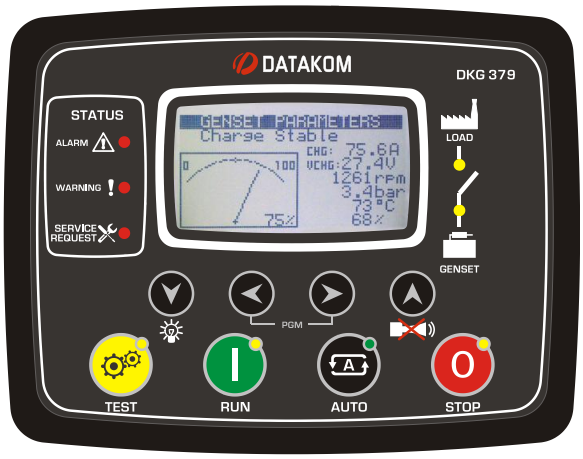
DKG-379

VARIABLE SPEED DC GENSET CONTROLLER

CANBUS AND MPU VERSIONS



DESCRIPTION

The DKG-379 is an advanced DC genset controller for both variable and fixed speed systems. It is presented in 3 different versions, as ANALOG DRIVE, POWER DRIVE and CANBUS DRIVE.

The controller has a precision PID loop providing exact matching of the optimal charging characteristics, as well as overvoltage, overcurrent, overspeed, overheat protections.

The POWER DRIVE version provides a 7 Amp-DC output, interfacing directly to the engine actuator or alternator excitation winding without the need for a governor controller or AVR. The CANBUS DRIVE version connects to ECU driven electronic engines providing engine control, protection and instrumentation without extra senders. ECU alarms are displayed in text. All versions offer a 0-10V analog output for speed or voltage control.

The fixed speed operation stops the genset precisely when batteries are fully charged, providing fuel economy and maintenance cost reductions.

The unit has precision, fully isolated measuring inputs for the battery bank voltage and the charge current. It supports both "**positive to ground**" and "**negative to ground**" installations. The current is measured through a DC current shunt placed in positive or negative output of the genset.

The genset starting is based on the precisely measured DC battery bank voltage. Once started, the controller will perform an optimal battery charging cycle and will stop the genset when batteries are fully charged. The optimal charge algorithm allows maximum battery life and minimal engine run time and fuel consumption.

During the charge cycle, the unit controls the engine rpm (or excitation) in order to apply the exact required DC voltage and current to batteries. The rpm control over CANBUS-J1939 is available for electronic engines.

The unit offers a PT100 type, battery temperature sensor input. If used, the temperature protection will allow longer battery life in hot environment and faster charge in cold conditions.

FEATURES

Compatible with 12V, 24V and 48V DC systems
DC power drive output (7A-DC)
ECU connection through J1939 CAN option
0-10V analog control output
Isolated Volt - Amp measurements
Battery temperature input for PT100 sensor
Optimal charging, provides longer battery life
Temperature dependent battery charging
Thermal protection, short circuit protection
Dual genset mutual standby operation
100 event logs with time stamp and measurements
Battery backed-up real time clock
Built in daily / weekly / monthly exerciser
Field adjustable parameters
RS-232 serial port
Free MS-Windows Remote monitoring SW
GSM and PSTN modem support
GSM SMS message sending on fault
MODBUS communications
Multiple language support
Customer logo display capability

MEASUREMENTS

Battery Volts
Battery temperature
Generator Volts
Generator Amps
Generator kW
Engine rpm
Engine battery Voltage
Engine Coolant Temperature
Engine Oil Pressure
Engine fuel Level
Engine Oil Temperature

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ABOUT THIS DOCUMENT

This document describes minimum requirements and necessary steps for the successful installation of the DKG-379 unit.

Follow carefully advices given in the document. These are often good practices for the installation of genset control units which reduce future issues.

For all technical queries please contact Datakom at below e-mail address:

datakom@datakom.com.tr

RELATED DOCUMENTS

FILENAME	DESCRIPTION
379_INSTE	DKG-379 Installation Guide

REVISION HISTORY

REVISION	DATE	AUTHOR	DESCRIPTION
01	04.04.2012	MH	First issue, firmware version 12, hardware version 02
02	24.12.2012	MH	Updated for firmware version 15, hardware version 03

TERMINOLOGY

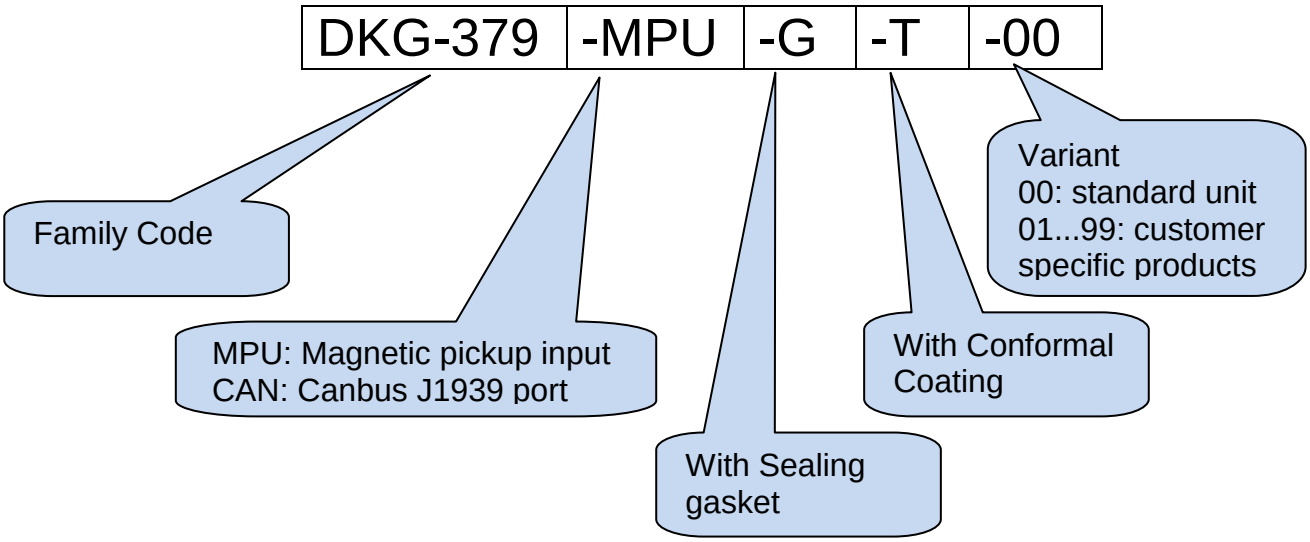
CAUTION: Potential risk of injury or death.

WARNING: Potential risk of malfunction or material damage.

ATTENTION: Useful hints for the understanding of device operation.

ORDERING CODES

The D-500 family units are available in various options and peripheral features. Please use below information for ordering the correct version:



SPARE PARTS

Screw type bracket
Stock Code=J10P01 (per unit)

Self Retaining type bracket
Stock Code=K16P01 (per unit)

Sealing Gasket, Stock Code= K44P01

SAFETY NOTICE

Failure to follow below instructions will result in death or serious injury

- **Electrical equipment should be installed only by qualified specialist. No responsibility is assured by the manufacturer or any of its subsidiaries for any consequences resulting from the non-compliance to these instructions.**
- **Check the unit for cracks and damages due to transportation. Do not install damaged equipment.**

- **Do not open the unit. There are no serviceable parts inside.**
- **Fuses must be connected to the power supply and phase voltage inputs, in close proximity of the unit.**

- **Fuses must be of fast type (FF) with a maximum rating of 6A.**

- **Disconnect all power before working on equipment.**

- **Any electrical parameter applied to the device must be in the range specified in the user manual. Although the unit is designed with a wide safety margin, over-range parameters may reduce lifetime, alter operational precision or even damage the unit.**
- **Do not try to clean the device with solvent or the like. Only clean with a dump cloth.**

- **Verify correct terminal connections before applying power.**
- **Only for front panel mounting.**

Resistive Current Shunt must be used for current measurement.

No direct connection allowed.

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1. INSTALLATION INSTRUCTIONS

Before installation:

- Read the user manual carefully, determine the correct connection diagram.
- Remove all connectors and mounting brackets from the unit, then pass the unit through the mounting opening.
- Put mounting brackets and tighten. Do not tighten too much, this can brake the enclosure.
- Make electrical connections with plugs removed from sockets, then place plugs to their sockets.
- Be sure that adequate cooling is provided.
- Be sure that the temperature of the environment will not exceed the maximum operating temperature in any case.

Below conditions may damage the device:

- Incorrect connections.
- Incorrect power supply voltage.
- Voltage at measuring terminals beyond specified range.
- Voltage applied to digital inputs over specified range.
- Overload or short circuit at relay outputs
- Connecting or removing data terminals when the unit is powered-up.
- High voltage applied to communication ports.
- Ground potential differences at non-isolated communication ports.
- Excessive vibration, direct installation on vibrating parts.

Resistive Current Shunt must be used for current measurement.

No direct connection allowed.

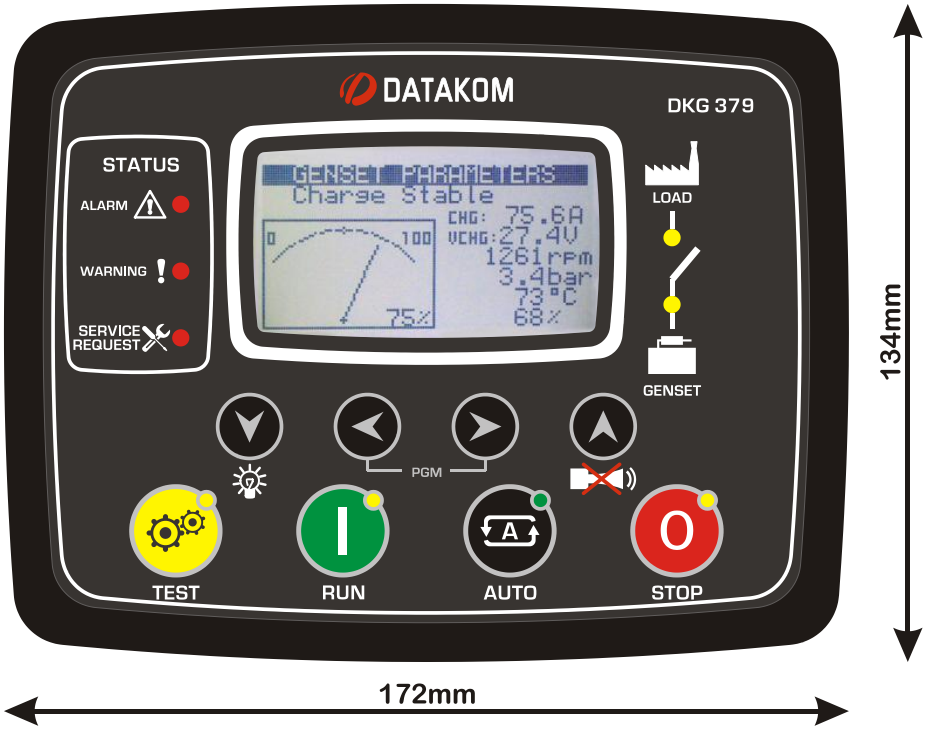
Below conditions may cause abnormal operation:

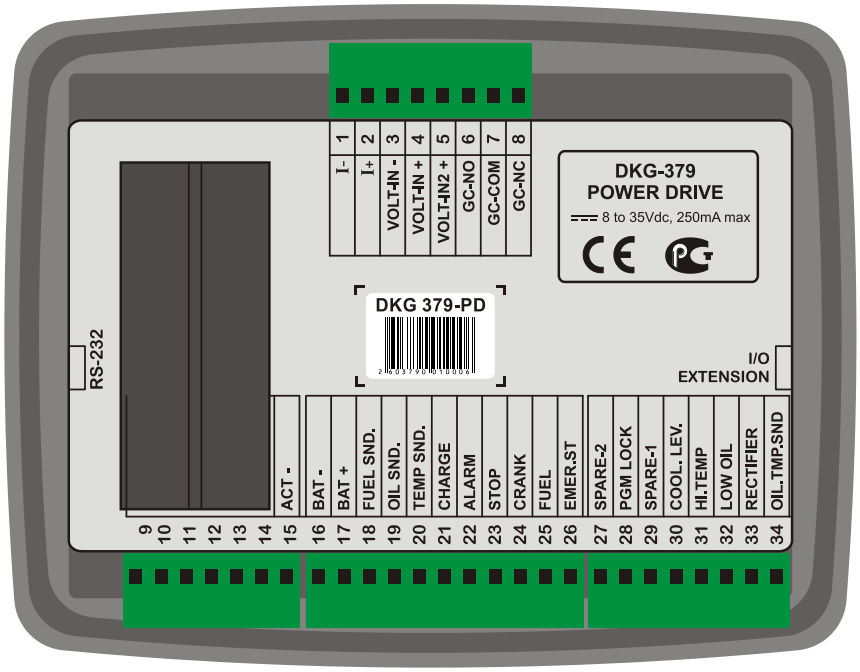
- Power supply voltage below minimum acceptable level.
- Current shunt polarity incorrect.
- Missing grounding.

2. MOUNTING

2.1. DIMENSIONS

Dimensions: 172x134x76mm (6.8”x5.3”x3.0”)
Panel Cutout: 151x111mm minimum (6.0”x4.4”)
Weight: 450g (1 lb)

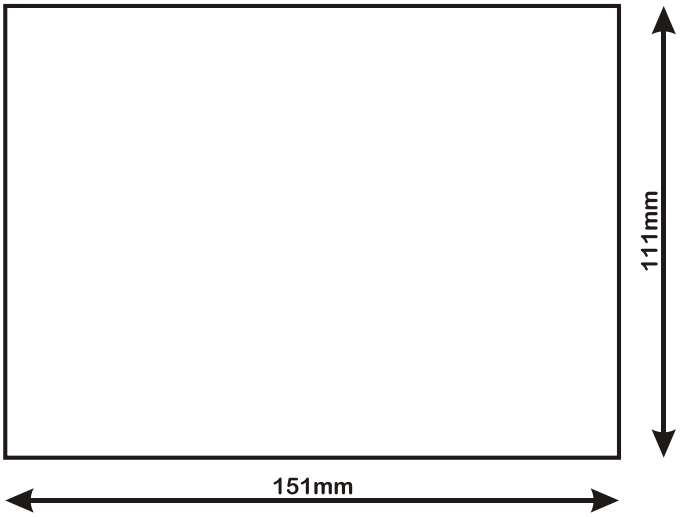




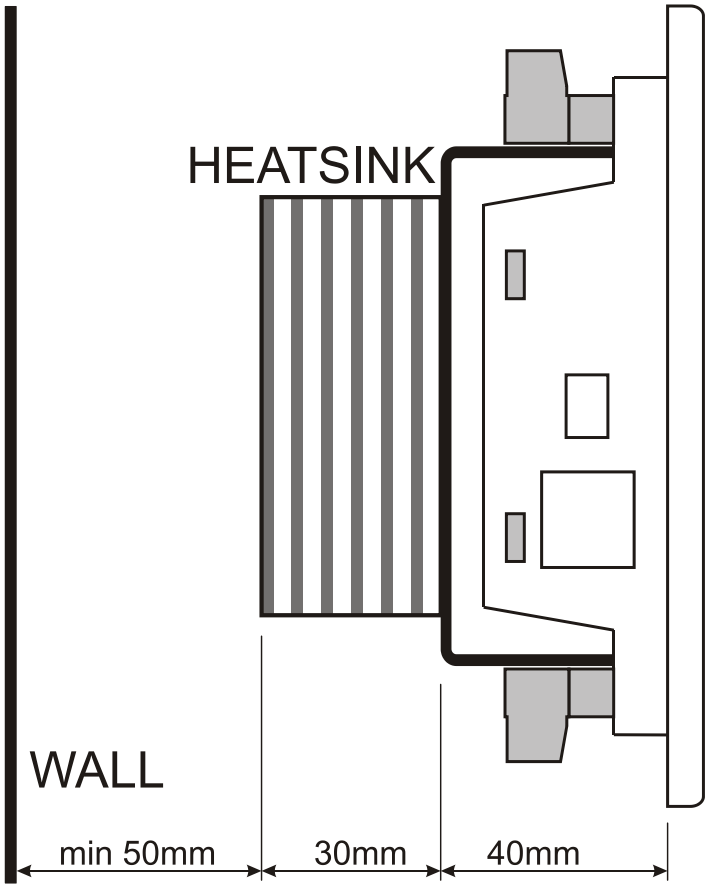
The unit is designed for panel mounting. The user should not be able to access parts of the unit other than the front panel.

Mount the unit on a flat, vertical surface. Before mounting, remove the mounting brackets and connectors from the unit, then pass the unit through the mounting opening.

Place and tighten mounting brackets.



