POWER FROM WITHIN

DC250 CONTROLLER

SMARTECH

A DIVISION OF MECC ALTE

TECHNICAL MANUAL

Revision	Date	Notes
00	30/11/2021	First version of the manual, written for DC250 version 01.00.
01	23/12/2021	Valid for DC250 version 1.02. 5.4.5, 7.3.5, 7.3.9.3, 7.6.4, 8.5
02	25/05/2022	Amendment chapter 3: technical characteristics
03	10/10/2022	Valid for DC250 version 1.05. 5.4.5, 5.5.5, 5.6.4, 5.6.5, 6.4.3, 6.4.7.11…6.4.7.17, 7.4.1, 7.4.2.1…7.4.2.3
04	14/04/2023	Valid for DC250 version 1.06. 5.6.4, 6.4.1, 6.4.6.7, 7.3.3, 7.3.7.1, 7.3.10, 7.3.10.1, 7.3.10.2.
05	30/05/2024	Valid for DC250 version 2.01. 5.4.5, 7.3.3, 7.3.7.1, 7.10.3.2, 7.10.3.3, 8.7-57
06	28/01/2025	Valid for DC250 version 2.02. 6.4.7.8, 7.3.4, 7.3.9.2
07	11/06/2025	Valid for DC250 version 2.05. 7.3.10.3, 7.3.10.4
08	13/06/2025	Changed the Auto-start application drawing.

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1 Introduction

1.1 Reference documents.

[1] Mecc Alte EAAM0752xxXA Parameters table for DC250.

[2] Mecc Alte EAAS0753xxXA Modbus table for DC250.

[3] Mecc Alte EAAP0457xxXA USB driver installation guide

[4] CANOPEN – Cabling and Connector Pin Assignment – CIA Draft Recommendation DR-303-1.

[5] BOSH CAN Specification – Version 2.0 – 1991. Robert Bosh Gmbh.

1.2 Safety information

Insufficient knowledge and/or failure to apply safety rules causes accidents during normal operation and/or during maintenance. To avoid accidents, before conducting any operation, read, understand, and follow the precautions and warnings contained in this manual.

This manual uses the following indications:

WARNING! It indicates a potentially dangerous situation that could cause severe injury or death. It also describes the necessary precautions to avoid the danger.

ATTENTION! It alerts you to a potentially dangerous situation that can cause injury, damage, or malfunction. It also describes the necessary precautions to avoid the danger.

INFORMATION! This indication provides information, clarifications, or clarifications useful for conducting the operation in progress.

1.3 Generalities and prerequisites

Before using DC250, carefully read this manual. For the proper use of this manual, you need specific expertise in the use and installation of engines and/or generators.

WARNING! Only qualified personnel can conduct interventions. Do not remove or modify any connections while the engine or the generator is running. Incorrect interventions on the connections can cause the disconnection of the utilities from the generator or from the engine.

Dangerous voltages may be present on the terminals of DC250; before conducting any operation on them, make sure you have disconnected the utilities from the generator/engine and have removed the respective fuses.

Mecc Alte makes a considerable effort to continuously improve and update its products; they are therefore subject to both hardware and software changes without notice. Functions described in this manual may therefore differ from those in your device.

1.4 Notes on configuring the parameters of DC250

DC250 uses configurable parameters. It is therefore difficult to describe all their combinations and effects. This document does not describe each parameter in detail: for this purpose, see document [1] (which is an integral part of this manual). DC250 provides a generic “factory” configuration; it is the responsibility of the installers to adapt the operating parameters to their specific application.

Although most configurable parameters are accessible from the front panel, **some particular features or configurations, due to their nature, can only be set or edited through the Mecc Alte Board Programmer4 PC Software** (hereinafter called “BoardPrg4”), which can be downloaded for free from the Mecc Alte website www.meccalte.com

It simplifies the configuration of DC250, and we strongly recommend its use. Furthermore, it allows saving on file the current configuration of the device, and the subsequent reuse on other identical devices. It also allows configuration, saving or loading of the characteristic curves of non-standard analogue sensors. The connection to the PC is possible through the USB and RS485 ports of DC250. For the sole purpose of configuring the DC250, you can supply it directly through the USB port.

1.5 Definitions

- SHUTDOWN: it indicates an anomaly that makes it impossible for the engine or the generator set to function. DC250 immediately disconnects the loads from the engine/generator and stops the engine without conducting the cooling cycle.
- DEACTIVATION: it indicates an anomaly that makes it impossible for the generator set to operate, but which is not dangerous for the engine. DC250 immediately disconnects the loads from the engine/generator, performs the engine cooling cycle (if it is in AUTO mode) and finally stops the engine.
- PRE-ALARM: it indicates an anomaly that requires an operator's manoeuvre, but which does not require the disconnection of the loads from the engine/generator or the shutdown of the engine.
- DIF (“Digital Input Function”): a numeric code follows, associated with a function used to configure the digital inputs (physical and virtual)
- DOF (“Digital Output Function”): a numeric code follows, associated with a function used for configuring the digital outputs.
- AIF (“Analogue Input Function”): a numeric code follows, associated with a function used for the configuration of the physical and virtual analogue inputs.
- AVF (“Analogue Virtual Function”): a numeric code follows, associated with a function used for configuring the virtual analogue inputs only.
- ST (“Status”): a numeric code follows, associated with a function used to configure the digital outputs or the virtual digital inputs, through the AND/OR logics.
- AL (“Alarm”): a numeric code follows, associated with an anomaly.
- ECU (“Engine Control Unit”): electronic engine control unit, which controls the engine operations.
- PMG (“Permanent Magnets Generator”): it is a type of alternator where there is no excitation control system, DC250 can indirectly control the voltage by the engine speed.

1.6 Conventions

The manual highlights the changes compared to the previous version with a vertical bar to the right of the paragraphs. It highlights changes to fields in a table with a grey background colour.

1.7 Software revisions.

The manual often references the software revisions of the DC250.

The software revision is part of the software code (present on the label applied on the back side of DC250, and visible directly on the display on page S.02).

The DC250 software code is EB0250354XXYY, where “XX” is the major software revision and “YY” is the minor revision. So, for example, the code EB0250354100 refers to the software revision “1.00” of DC250.

1.8 Maintenance and cleaning.

Only qualified personnel can take care of the maintenance of the DC250, in compliance with the regulations in force, to avoid damage to people or things.

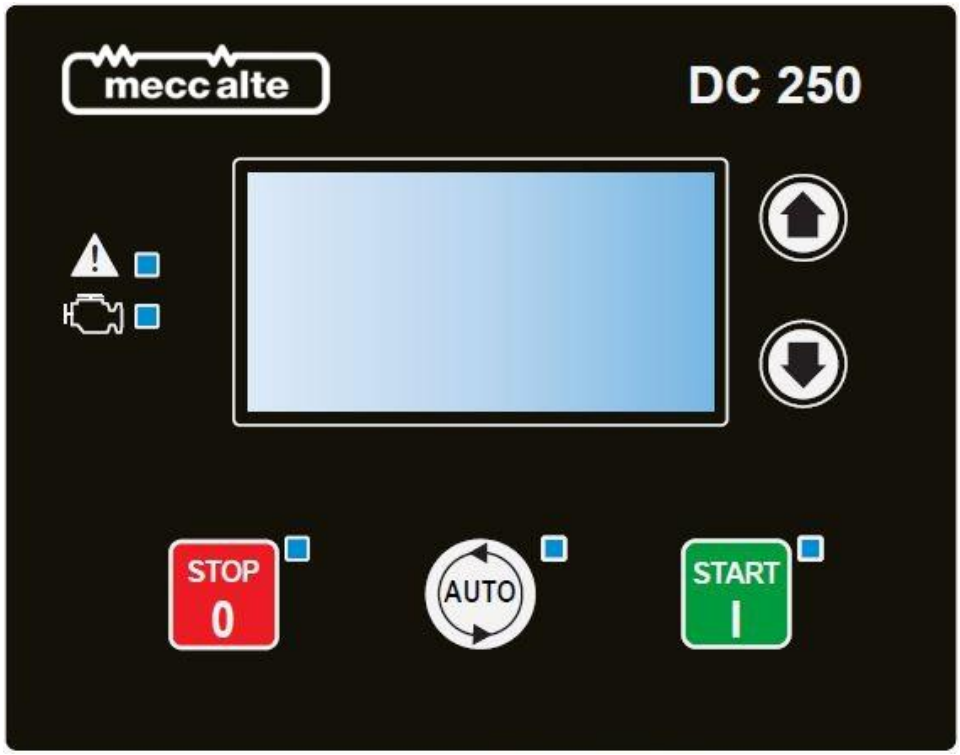
Clean the front panel only with a soft cloth, do not use abrasive products, liquid detergents, or solvents.

1.9 Information on disposal.

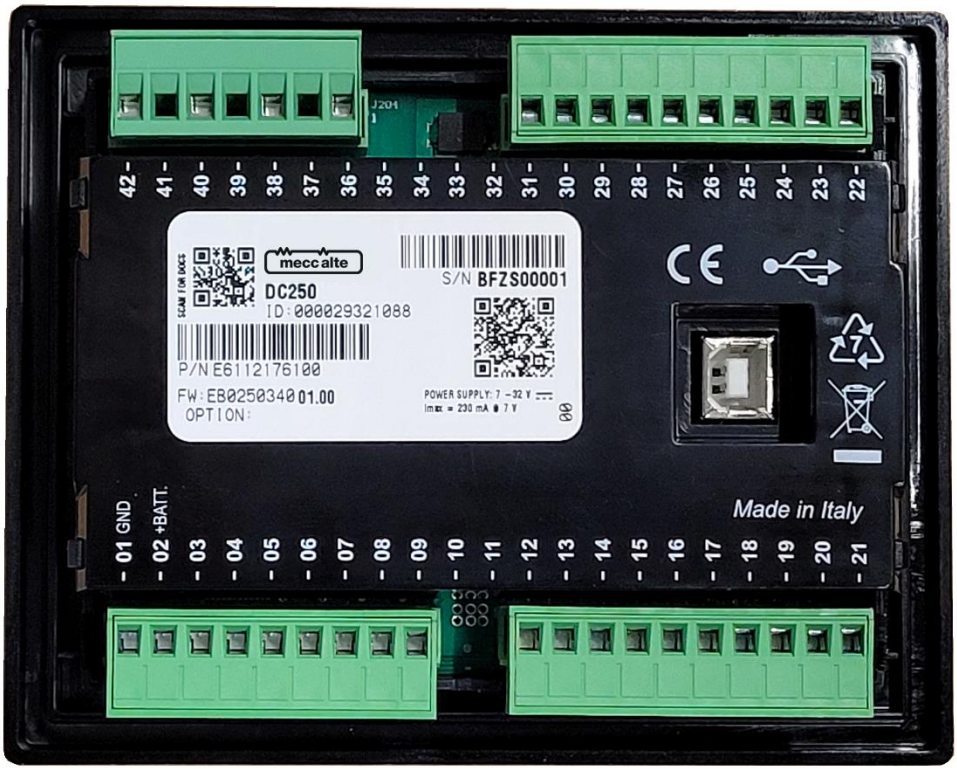
INFORMATION! on the disposal of old electrical and electronic equipment (valid for European countries that have adopted separate collection systems).

Do not dispose products with a crossed-out wheeled bin symbol  with normal household waste. Recycle old electrical and electronic products at a special facility capable of treating these products and disposing of their components. To find out where and how to deliver these products to the place closest to you, contact the appropriate municipal office. Appropriate recycling and disposal help to conserve nature and prevent harmful effects on health and the environment.

2 Views of DC250



DC250 front view.



DG250 rear view

3 Technical features

Power supply +VBATT (T.01, T.02).	
Operating range.	7..32 Vdc in continuous operation. Reverse polarity protection with built-in self-resetting fuse. Integrated maximum voltage protections at 60 Vdc. Guaranteed operation during engine cranking up to 5 Vdc for an indefinite time. When powered and each time the operator selects the OFF/RESET mode, DC250 self-recognizes the rated power supply voltage (12/24 Vdc) and uses it for the management of low/high voltage pre-alarms, and for the selection of the proper excitation current of the battery charging alternator (signal D +).
Current consumption in stand-by.	No digital input active, resistive analogue inputs not connected: 54 mA @ VBATT = 13.5 Vdc, display backlight lamp activated. 41 mA @ VBATT = 13.5 Vdc, display backlight lamp activated. 30 mA @ VBATT = 27.0 Vdc, display backlight lamp activated. 23 mA @ VBATT = 27.0 Vdc, display backlight lamp activated. No digital input active, resistive analogue inputs at 100Ω: 67 mA @ VBATT = 13.5 Vdc, display backlight lamp activated. 51 mA @ VBATT = 13.5 Vdc, display backlight lamp activated. 36 mA @ VBATT = 27.0 Vdc, display backlight lamp activated. 29 mA @ VBATT = 27.0 Vdc, display backlight lamp activated.
Current consumption in Deep Standby Mode.	<3.7 mA @ VBATT = 7.0 Vdc. <4.7 mA @ VBATT = 13.5 Vdc. <5.6 mA @ VBATT = 27.0 Vdc.
Maximum current absorption in operating conditions.	Conditions: Internal buzzer activated. Display backlight lamp activated. Digital inputs activated (connected to GND). Analogue inputs at 0 Ω Digital outputs not activated. Excitation current for D+ not provided. CAN BUS communication in progress. Maximum absorption: 256 mA @ 7.0 Vdc. 130 mA @ 13.7 Vdc. 70 mA @ 24.0 Vdc.
Overvoltage Category	OVCII
Pollution degree	PD2

Voltmetric measurement input (T.40, T.42).	
Input type.	Two inputs for measuring DC voltages. Twelve bits analogue/digital conversion. DC voltage measurements referred to the negative power supply of DC250. DC250 calculates the real DC voltage as the difference between the voltages measured on T.42 (-) and T.40 (+).
Type of measurement.	True RMS value (TRMS).
Sampling frequency.	10 KHz.
Input impedance.	> 2 MΩ (terminal-GND).
Maximum measurable voltages.	±105 Vdc.
Impulse withstands.	2 KVdc (class 3) on transient 1.2/50µs (EN61000-4-5).
Resolution.	0.1 Vdc.
Accuracy.	<0.5% of the full scale.

Amperometric measurement input (T.36, T.38).	
Input type.	A differential analogue input for DC voltage measurement, optimized for connecting an external shunt resistor. Twelve bits analogue/digital conversion. Measuring circuit galvanically isolated.
Type of measurement.	True RMS value (TRMS).
Sampling frequency.	10 KHz.
Input impedance.	> 28 kΩ (between terminals T.36 and T.38).
Maximum measurable voltages.	±200 mVdc.
Insulation voltage.	3000 Vdc (t = 60 sec).
Insulation impedance.	> 1000 MΩ (terminal-GND).
Impulse withstands.	2 KVdc (class 3) on transient 1.2/50µs (EN61000-4-5).
Resolution	0.1 mVdc. 0.1 Adc. 0.1 kW. 0.1 kWh.
Accuracy.	< 0.2% of full scale (excluding the shunt error). The DC current measurement accuracy depends on the accuracy class of the shunt used. We recommend using shunts with an accuracy class of 0.5 or better.

Pick-up input for engine speed measurement (T.24, T.25)	
Input type.	If the sensor has only one wire, use only the T.24 terminal. Filtered for blocking DC currents.
Minimum voltage.	< 2 Vrms (from 50 to 5kHz). 1.3 Vrms @ 3 kHz. See in detail the curve at paragraph 5.2.3.1.
Maximum voltage.	60 Vrms.
Frequency range.	1…10000 Hz.
Resolution.	1 rpm.

"W" input for engine speed measurement (T.26)	
Input type.	Referred to GND. Filtered for blocking DC currents.
Minimum voltage.	< 2 Vrms (from 20 to 1 kHz). 4.4 Vrms @ 3 kHz. See in detail the curve at paragraph 5.2.3.2.
Maximum voltage.	60 Vac.
Frequency range.	1…10000 Hz.
Resolution.	1 rpm.

Output and analogue input D+ (T.09)	
Output type.	Current output with value automatically switched according to the supply voltage + VBATT.
Excitation current.	200 mA @ 13.5 Vdc. 100 mA @ 27.0 Vdc.
Input type.	Analog input for acquiring voltage measurements from 0 to 60 Vdc (with respect to GND). Used to diagnose the correct voltage supply of the engine battery charger. Alternatively, the input can work as a generic voltage analogue input, or as an additional digital input with activation at + VBATT.
Frequency range.	1…10000 Hz.
Sampling frequency.	10 kHz.
Resolution.	0.1 Vdc.
Accuracy.	< 0.5% of the full scale.

Resistive analogue inputs (T.13 … T.15, common T.12)	
Input type.	Three inputs for resistive sensors plus an input for measurement and compensation of the reference potential of their common negative. The three measurement inputs can also work as digital inputs with GND activation, with status change voltage of 1.17 Vdc.
Resistive inputs.	Measurement range: 0 – 3000Ω. Injected current: 25 mA maximum.
Sensor disconnected signalling.	> 3000 Ω.
Sampling frequency.	10 kHz.
Resolution.	0.1 bar. 0.1 °C. 0.1 %.
Accuracy.	< 1 % for measuring range between 0 and 1000 Ω. < 2 % for measuring range between 0 and 3000 Ω.
Compensation range.	Between -2.7 Vdc and +3.5 Vdc with sensor resistances of 100Ω. The compensation range increases for lower resistance values and decreases for higher resistance values.

Voltage analogue input (T.16)	
Input type.	Voltage analogue input. Alternatively configurable as a digital input.
Measurement range.	0…10 Vdc (rispetto a GND).
Sensor disconnected signalling.	-
Sampling frequency.	10 kHz.
Resolution.	0.1 Vdc.
Accuracy.	< 0.5% of the full scale.

Digital inputs (T.16 … T.19)	
Input type.	Four digital inputs with common power supply internally connected to the positive power supply terminal of DC250 (+ VBATT, T.02). To activate the input, connect the input terminal to negative power supply GND (T.01). Using parameters, you can select the inversion of the activation logic, the function, and the delay of each individual input. You can configure the input T.16 as an analogue input for measuring DC voltages.
Activation / deactivation threshold.	1.55 Vdc.
Voltage with open input.	4.1 Vdc per T.16. 4.6 Vdc per T.17…T.19.
Typical closed contact current.	4.0 mA per T.16. 4.6 mA per T.17…T.19.
Minimum / maximum applicable voltage.	+60 Vdc. -24 Vdc.

Digital outputs (T.03 … T.04)	
Output type.	Two independent static outputs. The positive power supply terminal of DC250 T.02 (+ VBATT) provides the output current. Using parameters, you can select the inversion of the activation logic and the function of each individual output. Their default configuration is for the starter motor and fuel solenoid valve.
Single output nominal current.	Maximum 10 Adc resistive for 10 s. Maximum 5 Adc resistive for continuous operation @ 32 Vdc. For currents higher than the rated one or for highly inductive loads (with values higher than 5mH) it is necessary to use an external relay.
Total nominal current T.03 + T.04.	Maximum 15 Adc resistive for 10 s. Maximum 10 Adc resistive for continuous operation. For currents higher than the rated one or for highly inductive loads (with values higher than 5mH) it is necessary to use an external relay.
Output impedance when activated.	Maximum 50 mΩ with IOUT = 3A.
Leakage current when deactivated.	Maximum 5µA @ 32 Vdc.
Protections.	Integrated thermal, short circuit, overvoltage, and reverse polarity protections. **Always use external opening overvoltage damping diodes especially in case of inductive loads.**

Digital outputs (T.05 … T.08)	
Output type.	Four independent static outputs. The positive power supply terminal of DC250 T.02 (+ VBATT) provides the output current. Using parameters, you can select the inversion of the activation logic and the function of each individual output.
Single output nominal current.	Maximum 500mAdc for continuous operation for each output.
Total nominal current (four outputs).	Maximum 1.2 Adc for continuous operation.
Output impedance when activated.	Maximum 350 mΩ.
Leakage current when deactivated.	Maximum 18µA @ 32 Vdc.
Protections.	Internal current limitation to 4 Adc maximum on transients less than 150 µs. Integrated thermal, overload, short circuit, overvoltage, and reverse polarity protections. The overload protection intervenes by limiting the current peak to an instantaneous value of 4 Adc, to allow the activation of loads that require a transient inrush current greater than the nominal. If this condition remains, after 150µs the progressive intervention of the thermal protection begins until the output switches off. **Always use external opening overvoltage damping diodes especially in case of inductive loads.**

Digital outputs (T.27 … T.30, common T.31)	
Output type.	Four independent static outputs. The positive power supply terminal of DC250 T.31 (COM) provides the output current. Using parameters, you can select the inversion of the activation logic and the function of each individual output.
Single output nominal current.	Maximum 500mAdc for continuous operation for each output.
Total nominal current (four outputs).	Maximum 1.2 Adc for continuous operation.
Output impedance when activated.	Maximum 350 mΩ.
Leakage current when deactivated.	Maximum 18µA @ 32 Vdc.
Protections.	Internal current limitation to 4 Adc maximum on transients less than 150 µs. Integrated thermal, overload, short circuit, over voltage and reverse polarity protection. The overload protection intervenes by limiting the current peak to an instantaneous value of 4 Adc, to allow the activation of loads that require a transient inrush current greater than the nominal. If this condition remains, after 150 µs the progressive intervention of the thermal protection begins until the output switches off. **Always use external opening overvoltage damping diodes especially in case of inductive loads**

CANBUS communication interface (T.20, T.21)	
Interface type.	One CANBUS port without galvanic isolation. 120 Ω termination resistor always inserted internally.
Protocols.	SAE J1939, MTU MDEC.
Nominal impedance.	120 Ω.

RS485 communication interface (T.22, T.23)	
Interface type.	One standard TIA/EIA Rs485 serial port, not isolated. Termination resistor (120 Ω) not included.
Electrical signals.	DATA+ (A), DATA– (B).
Settings.	Baud rate selectable by parameter: 300, 600, 1200, 2400, 4800, 9600*, 19200, 38400, 57600, 115200 bps. Parity: none *, even, odd. Stop bits: one*, two. * Default settings.
Protocols.	Modbus RTU Slave.

USB 2.0 communication interface	
Interface type.	One USB 2.0 port not isolated usable in “FUNCTION” mode. USB type B connector. Connection with PC through USB driver. The PC directly supplies DC250 when connected, with a maximum absorption of 250 mA from the USB port.
Protocols.	Modbus RTU Slave.
Maximum distance.	6 m.

Display	
Display type.	Monochromatic transflective graphic LCD, backlit with white LEDs.
Resolution.	128 x 64 pixels.
Pixel size.	0.48 x 0.48 mm.
Visual area size.	65 x 33 mm.
Contrast.	Self-adjusting with temperature, with the possibility of manual corrections.

Environmental conditions	
Operating temperature.	From -30 °C to +60 °C, humidity 95% non-condensing.
Storage temperature.	From -35 °C to +80 °C.
Climatic sequence	IEC 60068-2-30. “DB DAMP HEAT CYCLIC” 20/55°C @ 95% RH 48 Hours. IEC 60068-2-78. “CAB DAMP HEAT STEADY STATE” 40°C @ 93% RH 48 Hours.
Operating altitude	Up to 2000 m (6561 ft.)
Indoor/ourdoor use	Outdoor use is permitted if the protection rating of the control cabinet is equal to or higher than that of the device (IP65 external with gasket for the front panel). In any case, the IP degree of protection must be adapted to the specific installation conditions of the system.

Case	
Material.	ABS + PC.
Dimensions.	141 (L) x 113 (H) x 39 (P) mm.
Cut-out dimensions.	118 x 92 mm.
Weight.	200 g. 260 g with connectors and fixings.
Protection degree.	IP65 external with gasket for the front panel. IP20 for inside panel.

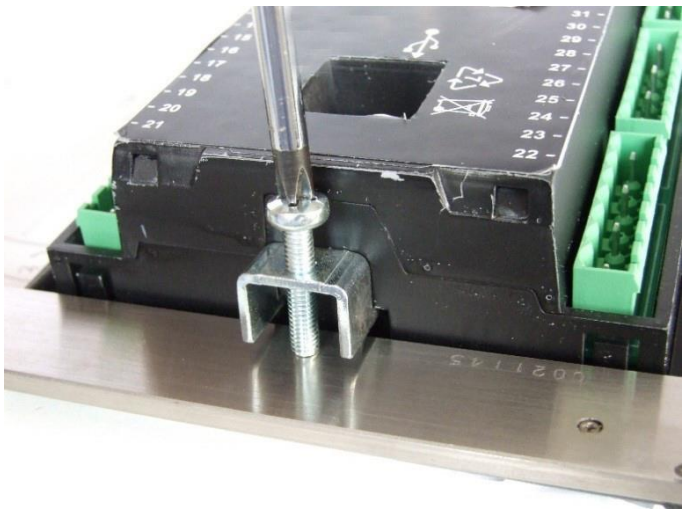
4 Installation

4.1 Mounting

Permanently mount DC250 on a panel or electrical cabinet. Makes the rear of the DC250 accessible only using keys or tools, and only by personnel authorized to perform maintenance operations. Mount DC250 so that no one can remove it without the use of tools. The electrical panel must guarantee adequate protection against severe weather.

WARNING! the operating temperature inside the panel can vary between -30 °C and +70 °C; the external (ambient) operating temperature can vary between -30 °C and + 60 °C.

The panel cut-out is 118 x 92 mm. The assembly takes place using two hooks with locking screws: positioned DC250 in the groove, insert the hooks in the slots on the sides and screw the screws. Be careful not to overtighten the screws so as not to damage the coupling slots on the DC250 case.



4.2 Cabling

Connect all the conductive parts of the electrical panel to the protective earth through permanent connections

Install an overcurrent protection on each single phase of the voltage measurement inputs. Use 1 A fuses. The section of the protective earth conductor of the electrical panel must be at least equal to the section of the wires used to wire the generator voltage to the panel. It must also comply with the limit value of the overcurrent protection used.

5 Connections and configuration

Connector	Terminal	Function	Description
JA (9 poles x 2.5 mm², screw terminal).	T.01	GND.	DC250 power supply.
	T.02	+BATT.	
	T.03	Digital output.	Configurable static output, pre-assigned to the starting motor control (START).
	T.04	Digital output.	Configurable static output, preassigned to command the fuel solenoid (FUEL).
	T.05	Digital output.	Configurable static output, pre-assigned to the stop in excitation command (STOP).
	T.06	Digital output.	Configurable static output, pre-assigned to command an external siren (HORN).
	T.07	Digital output.	Configurable static output.
	T.08	Digital output.	Configurable static output, pre-assigned to command the GCB circuit breaker for connecting the generator to the user.
	T.09	D+.	Output for the excitation of the engine alternator battery charger. Battery charge DC voltage measurement input. Alternatively, you can use it as an analogue input for DC voltage, or as a digital input.

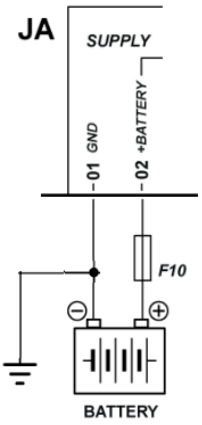
Connector	Terminal	Function	Description
JB (10 poles x 2.5 mm², screw terminals).	T.12	Analogue input reference.	Configurable resistive sensors, for the acquisition of oil pressure, coolant temperature, fuel level etcetera. Alternatively, they can be digital inputs.
	T.13	Analogue input 0...3 kΩ.	
	T.14	Analogue input 0...3 kΩ.	
	T.15	Analogue input 0...3 kΩ.	
	T.16	Digital input. Analogue input 0...10V.	Configurable digital input. Alternatively, it can be a generic 0-10 Vdc analogue input.
	T.17	Digital input.	Configurable digital input.
	T.18	Digital input.	Configurable digital input, preassigned for the connection of the emergency button (EME).
	T.19	Digital input.	Configurable digital input.
	T.20	CAN_H.	CAN BUS connection to the ECU.
	T.21	CAN_L.	

Connector	Terminal	Function	Description
JC (10 poles x 2.5 mm², screw terminals).	T.22	RS485 A+.	RS485 connection, Modbus RTU slave protocol.
	T.23	RS485 B-.	
	T.24	Pick-up.	Connection to the magnetic pick-up sensor of the engine, for measuring the engine rotation speed.
	T.25	Pick-up RTN.	
	T.26	W.	Connection to the W signal of the alternator battery charger, for measuring the engine speed.
	T.27	Digital output.	Static configurable outputs. When active, they output the voltage (positive) connected to terminal T.31.
	T.28	Digital output.	
	T.29	Digital output.	
	T.30	Digital output.	
	T.31	Common positive for digital outputs.	

Connector	Terminal	Function	Description
JD (7 poles x 2.5 mm², screw terminals).	T.36	DC current (+).	Connection to the shunt for measuring the DC current of the generator.
	T.38	DC current (-).	
	T.40	DC voltage (+).	Connection for measuring the DC voltage of the generator. The measurement is differential (not referred to GND): see paragraph 3 for maximum excursions with respect to GND.
	T.42	DC voltage (-).	

Connector	Terminal	Function	Description
JX USB B		USB	USB connection in FUNCTION mode, for DC250 configuration.

5.1 Power supply (T.01 … T.02)



Connect a continuous power source (usually the engine starting battery) to terminal T.01 (GND, negative) and to terminal T.02 (+ BATT, positive). See the paragraph 3 for the maximum applicable voltages.

The negative terminal T.01 is the reference and the common return of the digital inputs, digital outputs, signals D+ and W. Connect it to the protective earth. You can still use systems that require insulation between battery negative and protective earth.

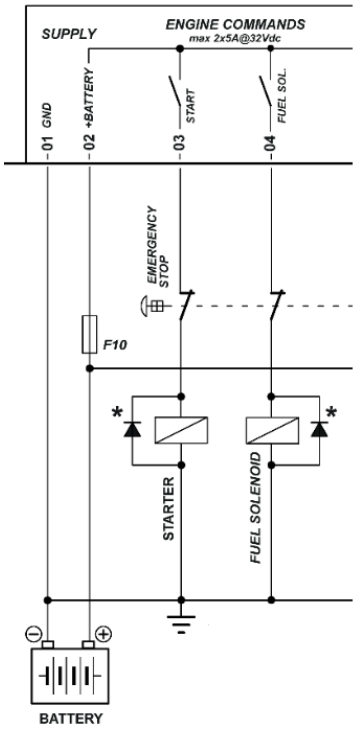
Although DC250 has an internal self-restoring fuse, it is necessary to use a fuse to protect the positive power supply T.02 line (F10 in the diagram). Through the terminal T.02 also flows all the current supplied by the six static outputs T.03...T.08 and of the D+ signal (T.09) and therefore it is necessary to pay attention to the sizing of the fuse.

DC250, when powered and each time the operator selects the OFF/RESET mode, self-recognizes the rated power supply voltage (12/24 Vdc), and uses it for the management of low/high voltage pre-alarms, and for selection of the excitation current of the charge alternator (D+ signal).

WARNING! during installation, connect the battery positives as a last step, after having opened all the fuses available in the panel

5.2 Engine connections

5.2.1 Starting and stopping



*Principle diagram for **de-energizing stop** system.*

5.2.1.1 T.03 Control for the engine starter (START)

Configurable static output, pre-assigned to the starting motor control (START). It outputs the voltage present on terminal T.02 (+ BATT).

DC250 activates this command when needs to start the engine, and automatically deactivates it within 200-300 ms from when it recognizes the engine running status.

If this command is not necessary (for example in motors with CAN BUS interface), you can use the output for other purposes.

In the same way, it is possible to use other outputs for the START command (by configuring them with the function DOF.1005 “Command to start the engine”). However, pay attention to the maximum current absorbed by each static output (they are not all the same).

ATTENTION! with particularly inductive loads (contactors, electromagnets) it is necessary to use an opening overvoltage damping diode.

ATTENTION! for currents higher than the rated one or for inductive loads with values higher than 5mH, it is necessary to use an external relay.

5.2.1.2 T.04 Command for the fuel solenoid (de-energizing stop)

Configurable static output, preassigned to control the fuel shut-off solenoid valve (FUEL), with **de-energizing stop** systems. It outputs the voltage present on terminal T.02 (+ BATT).

DC250 activates this command before starting the engine (guaranteed at least two hundred ms between the activation of this command and the activation of the crank command). It deactivates the command for stopping the engine. If DC250 uses other commands to stop the engine, it is possible to delay this command (with respect to the actual stop command) by means of parameter P.0234 (“Delay between STOP and FUEL commands”).

If this command is not necessary (for example in motors with CAN BUS interface), you can use the output for other purposes.

In the same way, it is possible to use other outputs for the FUEL command (by configuring them with the function DOF.1003 “Fuel solenoid”). However, pay attention to the maximum current absorbed by each static output (they are not all the same).

ATTENTION! with particularly inductive loads (contactors, electromagnets) it is necessary to use an opening overvoltage damping diode.

ATTENTION! for currents higher than the rated one or for inductive loads with values higher than 5mH, it is necessary to use an external relay.

5.2.1.3 T.05 Command for the stop solenoid (energizing stop)

Configurable static output, preassigned to command the solenoid for the **energizing stop** system (STOP). It outputs the voltage present on terminal T.02 (+ BATT).

Use the **energizing stop** system for safety reasons: with the **de-energizing stop** in fact, if the wire connected to terminal T.04 accidentally disconnects, the engine stops. With the **energizing stop** however, the engine does not stop until activation of the explicit stop command.

DC250 activates this command to stop the engine. It deactivates it when the engine completely stops, or, in any case, after the P.0213 delay (“Duration of the stop command”).

If this command is not necessary (for example in motors with CAN BUS interface), you can use the output for other purposes.

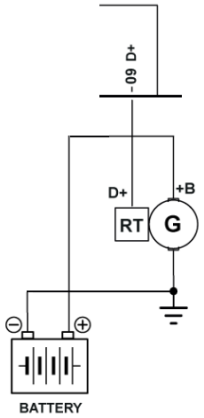
In the same way, it is possible to use other outputs for the STOP command (by configuring them with the function DOF.1006 “Stop solenoid”). However, pay attention to the maximum current absorbed by each static output (they are not all the same).

ATTENTION! with particularly inductive loads (contactors, electromagnets) it is necessary to use an opening overvoltage damping diode.

ATTENTION! for currents higher than the rated one or for inductive loads with values higher than 5mH, it is necessary to use an external relay.

WARNING! the connection of the emergency button in series to terminal T.04 does not work with **energizing stop system**. For these systems, if the functionality of the emergency button has to be guaranteed regardless of DC250 operation, it must have a double contact: a “normally closed” contact connected in series to T.03 to cut off the power supply to the starter motor, and one “normally open” contact connected between T.02 (+ BATT) and T.05 (STOP) without intermediate fuses (pressing the emergency button supplies positive voltage to the stop command bypassing the DC250 command)

5.2.2 5.2.2 Excitation/operation check of the charge alternator D+ (T.09)



INFORMATION! Terminal T.09 is not by default associated with the management of the charge alternator. To associate it, set parameter P.4001 ("Function of the analogue input T.09 (DP)" with the AIF.1300 function ("D+ signal").

With the engine and the charge alternator stopped, the terminal D+ is a short circuit to GND, and the voltage across it is close to 0 Vdc. During (or immediately after) the starting of the engine (under normal operating conditions), with the rotation of the charge alternator, the D+ voltage rises above the rated battery voltage. When the engine stops, or even if only the charge alternator stops due to the breaking of the belt that drives it, the D+ voltage goes back to 0 Vdc. The same also happens in the event of a failure of the charge alternator.

When DC250 starts the engine, terminal T.09 supplies the current necessary for the excitation of the charge alternator. The supplied current is internally limited (see paragraph 3 for 12 Vdc and 24 Vdc currents); the selection of the current level is automatic based on the DC250 supply voltage T.02. DC250 activates the excitation command together with the engine start command.

During the cranking cycle of the engine (until the deactivation of the START command), DC250 activates the excitation command for thirty seconds and then it deactivates/activates cyclically every five seconds, until the end of the cranking sequence. After deactivation of the START command, the excitation command is active for a further five seconds and then released.

Through terminal T.09, DC250 measures the D+ voltage of the charge alternator, both during engine starting and during its operation. It uses the voltage measurement for two purposes:

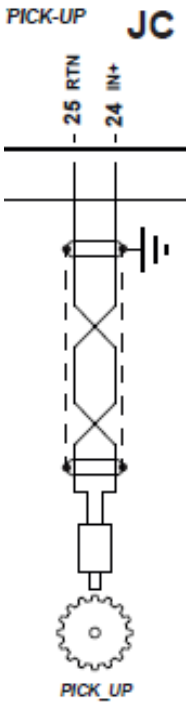
- Detect the engine running status, to deactivate the START command for the starter motor. This function is normally disabled, as it often happens that the voltage on terminal D+ rises before the engine really starts. To enable it, make sure that parameters P.0230 and P.0231 are both different from zero and that P.0231 is greater than P.0230.
- Diagnose a failure of the charge alternator. If during engine operation the D+ voltage drops to 0 Vdc (or does not rise after starting), the charge alternator does not recharge the battery.

