

Digital Motor Electronics (DME/ECM)

The N55 engine is equipped with the Bosch engine management MEVD17.2 :

- The MEVD17.2 is integrated in the intake system and is cooled by the intake air.
- The MEVD17.2 is FlexRay-compatible and directly supplies voltage to the sensors and actuators.

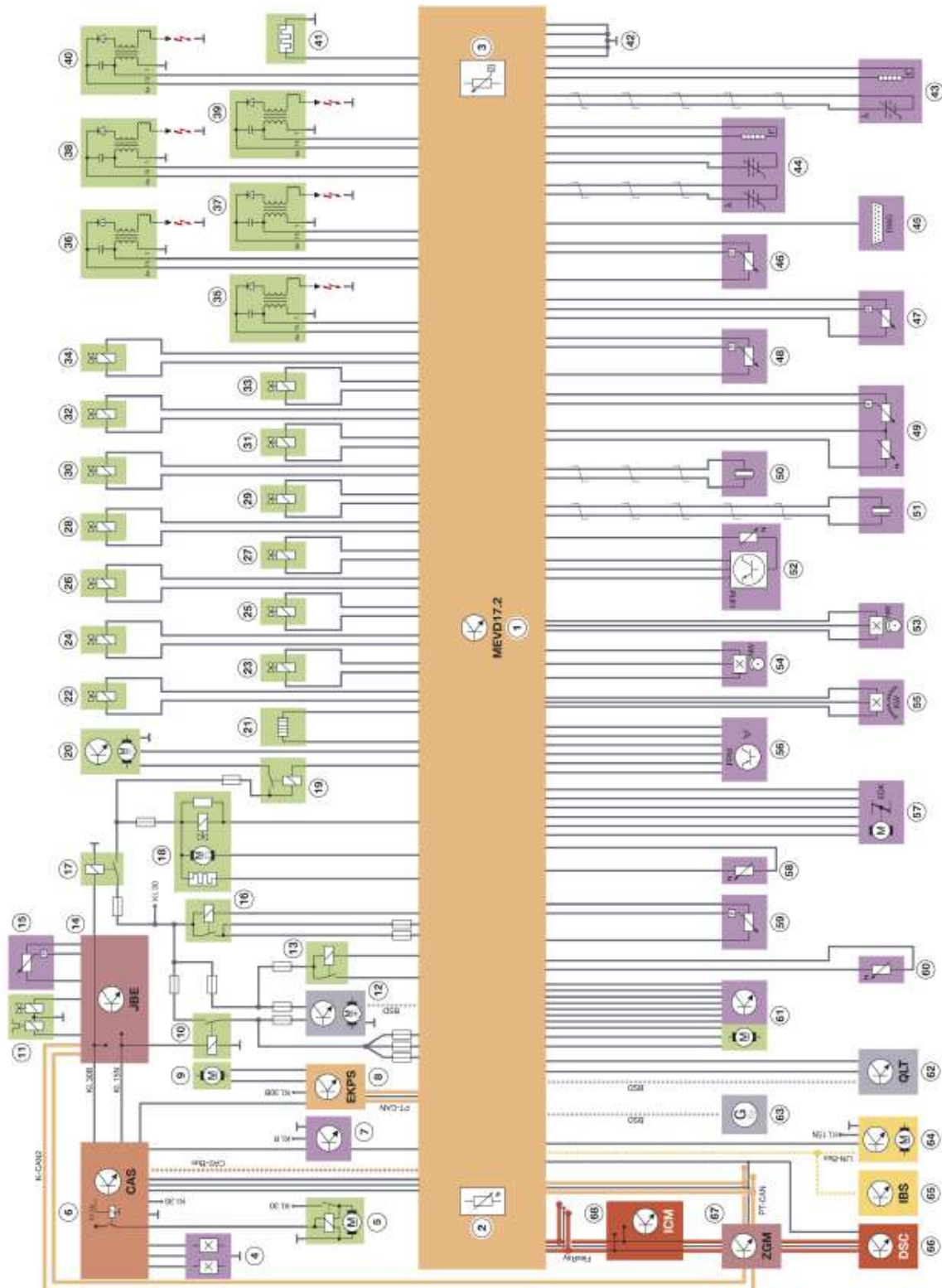
The top side of the DME housing also serves as the bottom section of the intake manifold. The housing is contoured in the area of the intake manifold to ensure optimum air flow. An O ring type seal is installed between the DME housing and the intake. The plug connections between the wiring harness and DME are water-tight.