Panel Cutout



Required Panel Depth

Two different types of brackets are provided:

Screw type bracket

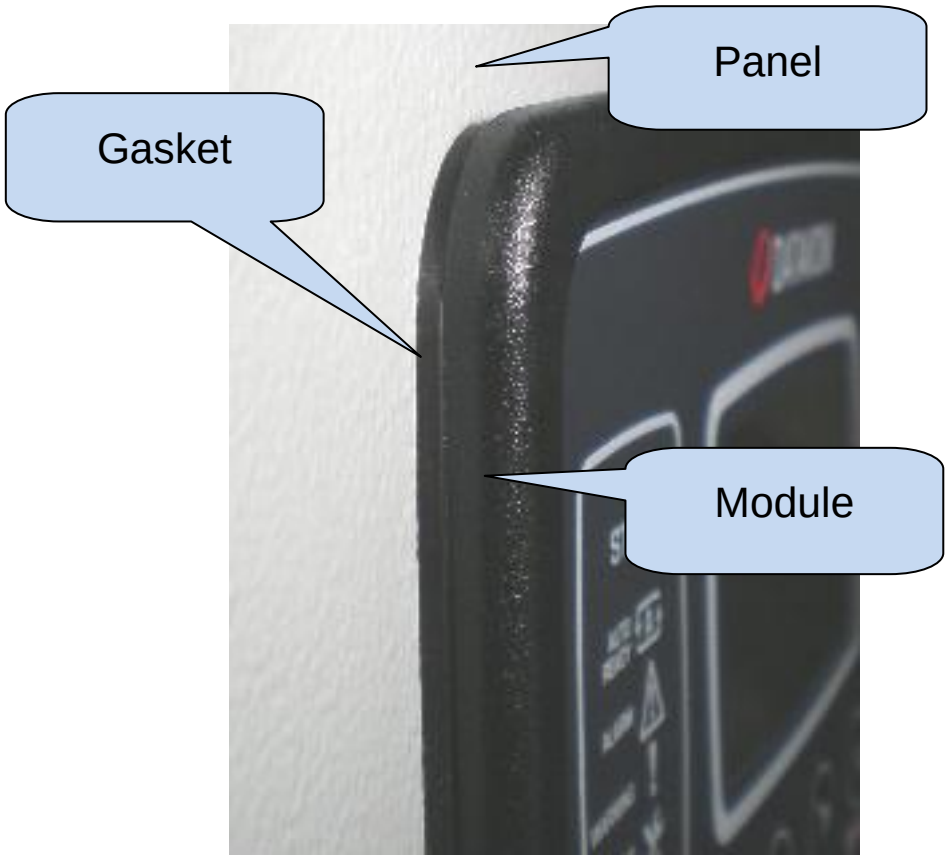
Self retaining type bracket

Installation of screw type bracket

Installation of self retaining type bracket

Do not tighten too much, this may break the unit.

2.2. SEALING, GASKET



The rubber gasket provides a watertight means of mounting the module to the genset panel. Together with the gasket, IEC 60529-IP65 protection can be reached from the front panel. A short definition of IP protection levels is given below.

1st Digit
0 Not protected
1 Protected against solid foreign objects of 50 mm diameter and greater
2 Protected against solid foreign objects of 12,5 mm diameter and greater
3 Protected against solid foreign objects of 2,5 mm diameter and greater
4 Protected against solid foreign objects of 1,0 mm diameter and greater
5 Protected from the amount of dust that would interfere with normal operation
6 Dust tight

2nd Digit
0 Not protected
1 Protected against vertically falling water drops
2 Protected against vertically falling water drops when enclosure is tilted up to 15 °
3 Protected against water sprayed at an angle up to 60 ° on either side of the vertical
4 Protected against water splashed against the component from any direction
5 Protected against water projected in jets from any direction
6 Protected against water projected in powerful jets from any direction
7 Protected against temporary immersion in water
8 Protected against continuous immersion in water, or as specified by the user

2.3. ELECTRICAL INSTALLATION

Do not install the unit close to high electromagnetic noise emitting devices like contactors, high current busbars, switchmode power supplies and the like.

Although the unit is protected against electromagnetic disturbance, excessive disturbance can affect the operation, measurement precision and data communication quality.

- **ALWAYS remove plug connectors when inserting wires with a screwdriver.**
- **Fuses must be connected to the power supply voltage inputs, in close proximity of the unit.**
- **Fuses must be of fast type (FF) with a maximum rating of 6A.**
- **Use cables of appropriate temperature range.**
- **Use adequate cable section, at least 0.75mm^2 (AWG18).**
- **Follow national rules for electrical installation.**
- **Current shunts must have 60mV output at nominal current.**

Resistive Current Shunts must be used for current measurement.

No direct connection allowed.

The engine body must be grounded. Otherwise faulty voltage and frequency measurements may occur.

For the correct operation of the exerciser and weekly schedule programs, adjust the real time clock of the unit through programming menu.

3. TERMINAL DESCRIPTIONS

3.1. BATTERY VOLTAGE INPUT

Supply voltage:	9 to 33VDC
Cranking dropouts:	Survives 0VDC during 100ms. The voltage before surge should be 9VDC minimum
Overvoltage protection:	Withstands 150VDC continuously.
Reverse voltage:	-33VDC continuous
Maximum operating current:	250mA @ 12/24VDC. (All options included, digital outputs open.)
Typical operating current:	200mA @ 12/24VDC. (all options passive, digital outputs open)
Measurement range:	0 to 36VDC
Display resolution:	0.1VDC
Accuracy:	0.5% + 1 digit @ 24VDC

3.2. BATTERY BANK DC VOLTAGE INPUTS

Measurement method:	Isolated DC voltage measurement
Sampling rate:	100K s/s
Input voltage range:	0 to 70 VDC
Measurement range:	0 to 70VDC
Input impedance:	215 K-ohms
Display resolution:	0.1VDC
Isolation:	500VAC, 1minute
Accuracy:	0.5% + 1 digit (±0.35V@50VDC)

3.3. BATTERY BANK CHARGE CURRENT INPUT

Measurement method:	Isolated DC voltage measurement
Sampling rate:	100 Ks/s
Input voltage range:	0 to 100 mVDC
Measurement range:	0 to 100 mVDC
Input impedance:	1000 ohms
Isolation:	500VAC, 1minute
Accuracy:	0.5% + 1 digit (±0.6A@100ADC)
Current shunt range:	1A/60mV to 5000A/60mV
Display resolution:	0.1ADC (shunt < 250A/60mV) 1ADC (shunt > 250A/60mV)

Be careful about not to applying more than 100mVDC, otherwise the unit may get damaged.

3.4. DIGITAL INPUTS

Number of inputs:	7 inputs, all configurable
Function selection:	from list
Contact type:	Normally open or normally closed (programmable)
Switching:	Battery negative or battery positive (programmable)
Structure:	47 k-ohms resistor to battery positive, 110k-ohms to battery negative.
Measurement:	Analog voltage measurement.
Open circuit voltage:	70% of battery voltage
Low level threshold:	35% of battery voltage
High level threshold:	85% of battery voltage
Maximum input voltage:	+100VDC with respect to battery negative
Minimum input voltage:	-70VDC with respect to battery negative
Noise filtering:	yes

3.5. ANALOG SENDER INPUTS AND SENDER GROUND

Number of inputs:	4 inputs, with configurable curve
Structure:	667 ohms resistor polarizing to 3.3VDC
Measurement:	Analog resistor measurement.
Open circuit voltage:	+3.3VDC
Short circuit current:	5mA
Measurement range:	0 to 5000 ohms.
Open circuit threshold:	5000 ohms.
Resolution:	1 ohms @ 300 ohms or lower
Accuracy:	2 %+1 ohm (±7 ohms @300 ohms)
Noise filtering:	yes

3.6. CHARGE INPUT TERMINAL

The Charge terminal is both an input and output.
When the engine is ready to run, this terminal supplies the excitation current to the charge alternator.
The excitation circuit is equivalent to a 2W lamp.
The threshold voltages for warning and shutdown alarm are adjustable through program parameter.

Structure:	• battery voltage output through 20 ohm PTC • voltage measurement input
Output current:	160mA @12VDC 80mA @24VDC
Voltage measurement resolution:	0.1VDC
Voltage measurement accuracy:	2% + 0.1V (0.9V @30VDC)
Charge Fail Warning Threshold:	adjustable
Charge Fail Shutdown Alarm Threshold:	adjustable
Open circuit voltage:	battery positive
Overvoltage protection:	> 500VDC continuous, with respect to battery negative
Reverse voltage protection:	-30VDC with respect to battery negative

3.7. DIGITAL OUTPUTS

The unit offers 4 digital outputs. Fuel and crank relays have fixed function. Other 2 relays have programmable function, selectable from list.

Structure:	Negative pulling protected semiconductor output. One terminal is connected to battery negative.
Max continuous current:	1.0 ADC
Max switching voltage:	33 VDC
Overvoltage protection:	40 VDC
Short circuit protection:	> 1.7 ADC
Reverse voltage protection:	500 VDC

3.8. LOAD CONTACTOR OUTPUT

Structure:	Relay output, normally open contact. Both terminals provided
Max switching current:	16A @250VAC/30VDC
Max switching power:	4000VA

3.9. ANALOG OUTPUT

Structure:	linear output for rpm/voltage control
Functionality:	Precision PID control output, regulating rpm/voltage for voltage matching, current control, temperature and rpm limiting.
Output impedance:	1 k-ohms
Output voltage:	0-10 V-DC
Frequency range:	10Hz to 10 kHz
Resolution:	0.1%
Accepted Load:	> 10 k-ohms

3.10. MAGNETIC PICKUP INPUT

Structure:	Differential frequency measurement input, MPU or charging pulses
Input impedance:	100 k-ohms
Input voltage:	1.0VAC-RMS to 100VAC-RMS
Frequency range:	10Hz to 10 kHz
Resolution:	1 rpm
Accuracy:	0.2% + 1 rpm (±3rpm @1500 rpm)
Flywheel teeth range:	1 to 500

If MPU unit is used, then use a twisted cable pair or coaxial cable for best results.

If charge alternator pulses are used, please connect only the MPU+ terminal and leave open the MPU- terminal.

Do not share MPU with other devices.

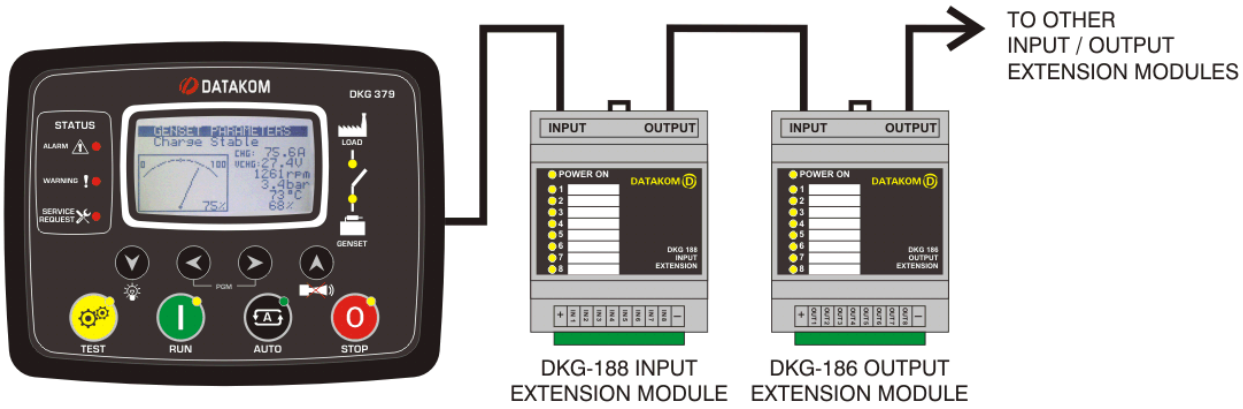
3.11. INPUT/OUTPUT EXTENSION

The module provides resources for 16 additional digital inputs and 16 additional digital outputs.

Digital inputs can be extended using **DKG-188 Digital Input Extension** modules, each one providing 8 inputs. Digital inputs are programmable through the main controller. The switching characteristic is not programmable and must be battery negative. Any function can be assigned to digital inputs.

Digital outputs can be extended using **DKG-186 Fet Extension** modules, each one providing 8 outputs. Digital outputs have the same electrical characteristics as on board outputs. They have programmable functions through the main controller. Any function can be assigned to any output.

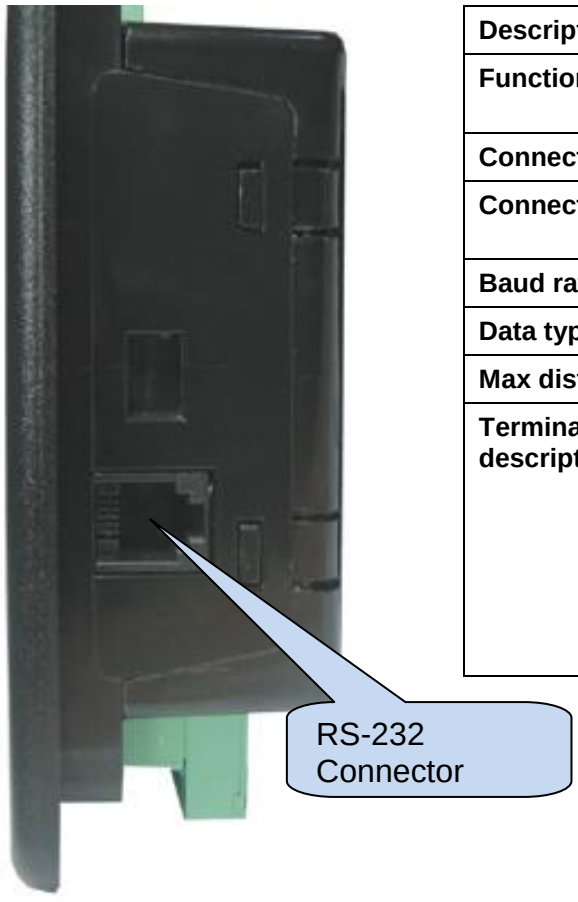
Input and output extension modules are connected to the main controller in a cascade structure, in any order. The connection cable is provided with each extension module.



3.12. J1939-CANBUS PORT

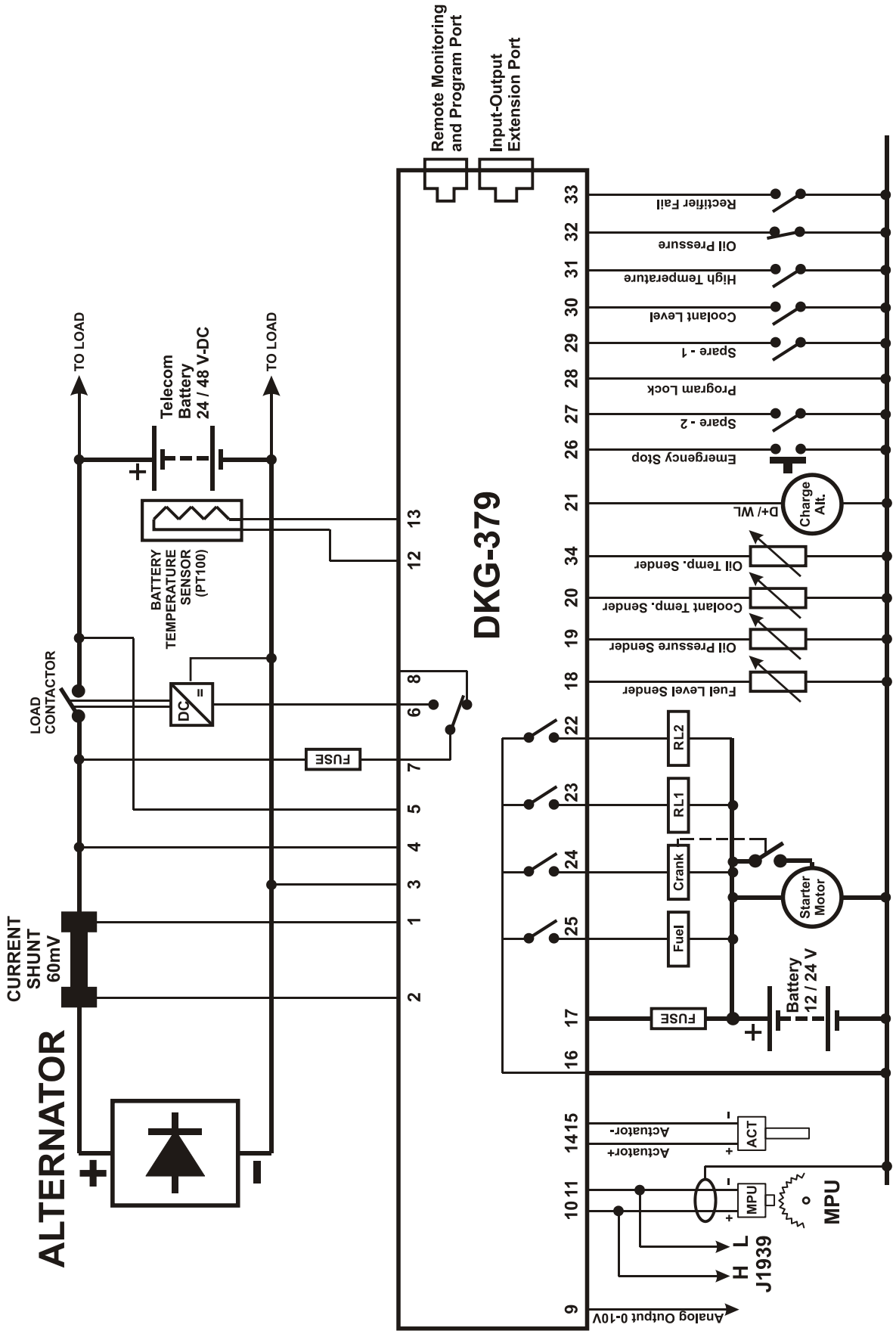
Structure:	CANBUS, non isolated.
Connection:	3 wires (CANH-CANL-GND).
Data rate:	250 kbps
Termination:	Internal 120 ohms provided
Common mode voltage:	-0.5 VDC to +15 VDC, internally clamped by transient suppressors.
Max distance:	200m with 120 ohm balanced cable

