System Description
Electronic Engine Governor

EMR 2

DEUTZ®

Chapter

Contents

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1 Introduction

This system description provides an overview of the design and operation of the electronic engine governor (EMR 2) as a control unit when used in engines of the model series 1012/1013/2012/2013/1015[1)].

In addition, an explanation is given of the functions of the EMR 2 and how problems with the EMR 2 can be recognized and overcome.

The EMR 2 is a further development of the previously utilized EMR.

Basically, it has the same functionality as the EMR, but is equipped with additional functions and extensions that are summarized in Chapter 4.2.

Reference is made to Chapter 8 for information regarding replacements,

1) Same system with Bosch EDC-actuator (1015).

General notes

It is our aim to permanently improve and extend the contents of this brochure. For this purpose, the experiences of the circle of users can be particularly helpful.

Should you desire changes, extensions, improvements, etc., we would welcome your input (Engine maintenance technology department, VS-TI). Please make as much use of this as you wish. In this way, you are assisting in making the next version more up-to-date. We pay close attention to every message and will prepare a new issue of the brochure at the appropriate time. We thank you in advance for your cooperation.

Your

DEUTZ AG

Maintenance technology engines

2 Important Notes

2.1 Operating instructions

☞ **IMPORTANT!**
The purpose of this document is the explanation and clarification of the design and functions of engines, engine components and systems.
The information contained herein always corresponds to the technical conditions valid at the time of going into print and are not subject to any immediate alteration service.

☞ **IMPORTANT!**
Applicable for the operation, maintenance and start-up are exclusively the information of the published and currently valid technical documentation, corresponding to the scope of delivery and function (such as operating instructions, switching diagrams, workshop manual, repair and adjustment instructions, technical circulars, service information, etc.).

2.2 Installation guidelines

☞ **IMPORTANT!**
For the mechanical installation of the apparatus, reference should be made to the applicable issue of the “Installation Guidelines for electronic systems of DEUTZ diesel engines”. More information can be obtained from the DEUTZ AG, dept. technical operation support.

⚠ **REMARKS!**
Sufficient ventilation of control unit and actuator must be ensured in order to prevent limitations of function and damage.

2.3 Damage

⚠ **REMARKS!**
Sensors and actuators may not be fitted individually to, or between, power sources for either inspection or testing purposes but only in connection with the EMR 2, as there is a danger of destruction!

⚠ **REMARKS!**
Despite polarity reversal protection in the control apparatus, it is necessary to prevent incorrect polarity. Incorrect polarity can damage control units!

⚠ **REMARKS!**
The plug connections of the control units are only dust and watertight when plugged into mating connection! Until the mating connector has been plugged in, the control units must be protected against spray water!

2.4 Customer side wiring, plug connection

☞ **IMPORTANT!**
In order to attain the required protection class (IP 66) at the control unit, the individual wire seals, plugs and sealing rings provided must be used.

☞ **IMPORTANT!**
The connection between pins and individual wires must only be carried out with the proper pinching tools.

⚠ **REMARKS!**
The voltage supply for inputs and outputs for the users must be able to be switched in a de-energized manner via the key switch (terminal 15) - not via continuous positive.

2.5 Remove plug

⚠ **REMARKS!**
Removing the 25-pole equipment plug and engine plug when the control unit is on, i.e. when the voltage supply is on (terminal 15 on) is not permitted.

1. Voltage supply off
   - only then -
2. pull out equipment plug and engine plug

2.6 Electrical welding

⚠ **REMARKS!**
In order to prevent damage when carrying out ELECTRIC welding of the installation, the plug connections at the control unit must first be pulled out.

⚠ **REMARKS!**
The ignition (terminal 15) must be switched off when working at the EMR 2.

3 System Description

3.1 Utilization of the EMR 2

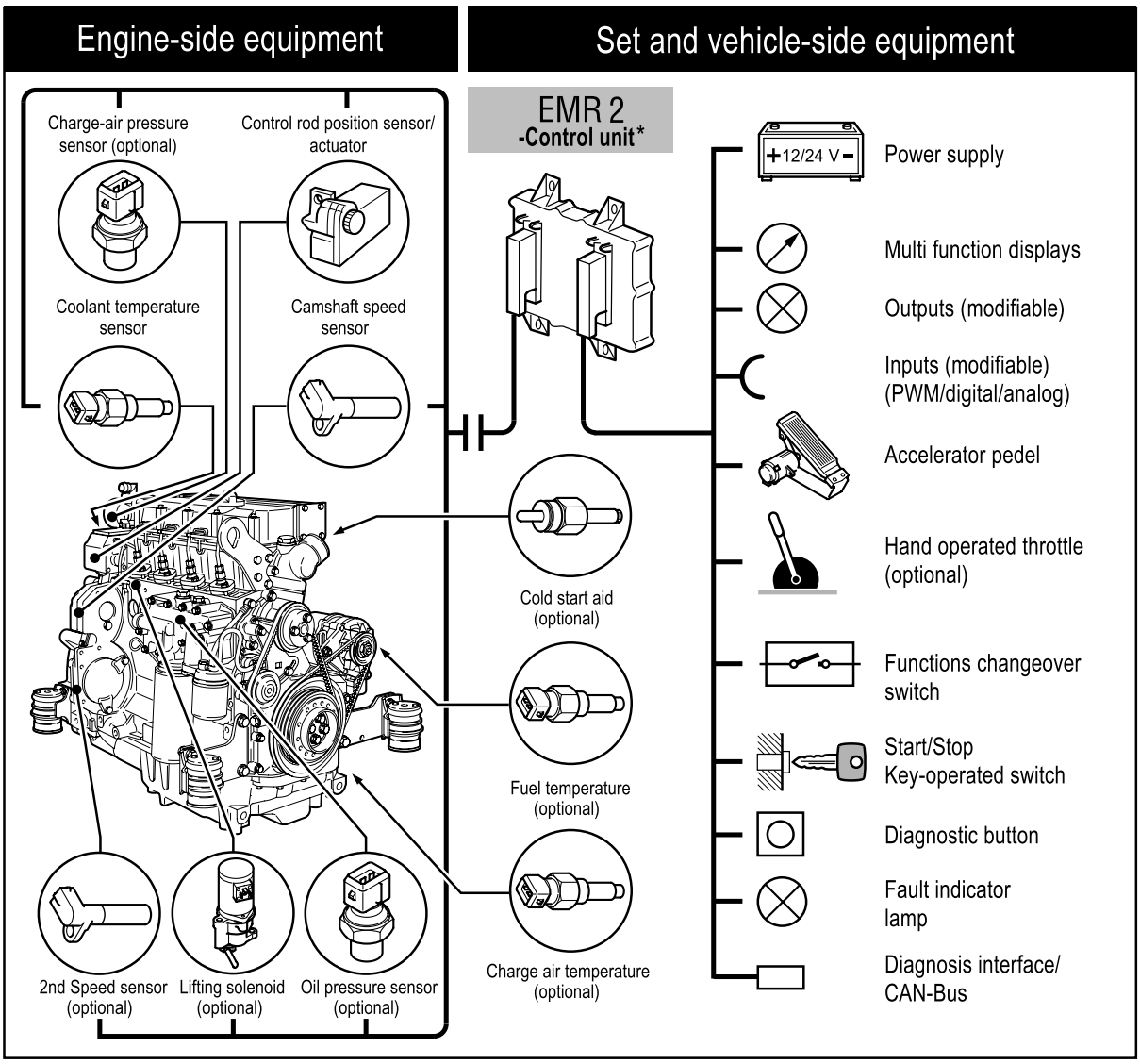
The purpose of the electronic engine governor (EMR 2) is the regulation of the speed of revolution of DEUTZ Diesel engines of the model series 1012/1013/2012/2013/1015 for applications in agricultural and construction machinery as well as in generating sets. It is designed for heavy duty also under difficult environmental conditions and possesses the corresponding protection classes.

The governor fulfils all the functions of the mechanical governor (variable speed governing, torque limitations, LDA function) and makes further functions available.

3.2 System overview

Basically, the EMR 2 consists of the sensors, the control unit and the actuator.
Engine-side as well as vehicle-side or plant-side installation are connected by means of separate cable harnesses to the EMR control unit. The cabling on the plant side is carried out by the vehicle or plant manufacturer.

For arrangement on the engine and plant/vehicle side, see the following figure.



*with atmospheric pressure sensor (otional)

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3.3 Description of functions

The sensors attached to the engine provide the electronics in the control unit with all the relevant physical parameters.

In accordance with the information of the current condition of the engine and the preconditions (accelerator pedal etc.), the EMR 2 controls an actuator that operates the control rod of the injection pump and thus doses the fuel quantity in accordance with the performance requirements.

The exact position of the regulating rod is reported back and, if necessary, is corrected, by means of the control rod travel sensor, situated together with the rotation magnets in a housing of the “actuator”.

The EMR 2 is equipped with safety devices and measures in the hardware and software in order to ensure emergency running (Limp home) functions (see Chapter 7.1).

In order to switch the engine off, the EMR 2 is switched in a de-energized fashion over the ignition switch. A strong spring in the actuator presses the control rod in the de-energized condition into the zero position. As a redundancy measure, an additional solenoid serves for switching off and this, independently of the actuator, also moves the control rod in the de-energized condition into the zero position.

After the programming, that is carried out over the ISO 9141 interface, the EMR 2 is possesses a motor-specific data set and this is then fixedly assigned to the engine. Included in this are the various application cases as well as the customer’s wishes regarding a particular scope of function. The result of this is that any later alteration must be reported back to the DEUTZ AG so that, in case of replacement anywhere in the world, the new control unit can be programmed with the current data set.

3.4 Basic equipment

Besides the control unit, the following components are required as **minimum equipment** for the operation of the engine:

Vehicle side:

- Energy supply (battery)
- Diagnostic interface (ISO 9141)
- Fault lamp/diagnostic lamp
- Diagnostic button
- Set point selection
- Key operated switch
- Function change-over switch
- Cable harness

Engine side:

- Actuator (contains control rod travel sensor and positioning magnet)
- Speed sensor (camshaft)
- Coolant temperature sensor (NTC)
- Cable harness

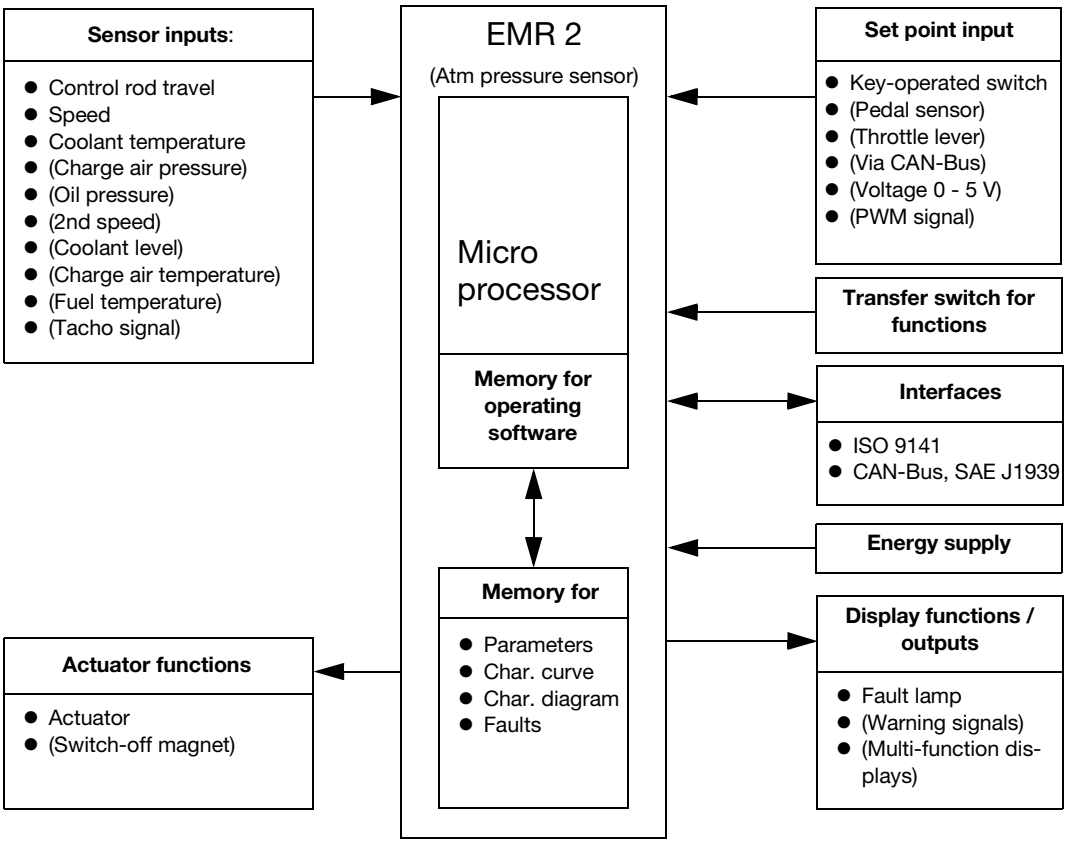
Further components and installation are possible depending on the application case or the desired functions (see chapters 4 and 6). The combination can be selected from the DEUTZ pocket handbook.