  If the condition persists for the delay P.0349 ("Delay for charge alternator failure"), DC250 activates the anomaly AL.005 ("Engine's battery charger failure"): parameter P.0357 ("Action for charge alternator failure") allows you to configure the type of fault (and consequently allows you to decide whether to stop the engine or not).

  Failure of the charge alternator does not in itself require stopping the engine. Usually, however, a belt drives the charge alternator. The same belt can drive other mechanical components of the engine, such as the radiator cooling fan. In these cases, the failure of the charge alternator may mean the failure of other fundamental services and requires stopping the engine.

  You can disable the AL.005 shutdown by setting the delay P.0349 to zero.

5.2.3 Measurement of engine rotation speed



DC250 can use a magnetic pick-up placed on the flywheel to measure the engine speed; in addition, or alternatively, it can use the W signal present on the charge alternator.

With engines equipped with ECU, DC250 can acquire the rotation speed directly via CAN BUS

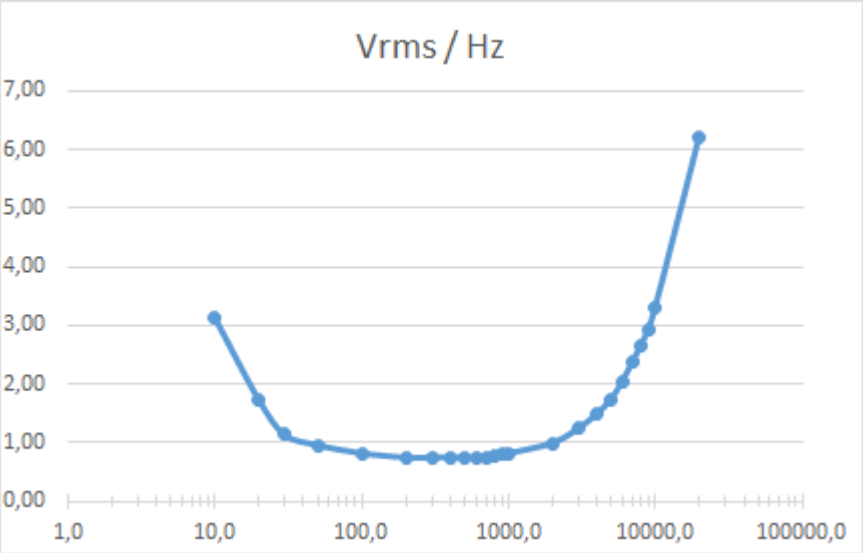
Parameter P.0133 allows setting the rated engine rotation speed (all speed protection thresholds are set as a percentage of P.0133).

5.2.3.1 Magnetic pick-up (T.24, T.25)

DC250 can manage:

- Two-wires pick-up sensors (isolated). This type is preferable. Connect the two wires to terminals T.24 (+) and T.25 (-) of DC250. Use shielded cable for the connection, with the shield connected on one side only.
- Single wire pick-up sensors. The sensor is not isolated, the return connection is directly the body of the sensor in contact with the metal structure of the engine. Connect only terminal T.24 (+), earthing both the metal structure of the engine and the negative power supply of DC250.

The measured signal is a sinusoid; the frequency depends on the rotation speed of the engine and on the number of teeth on the flywheel. See the table below for the minimum characteristics of the input signal. If the voltage is too low, you can increase the signal by screwing the pick-up to bring it closer to the flywheel but paying the utmost attention so that it does not hit it during the rotation of the flywheel.



It is usually possible to use only one pick-up sensor connected to both DC250 and to another devices, such as a speed governor, but paying attention to respect the polarity of the connections. Also check that the signal amplitude is sufficient.

See the graph above for the minimum characteristics of the input signal as a function of frequency.

The number of teeth of the flywheel must be set in parameter P.0110 (“number of teeth of the pick-up wheel”); enter zero to disable the speed measurement from the pick-up.

5.2.3.2 W signal (T.26)

Charge alternators usually have a “W” terminal, which provides a sinusoidal signal (or square wave) whose frequency is proportional to the rotation speed of the charge alternator itself. The W signal has an amplitude between 0 Vdc and the recharge voltage, with a frequency proportional to the engine rotation speed, but which depends on how the charge alternator itself and on the pulleys that runs the belt that drags him.

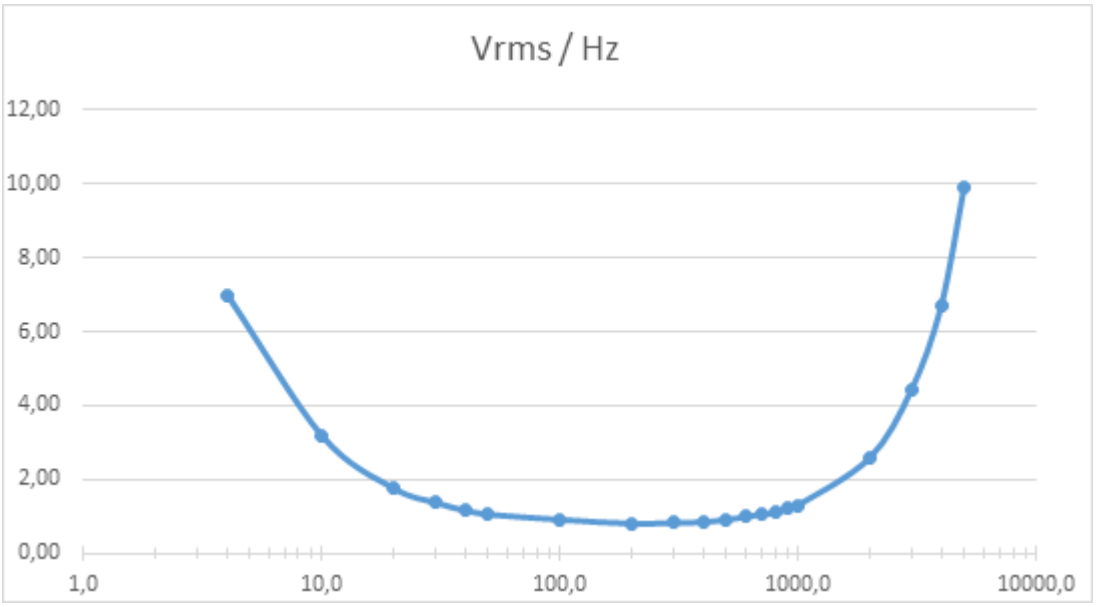
Connect the W signal of the charge alternator to terminal T.26, making sure that the negative power supply of DC250 is common to the negative of the starter battery.

It is also possible to connect this terminal to the internal alternating voltage of the main alternator of the generator (before the diode bridge).

Parameter P.0111 (“Rpm/W ratio”) allows you to set the ratio between the frequency of the signal W (or of the alternating voltage of the main alternator) and the real engine speed: it also has a decimal part, because the ratio between the two frequencies may not be an integer.

This ratio depends on the construction information of the engine/generator, but you can calculate it empirically. Knowing the real engine speed and checking the measured speed on the DC250 display, you should increase P.0111 if the measured speed is higher than the real one, or vice versa, until DC250 shows the real speed.

See the graph below for the minimum characteristics of the input signal as a function of frequency.

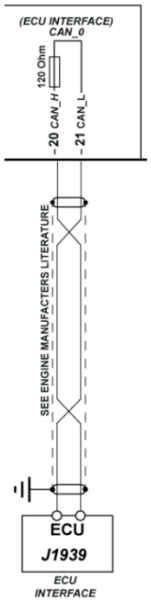


5.2.4 Resistive analogue sensors (T.12…T.15)

DC250 can acquire characteristic measurements of the engine (oil pressure, coolant temperature, oil temperature, fuel level) using three analogue inputs (T.13, T.14 and T.15) capable of measuring resistances (see paragraph 3 for the measuring range). See chapter 5.6 for the connection and configuration of the analogue inputs.

Internally, DC250 only provides standard conversion curves for VDO sensors. Using the BOARDPRG4 software, however, it is possible to transfer curves for different sensors to DC250 or create your own curves (see paragraph 5.6.5).

5.2.5 CAN BUS connection to the ECU (T.20, T.21)



With the latest generation electronic motors, quite all the connections listed in the previous paragraphs become superfluous. With a single connection (CAN BUS in fact) DC250 can command the starts and stops of the engine, as well as control its speed, acquire measurements (including the rotation speed, the coolant temperature, and the oil pressure) and show the diagnostic codes activated by the engine itself.

For the connections it is necessary to use a cable for CAN BUS connections of the specific type (see documents [4] e [5]).

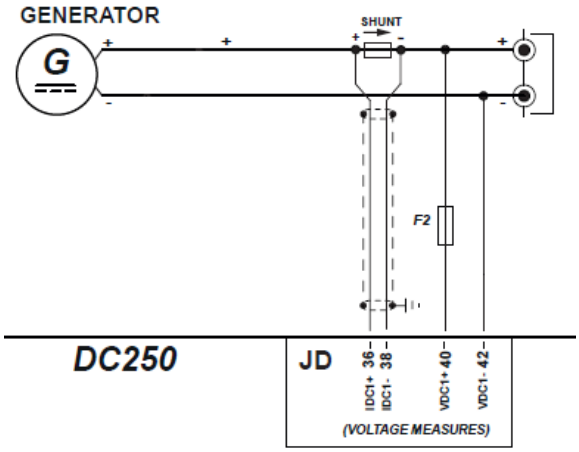
The DC250 CAN BUS interface is not galvanically isolated. Connect terminal T.20 to the CAN_H terminal of the ECU. Connect the terminal T.21 to the CAN_L terminal of the ECU. Connect the cable shield to signal ground on one side only.

CAN BUS requires 120 Ω termination resistor on the two ends of the connection:

- DC250 has one of the two required resistances inside.
- Normally the ECUs integrate the termination resistor inside them; otherwise, connect a 120 Ω resistor directly on the CAN_H and CAN_L terminals of the ECU.

Use the parameters of menu 7 (P.0700, F.0700 and P.0703) to select the ECU type and the required commands.

5.3 Generator connections



5.3.1 T.40...T.42: DC voltage measurement

Connect the generator DC voltage to terminals T.40 (+) and T.42 (-). DC250 makes a differential measurement, therefore it is not necessary to connect the negative pole (-) to the protective earth. See the paragraph 3 for maximum DC voltage difference between terminals and GND. DC250 makes true effective voltage measurement (TRMs).

Parameter P.0102 allows to set the nominal DC voltage of the generator (all the protection thresholds on the DC voltage can be set as a percentage of P.0102).

5.3.2 T.36...T.38: DC current measurement

DC250 makes the measurement of the DC current through an external shunt resistor, connected to terminals T.36 (+) and T.38 (-). For the connection of the shunt, it is advisable to use a shielded cable.

See the paragraph 3 for the maximum measurable voltage on the shunt: select the shunt most suitable for the power of the generator, considering the margin necessary to manage the overload protection, but also the measurement accuracy required.

The accuracy of the measurement also depends on the accuracy class of the used shunt. For example, considering a 250 Adc/200 mVdc shunt with an accuracy class of 0.5, the measurement error introduced by DC250 will be a maximum of 0.5 Adc, while the measurement error introduced by the shunt will be a maximum of 1.25 Adc. We recommend using a shunt with an accuracy class of at least 0.5 (or better) if you want to take advantage of the accuracy of DC250.

Set the current/voltage ratio of the shunt with parameter P.9601 (“Ratio A/V for current”).

Parameter P.9502 allows to set the nominal DC current of the generator (all the protection thresholds on the DC current can be set as a percentage of P.9502).

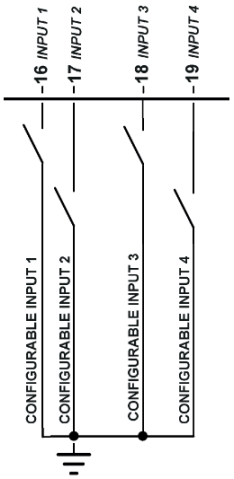
5.4 Digital inputs

DC250 has four dedicated digital inputs (T.16…T.19). If you do not need terminals T.13…T.15 as analogue inputs, you can use them as digital inputs. In the same way, if you do not need terminal T.09 as analogue input or D+ signal, you can use it as a digital input.

DC 250 can therefore manage a maximum of eight digital inputs. It also manages sixteen “virtual” digital inputs, not existing, but evaluated as a logical combination of physical or virtual inputs, outputs, anomalies, or logic states, by means of appropriate programming (AND/OR logic). You must use BOARDPRG4 for programming the AND/OR logics.

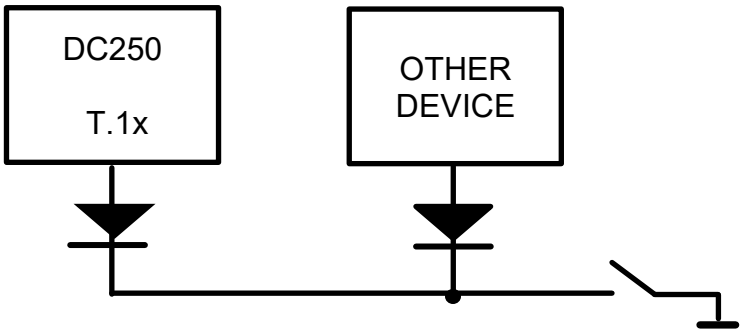
You can configure the polarity, the function, and activation delay for all digital inputs.

5.4.1 Physical digital inputs (T.16 ... T.19)



DC250 has four digital inputs, activated by connecting them to GND.

If you use the same command signal shared between multiple devices in addition to DC250, we recommend using diodes in series with the inputs as shown in the following figure:



The default functions for the inputs are:

Terminal	Function
T.16	DIF.2032 – “Remote start request”
T.17	DIF.0000 – “Not used”
T.18	DIF.4201 – “Emergency stop”
T.19	DIF.0000 – “Not used”

WARNING! The default configuration of input T.18 is for acquiring the signal of an emergency button; for safety reasons this function uses an inverted logic, i.e., during normal operation terminal T.18 must remain connected to GND through an NC contact of the emergency button; when the contact opens, DC250 activates the relative shutdown.

5.4.2 Resistive analogue inputs used as digital (T.13 … T.15)

It is possible to individually configure the three resistive analogue inputs as digital inputs, using the AIF.0100 function (“Used as digital input”), see paragraph 5.6. Once configured, they will appear in the configuration menu of the digital inputs and will be manageable just like the other inputs.

To activate the input, connect it to GND, to deactivate it just leave it floating.

5.4.3 Input D+ used as digital input (T.09)

It is possible to configure the T.09 input as a digital input, using the AIF.0100 function (“Used as digital input”) in parameter P.4001. Once configured, it will appear in the configuration menu of the digital inputs and will be manageable just like the other inputs.

To activate the input, connect it to a voltage higher than 4.0 Vdc (not to GND like the other digital inputs). To deactivate it, just leave it floating or connect it to a voltage lower than 3.5 Vdc.

5.4.4 Virtual digital inputs

DC250 manages the virtual digital inputs exactly as if they were physical inputs (without any limitation); DC250 does not acquire their status by the hardware but determines them by software. In fact, you can associate an AND/OR logic to each virtual digital input, which determines its status.

To give a practical example, suppose you want to activate a pre-alarm if a digital input prevents the GCB circuit breaker from closing, but only if DC250 is in AUTO mode and if the engine is running. We are going to use virtual digital input #1 (as an example).

Using the BOARDPRG4 software, we associate an AND/OR logic (see 5.5.5) configured as AND to the virtual digital input #1, with the following list of conditions:

- ST.088 (“Inhibition of power supply to users due to digital input”).
- ST.032 (“Engine running”).
- ST.002 (“AUTO”).

DC250 will therefore activate the virtual digital input when all the three previous conditions are true. We set the function DIF.4001 (“Generic pre-alarm”) in parameter P.2151. We set the desired delay (for example 0.5 s) in parameter P.2152.

5.4.5 Digital inputs configuration

By default, DC250 considers all digital inputs “active” when connected to the negative power supply (or to a DC voltage for T.09); it considers them “inactive” when not connected to anything. You can invert the logical state of the input (with respect to the physical state) by selecting the “Reverse polarity” box on the BOARDPRG4 input configuration page. The box appears only if the selected function is different from DIF.0000 - “Not used”.

It is also possible to invert the logic state (always individually for each input), by operating directly on the DC250 using the parameters:

- P.2000 for the inputs T.16...T.19.
- P.2100 for the inputs T.13...T.15 e T.09.

These parameters have one bit for each input:

- A zero bit means that the related input is “active” when connected to the negative power supply of DC250 (or to a DC voltage for T.09).
- A bit at one means that the relative input is “active” when not connected to anything: it will become “inactive” when connected to the negative power supply of DC250 (or to a DC voltage for T.09).

All bits are zero as default.

DC250 provides three parameters for each input:

- A parameter that configures its function (P.2001 for the T.16 input, the following parameters for the other inputs).
- A parameter that configures an activation delay (P.2002 for the T.16 input, the following parameters for the other inputs).
- A parameter that configures the message to be shown on the display (P.2003 for input T.16, the subsequent parameters for the other inputs).

See document [1] for the parameters list. DC250 uses the parameters that configure the delay and the message only for specific functions of the inputs. The following table shows when used.

INFORMATION! in BOARDPRG4 the delay and message boxes always appear even if not used by DC250.

Function	Delay	Message	Description
0000-Not used			Not used.
1001-Request for GCB closure			See 7.6.4.1.
1002-Request for GCB opening			See 7.6.4.1.
2001-Command for resetting alarms			See 8.3.
2032-Remote start request	Yes		See 7.3.5.
2033-Manual START command			See 7.3.5.
2034-Manual STOP command			See 7.3.5.
2061-Request for idle speed			See 7.3.9.
2071-Inhibit DPF regeneration			See 7.3.9.
2072-Force DPF regeneration			See 7.3.9.
2073-Consent for DPF regeneration			See 7.3.9.
2271-Remote OFF			See 7.1.
2272-Remote MAN			See 7.1.
2273-Remote AUTO			See 7.1.
2371-Speed increase			See 7.3.10.3.
2372-Speed decrease			See 7.3.10.3.
2373-Speed reset			See 7.3.10.3.
2502-Inhibition of power supply to users			See 7.6.4.2.
2511-Front panel lock			See 6.2.
2512-Remote commands lock			See 5.7.
2703-Enables the load thresholds			See 9.1.
2751-Enables the generator/engine usage planning			See 7.3.3.
3001-Status of GCB circuit breaker	Yes		See 7.6.1.2.
3301-Level for starting fuel pump			See 7.3.9.3.2
3302-Level for stopping fuel pump			See 7.3.9.3.2

Function	Delay	Message	Description
3311-Level for starting AdBlue pump			See 7.4.2.3
3312-Level for stopping AdBlue pump			See 7.4.2.3
4001-Generic pre-alarm	Yes	Yes	See 8.5
4003-Generic deactivation	Yes	Yes	See 8.5
4004-Generic shutdown	Yes	Yes	See 8.5
4011-Pre-alarm (after oil delay)	Yes	Yes	See 8.5
4013-Deactivation (after oil delay)	Yes	Yes	See 8.5
4014-Shutdown (after oil delay)	Yes	Yes	See 8.5
4021-Pre-alarm (whit connected loads)	Yes	Yes	See 8.5
4023-Deactivation (whit connected loads)	Yes	Yes	See 8.5
4024-Shutdown (whit connected loads)	Yes	Yes	See 8.5
4031-Pre-alarm (when FUEL is active)	Yes	Yes	See 8.5
4033-Deactivation (when FUEL is active)	Yes	Yes	See 8.5
4034-Shutdown (when FUEL is active)	Yes	Yes	See 8.5
4051-Pre-alarm (stops fuel pump)	Yes	Yes	See 8.5
4201-Emergency stop	Yes	Yes	See 8.7 (48)
4211-Low fuel tank level shutdown	Yes	Yes	See 8.7 (25) See 7.3.9.3.2
4212-Low fuel tank level pre-alarm	Yes	Yes	See 8.7 (27) See 7.3.9.3.2
4213-High fuel tank level pre-alarm	Yes	Yes	See 8.7 (29) See 7.3.9.3.2
4221-Low oil pressure shutdown	Yes	Yes	See 8.7 (41) See 7.3.1
4222-Low oil pressure pre-alarm	Yes	Yes	See 8.7 (43) See 7.3.1
4231-High coolant temperature pre-alarm	Yes	Yes	See 8.7 (31)
4232-High coolant temperature shutdown	Yes	Yes	See 8.7 (33)
4241-Over load	Yes	Yes	See 8.7 (15)
4251-Over speed	Yes	Yes	See 8.7 (17)

5.5 Digital outputs

DC250 provides ten static digital outputs, divided into three blocks:

- T.03…T.04.
- T.05…T.08.
- T.27…T.30.

You can configure the function and the activation polarity of each digital output. See the paragraph 3 for the electrical characteristics of each output.

The default functions for the digital outputs are:

Terminal	Function
T.03	DOF.1005 – “Command to start the engine”
T.04	DOF.1003 – “Fuel solenoid”
T.05	DOF.1006 – “Stop solenoid”
T.06	DOF.3152 – “External horn”
T.07	DOF.0000 – “Not used”
T.08	DOF.2034 – “Stable closing command for GCB”
T.27	DOF.0000 – “Not used”

Terminal	Function
T.28	DOF.0000 – “Not used”
T.29	DOF.0000 – “Not used”
T.30	DOF.0000 – “Not used”

5.5.1 T.03...T.04 static digital outputs

Two static digital outputs, fully programmable. When activated, they provide the positive supply voltage present on the power supply terminal T.02.

ATTENTION! with particularly inductive loads (contactors, electromagnets) use an opening overvoltage damping diode

ATTENTION! for currents higher than the rated one or for inductive loads with values higher than 5mH, use an external relay.

5.5.2 T.05...T.08 static digital outputs

Two static digital outputs, fully programmable. When activated, they provide the positive supply voltage present on the power supply terminal T.02.

ATTENTION! with particularly inductive loads (contactors, electromagnets) use an opening overvoltage damping diode

ATTENTION! for currents higher than the rated one or for inductive loads with values higher than 5mH, use an external relay.

5.5.3 T.27...T.31 static digital outputs

Two static digital outputs, fully programmable. When activated, they provide the positive supply voltage present on the power supply terminal T.31.

ATTENTION! with particularly inductive loads (contactors, electromagnets) use an opening overvoltage damping diode

ATTENTION! for currents higher than the rated one or for inductive loads with values higher than 5mH, use an external relay.

5.5.4 Digital outputs configuration

All the digital outputs of DC250 are individually fully configurable.

By default, DC350 activates an output when the relative function requires it (for example, it activates the fuel pump output when needs to start the pump). Using BOARDPRG4 it is possible to invert the activation logic simply by selecting the “Reverse polarity” box at the top of the configuration page of each individual output.

You can also invert the logic of the outputs by operating directly on DC250 (always individually for each output) using parameter P.3000. This parameter has a bit for each output:

- A zero bit means that the relative output is normally at rest, DC250 activates it when required.
- A one bit means that DC250 normally activates the relative output, it deactivates it when required.

All bits are zero for default.

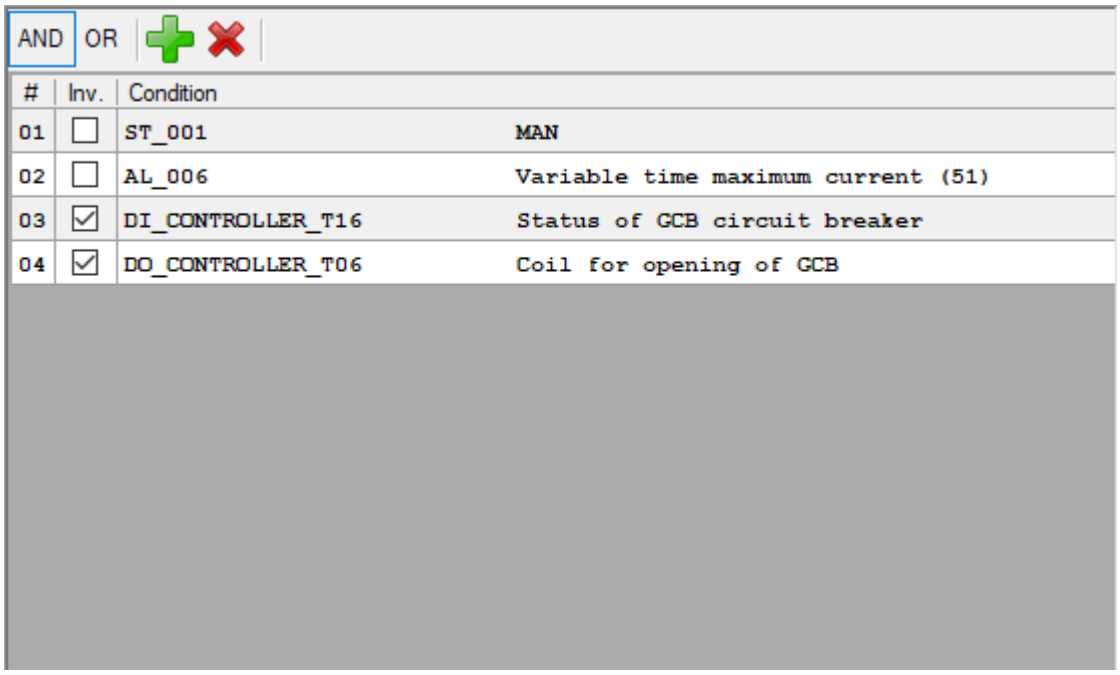
DC250 provides one parameter for each output, configuring its function (P.3001 for output T.03, the subsequent parameters for the other outputs). See the document [1] for the parameters list.

Function	Description
0000-Not used	Not used.
0103-AND/OR logic	See 5.5.5.
1001-Preheating of glow plugs	See 7.3.5.
1003-Fuel solenoid	See 7.3.5.
1005-Command to start the engine	See 7.3.5.
1006-Stop solenoid	See 7.3.5.
1007-Command for idle speed	See 7.3.5.
1032-Fuel pump	See 7.3.9.3.
1034-Solenoid for fuel pump	See 7.3.9.3.
1035-Inhibit DPF regeneration	See 7.3.9.
1036-Force DPF regeneration	See 7.3.9.
1037-AdBlue pump	See 7.4.2.3
1038-Solenoid for AdBlue pump	See 7.4.2.3
2031-Minimum voltage coil for GCB	See 7.6.1.1.
2032-Coil for opening of GCB	See 7.6.1.1.
2033-Coil for closure of GCB	See 7.6.1.1.
2034-Stable closing command for GCB	See 7.6.1.1.
2061-Light command 1	See 7.6.3.
2062-Light command 2	See 7.6.3
2063-Light command 3	See 7.6.3
2064-Light command 4	See 7.6.3
2065-Light command 5	See 7.6.3
2066-Light command 6	See 7.6.3
2067-Light command 7	See 7.6.3
2068-Light command 8	See 7.6.3
3001-Off/reset	See 7.2.1.
3002-Manual	See 7.2.1.
3003-Automatic	See 7.2.1.
3011-Not in Off/reset	See 7.2.1.
3032-Generator in tolerance	See c).
3061-Engine running	See 7.3.8.
3121-Load thresholds	See 9.1.
3151-Reset of the anomalies	See 8.4.
3152-External horn	See 8.4.
3153-Lamp test	See 6.2.
4001-Pre-alarms	See 8.4.
4003-Deactivations	See 8.4.
4004-Shutdowns	See 8.4.
4005-Shutdowns and deactivations	See 8.4.
4031-Anomalies of the generator	See 8.4.
4032-Anomalies of the engine	See 8.4.
4034-Anomalies of the fuel	See 8.4.
4035-Anomalies of circuit breakers	See 8.4.

5.5.5 AND/OR logics

The AND/OR logics are a list of boolean conditions (true/false, on/off, 1/0) configurable by the operator (programming) and evaluated by DC250, which stores their result into a digital output or into a virtual digital input. To use AND/OR logics with a digital output, use the DOF.0103 function.

INFORMATION! You cannot configure the AND/OR logics directly from the DC250 panel, you need a PC with the BOARDPRG4 software



First, you must decide whether DC250 must evaluate the list of conditions as AND (all verified) or as OR (at least one condition verified). It is not possible to have mixed AND/OR logic (it is possible using virtual digital inputs, see later).

You can add up to thirty conditions. You can individually deny each condition: in the previous figure, for example, DC250 will verify that the digital input T.16 and the digital output T.06 are both inactive. You can add the following conditions:

- DI_XXX: logical state of the digital inputs.
- DO_XXX: logical state of the digital outputs.
- AL_XXX: anomalies.
- ST_XXX: internal states of DC250.
- AT_XXX: states related to the thresholds on analogue measurements (see par. 5.6.4).

The following table shows the list of internal states available for AND/OR logics

State	Description
ST.000	OFF_RESET
ST.001	MAN
ST.002	AUTO
ST.006	Acknowledgment of anomalies in progress
ST.007	Reset of anomalies in progress
ST.008	Pre-alarms
ST.010	Deactivations
ST.011	Shutdowns
ST.012	Not recognized pre-alarms
ST.014	Not recognized deactivations
ST.015	Not recognized shutdowns
ST.024	Generator present (voltages/frequency)
ST.025	Generator absent or out of thresholds

State	Description
ST.026	Delay for generator in thresholds
ST.027	Generator in thresholds
ST.028	Delay for generator absent or out of thresholds
ST.032	Engine running
ST.033	Lube oil protections enabled
ST.035	Engine management: stopped
ST.036	Engine management: starting
ST.037	Engine management: idle speed
ST.038	Engine management: delay before supply
ST.039	Engine management: ready to supply
ST.040	Engine management: cooling down
ST.041	Engine management: stopping
ST.064	GCB status
ST.068	GCB closure command (stable)
ST.070	GCB minimum voltage coil
ST.071	GCB opening pulse
ST.072	GCB closure pulse
ST.087	Inhibition of power supply to users due to starting for low battery voltage
ST.088	Inhibition of power supply to users due to digital input
ST.090	Inhibition of power supply to users due to serial port command
ST.096	Ready to supply
ST.104	Supplying
ST.112	Sync per second
ST.113	Sync per minute
ST.114	Sync per hour
ST.128	Glow-plugs preheat command
ST.130	Fuel solenoid
ST.132	Crank motor
ST.133	Stop solenoid
ST.134	Idle speed command
ST.137	Inhibit DPF regeneration
ST.138	Force DPF regeneration
ST.139	AdBlue pump command
ST.140	AdBlue solenoid command
ST.256	CAN 0 BUS-OFF
ST.257	CAN 0 ERR-PASSIVE
ST.258	CAN 0 ERR-ACTIVE
ST.259	No communication on CAN 0
ST.304	START button
ST.305	STOP button
ST.308	AUTO button
ST.310	UP button
ST.311	DOWN button
ST.320	Status #01 from engine management by file
ST.321	Status #02 from engine management by file
ST.322	Status #03 from engine management by file
ST.323	Status #04 from engine management by file
ST.324	Status #05 from engine management by file
ST.325	Status #06 from engine management by file
ST.326	Status #07 from engine management by file
ST.327	Status #08 from engine management by file
ST.328	Status #09 from engine management by file

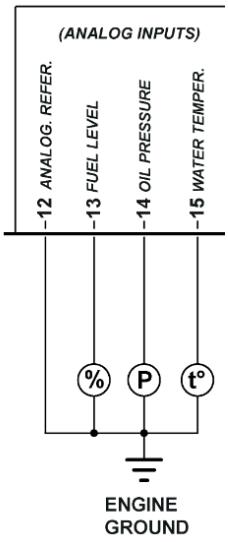
State	Description
ST.329	Status #10 from engine management by file
ST.330	Status #11 from engine management by file
ST.331	Status #12 from engine management by file
ST.332	Status #13 from engine management by file
ST.333	Status #14 from engine management by file
ST.334	Status #15 from engine management by file
ST.335	Status #16 from engine management by file
ST.336	Application type: Auto Start
ST.346	Application type: DRIVE (engine only)
ST.347	Application type: Lighting tower
ST.368	Active regeneration status: not active (spn3700=0)
ST.369	Active regeneration status: active (spn3700=1)
ST.370	Active regeneration status: will start soon (spn3700=2)
ST.371	DPF status: regeneration not required (spn3701=0)
ST.372	DPF status: regeneration needed - lowest level (spn3701=1)
ST.373	DPF status: regeneration needed - moderate level (spn3701=2)
ST.374	DPF status: regeneration needed - highest level (spn3701=3)
ST.998	Always ON
ST.999	Always OFF

5.6 Analogue inputs

DC250 provides three inputs designed for connection to resistive sensors T.13, T.14, T.15, and a common terminal T.12. In addition to these, there are two analogue voltage measurement inputs with reference to GND:

- T.09: as an alternative to use as a D+ signal, you can use it as an analogue input for voltage signals (see paragraph 3 for the voltage range).
- T.16: as an alternative to use as a digital input, you can use it as an analogue input for voltage signals (see paragraph 3 for the voltage range).

5.6.1 Resistive analogue inputs (T.13 …T.15)



See paragraph 3 for the resistance range of the inputs. The three inputs are electrically identical to each other. You can individually configure each input for measuring resistive signals; by default, the analogue measurements are not enabled.

ATTENTION! in any case we recommend respecting the functions provided for each single resistive input (to respect the names already provided in BOARDPRG4 and the reference diagrams)

- T.13: FL - fuel level.
- T.14: OP – oil pressure.
- T.15: CT – coolant temperature.

5.6.1.1 Common reference terminal (T.12)

This is not a real measurement input: DC250 uses it only together with the three inputs for resistive sensors.

DC250 uses it to compensate the non-equipotentiality between the electrical ground of DC250 (terminal T.01) and the electrical ground of the engine, usually generated by the voltage drop on the connection cables. This happens when the connections between the panel and the engine are long and there is a circulation of current in the connections, for example due to the presence of the battery charger inside the electrical panel.

ATTENTION! Connect T.12 via a dedicated wire directly to the metal structure of the engine (i.e., where the sensors are normally screwed). Do not connect T.12 to GND in the electrical panel or directly to terminal T.01. Make this connection with a wire as short as possible. Avoid letting it pass near power cables

When working with negative isolated sensors (from the engine), for example for fuel level sensors mounted on plastic tanks, connect T.12 both to the sensor return and to the electrical ground of the engine.

The system can effectively compensate for both positive and negative potentials (see paragraph 3 for the maximum compensation range).

5.6.2 D+ input used as analogue input (T.09)

When you do not need excitation and control for the charge alternator, you can configure T.09 as a voltage analogue input (see the paragraph 3 for the range with respect to the negative power supply GND), associating it to one of the available functions through parameter P.4001 (any function except AIF.1300 (“D+ signal”).

5.6.3 Digital input used as analogue (T.16)

You can configure the input T.16 to acquire voltage analogue signals (see paragraph 3 for the maximum voltage range), by selecting any function in parameter P.4033 except AIF_0100 (“Used as digital input”). By default, terminal T.16 is a digital input.

5.6.4 Configuration and functions of the analogue inputs

You can use the analogue inputs for the acquisition of various quantities, predefined or generic (and therefore customizable). You may use specific input to acquire specific quantities (see the following table).

Working with engines equipped with ECU, DC250 normally acquires the quantities relating to the engine (pressures, temperatures) directly via CAN BUS; you may sometimes use and configure the resistive fuel level sensor.

You can associate predefined conversion curves (for the most common sensors on the market) to each analogue input, using the BOARDPRG4 program. Alternatively, it is possible to define custom curves (see par. 5.6.5).

Each analogue input provides a set of eight parameters, which define its function, name and two sets of thresholds useable for distinct functions. In the following we refer to the parameters provided for input T.13, refer to document [1] for the parameters related to the other inputs:

- A parameter that configures the function (P.4009 for input T.13).
- A parameter that configures a message for the display (P.4010 for input T.13).

- Two thresholds made up of three parameters each:
  - A parameter that configures the threshold value (P.4011 and P.4014 for input T.13).
  - A parameter that configures a delay to manage the “out of range” condition (P.4012 and P.4015 for input T.13).
  - A parameter that configures the options and actions for the “out of range” condition (P.4013 and P.4016 for input T.13).

INFORMATION! the thresholds defined here are independent from those set in the “Protections” menu; for example, for the coolant temperature sensor you can set a high-temperature threshold through parameter P.0337 to stop the engine, and a pair of independent temperature thresholds through the parameters described above used to create other alarms, different signals, or logics.

DC250 shows the message configured (in the example parameter P.4010) when it uses the thresholds to activate pre-alarms and/or shutdowns (see later).

DC250 also uses the message with the AIF.2001 function (“Generic sensor”). In this case, DC250 displays the acquired measurement on page G.36, preceded by the configured message. Note: using the AIF.2051 function instead of AIF.2001, DC250 will not show the acquired measurement on the display, but it still uses the thresholds to manage digital outputs and activate pre-alarms/shutdowns.

The two thresholds are completely independent of each other. The third parameter of each threshold is a “bit” parameter that allows you to associate the following options to each threshold:

- Bit 0:
  - OFF: DC250 checks if the measurement is greater than the threshold.
  - ON: DC250 checks if the measurement is less than the threshold.
- Bit 1: value copied in the “internal state” associated with the analogue input in case of “out of range” condition.

- Bit 4: DC250 activates a pre-alarm if the measurement is “out of range”.
- Bit 6: DC250 activates a deactivation if the measurement is “out of range”.
- Bit 7: DC250 activates a shutdown if the measurement is “out of range”.

