Measured value blocks in vehicles up to model year 2001

Measured value blocks in vehicles up to model year 2001

List of available display group numbers

Display group no.	Display zone	Designation	Details on page
01	1	Compressor shutoff criteria	01-167
	2	Voltage for the air-conditioner magnetic clutch -N25 (in Volt).	
	3	Voltage, terminal "15" (in Volt).	
	4	Signal for ignition off time (stationary period).	
02	1-4	Left temperature flap positioning motor -V158	01-172
03	1-4	Right temperature flap positioning motor -V159	01-173
04	1-4	Central flap positioning motor -V70	01-174
05	1-4	Defrost flap positioning motor -V107	01-176
06	1-4	Air flow flap positioning motor -V71.	01-177

Display group no.	Display zone	Designation	Details on page
07	1	Calculated ambient temperature (for ambient temperature indicator -G106, installed in dash panel insert)	01-178
	2	Temperature sensor for fresh air intake duct -G89	
	3	Ambient temperature sensor -G17	
	4	Coolant temperature (calculated by -E87)	
08	1	Vent temperature sender, left -G150	01-180
	2	Vent temperature sender, right, -G151	
	3	Footwell vent temperature sender -G192	
	4	Dash panel temperature sensor -G56	

Display group no.	Display zone	Designation	Details on page
09	1	Specified voltage at fresh air blower -V2	01-181
	2	Actual voltage at fresh air blower -V2	
	3	Voltage at terminal 58d (downstream of lighting controller -E20) in %	
	4	Operating and display units with part numbers up to and including index "A" Display zone not used.	
		Operating and display units with part numbers from index "B" onwards (with indexes "B", "C", "F" and "G", gradual introduction from software version "D60"). Voltage at terminal "58s"	

Note:

Display zone "4" in display group "09" is only assigned on operating and display units with the part number 4B0 820 043 from index "B" onwards (with indexes "B", "C", "F" and "G", gradual introduction from software version "D60").

Display group no.	Display zone	Designation	Details on page
10	1	Engine speed	01-183

	2	Vehicle speed	
	3	Auxiliary Heater	
	4	Additional heater on/off	
11	1	Coolant temperature (transmitted by dash panel insert)	01-185
	2	Air conditioner compressor cut-in	
	3	Air conditioner pressure switch -F129	
	4	Operating and display units with part numbers up to and including index "G" and with indexes "P", "Q", "R" and "S". Display zone not used.	
		Operating and display units with part numbers with indexes "H", "J", "K" or "L" and from index "T" onwards. Ignition key assignment	

Note:

Display zone "4" in display group "11" is only assigned on operating and display units with the part number 4B0 820 043 with indexes "H", "J", "K" or "L" and from index "T" onwards.

Display group no.	Display zone	Designation	Details on page
12	1	Sunlight penetration photosensor -G107 (left side)	01-189
	2	Sunlight penetration photosensor -G107 (right side)	
	3	Display zone not used.	
	4	Display zone not used.	
13	1...4	Operating and display units with part number with index "H", "J", "K" or "L" and from index "T" onwards and with index "AE", "AF", "AG", "AH". The last four compressor shut-off criteria which were effective for longer than 20 seconds.	01-191

Note:

Display group "13" is only assigned in operating and display units with the part number 4B0 820 043 with index "H", "J", "K" or "L" and from index "T" onwards and with index "AE", "AF", "AG" or "AH".

Display group 01 (compressor shutoff criteria, voltage for the air conditioner magnetic clutch and at terminal "15")

Notes:

- If one of the compressor shut-off criteria 1, 8, 11 or 12 exists, the magnetic clutch -N25 cannot be actuated during the final control diagnosis (=>Page 01-99)
- If compressor shutoff criterion "5" appears in addition to another compressor shutoff condition, disregard shutoff criterion "5".
- If several compressor shutoff conditions exist simultaneously (display zone 1), the display will either show them all alternately or it will show only the shutoff condition assigned the highest priority by operating and display unit -E87.
- If pressure switch -F129 is open, compressor shutoff criterion "1" (overpressure) first appears and then the compressor is switched off. If pressure switch -F129 remains open for more than 30 secs. the program switches to compressor shutoff criterion "3" (vacuum, refrigerant circuit empty).

