## Test table

## Display group 001

## Display zones

1 ... rpm NoteNote

Explanations
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 $=90 \mathrm{rpm}$

If the ignition is switched on (engine off) a value of 90 rpm is displayed. This is not a faultlf 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 NoteNote values whilst driving $\rightarrow$ Chapter

## "Safety precautions"

- Minimum value $=60 \mathrm{rpm}$

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 faultlf no value is displayed:

Check sender, to do this perform electrical test $\rightarrow$ Chapter
$3 \ldots \% \quad$ 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 increasedlf 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, $90 \ldots$ ), 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 $\longrightarrow$ Chapter

## "Safety precautions"

1st
GEAR ... 5th
GEAR
R-GEAR
LG 1-2

- R-GEAR = reverse gear is engaged
- 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 $015 \rightarrow$ Anchor and $016 \rightarrow$ 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: $3.7 \ldots 4.1 \mathrm{~V}$
- 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
$3 \ldots$ 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 $\longrightarrow$ Chapter

- Measured value may differ from measured value of engine control unit by up to $5{ }^{\circ} \mathrm{C}$


## Display group 003

## Display Explanations

## zones

1 ... rpm
Engine speed $\rightarrow$ Anchor, measured value block 001, display zone 1
$2 \ldots \mathrm{rpm} \quad$ Gearbox speed $\rightarrow$ Anchor, measured value block 001, display zone 2
$3 \ldots$. $\%$ Actual clutch position. The voltage values from the clutch travel sender -G162- ( $\rightarrow$ Anchor, measured Note 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 \%
$4 \underset{\%}{0} \ldots 100$ 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

XXXXXXXX Input information 1, 8-digit display (e.g. 00101101), description $\rightarrow$ Anchor
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 $\rightarrow$ Anchor

## Input information 1 in display zone 1 of display group 004

## Display zone 1 Explanations

12345678

0

0
X

Display is always " 0 "
Display is always "0"

- "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 "
X $\quad$ " 0 " = no starting procedure

- "1" = start prompt by ignition lock

X • "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
X - "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
X • "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 Explanations

122345678
0

| 0 |  |  |  | Ignore |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |
|  | 0 |  |  | Ignore |
|  |  |  |  |  |
|  |  |  |  | Ignore |
|  |  |  | 0 | Ignore |
|  |  |  | 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
X • " 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



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 <br> $\begin{array}{llllllll}1 & 2 & 3 & 4 & 5 & 6 & 8\end{array}$

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 $3-\mathrm{N} 286$ - is off (disconnected from voltage)

With deviations:
Perform electrical test $\rightarrow$ Chapter
0
0
0
X This display must always be the same as the display at item 1
X Switching status of gear selector valve $4-$ N287- . This display must always be the same as the display at item 8

Operate the selector lever when the vehicle is stationary with the ignition on and brake pedal pressed.

Selector lever in "R"; selector lever in tiptronic and 3rd / 4th gear Note selected:

- "0" = gear selector valve $4-\mathrm{N} 287$ - is on (energised)

Selector lever in tiptronic and 1st or 2nd / 5th gear Note selected:

- "1" = gear selector valve $4-\mathrm{N} 287$ - is off (disconnected from voltage)

With deviations:
Perform electrical test $\rightarrow$ Chapter
1
1
$X$ This display must always be the same as the display at item 6
The display in the dash panel insert indicates the gear currently engaged.