- Bit 8: DC250 activates an anomaly only if the engine is running.
- Bit 9: DC250 activates an anomaly only if the low oil pressure mask time has elapsed.
- Bit 10: DC250 activates an anomaly only if the engine/generator supplies the loads.
- Bit 11: DC250 activates a fault only if the fuel solenoid is open.
- Bit 14: the anomaly also involves stopping the fuel pump.

You can set any combination of these bits.

The following table shows the list of functions that can be associated with the analogue inputs:

Function	Description	Threshold	T.09	T.13 T.14 T.15	T.16
0000-Not used			X	X	
0100-Used as digital input			X	X	X
1000-Oil pressure (VDO)		X		X	
1001-Oil pressure (generic)		X	X	X	X
1100-Oil temperature (VDO)		X		X	
1101-Oil temperature (generic)		X	X	X	X
1110-Coolant temperature (VDO)		X		X	
1111-Coolant temperature (generic)		X	X	X	X
1200-Oil level (VDO)		X		X	
1201-Oil level (generic)		X	X	X	X
1210-Coolant level (VDO)		X		X	
1211-Coolant level (generic)		X	X	X	X
1220-Fuel level (VDO)		X		X	
1221-Fuel level (generic)		X	X	X	X
1300-D+ signal		X	X		
2001-Generic sensor (page 1)	X	X	X	X	X
2051-Generic sensor	X	X	X	X	X
2423-Setpoint for regulation		X	X	X	X

All the odd AIF.XXXX functions require the use of the BOARDPRG4 program to define or load the sensor characteristic curve.

The AIF.1000, AIF.1100, AIF.1110, AIF.1200, AIF.1210, AIF.1220 functions, instead, use predefined conversion curves suitable for the most common VDO sensors.

VDO temperature sensor (AIF.1100, AIF.1110)	
0 °C	1800 Ω
50 °C	195 Ω
100 °C	38 Ω
150 °C	10 Ω

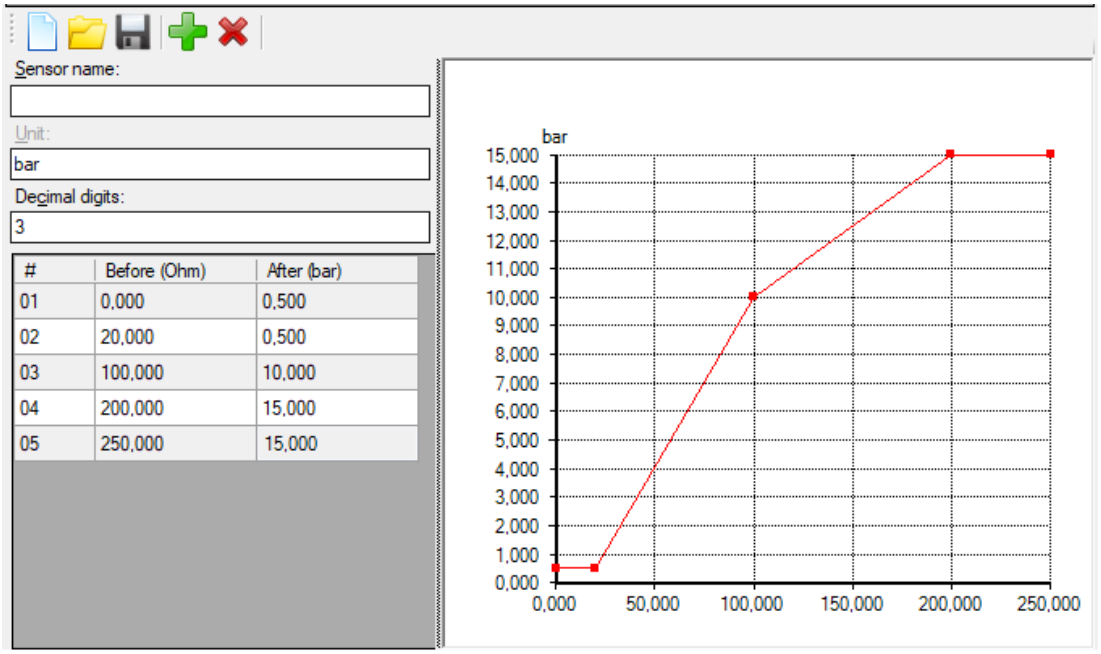
VDO pressure sensor (AIF.1000)	
0 bar	9 Ω
10 bar	180 Ω

VDO level sensor (AIF.1200, AIF.1210, AIF.1220)	
0 %	180 Ω
100 %	10 Ω

5.6.5 Conversion curves

Conversion curves are a tool that allows you to convert a numerical value into another numerical value. You can use them to convert the value acquired by a voltage or resistance analogue input into the real unit of measurement of the sensor.

INFORMATION! You cannot make the configuration of the conversion curves directly from the DC250 panel, you must do it through a PC with the BOARDPRG4 software. Once created, you can save the curve into a file for later re-use on other devices as well



The previous figure shows a hypothetical resistance/pressure conversion curve associated with a resistive analogue input. You can add up to thirty-two points to the graph, thus also creating non-linear curves. Note in the example that the configured curve has two horizontal segments at the beginning and at the end, obtained by putting two equal values in the “After” column corresponding to two different values in the “Before” column. This is not mandatory, but it allows you to impose a saturation limit on one or both ends of the curve. DC250, in fact, extends the first and last segment of the curve to infinity. Being horizontal, whatever value the measure “to be converted” takes, you will obtain the same value as the “converted” measure.

The BOARDPRG4 software allows (using the buttons on the top left) to save the curve on a file, to then be able to reuse it in other applications. It is therefore possible to make an archive of the conversions associated with the used sensors.

If the curve is associated with a physical analogue input configured with the AIF.2001 function (“Generic sensor”), DC250 will display the converted measurement on page G.36: in this case it is also possible to specify (using the conversion curve) the number of decimal digits for the displayed value and its unit of measurement.

5.7 Communication ports

DC250 provides two communication ports:

- One USB port.
- One RS485 port.

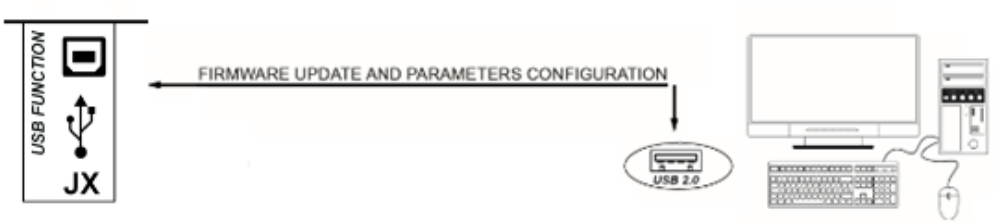
On both, DC250 supports the Modbus RTU protocol, in SLAVE/SERVER mode. Through Modbus, it is possible to read from DC250 all measures and states. It is also possible to modify the configuration parameters (knowing the access passwords) and send commands (knowing the command password).

You can protect the write/command access to the communication ports with two passwords:

- P.0469 (menu 1.1.2). It is an alphanumeric password of up to seven characters. By default, it is blank, which means no password. If set to any value other than blank, it protects the DC250 from any write access (commands, counter reset, parameter setting). To be able to access DC250 in writing, first write the correct password in the provided registers (again via Modbus)
- P.0004 (menu 1.1.2). It is a numeric password (0… 9999). By default, it is set to “123”. If set to any value other than “0”, it protects the DC250 from commands received through the communications ports. To send commands via Modbus to the DC250, you must precede each command with the password contained in P.0004. It is also possible to disable the

commands received through the communication ports, using a digital input configured with the DIF.2512 function ("Remote command lock"): the commands are enabled if the input is not active or if it does not exist

5.7.1 USB port



The USB port is available on the JX connector, with type B connector. The USB protocol specifications do not allow its permanent use in the industrial field due to the limited length of the cable and the high sensitivity to electrical disturbances, even on the PC side. For this reason, you should connect to the USB port only when necessary.

INFORMATION! The PC directly supplies the DC250 through the USB cable, to easily programming the parameters, without needing external power supplies. Make sure that the PC can supply at least 300 mA through the USB port used

INFORMATION! When powered through USB port only, DC250 may reduce the illumination of the LCD display (compared to normal operation): this is not a DC250 defect

ATTENTION! When powered through USB port only, DC250 is not operational, and you cannot use it to control the generator.

Before connecting to the PC, you must first install the CDC_USB_Win.inf driver supplied by Mecc Alte:

- Windows 10 or later: driver already installed; you do not need to do anything else.
- Windows 7 or earlier, 32-bits: the BOARDPRG4 program automatically installs the driver.
- Windows 7 or earlier, 64-bits: You must manually install the driver. See document [3] for the installation procedure.

Once installed, the PC will detect the DC250 as a new serial port, useable exactly as a standard RS232 serial port.

The only configuration parameter for the USB port is P.0479; it allows you to invert (compared to the standard) the order of the Modbus registers when DC250 must transmit 32-bits information:

- 0 – LSWF: the lowest index register contains the least significant part of the 32-bits value (standard).
- 1 – MSWF: the lowest index register contains the most significant part of the 32-bits value.

5.7.2 RS485 port (T.22 …T.23)

This port is not galvanically isolated, and allows remote monitoring/control of the DC250, with the distances guaranteed by the RS485 standard.

Connect the positive line (A +) to terminal T.22; connect the negative line (B-) to terminal T.23. DC250 does not include the 120 Ω termination resistor; therefore, if needed, you must connect it in parallel to the incoming lines on the two terminals T.22 and T.23.

It is possible to configure this port with the parameters present in menu 5.1:

- P.0452: DC250 Modbus address.
- P.0453: communication speed (baud rate).
- P.0454: communication characteristics (number of data bits, number of stop bits, parity).
- P.0470: allows you to invert (compared to the standard) the order of the Modbus registers when DC250 must transmit 32-bits information:
  - 0 – LSWF: the lowest index register contains the least significant part of the 32-bits value (standard).
  - 1 – MSWF: the lowest index register contains the most significant part of the 32-bits value.

6 Commands and indications

6.1 DC250 front panel

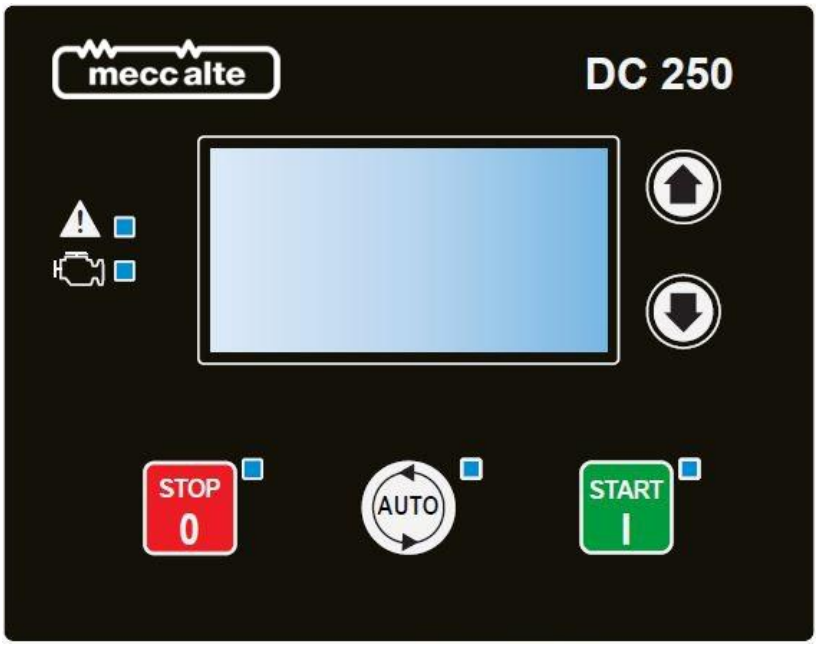


Fig. 1 –DC250 front panel

6.2 Buttons

By default, each time you press any button, the DC250 emits a short confirmation tone. You can turn off the sound by setting bit seven of parameter P.0495 to 1.

DC250 has few buttons. It uses them in diverse ways, to allow all the necessary operations. The possible ways are:

- Button pressed and released quickly.
- Button pressed for a long time.
- Multiple buttons pressed together.

It is possible to disable quite all the commands activated with the buttons, using a digital input configured with the DIF.2511 function (“Front panel lock”): the commands are enabled if the input is not active or if it does not exist. In the following tables, the second column indicates whether the digital input blocks the commands.

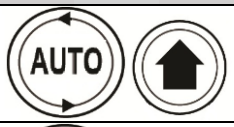
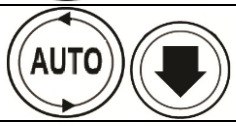
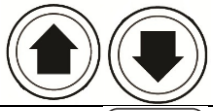
When DC250 activates an anomaly, you can “recognize” it by pressing any button: in this case DC250 “consumes” the button, thus it does not perform its real function until you press it again.

The following table shows the functions associated with the buttons when pressed individually.

Button	LOCK	Function
		Not in program function: Pressed briefly, it selects the next page. Pressed for one second allows you to select the display mode. In program function it selects the following menu item. During parameter modification: it increases the value of the parameter.
		Not in program function: Pressed briefly, it selects the previous page. Pressed for one second from the page allowing mode selection, it accesses the first page of the selected mode. In program function it selects the previous menu item. During parameter modification: it decreases the value of the parameter.
		In OFF/RESET mode, while the operator presses the button, DC250 turns on all the indicator lights, to check their efficiency. If there are digital outputs configured with the DOF.3153 function (“Lamp test”), DC250 also activates them, allowing you to check the efficiency of external signalling devices.
	Yes	In OFF/RESET mode, if pressed for 5 seconds, it allows the DC250 to switch to energy saving mode (it appears unsupplied).
		In program function, it allows you to go back to the previous menu. During parameters modification, if pressed for two seconds restores the old value.
	Yes	In MAN mode, if the engine is running and there are utilities connected to the engine/generator, DC250 uses the button to disconnect them (function disabled with bit six of parameter P.0495): A short press allows the disconnection of the loads. A pressure longer than two seconds allows the disconnection of the loads and the engine stop (see 7.6.3). For AUTO-START and DRIVE applications, it results into the command of the GCB switch (for DRIVE you can consider a clutch instead of a circuit breaker). For LIGHTING TOWER applications, on the other hand, a short press allows you to turn off one group of lights, while a long press turns them all off.
	Yes	In MAN mode, if the engine is running but there are no loads connected to the engine/generator, DC250 uses the button to stop the engine.
	Yes	In AUTO mode, a short press of the button causes the activation of the anomaly AL.007 (“Manual stop command in automatic mode”), if enabled with bit zero of parameter P.0495.
	Yes	In MAN or AUTO mode, by pressing the button for about half a second, the DC250 switches to OFF/RESET mode.
	Yes	In OFF/RESET or MAN mode, by pressing the button for about half a second, the DC250 switches to AUTO mode.
		In programming, it allows to enter a submenu, to activate the modification procedure, and to confirm the new value.
	Yes	In OFF / RESET or AUTO mode, by pressing the button for about half a second, the DC250 switches to MAN mode. With the engine stopped and the “Protected start” function disabled (bit two of P.495), DC250 also commands the start of the engine, otherwise you need to press the button again.
	Yes	In MAN mode, DC250 uses the button to start the engine (if stopped) (see 7.3.3).

Button	LOCK	Function
	Yes	In MAN mode, with the engine running, DC250 uses the button to connect the loads to the generator or to the engine (function disabled with bit six of parameter P.0495). For AUTO-START and DRIVE applications, it results into the command of the GCB switch (for DRIVE you can consider a clutch instead of a circuit breaker). For LIGHTING TOWER applications, on the other hand, a short press allows you to switch on one group of lights, while pressing for at least two seconds switches them all on.

The following table shows the functions associated with combinations of multiple buttons.

Buttons	LOCK	Function
		Pressed in order, they allow you to increase the contrast of the LCD display.
		Pressed in order, they allow you to decrease the contrast of the LCD display.
	Yes	If kept pressed for five seconds, they allow to reset any counters shown on the display, or to reload the defaults for the configuration parameters to which you have access.
		If pressed during power on of DC250, they allow access to special functions.
		In OFF/RESET mode, if kept pressed for a second, they allow access to the configuration parameters.

The state of the buttons is available for the AND/OR logics through the following internal states:

- ST.304 - “START button”.
- ST.305 - “STOP button”.
- ST.308 - “AUTO button”.
- ST.310 - “▲ button”.
- ST.311 - “▼ button”.

6.3 Signalling lamps

Lamp switched off	Lamp switched off	Lamp blinking
☐	▣	◙

STOP 0 ☐	▣	It indicates that the operating mode is OFF/RESET.
	◙	It indicates that you are accessing PROGRAMMING.
	☐	DC250 is in another operating mode.
AUTO ☐	▣	It indicates that the operating mode is AUTO.
	☐	DC250 is in another operating mode.
START I ☐	▣	It indicates that the operating mode is MAN.
	◙	Indicates that the operating mode is MAN and that the protected start mode is active.
	☐	DC250 is in another operating mode.
⚠ ☐	▣	It indicates that at least one shutdown or one deactivation is active.
	◙	It indicates that at least one pre-alarm is active.
	☐	There are no anomalies.
☐	▣	Engine running.
	◙	Engine running, but the generator voltage (or the engine speed) is out of tolerance.
	☐	Engine stopped.

6.4 Multifunction display

6.4.1 LCD backlight

DC250 manages the backlight lamp, switching it off if the operator does not press any button within a configurable time (P.0492). To turn it back on, just press any button. It is possible to disable automatic switch off by setting parameter P.0492 to zero.

During the cranking phase of the engine, DC250 automatically turns off the lamp to reduce the consumption of DC250, to make more autonomy available in the event of critical conditions of the starter battery. To keep the lamp switched on during cranks, set bit 4 of parameter P.0495. Using parameter P.0493, it is possible to force the lamp to always be on when the engine is running.

6.4.2 Contrast regulation

For a correct visualization of the display according to the ambient temperature conditions, it may be necessary to manually adjust the contrast:

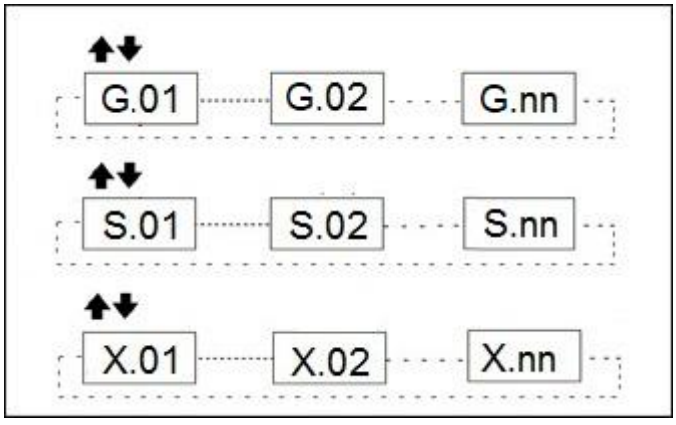
- Press the AUTO + ▼ buttons in sequence to decrease the contrast (lighten).
- Press the AUTO + ▲ buttons in sequence to increase the contrast (darken).

6.4.3 Navigating between modes

The display has different viewing modes, each made up of different pages:

Mode	Icon	Description	Page identifier
PROGRAMMING		Programming	P. XX
STATUS		Status information	S. XX
MEASURES		Engine and generator measurements.	G. XX
HISTORY LOGS		History logs	H. XX

Pressing the ▲ button for at least one second opens the mode selection menu (a window with icons that identify the available modes). With the ▲ and ▼ buttons you can scroll through the list (the icon of the selected mode is in reverse). By keeping the ▼ button pressed for at least one second, DC250 shows the selected mode.

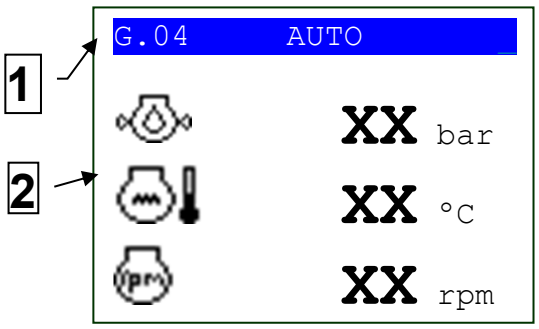


To view the pages within the selected mode, use the ▲ and ▼ buttons.

It is possible to use parameters P.2992 and P.2994 to hide some pages relating to categories “S” and “G”. These parameters can be set in bits, where each bit corresponds to a display page. For example, setting P.2992 to “00000001” (bit 0 active) hides page G.01.

6.4.4 Structure of the display area

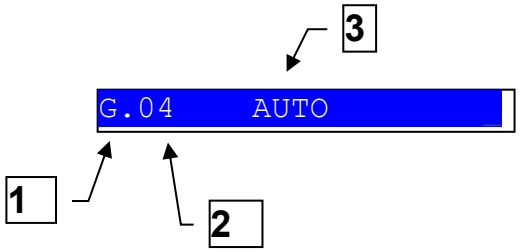
LEGEND:
1 – Status bar
2 – Data area



6.4.5 Top status bar

The top status bar contains information about navigation and status.

LEGEND:
1 – Mode identifier.
2 – Page identifier.
3 –DC250 operating mode.



The mode identifier (1), together with the page identifier (2) allows you to unambiguously identify and refer to a display page. The manual references the pages always with the previous combination.

The DC250 operating mode can be OFF, MAN or AUTO. It does not change as pages change.

On the right side, a key icon may appear if:

- A digital input configured with the DIF.2511 function (“Front panel lock”) is disabling the front panel commands.
- A digital input is forcing the DC250 operating mode (OFF/RESET, MAN, AUTO), and therefore you cannot use the STOP, MAN and AUTO buttons.

⚠ **ATTENTION!** the “@” symbol may also appear on the right to indicate that DC250 is modifying the non-volatile memory: do not disconnect the DC250 power supply when this symbol is visible, otherwise you risk losing the contents of the memory itself.

6.4.6 Status information (S.XX)

In this mode, DC250 provides information about the system status. It is possible to scroll through the different pages using the navigation buttons ▲ and ▼.

6.4.6.1 S.01 STATUS

This page displays system status information. It contains:

- On the top left, the DC250 operating mode:
  - : OFF/RESET.
  - : MAN.
  - : AUTO.
- On the top right, the status of the working sequence of the engine:
  - : engine stopped.
  - : glow plug preheating (DIESEL engines).
  - : fuel solenoid opening.
  - : cranking.
  - : delay between starting attempts.
  - : engine running at idle speed.
  - : delay before supply.
  - : engine running.
  - : cooling down.
  - : stopping.
- On the centre right, the status of the generator voltage (absent, low, high) (not for DRIVE application).
  - : no voltage.
  - : voltage present but out of tolerance (low).
  - : voltage present but out of tolerance (high)
  - : voltage present and in tolerance.
- On the bottom left, the status of the loads:
  - AUTO-START application:
    - : GCB circuit breaker closed.
    - : GCB circuit breaker open.
    - : GCB circuit breaker closing.

- : GCB circuit breaker opening.

  - DRIVE application:

- : clutch engaged.
- : clutch disengaged.

  - LIGHTING TOWER application:

- : at least one group of lights on.
- : all groups of lights are off.

- The presence of any inhibitions for the connection of loads to the engine/generator:

  - : connection inhibited by contact or because the engine is running to recharge the starter battery.
  - : starting inhibited by command received from the communication ports.

DC250 can also shows a time associated with this information; for example, during the cooling cycle of the engine, the time remaining until the end of that cycle.

6.4.6.2 S.02 DC250

This page shows DC250 specific information:

- Date/time (blinking if not valid).
- Unique alphanumeric identifier (ID Code)
- Software code and version.

6.4.6.3 S.03 COMMUNICATION

This page displays the communication status on the communication interfaces of DC250 (USB, RS485 and CAN BUS). In case of operating problems, check the information on this page:

- USB: the following icons show the communication status:
  - : communication in progress.
  - : communication not in progress.
- RS485: the following icons show the communication status:
  - : communication in progress.
  - : communication not in progress.
- CAN BUS: the status can be:
  - ERROR-ACTIVE: normal operation.
  - ERROR-PASSIVE: errors, but the communication is still in progress.
  - BUS-OFF: DC250 disconnected from the bus due to errors.

DC250 shows the instant counters of transmission/reception errors and the maximum values they have reached. To reset the maximum values (and at the same time force the exit from the BUS-OFF state) you need to:

- Keep the ▼ button pressed: DC250 highlights the counters.
- Press the ▲ and ▼ buttons for five seconds.

It is possible to obtain the same effect by sending a Modbus command through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):

- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102: write the value “64” to reset the counters and force the exit from the BUS-OFF state.

6.4.6.4 S.04 DIGITAL INPUTS

This page shows the status of:

- Physical digital inputs.
- Analog inputs used as digital (dashes if not used as digital).
- Virtual digital inputs.

Keep the ▼ button pressed, to change the visualization mode of the inputs:

- LOGICAL STATE: shows the logic level of the input (active or inactive) used in the management of the operating sequence.
- PHISICAL STATE: shows the electrical level (active or inactive, or high or low) present on the input; it can be opposite with respect to the corresponding logical state. Shown in reverse.

6.4.6.5 S.05 DIGITAL OUTPUTS

This page displays the status of the digital outputs. Keep the ▼ button pressed, to change the visualization mode of the outputs:

- LOGICAL STATE: shows the logic level of the outputs (active or inactive) used in the management of the operating sequence.
- STATO FISICO: shows the electrical level (active or inactive, or high or low) present on the output; it can be opposite with respect to the corresponding logical state. Shown in reverse.

6.4.6.6 S.06 ANALOGUE INPUTS

This page displays the electrical measurement of the analogue inputs:

- T.13, T.14, T.15: displays the measured voltage and the corresponding Ω.
- T.09, T.12, T.16: displays the measured voltage.

6.4.6.7 S.07 ENGINE SPEED REGULATION

This page shows some measurements related to the function that allows the regulation of a quantity through a closed control loop, acting on the engine rotation speed (7.3.10). It shows:

1. The name of the controlled quantity (for example "Generator voltage").
2. The "desired value" of the controlled quantity (for example the nominal voltage of the generator). This is the instantaneous reference value: when the engine is started it starts from the "actual value" of the controlled quantity and goes up/down to the "desired value" with the ramp configured with P.9672.
3. The "current value" of the controlled quantity (for example the real voltage supplied by the generator).

4. The correction command (percentage): DC250 converts it into a speed request (rpm) with parameters P.0713 and P.0714, then sends it to the engine ECU.

   The measurements referred to in points 2 and 3 are displayed with the unit of measurement and with the number of decimal digits configured (see 7.3.10).

   DC250 then shows (on the last line):

- The time until activation of the control loop (countdown).
- The wording “LD” if the control loop is disabled because the users are not connected to the generator/engine.
- The wording "DB" if the instantaneous error on the controlled quantity is lower than the dead band ("suspended" control loop).

  C250 hides this page if the operator disables the voltage control loop (P.9673 and P.9674 both at zero).

6.4.7 Generator and engine measurements (G.XX)

In this mode, DC250 shows in a complete way the measurements made on the electrical lines of the generator (if present) and on the various sensors of the engine. It is possible to scroll through the different pages using the navigation buttons ▲ and ▼.

6.4.7.1 G.01 UNIFILARE

This page displays the single-line diagram of the system. The diagram differs according to the application, and includes:

- The following measures (if available):
  - The engine rotation speed.
  - The DC voltage of the generator (not for DRIVE application).
  - The DC current of the generator (not for DRIVE application).
  - The power supplied by the generator (not for DRIVE application).
- The engine status is common to all applications, DC250 shows it with the following icons:
  - Stopped.
  - Preheating glow plugs.
  - Opening fuel solenoid.
  - Cranking.
  - Running at idle speed.
  - Running.
  - Cooling down.
  - Stopping (shown also in case of fail to stop).

  Below the icon, when needed, DC250 shows the time remaining until the status change (for example during the engine cooling cycle).
- DC250 shows the status of the generator in the AUTO-START and LIGHTING TOWER applications. The symbol is “empty” with the generator stopped, “empty” and flashing with the generator running but not in the tolerance window, and “full” when the generator is able to deliver.
- AUTO-START
  - The circuit breaker icon shows:
    - The open/close status.
    - The discrepancy between the actual state of the circuit breaker and the relative command (in this case the two contact points of the circuit breaker flash).
  - DC250 uses the “full” symbol with loads powered by the generator.
- DRIVE:
  - The clutch symbol (engaged/disengaged).

- ○ The pump symbol identifies a generic mechanical load.
- LIGHTING TOWER:
- ○ Displays the lamps depending on the configured control outputs:
- ▪ group of lights switched off.
- ▪ waiting before switching on a group of lights.
- ▪ group of lights switched on.
- ▪ waiting before switching off a group of lights.

6.4.7.2 G.02 ANOMALIES

DC250 automatically shows this page in case of a new anomaly. For each anomaly, it shows:

- A letter which identifies the type:
- ○ “A”: shutdown.
- ○ “D”: deactivation.
- ○ “W”: pre-alarm.
- A three-digit numeric code that uniquely identifies the anomaly. This code flashes if the operator has not yet recognized the anomaly.
- A symbol that identifies the anomaly, for a complete list see paragraph 8.

Each anomaly uses two lines of the LCD display. The anomaly shown above is the most recent in chronological order. If there is not enough space to view all the anomalies, DC250 shows only the most recent. To see the others, you need to:

- Press and hold the ▼ button for one second: DC250 selects the first anomaly.
- Use the ▲ ▼ buttons to scroll through all the anomalies.
- When finished, press, and hold the ▲ button for one second.

Anomalies may require showing additional information. For example, anomalies 198 and 199 (cumulative pre-alarms/shutdowns received via CAN BUS from the engine electronic control units) also require the display of the individual diagnostic codes. For each diagnostic code, DC250 shows the following:

- The ECU which generated the anomaly.
- The SPN code (it is a standard code defined by the SAE J1939 standard, which identifies the mechanical component that has the problem).
- The FMI code (it is a standard code defined by the SAE J1939 standard, which identifies the type of problem).
- The number of times the ECU triggered this diagnostic code (OC).
- The specific alarm code for the connected ECU (DTC).
- An alphanumeric description (always in English) of the problem.
- ECUs may not indicate SPN, FMI and OC, but the DTC code and an alphanumeric description are always present.

If one or more of the above information is not available, DC250 replaces them by dashes or hides them. If there are multiple diagnostic codes active at the same time, DC250 cyclically alternates them on the display every two seconds.

The diagnostic codes remain stored (even if the ECU deactivates them) until the operator recognizes the CAN BUS yellow/red lamp pre-alarm.

DC250 shows the additional information relating to anomalies on the last three lines of the display. In case of two or more anomalies, to view the additional information it is necessary to:

- Press and hold the ▼ button for one second.
- Use the ▲ ▼ buttons to select the anomaly.

6.4.7.3 G.03 ENERGY

This page is not visible for the DRIVE application. DC250 also hides it if the operator did not configure the characteristic ratio of the measurement shunt.

Displays the active energy meters (partial and total) managed by DC250 when the generator supplies the loads. DC250 counts active energy only if positive (not in case of an energy inversion). From this page it is possible to reset the partial counter:

- Press and hold the ▼ button for one second: DC250 highlights the counter.
- Press the ▲ and ▼ buttons for five seconds.
- Press and hold the ▲ button to deselect the counter.

Attention: if you configured a password in parameter P.0001 (“user” protection level), you will not be able to reset the counter until you enter this password (login) in parameter P.0000 (“Access code”).

6.4.7.4 G.04 ENGINE 1

It contains the fundamental quantities for the engine management:

- : Lube oil pressure (bar).
- : Coolant temperature (°C).
- : Rotation speed (rpm).

DC250 replaces the not available measures with dashes.

6.4.7.5 G.05 ENGINE 2

It contains other quantities for the engine management:

- : Starting battery voltage (V) (measured by DC250).
- : Fuel level in the daily tank (%).
- : Selected ECU.

DC250 replaces the not available measures with dashes.

6.4.7.6 G.06 ENGINE AUX

It contains other quantities for the engine management, when DC250 acquires them using its analogue inputs. If DC250 acquires them through the CAN BUS connection, it displays them on other pages. DC250 automatically hides this page if none of the following measures are available:

- Rotation speed from magnetic pick-up sensor (terminals T.24…T.25).
- Rotation speed from W sensor (terminal T.26).

- Coolant level (functions AIF.1210 o AIF.1211 for the configuration of the analogue inputs).
- Lube oil temperature (functions AIF.1100 o AIF.1101 for the configuration of the analogue inputs).
- Lube oil level (functions AIF.1200 o AIF.1201 for the configuration of the analogue inputs).

DC250 hides the not available measures.

6.4.7.7 G.07 COUNTERS

This page contains various counters (managed by DC250) concerning the engine:

- : cranks counter (clearable).
- : running hours (clearable).
- T: running hours (total, not clearable).

You can reset the first two counters (individually):

- Keep the ▼ button pressed for one second: DC250 highlights one of the counters.
- Use the ▲ and ▼ buttons to select the counter you want to reset.
- Press the ▲ and ▼ buttons for five seconds.
- Press and hold the ▲ button to deselect the counters.

Attention: if you configured a password in parameter P.0001 (“user” protection level), you will not be able to reset the counters until you enter this password (login) in parameter P.0000 (“Access code”).

6.4.7.8 G.08 MAINTENANCE

This page shows the counter for the remaining hours to the next maintenance , managed by DC250 (not resettable). If no maintenance interval is set, it is not visible. Otherwise, DC250 shows it negative if the configured interval has already expired.

From version 2.02, this page also contains the counter of minutes remaining until the engine stops MAN. The counter is visible only if a time is configured in parameter P.02690. It will be displayed as “-----” if the function is disabled (e.g. controller not in manual mode), otherwise it shows the minutes remaining until the engine stops (00:00 if the configured interval has already expired).

6.4.7.9 G.09 FUEL PUMP

DC250 hides this page if the operator did not configure any digital output with the DOF.1032 function (“Fuel pump”).

It shows the following information:

- The fuel pump command mode:
  - : MAN-OFF.
  - : MAN-ON.
  - : AUTO.
- The fuel level in the daily tank (only if DC250 controls the pump according to an analogue level). DC250 displays it with a horizontally filled bar, which also graphically shows the pump start/stop thresholds
- Activation requests for the pump, depending on the fuel level:

- Start required.
- Stop required.
- In hysteresis.

- The actual status of the pump, eventually with the time remaining before the next change of status:
- : pump off.
- : pump on.

From this page, you can manually select the control mode of the pump:

- Press and hold the ▼ button: DC250 will highlight in reverse the icons identifying the current mode.
- Use the ▲ and ▼ buttons to select the desired mode.
- Confirm by keeping the ▼ button pressed or cancel the change by keeping the ▲ button pressed.

For information on pump management, see paragraph 7.3.9.3.

6.4.7.10 G.10 DASHBOARD

This page, as indicated by the name, shows all standard lights (lamps) activated by the ECU. This is information acquired via CAN BUS. If none of this information is available, the page is not visible. The lamps displayed are:

- SPN 1081 (“WAIT TO START LAMP”). It is necessary to wait for the ECU to finish the preliminary operations before starting the engine.
- SPN 624 (“AMBER WARNING LAMP”) and SPN3040 (“FLASH AMBER WARNING LAMP”). The ECU signals the presence of a diagnostic code (therefore of a problem) which now does not prevent its operation
- SPN 623 (“RED STOP LAMP”) and SPN3039 (“FLASH RED STOP LAMP”). The ECU signals the presence of a diagnostic code (therefore a problem) that prevents its operation
- SPN 1213 (“MALFUNCTION INDICATOR LAMP”) and 3038 (“FLASH MALFUNCTION INDICATOR LAMP”). Indicates that the engine emissions system has a malfunction or is working outside standard operating conditions. It can be solid or flashing
- SPN 3697 (“DIESEL PARTICULATE FILTER LAMP COMMAND”) and 6915 (“SCR SYSTEM CLEANING LAMP COMMAND”). The ECU requires the regeneration of the particulate filter (or the cleaning of the SCR system). It is solid if the quantity of particulate in the filter is above the “regeneration request” threshold but below the pre-alarm threshold. It becomes flashing if it is above the pre-alarm threshold
- SPN 3703 (“DIESEL PARTICULATE FILTER ACTIVE REGENERATION INHIBITED DUE TO INHIBIT SWITCH”) and 6918 (“SCR SYSTEM CLEANING INHIBITED DUE TO INHIBIT SWITCH”). Indicates that an explicit command inhibits the regeneration of the particulate filter (or the cleaning of the SCR system). It is solid (it is a state, not an anomaly). However, if the condition persists for a long time and the level of soot in the filter becomes extremely high, the ECU activates a diagnostic code with a red lamp and stops the engine: in this case the icon becomes fixed or flashing, like the red lamp
- SPN 3698 (“EXHAUST SYSTEM HIGH TEMPERATURE LAMP COMMAND”). Signals an elevated temperature (real or possible) in the emissions management system (probably because regeneration is in progress or about to start): the ECU could apply a reduction in engine performance (derating). It is solid.
- SPN 5245 (“AFTERTREATMENT DIESEL EXHAUST FLUID TANK LOW LEVEL INDICATOR”). Indicates a low level of the catalyst liquid tank (DEF - DIESEL EXHAUST FLUID), also called AdBlue. It is solid if the level is below normal, flashing if the low level determines a power derating.