Display zone	Display	
1	Code	Compressor shutoff criteria:
	0	Compressor switched on: ▪ No shut-off criterion identified (if compressor is not switched on, perform

		Final control diagnosis => Page 01-285).
	1	Compressor switched off: ▪ Open pressure switch -F129 (between contacts 2 and 1) (overpressure or loose contact in the wiring). Fault remedy =>Fault table, Page 01-285.

Display zone	Display	
1	Code	Compressor shutoff criteria:
	2	Vacant
	3	Compressor switched off: ▪ Open pressure switch -F129 (between contacts 2 and 1) (overpressure, empty refrigerant circuit or open circuit). Fault remedy =>Fault table, Page 01-285.
	4	Vacant
	5	Compressor switched off:
	6	Compressor switched off: ▪ Compressor switched off via the -E87 "ECON" button. Switch on compressor (press "Auto" button).

Display zone	Display	
1	Code	Compressor shutoff criteria:
	7	Compressor switched off: ▪ Compressor switched off via the -E87 "OFF" button. Switch on compressor (press "Auto" button).
	8	Compressor switched off: ▪ Measured ambient temperature less than 2 °C (Celsius). Ambient temperature less than 2°C (place vehicle in heated area for test) Temperature sensor (-G17 or -G89) issues incorrect values (check => Page 01-178).
	9	Vacant
	10	Compressor switched off: ▪ Supply voltage for air-conditioner magnetic clutch -N25 less than 9.5 V (=> display zone 3 and fault table, Page 01-35).
	11	Compressor switched off:

Display zone	Display	
1	Code	Compressor shutoff criteria:
	12	Compressor switched off: ▪ AC compressor cut-in. The engine control unit has switched off the compressor (check => display group 10, Page 01-99).
	13	Compressor switched off: ▪ Compressor cut-in delay (approx. 10 secs.) at engine speeds above 6000 rpm. Of no significance for customer service
	14	Compressor switched off: ▪ Air-conditioner pressure switch -F129 (switch between contacts 1 and 2) actuated 30x during the current driving period. Loose contact in wiring between -F129 and -E87. Fault at switch -F129 or in refrigerant circuit (=> Fault table, Page 01-285).

Display zone	Display
2	Voltage at air-conditioner magnetic clutch -N25 in V (connector -B-, contact -3-). If the display value is less than 12 V while the engine is running

	and the air-conditioner magnetic clutch -N25 is on, check wiring to -E87 (positive and earth), using current flow diagram.
3	Voltage at terminal "15" in V (connector -D-, contact -9-). If the display value is less than 12 V while the engine is running, check wiring to -E87 (positive and earth), using current flow diagram.
4	Signal for ignition off time (stationary time) 1) Time between the last ignition switch-off and renewed switch-on. Display value between 00:00 h and 04:00 h.

1) If, when the ignition is switched on, no "ignition off time" signal is detected by the operating and display unit -E87(transmitted by the dash panel insert), the -E87 assumes a standing time of more than 4 hours and it is assumed that the engine temperature is the same as the ambient temperature. In heating mode, the fresh air blower may thus have a delayed start despite the engine being warm. Ambient temperature indicator -G106 in the dash panel insert may also display incorrect ambient temperature values.