3.13. RS-232 PORT (OPTIONAL)



Description:	RS-232, non isolated.	
Functionality:	External modem, PC connection, PLC connection	
Connector:	RJ11-6pin	
Connection:	6 wires (Rx-Tx-DTR-CxD-GND-+10V). Full duplex.	
Baud rate:	9600 bauds	
Data type:	8 bit data, no parity, 1 bit stop	
Max distance:	15m	
Terminal description:	1: DTR output 2: Tx output 3: CxD input 4: GND 5: Rx input 6: +10V	6 1 Front view of RJ11 6 pin connector

4. CONNECTION DIAGRAM



5. TERMINAL DESCRIPTION

Term	Function	Technical data	Description
1	**CURRENT MEASUREMENT INPUT NEGATIVE**	60mV DC input	Connect the current measuring shunt resistor outputs to these terminals. Current measurement circuit is isolated from the rest of the device. Thus the current shunt may be placed in positive or negative branch of the alternator without affecting measurement quality. Be careful about the polarity, otherwise the unit will display faulty current measurements. Be careful about not to applying more than 100mVDC, otherwise the unit may get damaged.
2	**CURRENT MEASUREMENT INPUT POSITIVE**		
3	**DC ALTERNATOR OUTPUT NEGATIVE**	70VDC input	Connect the DC alternator and load outputs to these terminals. Be careful about the polarity, otherwise the unit will display faulty measurements. Be careful not to apply more than 70VDC, otherwise the unit may get damaged.
4	**DC ALTERNATOR OUTPUT POSITIVE**		
5	**DC LOAD POSITIVE TERMINAL**		
6	**LOAD CONTACTOR NO TERMINAL**	Relay output, 16A-DC	This output provides energy to the load contactor.
7	**LOAD CONTACTOR COMMON TERMINAL**		
8	**LOAD CONTACTOR NC TERMINAL**		
9	**ANALOG OUTPUT**	0-10 VDC	Precision PID control output, regulating rpm/voltage for voltage matching, current control, temperature and rpm limiting.

CANBUS VERSIONS			
10	**CANBUS-H**	Digital communication port	Connect the J1939 port of an electronic engine to these terminals. The 120 ohm terminating resistors are inside the unit. Please do not connect external resistors. Use a twisted cable pair or coaxial cable for best results.
11	**CANBUS-L**		

MPU INPUT VERSIONS			
10	**MPU +**	Analog input, 1.0 to 100V-AC	Connect the MPU unit or the charge alternator pulse output to these inputs If MPU unit is used, then use a twisted cable pair or coaxial cable for best results. If charge alternator pulses are used, please connect only the MPU+ terminal and leave open the MPU- terminal.
11	**MPU -**		

Term	Function	Technical data	Description
12	**TEMP MEASUREMENT INPUT**	PT100 sensor input	Connect the battery bank temperature sensor to these inputs. The sensor must be of PT100 type. Polarity is not important. The sensor will be used to protect the battery bank from overheating during charge cycle.
13	**TEMP MEASUREMENT INPUT**		
14	**ACTUATOR +**	Output, 10A max	These outputs supply energy to the electric actuator. The output voltage will increase in order to supply more fuel to the engine. A short circuit protection is provided.
15	**ACTUATOR -**		
16	**GROUND**	O VDC	Power supply negative connection.
17	**BATTERY POSITIVE**	+12 or 24VDC	The positive terminal of the DC Supply shall be connected to this terminal. The unit operates on both 12V and 24V battery systems.
18	**FUEL LEVEL SENDER**	Input, 0-5000 ohms	Analogue fuel level sender connection. Do not connect the sender to other devices. The input has programmable ohms for VDO senders.
19	**OIL PRESSURE SENDER**	Input, 0-5000 ohms	Analogue oil pressure sender connection. Do not connect the sender to other devices. The input has programmable characteristics and connects to any kind of sender.
20	**COOLANT TEMP. SENDER**	Input, 0-5000 ohms	Analogue high temperature sender connection. Do not connect the sender to other devices. The input has programmable characteristics and connects to any kind of sender.
21	**CHARGE**	Input and output	Connect the charge alternator's WL/D+ terminal to this terminal. This terminal will supply the excitation current and measure the voltage of the charge alternator.
22	**RELAY-2 (HORN RELAY)**	Output 1A/28VDC	This output has programmable function, selectable from a list.
23	**RELAY-1 (STOP RELAY)**	Output 1A/28VDC	This output has programmable function, selectable from a list.
24	**START RELAY**	Output 1A/28VDC	This output controls the engine cranking.
25	**FUEL RELAY**	Output 1A/28VDC	This output is used for fuel solenoid control.

Term	Function	Technical data	Description
26	**EMERGENCY STOP**	Digital inputs	These inputs have programmable characteristics selected via the program menu. Each input may be driven by a 'normally closed' or 'normally open' contact, switching either battery+ or battery-. The effect of the switch is also selectable from a list. See PROGRAMMING section for more details.
27	**SPARE-2**		
28	**PROGRAM LOCK**		
29	**SPARE-1**		
30	**COOLANT LEVEL**		
31	**HIGH TEMP**		
32	**LOW OIL PRESSURE**		
33	**RECTIFIER FAIL**		
34	**OIL TEMP. SENDER**	Input, 0-5000 ohms	Analogue oil temperature sender connection. Do not connect the sender to other devices. The input has programmable characteristics and connects to any kind of sender.

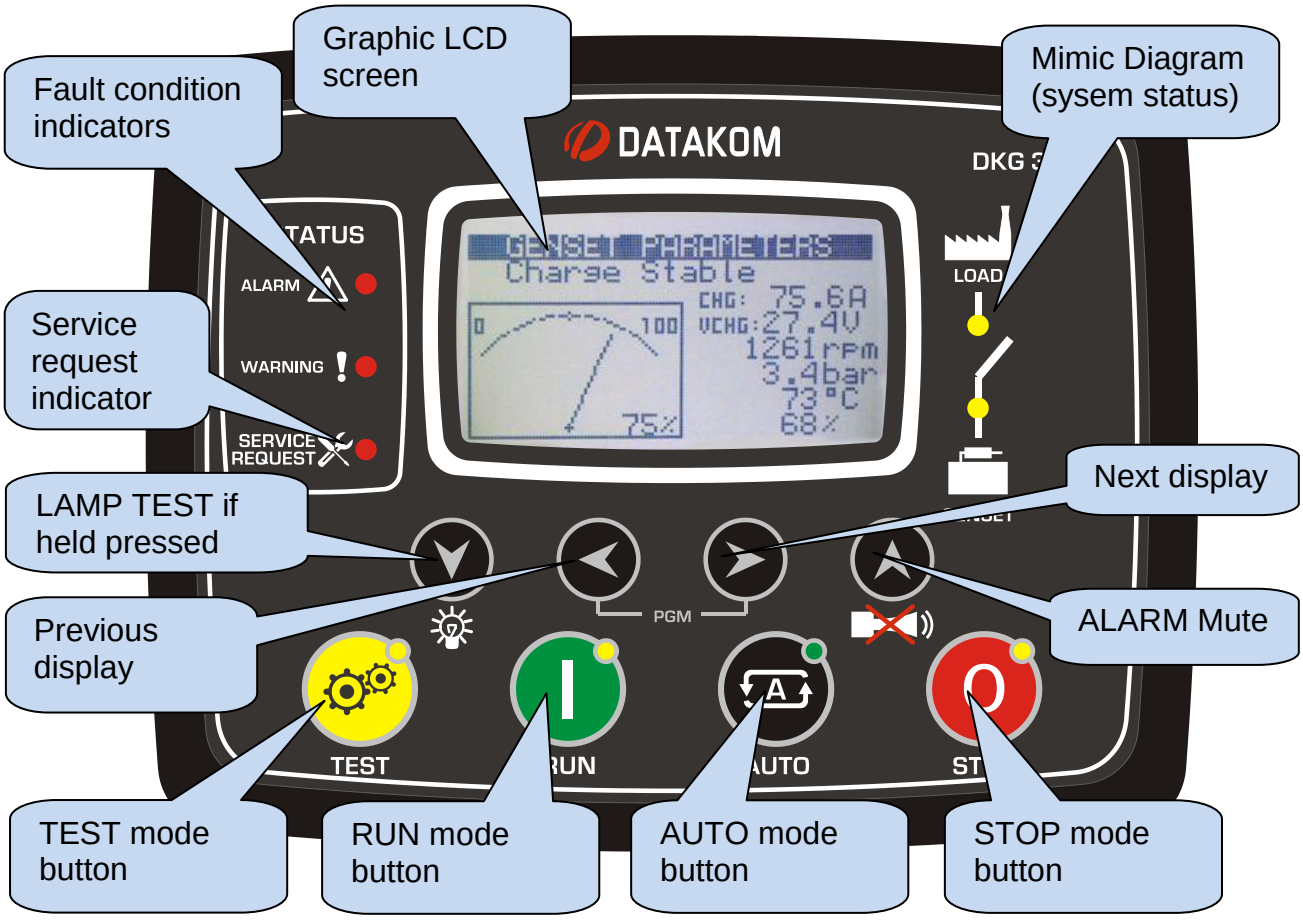
6. TECHNICAL SPECIFICATIONS

DC Supply Range: 9.0 to 33.0 V-DC
Cranking dropouts: survives 0 V for 100ms.
Typical Standby Current: 200 mA-DC
Maximum Operating Current: 250 mA-DC (outputs open)
Load Contactor Relay Output: 16 A / 250V-AC / 30V-DC
DC Outputs: 1A @ 28V protected semiconductor outputs
Charge excitation: min 2 Watts
Analog Output:
- **Output Range:** 0-10V-DC
- **Output Impedance:** 1K-ohms
- **Max Load:** 10K-ohms

Digital Inputs: 0 to 33V-DC
Analog sender input range: 0-5000 ohms.
Battery Temp. Input: standard PT100 sensor
Magnetic pickup input:: 1.0 – 100VAC-RMS
Magnetic pickup frequency: 10 KHz max.
Alternator voltage: 0 to 70V-DC
Battery bank voltage: 0 to 70V-DC
Current input: from DC shunt, 60mV at rated current
Rated Current range: 1 to 5000 ADC at 60mV
Actuator Output Voltage: 0 to 12/24V
Actuator Drive: 7A-DC max, current limited, short circuit and thermally protected.
Actuator Short Circuit Protection: min 9 Amp
Serial port: RS-232, 9600 bauds, no parity, 1 bit stop
Operating temp.: -20°C (-4°F) to 70°C (158°F).
Storage temp.: -40°C (-40°F) to 80°C (176°F).
Maximum humidity: 95% non-condensing.
Dimensions: 172 x 134 x 76 mm (WxHxD)
Panel Cut-out Dimensions: 151x111 mm minimum.
Weight: 450 g (approx.)
Case Material: High Temperature ABS/PC (UL94-V0)
IP Protection: IP65 from front panel, IP30 from the rear
CE Conformity reference standards:
- EN 61010 (safety requirements)
- EN 61326 (EMC requirements)

7. DESCRIPTION OF CONTROLS

7.1. FRONT PANEL FUNCTIONALITY



7.2. PUSHBUTTON FUNCTIONS

BUTTON	FUNCTION
	Selects TEST mode. The genset runs and starts charging
	Selects RUN mode. The genset runs off-load.
	Selects AUTO mode. The genset runs when necessary and starts charging.
	Selects OFF mode. The genset stops.

BUTTON	FUNCTION
	LAMP TEST when held pressed. Selects next item or decrease value in program mode.
	Selects previous display.
	Selects next display.
	Resets the ALARM RELAY. Selects previous item or increase value in program mode.
	When held pressed for 5 seconds, enters PROGRAMMING mode.

7.3. DISPLAY SCREEN ORGANIZATION

The unit has a graphical 128x64 pixel LCD display. It shows:

-Measured parameters,
-The company logo,
-The alarm list
-Software version and date-time information,
-Statistical counters,
-Event records,
-Program parameters.

Navigation between different screens is made with the and buttons. Each depression of the button switches the display to the next screen. Each depression of the button switches the display to the previous screen.

During operation, the unit will switch automatically between different screens, displaying always the most important parameters for the current operating status.

If an alarm or warning occurs during operation, in other then programming mode, the display will automatically switch to **ALARM LIST** position. The or buttons will not function. To enable display navigation, press **ALARM MUTE** button first. If there is more than one alarm, the next alarm is displayed by pressing the button. Thus all existing alarms can be scanned. When there is no more alarm to display '**END OF ALARM LIST**' will be displayed.

The display has a **backlight** illumination feature. The **backlight** turns on with the depression of any button or when the genset runs. It turns off after 4 hours to allow power economy.

Description	**Contents**	
Genset parameters	Genset status Alternator Current, Genset Active Power (kW)	 Alternator Voltage Engine rpm
Engine parameters	Genset status Oil Pressure, Coolant Temperature, Fuel Level,	 Engine rpm Battery Voltage Oil Temperature
Complete Genset parameters	Genset status Alternator Voltage Alternator Current Oil Temperature Genset Active Power (KW) Engine rpm	 Load Voltage Oil Pressure Coolant Temperature Fuel Level Battery Voltage
Graphical Genset parameters	Genset status Genset Active Power (%),	 Alternator Current Alternator Voltage Engine rpm Oil Pressure Coolant Temperature Fuel Level

Below screens are applicable to J1939 enabled versions only.

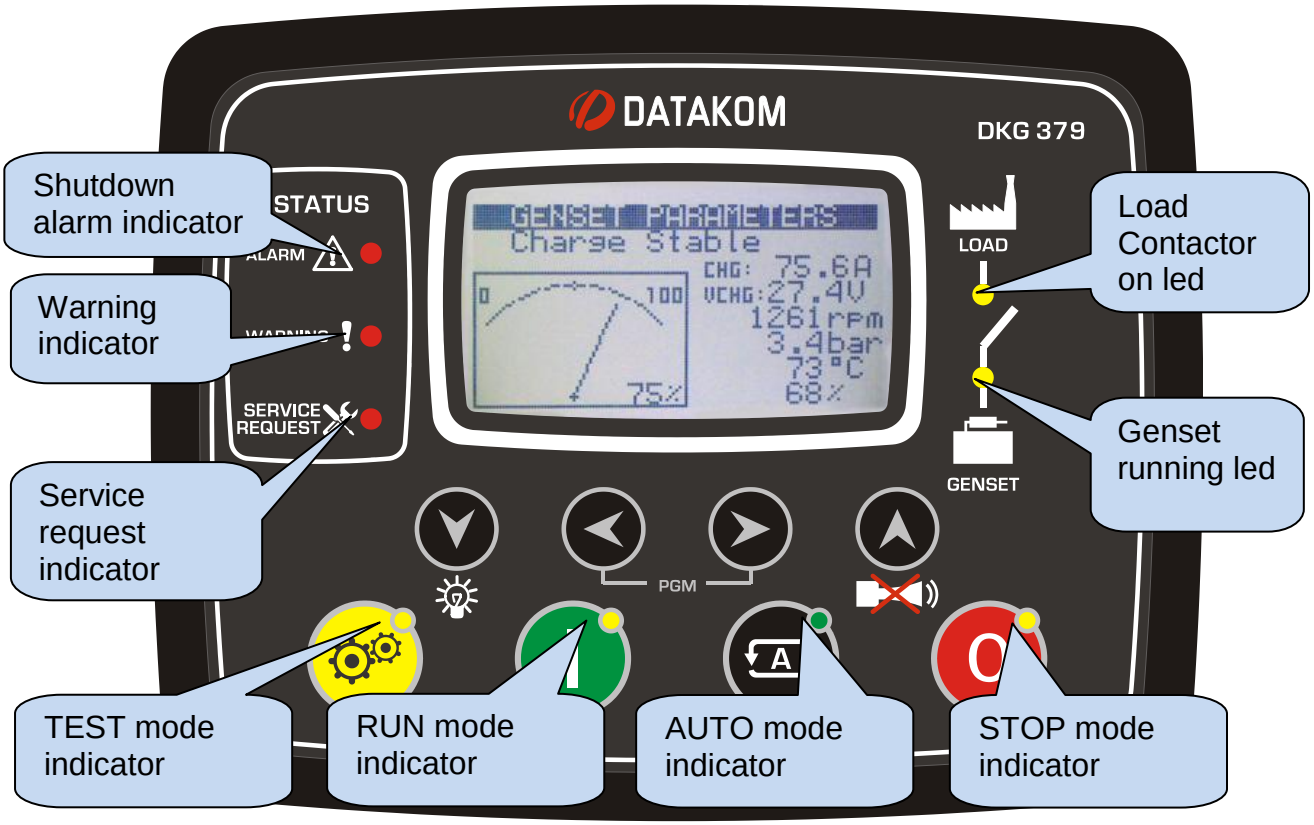
Description	Contents
CANBUS Measurements 1 / 6	Percent Torque Percent Load Fuel Pressure
CANBUS Measurements 2 / 6	Fuel Rate Average Fuel Economy Total Engine Hours
CANBUS Measurements 3 / 6	Air Pressure Ambient Air Temperature Oil Temperature
CANBUS Measurements 4 / 6	Intake Manifold 1 Temperature Exhaust Gas Temperature Fuel Temperature
CANBUS Measurements 5 / 6	Boost Pressure Air Filter Differential Pressure Crank Case Pressure
CANBUS Measurements 6 / 6	Coolant Level Oil Level Coolant Pressure

Below screens are applicable to all versions.