This page also shows all the diagnostic codes activated by the ECU, even if the DC250 is in OFF / RESET.

Note: DC250 forces the visualization of this page every time the ECU activates a lamp.

6.4.7.11 E.12 Emission levels exceedance

It contains a series of standard diagnostic information (J1939-DM32) concerning the exceeding of the emission levels, acquired via CAN-BUS from the engine control unit. The controller displays this page only if the ECU transmits this diagnostic information.

A maximum of eight diagnostic information is managed, each of which contains:

- The SPN code, that identifies the engine component causing or having the problem.
- The FMI code, that identifies the type of problem.
- The time (in hours) from here this diagnostic code is active.
- The time (in hours) that this diagnostic code has been active in the past.
- The remaining time (in hours) to the derating of the engine performances.

If two or more codes are active at the same time, they are alternated on the display every two seconds.

6.4.7.12 G.12…G.22 CAN BUS

They contain a series of standard information (J1939) acquired via CAN BUS from the ECU. The amount of information available depends on the ECU. DC250 does not display unavailable information. The number of pages displayed therefore depends on the actual information transmitted by the ECU. The information shown on this page are:

- spn 22: Engine Extended Crankcase Blow-by Pressure
- spn 51: Engine Throttle Position.
- spn 52: Engine Intercooler Temperature.
- spn 91: Accelerator Pedal Position 1.
- spn 92: Engine Percent Load At Current Speed.
- spn 94: Engine Fuel Delivery Pressure.
- spn 96: Fuel Level 1
- spn 98: Engine Oil Level.
- spn 100: Engine Oil Pressure.
- spn 101: Engine Crankcase Pressure.
- spn 102: Engine Intake Manifold #1 Pressure.
- spn 105: Engine Intake Manifold #1 Temperature.
- spn 106: Engine Intake Air Pressure
- spn 107: Engine Air Filter 1 Differential Pressure
- spn 108: Barometric Pressure.
- spn 109: Engine Coolant Pressure.

- spn 110: Engine Coolant Temperature.
- spn 111: Engine Coolant Level.
- spn 132: Engine Intake Air Mass Flow Rate
- spn 156: Engine Injector Timing Rail 1 Pressure.
- spn 157: Engine Injector Metering Rail 1 Pressure.
- spn 158: Key switch Battery Potential.
- spn 166: Engine Rated Power.
- spn 168: Battery Potential / Power Input 1
- spn 171: Ambient Air Temperature.
- spn 172: Engine Intake 1 Air Temperature
- spn 173: Engine Exhaust Gas Temperature
- spn 174: Engine Fuel Temperature 1.
- spn 175: Engine Oil Temperature 1.
- spn 182: Engine Trip Fuel.
- spn 183: Engine Fuel Rate.
- spn 189: Engine Rated Speed.
- spn 190: Engine Speed.
- spn 247: Engine Total Hours of Operation.
- spn 249: Engine Total Revolutions
- spn 250: Engine Total Fuel Used.
- spn 411: Engine Exhaust Gas Recirculation 1 Differential Pressure
- spn 412: Engine Exhaust Gas Recirculation 1 Temperature
- spn 441: auxiliary temperature “1”
- spn 442: auxiliary temperature “2”
- spn 512: Driver's Demand Engine - Percent Torque.
- spn 513: Actual Engine - Percent Torque.
- spn 514: Nominal Friction - Percent Torque.
- spn 515: Engine's Desired Operating Speed.
- spn 544: Engine Reference Torque
- spn 977: Fan Drive State
- spn 1029: Trip Average Fuel Rate

- spn 1108: Engine Protection System Timer Override
- spn 1127: Engine Turbocharger 1 Boost Pressure
- spn 1135: Engine Oil Temperature 2.
- spn 1136: Engine ECU Temperature.
- spn 1172: Engine Turbocharger 1 Compressor Intake Temperature
- spn 1180: Engine Turbocharger 1 Turbine Intake Temperature
- spn 1181: Engine Turbocharger 2 Turbine Intake Temperature
- spn 1182: Engine Turbocharger 3 Turbine Intake Temperature
- spn 1183: Engine Turbocharger 4 Turbine Intake Temperature
- spn 1241: Engine Fuel System 1 Gas Mass Flow Rate
- spn 1636: Engine Intake Manifold 1 Temperature (High Resolution)
- spn 1637: Engine Coolant Temperature (High Resolution)
- spn 1639: Fan Speed
- spn 2432: Engine Demand – Percent Torque
- spn 2433: Engine Exhaust Manifold Bank 2 Temperature 1
- spn 2434: Engine Exhaust Manifold Bank 1 Temperature 1
- spn 2629: Engine Turbocharger 1 Compressor Outlet Temperature
- spn 2630: Engine Charge Air Cooler 1 Outlet Temperature
- spn 2659: Engine Exhaust Gas Recirculation 1 Mass Flow Rate
- spn 2978: Estimated Engine Parasitic Losses - Percent Torque
- spn 3357: Actual Maximum Available Engine - Percent Torque
- spn 3543: Engine Operating State
- spn 3563: Engine Intake Manifold #1 Absolute Pressure
- spn 4152: Engine Exhaust Bank 2 Temperature Average
- spn 4153: Engine Exhaust Bank 1 Temperature Average
- spn 4154: Actual Engine - Percent Torque (Fractional)
- spn 5053: Engine Trip Fuel (High Resolution)
- spn 5054: Engine Total Fuel Used (High Resolution)
- ECU specific diagnostic codes.

  It is possible to reset spn 182 and 1029 (if displayed) directly in the ECU (if it supports the command) by holding down the ▲ and ▼ buttons within this page for 5 seconds.

It is possible to obtain the same effect by sending a Modbus command through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):

- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102: write the value “67” to reset the counters.

Attention: if you configured a password in parameter P.0001 (“user” protection level), you will not be able to reset the counters until you enter this password (login) in parameter P.0000 (“Access code”).

6.4.7.13 G.23 EXHAUST GAS THREATMENT

This page relates to the TIER4 (US) and STAGE V (EU) regulations. It is visible only if the ECU connected in CAN BUS transmits information relating to the treatment of the exhaust gases. It shows:

- spn 3701 “Aftertreatment Diesel Particulate Filter Status”.
- spn 3700 “Aftertreatment Diesel Particulate Filter Active Regeneration Status”.
- spn 3699 “Aftertreatment Diesel Particulate Filter Passive Regeneration Status”.
- The status of the manual regeneration of the particulate filter (ECU specific, for example SCANIA).

It also shows any inhibitions that prevent the regeneration of the filter:

- spn 3703 “Diesel Particulate Filter Active Regeneration Inhibited Due to Inhibit Switch”.
- spn 3711 “Diesel Particulate Filter Active Regeneration Inhibited Due to Low Exhaust Temperature”.
- spn 3712 “Diesel Particulate Filter Active Regeneration Inhibited Due to System Fault Active”.
- spn 3713 “Diesel Particulate Filter Active Regeneration Inhibited Due to System Timeout”.
- spn 3714 “Diesel Particulate Filter Active Regeneration Inhibited Due to Temporary System Lockout”.
- spn 3715 “Diesel Particulate Filter Active Regeneration Inhibited Due to Permanent System Lockout”.
- spn 3716 “Diesel Particulate Filter Active Regeneration Inhibited Due to Engine Not Warmed Up”.
- spn 3750 “Aftertreatment 1 Diesel Particulate Filter Conditions Not Met for Active Regeneration”.
- spn 3702 “Diesel Particulate Filter Active Regeneration Inhibited Status”.

Finally, it shows the selected mode with which the DC250 manages the regeneration of the filter:

- Automatic.
- Forced.
- Inhibited.

If the digital inputs do not force this mode, you can manually change it from this page:

- Press and hold the ▼ button for one second: DC250 will highlight the current mode.
- Use the ▲ and ▼ buttons to select the desired mode.
- Press and hold the ▼ button for one second to confirm the new mode, or ▲ for one second to abort the change.

6.4.7.14 G.24…G.28 EXHAUST GAS THREATMENT

This page relates to the TIER4 (US) and STAGE V (EU) regulations. It is visible only if the ECU connected in CAN BUS transmits information relating to the treatment of the exhaust gases. The amount of information available depends on the ECU. DC250 does not show unavailable information. The number of pages displayed therefore depends on the actual information transmitted by the ECU. The information shown on this page is:

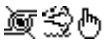
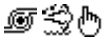
- Spn 4765 (“aftertreatment 1 diesel oxidation catalyst intake temperature”).
- Spn 4766 (“aftertreatment 1 diesel oxidation catalyst outlet temperature”).
- Spn 4781 (“aftertreatment 1 diesel particulate filter soot mass”).
- Spn 3719 (“aftertreatment 1 diesel particulate filter soot load percent”).
- Spn 5466 (“aftertreatment 1 diesel particulate filter soot load regeneration threshold”).
- Spn 3720 (“aftertreatment 1 diesel particulate filter ash load percent”).
- Spn 3251 (“aftertreatment 1 diesel particulate filter differential pressure”).
- Spn 3242 (“aftertreatment 1 diesel particulate filter intake temperature”).
- Spn 81 (“aftertreatment 1 diesel particulate filter intake pressure”).
- Spn 3246 (“aftertreatment 1 diesel particulate filter outlet temperature”).
- Spn 3721 (“aftertreatment 1 diesel particulate filter time since last active regeneration”).
- Spn 1761 (“aftertreatment 1 diesel exhaust fluid tank volume”).
- Spn 3031 (“aftertreatment 1 diesel exhaust fluid tank temperature 1”).
- Spn 3515 (“aftertreatment 1 diesel exhaust fluid temperature 2”).
- Spn 3516 (“aftertreatment 1 diesel exhaust fluid concentration”).
- Spn 5963 (“aftertreatment 1 total diesel exhaust fluid used”).
- Spn 6563 (“aftertreatment trip diesel exhaust fluid”).
- Spn 4360 (“aftertreatment 1 SCR intake temperature”).
- Spn 4363 (“aftertreatment 1 SCR outlet temperature”).
- Spn 4332 (“aftertreatment 1 SCR system 1 state”).
- Spn 4331 (“aftertreatment 1 diesel exhaust fluid actual dosing quantity”).
- Spn 4334 (“aftertreatment 1 diesel exhaust fluid dozer 1 absolute pressure”).
- Spn 5246 (“aftertreatment SCR operator inducement severity”).
- Spn 3241 (“aftertreatment 1 exhaust temperature 1”).
- Spn 3236 (“aftertreatment 1 exhaust gas mass flow rate”).
- Spn 3237 (“aftertreatment 1 intake dew point”).
- Spn 3238 (“aftertreatment 1 exhaust dew point”).
- Spn 3239 (“aftertreatment 2 intake dew point”).

- Spn 3240 (“aftertreatment 2 exhaust dew point”).
- Spn 5826 (“emission control system operator inducement severity”).

6.4.7.15 G.29 ADBLUE PUMP

DC250 hides this page if the operator did not configure any digital output with the DOF.1037 function (“AdBlue pump”).

It shows the following information:

- The pump command mode:
  -  : MAN-OFF.
  -  : MAN-ON.
  -  : AUTO.
- The AdBlue fluid level in the daily tank (spn 1761 “Aftertreatment 1 Diesel Exhaust Fluid Tank Volume”). DC250 displays it with a horizontally filled bar, which also graphically shows the pump start/stop thresholds
- Activation requests for the pump, depending on the AdBlue fluid level:
  - Start required.
  - Stop required.
  - In hysteresis.
- The actual status of the pump, eventually with the time remaining before the next change of status:
  -  : pump off.
  -  : pump on.

From this page, you can manually select the control mode of the pump:

- Press and hold the ▼ button: DC250 will highlight in reverse the icons identifying the current mode.
- Use the ▲ and ▼ buttons to select the desired mode.
- Confirm by keeping the ▼ button pressed or cancel the change by keeping the ▲ button pressed.

For information on pump management, see paragraph 7.4.2.3.

6.4.7.16 G.30…G.35 CAN BUS

DC250 supports the management of external configuration files that describe the CAN BUS communication with the ECU. These files may include the definition of one or more pages for the display, dedicated to displaying the specific measures/states of that ECU (usually when they do not follow the J1939 standard). For example, if you use the files relating to MAN DATALOGGER, DC250 displays all the measurements acquired by those ECU in a single page.

DC250 provides up to six pages. The configuration file defines the number of measures shown and their description.

6.4.7.17 G.36 EXTERNAL MEASUREMENTS

This page shows the measurements acquired by the analogue inputs configured as AIF.2001 (“Generic sensor page 1”). The operator has the possibility to acquire measurements that are not necessary for the DC250, and to view them on the display.

DC250 shows one measure per row: it shows the text configured for the analogue input (P.4010 for the T.13 input), followed by the measure.

6.4.8 Historical archives (H.XX)

DC250 makes periodic or event-based recordings, partially configurable with the programming parameters. Note: DC250 blocks the recordings if it is in OFF/RESET mode or if any shutdown or deactivation is active.

DC250 shows the historical archives on its display and allows downloading them via PC through the communication ports.

DC250 manages four types of archives:

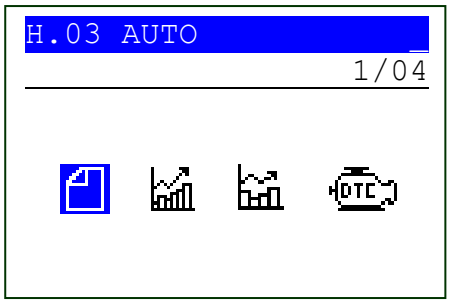
#	Description	Icon	Maximum number of records
1	Events.		64
2	Fast periodical recordings.		42
3	Slow periodical recordings.		64
4	DTC-ECU.		16

To show the archives, you must

- Press the ▲ button for at least one second to display the page for selecting the display mode.
- Select the icon with buttons ▲ e ▼.
- Press and hold the ▼ button for one second.

After this operation, DC250 shows the page described in the next paragraph.

6.4.8.1 Archive selection



The first row always shows the index of the selected archive and the number of available archives. The following rows shows the icons associated with the available historical archives.

DC250 highlights the selected item (REVERSE). Use the ▲ and ▼ buttons to select the desired historical archive.

Hold down the ▼ button for one second to access the selected archive. To return to this page from the selected archive, hold down the ▲ button for one second.

6.4.8.2 Events pages

The instant an event occurs (previously configured), DC250 adds a recording to this archive. The total capacity is sixty-four recordings. If the archive is full, each new event overwrites the oldest one (that is, DC250 keeps in memory the last sixty-four events). For each event, in addition to a numerical code that identifies it, DC250 records the date/time, the DC250 operating mode, the state of the engine, the state of the generator and the state of the circuit breaker/clutch. If the event is an anomaly, DC250 also records the measures described for the measurements' archives. Parameter P.0441 ("Events to log") allows you to enable the recording of groups of events. It is a bit-settable parameter:

Bit	Description
0	Board operating mode
1	-
2	Generator status
3	Engine status
4	Circuit breakers status
5	Circuit breakers commands
6	Start/stop requests
7	Pumps commands

Below is a table showing the codes for all events:

Code	Icon	Recording cause
EVT.1001		DC250 in OFF/RESET.
EVT.1002		DC250 in MAN.
EVT.1003		DC250 in AUTO.
EVT.1020		Generator voltage absent.
EVT.1021		Generator voltage present.
EVT.1022		Generator voltage in tolerance.
EVT.1030		GCB closure command. Clutch engaging command.
EVT.1031		GCB opening command. Clutch disengaging command.
EVT.1032		GCB closed. Clutch engaged.
EVT.1033		GCB open. Clutch disengaged.
EVT.1040		Engine stopped.
EVT.1041		Engine cranking.
EVT.1042		Engine running.
EVT.1043		Engine cooling down.
EVT.1044		Engine stopping.
EVT.1045		Engine running at idle speed.
EVT.1050		Manual start command.
EVT.1051		Manual stop command.
EVT.1053		Automatic stop command.
EVT.1054		Remote start command from digital input.
EVT.1056		Remote start command from communication port.
EVT.1057		Remote stop command from communication port.
EVT.1058		Remote start command from planning.
EVT.1064		Remote start command for low starting battery voltage.
EVT.1070		Fuel pump on.
EVT.1071		Fuel pump off.
EVT.1072		AdBlue pump on.
EVT.1073		AdBlue pump off.
EVT.1074		Reset.
EVT.1075		Clock/calendar not valid (but used).
EVT.1076		Clock/calendar updated.

EVT.1077		New power on.
EVT.1078		Reloaded the default values for the configuration parameters.
EVT.1079		Energy saving mode activated.

DC250 also store the anomalies as events. It records them with their own alarm code, with in addition:

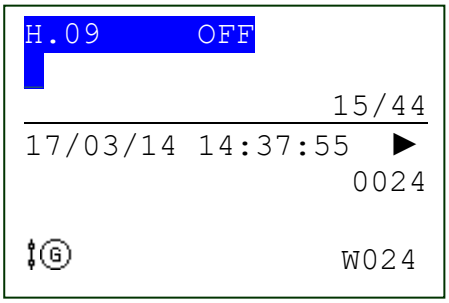
- EVT.2000: in case of pre-alarms.
- EVT.4000: in case of deactivations.
- EVT.5000: in case of shutdowns.

When shown on the display, DC250 subtracts the value 2000, 4000 or 5000 and replaces it with the letter “W”, “D” or “A” before the alarm code. For example, by simulating an emergency stop event we will obtain a view of this type in the archive window:

- 0048: STOP A048.

If you read the same event via USB, DC250 will identify it with the code 5048, where the thousands digit will identify the type (5 = shutdown), followed by the code (048 = Emergency Stop). For a complete list of fault codes see [1].

To display each event, DC250 uses at least three display pages: if the event displayed is one of the twenty-one most recent anomalies, the pages used become four or five. The pages have the following format:



The second line shows the index of the currently displayed event (15) with respect to the total events stored (44). The third line shows the recording date/time; on the right it also shows two arrows that indicate the availability of other pages on the right and left of the current page for the current event. The following lines show different information based on the selected page.

- The first page displays the numeric code of the event (“0024” in the example) and one or more icons that identify the event (“W024 GCB not open”).
- The second page shows the system states at the recording time: DC250 operating mode, the engine and generator states (the latter not for the DRIVE application).
- The third page shows the status of the GCB circuit breaker or of the clutch at the recording time.
- See the next chapter for the description of pages from fourth to fifth.

The most recent event is the one associated with the highest number. Using the ▲ and ▼ buttons, you can cyclically scan all the recordings.

By holding down the ▼ button for one second, DC250 activates the navigation between the pages related to the single event (the numbers that identify the event and the number of stored events start flashing). At this point, using the ▲ and ▼ buttons, DC250 shows cyclically all the pages of the selected event. To be able to select another event, press and hold the ▲ button for one second.

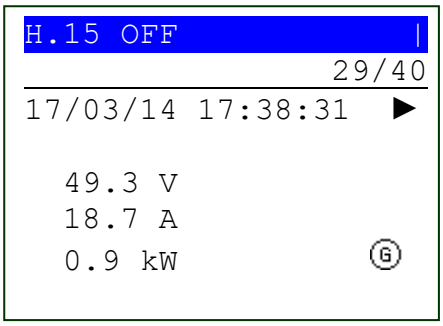
6.4.8.3 Pages for the periodical recordings

With a rhythm configurable through parameters P.0442 (“interval for fast periodical recordings – sec”) and P.0443 (“interval for slow periodical recordings - min") DC250 records the following analogue quantities:

- Starter battery voltage, rotation speed, coolant temperature, oil pressure and fuel level.
- Generator voltage, current and power. **DC250 hides this page for DRIVE applications.**

Each recording is also associated with its own date and time. DC250 replaces unavailable quantities with dashes on the display.

DC250 uses one/two display pages for displaying the information. The pages have the following format:



The second line shows the currently displayed record (29) out of the total of records (40). The third line shows the recording date/time; on the right it also shows two arrows indicating the availability of other pages on the right and on the left of the current page for the current record. The following lines show different information based on the selected page (see above).

The most recent entry is the one associated with the highest number. Using the ▲ and ▼ buttons, you can cyclically scan all the recordings.

Keep the ▼ button pressed to activate the navigation between the pages linked to the single recording (the number that identifies the recording and that of the stored recordings start flashing). At this point, use the ▲ and ▼ buttons to cyclically scan all the available pages. To be able to select another recording, press and hold the ▲ button.

6.4.8.4 Archives for fast periodical recordings

DC250 records in the fast periodical archive with a rhythm configurable through parameter P.0442 (“interval for fast periodical recordings – sec”) and by default equal to 60 seconds. This archive has a capacity of forty-two records. At each subsequent recording, DC250 overwrites the oldest one.

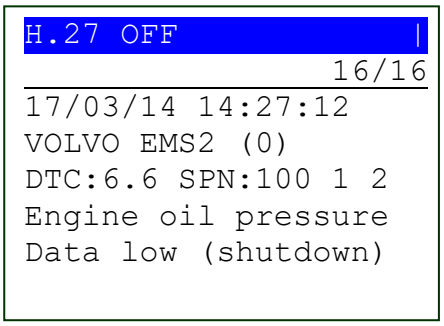
6.4.8.5 Archives for slow periodical recordings

DC250 records in the slow periodical archive with a rhythm configurable through parameter P.0443 (“interval for slow periodical recordings – min”) and by default equal to 30 minutes. This archive has a capacity of sixty-four records. At each subsequent recording, DC250 overwrites the oldest one.

6.4.8.6 Pages for diagnostics codes of ECUs connected in CAN BUS (DTC).

DC250 records the diagnostic codes that the ECU sends on the CAN BUS line. The diagnostic message consists of the DTC and SPN fields, and of the description of the anomaly. This archive has a capacity of sixteen records. At each subsequent recording, DC250 overwrites the oldest one.

DC250 uses just one pages for each diagnostic code.



The second line shows the currently displayed record, with respect to the total number of records (maximum records are sixteen). The third line shows the recording date and time. The fourth line identifies the ECU that activated the diagnostic code. The fifth line shows the diagnostic code:

- DTC (Diagnostic Trouble Code): it is a non-standard diagnostic code, specific to the connected ECU. You can find it in the engine technical manual (in the example, the code “6.6” in the engine technical manual will describe the low oil pressure problem).
- SPN (Suspect Parameter Number): it is a standard numerical code that identifies the part of the engine on which the problem occurred (in the example “100” identifies the measurement of the oil pressure)
- FMI (Fault Mode Identifier): it is a standard numerical code between 0 and 31 that identifies the type of problem (in the example “1” indicates a too low value, such as to require the stop of the engine).
- OC (Occurrence Count): it indicates the number of times the ECU activated this diagnostic code (in example “2”).

In addition, if DC250 knows the combination of the SPN and FMI codes (or the DTC code), it also shows a textual description of the problem.

The most recent entry is the one associated with the highest number. Using the ▲ and ▼ buttons, you can cyclically scan all the recordings.

6.4.8.7 Exiting the historical archives visualization

To exit the archive view, press the ▲ button until you go back to the page allowing selecting the display mode.

6.4.8.8 Emptying the archives

To empty an archive, first select it and then keep the ▲ and ▼ buttons pressed for five seconds, until the DC250 shows a message on the display.

It is also possible to empty the archives by sending Modbus commands through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):

- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102: write the value:
  - “62” to empty the historical archive of events.
  - “63” to empty the historical archive of the periodical recordings (both).
  - “61” to empty the historical archive of the ECU’s diagnostic codes.

6.4.9 Parameters’ programming (P.XX)

This paragraph describes the general structure of the programming function and the operating procedure that allows you to view and/or modify the parameters by acting directly from the DC250 keyboard.

WARNING! incorrect programming of one or more parameters can cause malfunctions or damage to things and/or people. Only qualified personnel can manage parameters' changes. Parameters can be password protected (see par. 6.4.9.9).

INFORMATION! DC250 manages a considerable number of parameters that allow the manufacturer, installer, and end user to configure it to adapt it to the specific needs of the application. This document does not contain the list of parameters (although it describes them in the various functions), but please refer to the document [1] which describes them in detail

ATTENTION! specific functions or configurations, due to their nature, can be set or modified exclusively through the PC program BOARDPRG4. The use of BOARDPRG4 is in any case strongly recommended because it simplifies the programming operations

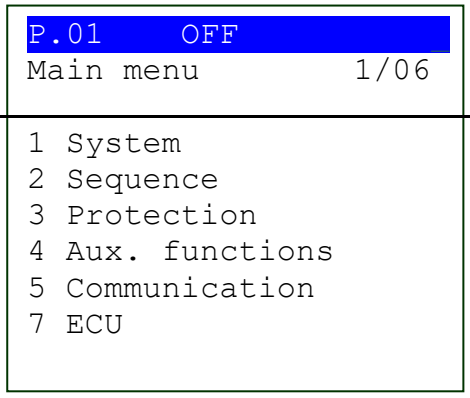
INFORMATION! You can modify the parameters using the DC250 keyboard only if DC250 is in OFF/RESET mode with the engine stopped.

6.4.9.1 Accessing the programming menu

To access the pages allowing parameters configuration, keep the STOP and AUTO buttons pressed for at least one second.

INFORMATION! During programming, the STOP, AUTO and START buttons take on a different function and you cannot use them to change the DC250 operating mode and to control the engine.

DC250 always shows the main menu at the start of the procedure:



- 1 (SYSTEM): allows you to select the application, to set the nominal values of the engine and generator, and to specify the connections between DC250 and the system. It is essential to set these parameters correctly because all the thresholds for activating the protections are percentage of them.
- 2 (SEQUENCE): allows you to change the operating sequences of the system. In this menu you can set the thresholds, the acquisition times, and enable/disable the functions inherent to the operating sequences.
- 3 (PROTECTION): it contains all the thresholds and delays related to the protections managed by DC250. To enable/disable a protection, simply change the time associated with it, leaving the threshold unchanged: setting the time to zero disables the protection. There are exceptions to this general rule. Please refer to the chapter dedicated to anomalies, which describes the disabling mode for each.
- 4 (AUXILIARY FUNCTIONS): this menu contains other menus that configure the auxiliary functions of the engine, the setting of the historical archive, and more.

- 5 (COMMUNICATION): allows you to configure the USB and RS485 communication ports.
- (CAN BUS): allows you to configure how DC250 communicates on the bus to acquire measurements, diagnostic codes, and to send commands to the ECU.

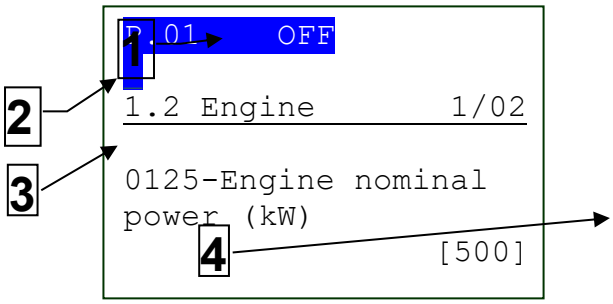
6.4.9.2 Menu selection

The second line always shows the name of the current menu, followed by the index of the selected submenu with respect to the number of items in the menu. The following lines of the display show the submenus. DC250 highlights the selected submenu in REVERSE. Using the ▲ and ▼ buttons, you can scroll the menus respectively towards the lower and upper index items, in a cyclical way (i.e., pressing ▲ from the first item switches to the last and vice versa).

By pressing the AUTO button, you enter the selected submenu, by pressing the STOP button you exit the menu (returning to the previous menu or exiting programming if you were already in the main menu).

6.4.9.3 Parameters organization

LEGEND:
1 – Status bar
2 – Current menu
3 – Current parameter
4 – Parameter's value



Entering a menu that has no further submenus, DC250 displays the first parameter contained in the menu (see previous figure).

The second line always shows the name of the current menu ("1.2 Engine" in the example). On the right it shows a pair of numbers ("1/02" in the example): the first is the index of the current parameter in the menu, the second indicates the number of parameters in the menu.

Each parameter is associated with a four-digit numeric code ("P.0125" in the example) which identifies it regardless of the language used. The fourth and fifth lines show both the numeric code and the description (in English) of the parameter.

The sixth line shows, in square brackets, the current value of the parameter. If DC250 encloses the value in the "<>" symbols, it means that the parameter is password protected and now the operator cannot change it.

DC250 may show (depending on the parameter) an additional value on the eighth line, related to the current value of the parameter. DC350 often shows this additional measurement when the parameter is a percentage of other values, to show its absolute value.

6.4.9.4 Selecting a parameter

Using the ▼ and ▲ buttons, you can scroll the menu respectively towards the upper and lower index items, in a cyclical way (i.e., pressing ▲ from the first item switches to the last and vice versa). Press the AUTO button to activate the parameter modification procedure (see next paragraph), press the STOP button to exit the menu (returning to the previous menu).

6.4.9.5 Modifying a parameter

You can modify a parameter only if DC250 shows its value between square brackets; if it encloses the value between "<>" symbols, you cannot modify it. In this case, you need to set an appropriate password.

If you have access to the parameter, press the AUTO button: the square brackets that enclose the value start flashing, indicating that the modification phase is in progress. To confirm the new value, press the AUTO button; to abort the modification and return to the original value, just hold down the STOP button for at least one second.

DC250 manages the following types of parameters:

- **Numeric**: you can change the value using the ▲ ▼ buttons, respectively to increase or decrease the value by one unit (if you press these buttons together with AUTO, DC250 will increase or decrease the value by ten units at a time). The modification is cyclical: trying to increase the value when it is already at the maximum, you go to the minimum and vice versa.
- **Numeric selecting from a predefined list** (for example the baud rates of the RS485 communication port): refer to the description of the numerical parameters, considering that the ▲ ▼ buttons allow you to pass to the next/previous value in the predefined list (with the AUTO button you can pass to the value that follows/precedes the current one by ten).
- **Numeric with selection of number-string pairs from a predefined list** (for example the function of a digital input): refer to the previous point.
- **Times**: refer to the description of the numerical parameters, with the exception that DC250 manages the increase/decrease maintaining valid values (for example, increasing from “00.59” switches to “01.00” and not to “00.60”).
- **Strings** (for example the plant name): in this case the display highlights (in reverse) the character currently selected in the string. The ▲ ▼ buttons act on the selected character (moving to the next/previous one in the ASCII table or to the one that follows/precedes it by ten positions pressing also AUTO), while the STOP and START buttons allow you to select a single character.
- **Bits**: DC250 manages these parameters as a group of bits. Each active bit enables a function, and each inactive bit disables a function. You can assign a value to each bit. The parameter must be set with the result of the sum of the values associated with the functions to be enabled. In the description of these parameters, you will have a table like the following:

Bit	Value	Hexadecimal value	Description
0	1	0x01	Function 1 enable.
1	2	0x02	Function 2 enable.
2	4	0x04	Function 3 enable.
3	8	0x08	Function 4 enable.
4	16	0x10	Function 5 enable.
5	32	0x20	Function 6 enable.
6	64	0x40	Function 7 enable.
7	128	0x80	Function 8 enable.

If the operator wants to:

- Disable all functions: must set the relevant parameter to zero.
- Enable all functions: the value to be set is the sum 1 + 2 + 4 + 8 + 16 + 32 + 64 + 128 = 255 (0xff in hexadecimal).
- Enable for example functions 3, 4, 6 and 8: the value to be set is the sum 4 + 8 + 32 + 128 = 172 (where 4 is the value associated with function 3, 8 with function 4, 32 with function 6 and 128 to function 8). In hexadecimal it becomes 0xAC.

Attention: the value must be set in hexadecimal notation:

6.4.9.6 Parameter limits

The operator does not need to verify that the set value is acceptable for DC250, as it is not possible to set unacceptable values.

This is true for the single parameter; however, it is possible to set two or more parameters in an inconsistent or even incompatible way. It is the operator's responsibility to verify that this does not happen.

6.4.9.7 Exiting the programming menu

To exit the programming menu, press the STOP button to go back through the menus to the main one and then press it again to exit programming. At the next access to programming, DC250 will show the main menu.

6.4.9.8 Loading factory default values

WARNING! This procedure permanently reloads the factory parameters according to the access rights.

Sometimes it may be convenient to reload the factory defaults for the parameters. To do this, you must first select the OFF/RESET mode, enter programming, then hold down the ▲ and ▼ buttons simultaneously and consecutively for five seconds. A message on the display will inform the operator that DC250 reloaded the factory values (only for the parameters for which you have access rights).

6.4.9.9 Protection passwords

Using three different password levels, you may limit the access to parameter programming. The password levels are (listed in order of priority):

- Manufacturer password (maker).
- Installer password (system).
- End user password (user).

DC250 protects each parameter with one of these passwords (in document [1] the “ACC” column indicates this association with a letter “C” for the manufacturer, “I” for the installer and “U” for the user).

You can modify a parameter protected by the manufacturer level only by entering the manufacturer password. The manufacturer and the installer can modify a parameter protected by the installer level. The manufacturer, the installer, and the user can modify a parameter associated with the user level.

The operator who must modify a parameter must first be recognized by DC250 as “manufacturer”, “installer” or “user” by typing the appropriate password in parameter P.0000 (menu “1.1.1 - Authentication", path " 1. System\1.1 Security\1.1.1. Authentication”).

After this operation, the operator will be able to modify the parameters, limited to those he has access to. The entered code will remain stored in P.0000 for 10 minutes from the end of programming. After this time, DC250 automatically resets it, and the operator must type it again to access programming.

You can customize the passwords using parameters P.0001 (manufacturer), P.0002 (installer) and P.0003 (user), available in the “1.1.2 Password” menu, path “1 System\1.1 Security\1.1.2 Password”. The value “0” for these parameters indicates the password is not set.

If you lose a password, you can reconfigure it by logging in with a higher-level password. For this reason, it is advisable to set at least the "manufacturer" password (P.0001): in fact, if someone else sets it or a lower password (even if only for distraction) without communicating it to you, you will no longer able to change any parameter. By knowing the "manufacturer" password, you will in any case able to cancel or change the other passwords. In case of loss of the “manufacturer” password, contact Mecc Alte.

The following examples show all combinations for assigning passwords.

- Example 1: P.0001 = 0 P.0002 = 0 P.0003 = 0

DC250 considers any operator a “manufacturer”, without having to set anything in P.0000. So, anyone can modify all the parameters, except the critical ones (this is the default situation of DC250).

- Example 2: P.0001 = 0 P.0002 = 0 P.0003 = UUU

No parameters are editable. By typing “UUU” in P.0000, the operator identifies himself operator as a “user” but, since no password is associated with the installer and the manufacturer, DC250 still considers him “manufacturer”. After entering this code, the operator can modify all parameters, except the critical ones.

- Example 3: P.0001 = 0 P.0002 = III P.0003 = UUU

  No parameters are editable. By typing “UUU” in P.0000, the operator identifies himself as a “user” and thus obtains permission to modify all the parameters associated with the user. By typing “III” instead, the operator identifies himself as an “installer” but, since no password is associated with the manufacturer, DC250 still considers it “manufacturer”. After entering this code, the operator can modify all parameters, except the critical ones.

- Example 4: P.0001 = CCC P.0002 = III P.0003 = UUU

  No parameters are editable. By typing “UUU” in P.0000, the operator identifies himself as a “user” and obtains permission to modify all the parameters associated with the user. By typing “III” the operator identifies himself as an “installer” and obtains permission to modify all the parameters associated with the installer and the user. By typing “CCC” the operator identifies himself as a “manufacturer” and thus obtains permission to modify all parameters.

- Example 5: P.0001 = CCC P.0002 = 0 P.0003 = 0

  Since no password is associated with the user and the installer, the parameters associated with them are freely programmable, without typing anything in P.0000. To modify the parameters associated with the manufacturer, type “CCC” in P.0000.

- Example 6: P.0001 = 0 P.0002 = III P.0003 = 0

  Since no password is associated with the user, the parameters associated with it are freely programmable, without typing anything in P.0000. By typing “III” in P.0000, the operator identifies himself as “installer” but, since no password is associated with the manufacturer, DC250 still considers him “manufacturer”. After entering this code, the operator can modify all parameters, except the critical ones.

- Example 7: P.0001 = CCC P.0002 = III P.0003 = 0

  Since no password is associated with the user, the parameters associated with it are freely programmable, without typing anything in P.0000. By typing “III” in P.0000, the operator identifies himself as an “installer” and thus obtains permission to change all the parameters associated with the installer and user. By typing “CCC” in P.0000, the operator identifies himself as a “manufacturer” and obtains permission to modify all parameters, except the critical ones.

- Example 8: P.0001 = CCC P.0002 = 0 P.0003 = UUU

  No parameters are editable. By typing “UUU” in P.0000, the operator identifies himself as a “user” but, since no password is associated with the installer, DC250 still considers him “installer”. It is therefore able to modify the parameters associated with the user and the installer. By typing “CCC” in P.0000, the operator identifies himself as a “manufacturer” and obtains permission to modify all parameters, except the critical ones.

  The value of a parameter is always readable, but the modification is possible only if P.0000 contains a suitable password. Parameters P.0001, P.0002 and P.0003 are exceptions: in fact, DC250 does not display them if P.0000 does not contain an adequate password.