Display group 02 (left temperature flap positioning motor -V158)

Display zone	Display
1	Actual feedback value of potentiometer -G220 (in the positioning motor -V158) Display value greater than 5 and less than 250 Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 200).
2	Specified feedback value of potentiometer -G220 (calculated by -E87). Display range: 5 to 250.
3	-G220 value determined during the "basic setting" and stored in -E87 with positioning motor set to "heating stop" (the temperature flap routes the air flow through the heat exchanger). Display value greater than 5 and less than 50
4	-G220 value determined during the "basic setting" and stored in -E87 with positioning motor set to "cooling stop" (the temperature flap routes the air flow past the heat exchanger). Display value greater than 200 and less than 250

Notes:

- If the display values in display zones 3 or 4 are outside the permitted range =>Fault table, Page 01-35.
- If the feedback value in display zone 1 is less than 5 (short circuit) or greater than 250 (open circuit), =>Perform electrical check Page 01-285.

- The actual feedback value (between 5 and 50 and between 200 and 250) is specified, for example, in the operating and display unit -E87 as the permissible tolerance range for the positioning motor stop for the left temperature flap or for flap.

Display group 03 (right temperature flap positioning motor -V159)

Display zone	Display
1	Actual feedback value of potentiometer -G221 (in the positioning motor -V159) Display value greater than 5 and less than 250 Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 200).
2	Specified feedback value of potentiometer -G221 (calculated by -E87). Display range: 5 to 250.
3	-G221 value determined during the "basic setting" and stored in -E87 with positioning motor set to "heating stop" (the temperature flap routes the air flow through the heat exchanger). Display value greater than 5 and less than 50
4	-G221 value determined during the "basic setting" and stored in -E87 with positioning motor set to "cooling stop" (the temperature flap routes the air flow past the heat exchanger). Display value greater than 200 and less than 250

Note:

In the event of deviations from specified values, observe notes on display group 02 (see Page 01-172).

Display group 04 (central flap positioning motor -V70)

Display zone	Display
	Actual feedback value of potentiometer -G112 (in the positioning motor -V70) Display value greater than 5 and less than 250

1	Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 200)
2	Specified feedback value of potentiometer -G112 (calculated by -E87). Display range: 5 to 250.
3	-G112 value determined during "basic setting" and stored in control unit -E87 with the positioning motor set to "lower stop" (central flap and footwell flap closed, air flow directed to the defrost flap) Display value greater than 5 and less than 50
4	-G112 value determined during the "basic setting" and stored in -E87with positioning motor set to "upper stop" (the central flap is open, the footwell flap is closed, the air flow is directed to the dash panel vents). Display value greater than 200 and less than 250

Notes:

- The following air conditioner operating statuses (and all intermediate settings) are possible via the levers fitted on the flaps depending on the positioning motor setting:

- Footwell flap and central flap closed = Defrost mode (air to windscreen)

- Footwell flap open and central flap closed = Air into footwell (feedback value in display zone 1 and 2 between 70 and 90).

- Footwell flap closed and central flap open = Air out of dash panel vents

- For further information see => Page 01-172 display group 02

Display group 05 (defrost flap positioning motor -V107)

Display zone	Display
1	Actual feedback value of potentiometer -G135 (in positioning motor -V107) Display value greater than 5 and less than 250 Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 200)
	Specified feedback value of potentiometer -G135

2	(calculated by -E87). Display range: 5 to 250.
3	Value for -G135 that was calculated during the "basic setting" and stored in control unit -E87 with the positioning motor set to "lower stop" (defrost flap closed) Display value greater than 5 and less than 50
4	Value for -G135 that was calculated during the "basic setting" and stored in control unit -E87 with the positioning motor set to "upper stop" (defrost flap open, air coming from dash panel defroster vents to windscreen) Display value greater than 200 and less than 250

Note:

In the event of deviations from specified values, observe notes on display group 02 (see Page 01-172).

Display group 06 (air flow flap positioning motor -V71)

Display zone	Display
1	Actual feedback value of potentiometer -G113 (in positioning motor -V71). Display value greater than 5 and less than 250 Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 200)
2	Specified feedback value of potentiometer -G113 (calculated by -E87). Display range: 5 to 250.
3	-G113 value determined during the "basic setting" and stored in the -E87 with the positioning motor set to "lower stop" (the air flow flap in the air conditioner intake area closed, the air conditioner in recirculated air mode). Display value greater than 5 and less than 50
4	-G113 value determined during the "basic setting" and stored in the -E87 with the positioning motor set to "upper stop" (the air flow flap in the air conditioner intake area open and the air conditioner in fresh air mode). Display value greater than

	200 and less than 250

Note:

In the event of deviations from specified values, observe notes on display group 02 (see Page 01-172).