Company Logo	DATAKOM
Alarm List	If no alarm exists, 'END OF ALARM LIST' will be displayed. Existing alarms, load_dumps, warnings and J1939 ECU warnings will be displayed as one screen for each entry. Switching to the next entry will be made with the button.
Date-Time, Software Version	Date and time. Operating software version. J1939 software version.
Statistical Counters 1 / 3	Engine Hours Run Total Genset Active Power (KW-h)
Statistical Counters 2/ 3	Engine Hours to Service Time to Service
Statistical Counters 3 / 3	Total Engine Cranks Total Engine Runs

The unit measures alternator, battery bank and engine parameters. The display of the parameters is organized as PARAMETER GROUPS and items in a group.

7.4. LED LAMPS



STATUS LEDS:

ALARM: Turns on when a shutdown alarm or loaddump condition exists.

WARNING: Turns on when a warning condition exists

SERVICE REQUEST: Turns on when at least one of the service counters has expired.

MODE LEDS: Each led turns on when the related mode is selected, either locally or remotely.

MIMIC DIAGRAM LEDS:

LOAD CONTACTOR ON: Turns on when the load contactor is activated.

GENSET RUNNING: This led turns on when the engine speed is at least 500 rpm.

8. DISPLAYING EVENT LOGS

The unit features 100 event logs with date-time stamp and full snapshot of measured values at the moment that the event has occurred.

Stored values in an event record are listed below:

Genset phase voltages L1-L2-L3
Genset phase currents L1-L2-L3
Genset frequency
Genset active power (KW)
Genset power factor
Engine rpm
Oil pressure
Coolant temperature
Fuel level
Battery voltage
Mains phase voltages L1-L2-L3
Mains frequency
Digital input statuses
Charge input status
J1939 VAlues (if applicable)

-event number
-event type / fault definition (see below for various event sources)
-date and time
-operation mode
-operation status (on-load, on-mains, cranking, etc...)
-alternator voltage DC
-battery bank voltage DC
-alternator current DC
-genset active power (kW)
-battery bank temperature
-oil pressure
-engine temperature
-fuel level
-oil temperature
-canopy temperature
-ambient temperature
-engine rpm
-battery voltage
-charge voltage
-module internal temperature

Event sources are:

-Shutdown alarms, Load dump alarms, Warnings
-Periodic records.

Event logs are displayed within the program mode menu. This is designed in order to reduce the interference of event logs with other measurement screens.

To **enter the event display**, press together and buttons for 5 seconds.

When the program mode is entered, below password entry screen will be displayed.

Skip the password entry screen by pressing the button 4 times. The screen below left will come.

Press again button. The last event is displayed.

The first page will display the event number, event type, fault type and date-time information.

When displaying event logs:

button will display the next information in the same event

button will display the previous information in the same event

button will display the same information of the previous event

button will display the same information of the next event.

9. STATISTICAL COUNTERS

The unit provides a set of non resettable incremental counters for statistical purposes.

The counters consist on:

- -total genset kWh
- -total engine hours
- -total engine cranks
- -total engine runs
- -engine hours to service
- -time to service

These counters are kept in a non-volatile memory and are not affected from power failures.

10. OPERATION OF THE UNIT

10.1. QUICK START GUIDE

STOPPING THE ENGINE: Press STOP button

STARTING THE ENGINE: Press RUN button

MANUAL LOAD TRANSFER: Press TEST button. The genset will run and take the load.

LOAD TEST: Press TEST button. The genset will run and take the load.

AUTOMATIC OPERATION: Press AUTO button.

Mode can be changed anytime without negative effect.
Changing the operation mode while the genset is running will result into a behavior suitable for the new operating mode.

10.2.STOP MODE

The STOP mode is entered by pressing the button.

In this mode, the genset will be in a rest state.

When STOP mode is selected, if the genset is running under load, then it will be immediately unloaded. The engine will continue to run during **Cooldown Timer** and will stop afterwards.

If the STOP button is pressed again, then the engine will immediately stop.

If the engine fails to stop after the expiration of **Stop Timer** then a **Fail to Stop** warning will occur.

If a **Remote Start** or **Force to Start** signal arrives in STOP mode, the genset will not start until AUTO mode is selected.

10.3. AUTO MODE

The AUTO mode is entered by pressing the  button.

The AUTO mode is used for the automatic charging of the battery bank. The controller will constantly monitor the battery bank voltage. It will run the engine and transfer the load when the voltage falls below programmed threshold.

If a panel lock input is defined and signal is applied, then mode change will not occur. However display navigation buttons are still enabled and parameters may be visualized.

The mains availability evaluation sequence is below:

- If the battery bank voltage is below threshold, this will generate an engine start request.
- If a Simulate Mains signal is present, then the engine start request is reset.
- If a Force to Start signal is present, then this will generate an engine start request.
- If a Remote Start input is defined, then this signal decides of the engine start request.

When an "engine start request" is occurred then the engine start sequence begins:

- The unit waits during Engine Start Delay for skipping erroneous engine start requests, if the engine start request is reset before the end of this timer, the genset will not start.
- The unit turns on the fuel and preheat glow plugs (if any) and waits for preheat timer.
- The engine will be cranked for programmed times during crank timer. When the engine fires, the crank relay will be immediately deactivated. See section **Crank Cutting** for more details.
- The engine will run at idle speed during Idle Speed Timer.
- The engine will run unloaded during engine heating timer.
- The engine will be accelerated smoothly until the alternator voltage matches the battery bank voltage. Then the load contactor output will be energized.
- **When the battery charging cycle ends then an engine stop sequence begins:**
- The controller decreases the rpm until charge current becomes zero.
- Then the load contactor is deactivated.
- The controller decreases the rpm until idle speed.
- If a cooldown period is given, the generator will continue to run at idle speed during the cooldown period.
- At the end of cooldown, the fuel solenoid will be de-energized, the stop solenoid will be energized for Stop Solenoid timer and the diesel will stop.
- The controller will wait until the battery voltage falls below the genset startup voltage.

If the operation of the genset is disabled by the weekly schedule, then the AUTO led will flash, and the operation of the genset will be as in the OFF mode.

10.4. RUN MODE, MANUAL CONTROL

The RUN mode is entered by pressing the  button.

When the RUN mode is selected, the engine will be immediately started.

The starting sequence is as described below:

- The unit turns on the fuel and preheat glow plugs (if any) and waits for preheat timer.
- The engine will be cranked for programmed times during crank timer. When the engine fires, the crank relay will be immediately deactivated. See section **Crank Cutting** for more details.
- The engine will run at idle speed during Idle Speed Timer.
- The engine will run unloaded until another mode is selected..

If Emergency Backup mode is enabled and if the battery bank voltage drops below threshold, then the load contactor will be activated.

When the charge cycle ends, the load contactor will be deenergized, but the engine will be kept running unless another mode is selected.

In order to stop the engine press  button or select another mode of operation.

10.5. TEST MODE

The TEST mode is entered by pressing the  button.

The TEST mode is used in order to test the genset under load.

Once this mode is selected, the engine will run as described in the AUTO mode, regardless of the battery bank voltage and a charging cycle will be initiated..

When the charging cycle is terminated, the genset will run at a speed to establish the “nominal charge voltage” and will feed the load indefinitely unless another mode is selected.

11. OPTIMAL CHARGING, VARIABLE SPEED OPERATION

It is strongly recommended to wire speed detection through MPU, charge alternator pulses or J1939-CANBUS and enter correct low and high rpm limit values in order to preserve engine speed protection.

The unit decides with precision the moment to run the genset and performs a high efficiency charging cycle.

The complete charging cycle will always include a float charge cycle. Following programming, a boost charging cycle may be added.

The maximum charge duration is limited with parameter "**Max Charge Time**". Following the value of the parameter "**Stop Current percent**", the controller will detect precisely the end-of-charge condition and will stop the engine before the expiration of the Max Charge Time parameter, providing fuel economy and longer service life.

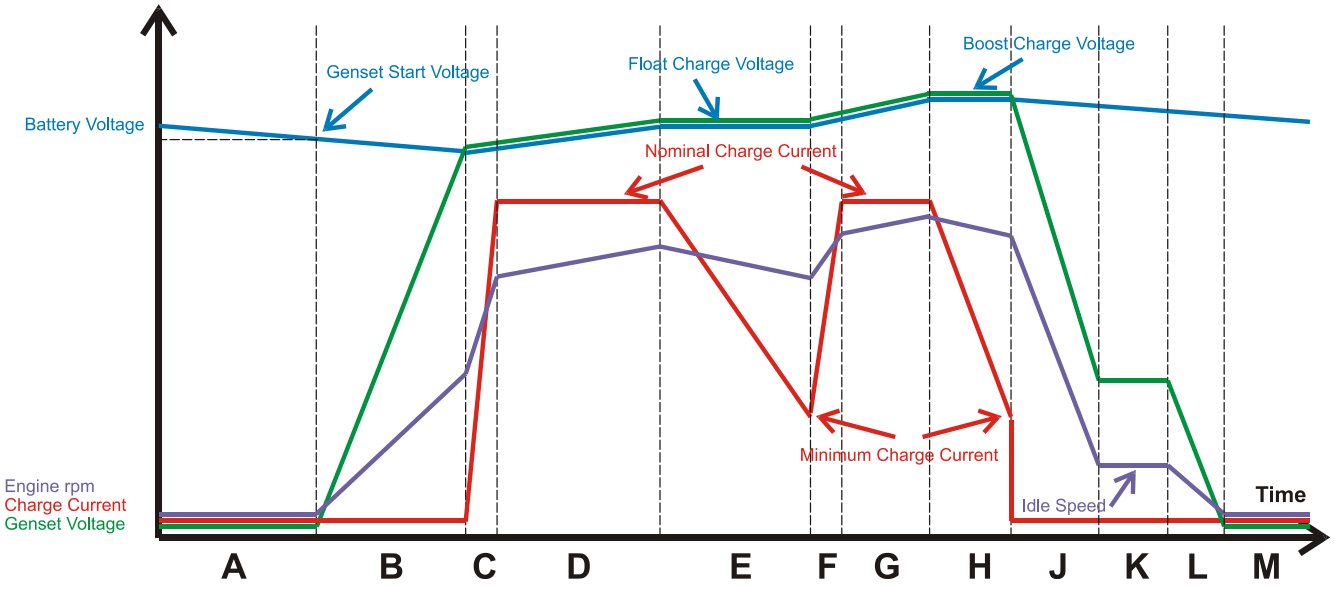
11.1. RELATED PARAMETERS

(1) Start to Charge Voltage	V	24.0	When the battery bank voltage falls below this level, then the controller will initiate an automatic charging cycle. The default value is set for a 24V battery bank.
(1) Max Charge Current	A	50	This is the maximum allowed charge current flowing from the alternator to the battery bank.
(1) Max Charge Time	min	120	This is the maximum duration of a charge cycle. Even if the charge cycle is not completed at the expiration of this timer, the engine will stop.
(1) Nominal Charge Volt	V	27.4	This is the float charge voltage of the battery bank. The default value is set for a 24V battery bank.
(1) Max Battery Temperature	°C	90	This is the maximum allowed temperature of the battery bank. If the temperature approaches this limit, then the charging current will be reduced.
(1) Boost Enable	-	0	**0**: No boost charge cycle **1**: Boost charge cycle is performed. The charge voltage will be set to the nominal boost voltage during boost execution time.
(3) Boost Start Current	%	30	If the boost charge is enabled, when the charge current goes below this percentage of the max charge current, then the boost charge cycle will be initiated.
(1) Boost Execution Time	min	3	If enabled, the boost charge is performed during this timer.
(1) Nominal Boost Voltage	V	28.8	This is the max charging voltage allowed during the boost cycle.

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) Stop Current percent	%	0	If this value is different from **zero**, when the charge current falls below this percentage of the max charge current, then the charge cycle will be supposed to be terminated. If this parameter is set to **zero**, the controller will monitor the charge current automatically. When the charge current is stabilized in a 5 minute interval, it will conclude that the charge cycle is terminated.
(2) PID Gain Value	-	10	This parameter defines the reaction speed of the actuator output. A high gain will cause faster reaction but brings a risk of instability. A low gain is slower to react but more stable.
(2) PID Stability Percent	%	10	This parameter defines the ratio of proportional to integral reaction of the PID loop. A high value will cause slower but more stable operation. A low value will cause faster operation but may cause instability.
(1) RPM High Limit	rpm	2000	This is the maximum allowed rpm of the engine during charge cycle. If the engine speed approaches this limit, the controller will stop increasing the current.
(1) Uncontrolled Charge Active	-	0	**0**: Optimal charging cycle is performed **1**: Uncontrolled charging cycle performed
(1) Starting Fuel	%	5	This is the default output level of the governor output during cranking.
(1) Idle Speed RPM	rpm	30	This is the engine speed in IDLE SPEED mode. This speed is maintained with PID control.
(1) Charge Voltage Threshold Timer	sec	1	When the battery bank voltage falls below the **Battery Start to Charge Voltage** during this timer, then the controller will initiate an automatic charging cycle.
(1) Must Start Voltage	V	0.0	When the battery bank voltage falls below this level, then the controller will initiate immediately an automatic charging cycle. If this parameter is set to zero, then only delayed start is active.

11.2. OPTIMAL CHARGE CYCLE DESCRIPTION

Below picture describes the charge cycle steps in detail.



Step_A:
The genset is at rest.
The load consumes power from the battery bank.
The battery bank voltage decreases slowly with discharge level.
When the battery bank voltage falls below the **start to charge voltage**, after the **charge voltage threshold** timer, the controller detects that the battery bank is discharged and decides to run the genset.

Step_B:
The engine is started, the genset output voltage increases with rpm increase.
The controller adjusts the rpm in order to match exactly the battery bank voltage.
When voltage matching is reached, the load contactor is closed. Thus load switching is performed with zero current. This provides longer contactor life.

Step_C:
The controller increases the rpm slowly until reaching the **maximum charging current**.

Step_D:
The rpm is controlled in order to keep the charging current constant at its maximum set value.
The battery bank voltage increases slowly until reaching the **nominal charge voltage**.

Step_E:
The rpm is controlled in order to keep the battery bank voltage at the **nominal charging voltage**.
The charge current decreases slowly.

Step_F:
When the charge current falls below the **boost start current**, the controller starts the optional boost charge cycle.

Step_G: The **maximum charging current** is maintained until the battery voltage reaches the **nominal boost voltage**.
The controller increases the rpm slowly until reaching the **maximum charging current**.

The battery bank voltage increases slightly with charge percentage.

Step_H:
The rpm is controlled in order to keep the battery bank voltage at **nominal boost voltage**.
The charge current decreases slowly.

Step_J:
When the charge current falls below the **stop current percent**, the controller decreases the rpm until charge current becomes zero, then opens the load contactor and decreases the rpm until idle speed.

Step_K:
The idle speed is kept constant until the end of cooldown period.

Step_L:
The engine comes to rest.
The load consumes power from the battery bank.
The battery bank voltage decreases slowly with discharge level.
The controller will wait until the battery bank voltage falls below the **start to charge voltage**.

11.3. EFFECT OF BATTERY BANK TEMPERATURE

If connected, the controller will take into account the battery bank temperature. The temperature sensor is of industry standard PT100 type. (not provided with the controller)

During the charging cycle, if the battery temperature approaches the **maximum battery temperature**, then the charge current will be reduced to a value lower than its maximum allowed limit.

When the temperature of the battery bank gets closer to the **maximum battery temperature**, the allowed charge current will be reduced further until reaching 0% at the maximum battery temperature.

Thus the battery bank will not be allowed to overheat, that increases the battery lifetime.

11.4. RPM CONTROL

The internal actuator driver will allow precise adjustment of the engine rpm during operation.

However the engine rpm will be limited to RPM high limit, whatever the charge current requirement is.

Thus the engine will be used with the greatest possible efficiency.

12. UNCONTROLLED CHARGING, FIXED SPEED OPERATION

It is strongly recommended to wire speed detection through MPU, charge alternator pulses or J1939-CANBUS and enter correct low and high rpm limit values in order to preserve engine speed protection.

This charging mode is selected through the program parameter "**Uncontrolled Charge Active**" in engine parameters group.

When this mode is selected, the controller will precisely decide the moment to run the genset.

The charge voltage and current are not controlled, but simply monitored. The control PID is not operative.