7 Operating sequence

7.1 Applications

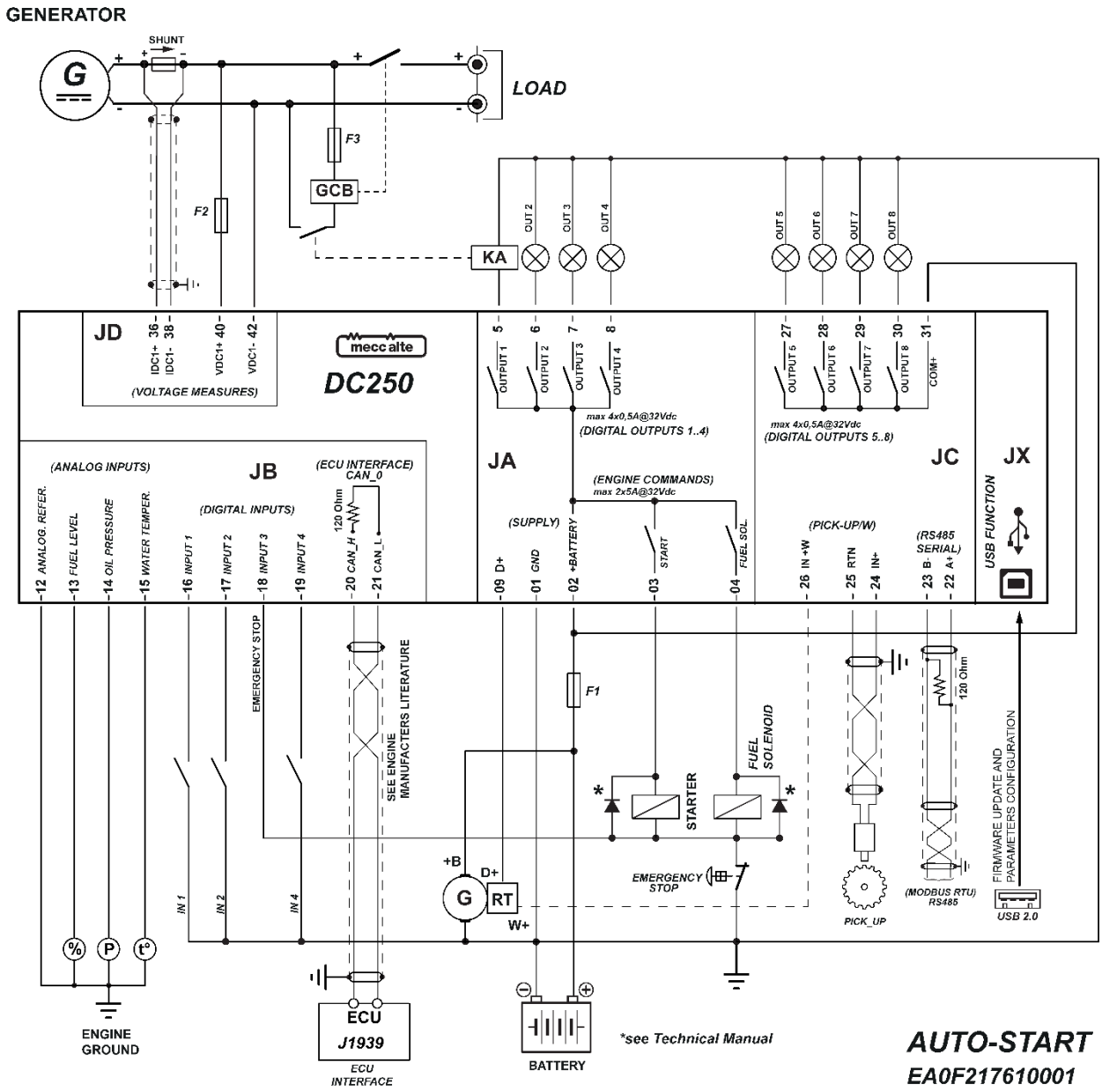
DC250 can manage three different applications; the following paragraphs provide the basic connections diagrams for these applications. You can select the application with parameter P.0802 (“Application type”):

- AUTO-START (P.0802 = 0): normal generator set, consisting of an engine, a DC alternator and eventually a GCB circuit breaker.
- DRIVE (P.0802 = 11): DC250 is prepared to manage only the engine (there is no DC alternator). Instead of the GCB circuit breaker, DC250 can manage a clutch.
- LIGHTING TOWER (P.0802 = 12): normal generator (consisting of an engine and a DC alternator), dedicated to the management of a LIGHTING TOWER. DC250 does not manage the GCB circuit breaker, but instead can manage up to eight commands for switching on and off the various groups of lights.

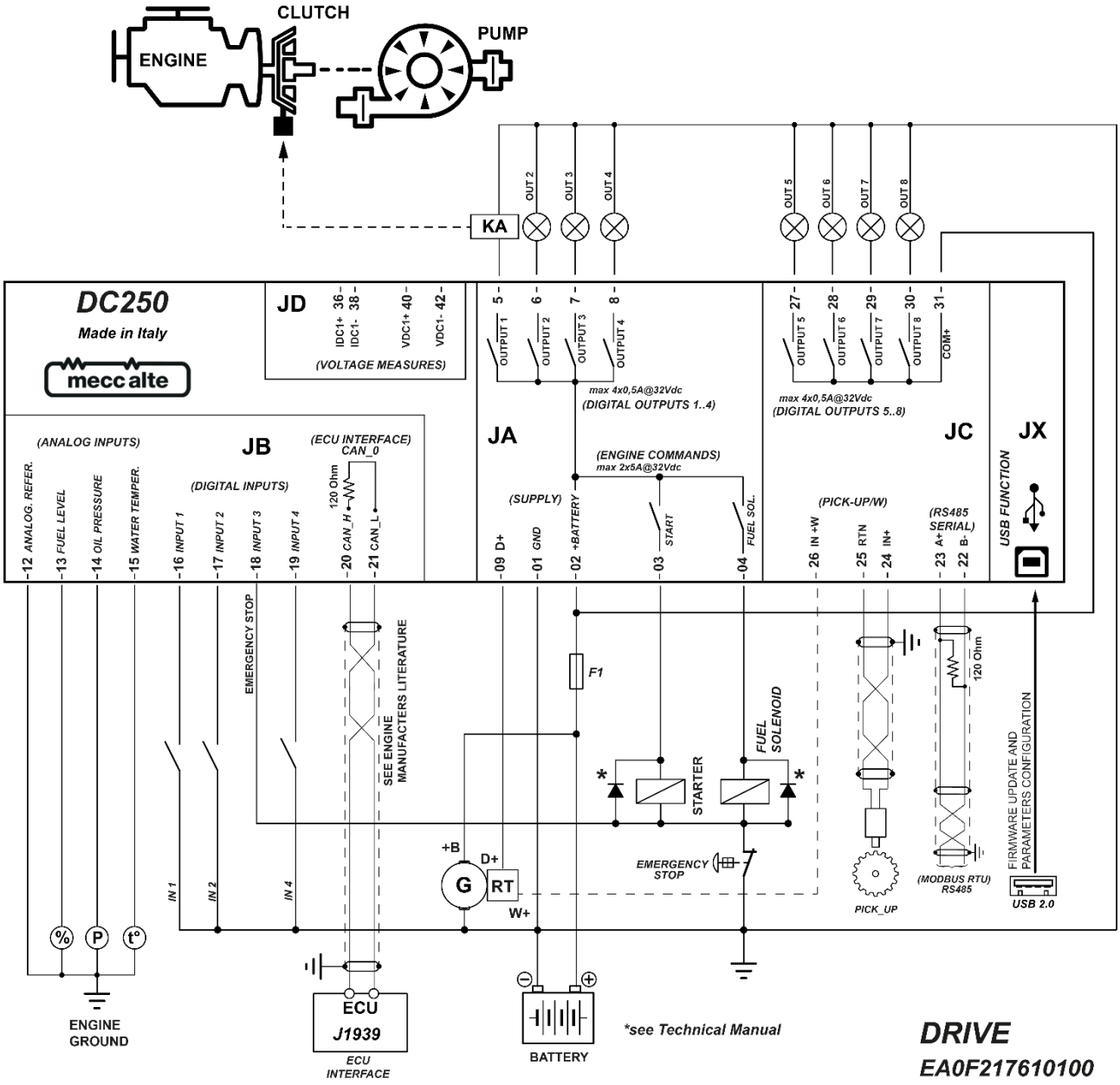
DC250 can signal the application in use through its digital outputs, using the AND/OR logic with the following internal states:

- ST.336: AUTO-START.
- ST.346: DRIVE.
- ST.347: LIGHTING TOWER.

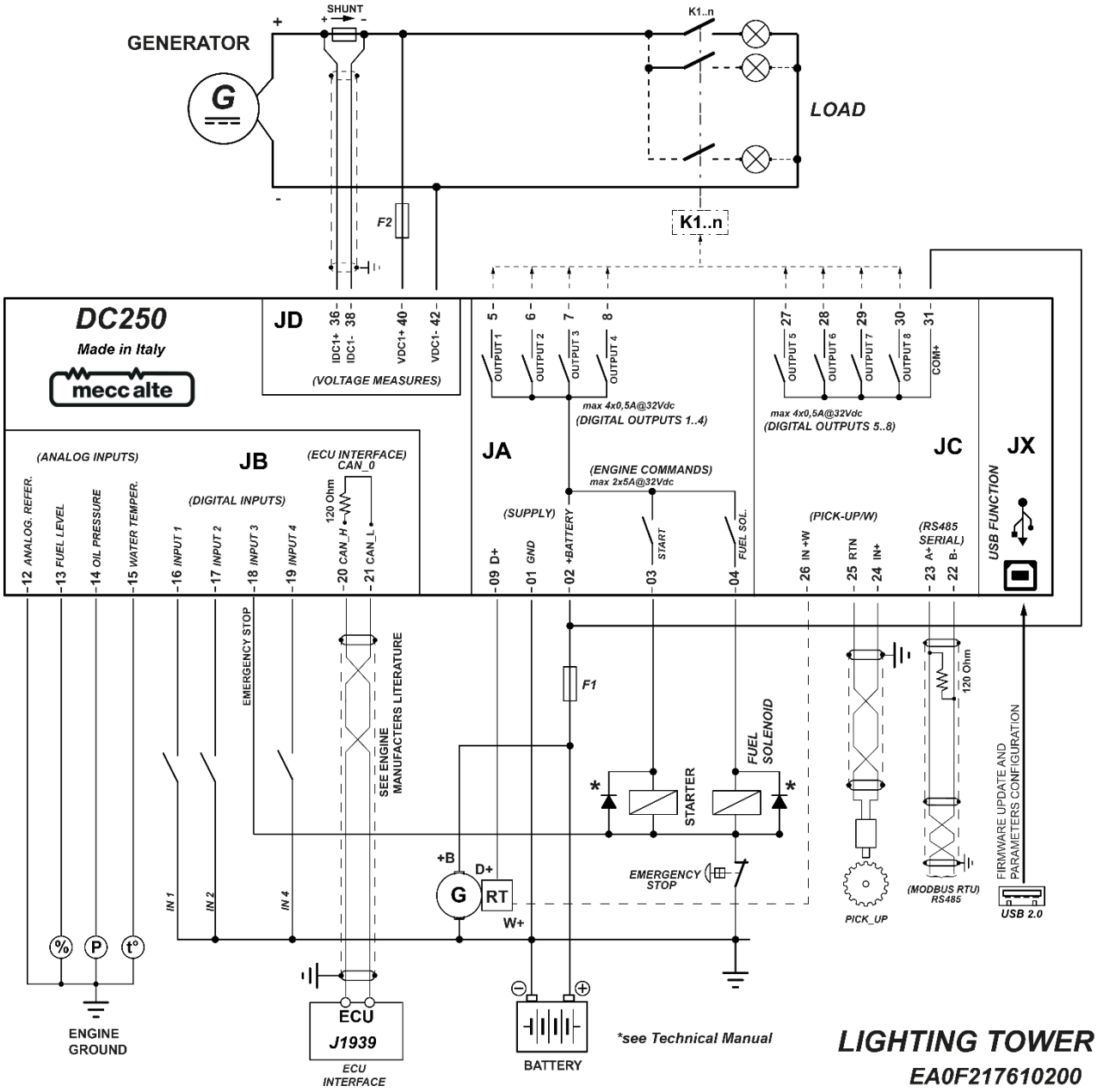
7.1.1 Principle connection diagram for AUTO-START application



7.1.2 Principle connection diagram for DRIVE application



7.1.3 Principle connection diagram for LIGHTING TOWER application



7.2 Operating mode

DC250 manages three operating modes:

- OFF/RESET: DC250 stops the engine, resets all the anomalies, and allows access the programming to change the parameters
  - AUTO-START: DC250 opens the GCB circuit breaker to disconnect the loads from the generator.
  - DRIVE: DC250 disengages the clutch to disconnect the engine from the loads.
  - LIGHTING TOWER: DC250 switches off all the group of lights.
- MAN: the operator manages starting and stopping of the engine (DC250 does not automatically perform these operations): since the protections are active, however, DC250 can automatically stop the engine (after disconnecting the loads) if needed. The operator cannot access the programming.
  - AUTO-START: the operator manually manages the GCB circuit breaker, but DC250 can automatically open it if needed.
  - DRIVE: the operator manually manages the clutch, but DC250 can automatically disengage it if needed.
  - LIGHTING TOWER: the operator manually manages the groups of lights, but DC250 can automatically switch all of them off if needed.
- AUTO: DC250 fully manages the starting and stopping of the engine, and the management of the GCB circuit breaker, of the clutch, or of the groups of lights (the operator cannot intervene). All protections are enabled. The operator cannot access the programming.

The operator can select the operating mode in three ways:

- Using the DC250's “STOP”, “AUTO” and “START” buttons. The operator must press the button for at least half a second to change the mode. DC250 disables the buttons if at least one of the inputs described in the following point exists and is active (in this case, it shows a key icon the first line of the display).
- Using one or more digital inputs configured with the following functions:
  - DIF.2271 “Remote OFF”.
  - DIF.2272 “Remote MAN”.
  - DIF.2273 “Remote AUTO”.

The activation of one of these inputs forces the DC250 operating mode, and it is no longer possible to use the buttons on the panel and not even the commands from the communication ports to change it (the first line of the display shows a key icon).

When none of these inputs are active, it becomes possible again to use the buttons and commands from the communication ports to change the operating mode.

If there are multiple inputs active at the same time, Remote OFF input has priority, followed by Remote MAN and lastly by Remote AUTO.

You can also use less than three inputs. For example, you can use only one input to force the AUTO mode: when the input is active DC250 is always in AUTO, when the input is deactivated DC250 remains in AUTO, but it is possible to use the buttons to switch to MAN or to OFF/RESET.

If you only use the Remote OFF input, DC250 behaves differently: when the input is active DC250 is always in OFF/RESET, when the input is deactivated DC250 returns to the mode it was in before the activation of the input.

- By sending Modbus commands through the communication ports. DC250 manages the commands only if none of the inputs described above are active (see paragraph 5.7). To send the command to change the mode it is necessary to write in sequence (within five seconds):

  - HOLDING REGISTER 101: write the password configured with parameter P.0004.
  - HOLDING REGISTER 102: write the value:
    - "1" to force the OFF/RESET mode.
    - "2" to force the MAN mode.
    - "3" to force the AUTO mode.

7.2.1 Events e signalling

DC250 records an event in the historical archive at each change in the operating mode (if enabled via bit zero of parameter P.0441):

- EVT.1001: passed in OFF/RESET mode.
- EVT.1002: passed in MAN mode.
- EVT.1003: passed in AUTO mode.

The following functions (related to the operating mode) are available for the digital outputs' configuration:

- DOF.3001 - "OFF/RESET". DC250 activates this output in OFF/RESET mode.
- DOF.3002 - "Man". DC250 activates this output in MAN mode.
- DOF.3003 - "Auto". DC250 activates this output in AUTO mode.
- DOF.3011 - "Not in OFF/RESET". DC250 activates this output in MAN or AUTO mode.

The DC250 operating mode is available for the AND/OR logics by the following internal statuses:

- ST.000 - "OFF/RESET".
- ST.001 - "Manual".
- ST.002 - "Automatic".

7.3 Engine

DC250 can start, stop, and protect the engine with a series of thresholds on the acquired measurements (pressure, temperature, speed). The following paragraphs describe in detail the management of the engine in all its parts.

7.3.1 Acquisition of measurements

7.3.1.1 Measurement of the rotation speed

DC250 can acquire the rotation speed (rpm) from its measurement inputs, or directly from the ECU through the CAN BUS connection. DC250 has two inputs for measuring the engine speed:

- Magnetic pick-up input (T.24, T.25). See paragraph 3 for the characteristics of the input signal. This input is enabled if parameter P.0110 (“Number of teeth of the pick-up wheel”) is different from zero. If enabled, it has priority over other acquisition systems.
- Input for the W signal of the charge alternator (T.26, T.01). See the paragraph 3 for the characteristics of the input signal. This input is enabled if parameter P.0111 (“Rpm/W ratio”) is different from zero. If enabled, it has priority over the measurement read via CAN BUS.

DC250 uses the rotation speed for:

- Visualization.
- Detect that the engine is running and disconnect the starter motor.
- Manage protection thresholds for both overspeed and under speed.

As an alternative (or in addition to) the measurement, DC250 can manage digital inputs configured with the functions:

- DIF.4251 (“Over speed”).

DC250 uses the previous contact for engine protections.

7.3.1.2 Measurement of the lube oil pressure

DC250 can acquire the oil pressure (bar) from its measurement inputs, or directly from the ECU via the CAN BUS connection. It is possible to use any analogue input (we recommend input T.14, which allows the connection of a resistive sensor): configure the input with the AIF.1000 function (“VDO oil pressure”) or AIF.1001 (“Generic oil pressure”). The first function configures the sensor described in the 5.6.4, the second allows you to select any sensor from the BOARDPRG4 library, or to define your own.

The measurement made with an analogue input of DC250 has priority over the measurement read via CAN BUS from the ECU.

DC250 uses the oil pressure for:

- Visualization.
- Manage low pressure protection thresholds.
- Detect that the engine is running and disconnect the starter motor.

As an alternative (or in addition to) the measurement of oil pressure, DC250 can manage digital inputs configured with the functions:

- DIF.4221 (“Low oil pressure shutdown”).
- DIF.4222 (“Low oil pressure pre-alarm”).

DC250 also uses the two previous contacts both for the engine protections and for the disconnection of the starter motor.

7.3.1.3 Measurement of the lube oil temperature

DC250 can acquire the oil temperature (°C) from its measurement inputs, or directly from the ECU via the CAN BUS connection. It is possible to use any analogue input (we recommend input T.15, which allows the connection of a resistive sensor): configure the input with the function AIF.1100 (“VDO oil temperature”) or AIF.1101 (“Generic oil temperature”). The first function configures the sensor described in the 5.6.4, the second allows you to select any sensor from the BOARDPRG4 library, or to define your own.

The measurement made with an analogue input of DC250 has priority over the measurement read via CAN BUS from the ECU.

DC250 uses the oil temperature for:

- Visualization.
- Manage high-temperature protection thresholds.

7.3.1.4 Measurement of the lube oil level

DC250 can acquire the oil level (%) from its measurement inputs, or directly from the ECU via the CAN BUS connection. It is possible to use any analogue input (we recommend input T.13, which allows the connection of a resistive sensor): configure the input with the AIF.1200 function (“VDO oil level”) or AIF.1201 (“Generic oil level”). The first function configures the sensor described in 5.6.4, the second allows you to select any sensor from the BOARDPRG4 library, or to define your own.

The measurement made with an analogue input of DC250 has priority over the measurement read via CAN BUS from the ECU.

DC250 uses the oil level for:

- Visualization.
- Manage low level protection thresholds (see5.6.4).

7.3.1.5 Measurement of the temperature of the coolant

DC250 can acquire the coolant temperature (°C) from its measurement inputs, or directly from the ECU via the CAN BUS connection. It is possible to use any analogue input (we recommend input T.15, which allows the connection of a resistive sensor): configure the input with the function AIF.1110 (“VDO coolant temperature”) or AIF.1111 (“Generic coolant temperature”). The first function configures the sensor described in the 5.6.4 paragraph, the second allows you to select any sensor from the BOARDPRG4 library, or to define you own.

The measurement made with an analogue input of DC250 has priority over the measurement read via CAN BUS from the ECU.

DC250 uses the coolant temperature for:

- Visualization.
- Manage high-temperature protection thresholds.
- Management of the engine cooling cycle.

As an alternative (or in addition) to the temperature measurement, DC250 can manage digital inputs configured with the functions:

- DIF.4231 (“High coolant temperature pre-alarm”).

- DIF.4232 (“High coolant temperature shutdown”).

DC250 also uses the previous two contacts for engine protections.

7.3.1.6 Measurement of the coolant level

DC250 can acquire the coolant level (%) from its measurement inputs, or directly from the ECU through the CAN BUS connection. It is possible to use any analogue input (we recommend input T.13, which allows the connection of a resistive sensor): configure the input with the AIF.1210 function (“VDO coolant level”) or AIF.1211 (“Generic coolant level”). The first function configures the sensor described in the 5.6.4 paragraph, the second allows you to select any sensor from the BOARDPRG4 library, or to define your own.

The measurement made with an analogue input of DC250 has priority over the measurement read via CAN BUS from the ECU.

DC250 uses the coolant level for:

- Visualization.
- Manage high-temperature protection thresholds (see5.6.4).

7.3.1.7 Measurement of the fuel level

DC250 can acquire the fuel level (%) from its measurement inputs, or directly from the ECU through the CAN BUS connection. It is possible to use any analogue input (we recommend input T.13, which allows the connection of a resistive sensor): configure the input with the AIF.1220 function (“VDO fuel level”) or AIF.1221 (“Generic fuel level”). The first function configures the sensor described in the paragraph 5.6.4, the second allows you to select any sensor from the BOARDPRG4 library, or to define your own.

The measurement made with an analogue input of DC250 has priority over the measurement read via CAN BUS from the ECU.

DC250 uses the fuel level for:

- Visualization.
- Manage protection thresholds.
- Manage the pump for loading fuel from the storage tank to the daily tank.

As an alternative (or in addition to) the measurement, DC250 can manage digital inputs configured with the functions:

- DIF.4211 (“Low fuel tank level shutdown”).
- DIF.4212 (“Low fuel tank pre-alarm”).
- DIF.4213 (“High fuel tank pre-alarm”).

DC250 uses the three previous contacts both for engine protections and for pump management.

7.3.2 Detecting the starting/stopped state and disconnecting the starter motor

DC250 defines three states of the engine:

- Stopped: DC250 allows the activation of the command for the starter motor.
- Non fermo: DC250 does not consider the engine to be running, therefore:
  - If the command for the starter motor is already active, DC250 holds it to try to start the engine
  - If the command for the starter motor is not active, DC250 prevents its activation (because the engine is rotating).

- Running: DC250 deactivates the starter motor and prevents its reactivation.

DC250 detects the state of the engine by evaluating the following conditions:

- **Engine rotation speed.** This control is enabled if the DC250 acquires the rotation speed (see 7.3.1) and if the nominal rotation speed (P.0133) it is different from zero. There are two thresholds (P.0224 and P.0225), which must both be different from zero and P.0225 must be greater than P.0224 (otherwise DC250 do not use this check). The two thresholds are percentages of P.0133. The instant state of the engine is:

  - Stopped if the rotation speed is lower than P.0224.
  - Not stopped if the rotation speed is higher than P.0224, but lower than P.0225.
  - Running if the rotation speed is higher than P.0225.

- **DC voltage on charge battery D+ signal**. This control is enabled if the D+ voltage measurement is enabled (P.4001 must be set as AIF.1300 - "D+ signal"). There are two thresholds (P.0230 and P.0231), which must both be different from zero and P.0231 must be greater than P.0230 (otherwise DC250 does not use this check). The two thresholds are percentages of the rated voltage of the starter battery (12/24 Vdc). The instant state of the engine is:

  - Stopped if the D+ voltage is lower than P.0230.
  - Not stopped if the D+ voltage is higher than P.0230, but lower than P.0231.
  - Running if the D+ voltage is higher than P.0231.

- **Engine lube oil pressure**. This control is enabled if parameter P.0232 ("Starter motor disconnection delay from oil pressure") is different from zero and if somehow DC250 can determine the condition of low oil pressure:

  - Oil pressure measurement is available, and one of the thresholds set with parameters P.0339 ("Pre-alarm level for low oil pressure") and P.0341 ("Shutdown level for low oil pressure") is different from zero. DC250 uses a hysteresis of 0.2 bar.
  - There are digital inputs configured to acquire the status of the oil pressure contacts (DIF.4221 and/or DIF.4222)

  The instant state of the engine is:

  - Stopped if DC250 detects a "low oil pressure" condition.
  - Running if DC250 does not detect a "low oil pressure" condition.

  Parameter P.0232 configures a delay: if the oil pressure rises too quickly before the engine starts, it may be useful to set it at 2-3 seconds.

- **CAN BUS connection**: if the ECU signals the running status on CAN BUS.

- **From the generator DC voltage (<u>not used for DRIVE applications</u>).** This control is enabled if parameter P.0102 ("Nominal generator voltage") is different from zero. Two thresholds are available (P.9651 and P.9652), which must both be different from zero and P.9652 must be greater than P.9651 (otherwise DC250 does not use this check). The two thresholds are percentages of the generator rated voltage (P.0102). The instant state of the engine is:

  - Stopped if the measured voltage is lower than P.9651.
  - Not stopped if the measured voltage is higher than P.9651, but lower than P.9652.
  - Running if the measured voltage is higher than P.9652.

  Globally, DC250 consider the engine:

- **Stopped** if all the previous conditions (all those not disabled) indicate the state of "stop" consecutively for five seconds.

- **Not stopped**, if at least one of the previous conditions indicates "in motion" or running.
- **Running**, if at least one of the preceding conditions indicates “running” consecutively for at least 0.2 seconds

7.3.3 Starting requests

DC250 allows starting the engine only if stopped (see 7.3.2), if no “shutdown” or “deactivation” are present, and only in the following conditions:

- In MAN mode, DC250 never starts the engine automatically, but always waits for a command from the operator. The operator can send the command in the following ways:

  - From the DC250 front panel. The operator must press the START button. If the protected start function is active (bit 2 of parameter P.0495=1), the first press of the button only selects the MAN mode, and it is necessary to press the button again to start the engine.
  - Using a digital input configured with the DIF.2033 function (“Manual start command”). The input simulates pressing the START button (the protected start function is irrelevant)
  - Using the Modbus commands via the communication ports (see paragraph 5.7) (the protected start function is irrelevant). To send the command it is necessary to write in sequence (within five seconds):
    - HOLDING REGISTER 101: write the password configured with parameter P.0004.
    - HOLDING REGISTER 102: write the value “11”.

  DC250 manages two different manual start-up sequences:

  - Fully manual. You can select this behaviour by setting P.0252 to zero. By holding down the START button, start-up begins. The operator establishes the duration: the attempt stops when the operator releases the START button (or when the engine starts). DC250 does not use this sequence in the case of Modbus commands.
  - Semi-automatic. You can select this behaviour by setting any values except zero into P.0252. By pressing and releasing the START button, DC250 makes P.0252 automatic attempts to start the engine; parameter P.0210 selects the maximum duration of the attempt. At the end, if the engine has not started, DC250 activates the pre-alarm AL.022 ("starting failure").

  In MAN, DC250 still makes only one start attempt (even in semi-automatic mode), without activating anomaly AL.022 ("failed to start").

- In AUTO mode, DC250 starts the engine automatically only if at least one of the following conditions occurs:

  - If the engine starter battery voltage is too low. In this case, DC250 starts the engine to make sure that the engine, through its charge alternator, recharges the battery. This function is enabled if parameter P.9655 is different from zero, and you can configure it with the following parameters:
    - P.9657 (“Engine starting threshold for low battery voltage”). It is a percentage of the rated voltage of the starter battery (12/24 Vdc).
    - P.9658 (“Delay before starting the engine for low battery voltage”).
    - P.9655 (“Engine running duration for low battery voltage”).

    If the starter battery voltage remains below the P.9657 threshold consecutively for P.9658 seconds, DC250 starts the engine and keeps it running for P.9655 minutes. If there are no other requests for automatic intervention, DC250 does not connect the loads to the engine/generator.
  - If explicitly requested through the weekly schedule. You can configure this function with the following parameters:
    - P.0426, P.0429, P.0432, P.0435 (“Planned days 01…04”).

- P.0427, P.0430, P.0433, P.0436 (“Planned start time 01…04”).
- P.0428, P.0431, P.0434, P.0437 (“Planned stop time 01…04”).

Using parameter P.0426, you can establish on which days of the week this function is active, the other two parameters select a time band, valid for all the selected days. The band start time (P.0427) refers to the days indicated in P.0426, while the band end time (P.0428) refers to the same day if the value is higher than P.0427, to the day next if lower (around midnight). Furthermore, setting P.0427 equal to P.0428 defines a range that covers the entire day.

As of revision 2.01, the management of weekly schedulers is extended to four daily time slots.

This function is always enabled. However, it is possible to configure an input with the DIF.2751 function (“Enables the generator/engine usage planning”): if this input exists, the planning is enabled only if the input is active.

- If a digital input configured with the DIF.2032 function (“Remote start request”) explicitly requests a remote start.
- By sending Modbus commands through the communication ports (see paragraph 5.7. To send the command it is necessary to write in sequence (within five seconds):

- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102: write the value

- “13” to request remote start.
- “21” to remove the remote start request.

In AUTO, DC250 starts the engine automatically, making P.0211 attempts if necessary; you can select the maximum duration of the single start attempt with parameter P.0210, the pause between two attempts with parameter P.0212.

7.3.4 Stop requests

DC250 always automatically stops the engine (without doing the cooling cycle) if one of the following conditions occurs:

- The DS250 operating mode changes to OFF/RESET.
- DC250 activates a “shutdown” or “deactivation” anomaly.

Outside the above conditions, DC250 stops the engine if:

- In MAN mode, DC250 always waits for a command from the operator. The operator can send the command in the following ways:

- From the DC250 front panel. The operator must press the STOP button. If the engine/generator supplies the loads, the STOP button disconnects the loads: in this case, press it twice or more to stop the engine, or held it down for at least two seconds.
- Using parameter P.0269 (Maximum running time in manual mode). The controller automatically stops the engine after the programmed time has elapsed.
- Using a digital input configured with the DIF.2034 function (“Manual STOP command”). In this case, DC250 disconnects the loads from the engine/generator and stops the engine.
- By sending Modbus commands through the communication ports (see paragraph 5.7. To send the command it is necessary to write in sequence (within five seconds):

- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102: write “21”.

In MAN, DC250 never executes the cooling cycle for the engine: it is eventually up to the operator to manually disconnect the loads, leave the engine running to cool it, then stop it.

- In AUTO mode, DC250 automatically stops the engine if none of the conditions listed in 7.3.3 are active. Optionally, it accepts manual stop commands (if enabled by bit zero of parameter P.0495 “Keyboard-screen options”). In this case, the manual stop command involves the activation of anomaly AL.007 ("Manual stop command in AUTO mode"): being a “shutdown”, DC250 stops the engine without executing the cooling cycle. The operator can send the command in the following ways

  - By pressing the STOP button on the DC250 front panel.
  - By sending Modbus commands through the communication ports (see paragraph 5.7. To send the command it is necessary to write in sequence (within five seconds):
    - HOLDING REGISTER 101: write the password configured with parameter P.0004.
    - HOLDING REGISTER 102: write “22”.

7.3.5 Idle speed requests

DC250 can manage reduced speed requests for the engine. It usually manages them only just after starting the engine, to allow it to warm up without load. Parameter P.0233 (“Idle speed cycle duration”) configures this feature: once this time has elapsed, DC250 brings the engine to the rated speed. Setting it to zero disables the cycle.

DC250 also manages idle speed requests through the digital inputs. In this case, dc250 MANAGES the request also after the end of the starting cycle and involves the disconnection of the loads from the engine/generator. Use the DIF.2061 function ("Request for idle speed"): DC250 keeps the engine at reduced speed when the input is active, at the rated speed when it is not active.

If DC250 is connected to the ECU via CANBUS, the operator can select the real engine speed during the "idle speed" cycle with parameter P.0710.

7.3.6 Engine commands

DC250 can use the following commands for engine management:

- START: command for the starter motor.
- FUEL: command for the fuel solenoid.
- STOP: command for the stop solenoid.
- PREHEAT: command for glow plug preheating for Diesel engines.
- IDLE: command for the management of the idle speed cycle.

All the digital outputs of DC250 are configurable, and it is therefore possible to associate the engine commands to the outputs in any way. DC250 assigns the START and FUEL commands by default to the outputs T.03 and T.04 (which can deliver a higher current), but it is possible to reassign them if necessary (see paragraph 5.5.4). DC250 assigns the STOP command by default to output T.05 (but it is possible to reassign it). For the other commands, being optional, there is no pre-assigned output.

To associate each of these commands to any of the outputs, it is necessary to act on parameter P.3001 (for output T.03 or the equivalent parameters for high outputs), using the values:

- DOF.1001: preheating of the glow plugs (PREHEAT).
- DOF.1003: fuel solenoid (FUEL).
- DOF.1005: command to start the engine (START).
- DOF.1006: stop solenoid (STOP).
- DOF.1007: commando for idle speed (IDLE).

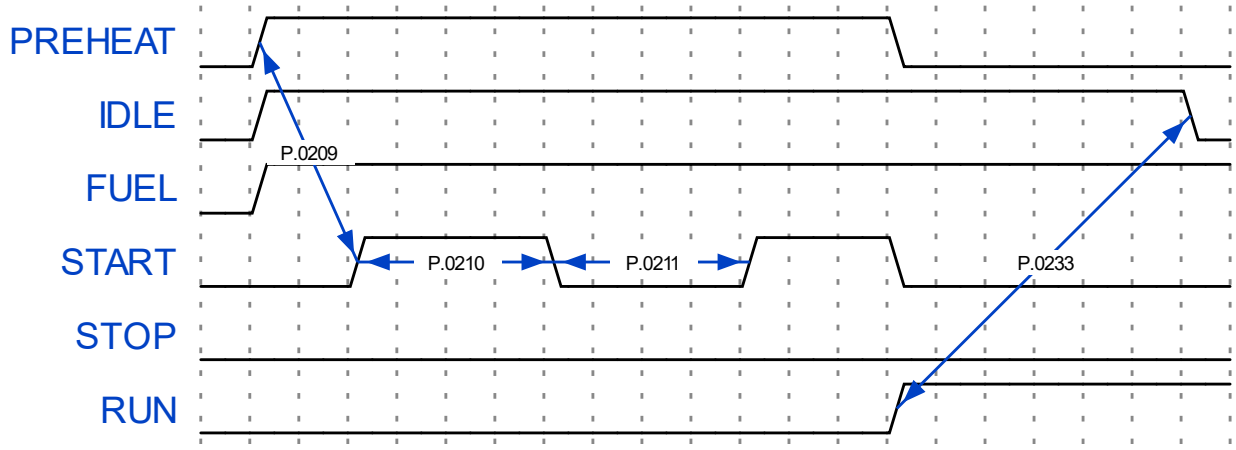
DC250 makes the internal engine commands available for AND/OR logics through the following internal states:

- ST.128: glow-plugs preheat command (PREHEAT).
- ST.130: fuel solenoid (FUEL).
- ST.132: crank motor (START).
- ST.133: stop solenoid (STOP).
- ST.134: idle speed command (IDLE).

7.3.7 Engine command sequence

7.3.7.1 Starting

With the engine stopped, DC250 deactivates all the outputs associated with the engine commands. When DC250 must start the engine, it behaves this way:



Before the starting cycle the controller activates the internal buzzer and, if configured, also the external one, but only if parameter P.0265 is different from zero. For this purpose, in fact, it is possible to configure a digital output with the DOF.3152 function (“External horn”). DC250 manages the output together with the internal buzzer; the aim is to use a more powerful horn or a lamp.

DC250 activates the FUEL and PREHEAT commands at the beginning of the starting cycle. At the same instant it also activates the IDLE command, but only if parameter P.0233 is different from zero.

DC250 activates the FUEL and PREHEAT commands at the beginning of the starting cycle. At the same instant it also activates the IDLE command, but only if parameter P.0233 is different from zero.

Parameter P.0209 (“Duration of the preheating cycle”) configures the delay between the PREHEAT and START commands. If P.0209 is set to zero, DC250 still guarantees at least two hundred ms between the two commands, to avoid the depression caused by the intake of the engine in the fuel duct from blocking the correct opening of the solenoid valve.