N55, engine management MEVD17.2



Index	Explanation
1	Engine wiring harness, sensor 1 (Module 100)
2	Engine wiring harness, sensor 2 (Module 200)
3	Connection, vehicle wiring harness (Module 300)
4	Engine wiring harness, Valvetronic (Module 400)
5	Connection, voltage supply (Module 500)
6	Engine wiring harness, injection and ignition (Module 600)

Digital Motor Electronics Circuit Diagram



N55, MEVD17.2 Circuit Diagram

Index	Explanation	Index	Explanation
1	Engine electronics Valvetronic, direct injection 17.2 MEVD17.2	35-40	Ignition coils
2	Ambient pressure sensor	41	Engine breather heater
3	Temperature sensor	42	Ground connections
4	Brake light switch	43	Oxygen sensor after catalytic converter
5	Starter	44	Oxygen sensor before catalytic converter
6	Car Access System (CAS)	45	Diagnostic socket
7	Clutch module	46	Low-pressure fuel sensor
8	Electronic fuel pump control (EKPS)	47	Intake manifold pressure sensor after throttle valve
9	Electric fuel pump	48	Fuel rail pressure sensor
10	Terminal 15N relay	49	Charge air temperature and pressure sensor
11	A/C compressor	50	Knock sensor, cylinders 1 - 3
12	Coolant pump	51	Knock sensor, cylinders 4 - 6
13	Valvetronic relay	52	Hot-film air mass meter (HFM)
14	Junction Box Electronics (JBE)	53	Intake camshaft sensor
15	Refrigerant pressure sensor	54	Exhaust camshaft sensor
16	Relay, ignition and injection	55	Crankshaft sensor
17	Terminal 30B relay	56	Accelerator Pedal Module (FPM)
18	Fuel tank leak diagnosis module (DMTL)	57	Throttle valve (MDK)
19	Electric fan relay	58	Coolant temperature sensor at engine outlet
20	Electric fan	59	Oil pressure sensor
21	Characteristic map thermostat	60	Oil temperature sensor
22	Diverter valve	61	Valvetronic servomotor
23	Fuel tank vent valve	62	Oil condition sensor
24	VANOS solenoid valve, intake camshaft	63	Alternator
25	VANOS solenoid valve, exhaust camshaft	64	Active cooling air flap control
26	Oil pressure control valve	65	Intelligent battery sensor (IBS)
27	Electropneumatic pressure converter (EPDW) for wastegate valve	66	Dynamic stability control (DSC)
28	Quantity control valve	67	Central Gateway Module (ZGM)
29-34	Fuel injectors	68	Integrated Chassis Management (ICM)

Functions

■ Fuel supply system

The fuel pressure sensor sends a voltage signal, corresponding to the system pressure applied between the fuel pump and the high pressure pump, to the engine control unit (DME/ECM). The system pressure (fuel pressure) is determined with the fuel pressure sensor upstream of the high pressure pump. The target pressure is constantly compared to the actual pressure in the DME.

If the target pressure deviates from the actual pressure, the engine control unit increases or decreases the voltage for the electric fuel pump. This voltage is sent in the form of a message via the PT-CAN to the EKP control unit.

The electric fuel pump (EKP) control unit converts the message into an output voltage for the electric fuel pump, thus regulating the required delivery pressure for the engine (or high pressure pump). The electric fuel pump is pilot-controlled in the event of signal failure (fuel pressure sensor). Should the CAN bus fail the EKP control unit operates the electric fuel pump with the applied system voltage. The fuel flows via the high pressure line to the fuel rail. The fuel is buffered in the fuel rail and distributed to the fuel injectors.