The maximum charge duration is limited with parameter "**Max Charge Time**". Following the value of the parameter "**Stop Current percent**", the charge current may also cause engine stop before the expiration of the Max Charge Time parameter.

12.1. RELATED PARAMETERS

(1) Start to Charge Voltage	V	24.0	When the battery bank voltage falls below this level, then the controller will initiate an automatic charging cycle. The default value is set for a 24V battery bank.
(1) Max Charge Time	min	120	This is the maximum duration of a charge cycle. Even if the charge cycle is not completed at the expiration of this timer, the engine will stop.
(1) Stop Current percent	%	0	If this value is different from **zero**, when the charge current falls below this percentage of the max charge current, then the charge cycle will be supposed to be terminated. If this parameter is set to **zero**, the controller will monitor the charge current automatically. When the charge current is stabilized in a 5 minute interval, it will conclude that the charge cycle is terminated.
(1) Uncontrolled Charge Active	-	0	**0**: Optimal charging cycle is performed **1**: Uncontrolled charging cycle performed
(1) Charge Voltage Threshold Timer	sec	1	When the battery bank voltage falls below the **Battery Start to Charge Voltage** during this timer, then the controller will initiate an automatic charging cycle.
(1) Must Start Voltage	V	0.0	When the battery bank voltage falls below this level, then the controller will initiate immediately an automatic charging cycle. If this parameter is set to zero, then only delayed start is active.

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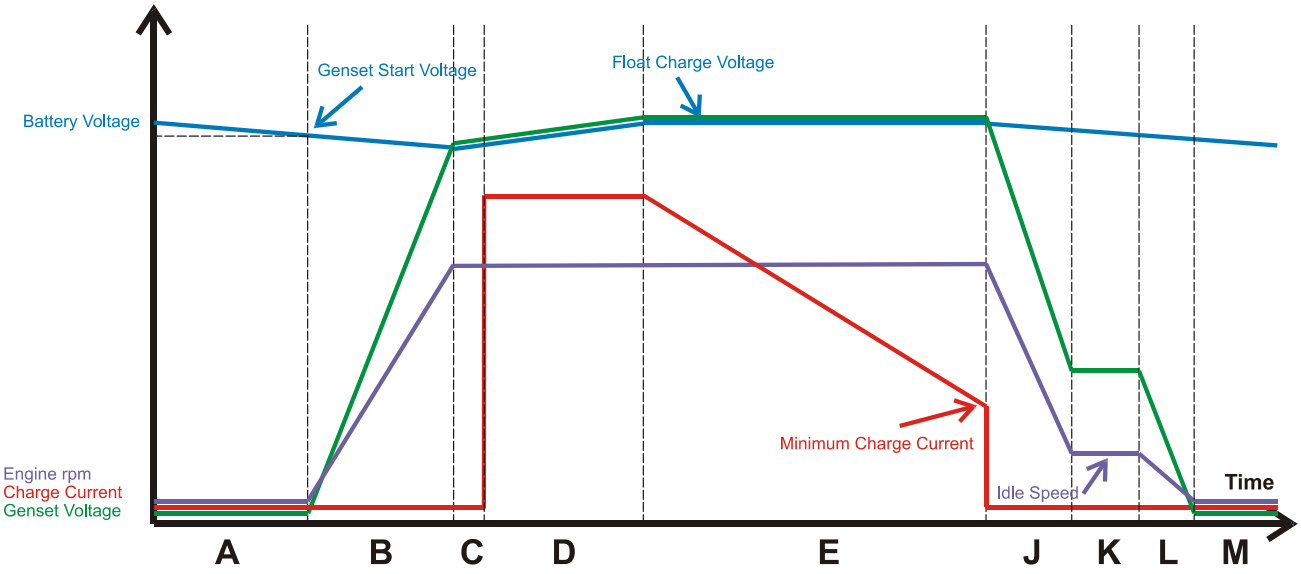
12.2. UNCONTROLLED CHARGE CYCLE DESCRIPTION

Below picture describes the charge cycle steps in detail.



Step_A:
The genset is at rest.
The load consumes power from the battery bank.
The battery bank voltage decreases slowly with discharge level.
When the battery bank voltage falls below the **start to charge voltage**, after the **charge voltage threshold** timer, the controller detects that the battery bank is discharged and decides to run the genset.

Step_B:
The engine is started, the genset output voltage increases with rpm increase.

Step_C:
After Genset Contactor Timer, the load contactor is closed. The genset starts the charging of the battery bank. The charge current is not controlled.

Step_D:
The battery bank voltage increases slowly until reaching the nominal genset DC output voltage.

Step_E:
The genset keeps the output voltage constant at the nominal genset DC output voltage.
The charge current decreases slowly.

Step_J:
When the charge current falls below the **stop current percent**, the controller opens the load contactor and activates the idle speed output (if enabled).

Step_K:
Engine cooldown period.

Step_L:
The engine comes to rest.
The load consumes power from the battery bank.
The battery bank voltage decreases slowly with discharge level.
The controller will wait until the battery bank voltage falls below the **start to charge voltage**.

13. PROTECTIONS AND ALARMS

The unit provides 3 different protection levels, being warnings, loaddumps and shutdown alarms.

1- **SHUTDOWN ALARMS:** These are the most important fault conditions and cause:
   - The **ALARM** led to turn on steadily,
   - The load contactor to be released immediately,
   - The engine to be stopped immediately,
   - The **Alarm** digital output to operate.

2- **LOAD_DUMPS:** These fault conditions come from electrical trips and cause:
   - The **ALARM** led to turn on steadily,
   - The load contactor to be released immediately,
   - The engine to be stopped after Cooldown period,
   - The **Alarm** digital output to operate.

3- **WARNINGS:** These conditions cause:
   - The **WARNING** led to turn on steadily,
   - The **Alarm** digital output to operate.

If a fault condition occurs, the display will automatically switch to the ALARM LIST page.

Alarms operate in a first occurring basis:

-If a shutdown alarm is present, following shutdown alarms, loaddumps and warnings will not be accepted,

-If a loaddump is present, following loaddumps and warnings will not be accepted,

-If a warning is present, following warnings will not be accepted.

If the ALARM MUTE button is pressed, the Alarm output will be deactivated; however the existing alarms will persist and disable the operation of the genset.

Alarms may be of **LATCHING** type following programming.

For latching alarms, even if the alarm condition is removed, the alarms will stay on and disable the operation of the genset.

Existing alarms may be canceled by pressing one of the operating mode buttons:

Most of the alarms have programmable trip levels. See the programming chapter for adjustable alarm limits.

13.1. SHUTDOWN ALARMS

Digital input alarms are fully programmable for the alarm name, sampling and action.

Only internal alarms are explained in this section.

GENSET LOW / HIGH SPEED	Set if the engine rpm is outside programmed limits. These faults will be monitored with **Holdoff Timer** delay after the engine is running. Low and high limits for warning and alarm are separately programmable. Another high engine rpm shutdown limit which is 12% above the high limit is always monitored and stops the engine immediately.
GENSET HIGH VOLTAGE	Set if the battery bank DC voltage goes over the programmed limit for **Overload Timer**. This fault will be monitored with **holdoff timer** delay after the engine is running.
HIGH BATTERY VOLTAGE	Set if the battery voltage goes above programmed limits. Both warning and alarm levels for high battery voltage are programmable.
FAIL TO START	Set if the engine is not running after programmed number of start attempts.
LOW CHARGE VOLTAGE	Set if a charge alternator failure (or broken belt) occurs. This fault condition may result to a **warning** or **alarm** following programming.
J1939 ECU FAIL	Set if no information has been received during 3 seconds from the ECU of the electronic engine. This fault condition is only controlled when fuel is on.
LOW OIL PRESSURE	Set if a signal is detected at the Low Oil Pressure Switch input or the oil pressure value measured from the sender is below the programmed limit. Warning and alarm limits are separately programmable for the oil pressure sender input. This fault will be monitored with **Holdoff Timer** delay after the engine is running. Also if the oil pressure switch is open at the beginning of a start attempt, then the engine will not be started and "**Oil Pressure Exists!**" information is displayed. When the oil pressure switch closes, normal operation will be resumed.
HIGH TEMPERATURE	Set if a signal is detected at the High Temperature Switch input or the coolant temperature value measured from the sender is above the programmed limit. Warning and alarm limits are separately programmable for the temperature sender input.
LOW FUEL	Set if a signal is detected at the low fuel level input or the the fuel level measured from the sender is below the programmed limit. Warning and alarm limits are separately programmable for the fuel level sender input.
EMERGENCY STOP	Set if a signal is detected at the emergency stop input.
SPARE-1 / SPARE-2	Set if a signal is detected from the related spare fault input.

13.2. LOADDUMP ALARMS

Digital input and analog sender alarms are fully programmable for the alarm name, sampling and action.

Only internal alarms are explained in this section.

OVERLOAD	Set if the alternator output current goes over the **Overcurrent Limit** for **Overload Timer**. If the current goes below the limit before expiration of the timer then no alarm will be set.
EXCESS POWER	Set if the genset power (KW) supplied to the load goes over the **Excess Power** limit for **Overload Timer**. If the power goes below the limit before expiration of the timer then no alarm will be set.

13.3. WARNINGS

GENSET LOW / HIGH SPEED	Set if the engine rpm is outside programmed limits. These faults will be monitored with **Holdoff Timer** delay after the engine is running. Low and high limits for warning and alarm are separately programmable. Another high engine rpm shutdown limit which is 12% above the high limit is always monitored and stops the engine immediately.
GENSET LOW / HIGH VOLTAGE	Set if the battery bank DC voltage goes outside programmed limits for **Overload Timer**. This fault will be monitored with **holdoff timer** delay after the engine is running.
LOW / HIGH BATTERY VOLTAGE	Set if the genset battery voltage is outside programmed limits.
FAIL TO STOP	Set if the engine has not stopped before the expiration of the **Stop Timer**.
LOW CHARGE VOLTAGE	Set if a charge alternator failure (or broken belt) occurs. This fault condition may result to a **warning** or **alarm** following programming.
J1939 ECU FAIL	Set when an engine fault code is received from the ECU of the electronic engine. This fault will not cause an engine stop. If necessary, the engine will be stopped by the ECU.
LOW OIL PRESSURE	Set if a signal is detected at the Low Oil Pressure Switch input or the oil pressure value measured from the sender is below the programmed limit. Warning and alarm limits are separately programmable for the oil pressure sender input. This fault will be monitored with **Holdoff Timer** delay after the engine is running. Also if the oil pressure switch is open at the beginning of a start attempt, then the engine will not be started and "**Oil Pressure Exists!**" information is displayed. When the oil pressure switch closes, normal operation will be resumed.
HIGH TEMPERATURE	Set if a signal is detected at the High Temperature Switch input or the coolant temperature value measured from the sender is above the programmed limit. Warning and alarm limits are separately programmable for the temperature sender input.
LOW TEMPERATURE	Set if the coolant temperature value measured from the sender is blow the **Engine Heating Temperature** limit.
LOW FUEL	Set if a signal is detected at the low fuel level input or the the fuel level measured from the sender is below the programmed limit. Warning and alarm limits are separately programmable for the fuel level sender input.
EMERGENCY STOP	Set if a signal is detected at the emergency stop input.
SPARE-1 / SPARE-2	Set if a signal is detected from the related spare fault input.
SERVICE REQUEST	Set if the service counter has expired. In order to reset the service counters please hold pressed both with  and  buttons during 5 seconds. The screen will display "Completed!"
SHORT CIRCUIT PROTECTION ACTIVE	Set if the actuator output is short circuited or overloaded. When the short circuit is removed, the unit will automatically revert to normal operation. However this warning will persist and must be reset manually.

14. PROGRAMMING

14.1. RESETTING TO FACTORY DEFAULTS

In order to resume to the factory set parameter values:

-hold pressed the **OFF, LAMP TEST** and **ALARM MUTE** buttons for 5 seconds,
-"**RETURN TO FACTORY SET**" will be displayed
-immediately press and hold pressed the **ALARM MUTE** button for 5 seconds
-factory set values will be reprogrammed to the parameter memory.

*Hold pressed **OFF, LAMP TEST** and **ALARM MUTE***

*Hold pressed **ALARM MUTE***

The program mode is used to adjust timers, operational limits and the configuration of the unit.

Although a free PC program is provided for programming, every parameter may be modified through the front panel, regardless of the operating mode.

When modified, program parameters are automatically recorded into a non-erasable memory and take effect immediately.

The program mode will not affect the operation of the unit. Thus programs may be modified anytime, even while the genset is running.

14.2. ENTERING THE PROGRAMMING MODE

To **enter the program mode**, press together ◄**MENU** and **MENU**► buttons for 5 seconds.

When the program mode is entered, below password entry screen will be displayed.

A 4 digit password must be entered using ▼, ▲ **,** **MENU**► and ◄**MENU** buttons.

The ▼, ▲buttons modify the value of the current digit. The **MENU**►**,** ◄**MENU** buttons navigate between digits.

The unit supports 3 password levels. The level_1 is designed for field adjustable parameters. The level_2 is designed for factory adjustable parameters. The level_3 is reserved. It allows recalibration of the unit.

The password level-1 is factory set to '**1234**' and the password level-2 is factory set to '**9876**'.

Passwords are not front panel adjustable.

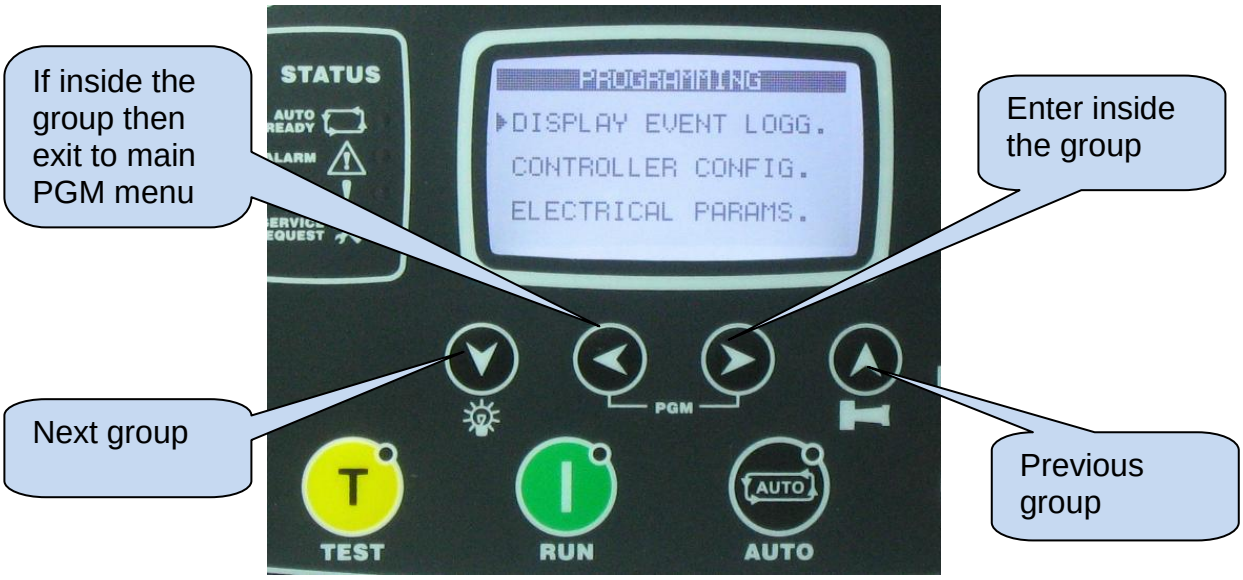
If a wrong password is entered, the unit will still allow access to the program parameters, but in read-only mode.

If password "0000" is entered, only EVENT LOG file will be available.