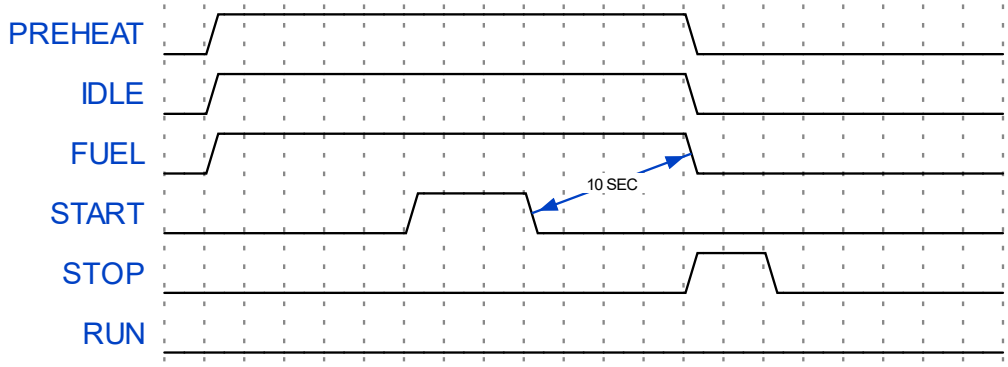
INFORMATION! it is possible to use the delay P.0209 even without physically associating the PREHEAT command to a digital output.

Parameter P.0210 (“Duration of crank command”) configures the duration of the START command. In MAN, if P.0252 is zero (completely manual start), the START command remains active until the operator releases the START button.

When DC250 detects the condition of engine running (RUN):

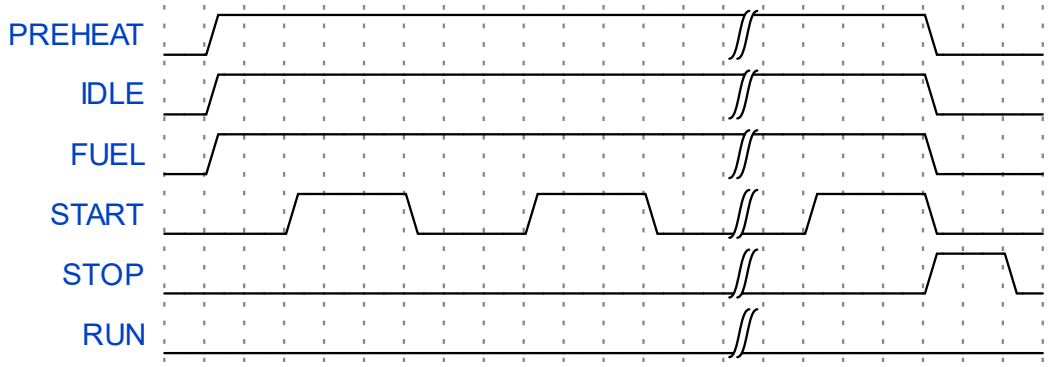
- Removes the START command (even if the operator is still pressing the button).
- Removes the PREHEAT command.
- Start counting the idle speed cycle time. Parameter P.0233 configures the duration of the cycle.

  If DC250 is in MAN mode and the operator releases the START button before the engine starts, DC250 waits for a fixed time of 10 seconds to see if the engine starts late: during this time, the FUEL command remains active (to allow the start).



After 10 seconds, DG250 commands a stop cycle (to prevent the engine from starting uncontrolled with a further delay).

If DC250 is in AUTO and the engine does not start within P.0210 seconds, DC250 removes the START command but leaves the FUEL, PREHEAT and IDLE commands (in case the engine is starting). Waits for the P.0212 delay (“Delay between crank attempts”), then tries again. After P.0211 attempts (“Number of crank attempts”), DG250 commands a stop cycle (to prevent the engine from starting uncontrolled with a further delay) and activates the anomaly AL.022 (“Failed to start”):



7.3.7.2 Real start-up check

After DC250 has detected the running condition, it waits for P.0217 seconds (“Maximum time for operating conditions”) to verify that the engine reaches an adequate rotation speed. The engine, in fact, could shut down (DC250 could have detected it running only due to the starter motor). In these cases, DC250 must try to start it again, until the configured attempts.

For AUTO-START and LIGHTING TOWER applications, DC250 makes this check on the generator DC voltage, but only if DC250 is in AUTO mode. DC250 verifies that the DC voltage is between the thresholds P.0301 and P.0303 (percentages of P.0102, “Nominal voltage of the generator”).

For DRIVE applications, on the other hand, DC250 makes this check on the engine speed, also in MAN mode. DC250 still uses the thresholds P.0301 and P.0302 but applies them to the rated rotation speed and compares them with the real engine speed.

If the engine does not reach an adequate rotation speed (but remains running), DC250 commands a stop cycle and activates the anomaly AL.008 ("Operating conditions failure ").

7.3.7.3 Stopping

DC250 can stop the engine in two ways:

a) With standard procedure. It only applies in AUTO mode if

- DC250 does no longer require the engine start-up.
- DC250 has activated a “deactivation” type anomaly (an anomaly typically dangerous for the loads but not for the engine)

b) With emergency procedure. It applies if:

- DC250 in OFF/RESET mode.
- Stop requests in MAN mode.
- DC250 has activated a “shutdown” type anomaly.

7.3.7.3.1 Stopping with standard procedure

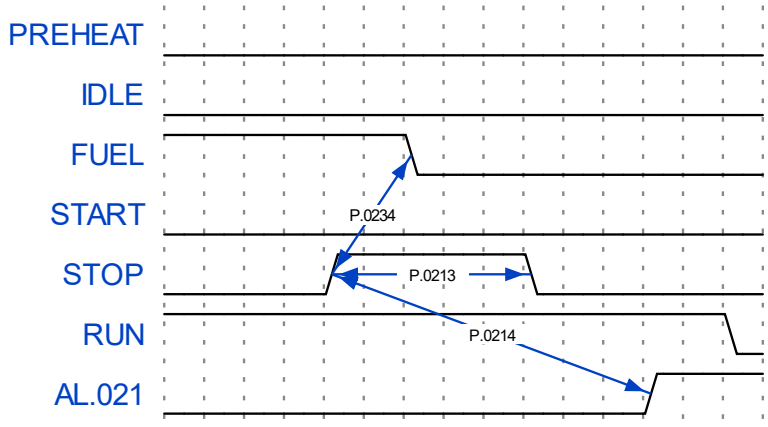
The standard shutdown procedure consists of first executing a cooling down cycle for the engine (during which DC250 disconnects the engine and/or generator from the loads).

DC250 executes this cycle only if the engine/generator previously supplied the loads. Parameter P.0215 (“Cooling cycle duration”) configures the duration of the cycle. You can also use parameter P.0271 to configure a temperature threshold below which the cooling cycle ends, and the engine stops. In any case, the maximum duration of the cooling cycle is parameter P.0215.

An emergency stop request can interrupt the cycle (a “shutdown” type anomaly or DC250 in OFF/RESET mode). In this case, or at the end of time P.0215, the stop cycle continues with the emergency procedure.

7.3.7.3.2 Stopping with emergency procedure

The emergency procedure consists in stopping the engine without running the cooling cycle. This procedure is also common to normal shutdown, after the cooling cycle.



During the stop phase, DC250 activates the STOP command. It uses this command for engines with an “energizing” stop system (see paragraph 5.2.1.3). The stop cycle lasts P.0213 seconds, after which DC250 removes the STOP command. For ECUs connected in CAN BUS, DC250 activates the digital stop command at the same time as the STOP command.

DC250 uses the FUEL command for engines with “de-energizing” stop system (see paragraph 5.2.1.2). DC250 removes the FUEL command with a delay compared to the STOP command (parameter P.0234 “Delay between STOP and FUEL commands”). You may use this delay when DC250 activates the stop command in other ways (for example via CAN BUS) for:

- Avoid that the engine, during stopping, causes a depression in the fuel ducts, which could cause the solenoid valve to jam at the next opening command.
- On electronic engines, to power the ECU through the FUEL output so that the ECU itself remains powered during the shutdown.

The engine must stop within P.0214 seconds (“Delay before the ‘fail to stop’ shutdown is activated”) from the activation of the STOP command: if the engine does not stop, DC250 activates the anomaly AL.021 ("Failed to stop").

7.3.8 Events and signalling

DC250 records an event for each variation of the engine state (if enabled through bit three of parameter P.0441):

- EVT.1040: Engine stopped.
- EVT.1041: Starting.
- EVT.1042: Engine running.
- EVT.1043: Engine cooling down.
- EVT.1044: Engine stopping.
- EVT.1045: Engine running at idle speed.

DC250 records an event for each variation of the start/stop requests (if enabled through bit six of parameter P.0441):

- EVT.1050: Manual start command.
- EVT.1051: Manual stop command.
- EVT.1053: Automatic start command.
- EVT.1054: Remote start command from digital input.
- EVT.1056: Remote start command from communication port.
- EVT.1057: End of the remote start command from communication port.
- EVT.1058: Remote start command from scheduler.
- EVT.1064: Remote start command for low voltage on the starting battery.

Furthermore, DC250 makes the engine states available for AND/OR logics through the following internal states:

- ST.032 – Engine running.
- ST.033 – Lube oil protections enabled.
- ST.035 – Engine sequence: stopped.
- ST.036 – Engine sequence: starting.
- ST.037 - Engine sequence: idle speed.
- ST.038 – Engine sequence: warming time.
- ST.039 – Engine sequence: ready to supply.
- ST.040 - Engine sequence: cooling down.
- ST.041 - Engine sequence: stopping.

- ST.096 – “Ready to supply”

Furthermore, it is possible to activate a digital output of DC250 when the engine is running, by configuring it with the function DOF.3061 (“Engine running”).

7.3.9 Auxiliary functions

7.3.9.1 Maintenance

DC250 can automatically notify the operator of the need to execute the periodic engine maintenance. This report is based on the count of the real working hours of the engine, since the last maintenance.

Parameters P.0424 and P.0425 configure the function. P.0424 (“Maintenance interval 1”) configures the working hours beyond which requiring maintenance. P.0425 (“Kind of action for maintenance”), on the other hand, configures the type of anomaly activated upon expiration: a pre-alarm, a deactivation, or a shutdown (AL.039 “Maintenance required”).

The function is enabled if parameter P.0424 contains a value other than zero. The count starts when this parameter is set. When the configured hours have passed, the DC250 stores (in its non-volatile memory) the maintenance request status. In this way, even removing the power supply to DC250, this signal remains, and the operator cannot cancel it. If P.0425 selects a “shutdown” or a “deactivation” the operator can no longer use the engine/generator until someone performs the required maintenance. To cancel the maintenance request (and therefore also the related signal) the operator must set again parameter P.0424: can set it to zero to disable the function, can simply confirm the previous value to request the next maintenance after the same number of hours, or can set the new required interval.

These parameters require the installer password, so the normal operator cannot ignore the message.

INFORMATION! if you select a shutdown or a deactivation, this function allows you to manage “hourly” rental contracts: once the agreed hours have elapsed, the operator will no longer be able to use the generator.

7.3.9.2 Maximum running time

DC250 manages this useful feature that allows the user to start the engine in manual mode, keeping it running only for a preset time, unless other shutdown conditions occur. Once the timer has elapsed, the engine will enter a normal shutdown and once stopped, the controller will automatically switch to OFF/RESET mode.

Parameters P.0269 and P.0270 configure the function. P.0269 (“Maximum running time in manual mode”) configures the working minutes during which the engine is running. If set to zero, this function is disabled.
On the other hand, P.0270 (“One shot maximum running time enable?”) configures the possibility of repeating the cycle again simply by pressing START (if set to “No”) or of executing it only once (if set to “Yes”). In this case, the operators will have to set the required time again each time they want to restart the engine manually.

This function is only available in manual mode.

7.3.9.3 Fuel pump

DC250 implements a complete management of the pump for loading the fuel from the storage tank into the daily tank.

For use this feature, you must configure one of the digital outputs of DC250 with the DOF.1032 function (“Fuel pump”). It is also possible to configure a digital output to control a solenoid on the pump line (DOF.1034 “Solenoid for the fuel pump”). In this case, parameter P.0405 (“Delay between solenoid and fuel pump”) configures the delay between the two commands (the solenoid opens before starting the pump and closes after stopping the pump).

Pump management includes automatic operation and manual controls, accessible from the front panel. Page G.09 (visible only with an output configured for pump control) allows selecting the pump control mode (see 6.4.7.9).

INFORMATION! the pump control mode is a normal parameter of DC250 (P.0400 “Fuel pump mode”) and therefore you can also change it from programming.

The available operating modes are:

- (AUTO): DC250 starts/stops the pump according to the fuel level in the daily tank, with a hysteresis band that prevents continuous starts/stops.
- (MAN-ON): DC250 stops the pump only when the tank is full. No hysteresis band: as soon as the tank is no longer full, DC250 starts the pump.
- (MAN-OFF): DC250 keeps the pump always stopped, even when the tank is empty.

Parameter P.0406 ("Power supply for the fuel pump") selects which is the power source of the pump between:

- 0 – Generator.
- 4 – Always supplied (the power supply source is always present).

DC250 turns off the pump if the selected source is not available. In OFF/RESET, DC250 always keeps the pump stopped. The display shows the status of the pump by the following symbols:

- : pump switched on.
- : pump switched off.

DC250 can work both with a contact level detection system and with an analogue measurement.

7.3.9.3.1 Using an analogue level transducer

To use this feature, DC250 requires that:

- That there is an analogue level transducer configured on an analogue input.
- Parameter P.0401 must associate to control the pump to this transducer (P.0401 = 0).
- Parameters P.0402 and P.0403 must configure the activation and deactivation thresholds for the pump (at least).
- If configured, DC250 also uses the minimum, low and high fuel level thresholds (parameters P.0347, P.0345, P.0343)

INFORMATION! if DC250 can verify the first two conditions, it manages the pump anyway, whatever the value of the thresholds. It uses the thresholds defined in the last condition even if the related tripping times are set to zero (to disable anomalies). The configuration of the thresholds is particularly important, and the operator should ensure scaling them (from bottom to top) in the order: minimum, low, start, stop, high. Based on the above, DC250 works even if the thresholds are not in this order, it is sufficient that the first three are all lower than the last two (within the two groups they can assume any order, although we do not recommend so).

7.3.9.3.2 Using a contact level transducer

To use this feature, DC250 requires that:

- The contact level transducer must exist.
- Parameter P.0401 must associate to control the pump to this transducer (P.0401 = 1).
- At least, the start and stop contacts must exist, and the operator must connect them to two digital inputs of DC250.
- If connected, DC250 also uses the minimum, low and high fuel level contacts.

INFORMATION! If DC250 can verify the first two conditions, it manages the pump anyway, whatever the connected contacts. DC250 uses the contacts indicated in the last condition even if the related tripping times are set to zero (to

disable anomalies). Therefore, pay attention to their configuration. Finally, the contacts must respect the following convention:

- Minimum level contact (function DIF.4211): activated when the fuel level is below the minimum threshold.
- Low level contact (function DIF.4212): activated when the fuel level is below the low threshold.
- Pump start command (function DIF.3301): activated when the fuel level is below the start threshold.
- Pump stop command (function DIF.3302): activated when the fuel level is **below** the stop threshold.
- High level contact (function DIF.4213): activated when the fuel level is above the high threshold.

7.3.9.3.3 Evaluation of the level

DC250 determines the state of the fuel level (for the purpose of controlling the pump) by calculating in the order all the following evaluations:

- If the level is below the pump start-up threshold, it assigns the **start** status.
- If there is a low-level threshold, and the level is lower than the threshold, it assigns the **low** status.
- If there is a minimum level threshold, and the level is lower than the threshold, it assigns the **minimum** status.
- If the level is higher than the pump stop threshold, it assigns the **stop** status.
- If there is a maximum level threshold, and the level is higher than the threshold, it assigns the **maximum** status.
- Otherwise, it assigns the **Hysteresis** status.

7.3.9.3.4 Automatic command of the pump

With reference to the state evaluated in the previous paragraph, DC250:

- Activates the pump if the level position is **start**, **low** or **minimum**.
- Deactivates the pump if the position is **stop** or **maximum**.
- Keeps the current command if the position is **Hysteresis**.

7.3.9.3.5 Manual command of the pump

The operator can activate and deactivate the pump at will. DC250, however, prevents starting if the level status (see previous paragraphs) is **stop** or **maximum**.

7.3.9.3.6 Protections

Parameter P.0404 allows setting the maximum activation duration of the pump. This parameter should set the time required for the pump to fill the daily tank in the worst conditions: tank empty and engine running at maximum power. If DC250 cannot fill the daily tank within this time (both in manual and automatic control), it stops the pump and activates the pre-alarm AL.064: it is in fact probable that there is a pump failure or in any case that the pump is not getting fuel from the storage tank. As soon as the operator recognized the anomaly, the pump restarts.

Sometimes it is necessary to block the pump (with a signal on the display) following system situations, for example if the storage tank is empty. In these cases, it is necessary:

- Configure a digital input with the DIF.4051 function (“Pre-alarm - stops the fuel pump”) (in parameter P.2001 or equivalent).
- Associate a delay to the input (in parameter P.2002 or equivalent).

If the input remains active for the configured time, DC250 activates an anomaly (pre-alarm) and stops the pump.

7.3.9.3.7 Signalling

DC250 records the activations and deactivations of the pump in the historical archive of the events, if bit seven of parameter P.0441 is active:

- EVT.1070: fuel pump activated.
- EVT.1071: fuel pump deactivated.

7.3.9.4 CAN BUS connection with the ECU of the engines

DC250 has a CAN BUS interface dedicated to interfacing with the electronic engine ECUs. See paragraph 5.2.5 for wiring information, and the paragraph 3 for the electrical characteristics of the interface.

To enable communication, the operator must first select the ECU type. Parameter P.0700 (accessible directly from the DC250 panel) allows you to select:

- Communication with old MTU ECUs, which do not support the J1939 protocol.
- A default generic communication for ECUs that implement the J1939 protocol (“1-J1939 standard”). This option normally allows you to read all the significant quantities from the ECU, and usually also to control the engine speed. However, it does not manage all the non-standard implementations of the ECU (usually the start/stop commands, sometimes also the speed control).

If you want to take advantage of all the peculiar characteristics of each specific ECU, it is necessary to operate in this way (but you need the BOARDPRG4 program):

- Select the value "300" in parameter P.0700. This value enables the transmission to DC250 of an external file, which describes in detail the communication with the specific ECU.
- On BOARDPRG4, using parameter F.0700, selects the file for the desired ECU. If it is not in the list, please update both BOARDPRG4 and DC250 to the latest software version available. If still not available, contact Mecc Alte.

ATTENTION! DC250 shows parameter F.0700 as P.0716 and does not allow the operator to change it.

It is then possible to decide whether to receive information only from the engine ECU or to send commands as well, using parameter P.0703:

- 0: DC250 does not transmit anything on the CAN BUS (it receives and displays the information transmitted by the ECU).
- 1: As for the value “0”, but DC250 asks the EQU to send “on demand” information.
- 2…90: DC250 also transmits all commands to the ECU (start, stop, low speed, rated rotation speed, protection override, regeneration commands), except for the speed command.
- 91…99: DC250 transmits all commands to the ECU.

Parameter P.0715 then allows you to customize in detail the communication with specific ECUs (MTU, VOLVO).

For speed regulation, DC250 uses parameter P.0840 (“Regulation offset”). It is a percentage value, which translates into rpm based on the value of parameters P.0713 and P.0714:

- P.0713: it configures the speed corresponding to 0% of P.0840.
- P.0714: it configures the speed corresponding to 100% of P.0840.

The operator can select the real engine speed during the "idle speed" cycle with parameter P.0710.

If you are using a PMG generator, DC250 needs to control the speed of the engine to indirectly control the DC voltage of the generator. See paragraph 7.3.10.

DC250 is also able to activate anomalies in case the ECU reports them on the CAN BUS. If the anomalies activated by DC250 create problems, parameter P.0704 allows to “mask” them: it is a bit parameter, you may use each bit to mask a specific anomaly (see document [1]).

Finally, DC250 can signal the lack of communication with the ECU: set a maximum time "without messages" with parameter P.0711 and select the type of anomaly with parameter P.0709: if DC250 does not receive messages from the ECU for P.0711 seconds, it activates the anomaly AL.098.

ATTENTION! if the control panel removes the power supply to the ECU with the engine stopped, leave parameter P.0711 at zero to avoid activating anomaly AL.098 by mistake.

Even if anomaly AL.098 is disabled, DC250 still activates anomaly AL.062 if an ECU has been selected (P.0700 different from "0") and the CAN BUS is in the BUS OFF state. This state, in fact, is caused by a hardware failure on the connection, not by the lack of communication of the ECU.

DC250 makes available for the AND/OR logics the states related to CAN BUS communication with the ECU:

- ST.256: CAN controller in BUS-OFF state.
- ST.257: CAN controller in ERROR_PASSIVE state.
- ST.258: CAN controller in ERROR_ACTIVE state
- ST.259: CAN controller in ERROR-ACTIVE state, but DC250 does not receive messages from the ECU.
- ST.320…ST.335: these states depend on the specific ECU.

7.3.10 Speed regulation

DC250 can optionally manage a closed control loop, which acts on the engine rotation speed, to regulate/control another quantity. See paragraphs 7.3.10.1 and 7.3.10.4 for examples of use.

If the DC250 must regulate the speed, the operator must somehow connect it to the speed regulator:

- ECU connected in CAN BUS. DC250 uses the CAN BUS line to send the speed variation commands to the ECU.
- Analog speed regulator. DC250 does not have an analogue output on board; however, it is possible to connect a DIPOT module (produced by Mecc Alte) on the CAN BUS interface of DC250, which accepts the standard speed command defined by SAE J1939 from the CAN BUS line and translates it into an analogue command for the speed regulator.

  Internally, DC250 manages a percentage command (0… 100%) for controlling speed. It translates this command into a rotation speed request: to do this, it uses parameters P.0713 and P.0714, which respectively indicate the speeds (in rpm) corresponding to the internal commands 0% and 100%. Basically, P.0713 must be set at the minimum required speed, P.0714 at the maximum one. If P.0713 is less than P.0714, the speed required to the engine will increase if the “real value” of the controlled quantity is lower than the “desired value”: by setting P.0713 > P.0714, you can obtain the opposite effect (see also bit 0 of P.9864).

  During the engine starting and stopping phases, DC250 maintains the percentage command at the value set with parameter P.0840 (“Regulation offset”). After P.1602 seconds from the real starting of the engine, DC250 activates the control loop.

INFORMATION! The bit 1 of parameter P.9864 allows to enable the control loop only when the loads are connected to the generator/engine (GCB closed / clutch engaged).

As soon as DC250 activates the control loop, the real value” of the controlled quantity can be quite different from the “desired value”: DC250 uses a ramp (configurable with parameter P.9672) to gradually increase or decrease the “desired value”, to avoid transients. The default value of the ramp is 1%/sec (percentage of the rated value of the controlled quantity). The values 0%/s and 100%/s disable the ramp.

Normally, the regulation error is calculated as “desired value” – “actual value”; the error is therefore positive if the actual value is lower than the desired value: the control loop will therefore tend to increase the engine rotation speed to increase the value of the controlled quantity.

If bit 0 of parameter P.9864 is activated, on the other hand, the error is calculated as “actual value” – “desired value”, therefore it is negative if the actual value is lower than the desired value: the control loop will therefore tend to decrease the engine rotation speed to increase the controlled quantity value (see also note on P.0713 and P.0714).

Parameters P.9673 and P.9674, allow you to vary the gains of the control loop, thus adjusting the reactivity and stability of the regulation. You must obtain the values for these parameters empirically in the field, verifying how the engine really responds.

To do this, it is advisable to introduce step changes into the “desired value” and check the delay with which the control loop adjusts the regulated quantity (also verifying any OVERSHOOT and instability). With BOARDPRG4, it is possible to modify P.0102 with the engine running.

We recommend starting with the default value “0.100” for both P.9673 and P.9674. You must then gradually increase P.9673, until the regulation becomes unstable: once reached the instability point, reduce P.9673 until the instabilities disappear.

At this point you can increase the value of P.9674 (not by much) to improve the accuracy of the regulated voltage as much as possible.

INFORMATION! A too high value of P.9673 causes a fast instability of the engine, a too high value of P.9674 causes a slow instability.

To further improve the engine stability, parameter P.9863 can be used to configure a minimum percentage error, below which DC250 won’t apply any correction to the engine speed command. For example, by setting P.9863 to 1%, the controller will keep the speed regulator command stable if the difference between the “actual value” and the “desired value” is between -1% and +1%. This band is called "dead band".

INFORMATION! the control loop is always enabled: if you do not want to use it, set P.9673 and P.9674 both to zero.

7.3.10.1 Speed regulation to control the DC voltage of the generator.

Normally, DC250 controls a gen-set equipped with PMG generators. On such generators, there is no excitation system to regulate the generated voltage: instead, DC250 controls the rotation speed of the alternator, therefore of the engine that drives it. If DC250 controls a gen-set equipped with a traditional speed regulator, DC250 must therefore manage a closed speed regulation loop, to ensure that the DC voltage generated is equal to the nominal value in all conditions.

INFORMATION! The market provides speed regulators for DC alternators with a voltage measurement input, able to perform this regulation autonomously.

The control loop must bring the measured voltage (terminals T.40, T.42) to the nominal value. The internal command will therefore tend to increase if the real voltage is lower than the nominal one, and vice versa.

To use this feature:

- Select “0-Generator voltage” in P.9860.
- Set P.0713 to the minimum speed required by the PMG generator, P.0714 to the maximum one.
- Turn off bit “0” of P.9864 (so that DC250 increases speed to increase alternator DC voltage).
- Set the DC voltage nominal value of the generator in P.9861: if P.9861 is left at “0”, DC250 uses the voltage rating set in P.0102.

- Select the “desired value” for the generator voltage. It is possible to configure an analogue input with the function “2423 – Setpoint for regulation” (use the relative curve to convert the electrical value acquired - Ohm or Vdc - into the format of the quantity to be controlled). If no analogue input is configured with function “2423”, the “desired value” is set with P.9862. If P.9862 is left at zero, DC250 uses the P.0102 value as the “desired value” as well.

7.3.10.2 Speed regulation to control the DC current of the generator.

Normally, DC250 controls a gen-set equipped with PMG generators. On such generators, there is no excitation system to regulate the generated current: instead, DC250 controls the rotation speed of the alternator, therefore of the engine that drives it. If DC250 controls a gen-set equipped with a traditional speed regulator, DC250 must therefore manage a closed speed regulation loop, to ensure that the DC current generated is equal to the nominal value in all conditions.

The control loop must bring the measured current (terminals T.36, T.38) to the nominal value. The internal command will therefore tend to increase if the real current is lower than the nominal one, and vice versa.

To use this feature:

- Select “1-Generator current” in P.9860.
- Set P.0713 to the minimum speed required by the PMG generator, P.0714 to the maximum one.
- Turn off bit “0” of P.9864 (so that DC250 increases speed to increase alternator DC current).
- Set the DC current nominal value of the generator in P.9861: if P.9861 is left at “0”, DC250 uses the current rating set in P.9502.
- Select the “desired value” for the generator current. It is possible to configure an analogue input with the function “2423 – Setpoint for regulation” (use the relative curve to convert the electrical value acquired - Ohm or Vdc - into the format of the quantity to be controlled). If no analogue input is configured with function “2423”, the “desired value” is set with P.9862. If P.9862 is left at zero, DC250 uses the P.9502 value as the “desired value” as well.

7.3.10.3 Bump speed regulation.

The control loop must increase or decrease the engine speed reference by the specified amount within the configured range, based on the status change of the digital inputs.

To use this feature:

- Select “2-Bump speed” in P.9860.
- Set the amount of speed in P.9865, used to increase/decrease the required signal (rpm).
- Set P.0713 to the minimum speed required by the PMG generator, P.0714 to the maximum one.
- Set the speed nominal value of the generator in P.9861: if P.9861 is left at “0”, DC250 uses the speed rating of the engine set in P.0133.
- Using one or more digital inputs configured with the following functions:
  - DIF.2371 “Speed increase”.
  - DIF.2372 “Speed decrease”.
  - DIF.2373 “Speed reset”.

“Speed increase” and “Speed decrease” digital inputs are mandatory to enable this function. The activation of one of these inputs increases or decreases the speed reference by the configured quantity. The activation of the reset input reloads the speed reference value with its nominal value.

All three inputs operate on the P.9862 setpoint:

- The “reset” input copies the rated speed (P.9861 or P.0133) into P.9862.

- The “speed increase input” adds the P.9865 value to P.9862 (max P.0714).
- The “speed decrease input” subtracts the P.9865 value from P.9862 (min P.0713).

Starting from firmware 2.05, the controller uses the ramp (P.9672) for moving the real speed in case of changes of P.9862; it also uses the ramp to move the speed from the idle value (P.0710) to the rated one after starting the engine.

The controller accepts the three commands only after P.1602 seconds from the engine running detection, and, if configured by P.9864, only when GCB is closed. The three commands can also be issued via communication ports.

7.3.10.4 Speed regulation.

The controller simply asks the speed governor to bring the real engine speed to the value configured into P.9862. However, it uses the ramp (P.9672) for moving the real speed in case of changes of P.9862; it also uses the ramp to move the speed from the idle value (P.0710) to the rated one after starting the engine.

The ramp is expressed as %/s of the rated speed; thus, you must properly set P.9861: if P.9861 is left at “0”, DC250 uses the speed rating of the engine set in P.0133.

The controller does not use the PID loop in this case. So, all parameters of the “speed control menu” are not used, except P.9860, P.9861 and P.9862.

To use this feature:

- Select “3- speed” in P.9860.
- Set P.0713 to the minimum speed required by the PMG generator, P.0714 to the maximum one.
- Set the speed nominal value of the generator in P.9861: if P.9861 is left at “0”, DC250 uses the speed rating of the engine set in P.0133.
- Set the required speed into P.09862.
- Set the idle speed in P.0710 (if needed).

7.3.10.5 Speed regulation to control other quantities.

In a “DRIVE” application, for example, the engine can be connected to a pump, and the engine speed command can be used to control the pump pressure.

Let's take an example of using this function.

- First you need to connect a sensor that measures the pump pressure to an analogue input of DC250 (let's assume you are using terminal T09):
  - Set P.4001 to “2051 – Generic sensor”.
  - Act on the relative curve to:
- Set the desired unit of measurement for the pressure (for example "bar"): it is then used to display the measurements on page S.07.
- Set the number of decimal digits to be displayed for the pressure measurements (for example 1): page S.07 will display both the "current value" and the "desired value" with this format.
- Set two or more points to convert the electrical measurement (volts DC) into a pressure measurement.
- Use P.9860 to select the analogue input used (in this case “9 – Analog input T09”).
- Set the nominal pressure value in P.9861: this step is very important because the control loop errors are expressed as a percentage of this value. It cannot be left at "0".

- If you want to make the pump work at a constant pressure, set the desired pressure in P.9862. Alternatively, it is possible to use a second analogue input (configured with the function "2423 - Setpoint for regulation"): use the related curve to convert the electrical measurement acquired by the input into a pressure setpoint for the pump.
- If the pump is connected to the engine via a clutch (or other mechanical device), activate bit 01 of P.9864: the speed regulation will be active only with the clutch engaged.
- Properly set the control loop activation delay (P.1602) (engine stabilization).
- Properly set the ramp (P.9672) and dead band (P.9863) values.
- Configure the speed regulator:
  - P.0713: minimum engine speed in rpm.
  - P.0714: maximum engine speed in rpm.
  - P.0840: percentage speed command (relative to the range P.0713…P.0714) to be used when starting/stopping the engine and in any situation when the control loop is not active.
  - Activate bit 0 of P.9864 if it is necessary to decrease the rotation speed to increase the pressure, otherwise leave it "inactive".
- Adjust control loop gains (P.9673 and P.9674).

7.4 TIER4 / Stage V

DC250 fully supports the TIER4 (US) and STAGE V (EU) directives relating to engine emissions. This support consists of two parts, display and control.

7.4.1 Display

DC250 displays the standard icons required by the regulations, based on the CAN BUS messages received from the ECU (page G.10):

-  Indicates that the engine emissions system has a malfunction or is working outside standard operating conditions. It can be solid or flashing.
-  Indicates that the ECU requires the regeneration of the particle filter (or the cleaning of the SCR system). It is solid if the quantity of particulate in the filter is above the “regeneration request” threshold but below the pre-alarm threshold. It becomes flashing if it is above the pre-alarm threshold.
-  Indicates that an explicit command inhibits the regeneration of the particulate filter (or the cleaning of the SCR system). It is usually solid (it is a state, not an anomaly). However, if the condition persists for a long time and the level of soot in the filter becomes extremely high, the ECU activates a diagnostic code with a red lamp and stops the engine: in this case the icon becomes fixed or flashing, like the red lamp.
-  Signals an elevated temperature (real or possible) in the emissions management system (probably because regeneration is in progress or about to start): the ECU could apply a reduction in engine performance (derating). It is solid.
-  Indicates a low level of the catalyst liquid tank (DEF - DIESEL EXHAUST FLUID), also called AdBlue. It can be solid if the level is below normal, flashing if the low level determines a power derating.

It also displays the following basic measurements (pages G.24 ... G.28):

- Percentage of soot in the particulate filter.
- Percentage of ash in the particulate filter.
- Catalyst liquid level (AdBlue) in the tank.

See paragraph 6.4.7.14 for the complete list of measures relating to the management of exhaust gases managed by DC250: the real availability of these measures depends on the ECU.

7.4.2 Control

7.4.2.1 Filter regeneration

The specification includes two commands for the ECU, to influence the regeneration of the particulate filter:

- Regeneration inhibition.

DC250 should activate this command when the application does not allow a derating of the engine performance or an increase in the engine speed. Regeneration, in fact, can involve both previous conditions. DC250 manages a PMG generator: the rotation speed affects the DC voltage that powers the loads, therefore, when DC250 connects the loads to the generator, must not allow regeneration.

This command should be temporary: in fact, if the level of soot in the filter increases beyond a dangerous limit for the filter itself and the ECU cannot do the regeneration, the ECU will apply a derating anyway and eventually it could shut down the engine.

- Forcing the regeneration. It is the opposite command: by checking the regeneration request from the ECU on the icons on page G.10, the operator can force it in the moments most favourable to him.

DC250 implements these commands in two ways:

- Parameter P.0446. This parameter can have three values:
  - 0 – Automatic. DC250 does not send any command to the ECU, which is therefore free to execute the regeneration when it deems appropriate.
  - 1 – Forced. DC250 sends the forcing command to the ECU for a maximum of P.0447 seconds (then it resets the parameter back to 0-Automatic). If the ECU can, it performs a regeneration cycle. Following this command, the ECU can activate the icons described above.
  - 2 – Inhibited. DC250 sends the inhibition command to the ECU, which therefore does not perform the regeneration, even if requested.

  The operator can modify the parameter directly from page G.23.
- As an alternative to the parameter, it is possible to use two digital inputs configured with the following functions:
  - DIF.2071: inhibit DPF regeneration.
  - DIF.2072: force DPF regeneration.

  If there is even only one of the inputs, the operator cannot change parameter P.0446 anymore (because the inputs force the value of the parameter). You can also use virtual digital inputs to build complicated logics to manage filter regeneration.

  Normally, DC250 uses the CAN BUS line to send these commands to the ECU. It is possible to use digital outputs, configured with the following functions:

- DOF.1035: inhibit DPF regeneration.
- DOF.1036: force DPF regeneration.

  The two commands (forcing and inhibition) are available for the AND/OR logics through the states ST.137 and ST.138.

  The controller makes available some information concerning the regeneration on the following internal states:

- ST.368: Active regeneration status: not active (spn3700 = 0).
- ST.369: Active regeneration status: active (spn3700 = 1).
- ST.370: Active regeneration status: it will start shortly (spn3700 = 2).
- ST.371: DPF status: regeneration not requested (spn3701 = 0).
- ST.372: DPF status: regeneration required - lowest level (spn3701 = 1).
- ST.373: DPF status: regeneration required - moderate level (spn3701 = 2).
- ST.374: DPF status: regeneration required - highest level (spn3701 = 3).

7.4.2.2 Consent to “active” regeneration of the filter

To perform the "active" regeneration of the particulate filter, ECUs may require a consent via CAN BUS, even if the operator did not “inhibit” nor “force” the regeneration. This consent avoids causing problems for loads resulting from an increase in the engine speed. DC250 sends the consent to “active” regeneration after disconnecting the loads from the generator (GCB open, clutch disengaged, groups of lights all off): however, if there is a digital input configured with the DIF.2073 function, then regeneration is allowed when this input is active.

Consequently, when DC250 “allows” the ECU to perform the "active" regeneration (SPN3700 = 1), it also disables the maximum speed protections.

7.4.2.3 Pump for AdBlue fluid

DC250 implements a complete management of the pump for loading the AdBlue fluid from the storage tank into the daily tank.

For use this feature, you must configure one of the digital outputs of DC250 with the DOF.1037 function (“AdBlue pump”). It is also possible to configure a digital output to control a solenoid on the pump line (DOF.1038 “Solenoid for the AdBlue pump”). In this case, parameter P.1495 (“Delay between solenoid and AdBlue pump”) configures the delay between the two commands (the solenoid opens before starting the pump and closes after stopping the pump).

Pump management includes automatic operation and manual controls, accessible from the front panel. Page G.29 (visible only with an output configured for pump control) allows selecting the pump control mode (see 6.4.7.15).

INFORMATION! the pump control mode is a normal parameter of DC250 (P.1490 “AdBlue pump mode”) and therefore you can also change it from programming.