■ Fuel quantity control

The rail pressure sensor measures the current fuel pressure in the rail. The excess fuel is returned to the inlet of the high pressure pump when the quantity control valve in the high pressure pump opens. Vehicle operation is restricted in the event of the high pressure pump failing.

The quantity control valve controls the fuel pressure in the rail. The engine management actuates the quantity control valve with a pulse width-modulated signal. Depending on the pulse width, a variable throttle cross section is released, thus providing the quantity of fuel required for the current load status of the engine. It is also possible to reduce the pressure in the rail.

■ Boost pressure control

The engine management controls the boost pressure with the wastegate valve at the turbocharger. An electropneumatic pressure converter (vacuum solenoid) receives the signals from the engine management and supplies vacuum to open the wastegate valve when the specified maximum boost pressure is reached.

A diverter valve is installed on the compressor housing of the turbocharger. It connects the pressure side to the inlet side of the induction system and is controlled directly by the engine management. The diverter valve eliminates undesirable peaks in the boost pressure that can occur when the throttle valve is quickly closed. Therefore it has a decisive influence on the engine acoustics while protecting the turbocharger and its related components.

A pressure wave is built up from the throttle valve to the turbocharger compressor wheel when the throttle valve is closed. This pressure wave acts against the throttle plate and the compressor blades pressing them against the bearings. The diverter valve reduces this pressure wave and thus the load on these components by “diverting” air pressure from the pressure side to the suction side of the compressor housing. This also maintains the turbocharger spooled (up to speed) for the next acceleration and reduces turbo lag.

■ Engine cooling

The engine cooling system utilizes an electric coolant pump. The heat management determines the current cooling requirement and controls the cooling system accordingly. Under certain circumstances, the coolant pump can be completely switched off, e.g. to rapidly heat up the coolant during the warm-up phase. The coolant pump continues to operate when the hot engine is shut down. The coolant capacity can therefore be varied regardless of the engine speed. In addition to the characteristic map thermostat, the heat management makes it possible to use various characteristic maps for controlling the coolant pump. In this way the engine control unit can adapt the engine temperature to the driving conditions.

The engine control unit regulates the following temperature ranges:

- 108°C/226°F = Economy mode
- 104°C/219°F = Normal mode
- 95°C/203°F = High mode
- 90°C/194°F = High mode and control with characteristic map thermostat

The engine management sets a higher temperature (108°C) when, based on vehicle operation, the engine control unit detects “Economy” mode. The engine is operated with relatively low fuel requirements in this temperature range. The internal engine friction is reduced at higher temperatures. The increase in temperature therefore results in low fuel consumption in the low load range. The driver wishes to utilize the optimum power developed by the engine in “High and control with characteristic map thermostat” mode. For this purpose, the temperature in the cylinder head is reduced to 90°C. This temperature reduction promotes improved volumetric efficiency, thus resulting in an increased engine torque. Adapted to the relevant driving situation, the engine control unit can now regulate a defined operating range. In this way it is possible to influence the fuel consumption and power output through the cooling system.

■ **System Protection**

If the coolant or the engine oil overheat during operation, certain vehicle functions are influenced to the effect that more energy is available to the engine cooling system.