14.3. NAVIGATING BETWEEN MENUS

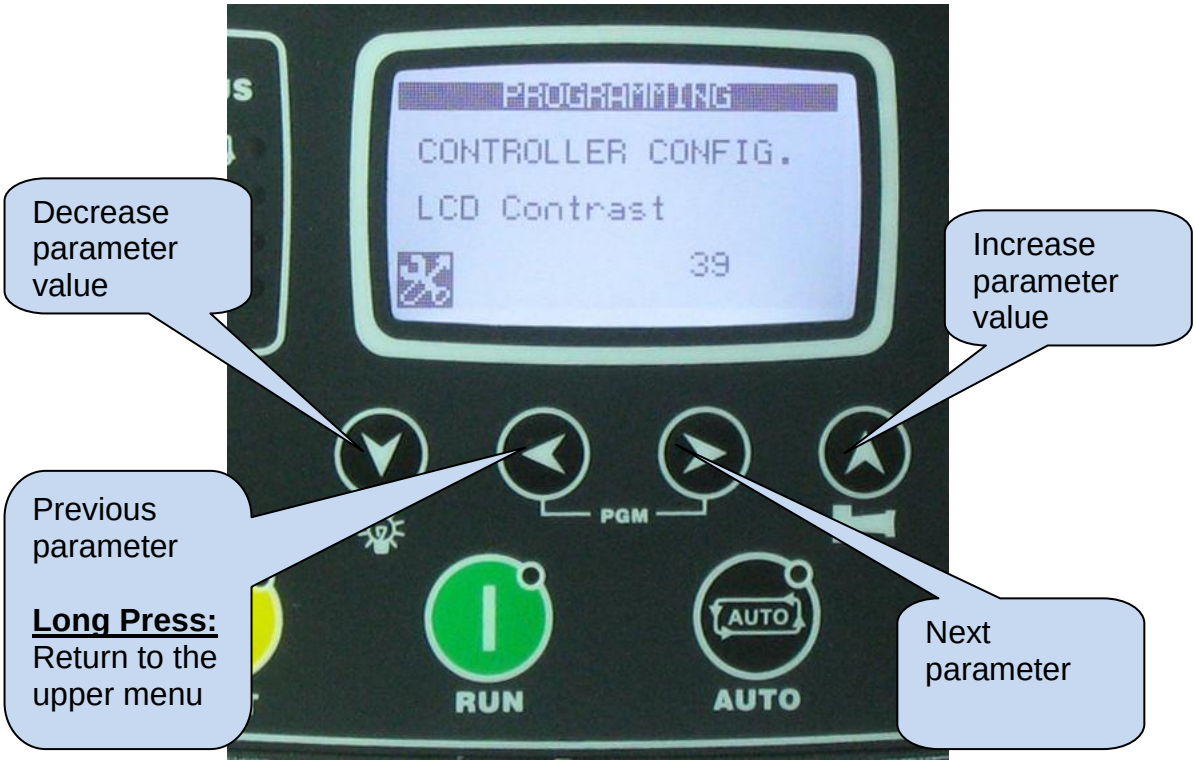
The program mode is driven with a two level menu system. The top menu consists on program groups and each group consists on various program parameters.

When program mode is entered, a list of available groups will be displayed. Navigation between different groups are made with ▼and ▲buttons. Selected group is shown in reverse video (blue on white). In order to enter inside a group, please press **MENU**▶ button. In order to exit from the group to the main list please press ◀**MENU** button.



Navigation inside a group is made also with ▼and ▲buttons. A list of available parameters will be displayed. Selected parameter is shown in reverse video (blue on white). In order display/change the value of this parameter, please press **MENU**▶ button. Parameter value may be increased and decreased with ▼and ▲buttons. If these keys are hold pressed, the program value will be increased/decreased by steps of 10. When a program parameter is modified, it is automatically saved in memory. If **MENU**▶ button is pressed, next parameter will be displayed. If ◀**MENU** button is pressed, then the list of parameters in this group will be displayed.

14.4. MODIFYING PARAMETER VALUE



14.5. PROGRAMMING MODE EXIT

To **exit the program mode** press one of the mode selection keys. If no button is pressed during 2 minutes the program mode will be cancelled automatically.

15. PROGRAM PARAMETER LIST

15.1. CONTROLLER CONFIGURATION GROUP

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) LCD Contrast	-	22	This parameter is used to set LCD contrast. Adjust for the best viewing angle.
(2) Language	-	0	**0:** English language selected. **1:** Turkish language selected. This language may depend on the country where the unit is intended to be used. **2:** Chinese language selected **3:** The unit will ask for manual language selection at power-on.
(1) Genset Default Display	-	0	This parameter selects the screen which is displayed during genset on load operation. **0:** screen 3 (or 4) electrical, large characters **1:** screen 5 engine parameters, large characters **2:** screen 6 (or 7) maximum information, small characters **3:** screen 8 (or 9) Details of each screen are explained in chapter 3.2
(2) Fault Holdoff Timer	sec	12	This parameter defines the delay after the engine runs and before the fault monitoring is enabled.
(1) Alarm Relay Timer	sec	60	This is the period during which the **ALARM** relay is active. If the period is set to 0, this will mean that the period is unlimited.
(1) Intermittent Alarm Relay	-	0	**0:** continuous **1:** intermittent (turns on and off every second)
(2) Charge Alternator Shutdown	-	0	**0:** The charge input generates **CHARGE FAIL** warning, and does not stop the engine. **1:** The charge input generates **CHARGE FAIL** alarm, and stops the engine.
(1) Emergency Backup Operation	-	0	**0:** In TEST mode, the load will not be transferred to the genset even if the mains fail. **1:** In TEST mode, the load will be transferred to the genset if the mains fail.

15.1. CONTROLLER CONFIGURATION GROUP (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) Exercise Day and Time	-	168	This parameter defines the start day and hour of the exerciser. Values higher or equal to 168 mean that the exerciser is off. The exercise may be selected to start at the beginning of the any hour of the week. The parameter value is the hour count of the start time. Examples: 0 = exercise starts at Monday 00:00 8 = exercise starts at Monday 08:00 24 = exercise starts at Tuesday 00:00 167 = exercise starts at Sunday 23:00 168 = exerciser off If a daily exercise is selected, then the day information is don't care and the exercise will be performed every day regardless of the day selection. If the monthly exerciser is selected, then the exercise will be performed during the first 7 days of each month at the programmed day and hour.
(1) Exercise Duration	min	10	This parameter defines the exercise duration and programmed in 10 minute steps up to 24 hours.
(1) Exercise Off/On Load	-	0	**0:** Exercise at **TEST** mode **1:** Exercise at **LOAD TEST** mode
(1) Exercise Period	-	1	**0:** exercise every day (the exercise will be performed every day regardless of the day selection of Exercise Dat and Time parameter). **1:** exercise once per week **2:** exercise once per month (the exercise will be performed during the first 7 days of each month at the programmed day and hour).
(2) Delayed Disable Start	-	0	**0:** The **SPARE-2** input has normal function **1:** The **SPARE-2** input has delayed disable start function. See chapter 6.8 for more info.
(2) Modem Enable	-	0	**0:** No modem connection, the serial port is connected to PC **1:** Modem connected.
(2) SMS Enable	-	0	**0:** SMS not enabled **1:** SMS enabled
(2) MODBUS Address	-	0	**0:** RAINBOW communication protocol. **1-144:** MODBUS communication. This parameter is also the MODBUS controller address of the unit.
(1) Oil Pressure in psi	-	0	**0:** oil pressure display in bars **1:** oil pressure display in psi
(1) Temperature in °F	-	0	**0:** temperature display in degrees C **1:** temperature display in degrees F
(2) Flashing Relay Timer	hours	0	**Delayed Simulate Mains Operation:** max genset running time after Simulate Mains signal disappears. **Dual Genset Systems:** flashing relay toggle timer. Please contact DATAKOM for dual genset mutual stanby operation.

15.1. CONTROLLER CONFIGURATION GROUP (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) Real Time Clock Adjust	-	117	This parameter trims precisely the real time clock circuit. Values from 0 to 63 speed up the clock with 0.25sec/day steps. Values from 127 to 64 slow down the clock with 0.25sec/day steps.
(2) Crank Teeth Count	-	30	This is the number of pulses generated by the magnetic pickup sensing unit in one turn of the flywheel. This parameter is also used in the conversion of the genset frequency to engine rpm. The frequency in Hz is multiplied with this parameter during conversion to rpm.
(2) SMS on Load Status Change	-	0	This parameter controls SMS sending when load contactor status is changed. No warning is generated. **0:** no SMS when load contactor status is changed **1:** SMS sent when load contactor status is changed
(2) Fuel Pump Low Limit	%	20	If the fuel level measured from the sender input falls below this level, then the FUEL PUMP function will become active.
(2) Fuel Pump High Limit	%	80	If the fuel level measured from the sender input goes above this level, then the FUEL PUMP function will become passive.
(2) Oil pressure sender fault effect	-	0	0: no effect 1:warning 2:loaddump
(2) Coolant temp sender fault effect	-	0	0: no effect 1:warning 2:loaddump
(2) Fuel level sender fault effect	-	0	0: no effect 1:warning 2:loaddump
(2) Oil temp sender fault effect	-	0	0: no effect 1:warning 2:loaddump

15.2. ELECTRICAL PARAMETERS GROUP

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) Current Shunt Rating	A	60	This is the rated value of the current shunt at 60mV-DC output voltage.
(2) Overcurrent Limit	A	0	If the current goes above this limit, during the period defined in **Overload Timeout** then a **Overcurrent Load Dump** alarm will be generated. If this parameter is 0 then Overcurrent check is disabled.
(2) Excess Power Limit	KW	0	If the active power goes above this limit, during the period defined in Overload Timeout then an **Excess Power Load Dump** alarm will be generated. If this parameter is 0 then Excess Power check is disabled.
(2) Overload Timeout	sec	5	This is the period between the current or active power go over the limits and **OVERCURRENT** or **EXCESS POWER** Load Dump alarms occur. This is also the period between the engine rpm goes out of the limits and **OVERSPEED** or **UNDERSPEED** alarms occur. This is also the period between the alternator voltage goes out of the limits and **HIGH VOLTAGE** or **LOW VOLTAGE** alarms occur.
(2) Genset Low Voltage Warning Limit	V	9.0	If the battery bank DC voltage goes under this limit, this will generate a **GENSET LOW VOLTAGE** warning.
(2) Genset High Voltage Warning Limit	V	63.0	If the battery bank DC voltage goes above this limit, this will generate a **GENSET HIGH VOLTAGE** warning.
(2) Genset High Voltage Shutdown Limit	V	66.0	If the battery bank DC voltage goes under this limit, this will generate a **GENSET HIGH VOLTAGE** alarm and the engine will stop.
(2) Low Battery Voltage Warning	V	9.0	If the battery voltage falls below this limit, this will generate a **LOW BATTERY** warning.
(2) High Battery Voltage Warning	V	15.5	If the battery voltage goes over this limit, this will generate a **HIGH BATTERY** warning.
(2) High Battery Voltage Shutdown	V	16.5	If the battery voltage goes over this limit, this will generate a **HIGH BATTERY** shutdown alarm and the engine will stop.
(2) Genset Contactor Timer	sec	1	This is the period after the mains contactor has been deactivated and before the generator contactor has been activated.
(1) Start to Charge Voltage	V	24.0	When the battery bank voltage falls below this level during **CHARGE VOLTAGE THRESHOLD** timer, then the controller will initiate an automatic charging cycle. The default value is set for a 24V battery bank.
(1) Max Charge Current	A	50	This is the maximum allowed charge current flowing from the alternator to the battery bank.
(1) Max Charge Time	min	120	This is the maximum duration of a charge cycle. Even if the charge cycle is not completed at the expiration of this timer, the engine will stop.
(1) Nominal Charge Volt	V	27.4	This is the float charge voltage of the battery bank. The default value is set for a 24V battery bank.

15.2. ELECTRICAL PARAMETERS GROUP (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) Max Battery Temperature	°C	90	This is the maximum allowed temperature of the battery bank. If the temperature approaches this limit, then the charging current will be reduced.
(1) Boost Enable	-	0	**0**: No boost charge cycle **1**: Boost charge cycle is performed. The charge voltage will be set to the nominal boost voltage during boost execution time.
(3) Boost Start Current	%	30	If the boost charge is enabled, when the charge current goes below this percentage of the max charge current, then the boost charge cycle will be initiated.
(1) Boost Execution Time	min	3	If enabled, the boost charge is performed during this timer.
(1) Nominal Boost Voltage	V	28.8	This is the max charging voltage allowed during the boost cycle.
(1) Stop Current percent	%	0	If this value is different from **zero**, when the charge current falls below this percentage of the max charge current, then the charge cycle will be supposed to be terminated. If this parameter is set to **zero**, the controller will monitor the charge current automatically. When the charge current is stabilized in a 5 minute interval, it will conclude that the charge cycle is terminated.
(2) PID Gain Value	-	10	This parameter defines the reaction speed of the actuator output. A high gain will cause faster reaction but brings a risk of instability. A low gain is slower to react but more stable.
(2) PID Stability Percent	%	10	This parameter defines the ratio of proportional to integral reaction of the PID loop. A high value will cause slower but more stable operation. A low value will cause faster operation but may cause instability.
(1) RPM High Limit	rpm	2000	This is the maximum allowed rpm of the engine during charge cycle. If the engine speed approaches this limit, the controller will stop increasing the current.
(1) Uncontrolled Charge Active	-	0	**0**: Optimal charging cycle is performed **1**: Uncontrolled charging cycle performed
(1) Battery Start to Charge Voltage	V	11.5	If this parameter is different from zero and if the engine battery voltage falls below this limit then the controller will run the engine unloaded, in order to charge engine battery. The running duration is determined by the battery charge timer parameter. Thus the engine battery will be kept from total discharge when the genset has not run for longtime.
(1) Battery Charge Timer	min	30	This parameter determines the engine battery charge running duration. The minimum run time is 2 minutes.
(1) Starting Fuel	%	5	This is the default output level of the governor output during cranking.
(1) Idle Speed RPM	rpm	30	This is the engine speed in IDLE SPEED mode. This speed is maintained with PID control.

15.2. ELECTRICAL PARAMETERS GROUP (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) Charge Voltage Threshold Timer	sec	1	When the battery bank voltage falls below the **Battery Start to Charge Voltage** during this timer, then the controller will initiate an automatic charging cycle.
(1) Must Start Voltage	V	0.0	When the battery bank voltage falls below this level, then the controller will initiate immediately an automatic charging cycle. If this parameter is set to zero, then only delayed start is active.

15.3. ENGINE PARAMETERS GROUP

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) Low Oil Pressure Warning	bar	1.4	If the oil pressure measured from the analog input falls below this limit, this will generate a **LOW OIL PRESSURE SENDER** warning.
(2) Low Oil Pressure Shutdown	bar	1.0	If the oil pressure measured from the analog input falls below this limit, this will generate a **LOW OIL PRESSURE SENDER** alarm is generated and the engine stops.
(1) High Temperature Warning	°C	95	If the coolant temperature measured from the analog input goes over this limit, this will generate a **HIGH TEMPERATURE SENDER** warning.
(2) High Temperature Shutdown	°C	98	f the coolant temperature measured from the analog input goes over this limit, this will generate a **HIGH TEMPERATURE SENDER** alarm and the engine will stop.
(2) Oil Pressure Sender type	-	1	This parameter selects the oil pressure sender type. **0:** Non standard sender. The sender characteristics are defined in **Sender Characteristics** table. **1:** VDO 0-7 bars (10-180 ohms) **2:** VDO 0-10 bars (10-180 ohms) **3:** DATCON 0-7 bars (240-33 ohms) **4:** DATCON 0-10 bars (240-33 ohms) **5:** DATCON 0-7 bars (0-90 ohms) **6:** DATCON 0-10 bars (0-90 ohms) **7:** DATCON 0-7 bars (75-10 ohms)
(2) Coolant Temp. Sender Type	-	1	This parameter selects the temperature sender type: **0:** The sender characteristics are defined in **Sender Characteristics** table. **1:** VDO **2:** DATCON DAH type **3:** DATCON DAL type
(2) Engine Heating Temperature	°C	0	If it is requested that the engine runs without load until reaching a certain temperature, this parameter defines the temperature. If the coolant temperature falls below this parameter, an **Engine Low Temperature** warning will occur.
(2) Engine Start Delay	sec	0	This is the time between the battery bank voltage falls below the set limit and the fuel solenoid turns on before starting the genset.
(2) Preheat Timer	sec	1	This is the time after the fuel solenoid is energized and before the genset is started. During this period the **PREHEAT** relay output is energized (if assigned by **Relay Definitions**)
(2) Crank Timer	sec	10	This is the maximum start period. Starting will be automatically cancelled if the genset fires before the timer.
(2) Wait Between Starts	sec	10	This is the waiting period between two start attempts.
(1) Engine Heating Timer	sec	4	This is the period used for engine heating following the program parameter.
(1) Cooldown Timer	min	1.0	This is the period that the generator runs for cooling purpose after the load contactor is released.

15.3. ENGINE PARAMETERS GROUP (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) Stop Solenoid Timer	sec	10	This is the maximum time duration for the engine to stop. During this period the STOP relay output is energized (if assigned by **Relay Definitions**). If the genset has not stopped after this period, a **FAIL TO STOP** warning occurs.
(2) Number of Starts	-	3	This is the maximum number of start attempts.
(2) Choke Timer	sec	5	This is the control delay of CHOKE output. The choke output is activated together with the crank output. It is released after this delay or when engine runs (whichever occurs first).
(2) Engine Heating Method	-	0	This parameter defines the engine heating method. The genset will not take the load before engine heating is completed. **0:** engine is heated during **Engine Heating Timer**. **1:** engine is heated until the coolant temperature reaches the **Engine Heating Temperature** and at least during the **Engine Heating Timer**.
(1) Service Engine Hours	hour	50	The **SERVICE REQUEST** led indicator will turn on after this quantity of engine hours from the last service. If the period is set to '0' no **SERVICE REQUEST** will be generated depending on engine hours.
(1) Service Period	month	6	The **SERVICE REQUEST** led indicator will turn on after this amount of time from the last service. If the period is set to '0' no **SERVICE REQUEST** will be indicated depending on time.
(2) Idle Speed Timer	sec	0	When the engine runs, the Idle output relay function will be active during this timer.
(2) Gas Solenoid Delay	sec	5	The gas solenoid of the gas engine will be opened after this delay during cranking.
(1) Low Fuel Warning	%	20	If the fuel level measured from the analog input falls below this limit, a **LOW FUEL LEVEL SENDER** warning is generated.
(2) Low Fuel Shutdown	%	10	the fuel level measured from the analog input falls below this limit, a **LOW FUEL LEVEL SENDER** shutdown alarm is generated and the engine stops.
(2) Fuel Consumption per Hour	%	0	This parameter is the threshold for sending FUEL THEFT and FUELLING sms messages. If this parameter is set to 0, then no Fuel Theft and Fuelling sms messages will be sent. If SMS is required, set this parameter to a value above the hourly fuel consumption of the genset.
(2) Crank Stop with Oil Pressure	-	0	**0:** no crank stop with oil pressure **1:** cranking is stopped when oil presure switch is open or the oil pressure measured is above shutdown limit.
(2) Crank Stop with Charge	-	0	**0:** no crank stop with charge input **1:** cranking is stopped when the charge alternator voltage is established.