4 System Functions

The EMR 2 makes a broad range of functions available and these can be activated by the application-dependent configuration and the allocation of the inputs and outputs. It makes possible signal exchange between the engine (via the engine plug) and the EMR 2, as well as between the vehicle (via the vehicle plug) and the EMR 2. The signals can be transmitted as analog, digital, impulse modulated (PWM signals) and as CAN-Bus messages.
Which functions are used, depends on the application conditions of the engine. Correspondingly, there are different variations of the functions and the pin assignments of the plugs.

The functions of the EMR 2 refer to the speed control, quantity limitations (fuel injection), monitoring, vehicle and apparatus functions and communication and diagnostic interfaces.

The EMR 2 offer a basic equipment on which all the optional variations can be structured.



The functions shown in brackets are optional.

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Because of the numerous possibilities of combinations, DEUTZ has defined function ranges. These can be crossed off in the DEUTZ pocket handbook. The switching diagram for each function range should also be noted especially for the wiring required on the customers side.

4.1 Overview features

Feature	Chapter	Description
Speed control	4.3	As variable speed, idling/end or fixed speed governor; choice of switchable governor features during operation, freezing the current speed, fixed speed governor for network synchronization or load distribution, overdrive speed
Set point input	4.4	By means of ● Pedal sensor and/or hand throttle ● External voltage signal (0 - 5 V) ● CAN Bus (remote electronics) ● Fixed speed signal (genset operation) ● Pulse width modulation (PWM) ● Touch control operation Up/Down (digital) Optimal adaptation to different applications
Torque limitation	4.5	Up to three performance curves can be set independently of each other within the framework of the engine limits
Governor behaviour (speed droop)	4.6	Constant, variable or switchable speed droop from 0 - 80 % for adaptation to the application
Engine Start/Stop	4.7	Engine switch-off by means of EMR actuator (additional safety using switch-off solenoid possible)
Monitoring and signal output functions	4.8	Coolant temperature and level, oil pressure, charge air temperature, fuel temperature → fault display and/or performance reduction or engine switch-off for engine protection
LDA function	4.9	Smoke limitation through charge air pressure and/or temperature-dependent limitation of the adjustment speed of the injection
Temperature-dependent start control	4.10	Improving the starting ability, gentle cold start without smoke ejection
Altitude correction	4.13	Engine protection because of reduced air pressure
Fuel volume correction	4.14	Compensation for loss of performance due to fuel heating
Emergency running	4.15	Emergency running after failure of set point signal (e.g. using accelerator pedal), the charge air sensor or the vehicle speed signal
Selection of cold start help installations	4.16	Failure of auxiliary control units, EMR 2 controls a selection of heating flange, glow plugs or flame starting apparatus
Data communication	5	Interfaces, diagnostics and programming
Output of fault fault blink codes	7.2	Simplified fault diagnosis

4.2 Function extensions

The EMR 2 has the same functions as the EMR but possesses extended and new functions.

The **new** functions in detail are:

- Improved speed control
- Third performance curve
- Smoke limitation = function of the charge air temperature
- Monitoring the charge air temperature, coolant level
- Altitude-referenced fuel quantity
- Control of an engine brake
- Special set point parameter for genset applications
- Special vehicle speed evaluation to DIN 11786
- New functions via the diagnostic button:
  - fault blink codes
  - clearing the fault memory 1
- 2 Independent fault memories (mirroring the first fault memory)
- Acquisition of a load collective
- Baud rate alteration for ISO communication possible
- Possibility of a software update for the operating software via the ISO interface
- Newly introduced or changed commands in ISO communication
- CAN Bus protocol to SAE J1939 has been greatly extended, but is upwards compatible to the present EMR applications.

Caution!

EMR and EMR 2 are separate systems. An exchange of control units and actuators is not possible (see Chapter 8).

4.3 Speed control

Provision is made for various variations of speed control that must be programmed in advance (at the end of the programming) depending on the application case (power generation, building or agricultural machines) and usage conditions. The variations depend on the type of programmed and the selected functions.

The following types of speed regulation (switches) are optional and are programmed at the works depending on the variant (pin assignment see Chapter 6.1):

Function	Variant	Description	Remarks
Variable speed control	Variable speed governor[1)]	Pure variable speed governor without addition and switch-over functions	Only one variant can be selected
	Fixed speed governor	Variable speed governor with fixed, pre-defined speed for gensets (1,500 or 1,800 rpm), desired speed of rotation is defined in the scope of customer supply (KLU).	
	Change-over switching speed 1 / 2[2)]	Variable speed governor with change-over switching possibility between two speeds.	
	Change-over switching speed fixed/ variable[2)]	Variable speed governor with change-over switching possibility between a fixed programmed and a variable speed of revolution.	
	Speed variable / freeze[2)]	Variable speed governor with change-over switching possibility between: freezing a current desired speed as set point independent of the pedal setting, and a variable revolution.	
	Speed memory function	Customer-specific solution for storing and calling up two speeds of revolution.	
Genset applications	Power generation governor with adjustable speed range	As for change-over switching fixed/variable speed. **Without Load** the speed can be adjusted in the speed range.	See also system description EMR Genset, TN 0297 9939
	Power generation for network synchronisation or Load distribution	As for change-over switching fixed/variable speed. The variable revolutions can be adjusted in the revolution range for network synchronization or load distribution.	
	Power generation governor with adjustable speed and switchable overdrive speed	As for change-over switching fixed/variable speed the power generator, in fixed speed mode, can be used as the overdrive speed without loading, in variable mode or for parallel switching.	
Variable speed-, Min/Max-control	Variable speed, Min/Max governor[2)]	Switching over between variable speed and Min/Max control.	
Min/Max-control	Min/Max governor[1)]	Idling and end revolutions for vehicle applications.	

1) Types of speed control

Variable speed control
For this type of control the speed of the engine is governed or kept constant with reference to the desired speed of revolution. For changes of load, the new required amount of fuel is set in accordance with a PID control. The desired value can be determined through various variants.

Min/Max control
For this type of control, the fuel injection quantity is determined on the basis of the desired value. the result of this is that, for this type of control, a speed of revolution depending on the load situation is set. The idling (= Minimum) and the end revolutions (= Maximum) are controlled taking into account the control parameter speed droop 1 and speed droop 2. The basis for this type of control is the drive characteristic field.

2) Change-over switching see point 4.3.1.

4.3.1 Switchable speed functions

The conditions for the switchable variants are selected by means of a switch (Input pin 18, GND pin 17 V plug). The switch closes a contact to $-U_{Batt}$.

The following is applicable for the switchable speed functions:

Switchable speed functions (for a selectable)	Switch open[1] (1/HIGH)	Switch closed (0/LOW)
Speed 1/ speed 2	Speed 1	Speed 2
Fixed / variable speed	Variable	Fixed
Speed variable / freeze	Variable	Freeze
Variable speed governor / Min/Max governor	Variable speed governor	Min/Max regulator

1) With an open switch, the underlined conditions above are activated as preset values (default values).

The switching condition can be displayed with the aid of the SERDIA diagnostic software (see Chapter 7.3)

4.3.2 Second speed input (optional)

This input can be used as a redundant speed input. If a second speed sensor has been installed, then the engine will not be switched off on failure of the first speed sensor but will switch over to the second one. The failure of a speed sensor is indicated by the continuous burning of the fault lamp. The operation of the engine can be limited by defining a lower desired speed (see also Chapter 7.1).

4.3.3 Excess speed protection

when the speed limit is exceeded, the EMR 2 moves the control rod into the Stop position. The output, engine switch off (Digital 3, M 2) is activated (if it is programmed) and a fault message is generated.

With applications in mobile machines the thrust mode is programmed as a safety measure.
Exceeding of the revolution limit can occur in thrust mode. In this case the control rod is moved to the zero position and the fault lamp lights up. The engine is protected against excess revolutions also in this type of operation.
After falling below the programmed recovery limit, the governing is again taken up and the fault lamp is extinguished. The parameters “Above speed limit” and “Recovery limit” are adjustable.

4.4 Set point settings

The following variants for the set point settings of the governor can be configured:

Function	Variant	Description	Remarks
Set point setting	Accelerator value sensor (SWG 1)	Setting with potentiometer (5 V reference voltage, max. 30 mA[1)], typ. 1 kΩ linear, pin 25, input pin 24, GND pin 23, V-plug[2)])	
	Voltage	Setting by means of external voltage (0.5 - 4.5 V, input pin 24, GND pin 23, V-plug)	Replacement for pedal value sensor
	Hand throttle (SWG 2)	Setting with hand throttle. The set point in the EMR 2 is determined by means of a maximum function (5 V reference voltage, max. 30 mA[1)], typ. 1 kΩ linear, pin 25, input pin 20, GND pin 23 V-plug)	
	Memory function	Freezing the current engine speed	Only possible in connection with the pedal value sensor (SWG 1)
	CAN	Setting via the CAN interface (see Chapter 6.1)	CAN = Controller Area Network
	Internal (fixed speed)	Setting via internal parameters. The parameter is determined in the customer scope of supply (KLU).	For gensets
	PWM signal 1 PWM signal 2	The desired value is set by means of an external PWM signal (frequecyz=100 Hz) with a modulation of 5 % to 95 % (see Chapter. 9.2) Input pin 18 or 20, GND pin 17 V-plug	Auxiliary for pedal value sensor

1) PIN 25: I_{max}=30 mA (Pedal value sensor and hand throttle combined).
2) V*plug = Vehicle plug / GND = Ground.

4.5 Fuel quantity limitation (performance curve)

In order to set the engine performance and the desired torque course, the maximum injection quantity/ thrust must be limited in accordance with the settings.

Provision is made in the EMR 2 for three performance curves. The performance curve is created as a characteristic curve with 13 freely selectable speed support points. The sampling points must be support points, whereby the sample of the engine is carried out with performance curve 1. The performance curve 2 is correspondingly corrected with the correction data of performance curve 1.

Function	Variant	Description	Remarks
Performance curve	Performance curve 1	Quantity limitation with a performance curve (performance curve 1)	Only 1 variant can be selected
	Performance curves 1/2	Switching between two performance curves	
	Performance curves 1/2/3	Change-over switching only via CAN	

Performance curve change-over switching (Input) pin 19, GND pin17 V-plug	Switch open (1/HIGH)[1)]	Switch closed (0/LOW)
Performance curve 1/ performance curve 2	Performance curve 1	Performance curve 2

1) With open switches, the underlined conditions above are activated as default values.

4.6 Droop control

One of the features of the electronic governing is that, in contrast to mechanical governors, the P-Gradient can be set to 0 % and switched over between two defined P-gradients. The maximum value lies at 80 %.

For limiting the P-gradient relationship of the mechanical governor, provision is made for a speed-dependent P-gradient function by means of a characteristic curve with eight speed support points.

Function	Variant	Description	Remarks
P-gradient	Constant P-gradient	P-gradient is constant within the whole speed range.	Only one variant can be selected
	Variable P-gradient	Speed-dependent P-gradient	
	P-gradients 1/2	Switching between two fixed P-gradients	
	Constant/variable	Switching between constant and variable P-gradients	

4

Switchable variant pin 21, GND pin 17 V-plug	Switch open (1/HIGH)[1)]	Switch closed (0/LOW)
P-Gradient 1/ P-Gradient 2	P-gradient 1	P-gradient 2
Constant / variable P-gradient	Constant	Variable

1) With open switches, the underlined conditions above are activated as default values..

