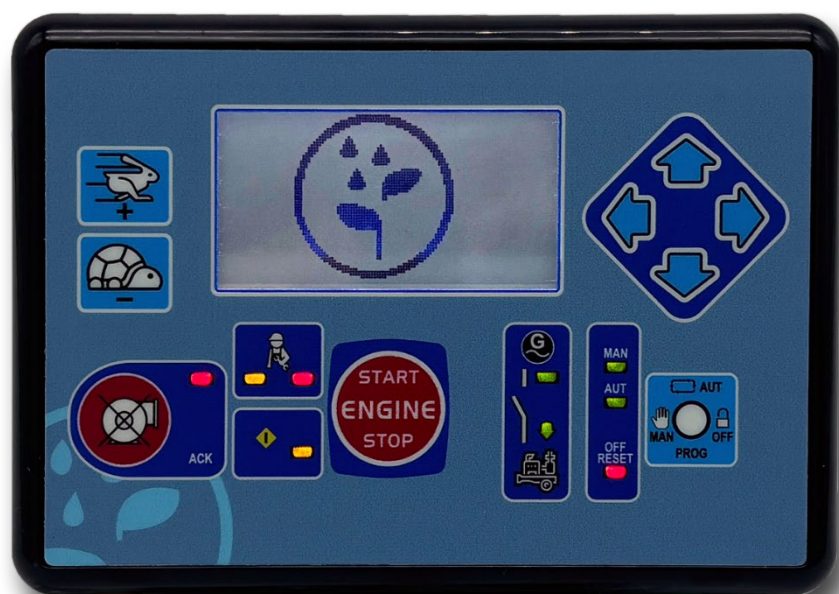


CEM-139

This controls and commands a generator and an irrigation motor pump. It manages a water pressure transmitter with digital pressure gauge. It enables manual adjustment of the engine rpm and stopping if a fault occurs. It automatically manages the inclusion of the generator on the load through a contactor.



USER'S MANUAL



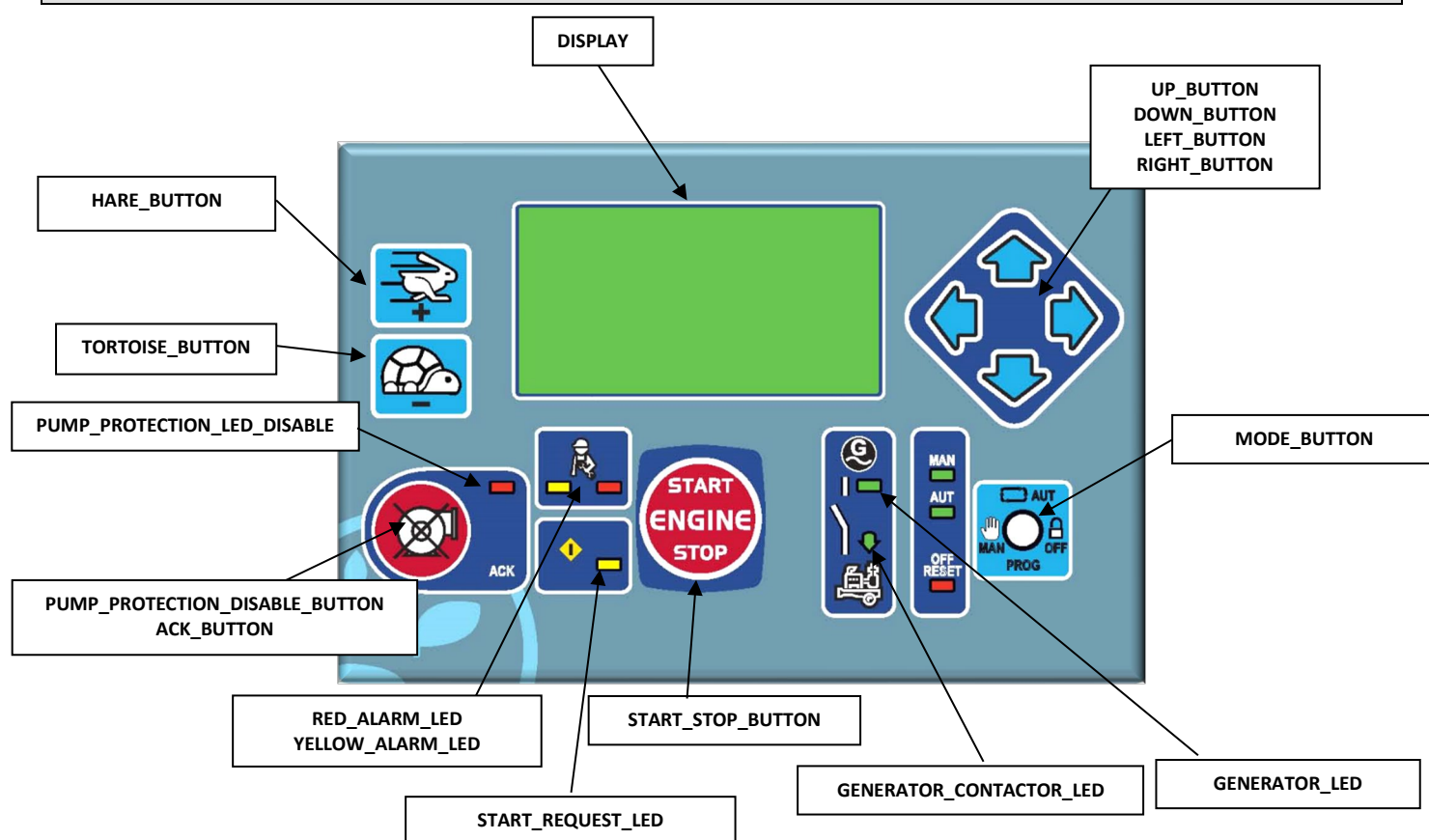
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CHRONOLOGY OF MANUAL REVISIONS			
Date	Revision	Description	Page
11/04/2023	0.01	First draft release	
21/04/2023	0.02	Engine overheating fault from active thermostat with engine protection active.	26
12/07/2023	0.03	Draft plate replaced.	
21/10/2024	1.00	Updated with firmware 1.02 release.	
09/01/2025	1.01	PTO output function added.	19
03/04/2025	1.02	PUMP and clutch protections.	13
07/07/2026	1.03	Key input documentation modified.	

INSTRUCTIONS IN BRIEF



PUMP_PROTECTION_LED_DISABLED	It flashes when pump protections are disabled.
PUMP_PROTECTION_DISABLE_BUTTON ACK_BUTTON	Press until LED starts to flash to disable pump protections. To re-enable, press again until the LED turns off. On some menus, this button is used to confirm the action indicated by the display.
GENERATOR_LED	On when the generator's parameters are correct.
GENERATOR_CONTACTOR_LED	On when the generator contactor is closed.
TORTOISE_BUTTON, HARE_BUTTON	Decelerates/accelerates the engine.
START_STOP_BUTTON	If the control unit is switched off, press the button for at least one second; the control unit will switch on, performing an LED test and checking for any faults. Starts/stops the engine when the control unit is on.
START_REQUEST_LED	On when a remote start-up is requested.
RED_ALARM_LED	It flashes if a fault has stopped the engine. In electronic engines, steadily lit indicates an active RED STOP fault in the engine ECU.
YELLOW_ALARM_LED	It flashes if there is a warning fault that does not stop the engine. In electronic engines, steadily lit indicates an active AMBER WARNING fault in the engine ECU.
UP_BUTTON, DOWN_BUTTON, LEFT_BUTTON, RIGHT_BUTTON	Press the arrows to browse display menus.
MODE_BUTTON	Acknowledging the general alarm. Selects the MANUAL MODE, OFF MODE, AUTOMATIC MODE modes

GENERAL DESCRIPTION

The control unit makes it possible to start or stop a diesel engine to which a three-phase generator and an irrigation pump are mechanically connected. It can manage both traditional engines and Stage V engines fitted with CAN Bus SAE J1939 protocol ECUs.

In the case of mechanical engines, a linear actuator connected to the control unit can vary the diesel engine's rpm. If it is an electronic engine, the rpm variation is managed by CAN Bus.

If a fault occurs, the control unit stops the engine.

The operator can start the engine manually and adjust the rpm until it reaches the typical 50/60 Hz of the generator. With the rpm speed at this level, the pump circulates water in the irrigation pipeline.

The control unit manages the remote control with modem via an app.

The start-up and stopping can also be triggered via external contact.

If necessary, pump protections can be disabled temporarily by simply operating the button on the front panel. It is also possible to set an operation timer that stops the engine when the time expires.

Functions can be managed easily thanks to the messages displayed. Pop-up messages highlight statuses in progress, showing any times about to expire or indicating which buttons to press; they also display, in text form, any triggered faults or pre-alarms that could stop the engine.

PROTECTION LIST

The control unit protects the machine by stopping the engine if a fault occurs.

List of generator protections	List of engine protections	List of pump protections
• Overvoltage/undervoltage. • Overfrequency/Underfrequency. • Overload/overload pre-alarm. • Phase asymmetry. • Incorrect phase sequence.	• Low engine oil pressure. • Engine too hot. • Fuel reserve. • No fuel. • Charging alternator fault. • Faults DM1 J1939. • Low coolant level. • Battery voltage low. • Battery voltage high. • Underspeed. • Overspeed. • Emergency button.	• Pump water low pressure. • Pump water high pressure. • Maximum pump water pressure. • Pump water transmitter fault.

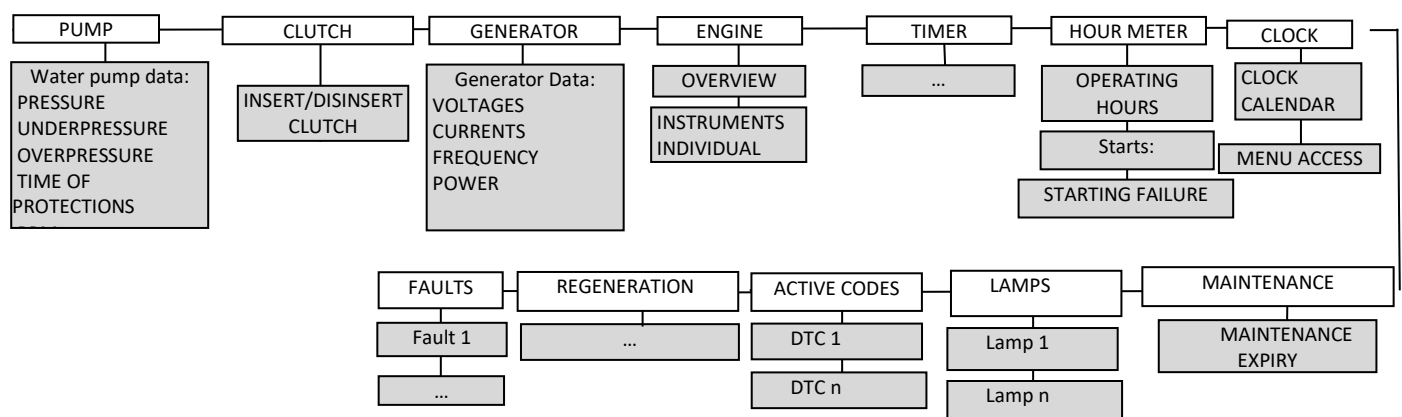
INSTRUMENTS

The control unit has a backlit 128 x 64 dot graphic display. It displays instruments and provides access to parameter setting. There is a list below of the main instruments displayed:

- Generator star and line-to-line voltages.
- Generator ammeters.
- Generator frequency meter.
- Active (kW), reactive (kVAR) and apparent (kVA) power supplied by the generator. The powers are displayed for each phase and as a sum of the phases.
- Generator power factor indicator displayed for each phase.
- Energy counter (kWh) supplied by the generator.
- Pump water pressure gauge.
- Battery voltage.
- D+ voltage (pre-excitation alternator).
- Fuel tank level indicator.
- Engine temperature in [°C] or [°F] (the instrument is disabled by default).
- Engine oil pressure in [bar], [kPa] or [psi] (the instrument is disabled by default).
- Engine revolutions (RPM).
- Total hour-meter.
- Partial hour-meter.
- Start-ups count.
- Starting failure counter.
- Maintenance expirations.
- Calendar clock.

NAVIGATING ACROSS INSTRUMENTS

The instruments displayed on the control unit are divided into pages, each with a uniform group of instruments; to move from one page to another, use the RIGHT_BUTTON and LEFT_BUTTON; to move within the pages, use the UP_BUTTON and DOWN_BUTTON.



OPERATION

MODE_BUTTON

Used to select the operating mode: MANUAL MODE, OFF MODE, AUTOMATIC MODE. The function selected is indicated by the corresponding light. The mode does not change when it wakes up from stand-by. The different modes can be selected based on the setting of the parameter DEVICE > MODE SETTING:

- KEYS: By pressing the MODE_BUTTON.
- CONTACTS: By activating the function-inputs AUTOMATIC MODE _ MANUAL MODE.

START_STOP_BUTTON

Used to:

- **Switch on the control unit.** If the control unit is switched off, press the button for at least one second; the control unit will switch on, performing an LED test and checking for any faults.
- **Start the engine.** If there are no faults which stop it, the engine will start at idling speed. If, on the other hand, there are faults which result in stoppage, the start-up will not occur.
- **Stop the engine.** If the engine is running, press the button for at least one second. The control unit decelerates the engine, reducing the RPM until it reaches minimum speed, and then will stop the engine.
- **Turning the engine ECU ON/OFF.** If an electronic engine was selected, the engine is off and the control unit is in manual mode, press for less than 1 second to power/depower the engine ECU without starting the engine (Ignition ON/OFF).

HARE_BUTTON and TORTOISE_BUTTON

The HARE_BUTTON and TORTOISE_BUTTON are used to accelerate and decelerate the engine manually. When the control unit is on, the buttons are always enabled, even when the engine is stopped.

UP_BUTTON, DOWN_BUTTON, LEFT_BUTTON and RIGHT_BUTTON

Used to browse display menus. They silence the alarm.

OFF MODE

When set to OFF MODE, the engine cannot be started in any way and, if it is running, it stops without the engine deceleration and cooling step. Faults are reset. If the OFF mode is excluded, simply press the MODE_BUTTON to reset the faults.

MANUAL MODE

In MANUAL MODE, the engine can be started or stopped with the START_STOP_BUTTON. For traditional engines, there is an output to pilot a linear actuator which is needed to vary the engine's rpm. The speed variations are obtained through impulses followed by pauses.

In electronic injection engines, relevant commands are sent via CAN BUS to obtain the variation.

The variation of the rpm can be managed in the following ways (see MANUAL RPM MGMT. > REV CONTROL):

- **KEYS**

In KEYS mode, the operator can press the HARE_BUTTON or TORTOISE_BUTTON to manually accelerate or decelerate the engine until it reaches the desired rpm.

- **SETPPOINT**

In SETPOINT mode, the operator can press the HARE_BUTTON; this causes the control unit to accelerate the engine until it reaches the set reference speed (SETPOINT) in a specific programmable time.

By pressing the TORTOISE_BUTTON the control unit decelerates the engine until the minimum is reached. This value is stored in the unit the first time the engine is decelerated with the press of the TORTOISE_BUTTON.

Reference RPMs can be programmed from the menu MANUAL RPM MGMT. > SETPOINT.

- **ENGINE SPEED 1-2**

In ENGINE SPEED 1-2 mode (available only for conventional engines), pressing the TORTOISE_BUTTON will activate the function-output ENGINE SPEED 1-2, which remains in the excited state until the HARE_BUTTON is pressed. After starting the engine, the function-output gets excited. Power to this function-output is cut by stopping the engine or if a fault arises that stops the engine.

- **ENGINE SPEED MIN-MAX**

In ENGINE SPEED MIN-MAX mode (available for electronic engines only), the engine is accelerated and decelerated automatically, brought to two fixed rpm values.

By pressing the HARE_BUTTON, it is brought to the value set in MANUAL RPM MGMT. > SETPOINT > MAXIMUM SETPOINT. By pressing the TORTOISE_BUTTON, it is brought to the value set in MANUAL RPM MGMT. > SETPOINT > MINIMUM SETPOINT.

AUTOMATIC MODE

The engine can be started in any one of the following ways:

- When function-input CALL is activated.
- From remote with app command.
- Via serial ports with appropriate MOD-BUS commands.

The engine can be stopped in any one of the following ways:

- Due to a stop-causing fault: the engine is decelerated and/or cooled (if so required by the fault that caused the stop) and stopped.
- Upon deactivation of the function-input CALL.
- When the function-input LOCKED is active.
- From remote with APP command.
- Via serial ports with appropriate MOD-BUS commands.

A series of start-up attempts are made until the engine is started; these can be programmed. If running of the entire series of start-up attempts is unable to start the engine, when the cycle is completed FAILURE TO START is displayed and the stop signal is activated. All engine protections are active in automatic mode.

The engine speed can be managed in the following ways (in accordance with the setting AUTOMATIC RPM MGMT. > REV CONTROL > MODE):

- **EXCLUDED**

No adjustment is operated. The engine can be accelerated and decelerated by using the relevant buttons.

- **USER RPM**

The reference RPM is detected with the engine running after a manual variation with the HARE_BUTTON and the TORTOISE_BUTTON; after 10 seconds, the message "RPM STORED" is displayed. During the subsequent start-ups, the control unit will bring the RPM to the stored value. The RPM can be changed at any time by pressing the relevant buttons. If the parameter RPM RESET is included, the stored RPM is reset at each stop. The time for the control unit to automatically bring the RPM to the stored value is set in AUTOMATIC RPM MGMT. > USER RPM > TIME.

- **AUTONOMOUS RPM**

The reference RPM must be set in AUTOMATIC RPM MGMT. > AUTONOMOUS RPM > SPEED. The control unit brings the RPM to this value every time the engine starts. At each stop, it brings the engine to idle speed. The time for the control unit to automatically bring the RPM to the stored value or to idle is set in AUTOMATIC RPM MGMT > AUTONOMOUS RPM > TIME.