Display group 07 (calculated ambient temperature for ambient temperature indicator -G106, measured values for fresh air intake duct temperature sensor -G89, ambient temperature sensor -G17 and calculated coolant temperature)

Display zone	Display
1	Calculated ambient temperature in °C(for ambient temperature indicator -G106 in auto-check system of dash panel insert).
2	Temperature sensor for fresh air intake duct -G89. Measured value of sensor in ° C (check => Electrical check, Page 01-285).
3	Ambient temperature sensor -G17 Measured value of sensor in ° C (check =>Electrical check, Page 01-285).
4	Coolant temperature calculated by -E87 in °C (auxiliary variable for control of fresh-air blower speed).

Notes (display zones 1, 2 and 3):

- The basis for the display in display zone 1 is the lower of the two measured ambient temperatures (=>display zones 2 and 3). When the ignition is switched off, the value is stored up to 4 hours.
- If the calculated ambient temperature is too low, the cause may be loose contact in one of the two temperature sensors -G17 or -G89 or in the associated wiring.
- The measured value from a defective temperature sensor is suppressed by -E87, and -E87 then uses an internal calculated value for the further control.

Notes on display zone 4:

- The coolant temperature calculated by -E87 is only used for air-conditioner control purposes if no coolant temperature is supplied by the dash panel insert =>Page 01-185 display group 11.
- The coolant temperature is calculated by the -E87 taking into account various input signals (time since the ignition was switched on, engine speed, engine running time, calculated ambient temperature, length of time since vehicle last driven, etc.).

Display group 08 (left vent temperature sender -G150, right vent temperature sender -G151, Footwell vent

temperature sender -G192 and dash panel temperature sensor -G56)

Display zone	Display
1	Vent temperature sender, left -G150 Measured value of sensor in ° C (check => Electrical check,

	Page 01-285).
2	Vent temperature sender, right, -G151 Measured value of sensor in ° C (check => Electrical check, Page 01-285).
3	Footwell vent temperature sender -G192. Measured value of sensor in ° C (check=> Electrical check, Page 01-285).
4	Dash panel temperature sensor -G56. Measured value of a sensor in °C. Installed in the -E87, cannot be replaced separately Air is blown from the area of the dash panel centre section to the sensor via blower -V42

Note:

The measured value from a defective temperature sensor is suppressed by -E87, and -E87 then uses an internal calculated value for the further control (the current measured value is displayed).

Display group 09 (voltage at fresh-air blower -V2, voltage at terminals 58d and 58s)

Display zone	Display
1	Specified voltage for fresh air blower -V2 (calculated by -E87). 0 V to 12.5 V (depending on the -E87 setting).
2	Actual voltage at fresh air blower -V2. Deviation from the specified voltage (in the vehicle voltage range) less than 0.7 V.
3	Voltage for illuminating the various display elements of -E87. Between 5 and 100% depending on the setting of the instrument illumination control -E20, terminal 58d, and the brightness determined by the photosensor in the dash panel insert (voltage at connector -A-, contact -5- to -E87). 25% with no signal from dash panel insert
4	Operating and display units with part numbers up to and including index "A" Display zone vacant (disregard display). Operating and display units with part numbers from index "B" onwards (with indexes "B", "C", "F" and "G", gradual

	introduction from software version "D60"). Voltage for the illumination of the switches in the operating and display unit -E87 (terminal 58s) 0...100% depending upon the position of the lighting and instruments control -E20, with side lights on (voltage at connector -C-, contact -7- to -E87). 10% or less than 1.0 V when side lights are off

Notes on display zones 3 and 4:

- Checking input voltage for terminals 58d and 58s at operating and display unit -E87 =>Electrical check, Page 01-285.
- The voltage at terminal 58d is generated as a square-wave signal by the dash panel insert. The brightness of -E87 displays is determined by the actuation time.
- Display zone "4" in display group "09" is only assigned on operating and display units with the part number 4B0 820 043 from index "B" onwards (with indexes "B", "C", "F" and "G", gradual introduction from software version "D60").
- The -E87 controls are only illuminated if voltage is applied to terminal 58s.
- The brightness of the -E87 display illumination can be changed via the -E20 illumination control, even if the side lights are switched off.