4.7 Engine start/stop

As soon as the control apparatus recognizes the start-speed, the control rod is freed for the start.
For switching the engine off, the EMR 2 must be switched via the key-operated switch in a de-energized manner. With this setting, the controlling rod is moved to the stop position by the spring action of the actuator and/or the redundancy solenoid.
The switching off of the engine can also be triggered by a fault in the EMR 2 (see Chapter 7.1, Self-Diagnostic).

Function	Variant	Description
Engine start/stop	Switching off with the EMR 2 actuator	In a de-energized condition, the EMR 2 actuator moves the control rod into the stop position and switches the engine off
	Redundant switching-off with the solenoid (pin M 2[1)] and M 1)	In addition, the engine is switched off by means of a solenoid (must be programmed in the control unit)

1) M 2: Engine plug, pin 2

4.8 Displays / Outputs (monitoring function)

By means of the digital PWM outputs and depending on the configuration, various signals can be displayed and output.

Fault lamp (Pin 4 vehicle plug)

A red fault lamp must be placed where it is easily visible at the customer apparatus side. The fault lamp serves as a rough estimate of the fault that has occurred; here the following means:

- Lamp 2 s on: Self diagnosis with switched on the voltage supply. Result: There are no faults.
- Continuous light: There is a fault message; however the system is operational (possibly limited).
- Flashing: Serious malfunction - engine will be switched off or engine cannot be started.
- Blink code: Query malfunction locality by means of diagnostic button.

For detailed information see Chapter 7.1.

Output signals (maximum of 4 output signals possible)

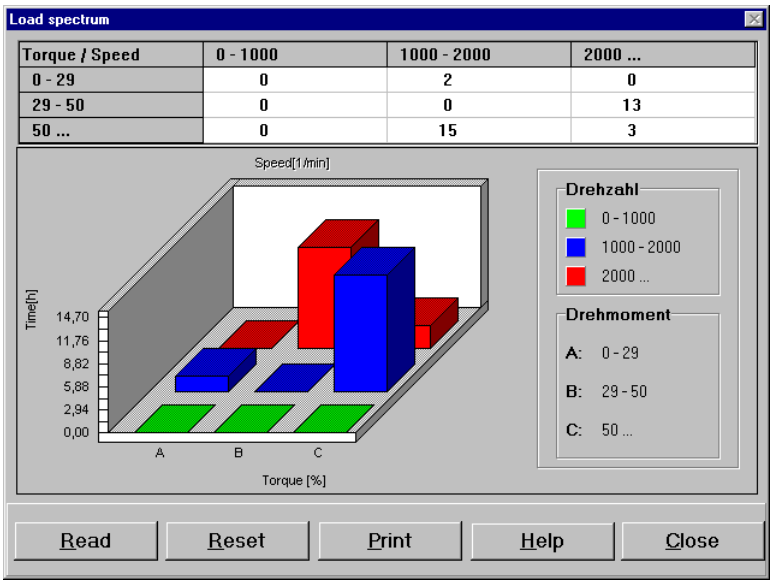
Function	Variant	Description
Display functions	Speed 1 (pin 16, vehicle plug)	Corresponding to the (No. of teeth on gear wheel) symmetrical square signal (Voltage level from 0 V to $+U_{Batt}$)
	Torque (pin 5, vehicle plug)	PWM signal (100 Hz) with button relationship from 5 to 95 %. Reference value: performance curve in the working point or M_{dMax}
	Warning signal coolant temperature (pin 3, vehicle plug)	Overstepping limiting value High/Low change-over switching
	Warning signal oil pressure (pin 15, vehicle plug)	Speed-dependent oil pressure control High/Low change-over switching
	Warning signal charge air monitor (pin variable)	General display for overstepping or falling below the limiting values
	Freely selectable digital output signal	By arrangement
	Freely selectable measuring or calculation value (PWM- signal)	

4

Load collective

The EMR 2 measures the loading of the engine. For this purpose, the respective load and revolution regions are allocated to the engine operating hours.

S1 to S9 are operating hours within the respective sector.



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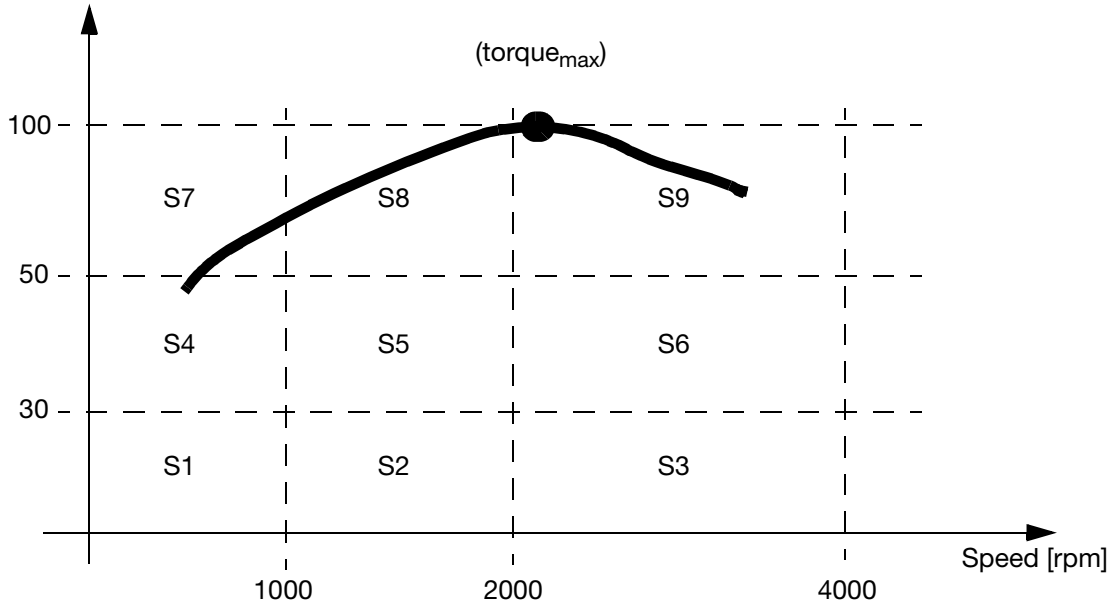
Torque referred to $torque_{max}$ [%]



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The load collective can only be displayed and printed with SERDIA.

4.9 LDA function

For mobile applications, the injection quantity for acceleration and dynamic load increase is limited with reference to the charge air pressure (smoke quantity-characteristic field). Usage: protection of the exhaust turbo supercharger and prevention of smoke ejection.

4.10 Temperature-dependent start control

In order to prevent smoke ejection and for optimizing the governing relationship, the start quantity, the speed ramp and the governor parameters are controlled with reference to the temperature (required basic function).

4.11 Speed throttling (input F 7)

This function is designed for a driving speed evaluation is accordance with DIN 11786.

4.12 Engine protection functions

All monitoring functions can be provided with a message lamp on the plant side (dependent on the scope of the function and the pins that can be assigned).

Oil pressure monitoring

The user is warned by means of the message lamp when

- the oil pressure has overstepped the warning limit and/or
- after a pre-warning period, the performance has been reduced by the EMR 2, or
- the oil pressure falls below the switch-off limit and, after a pre-warning period, the engine is switched off.

Coolant temperature monitoring

The user is warned by means of the message lamp when

- the temperature exceeds the warning limit and/or
- after a pre-warning period, the performance has been reduced by the EMR 2, or
- the temperature exceeds the switch-off limit and, after a pre-warning period, the engine is switched off

Charge air monitoring

The user is warned by means of the message lamp when

- the temperature exceeds the warning limit and/or
- after a pre-warning period, the performance has been reduced by the EMR 2, or
- The temperature exceeds the switch-off limit and after a pre-warning period, the engine is switched off.

Coolant monitoring

The user is warned by means of the message lamp when

- the coolant level falls below the warning limit and/or
- after a pre-warning period, the performance has been reduced by the EMR 2, or
- the the coolant level falls below the switch-off limit and, after a pre-warning period, the engine is switched off.

4.13 Altitude correction

The altitude correction is carried out by means of an Atmospheric pressure sensor in the control unit. Two different control unit variants are offered (with and without atmospheric pressure sensor).

4.14 Fuel volume control

Compensation for loss of performance due to fuel heating. Necessary variant with fuel temperature sensor.

4.15 Emergency running (limp home)

The EMR 2 provides comprehensive emergency running functions that are configured depending on the field of application. These functions are necessary in order that, in an emergency, the operation can be continued with auxiliary speed. In detail, this function can be activated by

a) set point default
b) charge air pressure
c) vehicle speed signal and/or
d) speed acquisition

It is also possible by the failure of the set point default to switch over via CAN Bus

a) on the accelerator pedal and
b) on auxiliary speed

The respective type of malfunction is defined in the fault memory.

4.16 Cold start installation

Failure of additional control units; if desired EMR 2 controls heating flange, glow plugs or flame start installation.

5 Interfaces

The EMR 2 is equipped with various interfaces. The wiring is carried out on the customers side and must be integrated in the vehicle plug. For pin assignment see the application-dependent switch diagrams.

5.1 Diagnostic interface (basic function)

The end programming of the EMR 2 is carried out via the serial diagnostic interface (according to ISO 9141).

With the aid of a PC connected to an interface and the SERDIA (see also Chapter 7.3) diagnostic software - measuring values, error messages and other parameters can be displayed and set - depending on access authorization. Furthermore, new control units can be programmed.

Communication is only possible with the electric power switched on.

5.2 CAN-Bus interface

The CAN-Bus interface (Controller Area Network) is increasingly being used in vehicles and is suitable for measuring values and data exchange with one or more apparatus-side control units (hydraulics, drive control, etc.). The SAE J1939 protocol is utilized for communication.

The following is an aid to utilization of the respective scope of functions:

- Selection according to the DEUTZ pocket handbook
- Definition before supply of engine
- Connection in accordance with connection diagram (see Chapter 12.1 to 12.3)

Subsequent changes to the configuration is only possible in conjunction with the DEUTZ operating partner and the aid of SERDIA (see Chapter 6).

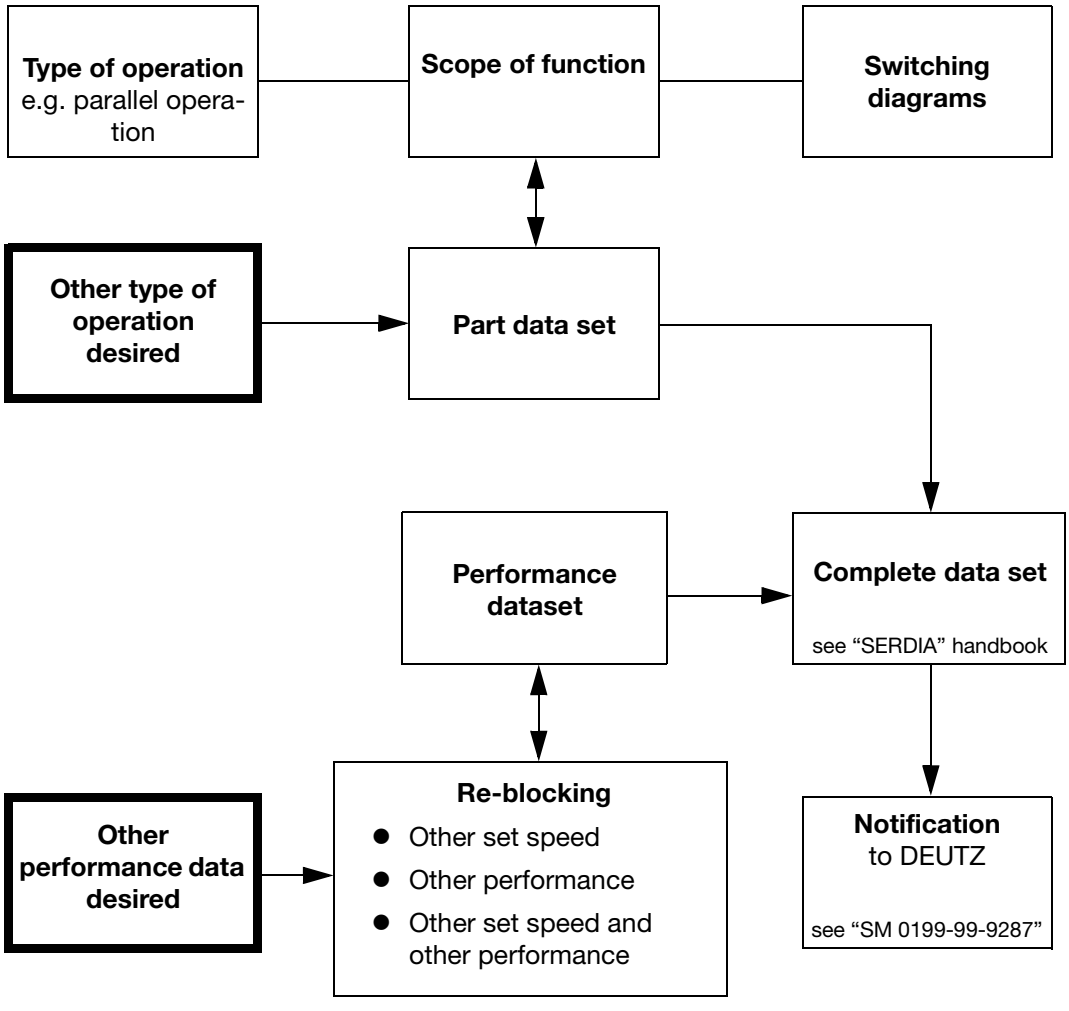
6 Configuration and Parameter Setting

The EMR 2 is specially programmed and configured for each individual engine, which means that the EMR 2 contains a specially engine-specific data set. Configuration is carried out via the externally accessible diagnostic interface (ISO 9141) and is strongly dependent on the customer's wishes, from the application cases and from the behaviour of a vehicle in operation.