CALL

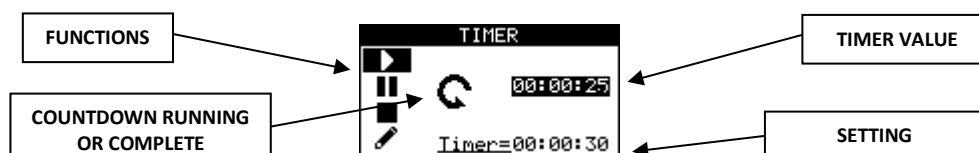
Remote start-up can only be carried out with the control unit in automatic mode. When the contact of the function-input CALL is closed and after the cut-in delay, the control unit commands the engine to start. When operating, the machine is protected from any faults. When the contact is open and after the delay, the engine is stopped. If they are enabled in the settings, the engine heating and cooling will be performed.

POWER SAVING AND KEY INPUT (terminal 45)

For the control unit to turn on, the KEY terminal (terminal 45) must be connected to a fused positive. The control unit supports a power saving mode which minimises power consumption: it enters power saving mode in any mode only when the engine is stopped and an inactivity period is exceeded; for the parameters, see the settings in the "STANDBY" menu. To exit power saving mode, a button must be pressed or the CALL 30 input activated. If the positive is cut from the KEY terminal when in power saving mode, the control unit will shut off completely, further reducing power consumption. To turn the control unit back on, a positive must be restored to the KEY terminal. If using a switch to shut off the control unit is not desired, a direct positive voltage must be connected to the input 45; otherwise, the control unit will remain off.

TIMER

The timer is used to operate the engine for a preset time (if necessary), up to a maximum of 96 hours. At the end, the machine is stopped and the message Stop at work end by timer. is displayed.



Use the UP_BUTTON and DOWN_BUTTON to change the selection of the function and the ACK_BUTTON to confirm the selection:

Symbol	Meaning
	START: starts the countdown
	PAUSE: pauses the countdown
	STOP: interrupts the countdown and restores the value
	EDIT: edits the setting

RESET

The device is reset by putting it in OFF mode. The following operations are carried out:

- Active faults restored.
- Engine protection timer restored.
- Pump protection timer restored.

ENGINE PROTECTIONS

ACTIVATION

Engine protections are enabled after ENGINE > ENGINE PROTECTION DELAY seconds (factory set at 10) from the end of the start-up impulse and disabled when the motor is stopped.

PROTECTIONS

Faults of the engine protection probes are indicated by the RED_ALARM_LED (lights up if fault causes engine stop) and YELLOW_ALARM_LED (lights up if fault does not cause a stop).

See list of engine faults, activation column: ENGINE PROTECTIONS ACTIVE.

ENGINE WARM-UP

In automatic mode, once engine start-up is completed, if the engine warm-up function is included, the engine will remain at idle speed for the set amount of time it takes to warm up. After this time has elapsed, the engine will reach its working RPM. Protections are active during the warm-up. This function is excluded by factory default.

ENGINE DECELERATION

If a stop occurs, the control unit decelerates automatically and stops the engine when the rpm remains unchanged for 5 consecutive seconds. There are some fault-generated stops that do not contemplate a deceleration.

ENGINE COOLING

During automatic stops or fault-generated stops (where applicable), the engine is cooled while running for a set time after deceleration. This function is excluded by factory default.

STOPPING SYSTEMS

Stopping can be achieved in two ways:

- With the solenoid valve or electromagnet energized when the engine is running and de-energized when the engine is stopped (default setting).
- With the electromagnet de-energized when engine is running and energized when it is stopped, remaining in this condition for the entire [STOP TIME] after engine not running has been detected.
- For ECU-managed engines with electronic injection system, removal of the ignition signal causes the stop.

If, after 120 seconds from receipt of the stop command, the control still detects the engine running signal, the **FAILURE TO STOP** trips.

GLOW PLUG PREHEATING

Activation of the glow plug output is adjustable — from a minimum of 0 seconds (command off) to a maximum of 60 seconds. Once activation of preheating has been completed, the engine start-up procedure begins. Glow plug post-heating can also be managed, i.e. maintaining output live for a set amount of time, even after the engine has been started (see section on programming).

ENGINE RUNNING DETECTION

Engine running is detected by revealing the generator frequency and voltage and by detecting the voltage and frequency of the battery charger alternator (permanent or pre-excitation magnets). As an alternative to the charging alternator, it is possible to use a magnetic (variable reluctance) pick-up. In engines managed by an injection control unit, the detection is based on the engine rpm transmitted by the control unit.

Engine running sources are adjustable (thresholds and times) and can be disabled. Once detected, the start-up system is interrupted.

TACHOMETER CALIBRATION

To calibrate the tachometer, access the programming mode ENGINE > ALTERNATOR CHARGE > ALTERNATOR W > CALIBRATION. If the pick-up is used instead of the charging alternator as engine speed detection, once detected is in the following menu: ENGINE > PICK-UP > CALIBRATION.

There is no need to calibrate the tachometer in engines managed by the injection control unit because the RPM is read via the CAN Bus line.

CLUTCH

The clutch is engaged when the engine speed threshold INSERTION is reached (after the DELAY).

It disengages when the engine speed falls below the threshold RELEASE (after the DELAY).

Thresholds and delays can be set in the programming menu.

This function is included by factory default. Be sure to direct the function CLUTCH to a programmable output, by default it is associated with output 47.

Using the CLUTCH it is possible to temporarily include or exclude CLUTCH management.

Via a instrument CLUTCH, is the possibility to force of the CLUTCH.



GENERATOR

With the engine running and with correct generator voltage and frequency, once the G.S. VOLTAGE PRESENT DELAY has elapsed, the generator contactor is closed. When operating, the generator is protected from any faults. When the engine stops, it commands the generator contactor to open.

VOLTMETRIC CONNECTIONS

The control unit can be configured to manage THREE-PHASE, TWO-PHASE and SINGLE-PHASE voltages. If the generator power is three-phase, the phases must be connected to terminals 96, 97 and 98 and the neutral to terminal 95. With two-phase connection, terminals 96 and 97 must be connected and the neutral must not be connected. Instead, with the single-phase connection, the phase must be connected to terminal 97 and the neutral to terminal 95.

GENERATOR VOLTMETRIC RELAYS

The voltmetric relays are located inside the control unit and serve to control the generator voltages and frequency. The parameters considered are: power failure, undervoltage, overvoltage, asymmetrical voltages, incorrect phase sequence, under-frequency and overfrequency. When each parameter has been accepted individually, after the generator voltage present delay has elapsed (programmed to 7 seconds), the generator contactor closes. It takes just one parameter outside the normal range to de-energize the generator contactor. Tripping of a fault is shown on the display and can cause the engine to cut out and activates the general alarm. See the FAULT LIST table.

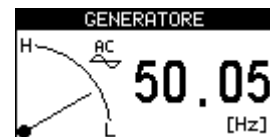
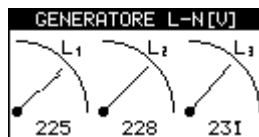
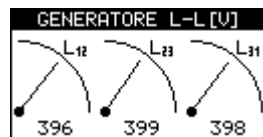
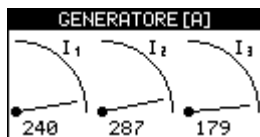
AMMETER INPUTS

Current transformers can be connected to the control unit to read the currents of individual phases. They are also used to calculate the power supplied by the generator. Just one transformer can be connected on phase L2 or three transformers, one for each phase. It can read up to 110% of the selected ammeter transformer full scale current. Having set the transformer, the OVERLOAD PRE-ALARM and OVERLOAD thresholds are automatically adjusted respectively to 95% and 100% of the nominal value of the A.T.

The instruments GENERATOR and POWER they display the electrical values measured:

GENERATORE L-L			
U_{12}	= 397	I_1	= 240
U_{23}	= 398	I_2	= 288
U_{31}	= 397	I_3	= 184
Hz=49.99			

GENERATORE L-N			
U_1	= 227	I_1	= 238
U_2	= 228	I_2	= 287
U_3	= 232	I_3	= 176
Hz=50.01			



POTENZA [1/2]	
kW	=34.9
kVA	=168.8
kVAR	=-14.9
Cosφ	=0.49

POTENZA [2/2]	
kWh	=103.6

kW	
L_1	=-28.4
L_2	= 68.8
L_3	= -5.6
Tot	= 34.8

kVAR	
L_1	=-43.6
L_2	=-14.8
L_3	= 47.6
Tot	=-14.4

kVA	
L_1	= 50.1
L_2	= 69.6
L_3	= 44.9
Tot	=164.4

Cosφ	
L_1	=-0.55
L_2	= 0.97
L_3	=-0.11
Tot	= 0.51

kWh	
L_1	= 37.6
L_2	= 51.6
L_3	= 16.5
Tot	=105.7

ENABLING

If IRRIGATION > PUMP PROTECTION SENSOR = WATER PRESSURE TRANSM. is set, the pump protections are enabled with the engine running after a time equal to IRRIGATION > PROTECTION ACTIVATION TIME > MINIMUM (factory set at 2) consecutive minutes, during which the following two conditions are verified:

- The water pressure remains stable; there are no oscillations greater than 2 BAR
- The water pressure is greater than the value of IRRIGATION > MINIMUM PRESSURE.

If IRRIGATION > PUMP PROTECTION SENSOR = PUMP PRESSURE SWITCH is set, the pump protections are enabled with the engine running after a time equal to IRRIGATION > PROTECTION ACTIVATION TIME > MINIMUM (factory set at 2) consecutive minutes, during which the function-input PUMP PRESSURE SWITCH did not activate.

In any case, the pump protections are enabled with the engine running after a time of IRRIGATION > PROTECTION ACTIVATION TIME > MAXIMUM minutes (factory set at 10).

Pump protections deactivate at the start of the engine stopping procedure. If the pump protections are active and the TORTOISE_BUTTON or HARE_BUTTON is pressed, the protections are deactivated for a time equal to IRRIGATION > PROTECTION ACTIVATION TIME > RESTART; factory setting is 10".

PUMP PROTECTIONS are not active if the CLUTCH is not engaged.

PUMP PROTECTION DISABLE BUTTON

To disable the pump protections, press the PUMP_PROTECTIONS_DISABLE button for at least 3 consecutive seconds with the engine running; the PUMP_PROTECTIONS_DISABLED_LED will flash to confirm they have been disabled. All controls except fault "Water pump maximum pressure" and "Engine temperature transmitter disconnected", will be disabled.

Pressing the button again or stopping the pump will cancel the disable command.

WATER PRESSURE TRANSM.

When the pump is controlled by the WATER PRESSURE TRANSM., all the protections use the pressure value readings as the baseline.

MINIMUM PRESSURE

If the working pressure is less than or equal to IRRIGATION > MINIMUM PRESSURE (factory set at 0.2), activation of the protections triggers the fault "Water pump underpressure" and the engine is stopped.

Water pump pressure transmitter fault

If the pressure transmitter (TPA) is disconnected or breaks, the fault "Water pump pressure transmitter fault" is triggered.

If the fault appears when the engine is started, it will stop the engine after 2 seconds.

If the fault appears before starting the engine, it will stop the engine 1 minute after the engine is started.

OVERPRESSURE AND UNDERPRESSURE

With pump protections active, if the pump pressure exceeds the OVERPRESSURE value, the fault "Water pump overpressure" is triggered; likewise, if the pressure drops below the UNDERPRESSURE value, the fault "Water pump underpressure" is activated. Both faults stop the engine.

UNDERPRESSURE and OVERPRESSURE values are established in two different ways depending on how the parameter IRRIGATION > PROTECTION TYPE is set.

AUTOMATIC ACQUISITION (factory setting)

When pump protections are activated, the unit takes the water pressure as the WORKING PRESSURE.

If the working pressure is greater than or equal to 4 bar:

- $OVERPRESSURE = WORKING\ PRESSURE + [HIGHER\ OVERPRESSURE\ DIFFERENTIAL]$ (factory set at 2 bar)
- $UNDERPRESSURE = WORKING\ PRESSURE - [HIGHER\ UNDERPRESSURE\ DIFFERENTIAL]$ (factory set at 2 bar)

If the working pressure is less than 4 bar:

- $OVERPRESSURE = WORKING\ PRESSURE + [LOWER\ OVERPRESSURE\ DIFFERENTIAL]$ (factory set at 1 bar)
- $UNDERPRESSURE = WORKING\ PRESSURE - [LOWER\ UNDERPRESSURE\ DIFFERENTIAL]$ (factory set at 1 bar)

Where:

[HIGHER UNDERPRESSURE DIFFERENTIAL] is the parameter

IRRIGATION > PUMP WATER UNDERPRESSURE > UPPER DIFFERENTIAL

[LOWER UNDERPRESSURE DIFFERENTIAL] is the parameter

IRRIGATION > PUMP WATER UNDERPRESSURE > LOWER DIFFERENTIAL

[LOWER OVERPRESSURE DIFFERENTIAL] is the parameter

IRRIGATION > PUMP WATER OVERPRESSURE > LOWER DIFFERENTIAL

[HIGHER OVERPRESSURE DIFFERENTIAL] is the parameter
IRRIGATION > PUMP WATER OVERPRESSURE > UPPER DIFFERENTIAL

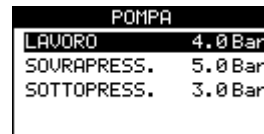
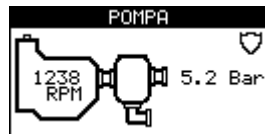
If the WORKING PRESSURE is lower than the UNDERPRESSURE DIFFERENTIAL value (whether LOWER or HIGHER), the UNDERPRESSURE value is set to the value of IRRIGATION > MINIMUM PRESSURE.

Water underpressure and overpressure thresholds can be changed manually at any time; see PUMP INSTRUMENT.

MANUAL ACQUISITION

This type of protection can only be included in MANUAL MODE and with the linear actuator is disabled, to exclude it go to the menu ENGINE RPM MANAGEMENT > RPM VARIATION.

The engine rpm must be pre-set by mechanically operating the engine accelerator. The operator must set the WORKING PRESSURE in the control unit by acting in the PUMP tool. The value is stored in a non-volatile memory and is therefore maintained even if the control unit battery is disconnected. If the pump protections are active, they are deactivated for a time equal to IRRIGATION > PROTECT.ACTIVAT. TIME > RESTART and then reactivated by setting the new limit values. The programming is made when you exit the edit mode if the value.



- $\text{OVERPRESSURE} = \text{WORKING PRESSURE} + [\text{OVERPRESSURE PERCENTAGE}]$ (factory set at 26%)
- $\text{UNDERPRESSURE} = \text{WORKING PRESSURE} - [\text{UNDERPRESSURE PERCENTAGE}]$ (factory set at 26%)

Where

[OVERPRESSURE PERCENTAGE] is the parameter

IRRIGATION > PUMP WATER OVERPRESSURE > DIFFERENTIAL

[UNDERPRESSURE PERCENTAGE] is the parameter

IRRIGATION > PUMP WATER UNDERPRESSURE > DIFFERENTIAL

The parameter IRRIGATION > PROTECTION TYPE must be programmed as MANUAL ACQUISITION.

Water pump maximum pressure

If the water pressure reading from the transmitter exceeds the threshold of IRRIGATION > MAXIMUM PRESSURE, the control unit activates the fault "Water pump maximum pressure" and stops the pump at once. This control is always active.

PUMP PRESSURE SWITCH

When the pump is controlled by PUMP PRESSURE SWITCH, all the protections use the function-input PUMP PRESSURE SWITCH as the baseline; it is therefore necessary to connect a pressure switch to an adequately programmed input.

Upon activation of the function-input PUMP PRESSURE SWITCH and once the time IRRIGATION > PUMP PRES.SWITCH DEL. has elapsed, if the pump protections are active, the fault "Water pump underpressure" will occur.

FILTER WASHING

When the function-input FILTER WASH is active, the UNDERPRESSURE value changes and is equal to IRRIGATION > FILTER WASH > PRESSURE. When the function-input deactivates, the UNDERPRESSURE value returns to the previous value.

If the function FILTER WASH (IRRIGATION > FILTER WASH > FUNCTION) is disabled, the function-input is not active.

CAVITATION

The control unit checks whether there is potential cavitation occurring in the pump; the method used is the intake vacuum measurement. The supported sensors are of 4-20mA type, the management must be enabled by selecting the VACUUM TX sensor in the menu IN-OUT > **IN 4-20 mA** > SENSOR

The management incorporates four independent faults:

- CAVITATION PRE-ALARM: The vacuum value remains below the set threshold and the intervention delay has passed; reset when the value normalises for more than 5 seconds.
- CAVITATION ALARM: The vacuum value remains below the set threshold and the intervention delay has passed; is not reset. Stops the machine.
- VACUUM TX INTERRUPTED: The signal read is anomalous for over 5 seconds; resets when the signal is normal for more than 5 seconds.
- MAX CAVITATION TIME: the pump has worked with CAVITATION PRE-ALARM active for longer than a threshold which can also be set non continuously. The total time can be reset in the menu IN-OUT > IN 4-20 mA > MAX CAVITATION TIME > RESET HOURS

It is necessary to program the fault levels and specify the sensor used; see 4-20mA sensor programming.

If the VACUUM TX value is enabled, this is indicated in the PUMP instrument



EMERGENCY STOP

Possible in manual or automatic mode. One or more buttons (latching type) with NC contact can be installed in series. Stopping is immediate, without engine deceleration; it activates the general alarm and the related message is displayed.

GENERAL ALARM

The GENERAL ALARM signal can be obtained by installing a signalling device at the specific output. It can be programmed (menu IN-OUT > GENERAL ALARM > DURATION) so that it is always on or remains on for a specific amount of time. It trips whenever the control unit detects a fault. Pressing one of the arrows silences the alarm.