Display group 10 (engine speed, compressor speed, vehicle speed, auxiliary heater and additional heater on/off)

Display zone	Display
1	Engine speed in rpm.
2	Vehicle speed in km/hour. 0 = No speed signal detected since the ignition was switched on. 1 = At least one vehicle speed signal detected since the ignition was switched on
3	Auxiliary heater. 0 = No auxiliary heater mode (voltage at connector -D- contact -1- less than 5 V) 1 = Auxiliary heater mode (voltage at connector -D- contact -1- greater than 5 V).
4	Additional heater on/off (observe only on vehicles with diesel engines) 1 = Additional heater on (input of -E87 switched to earth). 0 = Additional heater off (input of -E87 open).

Notes on display zone 2:

If the vehicle is moving at more than 1 km/h, this speed will be displayed.

Notes on display zone 3:

- If -E87 remains in operation after the ignition is switched off and if the display shows "1", locate and rectify short to positive to connector -D-, contact -1- using current flow diagram.
- If voltage is applied to the input with the ignition switched off, -E87 starts up, fresh-air blower is actuated with max. 6V and air flow is routed to windscreen.

Notes on display zone 4:

- Only envisaged for vehicles with diesel engines; depending on vehicle equipment, an electric additional heater is provided or the additional heating function is assumed by the auxiliary heater=> Page 01-111.
- The display zone can be disregarded in vehicles with petrol engine.
- The engine control unit switches on the additional heater provided that certain criteria are satisfied =>Page 01-116 and

=> Relevant Workshop Manual Diesel Direct Injection and Glow Plug System; Repair group 01

Display group 11 (Coolant temperature supplied by dash panel insert, air conditioner compressor cut-in, pressure switch -F129 and ignition key assignment)

Display zone	Display
1	Coolant temperature in °C supplied by dash panel insert (auxiliary variable for control of fresh-air blower speed, coolant temperature too high). -9 °Cto 117 °C = coolant temperature in permissible range/signal OK. -10 °C= no signal detected from dash panel insert. -65 °C= no signal from dash panel insert detected or voltage at connector -A-, contact -3- less than 5 V. 118 °C= coolant temperature too high (temperature switch closed, dash panel insert has switched output to earth, voltage at connector -A-, contact -3- less than 5 V) =>Display group 01, Page 01-167 display zone 1.

Notes on display zone 1:

- Checking the coolant temperature and the dash panel insert.

- Up to a coolant temperature of approx. 50 °C use is made for control purposes of a mean value from the coolant temperature calculated by -E87 and the coolant temperature supplied by dash panel insert. From approx. 50 °C onwards, only the value provided by the sash panel insert is used.
- If the signal from the dash panel insert cannot be evaluated by -E87, -10 °C or -65 °C is displayed as coolant temperature and use is made for control purposes of the value calculated by -E87. When -65°C is displayed, the compressor cannot be switched on.
- At a coolant temperature of 118 °C, the dash panel insert switches the output to earth, -E87 deactivates the air-conditioner magnetic clutch -N25 and a coolant temperature of 118 °C is displayed.

Display zone	Display
	Air conditioner compressor

2	cut-in. 0 = "Open" AC compressor cut-in output (voltage at connector -C- contact -12- less than 5 V). 1 = "Closed" AC compressor cut-in output (voltage at connector -C- contact -12- greater than 5 V).
3	Air-conditioner pressure switch -F129 1 = Open pressure switch (voltage at connector -C- contact -2- less than 2 V). 0 = Closed pressure switch (voltage at connector -C- contact -2- greater than 2 V).