Access to the various parameters is protected (by password) by means of access authorizations organized on four levels and can only be carried out by authorized personnel.

More than 1200 different parameters are available. Access to these parameters, as well as to other data, can be carried out by means of the special SERDIA diagnostic software installed on a PC (see Chapter 7.3).

☞ **Important!**
Rebuilding, as well as alteration to the parameters can only be carried out in conjunction with the corresponding DEUTZ operating partners. For this purpose SERDIA Level III is required.
In connection with the above-mentioned possibilities, the changed data sets must be reported back to DEUTZ (see Service Note No. 0199-99-9287).



6.1 Function overview, pin assignment and configuration example

Summarized function overview with examples of function selection

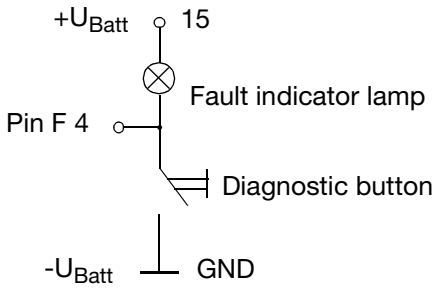
The user-referenced selection is carried out using the DEUTZ pocket handbook

Functions	Plug engine/vehicle	Pin	Input/Output	Scope of function (Example[1)])
Scope of function				0211 2291
Model No.				0029 3766
No. of connection diagram engine side				0419 9752
No.of connection diagram vehicle/plant side				0419 9780
Sensor inputs				
Speed sensor 1 (camshaft)	E	12, 13	E	●
Speed sensor 2 (crankshaft)	E	10, 11	E	-
Charge air sensor (LDA function)	E	23, 24, 25	E	-
Oil pressure sensor	E	20, 21, 22	E	●
Atmospheric pressure sensor (in control unit)	-	-	-	-
Coolant level sensor	E	6, 8	E	-
Charge air temperature sensor	E	4, 8	E	-
Fuel temperature sensor	E	5, 8	E	-
Coolant temperature sensor	E	9, 8	E	-
Control rod travel sensor	E	16, 17, 18, 19	E	●
Actuator functions				
Operating solenoid	E	14, 15	A	-
Dig. output (PWM)	E	3	A	-
Solenoid	E	2	A	●
Default functions (set point defaults via)				
Hand throttle	V	23, 20, 25	E	-
Voltage	V	23, 24	E	-
Accelerator pedal (potentiometer)	V	23, 24, 25	E	●
CAN	V	12, 13	E/A	●
PWM signal 1	V	17, 18	E	-
PWM signal 2	V	17, 21	E	-
Memory functions				
Fixed speed (upper limit)	V	17, 18	E	-
Fixed speed (lower limit)	V	17, 21	E	-
Freeze current speed	V	17, 19	E	-
Limit fuel quantity of a performance curve				●
Switch-over functions				
speed 1 / 2	V	17, 18	E	-
Fixed / variable speed	V	17, 18	E	-
Freezing / variable speeds	V	17, 18	E	-
Variable speed governor min/max regulation	V	17, 18	E	-
Performance curve1 / 2	V	17, 19	E	-
Performance curve1 / 2 / 3 (via CAN)	V	12, 13	E	-
P-gradient 1 / 2	V	17, 21	E	●
P-gradient const. / variable	V	17, 21	E	-
Key-operated Start/Stop, energy supply	V	1, 14		●
Display / output functions				
Fault lamp	V	4, (Cl. 15)	A	●
Warning coolant temperature	V	3, (Cl. 15)	A	●
Warning oil pressure	V	15, (Cl.15)	A	●
speed	V	16, (Cl. 15)	A	-
Torque (reserve)	V	5, (Cl. 15)	A	-
Warning monitoring charge air				-
Freely selectable digital output signal				-
Freely selectable measuring or calculation value				-
Load collective				●
Diagnostic interface				
ISO 9141-L	V	10	E/A	●
ISO 9141-K	V	11	E/A	●
CAN-Bus (SAE J1939 protocol				
CAN-H	V	12	E/A	●
CAN-L	V	13	E/A	●

1) Above example applicable to genset series 1012/1013, single frequency generating sets.

7 Diagnostic Button and Fault Indicator Lamp

Diagnostic button and fault indicator lamp must be placed in the vehicle or plant on the customer side. They can be used for diagnosis.



Diagnostic button switch diagram

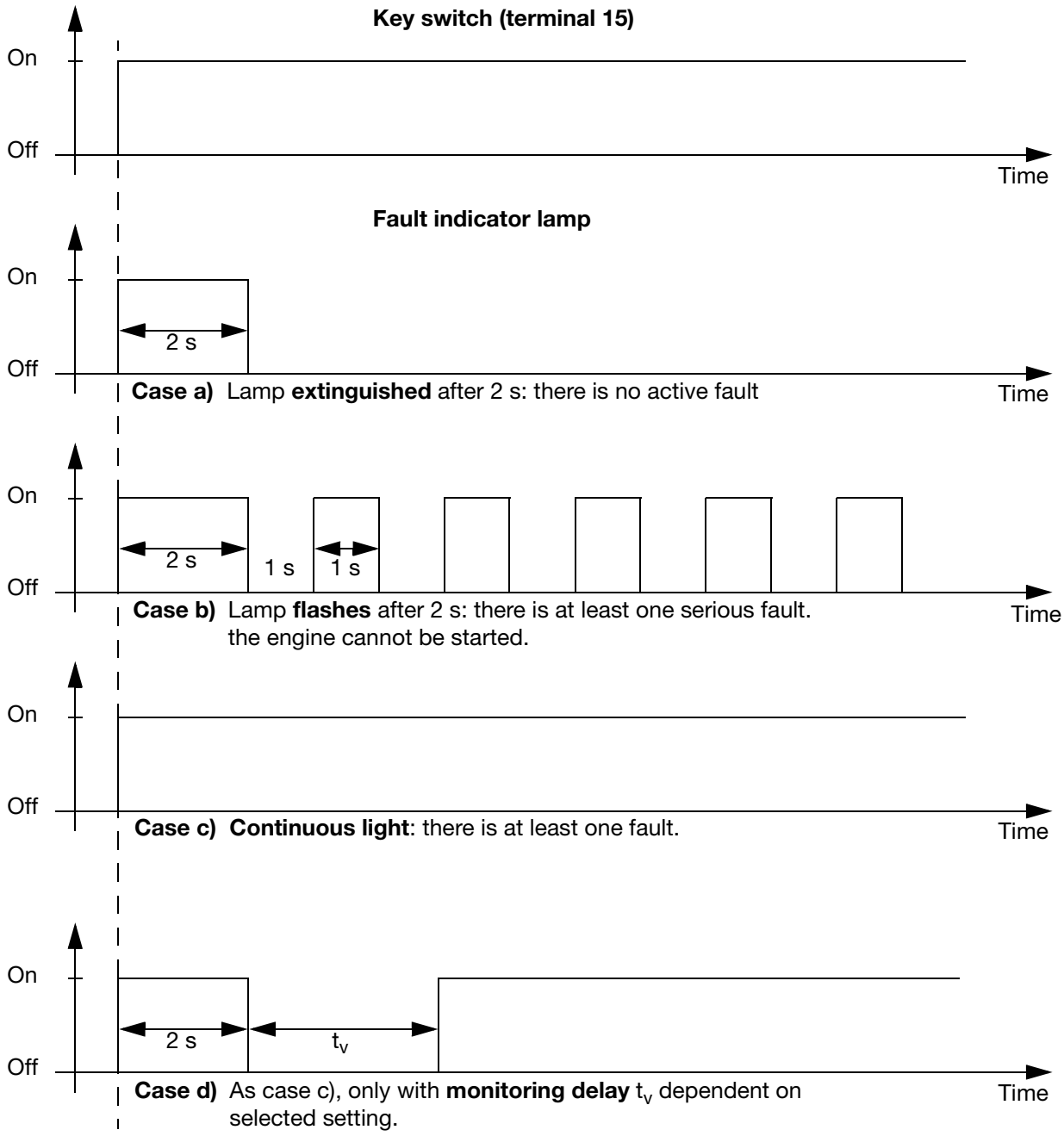
7.1 Self-diagnostic (without operating the diagnostic button)

The EMR 2 possesses numerous protection functions for the engine - depending on the available measuring points or sensors. Depending on the seriousness of the recognized fault, the engine may run on in reduced mode (limp home), whereby the fault indicator lamp is continuously lit, or the engine is switched off, whereby the fault indicator lamp flashes.

A lit fault indicator lamp indicates an error in the wiring (short circuit, cable break) or a defect in the displays of the corresponding sensors. A further source of faults could be falling below or exceeding the measuring value limits (see Chapter 9.4).

Faults in the electronics are registered or stored in the control unit and shown by the fault indicator lamp. The fault indicator lamp is extinguished as soon as the fault has been removed. Only when the electronics has been switched to emergency running (-speed), need the engine be switched off briefly with the key-operated switch in order to extinguish the fault indicator lamp.