IMMINENT START

Every automatic start-up is preceded by the intermittent activation of the general alarm output for 8 seconds; then, 3 seconds later, the start-up cycle begins. If a buzzer is connected to this output, the operator is notified that start-up is imminent. This function can be bypassed (IN-OUT > GENERAL ALARM > IMMINENT START).

MAINTENANCE

To make machine maintenance as easy as possible, three scheduled maintenance programs can be set up. When the event occurs, a fault is enabled that indicates that the programmed expiry has been reached; these signals cannot be cancelled in the same way as other faults, but must be restored individually. It is possible to program a stop at the maintenance due date.

Programmed expiries can be associated with:

- MOTOR HOURS: motor running hours.
- RUNNING HOURS: hours of operation of the control unit. See MENU > DATA > DEVICE > Time:
- CALENDAR

The message displayed can be personalised.

COMMISSIONING

Always as a way to ease maintenance management, the date the system was commissioned can be included under the item: MAINTENANCE > COMMISSIONING.

This date is displayed in the section DATA > RETENTION under the settings menus.

EVENT LOG

Up to 5375 events are stored. Data displaying in LOG > LOG is as follows:



The event with the greatest number indicates the last event that occurred, 1 is the first. If no events are stored, the display shows EMPTY LOG

The events are:

EVENT	DATUM 1	DATUM 2	SAVING
FAULT	ACTIVATED = Onset	NUMBER OF ACTIVE FAULTS	At fault onset/resolution.
	DEACTIVATED = Resolved		
MANUAL START START BY CALL	---	---	On presentation of request
MANUAL STOP STOP REQUEST BY TIMER REOMOTE STOP REQUEST	---	---	On presentation of request
SWITCH-ONS	Total number of start-ups	---	Upon start-up of device
ENGINE STARTED	HOURS (TOTAL)	---	As soon as an engine running is detected, stores the total engine running time.
ENGINE STOPPED	HOURS (PARTIAL)	---	As soon as an engine stop is detected, stores the partial start time.
BATTERY VOLTAGE	BATTERY	---	Every day On start-up

			With engine running each hour
FUEL LEVEL	%	---	Every day On start-up With engine running each hour
ENGINE PROTECTIONS	ACTIVATED	---	On activation/deactivation of engine protections
	DEACTIVATED		
PUMP PROTECTIONS	EXCLUDED	ACTIVATED	On activation/deactivation of pump protections.
	INCLUDED	DEACTIVATED	On disable/enable of pump protections
PRESSURE LIMITS	UNDERPRESSURE BAR	OVERPRESSURE BAR	On activation of pump protections
WATER PRESSURE	BAR	---	With engine running every 15 minutes
MOTOR RPM	RPM	---	With engine running every 15 minutes
ENGINE TEMPERATURE	°C	---	With engine running every 15 minutes
OIL PRESSURE	BAR	---	With engine running every 15 minutes
LOW CONSUMPTION	ACTIVATED	---	When in and out of POWER SAVING mode.
	DEACTIVATED		
DELETE HISTORY	---	---	A delete has occurred in the event log.
FAULT RESET	---	---	On reset of the control unit.
MANUAL MODE	---	---	Input in MANUAL mode.
AUTOMATIC MODE	---	---	Input in AUTOMATIC mode.
OFF MODE	---	---	Input in OFF mode.
VACUUM TX	BAR	---	With engine running each hour (when enabled)
ACTIVE CODES	Spn Fmi	ACTIVATED = Onset	At the onset/resolution of a DTC error indicated by the engine control unit
		DEACTIVATED = Resolved	
REGENERATION	START	---	At the start/end of the regeneration procedure for stage V engines
	STOP		

Example of Fault Event:

Fault onset,
1 fault active

STORICO n°=79 Tot=751 ON=116h35m31s 15:14.30 11 Gen 2024 SOTTOTENSIONE G.E. ATTIVO NUMERO ANOMALIE:1	STORICO n°=82 Tot=751 ON=116h35m53s 15:14.52 11 Gen 2024 SOTTOTENSIONE G.E. DISATTIVO NUMERO ANOMALIE:0
---	--

Fault resolved,
0 faults active

UP_BUTTON and DOWN_BUTTON modify the event index. LEFT_BUTTON to exit.

PROGRAMMABLE INPUTS

Certain inputs have fully programmable activation parameters regarding DELAY TIME and the ACTIVATION LEVELS (active CLOSED or active OPEN). The inputs can be addressed to a FUNCTION-INPUT or associated with a FAULT. In the second case, also the TEXT DISPLAYED, ACTIVATION TIME, and STORAGE can be programmed.

If several inputs are associated to a FUNCTION-INPUT, the latter will be active when at least one input is active.

The programmable inputs are as follows:

Terminal number	Close at:
30	Negative
32	Negative
33	Negative
41	Negative
42	Negative
46	Positive

Table of FUNCTION-INPUTS that can be associated:

FUNCTION	DESCRIPTION			
"_ _ _ _"	No association			
PUMP PRESSURE SWITCH	Pressure switch for the water pump; see pump protections			
CALL	Starts the engine; see START/STOP			
FILTER WASH	Indicates filter washing in progress; see pump protections			
LOCKED	Locking; see START/STOP			
FUEL PRESSURE SWITCH	Fuel pressure switch			
REGENERATION CONSENT	Enables the input to which an external selector/switch can be connected to signal to the control unit that the safety conditions to be able to perform manual regeneration are met. With the safety conditions enabled, it is not possible to start the engine, see fault Attempted to start with safety conditions on.			
AUTOMATIC MODE _ MANUAL MODE	Forces the control unit to Automatic or Manual mode. Only works with terminal 46 and the setting DEVICE > MODE SETTING = CONTACTS. Works in combination with terminal 45.			
	Terminal 45	0	1	1
	Terminal 46	0	1	0
	Mode	OFF	AUT	MAN

PROGRAMMABLE OUTPUTS

FUNCTION-OUTPUTS and FAULTS can be associated with each programmable output. The output is activated when the FUNCTION-OUTPUT or associated FAULT is active.

If several FUNCTION-OUTPUTS or FAULTS are associated with an output, the output will be active when at least one function-output or fault is active.

The programmable outputs are as follows:

Terminal number	Output:
6	Positive
19	Positive
47	Positive
48-49	Clean contact
70	Positive

The table of FUNCTION-OUTPUTS that can be associated is given below.

FUNCTION	Description
"----	No association.
KEY	Positive before the start-ups; remains positive for the period the engine is running and deactivates after the engine has turned off.
GLOW PLUGS	Manages pre-heating glow plugs.
GENERAL ALARM	Positive if a general alarm is active; deactivates when silenced.
PETROL STARTER	Petrol engine STARTER management; activated during EVEN-NUMBERED start-ups in the sequence.
ENGINE RUNNING	Activates the output and signals that the engine is actually running.
ENGINE DEL. RUNNING	Indicates, if output is activated, that the engine is actually running and 20 seconds have elapsed (this time cannot be programmed).
STOP WITH ELECTROMAG.	Management of the engine stop command excited during stopping phase is associated to the output.
STOP IN PROGRESS	Indicates that the control unit is running the stopping procedure. Restores with the engine stopped or with a failed stop condition.
ENGINE SPEED 1-2	The output activates when the TORTOISE_BUTTON is pressed and deactivates when the HARE_BUTTON is pressed.
OPERATING POINT REACHED	The operating point is within the control range and the control is active.
CONTROL UNIT ON	Active when the control unit is on; deactivated when the control unit enters standby.
CLUTCH	See description in section CLUTCH.
PTO	Contact PTO management. Positive after 0.5 sec from engine start with duration 2 sec..

ENGINE

It can manage conventional engines or engines managed by an electronic injection control unit that supports the CAN BusJ1939 protocol. Conventional engines managed are:

- DIESEL

In diesel engines, the function-output GLOW PLUGS (glow plug) is used to pilot the engine's PREHEATING and POST-HEATING (pre-heating and post-heating, respectively).

- PETROL

In petrol engines, the function-output PETROL STARTER is used; this activates during even-numbered start-up attempts (2, 4, etc.).

ECU-EQUIPPED ENGINES

When an ECU-equipped engine is used, the control unit dialogues with it in order to:

- Adjust the engine rpm.
- Gather the values read (temperature, RPM, pressures, etc.)
- Gather active engine fault codes.

The control unit supports different types of engines, selected via the parameter in ENGINE ECU > ENGINE TYPE

ENGINE TYPE	SUPPORTED ENGINES
NO CAN BUS	Engines without engine ECU
SAE J1939 GENERIC	Generic engine with ECU compliant with standard SAE J1939
FPT STAGE V	FPT F34, F36, N45, N67 engines
DOOSAN STAGE V	Doosan D18, D24, D34 engines
KOHLER STAGE V	KDI2504TCR, KDI1903TCR, KDI3404TCR Kohler engines

ECU READINGS

If the ECU reads an instrument, it is indicated; in the example, the battery voltage and D+ voltage are read by the control unit. If an engine instrument is disabled in the ECU, it is not displayed.

If the following error is displayed in error, in the example the oil temperature:



The instrument can be disabled and greyed out even if the ECU returns a correct value.
The summary table is provided below:

Symbol	Parameter	Source	UM
	RPM	ECU: spn 190	RPM
	TEMPERATURE	ECU: spn 110	°C/°F
	OIL PRESSURE	ECU: spn 100	BAR/kPa
	FUEL LEVEL	ECU: spn 96	%
	OIL TEMPERATURE	ECU: spn 175	°C/°F
	INTAKE TEMP.	ECU: spn 105	°C/°F
	TURBO TEMPERATURE	ECU: spn 176	°C/°F
	FUEL PRESSURE	ECU: spn 94	BAR/kPa
	COOLANT PRESSURE	ECU: spn 109	BAR/kPa
	INSTANT CONSUMPTION	ECU: spn 183	l/h
	FUEL TEMPERATURE	ECU: spn 174	°C/°F
	ENGINE TORQUE	ECU: spn 513	%
	ENGINE LOAD	ECU: spn 92	%
	INTERCOOLER TEMPERATURE	ECU: spn 52	°C/°F
	COOLANT LEVEL	ECU: spn 111	%
	OIL LEVEL	ECU: spn 98	%
	SOOT LEVEL	ECU: spn 3719	%
	ASH LEVEL	ECU: spn 3720	%
	REAGENT LEVEL	ECU: spn 1761	%
	REAGENT TEMPERATURE	ECU: spn 3031	°C/°F

FAULT CODES ACTIVE

The ACTIVE CODES instrument group shows faults detected by the engine's ECU. The LEDs do not flash but are steady-on, in line with the RED STOP and AMBER WARNING signals of the DM1 message. Some ECU faults are translated. The representation is as follows:



The icons in the lower centre indicate the status of the RED STOP/AMBER WARNING and MALFUNCTION/PROTECT signals sent by the DM1 command. Fault translations are:

SPN	FMI	FAULT
100	1	Low engine oil pressure
110	0	Engine overtemperature
190	0	Engine overspeed
111	1	Low coolant level
4781	15	Performance limit 50%
4781	16	Performance limit 70%
5838	31	Impeded EGR valve
5839	31	Interruption of dosing

5841	31	Poor reagent quality
5842	31	Tampering of Nox control system

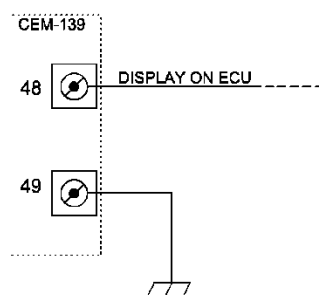
FPT STAGE V ENGINES

CONNECTIONS

For connection to the engine, refer to the following table:

Terminal Number	ECU Terminal	Function
17	+15 KEY SW IN	ECU activation
84	CAN H	ECU communication
85	CAN L	
66	D+ charging lamp	Alternator pre-excitation and condition check
15	+50 CRANK IN	Engine starting
48-49	DISPLAY ON	Signals the activity to the ECU.

It is necessary to activate the “CONTROL UNIT ON” function on the output 48-49 used for the DISPLAY ON of the ECU; the connection must be made as follows:



SIGNALLING LAMPS

The instrument LAMPS displays the information sent by the engine ECU via a symbol and an explanatory message. The table shows all the signals managed by the control unit and the likely corresponding fault.

Symbol	Signal	Fault
	High liquid coolant temperature warning	Warning overtemperature detected by the ECU
	High liquid coolant temperature	Overtemperature detected by the ECU
	Low engine oil pressure	Low oil pressure detected by the ECU
	Glow plugs preheating in progress	
	Water in fuel	
	Air Filter clogged	
	Fuel Pre-Filter clogged	
	Fuel Filter clogged	
	Automatic catalyst management required	
	Catalyst management on going	
	Catalyst manag.Req. Medium Level	
	Catalyst manag.Req. High Level	
	Catalyst management Req. SERVICE	
	Automatic catalyst manag. on going	
	Automatic catalyst manag. inhibited	
	Catalyst management inhibited	
	Low idle increase level 1	
	Low idle increase level 2	

	EGR/DPF Inducement First Step	
	Technical Failure First Step	
	DEF Level Inducement Lev.1	
	DEF Quality Inducement Lev.1	
	EGR/DPF Inducement Second Step	
	Technical Failure Second Step	
	DEF Level Inducement Lev.2	
	DEF Quality Inducement Lev.2	
	EGR/DPF Inducement Final Step	
	Technical Failure Final Step	
	DEF Level Inducement Lev.3	
	Poor reagent quality Level 3	
	Engine oil change required	

MANAGEMENT OF EMISSIONS REDUCTION DEVICES

The control unit supports the emissions reduction system for FPT Stage V4 engines equipped with MD1 engine control unit. Regeneration operations for the catalytic converter can be handled on the control unit panel and you have the option to see the related information.

REGENERATION

There are several regeneration modes:

- AUTOMATIC REGENERATION**

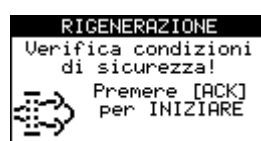
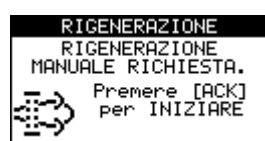
This is set off automatically and periodically by the engine ECU and ends only when conditions are suitable (temperature at the exhaust, engine speed, etc.) for a sufficient period of time. There is the possibility to enable/disable automatic regeneration via the parameter in ENGINE ECU > FPT S5 PARAMETERS > AUTOMATIC REGENERATION.

You can follow the status of the automatic regeneration through the signals in the instrument LAMPS.

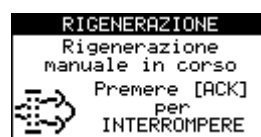
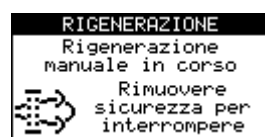
- MANUAL REGENERATION**

Must be performed under required engine conditions (load, speed, etc.) and a consent has to be given to start it. There is the possibility to enable/disable manual regeneration via the parameter in ENGINE ECU > FPT S5 PARAMETERS > MANUAL REGENERATION.

When the engine ECU signals the request for manual regeneration, the instrument REGENERATION is activated, prompting the operator to give the consent to start the procedure, which must be carried out under safe conditions. It is possible to program the control unit in order to use an external selector/switch to signal that the safety conditions have been verified and then provide consent for regeneration; see the function-input REGENERATION CONSENT. If you do not want to use any external consent, it will only a message reminding the operator to check the safety conditions before starting regeneration will be displayed



In both cases, the operator will be requested to start the procedure by pressing and holding the ACK_BUTTON for around 3 seconds. With regeneration in progress, it can be interrupted, if using the external consent a request is made to remove it, otherwise once again by pressing and holding the ACK_BUTTON for 3 seconds.



You can follow the status of the manual regeneration through the signals in the instrument LAMPS.

- SERVICE REGENERATION**

When the particulate build-up level in the DPF rises to the point of exceeding a certain threshold, significant engine derating occurs. In this case, Service will need to intervene.

OIL COUNTER RESET

The engine ECU relies on counters to track the quality of the engine oil based on the time since the last change, the specific use, and the number of regenerations made.

Once a certain threshold is exceeded, the ECU gives a signal to change the oil, displayed in the instrument LAMPS. After changing the engine oil, these counters have to be reset to inform the ECU of the change; the reset must be carried out with the engine off and the control unit in AUT or MAN.

From the HOUR METER instrument you will need to press the UP_BUTTON to access the OIL COUNTERS RESET instrument, with which it is possible to reset the oil counters by pressing and holding the ACK_BUTTON for around 3 seconds.



DOOSAN STAGE V ENGINES

CONNECTIONS

For connection to the engine, refer to the following table:

Terminal Number	ECU Terminal	Function
17	+15 KEY SW IN	ECU activation
84	CAN H	ECU communication
85	CAN L	
66	D+ charging lamp	Alternator pre-excitation and condition check
15	+50 CRANK IN	Engine starting

SIGNALLING LAMPS

The instrument LAMPS displays the information sent by the engine ECU via a steady or flashing symbol and an explanatory message. The table shows all the signals managed by the control unit.

Symbol	Flash	Signal
	Steady	Oil level too high
		Low oil level warning
		Low oil level
		Very low oil level
		Engine oil change required
	Steady	Glow plugs preheating in progress
	Steady	Water in fuel
	Steady	Catalyst management on going
	Slow	Catalyst management required
	Fast	Catalyst management required
	Steady	Automatic catalyst manag. on going
	Steady	Catalyst management inhibited
	Steady	Low Reagent Level < 25%
	Slow	Low Reagent Level < 10%
	Fast	Low Reagent Level < 2.5%
	Steady	EGR/DEF Inducement First Step
	Slow	EGR/DEF Inducement Second Step
	Fast	EGR/DEF Inducement Final Step

MANAGEMENT OF EMISSIONS REDUCTION DEVICES

The control unit supports the emissions reduction system for Doosan Stage V engines. Regeneration operations for the particulate filter can be handled on the control unit panel and you have the option to see the related information.