The available operating modes are:

- (AUTO): DC250 starts/stops the pump according to the AdBlue level in the daily tank, with a hysteresis band that prevents continuous starts/stops.
- (MAN-ON): DC250 stops the pump only when the tank is full. No hysteresis band: as soon as the tank is no longer full, DC250 starts the pump.
- (MAN-OFF): DC250 keeps the pump always stopped, even when the tank is empty.

Parameter P.1496 ("Power supply for the AdBlue pump") selects which is the power source of the pump between:

- 0 – Generator.
- 4 – Always supplied (the power supply source is always present).

DC250 turns off the pump if the selected source is not available. In OFF/RESET, DC250 always keeps the pump stopped. The display shows the status of the pump by the following symbols:

- : pump switched on.
- : pump switched off.

DC250 can work both with a contact level detection system and with an analogue measurement.

7.4.2.3.1 Using an analogue level transducer

To use this feature, DC250 requires that:

- DC250 must acquire the AdBlue fluid level via CAN BUS from the ECU (SPN 1761 - SAE J1939). The ECU must therefore provide this measure.
- Do not configure the contacts for the level (see next paragraph), otherwise DC250 uses those.
- Parameters P.1492 and P.1493 must configure the activation and deactivation thresholds for the pump. Check that the activation threshold (P.1492) is lower than the deactivation threshold (P.1493).

7.4.2.3.2 Using a contact level transducer

To use this feature, DC250 requires that:

- The contact level transducer must exist.
- The start and stop contacts must exist, and the operator must connect them to two digital inputs of DC250.

The contacts must respect the following convention:

- Pump start command (function DIF.3311): activated when the AdBlue fluid level is below the start threshold.
- Pump stop command (function DIF.3312): activated when the AdBlue fluid level is **below** the stop threshold.

7.4.2.3.3 Evaluation of the level

DC250 determines the state of the AdBlue fuel level (for the purpose of controlling the pump) by calculating in the order all the following evaluations:

- If the level is below the pump start-up threshold, it assigns the **start** status.
- If the level is higher than the pump stop threshold, it assigns the **stop** status.
- Otherwise, it assigns the **Hysteresis** status.

7.4.2.3.4 Automatic command of the pump

With reference to the state evaluated in the previous paragraph, DC250:

- Activates the pump if the level position is **start**.
- Deactivates the pump if the position is **stop**.
- Keeps the current command if the position is **Hysteresis**.

7.4.2.3.5 Manual command of the pump

The operator can activate and deactivate the pump at will. DC250, however, prevents starting if the level status (see previous paragraphs) is **stop**.

7.4.2.3.6 Protections

Parameter P.1494 allows setting the maximum activation duration of the pump. This parameter should set the time required for the pump to fill the daily tank in the worst conditions. If DC250 cannot fill the daily tank within this time (both in manual and automatic control), it stops the pump and activates the pre-alarm AL.095: it is in fact probable that there is a pump failure or in any case that the pump is not getting AdBlue fluid from the storage tank. As soon as the operator recognized the anomaly, the pump restarts.

7.4.2.3.7 Signalling

DC250 makes the commands for the pump and the solenoid valve available in two internal states (usable in AND/OR logics):

- ST.139: pump command.
- ST.140: solenoid command.

Furthermore, DC250 records the activations and deactivations of the pump in the historical archive of the events, if bit seven of parameter P.0441 is active:

- EVT.1072: fuel pump activated.
- EVT.1073: fuel pump deactivated.

7.5 Generator

INFORMATION! this paragraph does not apply to DRIVE applications, where the generator does not exist

DC250 measures the DC voltage of the generator to protect the loads and the generator itself from operations outside the tolerance thresholds. If DC250 communicates with the ECU via CAN BUS to DC250, DC250 can also control the engine speed to bring the PMG generator voltage to the nominal value. To connect the generator to DC250 see par. 5.3.

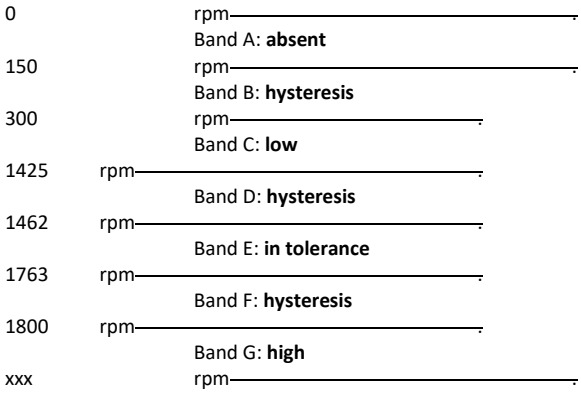
7.5.1 Checking the rotation speed

If DC250 acquires the engine speed, it checks that it is within the tolerance bands. There are various parameters relating to the measurement of the rotation speed:

- P.0133: engine's nominal speed. All the thresholds relating to the rotation speed are percentages of it.
- P.0202: In this case, it is the hysteresis applied to all the thresholds associated with the rotation speed. It is a percentage value with respect to P.0133
- P.0224: threshold (percentage with respect to P.0133) below which DC250 considers the engine stopped.
- P.0225: threshold (percentage with respect to P.0133) above which DC250 considers the engine running.
- P.0358: low speed threshold (percentage with respect to P.0133) (below which DC250 does not allow connecting the generator to the loads).
- P.0333: high speed threshold (percentage compared to P.0133) (above which DC250 does not allow connecting the generator to the loads).

Let us take a practical example on the various thresholds used, with the default values for the parameters mentioned above.

Parameter	Description	Factory default	Speed (rpm)
P.0133	Engine's nominal speed	1500	1500
P.0224	Threshold for engine stopped (rpm).	10.0 %	150
P.0225	Threshold for engine started (rpm).	20.0 %	300
P.0358	Minimum speed threshold.	90.0 %	1425
P.0333	Maximum speed threshold.	120.0 %	1800
P.0202	Hysteresis	2.5 %	37



DC250 applies the hysteresis (configured entirely in the direction for entering the thresholds) to the two configurable thresholds (P.0358 and P.0353). This means that the speed is out of tolerance if it is outside the thresholds P.0358 and P.0333, it is within tolerance if it is within the thresholds P.0358+hysteresis and P.0333-hysteresis, otherwise it keeps the previous state.

If the speed is in bands B, D, F it maintains the state it had previously (hysteresis). For example, if the voltage was in band E and now it is in band D, DC250 still considers it “in tolerance”. If, on the other hand, it was in band C and is now in band D, DC250 considers it "Low".

DC250 also uses the thresholds P.0358 and P.0333 to manage the engine protections. You can individually disable these protections by setting the relative parameter that specifies the delay to zero (respectively P.0359 and P.0334). DC250 in any case uses the thresholds to establish the state of the rotation speed: DC250 does not allow connecting the loads to the generator if the speed is not within the tolerance range, even if the operator disabled the speed protections.

7.5.2 Checking the DC voltage

There are various parameters related to the measurement of the generator DC voltage:

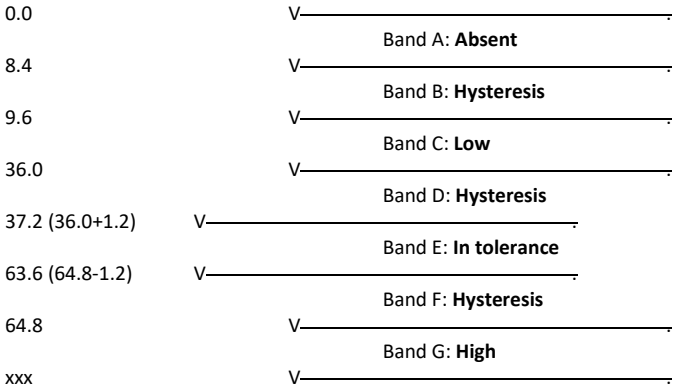
- P.0102: nominal voltage of the generator. The thresholds are percentages of it.
- P.0202: in this situation, it is the hysteresis applied to all the thresholds associated with the generator voltage. It is a percentage value with respect to P.0102.
- P.9651: threshold (percentage with respect to P.0102) below which DC250 considers the engine stopped.
- P.9652: threshold (percentage with respect to P.0102) above which DC250 considers the engine running.
- P.0301: threshold (percentage with respect to P.0102) for low generator voltage (below which DC250 does not allow connecting the generator to the loads).
- P.0303: threshold (percentage with respect to P.0102) for high generator voltage (above which DC250 does not allow connecting the generator to the loads)

Let us take a practical example on the various thresholds used, with the default values for the parameters mentioned above.

Parameter	Description	Factory default	Vdc voltage
P.0102	Nominal voltage of the generator.	48 Vdc	48.0
P.9651	Threshold for engine stopped (Vdc).	17.5 %	8.4
P.9652	Threshold for engine started (Vdc).	20.0 %	9.6
P.0301	Shutdown level for low voltage.	75.0 %	36.0
P.0303	Shutdown level for high voltage.	135.0 %	64.8
P.0202	Hysteresis.	2.5 %	1.2

DC250 applies the hysteresis (configured entirely in the direction for entering the thresholds) to the two configurable thresholds (P.0301 and P.0303). This means that the voltage is out of tolerance if it is outside the thresholds P.0301 and P.0303, it is within tolerance if it is within the thresholds P.0301+hysteresis and P.0303-hysteresis, otherwise it maintains the previous state.

Considering these values, DC250 identifies the following bands:



If the voltage is in the bands B, D, F it maintains the state it had previously (hysteresis). For example, if the voltage was in range E and now it is in range D, DC250 still considers it “in tolerance”. If, on the other hand, it was in band C and is now in band D, DC250 considers it "Low".

DC250 also uses the thresholds P.0301 and P.0303 to manage the protections of the generator. The operator can individually disable these protections by setting the relative delay parameter to zero (respectively P.0302 and P.0304). DC250 uses the thresholds to establish the voltage status: this allows DC250 not to connect the loads to the generator if the voltage is not within the tolerance range, even if the operator disabled voltage protections.

7.5.3 Generator status

For general management purposes, the generator can be in three conditions

a) Stable out of tolerance: the status of the DC voltage of the generator, and the status of the engine rotation speed must be different from "In tolerance" consecutively for two seconds.

b) Stable within tolerance: the state of the DC voltage of the generator, and the state of the engine rotation speed must be "In tolerance" consecutively for half a second

c) Transitional: we are passing from condition "a" to phase "b" or vice versa.

7.5.4 Events and signalling

DC250 records any change in the status of the generator in the historical archive of the events (if enabled via bit two of parameter P.0441):

- EVT.1020: No voltage on the generator.
- EVT.1021: Voltage on the generator, but out of tolerance.
- EVT.1022: Voltage on the generator, and in tolerance.

The following functions (linked to the status of the generator) are also available for configuring the digital outputs:

- DOF.3032 - “Generator in tolerance”. DC250 activates this output when the voltage is within tolerance of the configured time.

Furthermore, DC250 makes the generator states available for AND/OR logics through the following internal states:

- ST.024 – “Generator voltage present”.
- ST.025 – “Generator out of tolerance or absent”.
- ST.026 – “Delay for generator in tolerance”.
- ST.027 – “Generator in tolerance”.
- ST.028 – “Delay for generator out of tolerance or absent”.

7.6 Loads management

The generic term of loads identifies different entities based on the type of system selected. The following paragraphs described separately the management of loads.

7.6.1 AUTO-START application

In AUTO-START applications, the loads are electric, powered in DC by the generator.

DC250 provides the management of a circuit breaker to connect the loads to the generator (GCB, “Generator Circuit Breaker”), but it is not compulsory. DC250 can command the opening and closing of the circuit breaker (it also provides manual controls).

It is possible to connect a digital input of DC250 to an auxiliary contact of the circuit-breaker, which indicates its real closing status: DC250 uses it to show the status of the GCB on the display, but also to manage the failure to open / failure to close anomalies.

Finally, DC250 can acquire the state of the circuit breaker without controlling it (GCB controlled externally).

The factory configuration of DC250 associates the digital output T.08 with the closure/opening command of GCB; it is however possible to use any digital output.

7.6.1.1 GCB circuit breaker command

In this type of system, the GCB circuit breaker is usually a simple contactor, with the coil powered by the DC voltage of the generator (in this way, if the engine shuts down, the contactor opens even without any explicit DC250 command). However, DC250 is also able (if required) to control a motorized circuit breaker.

Four different commands are available for managing the GCB, which can be associated with one or more digital outputs (see par. 5.3).

INFORMATION! if the operator does not configure any output with these commands, DC250 considers the circuit breaker as "externally controlled".

- DOF.2031 - “Minimum voltage coil for GCB”. You can use this function to power the possible undervoltage coil of a motorized circuit breaker. DC250 deactivates this output when it wants to open the circuit breaker, activates it before closing the circuit breaker: DC250 will activate the real closing command with at least 0.5 seconds of delay from the activation of this output. Use a “normally open” contact of the external relay for this command (with DC250 not powered, the external relay is de-energized, thus de-energizing the minimum voltage coil of the circuit breaker).
- DOF.2032 - “Coil for opening the GCB”. DC250 activates this output when it wants to open the circuit breaker: the output returns to rest as soon as the circuit breaker opens (or when the opening time-out expires). To make sure that this command is active with DC250 not powered, configure this output with “reverse polarity” (the static output will always be active, DC250 will disable it to open the circuit breaker) and use a “normally closed” contact of the external relay.
- DOF.2033 - “Coil for closing the GCB”. DC250 activates this output when it wants to close the circuit breaker (ensuring that the eventual DOF.2031 function has been active for at least 0.5 seconds): the output returns to rest as soon as the circuit breaker closed (or when it expires the closing time-out). Use a “normally open” contact of the external relay for this command (with DC250 not powered, the external relay de-energizes, thus removing the closing command).
- DOF.2034 - “Stable closing command for GCB”. Use this command for contactors. DC250 activates this output when it wants to close the contactor (ensuring that any DOF.2031 function has been active for at least 0.5 seconds): the output remains active even when the contactor closes. DC250 deactivates this output when it wants to open the contactor: the output remains inactive even when the contactor opens. Use a “normally open” contact of the external relay for this command (with DC250 not powered, the external relay is de-energized, cutting off power to the coil of the contactor).

Parameter P.0220 ("Minimum delay between the opening/closing commands (and vice versa) of the circuit breakers") prevents inversions of the circuit breaker command if a minimum time has not passed since the last command.

7.6.1.2 Acquisition of the status of the GCB circuit breaker

To connect the actual closing status of the circuit breaker to DC250, configure a digital input with the DIF.3001 function (“Status of GCB circuit breaker”). If configured (not mandatory), DC250 uses this feedback to:

- Activate the “fail to open” and “fail to close” pre-alarms.
- To know the state of the circuit breaker when controlled externally.
- To show the real state of the circuit breaker on the display pages.

DC250 uses the delay associated with the input (P.2002 for input T.16 or equivalent parameter for the other inputs) as the maximum time for opening or closing the circuit breaker.

INFORMATION! the acquisition of the status of the circuit breaker is mandatory if you use the DOF.2032 or DOF.2033 functions.

7.6.2 DRIVE application

In DRIVE applications, the loads are mechanical, driven by the engine itself. DC250 foresees the management of a clutch (it is not compulsory), to connect the mechanical loads to the engine.

All the description in chapter 7.6.1 applies also to DRIVE application, replacing the term "GCB" with the term “clutch”.

7.6.3 LIGHTING TOWER application

In LIGHTING TOWER applications, the electrical loads are the various groups of lights. There are a maximum of eight commands to switch the lighting groups on/off:

- DOF.2061 (“Light command 1”).
- DOF.2062 (“Light command 2”).
- DOF.2063 (“Light command 3”).
- DOF.2064 (“Light command 4”).
- DOF.2065 (“Light command 5”).
- DOF.2066 (“Light command 6”).
- DOF.2067 (“Light command 7”).
- DOF.2068 (“Light command 8”).

The operator can use only part of the previous commands; if you do not need all of them, it is advisable (but not mandatory) to use adjacent functions starting with DOF.2061.

Sometimes, it is necessary to switch on only a part of the groups of lights available: in MAN, it is the operator's task to switch on only those required (see 7.6.4.2). In AUTO (but also in MAN if the operator holds down the START button for at least 2 seconds), DC250 switches on the number of groups of lights configured in parameter P.9773 (“Maximum number of lights”). Normally the operator will configure P.9773 with the real number of commands available, in case of need he may reduce it.

When working with PMG alternators, it is useful to avoid turning on the groups of lights all together (to give the speed controller time to adjust the engine speed, so that the alternator can supply the same DC voltage as the required power changes). Parameter P.9772 (“Delay between turning on the lights”) allows you to set this delay.

DC250 always respects this delay when switching on the groups of lights. Normally it respects it even during shutdown; exceptions are:

- Manually stopping the engine by keeping the STOP button pressed for two seconds (if bit one of parameter P.9774 is at zero).
- Stopping the engine due to shutdowns or deactivations, or when the operator forces DC250 in OFF/RESET mode.

The configured DOF.206x functions determinate the switching sequence of the group of lights: the switching off sequence is the opposite one.

There is no activation feedback for the group of lights. DC250 can however detect the misfire by monitoring the current delivered by the generator. To use this function, you must first set the rated current of each group of lights, with the parameters:

- P.9840 (“Rated current for group of lights #1”).
- P.9841 (“Rated current for group of lights #2”).
- P.9842 (“Rated current for group of lights #3”).
- P.9843 (“Rated current for group of lights #4”).
- P.9844 (“Rated current for group of lights #5”).
- P.9845 (“Rated current for group of lights #6”).
- P.9846 (“Rated current for group of lights #7”).
- P.9847 (“Rated current for group of lights #8”).

DC250 converts the current delivered by the generator as a percentage with respect to the sum of the rated currents of the groups of lights switched on.

Then a percentage threshold must be set (P.9848 “Low current level for alarm”). If the real percentage current is lower than the threshold P.9848 consecutively for the time P.9849 ("Delay for low current alarm"), DC250 activates the anomaly AL.094 ("Low current"): parameter P.9850 allows you to configure the type of anomaly.

Parameter P.9774 allows you to set options in the management of the groups of lights:

- Bit 0: if activated, when the operator starts the engine manually, DC250 automatically switches on the configured groups of lights.
- Bit 1: if activated, DC250 uses the delay configured with P.9772 even when the operator presses the STOP button for two seconds (manual shutdown command of all groups of lights). In this case, to stop the engine, the operator must press STOP a second time.

7.6.4 Command logic

This paragraph is applicable only DC250 controls the circuit breaker, the clutch, or the groups of lights.

Regardless of the application, DC250 forces the disconnection of the loads from the engine/generator in the following cases:

- DC250 in OFF/RESET mode.
- Presence of shutdowns or deactivations.
- Stop requests for the engine.
- Engine stopped or stopping.
- The idle speed cycle is in progress (ore required).

If DC250 does not need to force the disconnection, it does not allow the connection of loads to the engine/generator in the following cases:

- If the “active” regeneration of the engine particulate filter is in progress (see paragraph 7.4.2.2).
- If the engine speed is outside the tolerance bands (see paragraph 7.5).
- For AUTO-START and LIGHTING TOWER applications, if the generator DC voltage is outside the tolerance bands (see paragraph 7.5).
- If DC250 is in AUTO mode, the delay P.0218 ("Warm-up time before connecting the loads") must also have elapsed from starting the engine. Note: for the "LIGHTING TOWER" application, if the automatic switching on of the lights is required after the manual engine start, DC250 still waits for the P.0218 delay.

7.6.4.1 Command logic in MAN

If DC250 is in MAN, the operator can require connect/disconnecting the loads to the engine/generator in three ways:

- From the DC250 front panel (you can disable this function with bit six of parameter P.0495). If the engine is running, DC250 does not normally uses the START button: it can therefore use it to connect the loads to the engine/generator. Similarly, if DC250 has connected the loads to the engine/generator, it uses the first press of the STOP button to disconnect them (holding STOP for two seconds disconnects the loads and stops the engine).

  LIGHTING TOWER application. Whit the engine running, DC250 switches on a group of lights every time the operator presses the START button; it switches off a group of lights every time the operator presses the STOP button. DC250 switches on/off the groups of lights in sequence. By holding the START button down for two seconds, DC250 turn on all groups of lights, pressing STOP for two seconds turns off all groups of lights and stops the engine.

- Using digital inputs.

  INFORMATION! this function is only available for AUTO-START and LIGHTING TOWER applications.

  You can use the following functions:

  - DIF.1001 - “Request for GCB closure”.
  - DIF.1002 - “Request for GCB opening”.

  DC250 manages both functions as pulse, that is, they do something only in the instant in which the input activates (if it remains active, they no longer do anything). Connect the inputs to external “normally open” buttons. If you only configure the input with the DIF.1001 function, activating the input commands the connection of the loads to the engine/generator, activating it again commands its disconnection.

- By sending a Modbus command through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):

  - HOLDING REGISTER 101: write the password configured with parameter P.0004.
  - HOLDING REGISTER 102:

    - **AUTO-START and DRIVE application**
      - “31” and “32” to disconnect the loads from the engine/generator.
      - “33” to connect the loads to the engine/generator.
    - **LIGHTING TOWER application**
      - “101” to switch on all groups of lights.

- “101” to switch off all groups of lights.
- “103” to switch on a group of lights (in sequence).
- “104” to switch off a group of lights (in sequence).

7.6.4.2 Command logic in AUTO

If DC250 is in AUTO mode and the application requires the engine start, DC250 usually automatically connect the loads to the engine/generator. The following cases are exceptions:

- DC2150 started the engine only for recharging the engine starter battery (see paragraph h7.3.3).
- The operator/application is explicitly requesting to disconnect the loads from the engine/generator.

  This request may result from the conditions listed in 7.6, or from an explicit command

  INFORMATION! this function is only available for AUTO-START and LIGHTING TOWER applications.

  The operator can activate the command in two ways:

  - It is possible to use a digital input configured with the DIF.2502 function (“Inhibition of power supply to the users”). When this input is active, DC250 disconnects the loads from the engine/generator
  - By sending a Modbus command through the communication ports (see paragraph 5.7). This command is temporary (lasts 30 seconds): you must therefore continuously confirm if you want to keep the loads disconnected from the engine/generator. To send the command it is necessary to write in sequence (within five seconds):
    - HOLDING REGISTER 101: write the password configured with parameter P.0004.
    - HOLDING REGISTER 102:
      - “31” and “32” to disconnect the loads from the engine/generator.
      - “33” to connect the loads to the engine/generator.

7.6.5 Events e signalling

INFORMATION! this paragraph applies only to AUTO-START and DRIVE applications.

DC250 records in the historical archive any commands for the connection/disconnection of the loads from the engine/generator, if enabled with bit five of parameter P.0441.

It also records any change in the real state of the connection of the loads to the engine/generator, if enabled with bit four of parameter P.0441.

The following event codes are available:

- EVT.1030: GCB closure command / clutch engage command.
- EVT.1031: GCB opening command / clutch disengage command.
- EVT.1032: GCB closed / clutch engaged.
- EVT.1033: GCB open / clutch disengaged.

DC250 makes the same commands and states available for AND/OR logics through the following internal states:

- ST.064 – “GCB status”.

- ST.068 – “GCB closure command (stable)”.
- ST.070 – “GCB minimum voltage coil”.
- ST.071 – “GCB opening pulse”.
- ST.072 – “GCB closing pulse”.
- ST.104 – “Supplying”.

Finally, DC250 makes available for the AND/OR logics the causes that prevent the connection of the loads to the engine/generator through the following internal states:

- ST.087: power supply inhibition of power supply for starting due to low battery voltage.
- ST.088: power supply inhibition for digital input.
- ST.090: power supply inhibition for command from communication port.

8 Anomalies

This chapter describes all the anomalies managed by the DC250. They can function as protection for the loads, for the generator or for the engine. They can also report events in the management of the application. Before describing them in detail, it is appropriate to give definitions.

DC250 defines three types of anomalies:

- **Pre-alarms**: these anomalies do not cause the engine to stop. They therefore indicate situations that are not dangerous when they arise, but the operator must take care of them because, if ignored, they could degenerate into one of the following categories.
- **Deactivations**: these anomalies cause the engine to stop. However, they are dangerous for the loads and not immediately for the engine. For this reason, DC250 immediately disconnects the loads from the engine/generator, then stops the engine with the standard procedure, i.e., with the cooling cycle. However, it is impossible to restart the engine until the operator recognizes the anomaly.
- **Shutdowns**: these anomalies cause the engine to stop. They are dangerous for the loads and/or for the engine/generator. For this reason, DC250 immediately disconnects the loads from the engine/generator and immediately stops the engine with the emergency procedure, i.e., without the cooling cycle. It is impossible to restart the engine until the operator resets the anomaly.

  To activate a shutdown, there must be no other shutdown s already active (there are exceptions highlighted below). On the other hand, deactivations and pre-alarms may be present.

  To activate a deactivation, there must be no shutdowns or other deactivations. However, other pre-alarms may be present.

  To activate a pre-alarm, there must be no shutdowns nor deactivations. However, other pre-alarms may be present.

  When DC250 needs to activate an anomaly, it executes the following actions:

- Activates the internal buzzer and, if configured, also the external one. For this purpose, in fact, it is possible to configure a digital output with the DOF.3152 function (“External horn”). DC250 manages the output together with the internal buzzer; the aim is to use a more powerful horn or a lamp.
- Forces the display page G.02. This page shows the numeric code and the icon of all active anomalies. The numeric code flashes to indicate that the operator has not yet recognized the anomaly
- Makes the lamp ⚠ blinking for pre-alarms, otherwise turns it on steady.
- If the anomaly is not a pre-alarm, it disconnects the engine/ generator from the loads and stops the engine (with or without the cooling cycle).

  The operator can execute three actions on anomalies:

- Silent the internal buzzer (and the external one too).
- Acknowledge the anomaly: it means telling DC250 that the operator took care of it.
- Reset the anomaly: it means telling DC250 that the operator fixed the problem.

8.1 Silencing the acoustic signal

The operator can silence the buzzer in two ways:

- By pressing any button on the DC250 panel.

- By sending a Modbus command through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):

  - HOLDING REGISTER 101: write the password configured with parameter P.0004.
  - HOLDING REGISTER 102: write the value “51”.

Parameter P.0491 (“Horn duration”) influences the management of the buzzer:

- If set to zero, DC250 will never activate the buzzer.
- If set to 999, DC250 activates the buzzer when a new anomaly arises, and deactivates it with the procedure described above.
- If set to a value between 1 and 998, DC250 activates the acoustic signal when a new anomaly arises and deactivates it with the procedure described above, or when the configured time has elapsed.

Silencing the horn does not mean recognizing the anomaly: it remains flashing on page G.02.

8.2 Acknowledging the anomaly

The operator can acknowledge the anomaly in two ways:

- By pressing any button on the DC250 panel (after silencing the buzzer).
- By sending a Modbus command through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):

  - HOLDING REGISTER 101: write the password configured with parameter P.0004.
  - HOLDING REGISTER 102: write the value “53”. This command also silences the buzzer if it is active.

When the operator acknowledged the anomaly, it stops flashing on page G.02. After that, if it is a pre-alarm, DC250 automatically resets it if the cause is no longer present.

If, on the other hand, the cause disappears before the operator acknowledges the anomaly, it remains on the display.

8.3 Resetting the anomaly

The operator can reset an anomaly only if the cause that activated it is no longer present. DC250 automatically resets the pre-alarms (after acknowledged) when the cause that originated them is no longer present. On the other hand, to reset deactivations and shutdowns, the operator can proceed in one of the following ways:

- Put DC250 in OFF/RESET mode.
- By sending a Modbus command through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):

  - HOLDING REGISTER 101: write the password configured with parameter P.0004.
  - HOLDING REGISTER 102: write the value “53”.

- Using a digital input configured with the DIF.2001 function (“Command for resetting alarms”). When the input becomes "active", DC250 performs a complete reset of all anomalies.

8.4 Events e signalling related to anomalies

DC250 records all anomalies (with their own code) in the events historical archive.

DC250 provides functions for configuring the digital outputs, related to anomalies:

- DOF.3151 (“reset o the anomalies”). DC250 activates this output for one second when executing the internal anomaly reset sequence. You can use this feature to reset any anomalies managed by external devices.
- DOF.3152 (“external horn”). DC250 activates/deactivates this output together with the internal buzzer. You can use it to control a more powerful buzzer and/or a lamp.
- DOF.4001: DC250 activates the output if at least one pre-alarm is active.
- DOF.4003: DC250 activates the output if at least one deactivation is active.
- DOF.4004: DC250 activates the output if at least one shutdown is active.
- DOF.4005: DC250 activates the output if at least one deactivation or one shutdown is active.
- DOF.4031: DC250 activates this output if at least one generator-related anomaly is active:
  - 001: Low generator voltage shutdown (27<<).
  - 002: High generator voltage shutdown (59>>).
  - 006: High generator current shutdown (51).
  - 008: Operating conditions not reached.
  - 016: Short circuit shutdown (50).
  - 056: Low generator voltage pre-alarm (27<).
  - 059: High generator voltage pre-alarm (59>).
- DOF.4032: DC250 activates the output if at least one engine-related anomaly is active:
  - 005: Charge alternator failure shutdown.
  - 021: Fail to stop shutdown.
  - 022: Fail to start shutdown.
  - 031: High coolant temperature pre-alarm (from contact).
  - 032: High coolant temperature pre-alarm (from measure).
  - 033: High coolant temperature shutdown (from contact).
  - 034: High coolant temperature shutdown (from measure).
  - 035: High oil temperature shutdown (from measure).
  - 037: Low battery voltage pre-alarm.
  - 038: High battery voltage pre-alarm.
  - 039: Service required (first counter).
  - 041: Low oil pressure shutdown (from contact).
  - 042: Low oil pressure shutdown (from measure).
  - 043: Low oil pressure pre-alarm (from contact).
  - 044: Low oil pressure pre-alarm (from measure).
  - 049: High power.
  - 054: High oil temperature pre-alarm (from measure).
  - 062: CAN BUS failure.
  - 065: Low coolant temperature pre-alarm (from measure).
  - 096: Magnetic pick-up failure.
  - 098: Communication timeout with the ECU.
  - 105: Charge alternator failure pre-alarm from CAN BUS.
  - 132: High coolant temperature pre-alarm from CAN BUS.
  - 134: High coolant temperature shutdown from CAN BUS.

- 135: Low coolant level shutdown from CAN BUS.
- 136: Low coolant level pre-alarm from CAN BUS.
- 137: Low battery voltage pre-alarm from CAN BUS.
- 142: Low oil pressure shutdown from CAN BUS.
- 144: Low oil pressure pre-alarm from CAN BUS.
- 158: High oil temperature pre-alarm from CAN BUS.
- 159: High oil temperature shutdown from CAN BUS.
- 198: Yellow lamp pre-alarm from CAN BUS.
- 199: Red lamp shutdown from CAN BUS

- DOF.4034: DC250 activates the output if at least one fuel related anomaly is active:

- 025: Low fuel level shutdown (from contact).
- 026: Low fuel level shutdown (from measure).
- 027: Low fuel level pre-alarm (from contact).
- 028: Low fuel level pre-alarm (from measure).
- 029: High fuel level pre-alarm (from contact).
- 030: High fuel level pre-alarm (from measure).
- 160: Water in fuel pre-alarm from CAN BUS.

- DOF.4035: DC250 activates the output if at least one circuit-breaker related anomaly is active:
- 014: Fail to close GCB / Fail to engage the clutch.
- 024: Fail to open GCB / Fail do disengage the clutch.

Furthermore, DC250 makes available the anomaly states for the AND/OR logics through the following internal states:

- ST.006 – “Acknowledgment of anomalies in progress”.
- ST.007 – “Reset of anomalies in progress”.
- ST.008 – “Pre-alarms”.
- ST.010 – “Deactivations”.
- ST.011 – “Shutdowns”.
- ST.012 – “Not recognized pre-alarms”.
- ST.014 – “Not recognized deactivations”.
- ST.015 – “Not recognized shutdowns”.

8.5 Anomalies related to digital inputs

You can use each digital input of DC250 to trigger faults. These anomalies differ in two types:

- **Specific**. The functions DIF.4201 and following configure these anomalies. DC250 knows how to manage them, and already has symbols (not configurable) associated with each anomaly.
- **Generic**. The functions DIF.4001… DIF.4051 configure these anomalies. DC250 will display a generic symbol for them. Furthermore, by using the appropriate functions, you can tell DC250 how to manage them.

The following paragraphs will describe the specific anomalies: the description will always refer to the digital input T.16 related parameters (P.2001 and P.2002). In document [1] there is a table showing the parameters related to all the other digital inputs.

The above also applies to generic anomalies. The following paragraphs will not describe them, because they would be infinite repetitions of the same description. Instead, we are going to describe them here, citing the parameters for input T.16.

DC250 assigns the numerical codes from 701 to 742 to the generic anomalies related to the digital inputs (document [1] contains a table showing the numerical code relating to each input). Using the function configuration parameter (P.2001), it is possible to select the type of anomaly (pre-alarm, deactivation, shutdown) and to define the management-conditions. Parameter P.2002, instead, configures the activation delay of the anomaly with respect to the activation of the input. Parameter P.2003 finally allows you to configure a message to be shown on the display when the anomaly is active.

ATTENTION! set the delay to "0" to disable the anomaly.

The following list shows the relevant functions for the digital inputs' configuration. The list groups them by three: the three functions for each group define the type of anomaly:

- DIF.4001, DIF.4003, DIF.4004. DC250 activates these anomalies if the digital input remains active consecutively for the configured time.
- DIF.4011, DIF.4013, DIF.4014. DC250 activates the anomaly only after the time configured in P.0216 ("Time mask for engine protections") from the start of the engine. It activates them if the digital input remains active consecutively for the configured time.
- DIF.4021, DIF.4023, DIF.4024. DC250 activates the anomaly only after connecting the loads to the engine/generator. It activates them if the digital input remains active consecutively for the configured time.
- DIF.4031, DIF.4033, DIF.4034. DC250 activates the anomaly only after opening fuel solenoid (FUEL command active, see 7.3.5). It activates them if the digital input remains active consecutively for the configured time.
- DIF.4051. DC250 activates this anomaly if the digital input remains active consecutively for the configured time. The activation of the anomaly causes the fuel pump to stop.

8.6 Anomalies related to analogue inputs

DC250, for each analogue input, allows setting two thresholds on the acquired measurement, and each threshold can activate an anomaly. These anomalies are generic, as DC250 does not know how to manage them. The following paragraphs will not describe them, because it would be an infinite repetition of the same description. Instead, we are going to describe them here, citing the parameters for the T.09 input.

DC250 assigns the numerical codes from 301 to 310 to the generic anomalies related to the analogue inputs (document [1] contains a table showing the numeric code for each input). DC250 will display a generic symbol followed by an arrow to indicate:

- : "high value" if DC250 activates the anomaly when the measurement is higher than the threshold.
- : "Low value" if DC250 activates the anomaly when the measurement is lower than the threshold.

The message set by the operator via parameter P.4010 will then follow.

For each analogue input, six parameters are then available to manage the thresholds, three for each threshold (P.4003, P.4004 and P.4005 for the first threshold of the first analogue input; P.4006, P.4007 and P. 4008 for the second threshold of the first analogue input).

In addition to the threshold values (P.4003 or P.4006) and the delays (P.4004 or P.4007), the operator must configure the options related to the threshold (P.4005 or P.4008). DC250 manages the parameter that configures the actions in bits (each bit enables/disables a function related to the threshold). For a description of these parameters, see 5.6.4.

ATTENTION! If you set the delay to "0", you do not disable the anomaly.

8.7 List of anomalies

INFORMATION! Since it is not possible to define which digital or analogue inputs will trigger the anomaly and not even what function they will perform, the list below refers to the configuration parameters of the analogue input T.09 and of the digital input T.16. The presence of the indication "or equivalent for the other inputs" next to a parameter indicates that it varies according to the used input.

In the following, we will use the words enable and activate:

- Enabling an anomaly means the occurrence of the minimum conditions necessary for DC250 to observe the cause generating the anomaly
- Activating an anomaly means the occurrence of the cause generating the anomaly after the enabling.

01 – Low generator voltage shutdown (27<<)

Icon: 

Type: Deactivation.

Category: Loads protection.

Related parameters: P.0102 Nominal voltage of the generator.

P.0202 Hysteresis for generator's measures.

P.0301 Shutdown level for low voltage (27<<).

P.0302 Delay for low voltage shutdown (27<<).

To disable: P.0302 = 0.

Enabled in: MAN, AUTO.

INFORMATION! not available for DRIVE application.

DC250 enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases. It enables the protection the first time the engine rotation speed and the generator voltage enter within their tolerance bands from the start of the engine (see paragraph 7.5). In MAN mode, it enables the protection only after connecting the loads to the engine/generator.

DC250 activates the protection if, in the previous conditions, the generator voltage is lower than the threshold P.0301 consecutively for the time P.0302.

02 – High generator voltage shutdown (59>>)

Icon: 

Type: Shutdown.

Category: Generator/loads protection.

Related parameters: P.0102 Nominal voltage of the generator.

P.0202 Hysteresis for generator's measures.

P.0303 Shutdown level for high voltage (59>>).

P.0304 Delay for high voltage shutdown (59>>).

To disable: P.0304 = 0.