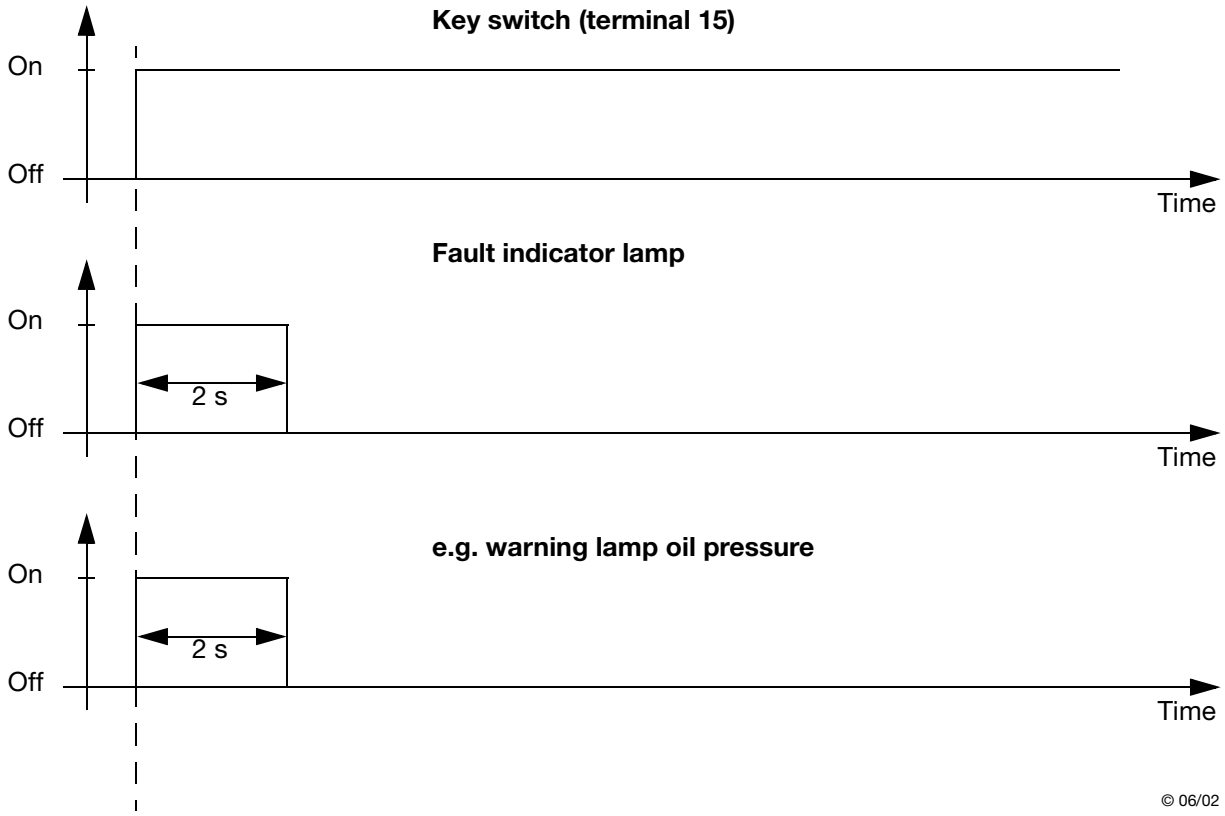
Also corrected or non-current faults remain stored in the control unit and can be read out or deleted with the SERDIA diagnostic software (see Chapter 7.3).


Key switch (terminal 15)
On
Off
Time
Fault indicator lamp
On
Off
2 s
Time
Case a) Lamp extinguished after 2 s: there is no active fault
On
Off
2 s
1 s
1 s
Time
Case b) Lamp flashes after 2 s: there is at least one serious fault.
the engine cannot be started.
On
Off
Time
Case c) Continuous light: there is at least one fault.
On
Off
2 s
t_v
Time
Case d) As case c), only with monitoring delay t_v dependent on selected setting.

7

Function control of the configured warning lamps

With the activation of the key switch (pin 15), the warning lamp is also switched on for the duration of the self-diagnostic (2 s).



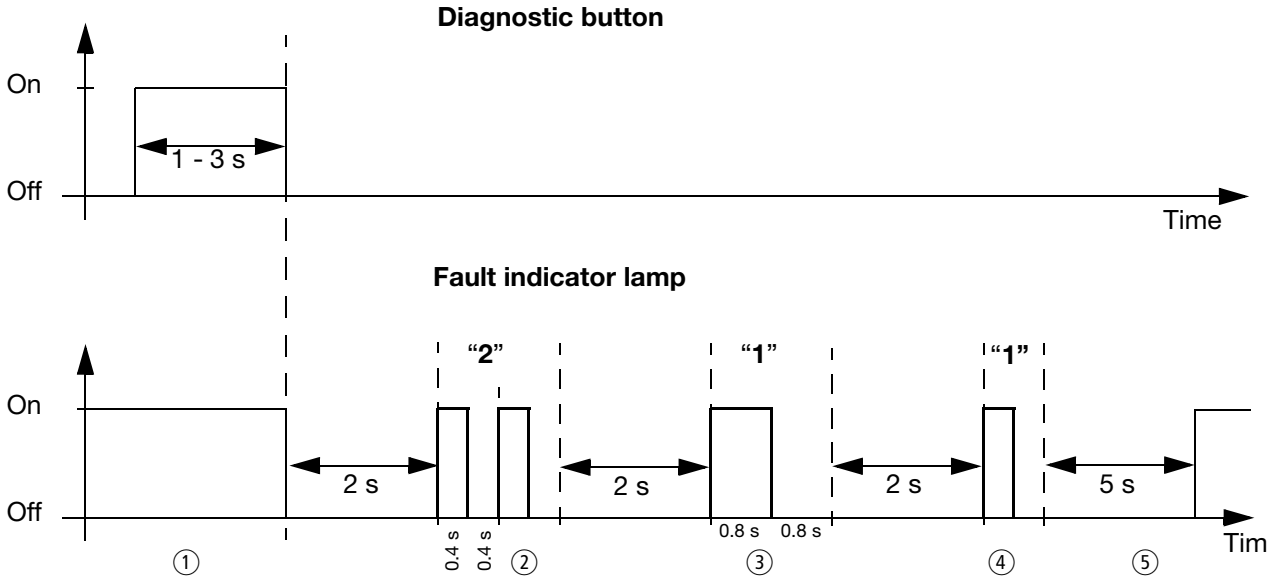
7

7.2 Diagnostic with Button and Error Code

With the diagnostic button there is the possibility of reading out the existing faults as blink codes and to delete the fault memory 1. The Diagnostic button and the fault indicator lamp are situated in the moving part of the vehicle.

7.2.1 Reading out a current fault memory blink codes

The fault indicator lamp shows a fault, e.g., it flashes or lights continuously. The Diagnostic button is depressed for a time period of 1 s to 3 s. The EMR 2 recognizes the request for a read out and starts to display the faults. (see blink code overview, Chapter 7.2.3). The read-out of the blink code is only possible after extinguishing of fault indicator lamp or after the initialization phase of the operating program. This means that the fault indicator lamp can also show continuous lighting after switching on if a fault has been recognized already after switching. The EMR 2 only shows **active** faults as blink codes.



In the following the steps for reading out the first blink code are shown:

① The fault indicator lamp indicates a fault, e.g. it flashes of lights continuously.

- Press diagnostics buttons 1 to 3:
  the flashing or continuous light of the fault indicator lamp is extinguished.

② After 2 s:
recognition by the EMR 2 (2×short flashes).

- Output of the flashing sequence of the first stored fault.
  (example: fault number 01, "speed sensor 1"):
  ③ after 2 s: 1×long
  ④ after 2 s: 1×short

- After fault code output
  ⑤ 5 s pause, then display of flashing or continuous light.

Steps for reading out the next fault:

① The fault indicator lamp indicates a fault, e.g. it flashes of lights continuously.

- Press diagnostics buttons 1 to 3:
  the flashing or continuous light of the fault indicator lamp is extinguished

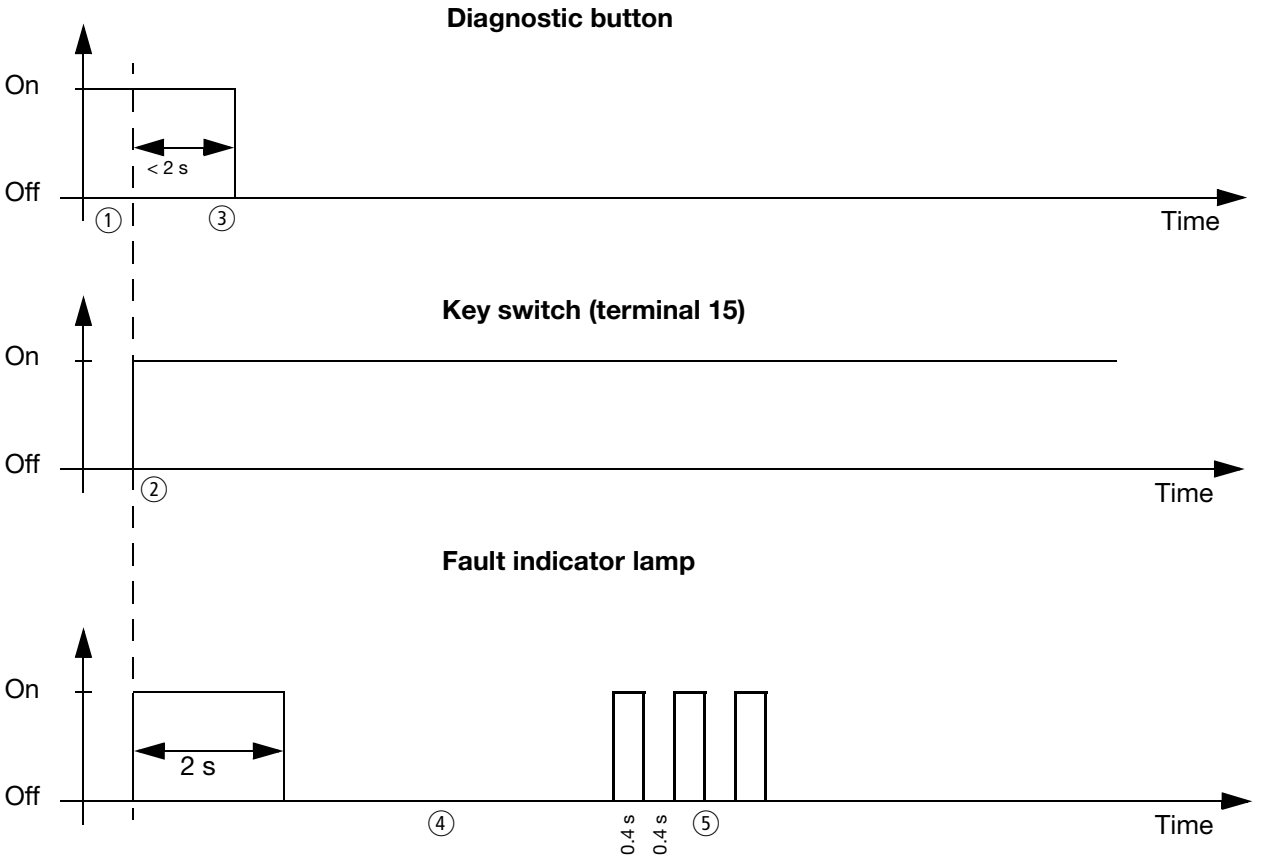
② After 2 s:
recognition by the EMR 2 (2×short flashes).

- The next blink code is output (③, ④)
- After fault code output
  ⑤ 5 s pause, then display of flashing or continuous light.

The steps can be repeated until the last stored fault code is output. After that, the first fault code is shown again.

7.2.2 Deletion of the fault memory 1

The EMR 2 has two fault memories (1 and 2). Every fault is stored in both memories at the same time. With the aid of the diagnostic button it is possible to delete **passive** faults in fault memory 1. The fault memory 2 can only be deleted with SERDIA.



The following shows the steps for deleting the fault memory 1:

① Press, and keep depressed, the diagnostic button.

② Switch ignition on.

③ Whilst the fault indicator lamp is lit up (duration 2 s) release diagnostic button.

④ All **passive** faults in faults in fault memory 1 are deleted.

⑤ The deletion process is confirmed by three short flash impulses.