REGENERATION

There are several regeneration modes:

- **AUTOMATIC REGENERATION**

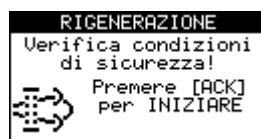
This is set off automatically and periodically by the engine ECU and ends only when conditions are suitable (temperature at the exhaust, engine speed, etc.) for a sufficient period of time.

You can follow the status of the automatic regeneration through the signals in the instrument LAMPS.

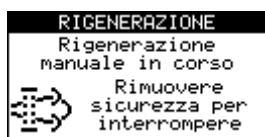
- **MANUAL REGENERATION**

Must be performed under required engine conditions (load, speed, temperature, soot level etc.) and a consent has to be given to start it. There is the possibility to enable/disable manual regeneration via the parameter in ENGINE ECU > MANUAL REGENERATION

If for some reason it cannot be performed, the engine ECU sends the Catalyst management inhibited signal visible in the LAMPS instrument; if the signal is not present, with the engine running and the engine protection active, the REGENERATION instrument is activated, with which it is possible to provide consent for the start-up of the procedure, which must be performed under safe conditions. It is possible to program the control unit in order to use an external selector/switch to signal that the safety conditions have been verified and then provide consent for regeneration; see the input function REGENERATION CONSENT. If you do not want to use any external consent, it will only a message reminding the operator to check the safety conditions before starting regeneration will be displayed



In both cases, the operator will be requested to start the procedure by pressing and holding the ACK_BUTTON for around 3 seconds. With regeneration in progress, it can be interrupted, if using the external consent a request is made to remove it, otherwise once again by pressing and holding the ACK_BUTTON for 3 seconds.



You can follow the status of the manual regeneration through the signals in the instrument LAMPS.

- **SERVICE REGENERATION**

When the particulate build-up level in the DPF rises to the point of exceeding a certain threshold, significant engine derating occurs. In this case, Service will need to intervene.

KOHLER STAGE V ENGINES

Manages emissions reduction devices such as the DPF (Diesel Particulate Filter) and SCR (Selective Catalytic Reduction). The control unit supports the emissions reduction system for KOHLER KDI 1903, KDI 2504 and KDI 3404 engines only.

➤ **DPF**

DPF regeneration operations can be handled on the control unit panel and you have the option to see the related information. Management of the DPF can be excluded.

DPF LAMPS

The DPF LAMPS instrument group shows DPF statuses. Here are a few examples:



REGENERATION

The REGENERATION instrument group lets you activate/interrupt manual regeneration, enable/disable automatic regeneration, and display soot and ash levels:



DPF LED

The DPF LED displays the most important statuses:

- ON
MANUAL or SERVICE regeneration request
- FLASHING
Forced regeneration in progress

DPF REGENERATION

There are several DPF regeneration modes:

AUTOMATIC REGENERATION

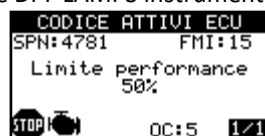
This is set off automatically and periodically by the engine ECU and ends only when conditions are suitable (temperature at the exhaust, engine speed, etc.) for a sufficient period of time. There are two ways to disable and enable automatic regeneration:

1. Go to the AUTOMATIC REGENERATION instrument and press the ACK_BUTTON.
2. Technical programming.

If a high temperature at exhaust is occurring, the warning may appear in the DPF LAMPS instrument. No signal by the LEDs.

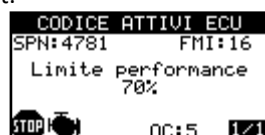
FORCED REGENERATION

Must be performed under required engine conditions (load, speed, etc.) and a consent has to be given to start it. A steady-on DPF_LED and the corresponding DPF_LAMP indicate a forced regeneration request. To start and stop the regeneration, go to the REGENERATION instrument and hold down the ACK_BUTTON. You can interrupt a regeneration always by pressing the ACK_BUTTON. The LED stays on during the entire DPF regeneration phase. If the regeneration request is ignored or several regenerations are interrupted, the particulate build-up level in the DPF increases and stifles engine performance. This is indicated by the DPF LAMPS instrument and corresponding fault:



SERVICE REGENERATION

When the particulate build-up level exceeds a certain threshold, a service regeneration is requested via a steady-on ENGINE_LED and DPF_LED. In this case, there is a significant drop in engine performance and service regeneration is required with use of a diagnostic instrument.



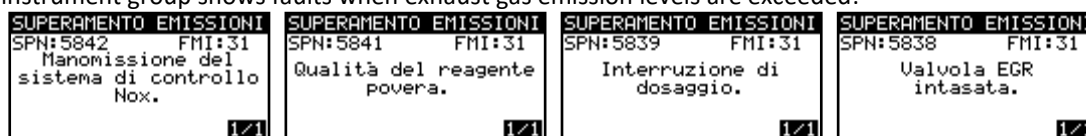
➤ SCR

The control unit indicates that the SCR system is malfunctioning or being tampered with and shows the related engine derating levels (inducement). The alert system was activated for the following reasons:

- Reagent level low
- Reagent quality poor
- Reagent dosing interrupted
- Malfunction of EGR valve
- Tampering with the monitoring system of the SCR.

DM32

The DM32 instrument group shows faults when exhaust gas emission levels are exceeded:



The codes are displayed as SPN and FMI; some are translated as per the table below:

SPN	FMI	TEXT
5842	31	NOx control system tampering.
5841	31	Poor reagent quality
5839	31	Dosing interrupted
5838	31	EGR valve clogged

SCR

The SCR instrument group consists of two instruments: reagent status and INDUCEMENT status

REAGENTE  12.8% 20°C	INDUCEMENT LIVELLO ATTUALE LEV.1 1/2	INDUCEMENT PROSSIMO LIVELLO per basso lvl urea: ----- per anomalia SCR: 36H00Min 2/2
---	---	--

SERIAL PORTS

The control unit has 5 serial ports: 3 RS485, 1 USB 2.0 and 1 CAN Bus.

- RS485: these ports can be used in slave mode so that an external device can poll the control unit using the MOD Bus RTU protocol.
- USB 2.0 is needed to:
 - Transfer settings using SW ZW-SMART.
 - Update the control unit's FW using SW ZW-UPG.
 - Querying with protocol MOD Bus RTU.
- CAN Bus: used to connect the control unit to the CAN Bus line of electronic engines with SAE J1939 protocol.

FAULTS

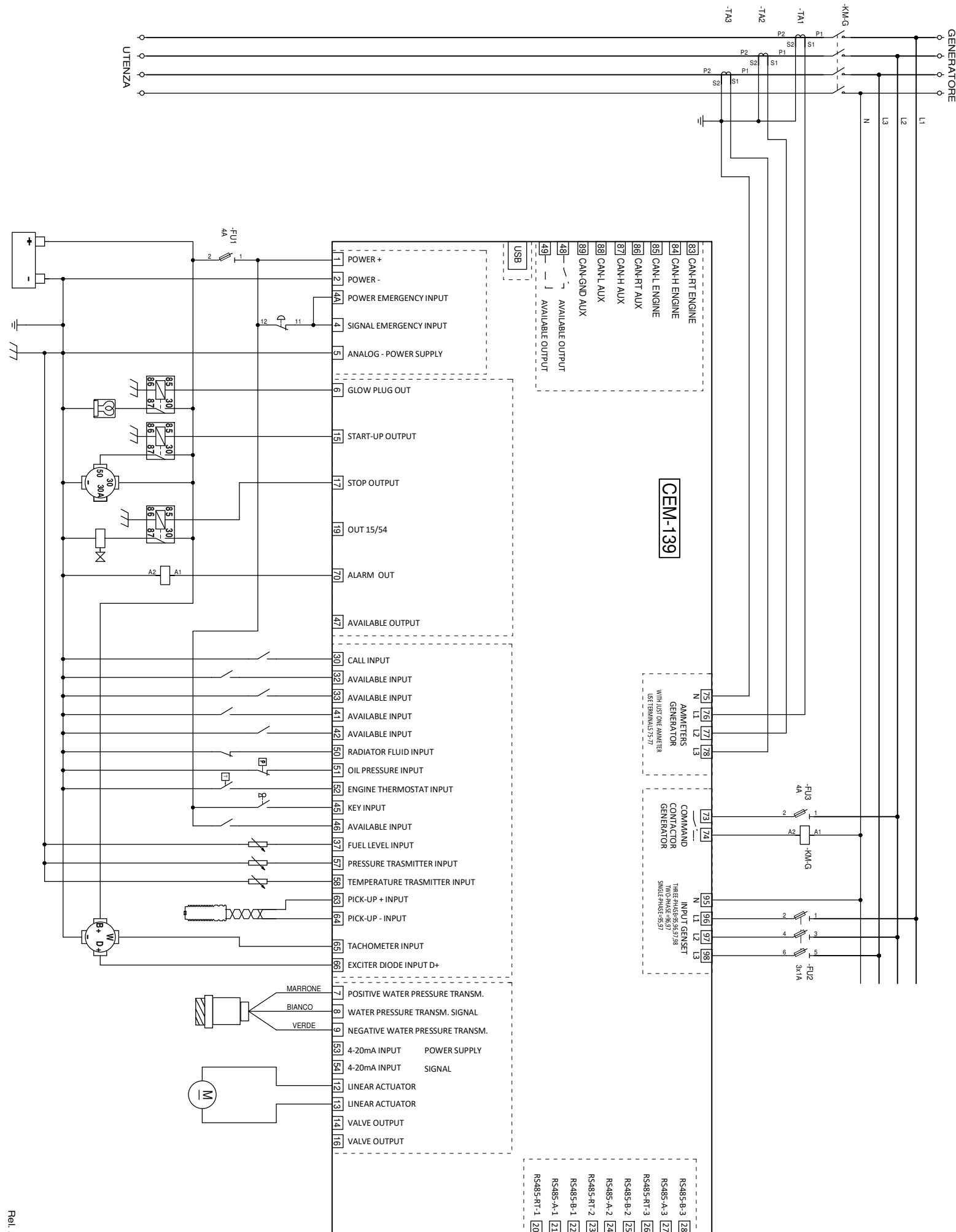
FAULT	SOURCE	ACTIVATION	MEMORY	STOP	WITH DECELERATION	WITH COOLING	Occurs when:
----	-	-	-	-	-	-	Unlinked fault
LOW OIL PRESSURE < Low engine oil pressure > OIL PRESSURE SWITCH	CONTACT OIL PRESSURE SWITCH	ENGINE PROTECTIONS ACTIVE	YES	YES	NO	NO	The oil pressure is lower than the pressure switch threshold and its contact is closed to ground.
< Oil pressure switch fault > ENGINE OVERTEMPERATURE < Engine overtemperature by thermostat >		WITH ENGINE STOPPED	YES	YES	NO	NO	The contact is open with engine stopped (the function can be disabled); this allows checking the integrity of the connection.
OVERTEMPERATURE WARNING < Engine overtemperature warning >	CONTACT THERMOSTAT	ENGINE PROTECTIONS ACTIVE	YES	YES	YES	YES	The temperature is higher than the thermostat threshold and its contact is closed to ground.
TEMPERATURE TX INTERRUPTED < Engine temperature transmitter disconnected >	TEMPERATURE TRANSMITTER	ALWAYS ACTIVE	YES	PRG	YES	YES	The temperature has exceeded the set threshold.
INCORRECT TEMP. TABLE < Incorrect temp. transmitter calibration table >		ALWAYS ACTIVE	NO	NO	-	-	The temperature transmitter is interrupted or malfunctioning.
PRES. TRASM. DISCON. < Low oil pressure warning >	-	ALWAYS ACTIVE	YES	NO	-	-	The CUSTOM engine temperature transmitter calibration table is incorrect.
PRES. TRASM. DISCON. < Pressure oil transmitter interrupted >		ALWAYS ACTIVE	YES	NO	-	-	The CUSTOM engine temperature transmitter calibration table is incorrect.
INCORRECT PRESSURE TABLE < Incorrect pressure transmitter calibration table >	OIL PRESSURE TRANSMITTER	ENGINE PROTECTIONS ACTIVE	NO	PRG	NO	NO	The oil pressure is lower than the set cut-in time threshold.
LOW FUEL PRESSURE < LOW FUEL PRESS >		ALWAYS ACTIVE	NO	NO	-	-	The engine pressure transmitter is interrupted or malfunctioning.
FUEL FLOAT TRANSM. FAULT < Fuel float connection disconnected >	FUEL PRESSURE SWITCH	ENGINE PROTECTIONS ACTIVE	YES	NO	-	-	The CUSTOM oil pressure transmitter calibration table is incorrect.
	FUEL PRESSURE SWITCH	ENGINE PROTECTIONS ACTIVE	YES	YES	NO	NO	The fuel pressure is lower than the pressure switch threshold and the contact is closed to ground (function-input FUEL PRESSURE SWITCH).
	FUEL FLOAT	ALWAYS ACTIVE	NO	NO	-	-	The fuel level transmitter is interrupted.

FUEL RESERVE < Fuel reserve >		ALWAYS ACTIVE	NO	NO	-	-	The fuel level is lower than the set threshold. Resets when the level rises above 2% of the threshold.
NO FUEL < Fuel finished>		ALWAYS ACTIVE	YES	PRG	YES	YES	Two simultaneous operations: -The fuel level is lower than the set threshold for the programmed range. -The ORANGE input (FUEL FLOAT SWITCH) is closed to ground.
FLOAT TABLE < Incorrect fuel float calibration table>	-	ALWAYS ACTIVE	YES	NO	-	-	The CUSTOM fuel float calibration table is incorrect.
COOLANT LEVEL < Low coolant level >	RADIATOR LEVEL	ALWAYS ACTIVE	YES	YES	YES	NO	The coolant has dropped below the minimum level.
ALTERNATOR FAULT < Charging alternator fault >	ALTERNATOR	ENGINE PROTECTIONS ACTIVE	YES	PRG	YES	YES	The alternator is not charging the battery or problem in the electrical system.
EMERGENCY < Engine stop Emergency pressed >	EMERGENCY BUTTON	ALWAYS ACTIVE	YES	YES	NO	NO	The emergency button is pressed.
FAULT IN i <FAULT In i> (30, 32, 33, 41, 42, 46)	CORRESPONDING INPUT	PRG	PRG	PRG	PRG	PRG	See PROGRAMMABLE INPUTS.
BATTERY UNDERVOLTAGE < Battery undervoltage >	BATTERY	ALWAYS ACTIVE	YES	PRG	YES	YES	The battery voltage is lower than the set threshold for the programmed time.
BATTERY OVERVOLTAGE < Battery overvoltage >		ALWAYS ACTIVE	YES	PRG	YES	YES	The battery voltage is higher than the set threshold for the time programmed.
FAILURE TO STOP < Failure of engine to stop >	SOLENOID VALVE OR ELECTROMAGNET	STOPPING PROCEDURE TERMINATED	YES	YES	-	-	Engine running is detected after the stopping system remained activated for the time ENGINE > STOP > FAILURE TO STOP.
UNDERSPEED < Engine Underspeed >	ALTERNATOR "W"	WHEN THRESHOLD REACHED	YES	PRG	NO	NO	The engine speed is lower than the set threshold.
OVERSPEED < Engine overspeed >		ALWAYS ACTIVE	YES	PRG	NO	NO	The engine speed is higher than the set threshold.
MAINTENANCE 1 MAINTENANCE 2 MAINTENANCE 3	SETTINGS	ALWAYS ACTIVE	YES	PRG	YES	NO	See settings.
KEYBOARD ERROR < Keyboard error>	-	IGNITION	YES	NO	-	-	Buttons were pressed in the ignition phase.
MEMORY ERROR < Non-volatile memory error>	-	ALWAYS ACTIVE	YES	NO	-	-	The non-volatile memory has a fault. To restore the error, switch the control unit off and on.
FAILURE TO START < Failure of engine to start>	-	STARTING PROCEDURE TERMINATED	YES	YES	NO	NO	The engine did not start up: -After a manual start-up -After a number of automatic start-up attempts equal to ENGINE > STARTING > START ATTEMPTS.
PUMP WATER UNDERPRESSURE < Water pump underpressure >	TPA-200	PUMP PROTECTIONS ACTIVE	YES	YES	YES	YES	See section PUMP PROTECTIONS.
PUMP WATER OVERPRESSURE < Water pump overpressure >		PUMP PROTECTIONS ACTIVE	YES	YES	YES	YES	
PUMP WATER MAX PRES. < Water pump maximum pressure >		ALWAYS ACTIVE	YES	YES	NO	NO	
PUMP WATER PRESS. TX FAULT < Water pump pressure transmitter fault>		ALWAYS ACTIVE	NO	YES	YES	NO	The values read by the transmitter are not consistent with the specifications. The transmitter could be disconnected or malfunctioning. See section PUMP PROTECTIONS.
PUMP PRESSURE SWITCH < Underpressure by pump pressure switch>	PUMP PRESSURE SWITCH	PUMP PROTECTIONS ACTIVE	YES	YES	YES	YES	See section PUMP PROTECTIONS.
ENGINE RPM FAULT < Engine RPM fault>		ENGINE PROTECTIONS ACTIVE	YES	NO	-	-	Engine rpm changed without control unit intervention (VAR).