## Display group 005

```
Display Explanations
zones
2 .. V Voltage of terminal 15 }->\mathrm{ 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-N = automatic operation gate N position

A-E - A-E = automatic operation gate D position (is identical to E position)
T-0

- $\mathrm{T}-0=$ tiptronic gate Middle position

T-MI

- T-MI = tiptronic gate Minus position

T-PL

- T-PL = tiptronic gate Plus position
???
- ??? = fault, invalid position

With deviations and with display "???":
Check values in measured value block $022 \rightarrow$ Anchor

Perform basic setting $\rightarrow$ Chapter
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: $0.030 \ldots 0.730 \mathrm{~A}$

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

- Specified value for disengaged clutch: $0.800 \ldots 0.900 \mathrm{~A}$

With deviations:
Check valve for clutch actuator -N255- , to do this perform electrical test $\rightarrow$ Chapter

## Display group 007

## Display Explanations <br> zones

1 ... rpm Engine speed $\rightarrow$ Anchor, measured value block 001, display zone 1
$2 \ldots \mathrm{rpm}$ Gearbox speed $\rightarrow$ Anchor, measured value block 001, display zone 2
$3 \ldots \mathrm{rpm}$ Calculated gearbox speed calculated from vehicle speed and engaged gear

- Minimum value $=60 \mathrm{rpm}$

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 $=3 \mathrm{~km} / \mathrm{h}$

Can be up to $7 \mathrm{~km} / \mathrm{h}$ 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 $3 \mathrm{~km} / \mathrm{h}$ 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 | $\ldots \%$ | Actual clutch position $\rightarrow$ Anchor, measured value block 003, display zone 3 |
| :--- | :--- | :--- |
| 2 | $\ldots$ | Gear engaged in gearbox $\rightarrow$ Anchor, measured value block 001, display zone 4 |
| 3 | $\ldots$ rpm | Engine speed $\rightarrow$ Anchor, measured value block 001, display zone 1 |
| 4 | $\ldots$ 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
$3 \quad \ldots \% \quad$ Actual clutch position $\rightarrow$ Anchor, measured value block 003, display zone 3
$4 \quad \ldots \% \quad$ Specified clutch position $\rightarrow$ Anchor, measured value block 003, display zone 4

## Display group 015

## Display Explanations <br> 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 $022 \rightarrow$ Anchor

Perform basic setting $\rightarrow$ Chapter

Perform electrical test $\rightarrow$ Chapter
2 ... V Not used
$3 \ldots$ 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: $3.8 \pm 0.4 \mathrm{~V}$

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

- Specified value: $1.6 \pm 0.4 \mathrm{~V}$

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: $3.8 \pm 0.4 \mathrm{~V}$

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

- Specified value: $3.0 \pm 0.4 \mathrm{~V}$

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

- Specified value: $2.0 \pm 0.4 \mathrm{~V}$

Selector lever in tiptronic and 5th gear selected:

- Specified value: $1.2 \pm 0.4 \mathrm{~V}$

With deviations:
Check values in measured value block $022 \rightarrow$ 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 $020 \rightarrow$ 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 $022 \rightarrow$ 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 $022 \rightarrow$ 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: $0.000 \ldots 2.500 \mathrm{~A}$

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: $0.000 \ldots 2.500 \mathrm{~A}$

The value of the current varies depending on the switching status of the valve (regulating valve)

## Display group 018

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


## Display group 019

| Display zones | Explanations |
| :---: | :---: |
| 1 | Gear to be engaged (specified gear) |
| 0 | - $0=$ idling gate |
| 1... 5 | - $1=1$. gear, $2=2 \mathrm{nd}$ gear, $3=3$ rd gear, $4=4$ th gear, $5=5$ th 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 |
| $2 \ldots$ | 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 $022 \rightarrow$ Anchor |

[^0]
## Display group 020

## Display Explanations <br> zones

1 ... V Voltage of terminal $15 \rightarrow$ Anchor, measured value block 002, display zone 3
$2 \ldots$ 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 $\rightrightarrows$ Chapter
$3 \ldots$ Supply voltage of gearbox sensors (internal)

- Specified value: approx. 5 V
$4 \ldots$ Voltage of sender for gearbox hydraulic pressure -G270-
- Specified value with ignition on (engine off): $2.7 \ldots 3.2 \mathrm{~V}$
- Specified value with engine running: $2.9 \ldots 4.4 \mathrm{~V}$

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 Explanations
zones
Slope \({ }^{\circ} \mathrm{C}\) here does not mean the temperature, but the upward or downward slope in per cent (\%). This is a calculated value within the control unit
\(2 \ldots\) Hill factor (calculated value within the control unit)
\(3 \ldots\) Sport factor (calculated value within the control unit)
\(4 \ldots\) Accelerator pedal position \(\rightarrow\) Anchor, measured value block 001, display zone 3
```

Display group 022

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


## Display <br> Explanations

zones
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
4 ... 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.


[^0]:    3 ... \%
    Accelerator pedal position $\rightarrow$ Anchor, measured value block 001, display zone 3