7.2.3 Fault blink code overview

Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	Blink code short 0,4 s	Blink code long 0,8 s	Blink code short 0,4 s	FMI	SPN	Cause	Remarks	Help
Zero error display	-	No faults	**2**	**-**	**-**	31	524287	No **active** faults present		
Revolutions / speed acquisition	01	Speed sensor 1	**2**	**1**	**1**	8	190	Sensor failure. Distance from gear too far. Additional fault impulses. Cable joint interrupted.	Governor in emergency operation (if sensor 2 available). Emergency switch-off (if sensor 2 not available or failed).	Check distance. Check cable connection. Check sensor and replace if required.
	02	Speed sensor 2	**2**	**1**	**2**	8	190		Governor in emergency operation (with sensor 1) Emergency switch-off (if sensor 1 not available or failed).	
	03	Speed sensor	**2**	**1**	**3**	8	84	Tacho failed. Additional fault impulses. Cable connection interrupted.	Governor in emergency operation. (see Chapter 4.15).	Check cable connection and Tacho. Replace if required.
	04	Excess speed switch-off	**2**	**1**	**4**	0	190	Speed was/is in excess of limit.e.	Engine stop. (see Chapter 4.3.3)	Check parameter (21). Check speed settings.
								Check PID setting. Check rods. Check actuator and replace if required. Check cable to actuator (impulse on incorrect speed). Check No. of teeth. For vehicles check for possible thrust mode.		
Sensors	05	Set point sensor 1 accelerator pedal)	**2**	**2**	**1**	2	91	Fault at corresponding sensor entry (e.g. short circuit or cable break).	See Chapter 4.15 influencing fault reaction. With failure of the sensor, the associated monitoring function is de-activated.	Check sensor cable. Check sensor and replace if required. Check fault limits for sensor.
	06	Set point sensor 2 (hand throttle)	**2**	**2**	**2**	2	201			
	07	Charge air pressure	**2**	**2**	**3**	2	102			
	08	Oil pressure	**2**	**2**	**4**	2	100			
	09	Coolant temperature	**2**	**2**	**5**	2	110			
	10	Charge air temperature	**2**	**2**	**6**	2	105			
	11	Fuel temperature	**2**	**2**	**7**	2	174			

Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	Blink code short 0,4 s	Blink code long 0,8 s	Blink code short 0,4 s	FMI	SPN	Cause	Remarks	Help
Functional fault warning	30	Oil pressure warning	**2**	**3**	**1**	1	100	Oil pressure below speed-dependent warning line characteristic	Fault message (disappears when oil pressure is again above recovery limit). After a delay time - fill limitation.	Check engine (oil level, oil pump). Check oil pressure sensor and cable. Check oil pressure warning line characteristic.
	31	Coolant temperature warning	**2**	**3**	**2**	0	110	Coolant temperature has exceeded warning level.	Fault message (disappears when coolant temperature again drops below recovery level). After a delay time - fill limitation.	Check coolant. Check coolant temperature sensor and cable.
	32	Charge air temperature warning	**2**	**3**	**3**	0	105	Charge air temperature has exceeded warning level.	Fault message (disappears when charge air temperature gain drops below recovery level). After a delay time - fill limitation.	Check charge air. Check charge air-temperature sensor and cable.
	34	Coolant level warning	**2**	**3**	**5**	1	111	Switch input “Low coolant level” is active.	Fault message.	Check coolant level. Check coolant level sensor and cable.
	35	Speed warning (with thrust mode operation).	**2**	**3**	**6**	14	SID 190	revolutions was/is above (top) revolution speed limit. “Thrust mode” function is active.	See Chapter 4.3.3 Excess speed protection.	Check parameters. Check speed settings(21).
								Check PID setting. Check rods. Check actuator and replace if required. Check cable to actuator. Check speed sensor (impulses on incorrect speed). Check No. of teeth. For vehicles check for possible thrust mode.		
	36	Fuel temperature warning	**2**	**3**	**7**	0	174	Fuel-temperature has exceeded warning level.	Fault message (disappears when fuel temperature again drops below recovery level).	Check fuel. Check fuel temperature sensor and cable.

Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	Blink code short 0,4 s	Blink code long 0,8 s	Blink code short 0,4 s	FMI	SPN	Cause	Remarks	Help
Functional fault, switch-off	40	Oil pressure switch-off	**2**	**3**	**1**	1	100	Oil pressure below switch-off limit	Emergency stop	Check engine (oil level, oil pump). Check oil pressure sensor and cable. Check oil pressure -switch-off limit.
	41	Coolant temperature switch-off	**2**	**3**	**2**	0	110	Coolant temperature has exceeded switch-off limit.		Check coolant level. Check coolant level sensor and cable. Check switch-off limit.
	42	Charge air temperature switch-off	**2**	**3**	**3**	0	105	Charge air temperature has exceeded switch-off limit.		Check charge air. Check charge air-temperature sensor and cable. Check switch-off limit.
	44	Coolant level switch-off	**2**	**3**	**5**	1	111	Switch input “Low coolant level” is active.	Emergency stop. Start lock.	Check coolant level. Check coolant level sensor and cable.
Actuator	50	Feedback	**2**	**5**	**1**	12	SID 24	Actuator not connected. Fault in actuator confirmation.	Emergency switch-off. Actuator cannot be operated.	Check actuator, replace if required. Check cable, check fault limits for “Confirmation”.
	52	Reference feedback				13	SID 24			Check actuator, replace if required. Check cable, check fault limits for “Rifeness confirmation”.
	53	Control travel difference				7	SID 23	Injection pump/actuator jammed or not connected. Difference between nominal/actual control travel is > 10 % of the overall control path.	Fault message (disappears when difference is < 10 %).	Check actuator/actuator rods / injection pump, replace if required. Check actuator cable.
	59	Auto calibration BOSCH-EDC pumps faulty operation	**2**	**5**	**2**	13	SID 23	No automatic actuator equalization possible. Incorrect input of the actuator reference values.	Engine stop / start lock. Governor cannot be taken into use. EDC actuator calibration required (see Chapter 8.4).	Check actuator and replaced if required. Check feedback cable. Check voltage supply/cables. Check fault limits and reference values of the feedback. Program the fault limits for feedback, save values. Switch ignition off and on again.Check again. If faulty, inform DEUTZ-Service and carry out automatic equalization again. Set fault limits again.

Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	Blink code short 0,4 s	Blink code long 0,8 s	Blink code short 0,4 s	FMI	SPN	Cause	Remarks	Help
Hardware inputs/ outputs	60	Digital output 3 (Switch-off solenoid, pin M 2)	**2**	**6**	**1**	2	SID 51	Fault (short circuit / cable break) at digital output.	Driver level is switched off.	Check cable of digital output (cable break or short circuit).
	62	Digital output 6, pin M 7	**2**	**6**	**2**	2	SID 60		Fault message.	
	63	Excess voltage switch-off solenoid	**2**	**6**	**1**	6	SID 51			
	67	Error Hand Setp1	**2**	**6**	**2**	11	91			
	68	Error CAN Setp1				2	898			
Communi-cation	70	CAN-Bus controller	**2**	**7**	**1**	12	SID 231	CAN-controller for CAN-bus is faulty. Fault removal despite re-initialising continuously not possible	Application-dependent.	Check CAN connection, terminating resistor (see Chapter 12.4), Check control unit.
	71	CAN interface SAE J 1939				9	SID 231	Overflow in input buffer or a transmission cannot be placed on the bus.		
	74	Cable break, short circuit or bus-error				14	SID 231			Check CAN connection, cable connection. Check sensor and replace if required.
Memory	76	Parameter programming (write EEPROM)	**2**	**8**	**1**	12	SID 253	Fault in parameter programming in the governor fixed value memory.	Emergency switch-off. engine cannot be started.	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service
	77	Cyclic program test				12	SID 240	Constant monitoring of program memory shows error (so-called “Flash-test”).		
	78	Cyclic RAM test				2	SID 254	Constant monitoring of working memory shows error.		Note values of parameters (3895 and 3896). Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.

Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	Blink code short 0,4 s	Blink code long 0,8 s	Blink code short 0,4 s	FMI	SPN	Cause	Remarks	Help
Control unit hardware	80	Power supply (Actuator)	**2**	**9**	**1**	2	SID 254	Power supply for actuator not in the permissible range.	Fault message (disappears when power again in the normal range).	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	83	Reference voltage 1				2	SID 254			
	84	Reference voltage 2	**2**	**8**	**2**	2	SID 254	Reference voltage for actuator not in the permissible range.	Fault message (disappears when power again in the normal range). Auxiliary value 5 V	Check voltage supply. Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	85	Reference voltage 4				2	SID 254			
	86	Internal temperature	**2**	**9**	**2**	12	171	Internal temperature for control unit not in permissible range.	Fault message (disappears when power again in the normal range).	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	87	Atmospheric pressure				12	108	Atmospheric pressure not in permissible range.	Fault message (disappears when power again in normal range). Atmospheric pressure monitoring function de-activated.	
Program logic	90	Parameter fault (EEPROM retrieval or checksum faulty).				2	SID 253	No data found or checksum of data is faulty (note: fault only occurs during setting of parameter / saving or reset.).	Engine cannot be started.	Check data for correct settings. Save parameters. Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	93	Stack overflow	**2**	**10**	**1**	2	SID 240	Internal calculation fault (so-called “Stack overflow” fault).	Emergency switch-off. Engine cannot be started.	Note parameters (3897 and 3898). Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	94	Internal fault				2	SID 254			

7.3 Diagnostic possibilities with the SERDIA software

SERDIA (Service Diagnosis) is a software program with the aid of which the user can monitor the measurement value on a running diesel engine from a PC or Notebook computer and can thus recognize faulty operating behaviour.

- With a stopped engine, it is possible to enter certain parameters in a targeted manner from the PC into the control unit (parameter setting) in order to change the operating behaviour of the engine.
- With the aid of the SERDIA diagnostic software, the fault messages stored in the control unit can be read out and evaluated.

Information is displayed on the following:

- Fault locality (e.g. pedal sensor, coolant temperature sensor).
- Fault type (e.g. lower limit exceeded, sporadic error).
- Environmental data/operating data (speed and operating hours at the time of the occurrence of the last fault).
- Number of fault localities
- Frequency of the fault
- Fault status (**active** - fault persists / **passive** - fault eliminated).

Fault messages of non-current and eliminated faults can be deleted with SERDIA.

- Function test

In the function test, the outputs and the control rod travel can be activated with the engine stopped.

- Input/output assignment

Display of the current input/output assignment.

- Measuring value depiction

A large selection of measuring values are available and these can also be used if there is no EMR 2 error (starting behaviour, engine saws, poor performance).

For this purpose, the PC is connected by an interface cable to the diagnostic interface. Communication with the control unit is carried out via a special EMR 2 protocol.

Working with SERDIA is described in a separate operating instruction.

8 Replacement of system components

In case of malfunction, the individual system components such as sensors, control unit, actuators, can be replaced but not repaired.

8.1 Replacement EMR ↔ EMR 2

The EMR 2 is a further development of the EMR. But are not compatible in the case of replacement. Only the part numbers (TN) that count for the respective system can be utilized.

8.2 Features of the Replacement of the Control Unit

Each control unit is fixedly assigned to the engine (engine number) in accordance with its individual application case. In case of a replacement, therefore, the control unit must be equipped

a) with its engine-specific data set and

b) with a ticket [engine number...]

Programming with an engine-specific data set is only possible with SERDIA (Levels III and IIIa) and can be carried out in two ways:

- By ordering a new control unit with information of the engine and part number (completion by DEUTZ-Parts Logistics).
- Transferring the data set 1:1 from the “old” control unit to the “new” control unit (see SERDIA manual).

Remarks:

– TN on control unit → **non** programmed control unit (stores unit).
Engine cannot be started!
Control unit must be programmed.

– TN in SERPIC → programmed and completed control unit (with engine number - ticket)

Caution!

Only setting alterations that have been notified back to DEUTZ permit proper return of a programmed and completed control unit with current data settings (see SM 0199-99-9287).

8.3 Features of the Replacement of the Actuator

8.3.1 Model series1012/1013/2012/2013

The actuators are replaceable on a 1:1 basis without additional programming.

8.3.2 Model series 1015

Actuator (EDC-actuator) and Bosch pump belong together (one TN). In the case of a replacement, the actuator (with the pump) must be calibrated with the control unit. This calibration is necessary (with SERDIA Level IIIa), because the new characteristic curves must be stored in the control unit.

8.4 Combination EMR, EMR 2, Control Unit and Actuator

EMR control units, see also SM 0199-99-9334.

Control unit	Actuator EMR 1012/1013/2012	Actuator EMR 2 1012/1013/2012	EDC actuator 1015
EMR	✓	Fault message Engine cannot be started	Calibration required
EMR 2	✓	✓	

The EMR 2 control unit automatically recognizes the actuator EMR or EMR 2. In order to limit errors, therefore, an “old” EMR actuator can be combined with the EMR 2 control unit. In reverse, a “new” EMR 2 actuator is not accepted by the EMR control unit (fault message).