15.3. ENGINE PARAMETERS GROUP (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) Low rpm Shutdown	rpm	0	If the engine speed goes under this limit, a **GENSET LOW SPEED** alarm is generated and the engine stops.
(2) Low rpm Warning	rpm	0	If the engine speed goes under this limit, a **GENSET LOW SPEED** warning is generated.
(2) High rpm Warning	rpm	2200	If the engine speed goes over this limit, a **GENSET HIGH SPEED** warning is generated.
(2) High rpm Shutdown	rpm	2400	If the engine speed goes over this limit, a **GENSET HIGH SPEED** alarm is generated and the engine stops.
(2) Fan turn-on temp	°C	90	If the coolant temp is above this limit then the fan relay function will become active.
(2) Fan turn-off temp	°C	80	If the coolant temp is below this limit then the fan relay function will become inactive.
(2) High Oil Temperature Warning	°C	100	If the oil temperature measured from the analog input goes over this limit, this will generate a HIGH OILTEMPERATURE SENDER warning.
(2) High Oil Temperature Shutdown	°C	120	f the oil temperature measured from the analog input goes over this limit, this will generate a HIGH OIL TEMPERATURE SENDER alarm and the engine will stop.
(2) Oil Temp. Sender Type	-	1	This parameter selects the oil temperature sender type: 0: The sender characteristics are defined in Sender Characteristics table. 1: VDO 2: DATCON DAH type 3: DATCON DAL type
(2) Speed up/down pulse minimum duration	msec	50	If the engine speed is controlled through up/down relays, this parameter defines the minimum pulse duration.
(2) Speed up/down pulse maximum duration	msec	250	If the engine speed is controlled through up/down relays, this parameter defines the maximum pulse duration.
(2) Speed up/down pulse delay	msec	20	This is the minimum delay between 2 successive speed up/down pulses.

15.3. ENGINE PARAMETERS GROUP (continued)

Below parameters are applicable to J1939 enabled versions only.

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) J1939 Enable	-	0	0: The J1939 port is inoperative. 1: The analog measurements (oil, temp, rpm) are picked_up from the ECU. If the ECU communication is lost, then the engine will be stopped.
(2) J1939 Engine Type	-	0	**00:** GENERIC ENGINE TYPE **16:** CUMMINS CM850 **32:** DETROIT DIESEL **48:** DEUTZ Generic **49:** DEUTZ EMR2 **50:** DEUTZ EMR3 **64:** JOHN DEERE **80:** PERKINS **81:** PERKINS ADEM 3 **82:** PERKINS ADEM 1.3 **96:** VOLVO (with CIU unit) **97:** VOLVO EMS2 **98:** VOLVO EDC4 **112:** CATERPILLAR ADEM II/III **128:** SCANIA S6 **129:** SCANIA Single Speed **130:** SCANIA All Speed **144:** IVECO **160:** MTU MDEC 302 **161:** MTU MDEC 201 **162:** MTU MDEC 303 **163:** MTU MDEC 304 **164:** MTU MDEC 505 **176:** BOSCH Generic **177:** BOSCH EDC 731 **178:** BOSCH EDC 9.3 **Other values:** Reserved. Do not use.
(2) J1939 Speed Adjust	%	50	This parameter adjusts the speed of an ECU controlled engine by +/- 8%.
(2) VOLVO Speed Toggle	-	-	This program parameter is not stored, but only used in order to activate the primary or secondary speed selection operation of a Volvo EMS-II engine control unit. 0: Initiate the primary speed select operation 1: Initiate the secondary speed select operation

15.4. ADJUST DATE AND TIME

These parameters allow adjusting the battery backup real time clock of the module. Once set, the clock will continue to run even if DC power is removed from the unit.

Parameter Definition	Unit	Min	Max	Description
Date	-	01	31	Current day of the month.
Month	-	01	12	Current month.
Year	-	00	99	Last two digits of the current year.
Hours	-	00	23	Current hour of the day.
Minutes	-	00	59	Current minute of the hour.
Seconds	-	00	59	Current second of the minute.

15.5. WEEKLY OPERATION SCHEDULE

Parameter Definition	Unit	Factory Set	Description
Monday Turn_on	-	24:00	Please review chapter 9 for a detailed description of weekly programming schedule operation.
Monday Turn_off	-	24:00	
Tuesday Turn_on	-	24:00	
Tuesday Turn_off	-	24:00	
Wednesday Turn_on	-	24:00	
Wednesday Turn_off	-	24:00	
Thursday Turn_on	-	24:00	
Thursday Turn_off	-	24:00	
Friday Turn_on	-	24:00	
Friday Turn_off	-	24:00	
Saturday Turn_on	-	24:00	
Saturday Turn_off	-	24:00	
Sunday Turn_on	-	24:00	
Sunday Turn_off	-	24:00	

If automatic operation is disabled by the weekly exerciser, the AUTO led will flash.

15.6. SENDER CHARACTERISTICS

Parameter Definition	Unit	Factory Set	Description
Oil Pressure Sender Ohms -1	ohm	10	Oil Pressure Sender point 1, ohm value
Oil Pressure Value -1	bar	0.0	Oil Pressure Sender point 1, bar value
Oil Pressure Sender Ohms -2	ohm	52	Oil Pressure Sender point 2, ohm value
Oil Pressure Value -2	bar	2.0	Oil Pressure Sender point 2, bar value
Oil Pressure Sender Ohms -3	ohm	90	Oil Pressure Sender point 3, ohm value
Oil Pressure Value -3	bar	4.0	Oil Pressure Sender point 3, bar value
Oil Pressure Sender Ohms -4	ohm	140	Oil Pressure Sender point 4, ohm value
Oil Pressure Value -4	bar	7.0	Oil Pressure Sender point 4, bar value
Oil Pressure Sender Ohms -5	ohm	156	Oil Pressure Sender point 5, ohm value
Oil Pressure Value -5	bar	8.0	Oil Pressure Sender point 5, bar value
Oil Pressure Sender Ohms -6	ohm	184	Oil Pressure Sender point 6, ohm value
Oil Pressure Value -6	bar	10.0	Oil Pressure Sender point 6, bar value

Parameter Definition	Unit	Factory Set	Description
Temperature Sender Ohms -1	ohm	38	Temperature Sender point 1, ohm value
Temperature Value -1	°C	100	Temperature Sender point 1, °C value
Temperature Sender Ohms -2	ohm	51	Temperature Sender point 2, ohm value
Temperature Value -2	°C	90	Temperature Sender point 2, °C value
Temperature Sender Ohms -3	ohm	134	Temperature Sender point 3, ohm value
Temperature Value -3	°C	60	Temperature Sender point 3, °C value
Temperature Sender Ohms -4	ohm	322	Temperature Sender point 4, ohm value
Temperature Value -4	°C	39	Temperature Sender point 4, °C value
Temperature Sender Ohms -5	ohm	650	Temperature Sender point 5, ohm value
Temperature Value -5	°C	20	Temperature Sender point 5, °C value
Temperature Sender Ohms -6	ohm	1630	Temperature Sender point 6, ohm value
Temperature Value -6	°C	02	Temperature Sender point 6, °C value

Parameter Definition	Unit	Factory Set	Description
Oil Temperature Sender Ohms -1	ohm	38	Temperature Sender point 1, ohm value
Oil Temperature Value -1	°C	100	Temperature Sender point 1, °C value
Oil Temperature Sender Ohms -2	ohm	51	Temperature Sender point 2, ohm value
Oil Temperature Value -2	°C	90	Temperature Sender point 2, °C value
Oil Temperature Sender Ohms -3	ohm	134	Temperature Sender point 3, ohm value
Oil Temperature Value -3	°C	60	Temperature Sender point 3, °C value
Oil Temperature Sender Ohms -4	ohm	322	Temperature Sender point 4, ohm value
Oil Temperature Value -4	°C	39	Temperature Sender point 4, °C value
Oil Temperature Sender Ohms -5	ohm	650	Temperature Sender point 5, ohm value
Oil Temperature Value -5	°C	20	Temperature Sender point 5, °C value
Oil Temperature Sender Ohms -6	ohm	1630	Temperature Sender point 6, ohm value
Oil Temperature Value -6	°C	02	Temperature Sender point 6, °C value

Parameter Definition	Unit	Factory Set	Description
Fuel Level Sender Ohms -1	ohm	4	Fuel Level Sender point 1, ohm value
Fuel Level Value -1	%	0	Fuel Level Sender point 1, % value
Fuel Level Sender Ohms -2	ohm	31	Fuel Level Sender point 2, ohm value
Fuel Level Value -2	%	25	Fuel Level Sender point 2, %value
Fuel Level Sender Ohms -3	ohm	67	Fuel Level Sender point 3, ohm value
Fuel Level Value -3	%	50	Fuel Level Sender point 3, %value
Fuel Level Sender Ohms -4	ohm	110	Fuel Level Sender point 4, ohm value
Fuel Level Value -4	%	75	Fuel Level Sender point 4 %value
Fuel Level Sender Ohms -5	ohm	180	Fuel Level Sender point 5, ohm value
Fuel Level Value -5	%	100	Fuel Level Sender point 5, %value
Fuel Level Sender Ohms -6	ohm	1000	Fuel Level Sender point 6, ohm value
Fuel Level Value -6	%	100	Fuel Level Sender point 6, %value

15.7. INPUT CONFIGURATION (Low Oil Pressure Switch) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

15.7. INPUT CONFIGURATION (High Temperature Switch) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

15.7. INPUT CONFIGURATION (Coolant Level Switch) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

15.7. INPUT CONFIGURATION (Rectifier Fail) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

15.7. INPUT CONFIGURATION (Emergency Stop) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

15.7. INPUT CONFIGURATION (Spare-1 Input) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

15.7. INPUT CONFIGURATION (Spare-2 Input) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

15.8. RELAY DEFINITIONS (password level-2)

The parameters below define the functions of relay outputs. The unit has 6 relay outputs. The fixed function relays are Fuel, Start and Generator Contactor. RELAY-1 and RELAY-2 have programmable functions, selected from a list.

The relays may be extended up to 21 using **Relay Extension Modules**.. Other relays are in the optional Extension Modules.

Parameter Definition	Unit	Fac.Set	Description
Relay 01 Definition		3	RELAY-1 function selected from list
Relay 02 Definition		1	RELAY-2 function selected from list
Relay 03 Definition		0	RELAY-3 function (expansion module) selected from list
Relay 04 Definition		2	RELAY-4 function (expansion module-1) selected from list
Relay 05 Definition		4	RELAY-5 function (expansion module-1) selected from list
Relay 06 Definition		5	RELAY-6 function (expansion module-1) selected from list
Relay 07 Definition		0	RELAY-7 function (expansion module-1) selected from list
Relay 08 Definition		2	RELAY-8 function (expansion module-1) selected from list
Relay 09 Definition		4	RELAY-9 function (expansion module-1) selected from list
Relay 10 Definition		5	RELAY-10 function (expansion module-1) selected from list
Relay 11 Definition		0	RELAY-11 function (expansion module-2) selected from list
Relay 12 Definition		2	RELAY-12 function (expansion module-2) selected from list
Relay 13 Definition		4	RELAY-13 function (expansion module-2) selected from list
Relay 14 Definition		5	RELAY-14 function (expansion module-2) selected from list
Relay 15 Definition		0	RELAY-15 function (expansion module-2) selected from list
Relay 16 Definition		2	RELAY-16 function (expansion module-2) selected from list
Relay 17 Definition		4	RELAY-17 function (expansion module-2) selected from list
Relay 18 Definition		5	RELAY-18 function (expansion module-2) selected from list

The function of a programmable relay output may be selected from the below list.

00	Fuel
01	Alarm
02	Start
03	Stop
04	Gen. Contactor
05	-
06	Choke
07	Preheat
08	Shutdown alarm
09	Shutdown or load_dump alarm
10	Shutdown or load_dump or warning
11	Automatic ready
12	Week. on time
13	Exerciser on
14	Load_dump alarm
15	Fuel Main winding
16	Mains Fail
17	Block Heater
18	Service Request
19	-
20	-
21	Flashing Relay
22	Gas Solenoid
23	Fuel Pump
24	-
25	-
26	Idle Speed
27	Cooler Fan
28	-
29	Crank 1/2 Selector
30	Speed Up Pulse
31	Speed Down Pulse
32	GenCB Open Pulse
33	GenCB Close Pulse
34	GenCB UV Coil
35	-
36	-
37	-
38	-
39	-

40	Oil switch alarm
41	Temp switch alarm
42	Coolant Level switch alarm
43	Rectifier alarm
44	Emerg.Stop alarm
45	Spare-1 Alarm
46	Spare-2 Alarm
47	Fuel Level switch alarm
48	Oil sender alarm
49	Temp sender alarm
50	Low speed alarm
51	High speed alarm
52	Low voltage alarm
53	High voltagealarm
54	Fail to start alarm
55	Low fuel sender alarm
56	High oil temp alarm
57	-
58	-
59	High battery voltage alarm
60	Charge fail alarm
61	-
62	-
63	-
64	Oil switch load_dump
65	Temp switch load_dump
66	Coolant Level switch load_dump
67	Rectifier load_dump
68	Emerg.Stop load_dump
69	Spare-1 load_dump
70	Spare-2 load_dump
71	Fuel Level switch load_dump
72	Oil sender fail ldd
73	Temp sender fail ldd
74	Fuel Lev sender fail ldd
75	Oil Temp snd fail ldd
76	-
77	-
78	-
79	-
80	Overcurrent load_dump
81	Excess power ldd
82	-
83	-
84	-
85	-
86	-
87	-

88	Oil switch warning
89	Temp switch warn.
90	Coolant Level switch warning
91	Rectifier warning
92	Emerg Stop warn.
93	Spare-1 warning
94	Spare-2 warning
95	Fuel Level switch warning
96	Oil sender warning
97	Temp sender warn.
98	Low speed warning
99	High speed warning
100	-
101	Low temp warning
102	Fail to stop warning
103	Low fuel sender warning
104	Service request warning
105	-
106	Low battery warning
107	High battery warning
108	Charge fail warning
109	-
110	-
111	-
112	Gen Low voltge warn.
113	Gen High voltge warn.
114	-
115	High oil temp warn.
116	-
117	-
118	-
119	-
120	Oil sender fail warn
121	Temp sender fail warn
122	Fuel sender fail warn
123	Oil temp snd fail warn
124	-
125	-
126	-
127	-

15.9. INPUT FUNCTION SELECT (password level-2)

The parameters below define the functions of digital inputs, selected from a list.

Functions from 12 to 23 activate also the related operating sequence.

The related input configuration parameters apply for each input, thus any signal can be programmed for NO or NC contact, closing to BAT+ or BAT-.

Parameter Definition	Fact. Set	Description
Input 01 Function Select	0	Oil Pressure Switch
Input 02 Function Select	1	High Temp. Switch
Input 03 Function Select	2	Low Coolant Level switch
Input 04 Function Select	3	Rectifier Fail
Input 05 Function Select	4	Emergency Stop
Input 06 Function Select	11	Spare-1 Input
Input 07 Function Select	10	Spare-2 Input

Input Function Select List

Number	Description
0	Oil Pressure Switch
1	High Temp. Switch
2	Low Coolant Level switch
3	Rectifier Fail
4	Emergency Stop
5	Alternator High Temp.
6	Door Open
7	Low Fuel Level Switch
8	Earthquake Detector
9	Spare-3 Input
10	Spare-2 Input
11	Spare-1 Input
12	Force AUTO Mode
13	Force OFF Mode
14	Force TEST Mode
15	Force LOAD TEST Mode
16	-
17	Priority Input
18	Remote Start Input
19	Disable Auto Start
20	Force to Start
21	Fault Reset
22	Alarm Mute
23	Panel Lock

15.10. SITE ID STRING

Parameter Definition	Factory Set	Description
Site Id String	DATAKOM SITE ID	This is the site Id string sent at the beginning of an SMS message for the identification of the genset sending the SMS message. Any 20 character long string may be entered.

15.11. MODEM1-2/SMS1-2-3-4 TELEPHONE NUMBERS

Enter numbers starting from first character. Do not leave blank characters at the beginning.

Program Group: Modem-1/SMS-1 Telephone Number (password level-2)

Parameter Definition	Factory Set	Description
Modem-1 / SMS-1 telephone number	----------	This telephone number buffer accepts up to 16 digits, including the wait charater (“,”) in order to enable dialing through a pabx. **If Modem Enabled:** This is the first telephone number used for modem calls. **If Modem Disabled:** This is the first SMS telephone number.