RPM SETPOINT TIMEOUT < Maximum speed regulation time exceeded >		ENGINE PROTECTIONS ACTIVE	YES	YES	NO	NO	The speed setpoint has not been reached in double the time set
CAN BUS < CAN BUS communication error >	ENGINE ECU CONNECTION	CAN BUS ACTIVE	NO	YES	NO	NO	The control unit is not communicating correctly with the ENGINE ECU.
Warning overtemperature detected by the ECU < ECU OVERTEMPERATURE >	ENGINE ECU CONNECTION	CAN BUS ACTIVE ENGINE PROTECTIONS ACTIVE	YES	PRG	YES	YES	Engine overtemperature pre-alarm sent by the engine ECU. Active fault only for Stage V engines.
Overtemperature detected by the ECU < ECU OVERTEMPERATURE >	ENGINE ECU CONNECTION	CAN BUS ACTIVE ENGINE PROTECTIONS ACTIVE	YES	YES	YES	YES	Engine overtemperature error sent by the engine ECU. Active fault only for Stage V engines.
Low oil pressure detected by the ECU < ECU LOW OIL PRESSURE >	ENGINE ECU CONNECTION	CAN BUS ACTIVE ENGINE PROTECTIONS ACTIVE	YES	YES	NO	NO	Low oil pressure error sent by the engine ECU. Active fault only for Stage V engines.
Vacuum transducer interrupted < VACUUM TX INTERRUPTED >	DELIVERY VACUUM SENSOR	ALWAYS ACTIVE	NO	NO	-	-	See cavitation description.
Pump cavitation pre-alarm < CAVITATION PRE-ALARM >		PUMP PROTECTIONS ACTIVE	NO	NO	-	-	
Pump cavitation alarm < CAVITATION ALARM >		PUMP PROTECTIONS ACTIVE	YES	YES	YES	YES	
Work hours threshold in cavitation exceeded < MAX CAVITATION TIME >		ALWAYS ACTIVE	YES	NO	-	-	
Attempted to start with safety conditions on < START WITH SAFETY ON >	CORRESPONDING INPUT	ALWAYS ACTIVE	NO	YES	NO	NO	Fault managed it will only if the input function REGENERATION CONSENT is programmed. The control unit signals the fault if an attempt is made to start the engine with safety conditions enabled. In order to be able to start the engine, it will be necessary to remove the safety conditions and then enable them with the engine running, when it is necessary to perform manual regeneration.
Generator undervoltage < G.S. UNDERVOLTAGE >	GENERATOR	10 seconds after passing the threshold.	YES	PRG	YES	YES	The generator voltage is lower than the set threshold.
Generator overvoltage < G.S. OVERVOLTAGE >		After engine running detection.	YES	PRG	YES	YES	The generator voltage is higher than the set threshold.
Generator underfrequency < G.S. UNDERFREQUENCY >		10 seconds after passing the threshold.	YES	PRG	YES	YES	The generator Hz value is lower than the set threshold.
Generator Overfrequency < G.S. OVERFREQUENCY >		ALWAYS ACTIVE	YES	PRG	NO	NO	The generator Hz value is higher than the set threshold.
The generator is not supplying voltage < GENERATOR NOT SUPPL. >		ALWAYS ACTIVE	YES	PRG	YES	YES	Although running, the generator does not deliver voltage.
Generator overload warning < G.S. OVERLOAD WARNING >		ALWAYS ACTIVE	NO	NO	NO	NO	The current absorbed by the generator has exceeded the pre-alarm threshold.
Generator overload < G.S. OVERLOAD >		ALWAYS ACTIVE	YES	PRG	YES	YES	The current absorbed by the generator has exceeded the alarm threshold.
Generator Overpower < G.S. OVERPOWER >		ALWAYS ACTIVE	YES	PRG	YES	YES	The power absorbed by the generator has exceeded the alarm threshold.
Incorrect genset phase sequence < INCORRECT PHASE SEQU. >		ALWAYS ACTIVE	NO	PRG	YES	YES	The sequence of the three generator phases is not correct.
Genset asymmetry out of range < G.S. ASYMMETRY >		ALWAYS ACTIVE	YES	PRG	YES	YES	The voltages between the three generator phases are not similar.

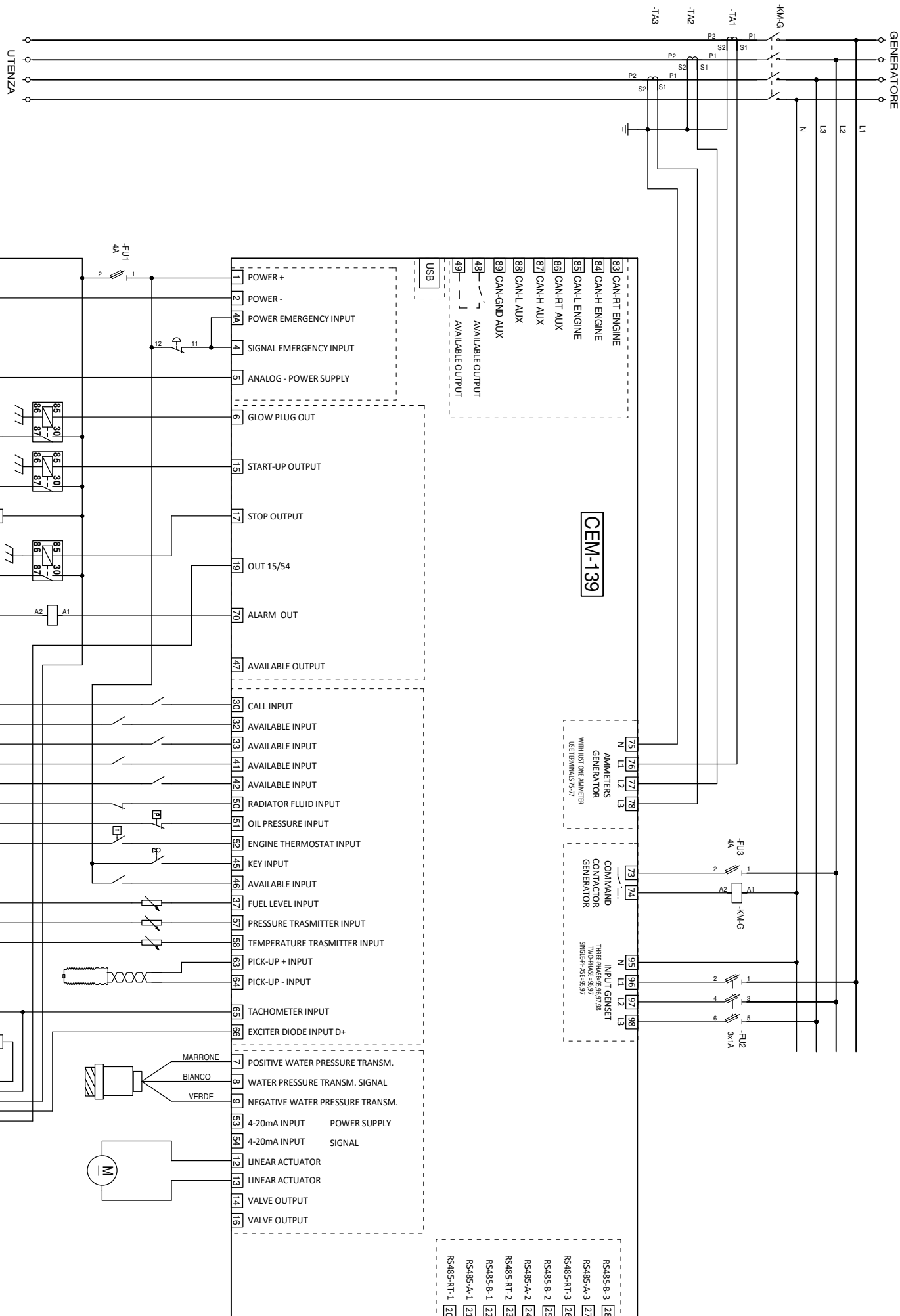
WIRING DIAGRAM

DIAGRAM FOR MECHANICAL MOTORS



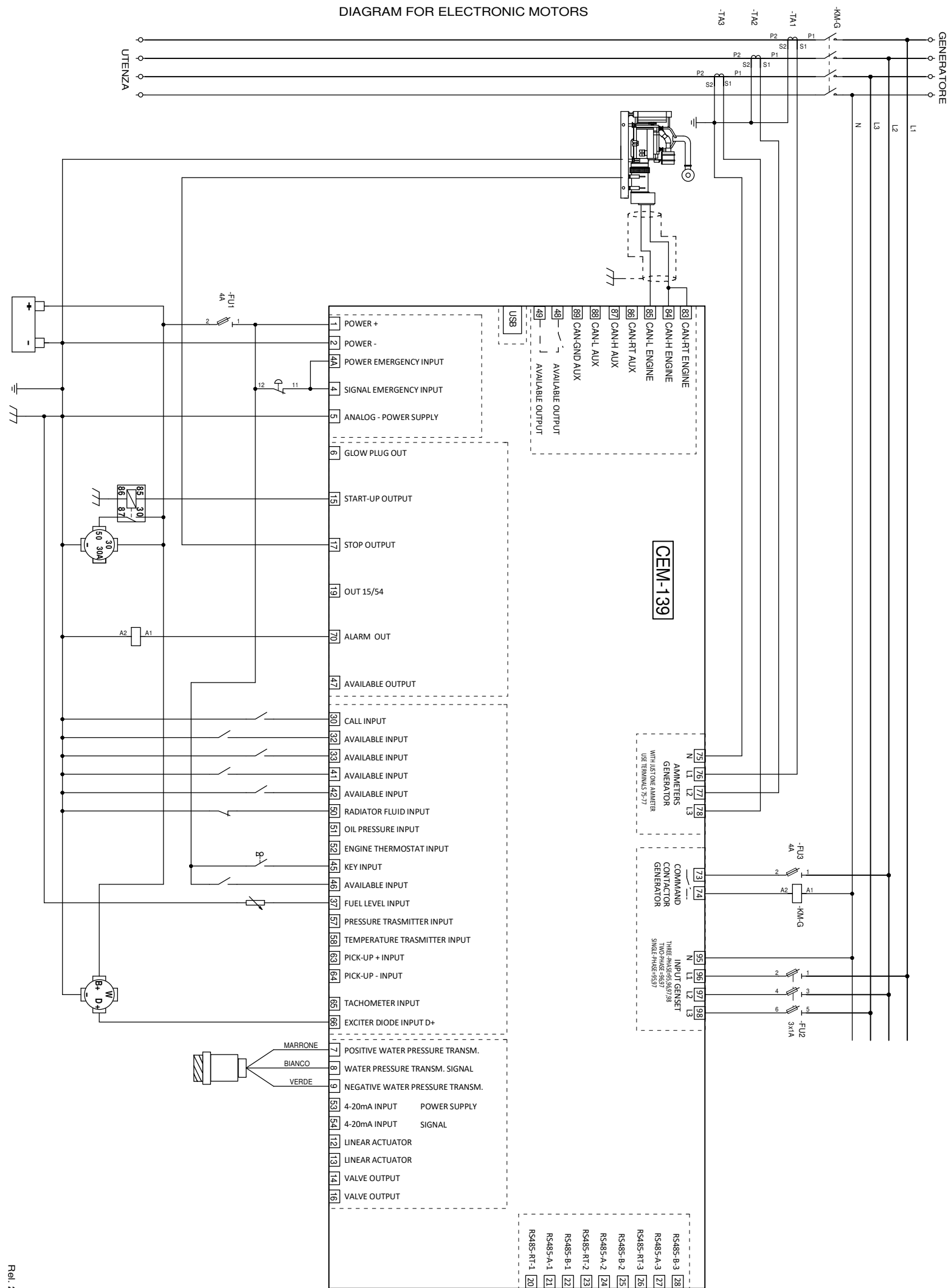
WIRING DIAGRAM

DIAGRAM FOR MECHANICAL MOTORS WITH PERMANENT MAGNETS ALTERNATOR



Basic scheme subject to change without notice.

DIAGRAM FOR ELECTRONIC MOTORS



SETTINGS

Programming can be accessed when the engine is stopping. Put the control unit in go to the <<PROG>> instrument (CLOCK instrument, then press UP_BUTTON), and then press and hold the UP_BUTTON until OK! is displayed. During setting, the FAULT_LED emits two quick flashes.



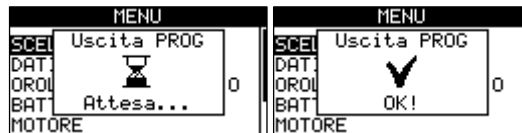
To move between the menus, use the UP_BUTTON, DOWN_BUTTON, RIGHT_BUTTON, LEFT_BUTTON and select the parameter to be displayed or modified with the RIGHT_BUTTON.

After period of time in settings without any activity, the control unit returns to the operating mode on its own.

To exit settings, press the MODE_BUTTON or go to the start menu:



Press and hold down the LEFT_BUTTON until OK! is displayed.



SETTING TYPES

There are multiple types of settings available:

- MULTIPLE CHOICE**

This allows one parameter to be selected from many, for example the language. The set parameter is the one with the black dot next to it; the selection can be changed using the UP_BUTTON and DOWN_BUTTON.



To confirm the parameter, press the ACK_BUTTON until OK is displayed.



To exit settings, press the LEFT_BUTTON or the MODE_BUTTON.

- PASSWORD**

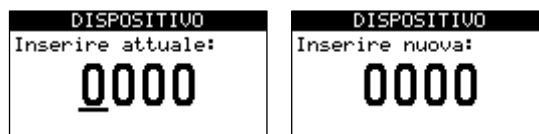
Access to some menus, or setting of some parameters, requires the entry of a numerical password:



One digit is entered at a time; use the LEFT_BUTTON and RIGHT_BUTTON to move the cursor, and the UP_BUTTON and DOWN_BUTTON to change the digit. To test, use the ACK_BUTTON until the result appears:



It is possible to change the password in the same manner; the existing password must be entered first.



To exit settings, press the TORTOISE_BUTTON.

- **CLOCK/CALENDAR**

The current time and date are displayed:

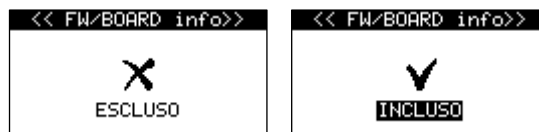


The value shown can be changed using the UP_BUTTON or DOWN_BUTTON. To change selection, use the RIGHT_BUTTON or the LEFT_BUTTON. To exit settings, use the TORTOISE_BUTTON or press the MODE_BUTTON. It does not require confirmation. The time is retained by the control unit even when it is not powered, thanks to an internal battery.

If the internal battery is not installed, the following date and time will be set on start-up: 1/01/2019, 00:00.00.

- **EXCLUSION**

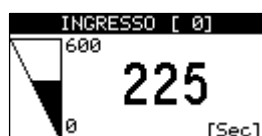
A parameter can be enabled or disabled; use the UP_BUTTON or DOWN_BUTTON to change the setting. If the parameter is modified, the text is highlighted.



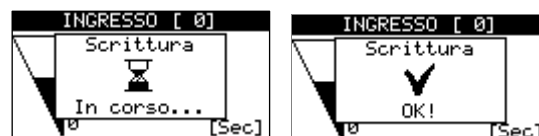
To set, press the ACK_BUTTON until OK is displayed. To exit settings, press the LEFT_BUTTON or the MODE_BUTTON.

- **VALUE**

The settings screen displays the value of the parameter in the centre (highlighted if modified), the unit of measurement at the bottom right, and the details and qualitative indication of the value on the left:



Use the UP_BUTTON or DOWN_BUTTON to modify the value and the ACK_BUTTON to confirm the value:



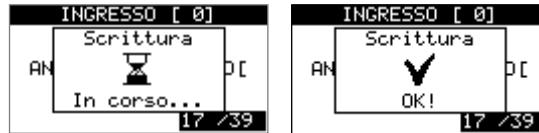
To exit settings, press the LEFT_BUTTON or the MODE_BUTTON. Normally, the set value takes effect only after OK! is displayed. In some settings, the value is modified instantly and retained only if confirmed: an example of this is the LCD contrast setting.

- **TEXT STRING SETTINGS**

The text to be modified is displayed at the centre, and the available characters at the bottom right. The cursor indicates the character being edited. Use the LEFT_BUTTON and RIGHT_BUTTON to move the cursor, and the UP_BUTTON and DOWN_BUTTON to change the character.



To set, press the ACK_BUTTON until OK is displayed.



To exit settings, use the TORTOISE_BUTTON or press the MODE_BUTTON.

- **TABLE SETTINGS**

In some cases table values must be set, for example for the fuel float sensor. The values are represented in two columns:

TEMPERATURA ACQUA		
80 °C	---	
85 °C	---	
90 °C	---	
95 °C	---	
100 °C	---	

The element being modified is highlighted and flashes. Use the RIGHT_BUTTON to increase the value and the LEFT_BUTTON to decrease it; once the value has been modified, two dots are displayed beside it. To set the entire table, press the ACK_BUTTON until OK is displayed:

TEMPERATURA ACQUA		
80 °C	15 Ω	•
85 °C	45 Ω	•
90 °C	79 Ω	•
95 °C	102 Ω	•
100 °C	177 Ω	•

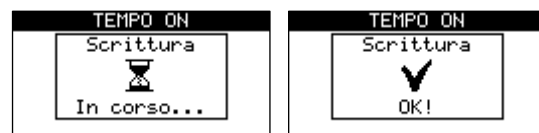
To exit settings, use the TORTOISE_BUTTON or press the MODE_BUTTON.

- **TIME**

Times can be modified in day/hour/minute format or hour/minute format. Two examples follow:



Use the LEFT_BUTTON and RIGHT_BUTTON to move the selection (flashing value with cursor) and the UP_BUTTON and DOWN_BUTTON to change the value; press the ACK_BUTTON to set the value. To exit settings, use the TORTOISE_BUTTON or press the MODE_BUTTON.

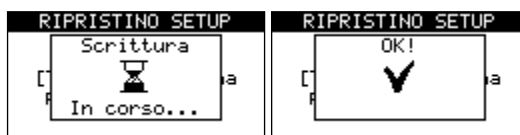


- **CONFIRM ACTION**

Some settings require confirmation; for example the factory settings reset SETUP RESETTING:



To confirm, press the ACK_BUTTON until OK is displayed:



- **SPECIAL CASES**

There are some special types of settings (for example, tachometer calibration TACHOMETER CALIBRAT.); please see the instructions on the display.