9 Technical Data

9.1 General Data

Designation	Technical data / Remarks
Nominal voltage	12 and 24 V DC, working range 10 ... 36 V DC, engine starting is possible from 6 V
Maximum cable length governor-engine	5 m (remote engine extension)
Current consumption (inc. actuator)	≤ 9 A, ≤ 11.5 A for 60 s, (fuse 15 A)
Permissible operating temperatures	-40 ... +85 °C
Dimensions	231 × 204 × 62 mm (length × width × height)
Weight	1.6 kg
Air humidity	< 98 % (at 55 °C)
Type of protection	IP 66k, IP X7, IP X9k to DIN 40050
Shock permissibility	< 50 g
Vibration	< 1,5 mm (at 10 ... 20 Hz) < 180 mm/s (at 21 ... 63 Hz) < 7 g (at 64 ... 2.000 Hz)
Resistance	Resistant to usual materials in an engine environment
Housing material	Cast aluminium, unvarnished
Diagnostic interface	Serial interface to ISO 9141
Data interface	CAN-Bus with protocol to ISO/DIS 11989, SAE J1939
Plug connection to vehicle/plant, cable harness	Company AMP, 2 x 25-pole, coded, individual strand isolation
EMV	Emitted interference to 95/54/EWG interference immunity up to 100 V/m to ISO 11452-2, ISO 7637, TR 10605
Load dump	U < 60 V (actuator not powered during the interference effects)

9.2 Signal Specification

Pin[1)]	Pin type/Signal type	Technical data / Remarks
		Inputs
F4, F6, F7, F18, F19, F20, F21, F24, M6, M11, M21, M24	Digital input	U_{low} < 2 V, U_{high} > 6,5 V, R_{pull} = 4.7 kΩ after +U_{Batt}
F4	Digital input	I_{sink} < 0.5 A, U_{rest} < 0.5 V, I_{leck} < 0.1 mA (ground switching), Diagnostic button (closing) after -U_{Batt}
F20, F24, M21, M24	Analog input	U_{in} = 0 ... 5 V, f_g = 7 Hz, R_i = 220 kΩ, U_{ref} = 5 V ± 25 mV, I_{max} = 25 mA
F18, F21	PWM input	U_{low} < 2 V, U_{high} > 6,5 V, R_{pull} = 4,7 kΩ, f_{in} < 500 Hz (typ. 100 Hz), T_{an}/T_{per} = 5 ... 95 %
M11, M13	Frequency input	Inductive sensor, U_{in} = 0,2 ... 30 V AC, f_{in} = 25 ... 9.000 Hz
F7, M11	Speed input	max. 255 Impulse/m
M17, M18, M19	Inductive input	Control travel sensor
M4, M5, M9	Temperature input	NTC resistance measurement, max. ± 4 °C (tolerance, typ. ± 2 °C)
		Outputs
F4	Digital output	I_{sink} < 0.5 A, U_{rest} < 0.5 V, I_{leck} < 0.1 mA (ground switching), Diagnostic button (closing) after -U_{Batt}
F3, F5, F15, F16, M3	Digital output (low side)	I_{sink} < 0.5 A, U_{rest} < 0.5 V, I_{leck} < 0.1 mA (ground switching)
M2	Digital power output (high side)	I_{source} < 4 A, U_{rest} < 0.5 V, I_{leck} < 0.1 mA (positive switching)
M7	Digital power output (low side)	I_{source} < 4 A, U_{rest} < 0.5 V, I_{leck} < 0.1 mA (ground switching)
M7	PWM power output	I_{source} < 4 A, U_{rest} < 0.5 V, I_{leck} < 0.1 mA (positive switching), f_{aus} < 500 Hz (typ. 100 Hz), T_{an}/T_{per} = 5 % ... 95 %
M14, M15	PWM power output	Actuator control (actuator), to 11.5 A
F5	PWM output	I_{sink} < 0.5 A, U_{rest} < 0.5 V, I_{leck} < 0.1 mA (ground switching), f_{aus} < 500 Hz (typ. 100 Hz), T_{an}/T_{per} = 5 % ... 95 %
F16	Frequency output	I_{sink} < 0.5 A, U_{rest} < 0.5 V, I_{leck} < 0.1 mA (ground switching), with Pull-Up resistance U_{aus} = 0 ... +U_{Batt}
		Interfaces
F10, F11	ISO 9141-Bus	Baud rate typ. 9,600 Baud, stimulation via L-line, communication via K-line
F12, F13	CAN-Bus	Extended CAN, < 250 kBaud

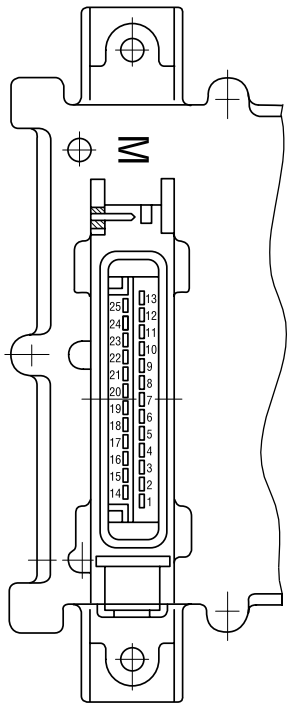
1) Double assignment possible.

All outputs are short circuit-protected against negative and positive polarity of the battery.

9.3 Plug assignments

The 25-pole plugs of the EMR 2 control unit are mechanically coded (different part numbers). Because of the different pins, the vehicle plugs (F) or the plant plugs (F) and engine plug (M) only into the sockets provided for them, so that incorrect plugging in is impossible.

9.3.1 Engine Plug (M)

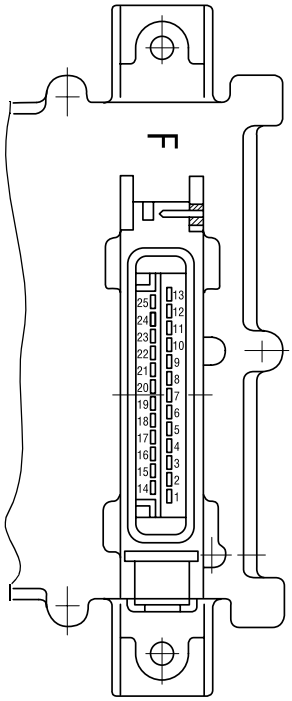


Pb_mst1 © 06/02

Pin No.	Designation	Description
1	Reserve	Reserve
2	Output: digital 3	Digital output for solenoid[1)]
3	Output: digital 4	For heating flange (optional)/ glow plug (optional)
4	Input (optional) Temp 1	Fuel temperature[2)]
5	Input (optional) Temp 2	Charge air temperature
6	Input (optional) DigIn 5	Coolant level / oil level
7	Output: PWM2/digital 6	
8	GND	Reference potential for analog signal at pin 9
9	Input: analog 7	Analog input for Coolant temperature sensor (NTC)
10	GND	Reference potential for analog signal at pin 11
11	Multi-function input: speed 2/DigIn 2	Digital input second engine speed (crankshaft) (optional) and speed signal (optional)
12	GND	Reference potential for analog signal at pin 13
13	Input: speed 1	Digital input first engine speed (camshaft)
14	STG -	PWM output, signal for actuator coil
15	STG +	PWM output, signal for actuator coil
16	Screen	Screening regulating rod travel sensor (for lines 17, 18, 19)
17	RF -	General connection for reference and measuring coil
18	RF REF	Analog input, reference signal of the reference coil
19	RF MESS	Analog input, measuring signal of the measuring coil
20	GND	Reference potential for signal at pin 21
21	Input: analog 4/digital 9	Analog input 4 (sensor signal oil pressure sensor) or digital input 9
22	+5 V REF	+5 V Reference voltage for signal at pin 21 (max. 15 mA)
23	GND	Reference potential for signal at pin 24
24	Input: analog 2/digital 7	Analog input 2 (sensor signal charge air) or digital input 7
25	+5 V LDA	+5 V Reference potential for signal at pin 24 (max. 15 mA)

1) For continuous power: < 4 A
2) Corresponds to special function”fuel temperature compensation at the EMR (0211 2571)

9.3.2 Vehicle Plug (F) / Plant Plug



Pb_fst1 © 06/02

Pin-No.	Designation	Description
1	U Batt -	Negative pole at battery (clamp 31)
2	GND	Reference potential for signal
3	Output: digital 2	PWM or digital output, various functions
4	Input / output: DigInOut	Fault lamp and diagnostic button
5	Output: PWM 1/Dig 1	PWM or digital output, various functions
6	Multi-function input: DigIn 3	Genset applications/gear shift/motor brake
7	Input: digital 10/velocity	Speed signal (tacho input)
8	NC	Not occupied
9	NC	Not occupied
10	L-line	Serial ISO 9141 interface
11	K-line	Serial ISO 9141 interface
12	CAN high	Interface for CAN-Bus
13	CAN low	Interface for CAN-Bus
14	U Batt +	Positive pole for battery (clamp 15)
15	Output: digital 5	Digital output, various functions
16	Output: digital 7/Frequency	Frequency, PWM or digital output, various functions
17	Ground	Reference potential for signal at pins 18, 19 and 21
18	Input: digital 1 / PWM 1	PWM 1 or digital input 1, various functions
19	Multi-function input: DigIn 4	Performance curve switching/genset applications
20	Multi-function input: digital 8 / analog 3	Hand hand throttle/genset applications, Digital (8) or analog input (3)
21	Input: digital 2 / PWM 2	PWM 2 or digital input 2, various functions
22	Screen	Screening (e.g. for lines hand throttle or PWG)
23	GND	Reference potential for signal at pin 24
24	Input: analog 1 / digital 6	Analog input 1 (pedal value sensor, PWG) or digital input 6
25	+5 V REF	+5 V Reference voltage for signal at pin 24

9.4 Sensor Data

Temperature sensor (NTC), coolant

Pins: Signal pin 9, GND pin 8, engine plug
Measuring range: -40 °C to 130 °C

Temperature sensor (NTC), fuel

Pins: Signal pin 5, GND pin 8, engine plug
Measuring range: -40 °C to 130 °C

Temperature sensor (NTC), charge air

Pins: Signal pin 4, GND pin 8, engine plug
Measuring range: -40 °C to 130 °C

Oil pressure sensor

Pins: Signal pin 21, GND pin 20, reference voltage +5 V pin 22, engine plug
Measuring range: 0 to 10 bar
Output signal: 0.5 V to 4.5 V DC

Charge air pressure sensor

Pins: Signal pin 24, GND pin 23, reference voltage +5 V pin 25, engine plug
Measuring range: 0.5 to 4 bar
Output signal: 0.5 V to 4.5 V DC

Speed sensor

Measuring range: 30 to 4,500 1/min
1st speed:
Conn. locality: camshaft, wheel box
Pins: Signal pin 13, GND pin 12, engine plug
- 44 Impulse/camshafts-revolutions for model series 1012/2012
- 48 Impulse/camshafts-revolutions for model series 1013/2013
- 167 Impulse/camshafts-revolutions for model series 1015

2nd speed (optional):
Conn. locality SAE-housing, crankshaft
Pins: Signal pin 11, GND pin 10, engine plug
- 129 Impulse/crankshafts-revolutions for model series 1012/1013
- Clamp w (dynamo impulses)

Coolant level sensor

Pins: Signal pin 6, GND pin 8, engine plug

Measuring range:

Atmospheric pressure sensor

Depending on unit configuration, integrated into control unit, see Chapter 4.13

10 Index of Specialist Terms

AGR	Exhaust gas return
Actuator	Actuator
AMP plug	Multi-pole plug of the AMP company
Baud rate	Data transmission speed [Bit/s]
CAN-Bus	Interface (Controler Area Network)
EDC-actuator	Actuator of the Bosch company
EEPROM	Memory module in the microprocessor
EER 2	Electronic engine governer
ELTAB	Electronic engine pocket handbook
EMV	Electromagnetic compatibility
F-plug	Vehicle plug / plant-side plug at the control unit
GND	Mass (Ground)
High	Switch open (high)
ISO	International Standard Organization
Clamp 31	Minus clamp at battery
KLU	Scope of customer supply
KM-temperature	Coolant temperature
LDA	Charge air pressure dependent full load stop
Limp home	Emergency running features
Load dump	Noise limit
Low	Switch closed (low)
M-plug	Engine plug
M_d	Torque
NC	Not assigned
NTC	Negative temperature coefficient
P-grad	Proportional gradient; P-grad = 0 (Isochronous); P-grad adjustable (Droop).
PID control	Proportional, integral, differential parts of the control
Pin	Plug pin
Pull-up resistance	Resistance to supply voltage
PWM-signal	Pulse width modulated signal
REF	Reference voltage or potential
SERDIA	DEUTZ service diagnosis software with interface
Setpoint	Setpoint
SWG 1/2	Setpoint sensor 1/2

11 Index

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12 Connection diagrams

The following connection diagrams present the maximum scope of the EMR2. Customer or model-specific wishes are not taken into account.

