged.

Display group 017

Display zones Explanations

1	V	Voltage of terminal 15 \rightarrow Anchor, measured value block 002, display zone 3
2	A	Valve for clutch actuator -N255- \rightarrow Anchor, measured value block 005, display zone 4
3	A	Current through gear selector valve 1 -N284- • Specified value: 0.000 2.500 A The value of the current varies depending on the switching status of the valve (regulating valve)
4	A	Current through gear selector valve 2 -N285- • Specified value: 0.000 2.500 A The value of the current varies depending on the switching status of the valve (regulating valve)

Display group 018

Display zones		Explanations	
1		Gear engaged in gearbox \rightarrow Anchor, measured value block 001, display zone 4	
2		Not used	
3	V	Actual voltage of potentiometer 1 for gear recognition -G239- \rightarrow Anchor, measured value block 015, display zone 3	
4	V	Actual voltage of potentiometer 2 for gear recognition -G240- \rightarrow Anchor, measured value block 015, display zone 4	

Display group 019

D zo	isplay ones	Explanations
1		Gear to be engaged (specified gear)
	0	• 0 = idling gate
	1 5	 1 = 1. gear, 2 = 2nd gear, 3 = 3rd gear, 4 = 4th gear, 5 = 5th gear
	6	• 6 = reverse gear
	251	• 251 = idling gate 1-2
	252	 252 = idling gate reverse gear
	253	 253 = idling gate 5th gear
	254	• 254 = idling gate 3-4
	255	 255 = transition between two positions
		At the latest after 1 second, these displays must be the same as the display in display zone 2. With deviations:
		Check values in measured value block 022 \rightarrow Anchor
2		Engaged gear (actual gear)At the latest after 1 second, these displays must be the same as the display in display zone 1. With deviations:

Check values in measured value block 022 $\underline{\longrightarrow}$ Anchor

3 ... % Accelerator pedal position \rightarrow Anchor, measured value block 001, display zone 3

Display group 020

Display Explanations

zones

4

- 1 ... V Voltage of terminal $15 \rightarrow$ Anchor, measured value block 002, display zone 3
- 2 ... V Voltage of terminal 30
 - A minimum voltage of 11.3 V is required to perform the final control diagnosis of the hydraulic control unit and the final control diagnosis of the gear actuator in the "Guided fault-finding"
 - A minimum voltage of 12.4 V is required to perform the basic setting

If reading does not match specification:

Check battery, renew if necessary

Check supply voltage of electronic manual gearbox control unit -J514- , to do this perform electrical test \rightarrow <u>Chapter</u>

- 3 ... V Supply voltage of gearbox sensors (internal)
 - Specified value: approx. 5 V
 - ... V Voltage of sender for gearbox hydraulic pressure -G270-
 - Specified value with ignition on (engine off): 2.7 ... 3.2 V
 - Specified value with engine running: 2.9 \ldots 4.4 V

The specified values may be checked by alternately pressing and releasing the brake pedal or moving the selector lever repeatedly between "STOP" and "N": The voltage value drops. On reaching the lower specified value, the hydraulic pump starts to operate. If the brake pedal is now no longer pressed, the voltage increases until it reaches the upper specified value. 4 V corresponds to approx. 48 bar in the pressure system, 3 V corresponds to approx. 36 bar.With deviations:

Perform final control diagnosis of the hydraulic control unit in the "Guided fault finding" \rightarrow Chapter

Display group 021

Display zones		Explanations
1	°C	Slope°C here does not mean the temperature, but the upward or downward slope in per cent (%). This is a calculated value within the control unit
2	%	Hill factor (calculated value within the control unit)
3	%	Sport factor (calculated value within the control unit)
4	0/	Accelerator padal position Anabor measured value black 001 display zapa 2

4 ... % Accelerator pedal position \rightarrow Anchor, measured value block 001, display zone 3

Display group 022

Display zones		Explanations
1		Selector lever position \rightarrow Anchor, measured value block 005, display zone 3
2	V	Specified voltage of potentiometer for selector lever, forwards/backwards -G272- \rightarrow Anchor, measured value block 015, display zone 1
3	%	Specified position of potentiometer for selector lever, forwards/backwards -G272- , converted into % \rightarrow Anchor, measured value block 016, display zone 1
4		Ignore

Display group 025

Display Explanations

zones

4

- 1 ... % Creep point NoteThe creep point is the torque at which the vehicle starts to move or tries to move (handbrake applied)
 - Specified value range: 55 ... 65 %
 - The creep point value must be less than or equal to the slip point in display zone 2 With deviations:

Perform basic setting \rightarrow Chapter

- 2 ... % Slip point NoteThe slip point is the torque at which the clutch begins to slip.
 - Specified value range: approx. 55 ... 85 %
 - The slip point value must be greater than or equal to the creep point in display zone 1 With deviations:

Perform basic setting \rightarrow Chapter

3 ... Number of remaining creep point adaptations
 Specified value: 0
 The programming (adapting) of the creep point is performed at the end of the basic setting. It must be repeated until the value is at "0".With deviations:

Perform basic setting \rightarrow Chapter

- ... Engine torque (filtered, effective torque)
 - Specified value: 0 ... 255

The creep point and the slip point are acquired and adjusted in the basic setting. Whilst driving, these two points are continuously re-acquired and improved. At 0 %, the clutch is fully engaged, at 100 % it is disengaged.