Notes on display zone 2:

- When air conditioner magnetic clutch -N25 is engaged, the output is closed (voltage greater than 5 V).
- If voltage drops below 5 V with magnetic clutch switched on (engine control unit switches input to earth), the -E87 switches the magnetic clutch off (=> display group 01, Page 01-167 display zone 1)

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Notes on display zone 3:

When air conditioner pressure switch -F129 is open (high/low-pressure switch between contacts 1 and 2), the compressor is switched off (=>display group 01, Page 01-167 display zone 1).

Display zone	Significance		Explanatory Notes
4	Operating and display units with part numbers up to and including index "G" and with indexes "P", "Q", "R" and "S". Display zone vacant (disregard display).		
	Operating and display units with part numbers with indexes "H", "J", "K" or "L" and from index "T" onwards.		
	Display 0 =	The ignition was switched on with a key for which there is no assignment in the dash panel insert. No information was received from the dash panel insert.	▪ Check adaption of the ignition key.
	Display 1 = (2, 3 or 4)	The ignition was switched on with the key which was set to position 1 (2, 3 or 4) in the dash panel insert.	▪ Up to 4 keys may be assigned.

Notes on display zone 4:

- When the ignition is switched on, the -E87 starts with the setting which was valid the last time the ignition was switched off with this key (temperature, air distribution, fresh air blower speed).

- In vehicles from model year 2000, the ignition key assignment is transmitted to the -E87 by the dash panel insert together with the coolant temperature and the signal "Engine temperature too high", when the ignition is switched on (data message). The key assignment can only by processed by operating and display units with the part number 4B0 820 043 and index "H", "J", "K" or "L" or from index "T" onwards and with index "AE", "AF", "AG" or "AH". If the coolant temperature is too high, no information

may be transmitted.

- The assignment of the ignition key can only be recognised and therefore transmitted by the dash panel insert on vehicles fitted with an immobiliser.

=> Electrical System; Repair group 90; Repair dash panel insert

- Check signal from dash panel insert =>Electrical test, Page01-285

Display group 12 (sunlight penetration photosensor -G107)

Display zone	Display
1	Sunlight penetration photosensor -G107 (penetration from left, depending on the sunlight penetration intensity and the version of -E87). 0%to 100%(corresponds to 4.5 V and 0.5 V). or 0....1000 w/m2
2	Sunlight penetration photosensor -G107 (penetration from right, depending on the sunlight penetration intensity and the version of -E87). 0%to 100%(corresponds to 4.5 V and 0.5 V). or 0....1000 w/m2
3	Display zone vacant (disregard display).
4	Display zone vacant (disregard display).

Notes:

- The display values for photosensor -G107 may be changed by shining an appropriate bulb at the sensor.

- If, irrespective of the light conditions for photosensor -G107, the display always shows about 90% of the maximum sunlight penetration, use the current flow diagram to check the cabling to photosensor -G107 for wrong connections.

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- In vehicles with operating and display unit -E87 with software version "D65" the measured intensity of sunlight penetration is displayed in the wrong unit (volt instead of watt). The correct value can be obtained by multiplying the display value by 2 and replacing volt by watt.

Display group 13: (The last four compressor shut-off criteria)

Display zone	Significance	Explanatory Notes
1	Fourth last compressor shutoff criterion	▪ Explanatory notes => Page 01-167 display group 01, display zone 1
2	Third last compressor shutoff criterion	

3	Last but one compressor shutoff criterion	
4	Last compressor shutoff criterion	

Notes:

- Display group "13" is only assigned in operating and display units with the part number 4B0 820 043 with index "H", "J", "K" or "L" and from index "T" onwards and with index "AE", "AF", "AG" or "AH".
- Only the last four compressor shut-off criteria which were effective for longer than 20 seconds are stored.