Enabled in: MAN, AUTO.

INFORMATION! not available for DRIVE application.

DC250 enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates the protection if, in the previous conditions, the generator voltage is higher than the threshold P.0303 consecutively for the time P.0304.

05 – Charge alternator failure.

Icon: ⎓

Type: Configurable.

Category: Engine protection.

Related parameters: P.4001 Function of the analogue input T09.

P.0230 Threshold for engine stopped (D+).

P.0231 Threshold for engine running/crank motor disconnect (D+).

P.0357 Action for charge alternator failure.

P.0349 Delay for charge alternator failure.

To disable: P.0349 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the analogue input T.09 to acquire the D+ signal (P.4001 = AIF.1300 - “D+ signal”). DC250 enables it after opening the fuel solenoid.

DC250 activates this protection if, in the previous conditions, the voltage on the D+ signal is lower than the threshold P.0230 consecutively for the time P.0349. Parameter P.0357 configures the type of the anomaly.

06 – High current shutdown (51)

Icon: Ⓐ↑

Type: Configurable.

Category: Generator protection.

Related parameters: P.9502 Nominal current of the generator.

P.0309 Shutdown level for high current (51).

P.0310 Delay for high current shutdown (51).

P.0323 Action on maximum current (50/51).

To disable: P.0310 = 0.

Enabled in: MAN, AUTO.

INFORMATION! not available for DRIVE application.

DC250 implements a time-dependent current protection (which therefore trips the faster the higher the current). DC250 uses the EXTREMELY INVERSE curve with I2t function. It is a generator protection, because it places a limit on the thermal accumulation of the generator during supply. To protect the engine, use the high-power protection.

The operator should define a maximum current value and a maximum time that the generator can withstand for this current. If the current is lower than the established threshold, the protection never trips. If it is higher than the threshold, the protection trips with a delay inversely proportional to the extent of the exceeding. To establish the thresholds, proceed as follows:

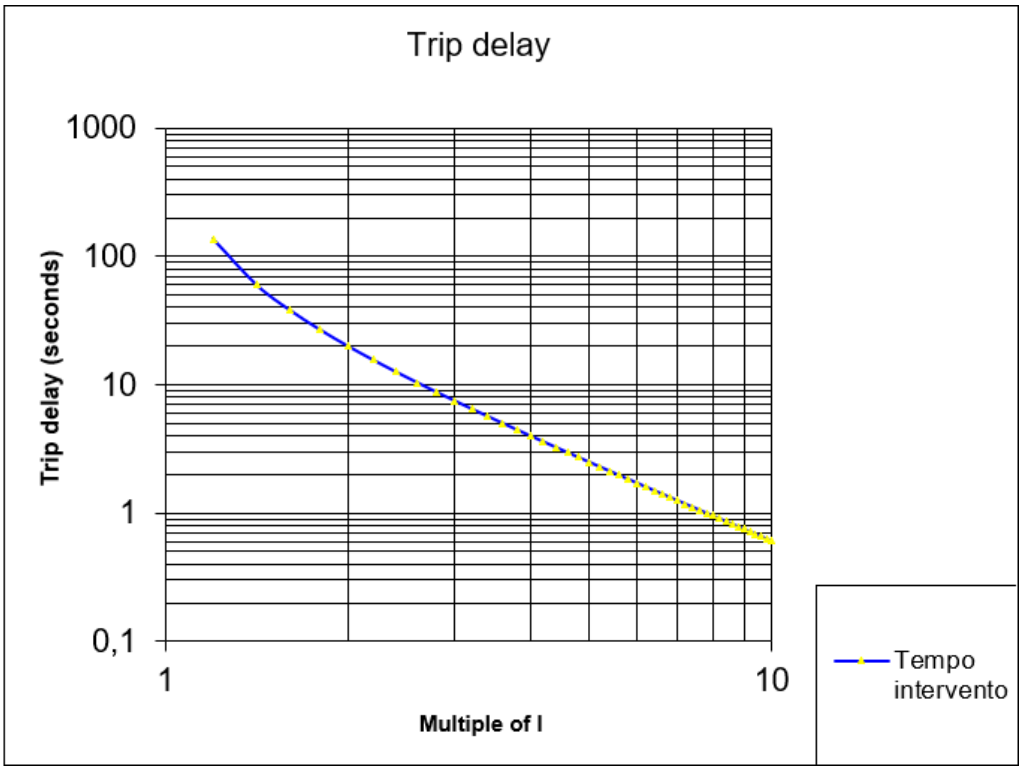
- For example, suppose that the rated current of the generator is two hundred Adc.
- Set the maximum current threshold with parameter P.0309, as a percentage of the rated current. In the previous example, if we want to set 250 A as threshold, we should write 125 (%) in P.0309.
- Set a tripping time in P.0310: the protection will trip in the configured time if the current is constantly equal to the P.0309 threshold multiplied by √2. In the previous example, if you set P.0310 = 10 s, the protection will trip in 10 seconds if the current is about 353 A, it trips faster if the current is greater, more slowly if it is less, it does not trip if it is less than 250 A.

To calculate the tripping time with a given current, use the following formula:

$$t_1 = \frac{P.0310}{\left(\frac{I}{P.0309}\right)^2 - 1}$$

Where “I” represents the current flowing in the circuit.

Keep in mind that DC250 manages the protection by calculating the integral value of the current over time, so that all the current values above the nominal threshold contribute to determining the tripping time, with their instantaneous weight given by the relationship above. The relationship is therefore experimentally verifiable by instantly passing from a normal load condition to an overload condition. Below is a graph showing the curve used by DC250 to activate the protection with a value of P.0310 equal to 60 seconds (I indicates the maximum current).



DC250 enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases. Parameter P.0323 configures the type of the anomaly.

07 – Manual stop command in AUTO mode

Icon:

Type: Shutdown.

Category: Generic.

Related parameters: P.0495 Keyboard-screen options

To disable: bit 0 di P.0495 = 1

Enabled in: AUTO.

This protection is always enabled. DC250 activates it in two cases:

- By pressing the “STOP” button on the DC250’s front panel.
- By sending a Modbus command through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):
  - HOLDING REGISTER 101: write the password configured with parameter P.0004.
  - HOLDING REGISTER 102: write the value “22”.

08 – Operating conditions not reached

Icon:

Type: Shutdown.

Category: Engine/generator protection.

Related parameters: P.0217 Maximum time for operating conditions

To disable: P.0217 = 0

Enabled in: (MAN), AUTO

DC250 enables this protection only after opening the fuel solenoid. It enables the protection also in MAN mode for DRIVE applications.

DC250 activates it if the engine rotation speed or the generator voltage do not enter stably within their tolerance bands within the time P.0217 from the detection of the engine running (or from the end of the idle speed cycle, if enabled).

14 – Fail to close GCB / Fail to engage the clutch

Icon:

Type: Deactivation/pre-alarm.

Category: Generic.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

INFORMATION! Not available for LIGHTING TOWER application.

DC250 enables this protection only if the operator configured a digital input for acquiring the status of the GCB (function DIF.3001 “Status of GCB circuit breaker” in parameter P.2001 or equivalent for other inputs) and the related delay is not

zero (parameter P.2002 or equivalent for other inputs). It disables the protection if the circuit breaker is externally managed.

DC250 activates it if the circuit breaker does not close within the configured delay (P.2002) from the closure command. In MAN it is a pre-alarm, in AUTO it is a deactivation (after three closure attempts).

15 – Short circuit (50) (from contact).

Icon:

Type: Shutdown.

Category: Generator protection.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital input for acquiring the trip contact of the circuit breaker (function DIF.4241 “Overload” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs).

DC250 activates it if the input is active consecutively for the configured time.

16 – Short circuit (50) (from measure).

Icon:

Type: Configurable.

Category: Generator protection.

Related parameters: P.9502 Nominal current of the generator.

P.0311 Shutdown level for short circuit (50).

P.0312 Delay for short circuit shutdown (50).

P.0323 Action on maximum current (50/51).

To disable: P.0312 = 0.

Enabled in: MAN, AUTO.

INFORMATION! not available for DRIVE application.

In addition to the overcurrent protection, DC250 also provides a short-circuit protection, to intervene as quickly as possible and not depend on the timing of the curve described for the overcurrent protection. Parameters P.0311 configures the current threshold, expressed as a percentage of the generator rated current (P.9502).

DC250 enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the current remains higher than the threshold P.0311 consecutively for the time P.0312. Parameter P.0323 configures the type of anomaly.

17 – Over speed (from contact).

Icon:

Type: Shutdown.

Category: Engine protection.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases. It also disables the protection during the “active regeneration” of the diesel particulate filter.

DC250 enables this protection only if the operator configured a digital input for acquiring the over speed contact (function DIF.4251 “Over speed” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs).

DC250 activates it if the input is active consecutively for the configured time.

18 – Over speed (from measure).

Icon: 

Type: Shutdown.

Category: Engine protection

Related parameters: P.0133 Engine’s nominal speed.

P.0333 Maximum speed threshold.

P.0334 Maximum speed delay.

To disable: P.0334 = 0

Enabled in: MAN, AUTO.

DC250 enables this protection only if the rotation speed measurement of the engine is available (see 7.3.1.1). it enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases. It also disables the protection during the “active regeneration” of the diesel particulate filter.

DC250 activates it if the acquired speed is higher than the P.0333 threshold consecutively for the P.0334 time. Threshold P.0333 is a percentage of the rated engine speed.

21 – Fail to stop

Icon: 

Type: Shutdown.

Category: Generic.

Related parameters: P.0214 Delay before the "fail to stop" shutdown (s)

To disable: P.0214 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only after opening the fuel solenoid.

DC250 activates it if the engine does not stop within the time configured by P.0214 (from the stop command).

DC250 can activate this shutdown even in presence of other shutdowns.

22 – Fail to start

Icon: 

Type: Shutdown.

Category: Battery protection.

Related parameters: P.0211 Number of crank attempts.

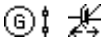
To disable: -

Enabled in: AUTO.

This protection is always enabled.

DC250 activates it if the engine does not start after P.0211 automatic crank attempts.

24 – Fail to open GCB / Fail to disengage the clutch

Icon: 

Type: Shutdown/pre-alarm.

Category: Generic.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

INFORMATION! Not available for LIGHTING TOWER application.

DC250 enables this protection only if the operator configured a digital input for acquiring the status of the GCB (function DIF.3001 “Status of GCB circuit breaker” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs). It disables the protection if the circuit breaker is externally managed.

DC250 activates it if the circuit breaker does not open within the configured delay (P.2002) from the opening command. The anomaly type could be:

- A shutdown: DC250 is in AUTO mode, the engine is running, and DC250 uses only the stable command for the GCB (DOF.2034 function in one of the digital outputs).
- Pre-alarms: in all other cases.

25 – Low fuel level shutdown (from contact).

Icon: 

Type: Shutdown.

Category: Generic.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

To disable: P.2002 = 0

Enabled in: MAN, AUTO

DC250 enables this protection only if the operator configured a digital input for acquiring the low fuel level shutdown contact (function DIF.4211 “Low fuel tank level shutdown” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs).

DC250 activates it if the input is active consecutively for the configured time.

26 – Low fuel level shutdown (from measure).

Icon: 

Type: Shutdown.

Category: Generic.

Related parameters: P.0347 Shutdown level for low fuel tank level (%).

P.0348 Delay for low fuel tank level shutdown.

To disable: P.0348 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the fuel level measurement is available (see 7.3.1.7).

DC250 activates it if the fuel level is lower than or equal to the P.0347 threshold consecutively for the time P.0348.

27 – Low fuel level pre-alarm (from contact)

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital input for acquiring the low fuel level pre-alarm contact (function DIF.4212 “Low fuel tank level pre-alarm” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs).

DC250 activates it if the input is active consecutively for the configured time.

28 – Low fuel level pre-alarm (from measure)

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.0345 Pre-alarm level for low fuel tank level (%).

P.0346 Delay for low fuel tank level pre-alarm.

To disable: P.0346 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the fuel level measurement is available (see 7.3.1.7).

DC250 activates it if the fuel level is lower than or equal to the P.0345 threshold consecutively for the time P.0346.

29 – High fuel level pre-alarm (from contact).

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital input for acquiring the high fuel level pre-alarm contact (function DIF.4213 “High fuel tank level pre-alarm” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs).

DC250 activates it if the input is active consecutively for the configured time.

30 – High fuel level pre-alarm (from measure).

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.0343 Pre-alarm level for high fuel tank level.

P.0344 Delay for high fuel tank level pre-alarm.

To disable: P.0344 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the fuel level measurement is available (see 7.3.1.7).

DC250 activates it if the fuel level is higher than or equal to the P.0343 threshold consecutively for the time P.0344.

31 – High coolant temperature pre-alarm (from contact)

Icon: 

Type: Pre-alarm.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

P.0216 Time mask for engine protections.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital input for acquiring the high coolant temperature pre-alarm contact (function DIF.4231 “High coolant temperature pre-alarm” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the input is active consecutively for the configured time, but only after P.0216 seconds from the start of the engine (it gives the possibility to start the engine with no load to cool it down).

32 – High coolant temperature pre-alarm (from measure).

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0216 Time mask for engine protections.

P.0335 Pre-alarm level for high coolant temperature.

P.0336 Delay for high coolant temperature pre-alarm.

To disable: P.0336 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the coolant temperature measurement is available (see 7.3.1.5). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the coolant temperature is higher than or equal to the P.0335 threshold consecutively for the time P.0336, but only after P.0216 seconds from the start of the engine (it gives the possibility to start the engine with no load to cool it down).

33 – High coolant temperature shutdown (from contact).

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

P.0216 Time mask for engine protections.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital input for acquiring the high coolant temperature shutdown contact (function DIF.4232 “High coolant temperature shutdown” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the input is active consecutively for the configured time, but only after P.0216 seconds from the start of the engine (it gives the possibility to start the engine with no load to cool it down).

34 – High coolant temperature shutdown (from measure)

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0216 Time mask for engine protections.

P.0337 Shutdown level for high coolant temperature.

P.0338 Delay for high coolant temperature shutdown.

To disable: P.0338 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the coolant temperature measurement is available (see 7.3.1.5). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the coolant temperature is higher than or equal to the P.0337 threshold consecutively for the time P.0338, but only after P.0216 seconds from the start of the engine (it gives the possibility to start the engine with no load to cool it down).

35 – High oil temperature shutdown (from measure)

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0216 Time mask for engine protections.

P.0375 Shutdown level for high oil temperature (°C).

P.0376 Delay for high oil temperature shutdown.

To disable: P.0376 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the oil temperature measurement is available (see 7.3.1.3). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the oil temperature is higher than or equal to the P.0375 threshold consecutively for the time P.0376, but only after P.0216 seconds from the start of the engine ("time mask for engine protections").

37 – Low battery voltage pre-alarm

Icon: 

Type: Pre-alarm.

Category: Battery protection.

Related parameters: P.0362 Pre-alarm level for low battery voltage (%).

P.0363 Delay for low battery voltage pre-alarm.

To disable: P.0363 = 0.

Enabled in: MAN, AUTO.

It is always enabled. DC250 disables it only when the starter motor is active.

DC250 activates it if the battery voltage is lower than the threshold P.0362 consecutively for the time P.0363.

Threshold P.0362 is a percentage of the nominal battery voltage: DC250 automatically detects the rated voltage (between 12 and 24Vdc) at power on and every time the operator forces the OFF/RESET mode. DC250 considers 12V rated voltage if in the above situations it measures a battery voltage lower than 17V, otherwise it considers 24 V.

38 – High battery voltage pre-alarm

Icon: 

Type: Pre-alarm.

Category: Battery protection.

Related parameters: P.0364 re-alarm level for high battery voltage (%).

P.0365 Delay for high battery voltage pre-alarm.

To disable: P.0365 = 0.

Enabled in: MAN, AUTO.

It is always enabled. DC250 disables it only when the starter motor is active.

DC250 activates it if the battery voltage is higher than the threshold P.0364 consecutively for the time P.0365.

Threshold P.0364 is a percentage of the nominal battery voltage: DC250 automatically detects the rated voltage (between 12 and 24Vdc) at power on and every time the operator forces the OFF/RESET mode. DC250 considers 12V rated voltage if in the above situations it measures a battery voltage lower than 17V, otherwise it considers 24 V.

39 – Service required

Icon: 

Type: Configurable.

Category: Generic.

Related parameters: P.0424 Maintenance interval 1 (running hours).

P.0425 Kind of action for maintenance.

To disable: P.0424 = 0.

Enabled in: MAN, AUTO.

DC250 activates it after P.0424 engine operation hours (from the last setting of P.0424). Parameter P.0425 configures the anomaly type.

The operator cannot reset this anomaly, even removing power supply. He can only reset it by setting P.0424 again, setting zero to disable the function, confirming the current value, or setting a different one.

Parameters P.0424 and P.0425 require the “installer” access level for programming: rental companies can therefore use this anomaly for managing hourly contracts, to block the engine at the end of the agreed hours.

41 – Low oil pressure shutdown (from contact)

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

P.0216 Time mask for engine protections.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital input for acquiring the low oil pressure shutdown contact (function DIF.4221 “Low oil pressure shutdown” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the input is active consecutively for the configured time, but only after P.0216 seconds from the start of the engine (it allows ignoring the normal low-pressure state at start-up).

42 – Low oil pressure shutdown (from measure)

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0216 Time mask for engine protections.

P.0341 Shutdown level for low oil pressure.

P.0342 Delay for low oil pressure shutdown.

To disable: P.0342 =0

Enabled in: MAN, AUTO.

DC250 enables this protection only if the oil pressure measurement is available (see 7.3.1.2). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the oil pressure is lower than or equal to the P.0341 threshold consecutively for the time P.0342, but only after P.0216 seconds from the start of the engine (it allows ignoring the normal low-pressure state at start-up).

43 – Low oil pressure pre-alarm (from contact)

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

P.0216 Time mask for engine protections.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital input for acquiring the low oil pressure pre-alarm contact (function DIF.4222 “Low oil pressure pre-alarm” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the input is active consecutively for the configured time, but only after P.0216 seconds from the start of the engine (it allows ignoring the normal low-pressure state at start-up).

44 – Low oil pressure pre-alarm (from measure)

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0216 Time mask for engine protections.

P.0339 Pre-alarm level for low oil pressure.

P.0340 Delay for low oil pressure pre-alarm.

To disable: P.0340 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the oil pressure measurement is available (see 7.3.1.2). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the oil pressure is lower than or equal to the P.0339 threshold consecutively for the time P.0340, but only after P.0216 seconds from the start of the engine (it allows ignoring the normal low-pressure state at start-up).

48 – Emergency stop

Icon: 

Type: Shutdown.

Category: Generic.

Related parameters: P.2001 Function of the input T16 or equivalent for other inputs.

P.2002 Delay for the input T16 or equivalent for other inputs.

To disable: P.2002 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital input for acquiring the emergency stop shutdown contact (function DIF.4201 “Emergency stop” in parameter P.2001 or equivalent for other inputs) and the related delay is not zero (parameter P.2002 or equivalent for other inputs).

DC250 activates it if the input is **not active** consecutively for the configured time.

The operator can also activate this protection by sending a Modbus command through the communication ports (see paragraph 5.7). To send the command it is necessary to write in sequence (within five seconds):

- HOLDING REGISTER 101: write the password configured with parameter P.0004.
- HOLDING REGISTER 102: write the value “99”.

DC250 can activate this shutdown even in presence of other shutdowns.

INFORMATION! The factory configuration of digital input T.18 is for the emergency stop button.

49 – Maximum power

Icon: 

Type: Configurable.

Category: Engine protection.

Related parameters: P.0125 Nominal power of the engine.

P.0350 Threshold for maximum power (32).

P.0351 Delay for maximum power (32).

P.0352 Action for maximum power (32).

To disable: P.0351 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the power is higher than the threshold P.0350 consecutively for the time P.0351. Parameter P.0352 configures the anomaly type.

54 – High oil temperature pre-alarm (from measure)

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0216 Time mask for engine protections.

P.0373 Pre-alarm level for high oil temperature.

P.0374 Delay for high oil temperature pre-alarm.

To disable: P.0374 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the oil temperature measurement is available (see 7.3.1.3). DC250 enables it only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates it if the oil temperature is higher than or equal to the P.0373 threshold consecutively for the time P.0374, but only after P.0216 seconds from the start of the engine ("time mask for engine protections").

56 – Low generator voltage pre-alarm (27<)

Icon: 

Type: Pre-alarm.

Category: Loads protection.

Related parameters: P.0102 Nominal voltage of the generator.

P.0202 Hysteresis for generator's measures.

P.0391 Pre-alarm level for low voltage (27<).

P.0392 Delay for low voltage pre-alarm (27<).

To disable: P.0392 = 0.

Enabled in: MAN, AUTO.

INFORMATION! not available for DRIVE application.

DC250 enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases. It enables the protection the first time the engine rotation speed and the generator voltage enter within their tolerance bands from the start of the engine (see paragraph 7.5). In MAN mode, it enables the protection only after connecting the loads to the engine/generator.

DC250 activates the protection if, in the previous conditions, the generator voltage is lower than the threshold P.0391 consecutively for the time P.0392.

57 – Clock/calendar not valid

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.0426, P.0429, P.0432, P.0435 Planned days

To disable: -

Enabled in: MAN, AUTO.

This protection is always enabled.

DC250 activates the protection if it detects the invalid clock status, and the operator configured functions that use the clock, such as weekly scheduling (P.0426 to P.0437). To disable the anomaly, set the clock.

59 – High generator voltage pre-alarm (59>>)

Icon: 

Type: Pre-alarm.

Category: Generator/loads protection.

Related parameters: P.0102 Nominal voltage of the generator.

P.0202 Hysteresis for generator's measures.

P.0393 Pre-alarm level for high voltage (59>).

P.0394 Delay for high voltage pre-alarm (59>).

To disable: P.0394 = 0.

Enabled in: MAN, AUTO.

INFORMATION! not available for DRIVE application.

DC250 enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases.

DC250 activates the protection if, in the previous conditions, the generator voltage is higher than the threshold P.0393 consecutively for the time P.0394.

62 –CAN BUS connection failure

Icon: 

Type: Configurable.

Category: Generic.

Related parameters: P.0700 Engine type.

P.0709 Action on Can-Bus fault.

To disable: P.0700 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection (P.0700 different from zero).

DC250 activates it if the internal CAN controller goes into the BUS-OFF state due to communication errors on the bus. Parameter P.0709 configures the anomaly type.

64 – Fuel pump failure

Icon: 

Type: Pre-alarm.

Category: Fuel pump protection.

Related parameters: P.0404 Fuel pump maximum activation time.

To disable: P.0404 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital output to control the fuel pump (function DOF.1032 – “Fuel pump” in parameter P.3001 or equivalent for other outputs) and if a time other than zero has been set in the parameter P.0404.

DC250 activates it if the pump remains activated consecutively for the set time. The activation of the pre-alarm turns off the pump, which will restart as soon as the operator recognizes the pre-alarm.

65 – Low coolant temperature pre-alarm (from measure).

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.0353 Pre-alarm level for low coolant temperature (°C).

P.0354 Delay for low coolant temperature pre-alarm.

To disable: P.0354 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the coolant temperature measurement is available (see 7.3.1.5).

DC250 activates it if the coolant temperature is lower than the P.0353 threshold consecutively for the time P.0354 (even with the engine stopped).

94 – Low current (from measure).

Icon: 

Type: Configurable.

Category: Generic.

Related parameters: P.9840…P.9847 Rated current for light #x.

P.9848 Low current level for alarm.

P.9849 Delay for low current alarm.

P.9850 Action for low current alarm.

To disable: P.9849 = 0.

Enabled in: MAN, AUTO.

INFORMATION! Available only for the LIGHTING TOWER application.

This protection is always enabled.

DC250 activates it if the generator current, compared as a percentage to the sum of the nominal currents of the groups of lights switched on, is lower than the threshold P.9848 consecutively for the time P.9849. Parameter P.9850 configures the type of anomaly

95 –AdBlue pump failure

Icon: 

Type: Pre-alarm.

Category: AdBlue pump protection.

Related parameters: P.1494 AdBlue pump maximum activation time.

To disable: P.1494 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured a digital output to control the AdBlue pump (function DOF.1037 – “AdBlue pump” in parameter P.3001 or equivalent for other outputs) and if a time other than zero has been set in the parameter P.1494.

DC250 activates it if the pump remains activated consecutively for the set time. The activation of the pre-alarm turns off the pump, which will restart as soon as the operator recognizes the pre-alarm.

96 – Magnetic pick-up failure

Icon: 

Type: Configurable.

Category: Engine protection.

Related parameters: P.0110 Number of teeth of the pick-up wheel.

P.0111 Rpm/W ratio.

P.0387 Delay for magnetic pickup failure.

P.0388 Action for magnetic pickup failure.

To disable: P.0387 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if it measures the engine rotation speed with its input dedicated to the magnetic pick-up (P.0110 other than zero) or with its input dedicated to the W signal (P.0111 other than zero).

DC250 activates it if detects the engine running condition, but the measurement of the rotation speed from the configured input is "0". This condition must persist for the time configured with P.0387 (set the time to zero to disable the protection). P.0388 configures the type of anomaly.

98 – Communication failure with the ECU

Icon: 

Type: Configurable.

Category: Generic.

Related parameters: P.0700 Engine type.

P.0709 Action on Can-Bus fault.

P.0711 Maximum time without messages from engine.

To disable: P.0711 = 0 (no for MTU engines).

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

For MTU engines with MDEC ECU (values from 140 to 143 in parameter P.0700), DC250 activates it as per specification, thus when DC250 does not receive the NMT ALIVE PDU message consecutively for the specified time.

For the other ECUs, DC250 activates the protection if it does not receive messages from the ECU consecutively for the time P.0711. Parameter P.0709 configures the anomaly type.

99 – Low engine speed shutdown (from measure)

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0133 Engine's nominal speed.

P.0358 Minimum speed threshold.

P.0359 Minimum speed delay.

To disable: P.0332 = 0.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the rotation speed measurement of the engine is available (see 7.3.1.1). It enables this protection only after opening the fuel solenoid and disables it during the engine start and stop phases. It enables the protection the first time the engine rotation speed and the generator voltage enter within their tolerance bands from the start of the engine (see paragraph 7.5).

DC250 activates it if the acquired speed is lower than the P.0358 threshold consecutively for the P.0359 time.

105 – Charge alternator failure pre-alarm from CAN BUS

Icon: ⎓

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 11 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the fault status of the charge alternator.

Maximum speed shutdown from CAN BUS

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 10 di P.0704 = “1”.

Enabled in: MAN, AUTO

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the over speed condition.

132 – High coolant temperature pre-alarm from CAN BUS

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 4 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the high coolant temperature condition.

134 – High coolant temperature shutdown from CAN BUS

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 5 di P.704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the high coolant temperature condition.

135 – Low coolant level shutdown from CAN BUS.

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 7 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the low coolant level condition.

136 – Low coolant level pre-alarm from CAN BUS

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 6 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the low coolant level condition.

137 – Low battery voltage pre-alarm from CAN BUS

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 9 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the low battery voltage condition.

142 – Low oil pressure shutdown from CAN BUS

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 1 di P.704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the low oil pressure condition.

144 – low oil pressure pre-alarm from CAN BUS

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 0 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the low oil pressure condition.

158 – High oil temperature pre-alarm from CAN BUS

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 2 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the high oil temperature condition.

159 – High oil temperature shutdown from CAN BUS

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 3 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the high oil temperature condition.

160 – Water in fuel pre-alarm from CAN BUS

Icon:

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

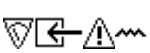
To disable: bit 8 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the water in fuel condition.

182 – Broken connection with a sensor (T.13)

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.4009 Function of the analogue input T13.

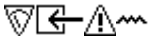
To disable: -.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the analogue input T.13 (P.4009 different from "0").

DC250 activates it when the analogue input measures more than three thousand Ω from terminal T.13.

183 – Broken connection with a sensor (T.14)

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.4017 Function of the analogue input T14.

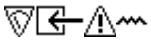
To disable: -.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the analogue input T.14 (P.4017 different from "0").

DC250 activates it when the analogue input measures more than three thousand Ω from terminal T.14.

184 – Broken connection with a sensor (T.15)

Icon: 

Type: Pre-alarm.

Category: Generic.

Related parameters: P.4025 Function of the analogue input T15.

To disable: -.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the analogue input T.15 (P.4025 different from "0").

DC250 activates it when the analogue input measures more than three thousand Ω from terminal T.15.

198 – Yellow lamp pre-alarm from CAN BUS

Icon: 

Type: Pre-alarm.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 14 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the yellow lamp condition.

199 – Red lamp shutdown from CAN BUS

Icon: 

Type: Shutdown.

Category: Engine protection.

Related parameters: P.0700 Engine type.

P.0704 Can-Bus anomalies disable mask.

To disable: bit 15 di P.0704 = “1”.

Enabled in: MAN, AUTO.

DC250 enables this protection only if the operator configured the CAN BUS connection with the ECU (P.0700 different from zero).

DC250 activates it when the ECU signals over the CAN BUS the yellow lamp condition.

The bit thirteen of parameter P.0704 allows configuring the protection as a pre-alarm.

9 Other functions

9.1 Power on

When powered, DC250 performs the following operations:

- It checks the status of the non-volatile memory (see 9.2).
- It records the event EVT.1077 ("New power on") in the historical archive of the events.
- It records the event EVT.1074 ("Reset") if the internal WATCH-DOG circuit restarted the software.
- It sets the operating mode (OFF/RESET, MAN, AUTO) depending on parameter P.0490 (“Operating mode at power on”).

9.2 Non-volatile memory

DC250 has a non-volatile memory inside (which does not require any power supply), used to store various information such as parameters, counters and more. DC250 divides the memory into areas. When powered, DC250 checks the data stored in each area: even if only one area is incorrect, DC250 shows an error message on the display; this can happen after a firmware update. This message contains a numeric code (expressed in hexadecimal notation); each active bit of this code corresponds to an invalid memory area. Below is a table with the areas and their bits.

Area	Version	Bit	Value	Description
1	1.00	0	1 (0001)	Coefficients for the calibration of the measurement inputs.
2	1.00	1	2 (0002)	Various information (LCD contrast, maintenance request).
3	1.00	2	4 (0004)	Counters.
4	1.00	3	8 (0008)	Historical archive of the diagnostic codes acquired via CAN BUS from the ECU.
5	1.00	4	16 (0010)	Parameters.

For example, if the value within the brackets was “0004”, it means that only the counter zone is not valid. If the value was “0012” it means that the parameter zones (0010) and the LCD contrast zone (0002) are not valid.

If any zone is not valid, DC250 does not execute the normal operating sequences until the operator presses the “AUTO + STOP” buttons: it is, in fact, necessary to take care of the situation, because it could cause malfunctions (think for example if the invalid area is the parameters’ one). Only after the operator pressed AUTO + STOP, DC250 will reload the factory defaults for the data stored in the invalid areas: thus, if the operator switches off DC250 without pressing AUTO + STOP, the next time it will show the same invalid memory message.

DC250 records the EVT.1078 event (“default values of the parameters”) every time it reloads (at power on) the factory default values for the area containing the configuration parameters.

9.3 Energy saving mode

This mode is useful for limiting the discharge of the engine starting battery with the system stopped. DC250 turns off and minimizes current consumption. To enable the energy saving mode, set a value other than zero in parameter P.0590 (“Delay before energy saving”).

To activate the energy saving mode you need to:

- Stop the engine.
- Disconnect the communication ports.
- Force DC250 in OFF/RESET mode.

After the time configured in P.0590, DC250 automatically activates energy saving: the LCD display and all the lights go off. You can also manually force this mode by pressing and holding the STOP button for at least five seconds.

DC250 adds a record in the historical archive of the events each time it activates the energy saving mode (EVT.1079 – “Energy saving mode activated”, if enabled by bit zero of parameter P.0441).

You can exit the energy saving mode in two ways:

- By pressing the START button.
- By changing the status of the digital input T.17.

Parameter P.0599 allow configuring the required status change on input T.17:

- “0-Disabled”: DC250 does not use T.17 for resume from energy save mode.
- “1-Rising edge”: DC250 resumes from energy save mode when the input becomes active.
- “2-Falling edge”: DC250 resumes from energy save mode when the input becomes not active.
- “3-Both edges”: DC250 resumes from energy save mode when the input becomes active and/or not active.

9.4 Power thresholds

INFORMATION! not available for DRIVE application.

This function allows you to monitor the trend of the electrical power over time to diagnose:

- A low power condition.
- A high-power condition, useable to disconnect part of the loads.

You need to make a first choice on the monitored condition (using parameter P.0481: by setting it to zero, DC250 will monitor the low power, otherwise the high power).

Sometimes, you may need to disable the function when not needed. In these cases, you must configure a digital input with the function DIF.2703 - “Enables the load thresholds”. If the input exists, DC250 enables the function only when it is "active".

9.4.1 Low power

The purpose of this function is to diagnose a low power state and report it via a digital output. Use the function DOF.3121 “Load thresholds” in parameter P.3001 (or the corresponding parameter for the other outputs) to associate an output with this function. If you do not configure any output in this way, the function is not available.

DC250 monitors the electrical power supplied by the generator, comparing it with two thresholds (which therefore establish a hysteresis band): it activates the output (thus signalling the low power status) if the power remains below the lower threshold for the configured time. Similarly, it deactivates the output if the power rises above the upper threshold for the configured time. The following parameters allows configuring thresholds and delays:

- P.0483: lower threshold (percentage of the rated power P.0125).
- P.0484: lower threshold delay (seconds).
- P.0485: upper threshold (percentage of the rated power P.0125).
- P.0486: upper threshold delay (seconds).

If you set the thresholds P.0483 and P.0485 to zero or in a non-consistent way, DC250 disables the function.

DC250 may also manages a delay, starting when a digital input configured as DIF.2703 “Enables the load thresholds” activates (if it exists). Parameter P.0482 configures the duration of this delay. During this delay, DC250 forces off the output, regardless of power. You may use this timing for allowing the system to stabilize.

9.4.2 High power

The purpose of this function is to diagnose a state of high power to disconnect part of the less priority loads. You can refer to the previous paragraph, considering that DC250 activates the output if the power exceeds the P.0485 threshold and deactivates it when it falls below the P.0483 threshold.

DC250 activates the output in a situation of maximum power, thus you can use it directly as a command for disconnecting part of the loads. Pay attention to the thresholds: when DC250 disconnects part of the loads, the power will decrease. If the lower threshold is too high, this will result in the deactivation of the output, which in turn could lead to the re-connection of the loads and therefore to a swing effect.

9.5 Counters

DC250 internally manages the following counters:

- Two counters (one resettable) of the energy (kWh) produced by the generator.
- One counter (resettable) of the engine starts.
- Two counters (one resettable) of the engine operating hours.
- One counter of the hours missing to the next maintenance.
- One counter (resettable) of the operating hours at load (GCB closed, clutch engaged, lights on).
- One counter of the DC250 powered hours.

DC250 shows these counters on its display (only the DC250 powered hours counter is not visible). However, all are readable through the communication ports. The operator can reset the “resettable” counters with an appropriate procedure or through the communication ports. DC250 saves all these counters into the non-volatile memory and therefore keeps their value even when not supplied. Since write operations “consumes” the non-volatile memories, DC250 minimizes the writings. For this reason, DC250 does not immediately save each counter when its value changes, and it is therefore important to know when DC250 saves them, and how to force a saving before disconnecting the power supply to DC250.

DC250 saves the counters (all together and at the same time) in the following conditions:

- Immediately after each engine start (when the engine starts, not after each start attempt).
- Immediately after each engine stop (when the engine stops, not when DC250 issues the stop command).
- At each increase of engine operating hours counters (overall, even if the operator started the engine for example six times for ten minutes each).
- Whenever the operator forces DC250 in OFF/RESET mode.
- Once per hour.
- When changing parameter P.0424 (maintenance interval).

DC250 also saves them when reset (individually or globally) from the front panel or from the communication ports. Note that counters may have a decimal part (for example the minute counters associated with the hour counters); DC250 also saves them in the non-volatile memory. By removing power supply in uncontrolled way, you risk losing this decimal part. However, it is sufficient to force DC250 in OFF/RESET mode to force a saving, before disconnecting the power supply.

9.5.1 Reset the counters

The reset procedure is common to all the counters but acts only on the one visible on the multifunctional display. See paragraph 6 for the description of the display page that contains the counters.

9.6 Clock/calendar

DC250 provides a hardware clock/calendar. It shows the date/time in detail on page S.02. You can program the clock/calendar from menu 4.7.1 or from the communication ports. DC250 uses the clock/calendar for various functions:

- Recordings on the historical archives.
- Weekly planning of the automatic start of the engine/generator.

DC250 records the event EVT.1075 (“Clock/calendar not valid but used”) in the historical archive if it recognizes the “invalid” status for the clock/calendar (as well as activating the anomaly AL.057). It also records the event EVT.1076 (“Clock/calendar updated”) when the operator sets the date/time (directly from the front panel or through the communication ports).

9.7 Plant name

It is possible to assign a name to the system by entering it in parameter P.0456. DC250 does not use it.

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DC250 Technical Manual
Code: EAAM075408EN
Rev. 08 | Date: 13/06/2025