PARAMETER SETTINGS

LANGUAGE CHOICE			
Parameter	Factory settings	Range	Notes
LANGUAGE	ITALIANO	ITALIANO	Resetting the language overwrites programmable fault text and maintenance operation text with the default language value. A CUSTOM language cannot be selected unless the messages have been programmed with the ZW-SMART software.
		ENGLISH	
		FRANÇAIS	
		DEUTSCH	
		ESPAÑOL	
		PORTUGUES	
		CUSTOM	

DATA				
Parameter	Variable		Factory settings	Notes
DATA	RELEASE HW	BOARD A RELEASE HW	Release and HW code of the device.	BOARD A RELEASE HW HW Code: _____40332676 Board: _____1.00 Assembly: _____1.00
		BOARD C RELEASE HW		BOARD C RELEASE HW HW Code: _____40332678 Board: _____1.00 Assembly: _____1.00
		BOARD D RELEASE HW		BOARD D RELEASE HW HW Code: _____40332679 Board: _____1.00 Assembly: _____1.00
		BOARD E RELEASE HW		BOARD E RELEASE HW HW Code: _____40332680 Board: _____1.00 Assembly: _____1.00
	RELEASE FW		Release and FW code of the device.	RELEASE FW FW Code: _____0x405A Boot: _____1.01 App: _____1.00
	INFO		Registration, model, serial number and system commissioning date.	INFO s.n.: 0001647400009999 Type: CEM-139 Mat: _0100102010021400 Avvio: _____10/09/2020

	DEVICE	Number of start ups, total running time and test date	DISPOSITIVO Time:_____123h45'32s Switch ON:_____22 Coll:_____25/10/2022
	RETENTION	Operation information	RETENTION Contaore:_____2:25 AVVIAMENTI_____48 MANCATI AVVIAMENTI__0

CALENDAR CLOCK				
Parameter	Variable	Factory settings	Range	Notes
CALENDAR CLOCK	DATE AND TIME	...		Clock/calendar settings.
	FORMAT	ANALOGUE	ANALOGUE	
			DIGITAL	

BATTERY				
Parameter	Variable	Factory settings	Range	Notes
ENTER PASSWORD		"0000"	"0000" – "9999"	Entering the correct password allows the parameters to be changed.
CHANGE PASSWORD		"0000"	"0000" – "9999"	Change the password for access to the menu.
VOLTMETER BATT.	INCLUDED	INCLUDED	INCLUDED	Displays the starting battery voltage measured between terminals 1 and 2. If disabled, faults "Battery undervoltage" and " Battery overvoltage" are not active.
			EXCLUDED	
BATTERY VOLTAGE	12 V	12 V	12 V	Nominal battery voltage; by setting a new value, the thresholds and delays of BATTERY UNDERVOLTAGE, BATTERY OVERVOLTAGE and ENGINE > ALTERNATOR CHARGE > ALTERNATOR D+ > ENGINE RUNNING D+ are reset to the default values.
			24 V	
BATTERY UNDERVOLTAGE	FAULT	INCLUDED	INCLUDED	See fault.
			EXCLUDED	
	THRESHOLD	11 V [12 V] 22 V [24 V]	(8 ÷ 14) V [12 V] (16 ÷ 28) V [24 V]	
	DELAY	2 s	(1 ÷ 5) s	
BATTERY OVERVOLTAGE	STOP	WITHOUT STOP	WITHOUT STOP	See fault.
			WITH STOP	
	FAULT	INCLUDED	INCLUDED	
			EXCLUDED	
BATTERY OVERVOLTAGE	THRESHOLD	16 V [12 V] 32 V [24 V]	(12 ÷ 18) V [12 V] (24 ÷ 36) V [24 V]	See fault.
	DELAY	2 s	(1 ÷ 5) s	
	STOP	WITH STOP	WITHOUT STOP	
			WITH STOP	

ENGINE				
Parameter	Variable	Factory settings	Range	Notes
ENTER PASSWORD		"0000"	"0000" – "9999"	Entering the correct password allows the parameters to be changed.
CHANGE PASSWORD		"0000"	"0000" – "9999"	Change the password for access to the menu.
ENGINE PROTECTION DELAY		10 s	(5 ÷ 60) s	Engine protection activation delay after engine running detected.
STOP	STOPPING SYSTEMS	ENERGIZ. IN RUN. MODE	ENERGIZ. IN RUN. MODE	Fuel supply system.
			ENERGIZ. IN STOP MODE	
	STOPPING TIME	20 s	(0 ÷ 60) s	Stopping system activation time with engine at a standstill.
	FAILURE TO STOP	120 s	(0 ÷ 120) s	See STOPPING FAILURE fault.
STARTING	STARTING TIME	5 s	(5 ÷ 25) s	Starter motor activation time.
	PAUSE TIME	5 s	(5 ÷ 10) s	Pause between start-up attempts.
	STARTING TIME	4	1 ÷ 15	See START-UP FAILURE fault

GLOW PLUGS	PREHEATING		0 s	(0 ÷ 60) s	Activated before start-up. 0 sec, pre-heating off. Too long a time can damage the glow plugs.
	POST-HEATING		0 s	(0 ÷ 60) s	Enabled throughout engine start-up and for the set time. 0 sec, post-heating off.
OIL PRESSURE CHECK			BEFORE STARTING	WITH ENGINE RUNNING	Checks only the opening of the contact with the engine running.
				BEFORE STARTING	Also checks closing of contact with engine switched off.
RADIATOR LEVEL PROBE			NORMAL OPERATION	NORMAL OPERATION	If there is no liquid, the probe switches off the ground signal.
				REVERSED OPERATION	If there is no liquid, the probe switches on the ground signal.
ENGINE TEMPERATURE	FUNCTION		EXCLUDED	EXCLUDED	Enables or disables the instrument and its function.
				INCLUDED	
	TYPE		TTAO/402	See list “ENGINE TRANSDUCERS”	Transmitters already entered.
	TABLE	25 °C	----	(0 ÷ 3200) Ω	Custom interpolation table which associates the resistance values with the temperature values. Associate at least two values. The fault TEMPERATURE TABLE ERROR will be generated if only one value, or else non-monotonic values, are entered.
		50 °C	----		
		70 °C	----		
		80 °C	----		
		85 °C	----		
		90 °C	----		
		95 °C	----		
		100 °C	----		
		120 °C	----		
	130 °C	----			
	OVERTEMP ERATURE WARNING	FAULT	EXCLUDED	EXCLUDED	See fault.
				INCLUDED	
		THRESHOLD	100 °C	(90 ÷ 140) °C	
	STOP	WITHOUT STOP	WITH STOP		
			WITHOUT STOP		
	TX INTERRUPT ED	FAULT	INCLUDED	EXCLUDED	
			INCLUDED		
OIL PRESSURE	FUNCTION		EXCLUDED	EXCLUDED	Enables or disables the instrument and its function.
				INCLUDED	
	TYPE		TPO/403	See list “ENGINE TRANSDUCERS”	Transmitters already entered.
	TABLE	0 bar	----	(0 ÷ 380) Ω	Custom interpolation table which associates the resistance values with the pressure values. Associate at least two values. The fault PRESSURE TABLE ERROR will be generated if only one value, or else non-monotonic values, are entered.
		1 bar	----		
		2 bar	----		
		3 bar	----		
		4 bar	----		
		5 bar	----		
		6 bar	----		
		7 bar	----		
		8 bar	----		
	9 bar	----			
	LOW OIL PRESS. WARN.	FAULT	EXCLUDED	INCLUDED	See fault.
				EXCLUDED	
		THRESHOLD	0,5 bar	(0 ÷ 6,0) bar	
		DELAY	1 s	(1 ÷ 5) s	
		STOP	WITHOUT STOP	WITH STOP	
				WITHOUT STOP	
FUEL LEVEL	FUNCTION		INCLUDED	EXCLUDED	Enables or disables the instrument and its function.
				INCLUDED	
	TYPE		VEGLIA	See list “ENGINE TRANSDUCERS”	Transmitters already entered.
	TABLE	0 %	----	(0 ÷ 380) Ω	Custom interpolation table which associates the resistance values with the fuel percentage values. Associate at least two values. The fault FLOAT TABLE ERROR will be generated if only one value, or else non-monotonic values, are entered.
		10 %	----		
		20 %	----		
		30 %	----		
		40 %	----		
		50 %	----		
		60 %	----		
		70 %	----		
		80 %	----		
		90 %	----		
	100 %	----			
	FUEL RESERVE	THRESHOLD	10 %	(0 ÷ 100) %	NO FUEL fault parameters from level.
		FAULT	INCLUDED	INCLUDED	

	FUEL FINISHED			EXCLUDED	NO FUEL fault (level or input) stops or not.	
		THRESHOLD	1 %	(0 ÷ 100) %		
		DELAY	3 s	(0 ÷ 60) s		
		STOP	WITH STOP	WITH STOP WITHOUT STOP		
ALTERNATOR CHARGE	ALTERNAT OR D+	FUNCTION	INCLUDED	INCLUDED EXCLUDED	Includes full management of D+: -fault -engine running	
		THRESHOLD	7 V [12 V] 14 V [24 V]	(3 ÷ 24) V	Assessment threshold	
		FAULT	INCLUDED	INCLUDED EXCLUDED	Includes D+ in the charging ALTERNATOR FAULT assessment.	
		STOP	WITHOUT STOP	WITH STOP WITHOUT STOP	Stop enabled or disabled in the event of fault.	
		ENGINE RUNNING	INCLUDED	INCLUDED EXCLUDED	Includes D+ in the engine running assessment.	
		PRE-EXCITATION	INCLUDED	INCLUDED EXCLUDED	Enables alternator pre-excitation.	
	ALTERNAT OR W	FUNCTION	INCLUDED	INCLUDED EXCLUDED	Includes full management of W.	
		FAULT	INCLUDED	INCLUDED EXCLUDED	Includes W in the charging alternator fault assessment.	
		STOP	WITHOUT STOP	WITH STOP WITHOUT STOP	Stop enabled or disabled in the event of fault.	
		ENGINE RUNNING W	INCLUDED	INCLUDED EXCLUDED	Includes W in the engine running assessment and in the RPM displayed.	
		CALIBRATION	----	(600 ÷ 5000) RPM	Performs RPM calibration. Provides access to parameter after entering the ENGINE password.	
	PICK-UP		FUNCTION	EXCLUDED	INCLUDED EXCLUDED	Detection of engine running from input 63 and 64 via a pick-up.
			FAULT	WITH STOP	WITH STOP WITHOUT STOP	The fault is generated when the pick-up stops generating frequency. It is saved . If a stop occurs, it does not cool the system .
			PICKUP INTERRUPTED	EXCLUDED	INCLUDED EXCLUDED	The pick-up circuit is interrupted. Stops without cooling the system . The fault is saved .
			ENGINE RUNNING PICKUP	EXCLUDED	INCLUDED EXCLUDED	Includes the pick-up in the engine running assessment and in the RPM displayed.
			CALIBRATION	----	(600 ÷ 5000) RPM	Performs RPM calibration. Provides access to parameter after entering the ENGINE password.
ENGINE RUNNING RPM			THRESHOLD	600 RPM	(300 ÷ 4000) RPM	Engine running assessment threshold.
UNDERSPEED		FUNCTION	EXCLUDED	INCLUDED EXCLUDED	UNDERSPEED fault settings	
		THRESHOLD	0 RPM	(0 ÷ 4000) RPM		
		STOP	WITHOUT STOP	WITH STOP WITHOUT STOP		
OVERSPEED		FUNCTION	EXCLUDED	INCLUDED EXCLUDED	OVERSPEED fault settings	
		THRESHOLD	4000 RPM	(0 ÷ 4000) RPM		
		STOP	WITH STOP	WITH STOP WITHOUT STOP		
MAXIMUM SPEED			4000 RPM	(0 ÷ 4000) RPM	The maximum RPM value that the engine can reach. When the engine reaches this value, the control unit does not allow the engine rpm to increase any further.	
MINIMUM SPEED			800 RPM	(0 ÷ 4000) RPM	Available only for electronic engines. It is the RPM value which is set on engine start-up.	
OUTPUT 15/54			FUNCTION 15/54	FUNCTION 15/54 ALWAYS ACTIVE	Activates during engine start-up. Always active; it turns off only with the control unit in power saving mode.	
HEATING TIME			0 s	(0 ÷ 600) s	Once the diesel engine start-up is completed, the control unit waits for the warm-up period before reaching the working RPM. Protections are active during the warm-up.	
COOLING TIME			0 s	(0 ÷ 600) s	Once deceleration is complete, the control unit waits for the cooling time before stopping the engine. Cooling does not take place if faults have occurred.	
Engine RPM fault		FUNCTION	INCLUDED	INCLUDED	Settings for the fault Engine RPM fault.	

REVS PER MINUTE	THRESHOLD	100 RPM	EXCLUDED	Tachometer adjustment to the generator frequency. Programming required when NOT using the "W" of the charge alternator
			(50 ÷ 1000) RPM	
	1500 / 1800 RPM		750 / 900 RPM	
			1000 / 1200 RPM	
			1500 / 1800 RPM	
			3000 / 3600 RPM	

ENGINE TRANSDUCERS

The control unit has already recorded some values of temperature, pressure and fuel float.

Temperature transmitter tables already entered in the control unit										
TYPE	25°C	50°C	70°C	80°C	85°C	90°C	95°C	100°C	120°C	130°C
TTAO/402	896 Ω	365 Ω	196 Ω	145 Ω	127 Ω	110 Ω	97 Ω	85 Ω	53 Ω	30 Ω
VDO/120	544 Ω	197 Ω	97 Ω	70 Ω	60 Ω	51 Ω	44 Ω	38 Ω	22 Ω	17 Ω
VDO/150	909 Ω	324 Ω	157 Ω	113 Ω	97 Ω	83 Ω	72 Ω	62 Ω	37 Ω	29 Ω
BERU	4036 Ω	1259 Ω	560 Ω	387 Ω	324 Ω	273 Ω	231 Ω	196 Ω	106 Ω	80 Ω
VEGLIA		708 Ω	399 Ω	245 Ω	210 Ω	175 Ω	153 Ω	130 Ω	75 Ω	59 Ω
JCB/1707	503 Ω	200 Ω	105 Ω	78 Ω	67 Ω	59 Ω	51 Ω	45 Ω		9
LOMBARDINI	927 Ω	322 Ω	155 Ω	112 Ω	96 Ω	83 Ω	71 Ω	62 Ω	36 Ω	29 Ω
F16173	2130 Ω	834 Ω	435 Ω	323 Ω	280 Ω	243 Ω	213 Ω	186 Ω	114 Ω	91 Ω
VSG40028	1896 Ω	813 Ω	387 Ω	275 Ω	234 Ω	199 Ω	171 Ω	145 Ω	80 Ω	64 Ω
DUTG	1232 Ω	579 Ω	294 Ω	159 Ω	142 Ω	126 Ω	109 Ω	92 Ω	56 Ω	35 Ω
DAEWOO	446 Ω	153 Ω	73 Ω	52 Ω	44 Ω	38 Ω	32 Ω	28 Ω	16 Ω	12 Ω
CUSTOM	-	-	-	-	-	-	-	-	-	-

Pressure transmitter tables already entered in the control unit										
TYPE	0BAR	1BAR	2BAR	3BAR	4BAR	5BAR	6BAR	7BAR	8BAR	9BAR
TPO/403	270 Ω	251 Ω	203 Ω	157 Ω	114 Ω	79 Ω	47 Ω	32 Ω	23 Ω	1 Ω
VDO	10 Ω		50 Ω		85 Ω		119 Ω		152 Ω	
VDO 29/10	9 Ω	38 Ω	57 Ω	77 Ω	99 Ω	114 Ω	134 Ω	149 Ω	164 Ω	180 Ω
LOMBARDINI	10 Ω	31 Ω	52 Ω	71 Ω	90 Ω	107 Ω	124 Ω	140 Ω	156 Ω	170 Ω
[10-180] Ω	10 Ω	27 Ω	44 Ω	61 Ω	78 Ω	95 Ω	112 Ω	129 Ω	146 Ω	163 Ω
[240-33,5] Ω	240 Ω	219 Ω	199 Ω	178 Ω	157 Ω	137 Ω	116 Ω	95 Ω	75 Ω	54 Ω
DD6E	7 Ω	39 Ω	72 Ω	104 Ω	132 Ω	159 Ω	187 Ω	215 Ω	242 Ω	270 Ω
VSG40030	259 Ω	215 Ω	172 Ω	139 Ω	106 Ω	83 Ω	60 Ω	46 Ω	32 Ω	21 Ω
CUSTOM	-	-	-	-	-	-	-	-	-	-

Fuel float tables already entered in the control unit		
TYPE	0%	100%
VEGLIA	300 Ω	0 Ω
VDO	10 Ω	181 Ω
DATCON	240 Ω	37 Ω
[10-180] Ω	10 Ω	180 Ω
[240-33,5] Ω	240 Ω	34 Ω
DUMP	5 Ω	90 Ω
EUROSWITCH	3 Ω	184 Ω
WITH CONTACT (W)	CHIUSO	APERTO
CUSTOM	-	-

ENGINE ECU					
Parameter	Variable	Factory settings		Range	Notes
ENTER PASSWORD	CAN_BUS_PSW	"0000"	"0000" – "9999"	Entering the correct password allows the parameters to be changed.	
CHANGE PASSWORD	CAN_BUS_PSW	"0000"	"0000" – "9999"	Change the password for access to the menu.	
ENGINE TYPE		NO CAN BUS		NO CAN BUS	Conventional mechanical engine
				SAE J1939 GENERIC	Choice of engine type equipped with control unit for electronic control of the injection system (ECM / ECU).
				FPT STAGE V	
				DOOSAN STAGE V	
				KOHLER STAGE V	
SWITCH-OFF OF INSTR. (only for electronic engines)	FUEL USED	EXCLUDED		INCLUDED	Instruments displayed on the control unit.
				EXCLUDED	
	INSTANT CONSUMPTION	INCLUDED		INCLUDED	
				EXCLUDED	
	ENGINE TEMPERATURE	INCLUDED		INCLUDED	
				EXCLUDED	