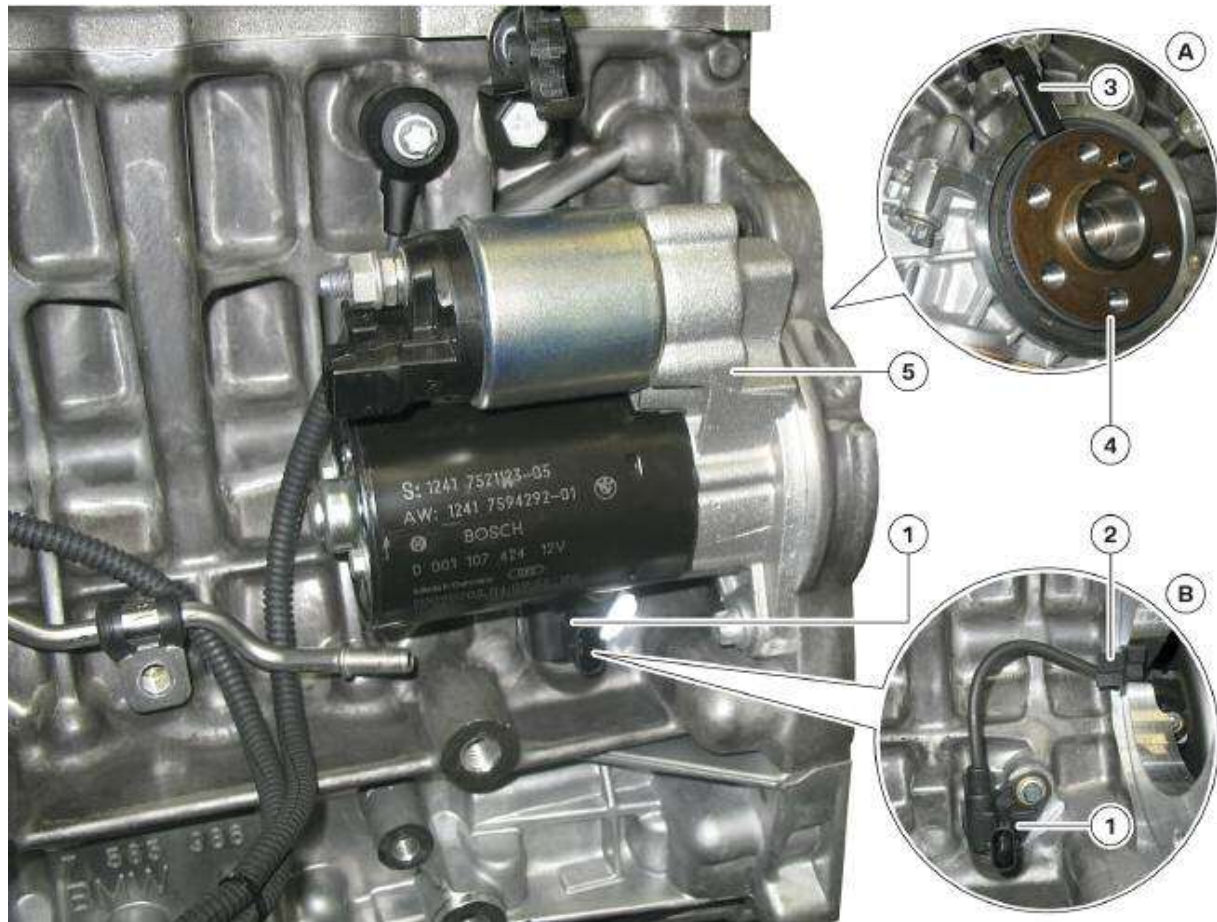
These measures are divided over two operating modes:

- Component protection
 - Coolant temperature between 117°C/242°F and 124°C/255°F
 - Engine oil temperature between 150°C/300°F and 157°C/314°F
 - Result: The output of the air conditioning system (up to 100%) and of the engine is reduced
- Emergency
 - Coolant temperature between 125°C/257°F and 129°C/264°F
 - Engine oil temperature between 158°C/316°F and 163°C/325°F
 - Result: The power output of the engine is reduced (up to 90%)

Crankshaft Sensor

The function of the new crankshaft sensor is identical to that of the crankshaft sensors used for the automatic engine start-stop function (MSA). The engine reversal detection is required for the MSA function. (MSA is not currently offered in the US.)

N55, location of crankshaft sensor



Index	Explanation
A	Direction of view towards crankshaft
B	Same view without starter
1	Connector
2	Dust seal
3	Sensor
4	Multi-pole trigger wheel

N55, crankshaft sensor with multipole sensor wheel



Index	Explanation
1	Connector
2	Dust seal
3	Sensor

Ignition Coil

New ignition coils have been developed for the N55 engine. The ignition coils have improved electromagnetic compatibility and are sturdier. The insulation has been reinforced with silicone and a metal collar shielding compared to the coils used on previous engines. See the Service Information section of this training material for more details.