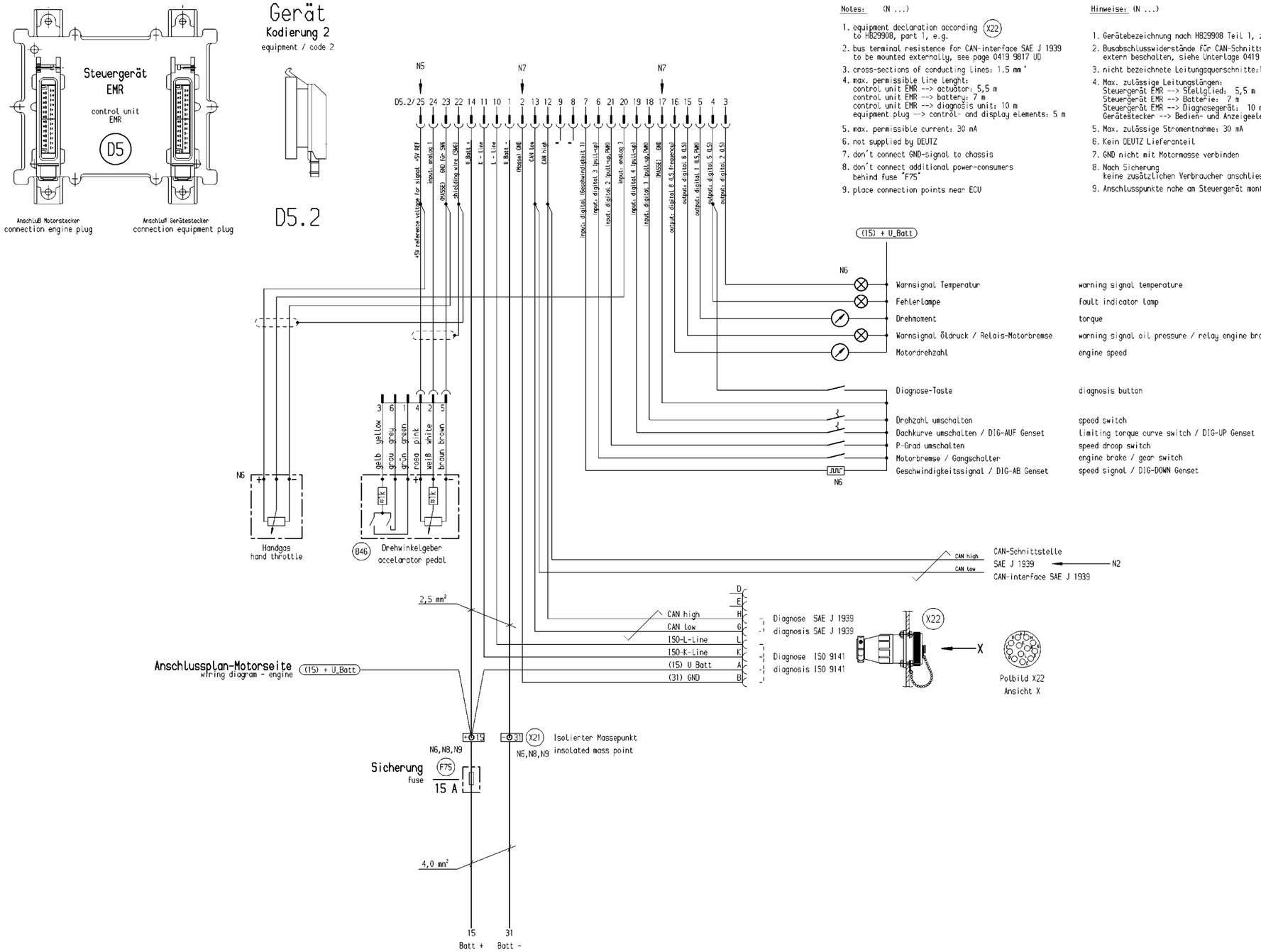
Only the switching diagram specific for the particular engine is binding. This is prepared by the DEUTZ customer representative before supply of the first engine as the switching diagram is **not** part of the documentation supplied with the engine.

Methods of obtaining the switching diagrams are:

- Sales or customer representative, or
- Dept. Sales Documentation (Format DIN-A2) or
- Sales drawing CD-ROM or
- Engine pocket handbook (from page 3.150, size DIN-A4) or
- ELTAB CD-ROM

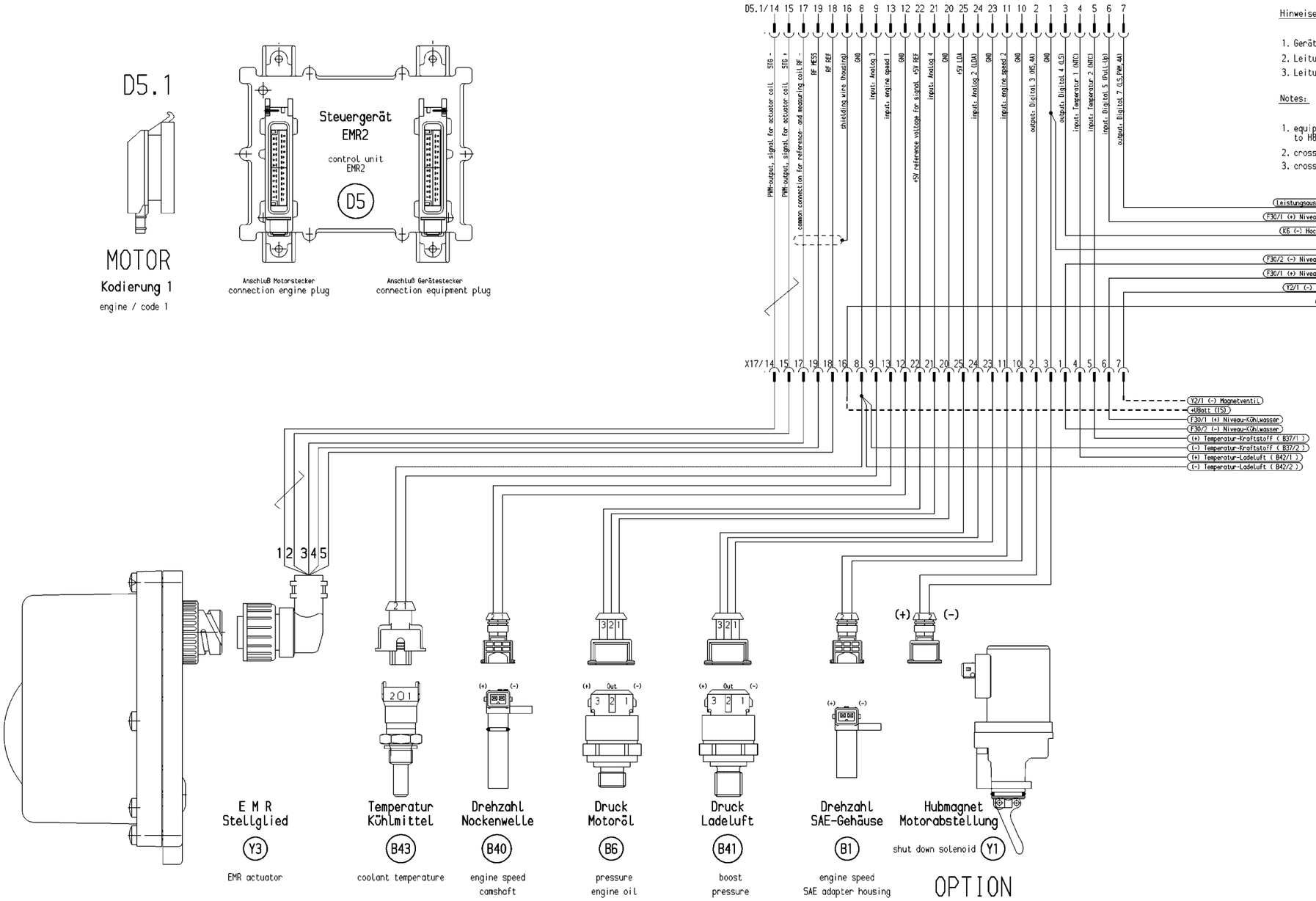
12.1 Anschlussplan Fahrzeug-/Anlagenseite

Connection diagram - Vehicle side / Unit side



12.2 Anschlussplan Motorseite (Blatt 1)

Connection diagram - Engine side (sheet 1)



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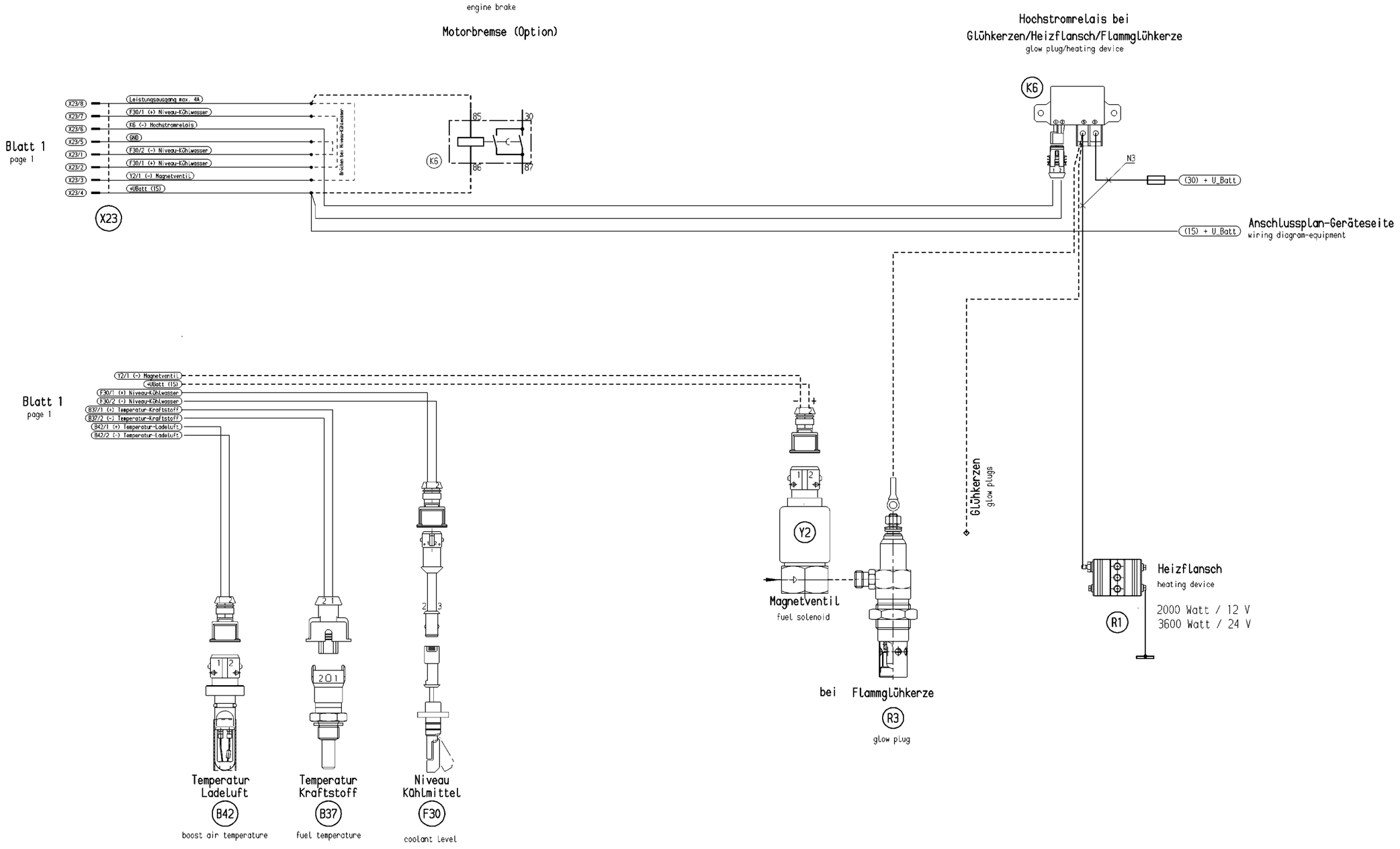
12.3 Anschlussplan Motorseite (Blatt 2)

Connection diagram - Engine side (sheet 2)



motorseite2 © 06/02

12.4 Anschlussplan für CAN-Bus und Diagnoseleitung

Connection Diagram for CAN-Bus and Diagnostic Line