	FUEL TEMPERATURE		INCLUDED	INCLUDED	
				EXCLUDED	
	TURBO TEMPERATURE		INCLUDED	INCLUDED	
				EXCLUDED	
	OIL TEMPERATURE		INCLUDED	INCLUDED	
				EXCLUDED	
	INTERCOOLER TEMPERATURE		INCLUDED	INCLUDED	
				EXCLUDED	
	INTAKE TEMP.		INCLUDED	INCLUDED	
				EXCLUDED	
	FUEL PRESSURE		INCLUDED	INCLUDED	
				EXCLUDED	
	COOLANT LEVEL		INCLUDED	INCLUDED	
				EXCLUDED	
	COOLANT PRESSURE		INCLUDED	INCLUDED	
				EXCLUDED	
	ENGINE TORQUE		EXCLUDED	INCLUDED	
				EXCLUDED	
	ENGINE LOAD		INCLUDED	INCLUDED	
				EXCLUDED	
OIL LEVEL		INCLUDED	INCLUDED		
			EXCLUDED		
SOOT LEVEL		INCLUDED	INCLUDED		
			EXCLUDED		
ASH LEVEL		INCLUDED	INCLUDED		
			EXCLUDED		
REAGENT LEVEL		INCLUDED	INCLUDED		
			EXCLUDED		
REAGENT TEMPERATURE		INCLUDED	INCLUDED		
			EXCLUDED		
ADDRESS (only for electronic engines)			1	1 ÷ 255	Control unit source address.
REV CONTROL (only for electronic engines)	FUNCTION		INCLUDED	INCLUDED	Sends the speed adjustment command.
				EXCLUDED	
	STEP	20		5 ÷ 500 RPM	Adjust the acceleration and deceleration speed.
TIME	100		10 ÷ 1000 ms		
KOHLER S5 PARAMETERS (only for Kohler Stage V)	DPF		INCLUDED	INCLUDED	Enables/disables the instruments for the particulate filter
				EXCLUDED	
	SCR		INCLUDED	INCLUDED	Enables/disables the instruments for the SCR system
				EXCLUDED	
	AUTOM. REGENERATION		INCLUDED	INCLUDED	Enables/disables automatic regeneration of the particulate filter
				EXCLUDED	
	INDUCEMENT PARAMETERS		IEUROPEAN LEGISLATION	EUROPEAN LEGISLATION	Selects the type of reference standard
			U.S.A. LEGISLATION		
FPT S5 PARAMETERS (only for FPT Stage V)	REGENERATION SIGNAL		MOMENTARY SIGNAL	MOMENTARY SIGNAL	Selects the type of signal used in the particulate filter regeneration procedure
				SOLID STATE	
	AUTOM. REGENERATION		INCLUDED	INCLUDED	INCLUDED
			EXCLUDED		
MANUAL REGENERATION		INCLUDED	INCLUDED	INCLUDED	Enables/disables forced regeneration of the particulate filter
			EXCLUDED		
OIL COUNTERS RESET		INCLUDED	INCLUDED	INCLUDED	Enables/disables option to reset the engine ECU oil quality-related counters. Function enabled only with engine off with SERVICE enabled.
			EXCLUDED		
ECU WARNING OVERTEMP.	FAULT	EXCLUDED	INCLUDED	INCLUDED	See fault Warning of overtemperature detected by ECU
				EXCLUDED	
	STOP	WITHOUT STOP	WITH STOP		
			WITHOUT STOP		
INJECTION OFF TIME (only for electronic engines)			30 s	(0 ÷ 60) s	Time for which the control unit keeps the injection signal disabled before entering standby (is added to the STAND-BY INPUT TIME in the menu DEVICE)

CURRENT TRANSFORMERS			
Parameter	Factory settings	Range	Notes
FUNCTION	INCLUDED	INCLUDED	Reading of currents included.
		EXCLUDED	Reading of currents excluded; power readings and related functions are also excluded (overloading, faults, power on demand).
RATIO	50/5	30/5, 40/5, 50/5, 60/5, 80/5, 100/5, 150/5, 200/5, 250/5, 300/5, 400/5, 500/5, 600/5, 800/5,	For an accurate reading, use of the following cables is recommended:

		1000/5, 1200/5, 1500/5, 2000/5, 2500/5, 3000/5, 4000/5	1 metre – 1.5mm ² 2 metres – 2.5mm ² 3 metres – 4mm ²
NUMBER OF AMMETERS	L1, L2, L3	L1, L2, L3	Connect the 3 A.T.s in the relative phases.
		L2	Connect only one ammeter to phase L2.

GENERATOR					
Parameter		Variable	Factory settings	Range	Notes
FUNCTION			ON	ON	Generator management included.
				OFF	Generator management excluded; voltage, current, frequency, power readings and related functions (overloads, faults, contactor) are also excluded.
TYPE OF CONNECTION			3-PHASE: L1-L2-L3-N	3-PHASE: L1-L2-L3-N	Connect terminals 95, 96, 97, 98.
				TWO-PHASE: L1-L2	Connect terminals 96, 97.
				SINGLE-PHASE: L2-N	Connect terminals 95, 97.
FREQUENCY			50 Hz	50 Hz	Automatically selects the G.S. UNDERFREQUENCY and G.S. OVERFREQUENCY parameters.
				60 Hz	
G.S. UNDERVOLTAGE	FAULT		INCLUDED	INCLUDED	The generator voltage is lower than or equal to the set threshold for the whole duration of the cut-in delay. Opens the generator contactor. The protection is enabled 10 seconds after the threshold is exceeded. If a stop occurs, it cools the system . The fault is saved .
	THRESHOLD	335 V [Three-phase and two-phase]	(50 ÷ 999) V		
		193 V [Single-phase]			
	DELAY	3 sec	(0 ÷ 10) sec		
	STOP	WITH STOP	WITH STOP	WITHOUT STOP	
G.S. VOLTAGE PRESENT	THRESHOLD	355 V [Three-phase and two-phase]	(50 ÷ 999) V	The voltage remains stable above the threshold for the whole duration of the delay. Close the generator contactor.	
		205 V [Single-phase]			
	DELAY	7 sec	(0 ÷ 600) sec		
G.S. OVERVOLTAGE	FAULT	INCLUDED	INCLUDED	The generator voltage remains greater than or equal to the set threshold for the whole duration of the cut-in delay. The protection is enabled after the engine running has been detected. Opens the generator contactor. If a stop occurs, it does not cool the system . The fault is saved .	
			EXCLUDED		
	THRESHOLD	440 V [Three-phase and two-phase]	(50 ÷ 999) V		
		254 V [Single-phase]			
	DELAY	3 sec	(0 ÷ 10) sec		
	STOP	WITH STOP	WITH STOP		WITHOUT STOP
G.S. UNDERFREQUENCY	FAULT	INCLUDED	INCLUDED	The generator frequency is lower than or equal to the set threshold for the whole duration of the cut-in delay. The protection is enabled 10 seconds after the threshold is exceeded. Opens the generator contactor. If a stop occurs, it cools the system . The fault is saved .	
			EXCLUDED		
	THRESHOLD	45 Hz	(0 ÷ 60) Hz		
	DELAY	5 sec	(0 ÷ 10) sec		
G.S. OVERFREQUENCY	FAULT	INCLUDED	INCLUDED	The generator frequency remains greater than or equal to the set threshold for the whole duration of the cut-in delay. Opens the generator contactor. The protection is always active. If a stop occurs, it does not cool the system . The fault is saved .	
			EXCLUDED		
	THRESHOLD	60 Hz [50 Hz]	(45 ÷ 85) Hz		
		72 Hz [60 Hz]			
DELAY	2 sec	(0 ÷ 10) sec			
G.S. OVERLOAD WARNING	FAULT	INCLUDED	INCLUDED	The generator current remains greater than or equal to the set threshold for the whole duration of the cut-in delay. The protection is always active. Does not stop the engine and is not saved .	
			EXCLUDED		
	THRESHOLD	47,5 A	0 ÷ full scale of the A.T.		
DELAY	10 sec	(0 ÷ 60) sec			
G.S. OVERLOAD	FAULT	INCLUDED	INCLUDED	The generator current remains greater than or equal to the set threshold for the whole duration of the cut-in delay. The protection is always active. Opens the generator contactor. If a stop occurs, it cools the system . The fault is saved .	
			EXCLUDED		
	THRESHOLD	50 A	0 ÷ full scale of the A.T.		
	DELAY	10 sec	(0 ÷ 60) sec		
GENERATOR NOT SUPPL.	FAULT	INCLUDED	INCLUDED	The generator does not generate voltage for the whole duration of the cut-in delay. The protection is always active. If a stop occurs, it does not cool the system . The fault is saved .	
			EXCLUDED		
	DELAY	60 sec	(0 ÷ 180) sec		
STOP	WITHOUT STOP	WITH STOP	WITHOUT STOP		
G.S. ASYMMETRY	FAULT	INCLUDED	INCLUDED	The percentage difference between generator voltages remains above the set threshold for the whole duration of the cut-in delay. The protection is always active. Opens the generator contactor. This imbalance represents the increase or decrease in	
			EXCLUDED		
	THRESHOLD	15 %	(5 ÷ 20) %		
	DELAY	15 sec	(0 ÷ 600) sec		
STOP	WITHOUT STOP	WITH STOP			

			WITHOUT STOP	voltage between the phases. If a stop occurs, it cools the system . The fault is saved .
INCORRECT PHASE SEQU.	FAULT	INCLUDED	INCLUDED	The phase connections are incorrect. It does not close the generator contactor. If a stop occurs, it does not cool the system . The fault is not saved .
	STOP	WITH STOP	WITH STOP	
G.S. OVERPOWER	FAULT	EXCLUDED	INCLUDED	The power delivered by the generator remains greater than or equal to the set threshold for the whole duration of the cut-in delay. The protection is always active. Opens the generator contactor. If a stop occurs, it cools the system . The fault is saved .
	THRESHOLD	3000 kW	EXCLUDED	
	DELAY	10 sec	(0 ÷ 3000) kW	
	STOP	WITHOUT STOP	(0 ÷ 60) sec	
SWITCH-OFF OF INSTR.	KILOWATTMETER	INCLUDED	WITH STOP	Instruments displayed on the control unit.
			WITHOUT STOP	
	KILOVARMETER	EXCLUDED	INCLUDED	
			EXCLUDED	
	KILOVOLTAMMETER	EXCLUDED	INCLUDED	
			EXCLUDED	
	POWER FACTOR METER	EXCLUDED	INCLUDED	
			EXCLUDED	
	KILOWATT-HOUR	EXCLUDED	INCLUDED	
			EXCLUDED	

ENGINE RPM MANAGEMENT					
Parameter	Variable	Factory settings	Range	Notes	
ENTER PASSWORD	PSW_ENGINE_RPM	"0000"	"0000" – "9999"	Entering the correct password allows the parameters to be changed.	
CHANGE PASSWORD	PSW_ENGINE_RPM	"0000"	"0000" – "9999"	Change the password for access to the menu.	
RPM VARIATION		INCLUDED	INCLUDED	Management of the engine linear actuator (rpm variator) can be excluded. By excluding this function, the "hare" and "tortoise" buttons have no effect and the control unit does not perform the adjustment of the engine rpm.	
			EXCLUDED		
ACTUATOR PWM		99 %	(0 ÷ 100) %	Actuator PWM	
THRUST DIRECTION		NORMAL	NORMAL	Enables selection of the accelerator lever's direction.	
			INVERTED		
MANUAL RPM MGMT.	REV CONTROL	MODE	KEYS	KEYS	The rpm is managed using the front buttons.
				SETPOINT	See parameter SETPOINT.
				ENGINE SPEED 1-2	See parameter ENGINE SPEED 1-2 (traditional engines only)
				ENGINE SPEED MIN-MAX	See parameter ENGINE SPEED MIN-MAX (electronic engines only)
	SETPOINT	SPEED	1500 RPM	(600 ÷ 4000) RPM	Setpoint set with MODE = SETPOINT.
		MINIMUM SETPOINT	800 RPM	(600 ÷ 4000) RPM	Setpoint set with MODE = ENGINE SPEED MIN-MAX. (Available only for electronic engines).
		MAXIMUM SETPOINT	1500 RPM	(600 ÷ 4000) RPM	
		TIME	20 s	(5 ÷ 600) s	Acceleration and deceleration time.
AUTOMATIC RPM MGMT	REV CONTROL	MODE	EXCLUDED	TOLERANCE	Tolerance on the established setpoint value.
				EXCLUDED	No automatic rpm adjustment managed.
				USER RPM	See parameter USER_RPM.
	USER RPM	RPM RESET	EXCLUDED	AUTONOMOUS RPM	See parameter AUTONOMOUS_RPM.
				INCLUDED	The RPM is set by the user and reset after every stop.
				EXCLUDED	On each start-up, the control unit brings the RPM back to the value set by the user.
		TIME	20 s	(5 ÷ 600) s	Parameters related to USER RPM.
		TOLERANCE	50 RPM	(20 ÷ 150) RPM	
	AUTONOMOUS RPM	SPEED	1500 RPM	(600 ÷ 4000) RPM	Parameters related to AUTONOMOUS RPM
		TIME	20 s	(5 ÷ 600) s	
		TOLERANCE	50 RPM	(20 ÷ 150) RPM	

IRRIGATION				
Parameter	Variable	Factory settings	Range	Notes
ENTER PASSWORD		"0000"	"0000" – "9999"	Entering the correct password allows the parameters to be changed.
CHANGE PASSWORD		"0000"	"0000" – "9999"	Change the password for access to the menu.
PUMP PROTECTION SENSOR		WATER PRESSURE TRANSM.	WATER PRESSURE TRANSM.	See PUMP PROTECTIONS
		PUMP PRESSURE SWITCH	PUMP PRESSURE SWITCH	

PROTECTION ACTIVATION TIME	MINIMUM	2 min	(0 ÷ 30) min	See PUMP PROTECTIONS
	MAXIMUM	10 min	(0 ÷ 30) min	
	RESTART	10 s	(5 ÷ 600) s	
PUMP WATER UNDERPRESSURE	FUNCTION	INCLUDED	INCLUDED EXCLUDED	The underpressure pump water fault can be excluded.
	DELAY	5 s	(0 ÷ 9999) s	Intervention time
	UPPER DIFFERENTIAL	2,0 BAR	(0,1 ÷ 3,0) BAR	Enabled if PROTECTION TYPE = AUTOMATIC ACQUISITION o ENGINE > IRRIGATION = INCLUDED
	LOWER DIFFERENTIAL	1,0 BAR	(0,1 ÷ 3,0) BAR	
PUMP OVERPRESSURE	FUNCTION	INCLUDED	INCLUDED EXCLUDED	The fault 'pump water pressure high' can be disabled.
	DELAY	5 s	(0 ÷ 9999) s	Intervention time
	UPPER DIFFERENTIAL	2,0 BAR	(0,1 ÷ 3,0) BAR	Enabled if PROTECTION TYPE = AUTOMATIC ACQUISITION o ENGINE > IRRIGATION = INCLUDED
	LOWER DIFFERENTIAL	1,0 BAR	(0,1 ÷ 3,0) BAR	
MAXIMUM PRESSURE		25,0 BAR	(1,0 ÷ 25,0) BAR	See PUMP PROTECTIONS
MINIMUM PRESSURE		0,2 BAR	(0 ÷ 1,0) BAR	See PUMP PROTECTIONS
FILTER WASH	FUNCTION	EXCLUDED	INCLUDED EXCLUDED	See PUMP PROTECTIONS
	PRESSURE	1 BAR	(0,2 ÷ 21,0) bar	
CLUTCH	FUNCTION	INCLUDED	INCLUDED EXCLUDED	Includes/Excludes CLUTCH management.
	INSERTION	THRESHOLD	800 RPM	See CLUTCH.
		DELAY	1 s	
	RELEASE	THRESHOLD	700 RPM	
		DELAY	1 s	
			(300 ÷ 4000) RPM	

IN-OUT				
Parameter		Factory settings	Range	Notes
ENTER PASSWORD		"0000"	"0000" – "9999"	Entering the correct password gives access to the rest of the menu.
CHANGE PASSWORD		"0000"	"0000" – "9999"	Change the password for access to the menu.
PROGRAMM. INPUTS				Menu
4-20mA input				Menu
PROGRAMMABLE OUTPUTS				Menu
GENERAL ALARM	IMMINENT START	EXCLUDED	INCLUDED EXCLUDED	See GENERAL ALARM
	DURATION	9999 s	(0 ÷ 9999) s	See GENERAL ALARM The value 9999 sec indicates operation with no time limit

PROGRAMM. INPUTS				
Parameter	Variable	Factory settings	Range	Notes
TYPE		See the table below	FAULT	Identifies whether the input is associated to a function or fault.
			FUNCTION	
FUNCTION (visible if TYPE = FUNCTION)		See the table below	See the full list of functions-input.	Identifies the function associated to the input.
CLOSING DELAY		See the table below	(0 ÷ 9999) s	Delay occurring upon activation.
OPENING DELAY		See the table below	(0 ÷ 9999) s	Delay occurring upon deactivation.
INTERVENTION		See the table below	ACTIVE CLOSED	The input is active if it is open or closed to common.
			ACTIVE OPEN	
STOP (visible if TYPE = FAULT)		See the table below	WITH STOP	Programming enabled if TYPE = FAULT Set the moment of activation, storing, the type of alarm and the text for the fault.
			WITHOUT STOP	
DECELERATION (visible if TYPE = FAULT)		See the table below	WITH DECELERATION	
			NO DECELERATION	
COOLING (visible if TYPE = FAULT)		See the table below	WITH COOLING	
			NO COOLING	
ACTIVATION (visible if TYPE = FAULT)		See the table below	ALWAYS ACTIVE	
			ACTIVE RUNNING	
MEMORY (visible if TYPE = FAULT)		See the table below	NOT STORED	
			STORED	
FAULT TEXT (visible if TYPE = FAULT)			'0' ÷ '9', ' ', 'A' ÷ 'Z'	When the language is changed, the text is reset to the default value.