CAUTION!!!

Always remove the ignition coils before opening the fuel system. Gasoline may damage the silicone insulation on the coils which may lead to arcking and subsequent engine misfiring.

Oil Pressure Sensor

The new oil pressure sensor can now determine the absolute pressure.

The sensor delivers a more accurate pressure reading which is required for the electronic volume control oil pump function.

The sensor design is identical to that of the (high) fuel pressure sensor. The DME supplies a voltage of 5 Volt to the oil pressure sensor.

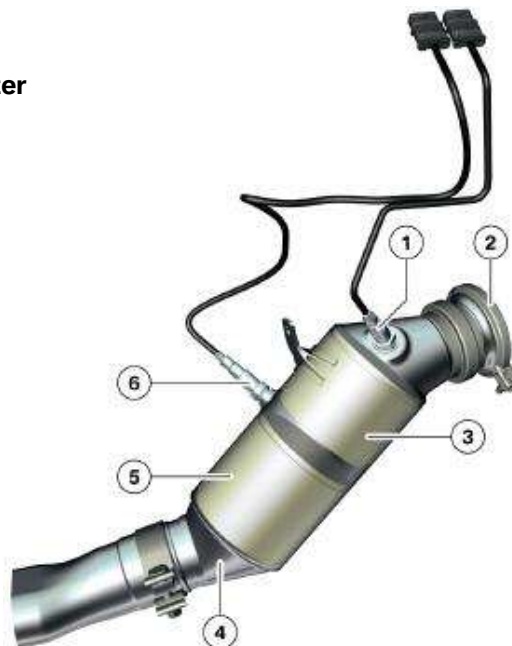


N55, oil pressure sensor

Oxygen Sensors

A new connector is used for the oxygen sensors. The new connector system provides greatly improved contacting properties and eliminates "background noise".

N55 engine, catalytic converter



Index	Explanation
1	Oxygen sensor upstream of catalytic converter
2	Connection at exhaust turbocharger
3	Ceramic monolith 1
4	Catalytic converter
5	Ceramic monolith 2
6	Oxygen sensor after catalytic converter

■ Oxygen sensor before catalytic converter

The Bosch oxygen sensor LSU ADV is used as the control sensor before the catalytic converter. The abbreviation LSU stands for “Lambdasonde Universal” and ADV for “Advanced”. The function is similar to that of the LSU 4.9 oxygen sensor and is therefore described in detail in the E71 X6 training material under “N63 engine” available in TIS and ICP.

The oxygen sensor before catalytic converter (LSU ADV) offers the following advantages:

- High signal stability specially during turbocharged operation due to low dynamic pressure dependence.
- Increased durability due to reduced pump voltage.
- Increased accuracy (by a factor of 1.7 compared to LSU 4.9).
- Ready for operation in < 5 seconds.
- Greater temperature compatibility.
- Improved connector with more effective contacting properties.

The LSU ADV has an extended measuring range, making it possible to measure precisely from lambda 0.65. The new oxygen sensor is ready for operation faster so that exact measured values are available within 5 seconds of start up.

The higher measuring dynamics of the sensor makes it possible to more effectively determine and control the fuel-air ratio separately for each cylinder. This results in a homogeneous exhaust flow that reduces emissions while also having a favorable effect on long-term emission characteristics.

■ Oxygen sensor after catalytic converter

The oxygen sensor after catalytic converter is also known as the monitoring sensor. The familiar Bosch LSF 4.2 monitoring sensor is used.

■ Hot-film air mass meter

The Siemens SIMAF GT2 hot-film air mass meter is used. This sensor is equipped with planar metal resistors on glass. Based on the tried and tested sensor technology used in the SIMAF GT1 for more than 15 years, the SIMAF GT2 represents a further-development and optimization with higher vibration resistance, improved accuracy (at all operating temperatures), and lower sensitivity to air pulsations and water.



Hot-film air mass meter

High Pressure Fuel Injector Valve

The HDEV5.2 solenoid type injector valves used on the N55 engine are a new development.