The factory settings for the inputs are the following:

PROGRAMM. INPUTS	TYPE	INPUT SETTINGS							
		CLOSING DELAY	OPENING DELAY	INTERVENTION	STOP	DECELERATION	COOLING	ACTIVATION	MEMORY
INPUT 30	CALL	1	1	ACTIVE CLOSED	NO	-	-	-	-
INPUT 32	FUEL PRESSURE SWITCH	5	1	ACTIVE CLOSED	YES	YES	NO	RUNNING	YES
INPUT 33	LOCKED	1	1	ACTIVE CLOSED	YES	YES	YES	ALWAYS	NO
INPUT 41	FAULT	1	1	ACTIVE CLOSED	NO	-	-	RUNNING	NO
INPUT 42	FAULT	1	1	ACTIVE CLOSED	YES	YES	NO	RUNNING	YES
INPUT 46	"----	1	1	ACTIVE CLOSED	NO	-	-	-	-

IN 4-20 mA				
Parameter	Variable	Factory settings	Range	Notes
SENSOR		----	----	Type of input sensor connected.
			VACUUM TX	
CALIBRATION	4 mA	-1BAR	(-1 ÷ 10) BAR	Calibration values of the vacuum sensor.
	20 mA	9 BAR	(-1 ÷ 10) BAR	
CAVITATION ALARM	FAULT	INCLUDED	INCLUDED	The vacuum value is below the set threshold and the intervention delay has passed.
			EXCLUDED	
	THRESHOLD	-0.9 BAR	(-1 ÷ 0) BAR	
	DELAY	15 min	(1 ÷ 9999) min	
CAVITATION PRE-ALARM	FAULT	INCLUDED	INCLUDED	The vacuum value is below the set threshold and the intervention delay has passed.
			EXCLUDED	
	THRESHOLD	-0.7 BAR	(-1 ÷ 0) BAR	
	DELAY	15 min	(1 ÷ 9999) min	
MAX CAVITATION TIME	FAULT	EXCLUDED	INCLUDED	Fault signalled if the working time of the pump with CAVITATION PRE-ALARM enabled exceeds the set threshold.
			EXCLUDED	
	THRESHOLD	50 h	(0 ÷ 999) h	
	RESET HOURS			Resets the pump operating hours with CAVITATION PRE-ALARM active.

PROGRAMMABLE OUTPUTS			
Parameter	Factory settings	Range	Notes
FUNCTION-OUTPUT	"----	"----	See PROGRAMMABLE OUTPUTS
		OUTPUT 6	
		OUTPUT 19	
		OUTPUT _48-49	
		OUTPUT 47	
		OUTPUT 70	
FAULTS	"----	"----	
		OUTPUT 6	
		OUTPUT 19	
		OUTPUT _48-49	
		OUTPUT 47	
		OUTPUT 70	

For the list of functions, refer to the section PROGRAMMABLE OUTPUTS; for the list of faults, refer to the section FAULTS. Programming default values are as follows:

Parameter	DEFAULT
OUTPUT 6	GLOW PLUGS
OUTPUT 19	15/54
OUTPUT 70	GENERAL ALARM
OUTPUT 47	CLUTCH
OUTPUT 48-49	CONTROL UNIT ON

SERIAL PORT				
Parameter	Variable	Factory settings	Range	Notes
ENTER PASSWORD		"0000"	"0000" - "9999"	Entering the correct password gives access to the rest of the menu.
CHANGE PASSWORD		"0000"	"0000" - "9999"	Change the password for access to the menu.
USB-VCP	VCP ADDRESS	1	1 ÷ 32	Address of the control unit with MOD Bus RTU Slave protocol.
	PROTOCOL	MOD BUS	MOD BUS CLI	Data exchange protocol. The CLI protocol is active during regular operation whereas in settings mode, MOD BUS is always active .
RS485 A	ADDRESS	1	1 ÷ 32	Communication parameters
	BAUDRATE	9600	1200 ÷ 115200	
	PARAMETERS	E,8,1	E,8,1	
			N,8,1	
RS485 B	ADDRESS	2	1 ÷ 32	Communication parameters
	BAUDRATE	9600	1200 ÷ 115200	
	PARAMETERS	E,8,1	E,8,1	
			N,8,1	
RS485 C	ADDRESS	3	1 ÷ 32	Communication parameters
	BAUDRATE	9600	1200 ÷ 115200	
	PARAMETERS	E,8,1	E,8,1	
			N,8,1	

DEVICE				
Parameter	Variable	Settings setting	Range	Notes
ENTER PASSWORD		“0000”	“0000” - “9999”	Entering the correct password gives access to the rest of the menu.
CHANGE PASSWORD		“0000”	“0000” - “9999”	Change the password for access to the menu.
STAND-BY	FUNCTION	INCLUDED	INCLUDED EXCLUDED	Enables or disables the unit’s power saving mode or Stand-By.
	STAND-BY INPUT TIME	30 s	(1 ÷ 1800) s	This is how long the unit takes to time out to power saving Stand-By mode and turn off.
	STANDBY INPUT FAULT	INCLUDED	INCLUDED EXCLUDED	If enabled, the control unit goes into power saving mode even if a fault is present.
DISPLAY	LCD CONTRAST	50 %	(0 ÷ 100) %	Display contrast
	BRIGHTNESS	100 %	(0 ÷ 100) %	Display brightness
SETUP RESETTING				Restore the default settings.
HOUER METER		0	0h 0’ – 1193046h 59’	Motor run time
FAILED STARTS		0	0 ÷ 65535	Number of failed starts
STARTS		0	0 ÷ 65535	Number of engine start-ups
UNIT OF MEASUREMENT	TEMPERATURE	°C	°C	Unit of measurement displayed for the TEMPERATURE measurement instruments.
			°F	
	PRESSURE	bar	Bar	Unit of measurement displayed for the PRESSURE measurement instruments.
			kPa	
Psi				
MANUAL MODE		INCLUDED	INCLUDED EXCLUDED	Makes it possible to exclude the manual mode.
AUTOMATIC MODE		INCLUDED	INCLUDED EXCLUDED	Makes it possible to exclude the automatic mode.
OFF MODE		INCLUDED	INCLUDED EXCLUDED	Makes it possible to exclude the off mode.
MODE SETTING		KEYS	KEYS	The MODE_BUTTON switches from one mode to another.
			CONTACTS	The switch from one mode to another is done via external contacts.

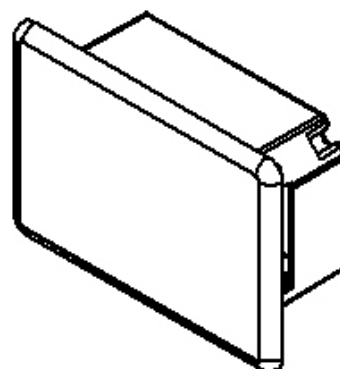
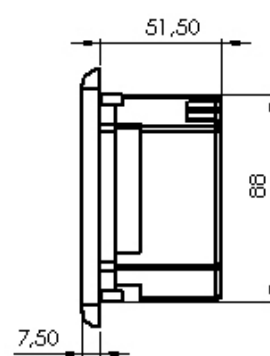
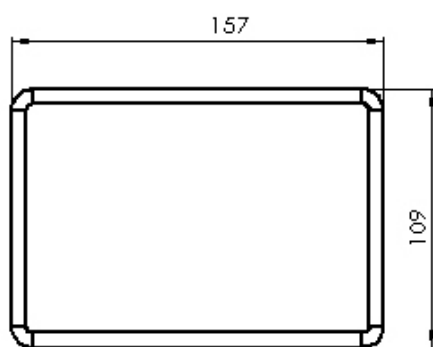
LOG				
Parameter	Variable	Factory settings	Range	Notes
ENTER PASSWORD		"0000"	"0000" - "9999"	Entering the correct password gives access to the rest of the menu.
CHANGE PASSWORD		"0000"	"0000" - "9999"	Change the password for access to the menu.
LOG				Display of event log, always accessible.
DELETE HISTORY				Delete the contents of the log, password access.

MAINTENANCE				
Parameter	Variable	Factory settings	Range	Notes
ENTER PASSWORD		"0000"	"0000" - "9999"	Entering the correct password gives access to the rest of the menu.
CHANGE PASSWORD		"0000"	"0000" - "9999"	Change the password for access to the menu.
MAINTENANCE 1 MAINTENANCE 2 MAINTENANCE 3	MODE	"____"	"____"	See maintenance.
			MOTOR HOURS	
			RUNNING HOURS	
			CALENDAR	
	EXPIRY	...	DATE MOTOR HOURS RUNNING HOURS Depending on the mode.	Indicates the data regarding the next scheduled maintenance expiry.
	MAINTENANCE TEXT	MAINTENANCE 1 MAINTENANCE 2 MAINTENANCE 3	'0' ÷ '9', ' ', 'A' ÷ 'Z'	Text displayed When the language is changed, the text is reset to the default value.
	STOP	INCLUDED	INCLUDED EXCLUDED	Enables or disables the stopping of the engine upon maintenance expiry.
	RESET			Resets the expired maintenance.
COMMISSIONING		...	CLOCK/CALENDAR	System commissioning date.

SERVICE (electronic engines only)				
Parameter	Variable	Factory settings	Range	Notes
SERVICE	EXCLUDED		INCLUDED	With the control unit in manual or automatic mode and the engine off, the engine ECU is kept active even when faults that cause the engine to stop occur.
			EXCLUDED	

REPLACING THE CONTROL UNIT and SETTINGS SW

Before replacing the control unit, we advise you to transfer all the technical settings to a personal computer and save them in an archive file. This operation can be performed using the ZW-SMART software, which can be requested from Elcos or downloaded from the website www.elcos.it. Hook up the control unit to the computer using the USB port, which can be accessed by removing the control unit's side panel. Make sure to close the side panel back again after use.



TECHNICAL SPECIFICATIONS

Power supply [1], [2]		
Suitable for batteries	12 Vdc	24 Vdc
Operating range	(8 ÷ 48) Vdc	
Absorption with engine not running	130 mA @12 Vdc	90 mA @24 Vdc
Absorption in stand-by	10 mA @ 12 Vdc	7 mA @ 24 Vdc
Absorption with contact open at terminal 45	0 A	
Voltage dip on battery power supply	From 10 Vdc to 0 Vdc for 20ms	
Digital inputs [30], [32], [33], [41], [42], [51], [52],		
Type of input	Negative	
Maximum current supplied	4 mA	
Voltage threshold for low signal	≤ 0.6 Vdc	
Voltage threshold for high signal	≥ 1 Vdc	
Digital inputs [4]		
Type of input	Positive	
Maximum current supplied	0,6 mA @48 Vdc	
Voltage threshold for low signal	≤ 2 Vdc	
Voltage threshold for high signal	≥ 2 Vdc	
Digital inputs [45], [46]		
Type of input	Positive	
Maximum current supplied	4 mA @ 48 Vdc	
Voltage threshold for low signal	≤ 1,7 Vdc	
Voltage threshold for high signal	≥ 2 Vdc	
Terminal input [65]		
AC voltage	(5.5 ÷ 65) Vac	
Measurement range	(50 ÷ 1500) Hz	
Terminal input [66]		
Applicable voltage	(0.5 ÷ 30) Vdc	
Pick-up input terminals [63 - 64]		
AC voltage	(0.5 ÷ 5.5) Vac	
Measurement range	(100 ÷ 15000) Hz	
Minimum pick-up impedance	> 400 Ω	
Generator voltmetric inputs [95], [96], [97], [98]		
Dielectric strength voltage between battery voltage circuits and generator voltage circuits		3750 Vac 50 Hz 1 sec
Rated insulation voltage	Genset voltage terminal	600 Vac
	Battery voltage terminal	48 Vac
Insulation class	1	
Measurement range	(80 ÷ 570) Vac three-phase	(45 ÷ 340) Vac single-phase
Accuracy	± 1%	
Frequency meter generador		
Measurement range	(45 ÷ 85) Hz	
Accuracy	±0.1Hz	
Ammeter inputs [75], [76], [77], [78]		
Measurement range	20 mA ÷ 6 Aac	
Ammeter transformer ratio	/5	
Maximum displayable current	4800 Aac	
Accuracy	± 1%	
TPA measurement inputs [7], [8], [9]		
Terminal 7 (Brown)	+5 Vdc	
Terminal 8 (White)	(0 ÷ 5) Vdc	
Terminal 9 (Green)	Ground	
4-20mA measurement inputs [53], [54]		
Terminal 53	Type	Positive, terminal [1]
	Maximum output voltage	26,6 Vdc
Terminal 54	(4 ÷ 20) mA, Rin = 240 Ω, Vinmax = 5 Vdc	
Digital outputs [6], [19], [47], [70]		
Type of output	Positive, closes on terminal 1	
Maximum load	0.25 A	
Digital outputs [15], [17]		
Type of output	Positive, closes on terminal [4A]	
Maximum load	Terminal 15	0.25 A
	Terminal 17	1.5 A
Digital outputs [48 – 49]		
Type of output	Clean contact	
Maximum applicable voltage	48 Vdc, 65 Vac	
Maximum load	0.25 A	
Outputs [73 – 74]		
Type of output	Clean contact	
Maximum applicable voltage	275 Vac	
Maximum load	3 A	
Displayed powers (kW, kVAR, kVA, kWh)		
Accuracy	± 2%	
Maximum displayable current	3300 kVA	

Actuator outputs [12 – 13]			
Type of output		Static, power supply from terminals [1] and [2].	
Maximum load		3 A	
Engine instruments [37], [57], [58]			
Oil pressure	(0 ÷ 380) Ω	(0.0 ÷ 9.0) BAR	(0 ÷ 900) kPa
Temperature	(0 ÷ 3200) Ω	(0 ÷ 140) °C	(0 ÷ 284) °F
Fuel level	(0 ÷ 380) Ω	(0 ÷ 100) %	
Accuracy (pressure gauge, thermometer, fuel level)		± 2%	
Lines of communication			
RS485 1, 2, 3 (no optoisolator)	Baud-rate	(1200 ÷ 115200) bps	
	Parity	None/even	
USB 2.0 (Type B)	Interface	Not isolated. Maximum cable length 3 m.	
CAN Bus (No optoisolator)	Baud-rate	250 kbps	
	Protocol	SAE J1939	
Environmental conditions			
Operating temperature		(-20 ÷ 60) °C	
Storage temperature		(-20 ÷ 60) °C	
Relative humidity		≤ 80%	
Protection class			
Back		IP 20	
Front		IP 54	
Container			
Weight		480g	
Dimensions (L x H x D)		(157 x 109 x 74) mm	
Perforations		(137 x 88) mm	
Material		PC/ABS V0	
Terminals [1], [2], [4A], [73], [74], [75], [76], [77], [78], [95], [96], [97], [98]			
Screw		M3	
Maximum section		2.5 mm ²	
Terminals (remaining)			
Screw		M2	
Maximum section		1 mm ²	
Installation			
Recessed			
4 nuts		M4	
Nut tightening torque		(1.0 ÷ 1.5) Nm	

WARNING

The control unit only controls and commands a diesel-engine driven irrigation pump. It commands the stop if a fault to probe-controlled parts occurs. It is also designed for installation on board the machine.

Warning: Compliance with the following recommendations is obligatory



- Always make connections following the wiring diagram provided in the manual.
- Never remove the rear cover from the control unit, as it could lose the IP protection.
- All works performed on the unit must be carried out with the engine off and with starter motor terminal 50 disconnected.
- Check the consumption of the connected devices is in line with the described technical specifications.
- The installation must always guarantee adequate dissipation of heat.
- Always install the device at a lower position than any other devices that produce or dissipate heat.
- Handle and connect without exposing the electronic circuit board to mechanical strain.
- Do not let cuttings of copper conductors or other metal residues drop onto the control unit.
- Never disconnect the battery terminals while the engine is running.
- Strictly avoid using a battery charger for emergency start-up; this could damage the control unit.
- To safeguard persons and equipment, always disconnect the electrical system terminals from the battery poles before connecting an external battery charger.

Device sensitive to electrostatic discharge



Do not open the container unless precautions to avoid electrostatic discharges have been taken.

This control unit is not suitable for operation under the following conditions:



- Where the room temperatures exceeds the limits specified in the technical data sheet.
- Where abrupt shifts in temperature and air pressure produce exceptional condensation.
- Where there is high pollution caused by dust, fumes, vapour, salts and corrosive or radioactive particles.
- There is high radiation of heat due to direct sunlight, ovens or the like.
- You suspect the presence of mould or pests.
- There is a danger of fire or explosion.
- Strong shocks or vibrations can be transmitted to the control unit.

Electromagnetic Compatibility

This control unit works correctly only if it is installed in systems that comply with regulations governing CE or UKCA marking; in fact, it complies with the immunity requirements given in EN61326-1, but this does not rule out the possibility that malfunctions could occur in extreme cases that may arise in particular situations.

The installer is responsible for checking that the level of perturbation does not exceed that specified in standards.

Operation and maintenance

We recommend the following maintenance on a weekly basis:



- checking the signals;
- checking the battery status;
- checking the wires are connected firmly and the condition of the terminals.

INFORMATION FOR ORDERING

Type	Item Code
CEM-139	00242333

STANDARD ACCESSORIES

Type	Item Code
CABLE FOR TPA-200	40500254
CABLE ADAPTER TPA-200 WITH FERRULE TERMINALS	40500261
TPA-200 PUMP WATER PRESSURE TRANSMITTER	70500255
REDUCING NIPPLE F1/4" GAS – M3/8" GAS	70190241
KIT MU CEM-139	40804482

ACCESSORIES AVAILABLE ON REQUEST

Type		Item Code
AST-015/00	Rod electrode, including accessories	40241012
E-25	Screw electrodes, including accessories	40190115
VAR-140 12V	Linear actuators	00571543
VAR-144 24V	Linear actuators	00571551
ZW-SMART	Programming software	00070212
TDA-190	Water vacuum transmitter	70500260

ONLINE DOCUMENTATION

Downloadable from the website www.elcos.it/



CONFORMITY
CE **UK**
CA