1 Booster phase:

Opening of the HDEV5.2 is initiated in the booster phase by a high booster voltage from the DME. The booster phase ends on reaching approximately 10 amps. The high current is achieved by a voltage of up to approximately 65 Volt.

2 Energizing phase:

In the energizing phase, the HDEV5.2 is completely opened by controlling the current to approximately 6.2 amps. At the end of the energizing phase, the current is reduced to the holding current level of approximately 2.5 amps.

3 Hold phase:

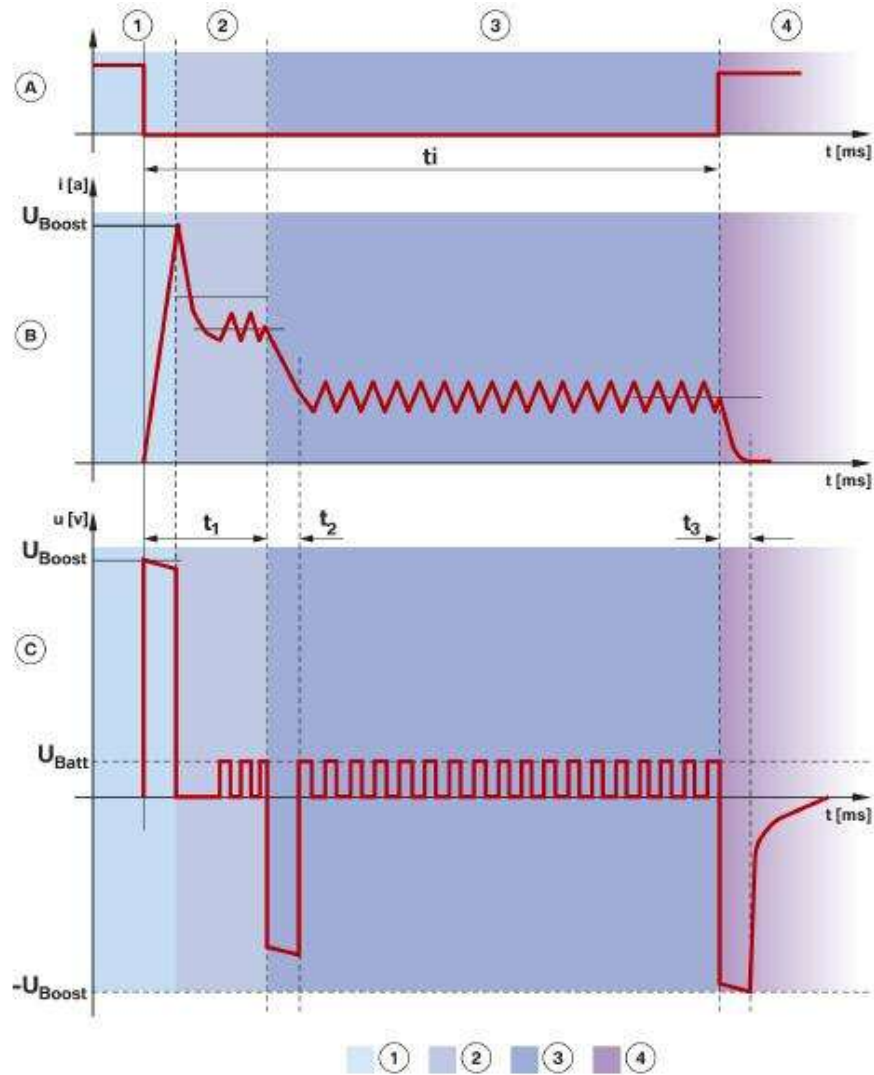
The energized HDEV5.2 is kept open by controlling the current at approximately 2.5 amps in the hold phase.

4 Switch off phase:

The current is switched off at the end of the injection time (in the switch off phase). At least 2 milliseconds elapse between two injection cycles.

Function

N55, actuation phases of the HDEV5.2



Index	Explanation	Index	Explanation
A	DME actuation signal	1	Booster phase
B	Current flow HDEV5.2	2	Energizing phase
C	Voltage at HDEV5.2	3	Hold phase
		4	Switch off phase