Program Group: Modem-2 / SMS-2 Telephone Number (password level-2)

Parameter Definition	Factory Set	Description
Modem-2 / SMS-2 telephone number	----------	This telephone number buffer accepts up to 16 digits, including the wait charater (“,”) in order to enable dialing through a pabx. **If Modem Enabled:** This is the second telephone number used for modem calls. **If Modem Disabled:** This is the second SMS telephone number.

Program Group: SMS-3 Telephone Number (password level-2)

Parameter Definition	Factory Set	Description
SMS-3 telephone number	----------	This SMS telephone number accepts up to 16 digits.

Program Group: SMS-4 Telephone Number (password level-2)

Parameter Definition	Factory Set	Description
SMS-3 telephone number	----------	This SMS telephone number accepts up to 16 digits.

Program Group: SMS-5 Telephone Number (password level-2)

Parameter Definition	Factory Set	Description
SMS-3 telephone number	----------	This SMS telephone number accepts up to 16 digits.

Program Group: SMS-6 Telephone Number (password level-2)

Parameter Definition	Factory Set	Description
SMS-3 telephone number	----------	This SMS telephone number accepts up to 16 digits.

16. CRANK CUTTING

In order to insure fast and reliable crank cutting, the unit uses various resources for engine running condition detection.

Cranking is stopped when **at least one** of below conditions is met:

- Crank timer expired:

The crank timer is adjusted through **Engine Parameters > Crank Timer**. The maximum allowed timer is 15 seconds.

- Genset rpm over threshold:

If the genset rpm reaches **Engine Parameters > Crank Cut RPM**, then cranking is immediately stopped.

- Charge alternator voltage over threshold

Following setting is necessary: **Engine Parameters > Charge Input Connected = 1**

If the charge alternator voltage reaches **Engine Parameters > Crank Cut Charge Voltage**, then cranking is immediately stopped.

- Oil pressure above threshold

Following setting is necessary: **Engine Parameters > Crank Cut with Oil Pressure = 1**

The crank cutting with oil pressure offers a programmable delay through **Engine Parameters > Crank Cut with Oil Pressure Delay**. The parameter is factory set to 2 seconds.

Both low oil pressure switch and oil pressure sender readings may be used for crank cutting. The oil pressure switch is always used. The sender may be disabled through **Controller Configuration > Oil Pressure Switch Priority** parameter.

If enabled, when oil pressure is detected, cranking is stopped after adjustable timer delay.

17. J1939 CANBUS ENGINE SUPPORT

The unit offers a special J1939 port in order to communicate with electronic engines controlled by an **ECU** (electronic control unit). The J1939 port consists of 2 terminals which are **J1939+** and **J1939-**.

The connection between the unit and the engine should be made with an appropriate balanced 120 ohms low capacitance coaxial cable. The external conductor should be grounded at one end only.

A **120 ohms** termination resistor is installed inside the unit. Please do not connect external resistor.

The J1939 port is activated by setting the program parameter **J1939 Enable** to **1**. The **J1939 Engine Type** parameter should be set accordingly. The list of available engines is given at the programming section. Please contact DATAKOM for the most current list of engines.

If the J1939 port is enabled then the **oil pressure**, **coolant temperature** and the **engine rpm** information are picked up from the **ECU** unit. If connected, the MPU unit and related analog senders are discarded.

The controller is able to read and display all below parameters, under condition that the engine sends these information. Most engines send only some of them. If the engine does not send a parameter, the unit will simply skip it. Thus only available information are displayed.

The complete list of J1939 display parameters is below:

1. Engine Brand, ECU Type, J1939 SW version
2. Engine Coolant Level
3. Engine Oil Level
4. Engine Coolant Pressure
5. Engine Fuel Delivery Pressure
6. Barometric Pressure
7. Engine Crankcase Pressure
8. Engine Turbocharger Boost Pressure
9. Engine Air Inlet Pressure
10. Engine Air Filter1 Differential Pressure
11. Engine Fuel Temperature
12. Ambient Air Temperature
13. Engine Air Inlet Temperature
14. Engine Intake Manifold1 Temperature
15. Engine Exhaust Gas Temperature
16. Engine Fuel Rate
17. Engine Instantaneous Fuel Economy
18. Engine Average Fuel Economy
19. Engine Total Fuel Used
20. Engine Total Hours
21. Engine Percent Load at Current Speed
22. Actual Engine Percentage Torque
23. Drivers Demand Engine Percentage Torque
24. Accelerator Pedal Position
24. Battery Potential Switched

The J1939 measurements are also available for Modbus operation. Please check chapter **Modbus Communications** for more details.

When the fuel output is active, if no information is received from the ECU during last 3 seconds, then the unit will give a **ECU FAIL** alarm and stop the engine. This feature prevents uncontrolled engine operation.

The **fault conditions of an electronic engine** are considered by the unit as **warnings** and do not cause engine stop. The engine is supposed protected by the ECU which will stop it when necessary.

The electronic engine **fault codes** are displayed **in text** within the alarm list table, together with their **SPN-FMI** codes. The complete list of fault codes is given in the engine manufacturer's user manual.

Below is a basic list of fault conditions (x denotes any FMI)

SPN	FMI	DESCRIPTION
94	x	Fuel filter restriction Fuel pressure sensor fail
98	x	Low oil level High oil level Oil level sensor fail
100	x	Low oil pressure Oil pressure sensor fail
102	x	High boost pressure Turbo outlet pressure sensor fail
105	x	Intake manifold temp high Intake manifold temp sensor fail
107	x	Air filter restriction Air filter sensor fail
108	x	Athmospheric pressure sensor fail
110	x	High coolant temperature Coolant temperature sensor fail
111	x	Low coolant level Coolant level sensor fail
164	x	High injector activation pressure Injector activation pressure sensor fail
168	x	Battery voltage failure
172	x	High inlet air temperature High inlet manifold air temperature Inlet manifold air temperature sensor fail
174	x	High fuel temperature Fuel temperature sensor fail
175	x	High oil temperature Oil temperature sensor fail
190	x	Overspeed Speed sensor loss of signal Speed sensor mechanical failure
228	x	Timing calibration required
234	x	Incorrect ecm software
620	x	ECU internal +5V fail
629	x	ECU hardware fail
651	x	Injector cylinder #1 fault
652	x	Injector cylinder #2 fault
653	x	Injector cylinder #3 fault
654	x	Injector cylinder #4 fault
655	x	Injector cylinder #5 fault
656	x	Injector cylinder #6 fault
657	x	Injector cylinder #7 fault
657	x	Injector cylinder #8 fault
678	x	ECU internal power supply fail
723	x	Secondary engine speed sensor fail
1108	x	Critical override enabled
1111	x	Check configuration parameters
2000	x	ECU failure

Below is a basic list of FMI codes.

Please be aware that these codes may differ slightly depending on the engine brand and model.

FMI	DESCRIPTION
0	Value too high" Valid data, but above the normal working range
1	"Value too low" Valid data, but below the normal working range
2	"Faulty data" Intermittent or faulty data or Short circuit to battery voltage, injector high voltage side
3	"Electrical fault" Abnormally high voltage or short circuit to battery voltage, injector low voltage side
4	"Electrical fault" Abnormally low voltage or short circuit to battery negative, injector low voltage or high voltage side
5	"Electrical fault" Abnormally low current or open circuit
6	"Electrical fault" Abnormally high current or short circuit to battery negative
7	"Mechanical fault" Faulty response from mechanical system
8	"Mechanical or electrical fault" Abnormal frequency
9	"Communication fault" Abnormal updating rate or Open circuit in injector circuit
10	"Mechanical or electrical fault" Abnormally large variations
11	"Unknown fault" Unidentified fault
12	"Component fault" Faulty unit or component
13	"Faulty calibration" Calibration values outside the limits
14	"Unknown fault" Special instructions
15	Data valid but above normal operating range - least severe level
16	Data valid but above normal operating range - moderately severe level
17	Data valid but below normal operating range - least severe level
18	Data valid but below normal operating range - moderately severe level
19	Received network data in error
20	not used (reserved)
21	not used (reserved)
22	not used (reserved)
23	not used (reserved)
24	not used (reserved)
25	not used (reserved)
26	not used (reserved)
27	not used (reserved)
28	not used (reserved)
29	not used (reserved)
30	not used (reserved)
31	Condition exist

18. SOFTWARE FEATURES

18.1. Charging the Engine Battery

The controller offers an automatic charge cycle for the engine battery.

When the engine battery weakens, the genset will run automatically during programmed period.

This operation is different from the battery bank charging. The engine will run unloaded in order to charge the engine battery, protecting it from total discharge when the genset has not run for a long time.

Related parameters:

Battery Start to Charge Voltage: If this parameter is different from zero and the engine battery voltage falls below this limit then the controller will run the engine unloaded, in order to charge engine battery. The running duration is determined by the battery charge timer parameter.

Battery Charge Timer: This parameter determines the engine battery charge running duration. The minimum run time is 2 minutes.

18.2. Speed UP/DOWN Relay Outputs

The DKG-379 is able to control the engine rpm through a **motorized potentiometer** using its **speed up/down** output functions.

In order to use speed up/down output functions, corresponding digital output functions of the Relay Definitions group should be set properly.

RELAY-1(terminal_23) and RELAY-2 (terminal_22) have programmable functions, selected from a list. Digital outputs may be increased using **Relay Extension Modules**. If RELAY-1 and RELAY-2 are not available, still speed up/down relays may be used with an extension module.

The function codes for speed up/down outputs are found in the function table of the Relay Definitions parameter group:

30	Speed Up Pulse
31	Speed Down Pulse

Related program parameters:

Speed up/down pulse minimum duration: minimum up/down pulse duration.

Speed up/down pulse maximum duration: maximum up/down pulse duration.

Speed up/down pulse delay: This is the minimum delay between 2 successive speed up/down pulses.

If speed_up or speed_down functions are assigned to digital outputs, then the unit will start to generate speed up/down pulses in order to control the external speed potentiometer. The governor control output will continue operation.

PID Gain Value and PID Stability Percent parameters will continue to affect the rpm stability.

The external potentiometer should be set to mid position at the initial condition.

18.3. Remote Start Operation

The unit offers the possibility of **Remote Start** mode of operation. Any digital input may be assigned as **Remote Start Input** using **Input Function Select** program parameters.

The **Remote Start** signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using programming menu.

It is also necessary to set the **ACTION** program parameter of the related input to **3** in order to prevent any alarm from this input.

When a **Remote Start** input is defined, the battery bank voltage is not monitored. When the **Remote Start** signal is present then the battery bank voltage will be supposed to be below genset starting threshold, inversely when the **Remote Start** signal is absent then the battery bank voltage will be supposed to be above threshold.

18.4. Disable Auto Start

The unit offers an optional **Disable Auto Start** signal input. Any digital input may be assigned as **Disable Auto Start** using **Input Function Select** program parameters**.**

It is also necessary to set the **ACTION** program parameter of the related input to **3** in order to prevent any alarms generated from this input.

The **Disable Auto Start** signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using the programming menu.

If the **Disable Auto Start** input is defined and the input signal is active, the battery bank voltage is not monitored and supposed to be above the genset starting threshold. This will prevent the genset from starting even in case of a low battery bank voltage. If the genset is running when the signal is applied, the current charge cycle will be performed until its end.

When the signal is passive, the unit will revert to normal operation and monitor the battery bank voltage in order to initiate a charge cycle.

The REMOTE START operation overrides DISABLE AUTO START and FORCE TO START operations.

18.5. Dual Genset Mutual Standby Operation

Dual genset intermittent operation consists of regular switching of the load between 2 gensets. The use of 2 gensets instead of one is due either to safety purposes in case of a genset failure or to a continuous operation requesting service stops.

The running period for each genset is adjustable using **Flashing Relay On Timer** and **Flashing Relay Off Timer** program parameters. If the time is adjusted as 0 hours, it will be actually set to 2 minutes for faster testing purposes.

A flashing relay output function is provided, based on the parameter **Flashing Relay On/Off Timers**. Each time the period programmed using **Flashing Relay Timer** elapses, the relay output will change position.

The flashing relay function may be assigned to any digital output using **Output Configuration** program parameters.

The dual genset intermittent operation uses also the **Disable Auto Start** feature. Please review related chapter for a detailed explanation of this feature.

Priority In Dual Genset Mutual Standby Operation:

It may be required that the dual genset system starts the same genset in normal conditions. The second genset will operate only if the first genset fails. This is achieved using the PRIORITY input.

Any digital input may be assigned as **Priority** using **Input Function Select** program parameters**.**

It is also necessary to set the **ACTION** program parameter of the related input to **3** in order to prevent any alarms generated from this input.

The **Priority** signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using the programming menu.

If a **Priority** input is defined, then the system will work in priority mode. If the priority signal is applied, the unit will become master. If the priority signal is not applied, then the unit will become the slave one and the other genset will start.

Please contact DATAKOM for a complete application manual.

18.6. External Control of the Unit

The unit offers total external control through programmable digital inputs. Any digital input may be programmed for below functions:

- Force STOP mode
- Force AUTO mode
- Force TEST mode
- Disable Auto Start
- Force to Start
- Fault Reset
- Alarm Mute
- Panel Lock

External mode select signals have priority on mode buttons of the unit. If the mode is selected by external signal, it is impossible to change this mode with front panel pushbuttons. However if the external mode select signal is removed, the unit will revert to the last selected mode via pushbuttons.

It is also possible to lock the front panel completely for remote command.

18.7. Automatic Exerciser

The unit offers 7 independent automatic exercisers. The exercise operation may be done on a weekly or monthly basis.

The start day and time of the exercise is programmable as well as its duration. The exercise may be done with or without load following programming.

Program parameters related to the exerciser are:

Exercise start day and hour

Exercise duration

Exercise off_load/on_load

Please refer to the programming section for a more detailed description of the above parameters.

When the start day and hour of exercise has come, the unit will automatically switch to either **RUN** or **TEST** mode. The engine will run. If the on_load exercise is selected then the load will be transferred to the genset.

If a mains failure occurs during the off-load exercise, the load will not be transferred to the genset unless the **Emergency Backup Operation** is allowed by setting the related program parameter to 1. Thus it is highly recommended that the Emergency Backup mode enabled with off-load exerciser.

At the end of the exercise duration, the unit will switch back to the initial mode of operation.

If any of the mode selection keys are pressed during exercise, then the exercise will be immediately terminated.

Using the weekly exercise mode and with suitable parameter setting, the unit may feed the load from the genset during predefined hours of each day. This operation may be used in high tariff periods of the day.

18.8. Weekly Operation Scheduler

In most applications, the genset is requested to operate only in working hours. Thanks to the weekly program feature, unwanted operation of the genset may be prohibited.

The scheduler is active only in **AUTO** mode. When the scheduler prevents genset operation in AUTO mode, the **AUTO** led will flash.

When the scheduler prevents genset operation in AUTO mode, the AUTO led will flash.

The scheduler consists of 144 programmable parameters, one for each hour in a week. Thus every hour of the week may be independently selected as ON or OFF times.

These programmable parameters allow the genset to operate automatically only in allowed time limits.

The unit has a battery backed-up precision real time clock circuit. The real time clock circuit will continue its operation even in power failures. The real time clock is precisely trimmed using the **Real Time Clock Adjust** program parameter. For more details check the programming section.

18.9. Engine Heating Operation

Especially on engines without a body heater, or with a failing one, it may be desired that the genset should not take the load before reaching a suitable temperature. The unit offers 2 different ways of engine heating.

1. Timer controlled heating:

This operation mode is selected when the **Engine Heating Method** parameter is set to **0**. In this mode, the engine will run during parameter **Engine Heating Timer**, and then the genset will take the load.

2. Timer and temperature controlled heating:

This operation mode is selected when the **Engine Heating Method** parameter is set to **1**. In this mode, at first the engine will run during parameter **Engine Heating Timer**, then it will continue to run until the measured coolant temperature reaches the limit defined in parameter **Engine Heating Temperature**. When the requested temperature is reached, the load will be transferred to the genset. This operation mode may be used as a backup to the engine body heater. If the engine body is warm the heating will be skipped.

18.10. Engine Idle Speed Operation

It may be required that the engine runs at the idle speed for a programmed duration for engine heating. The idle operation duration is adjusted with the parameter **Idle Speed Timer**. The idle speed will be set by the governor control unit of the engine.

Any digital output may be assigned as **IDLE output** using **Relay Definition** program parameters.

The Idle speed operation is performed both in engine start-up and cool-down sequences. Low speed and low voltage protections are disabled during idle speed operation.

18.11. Engine Block Heater

The unit is able to provide a digital output in order to drive the block heater resistor. The temperature reference is the coolant temperature measured from the analog sender input.

The block heater output function may be assigned to any digital output using **Relay Definition** program parameters.

The engine body temperature limit is adjusted using the parameter **Engine Heating Temperature**. The same parameter is used for engine heating operation.

The relay will become active if the body temperature falls to 4 degrees below the limit set by **Engine Heating Temperature**. It turns off when the body temperature exceeds **Engine Heating Temperature**.

18.12. Fuel Pump Control

The unit is able to provide a digital output function in order to drive the fuel pump motor. The fuel pump is used in order to transfer fuel from the large capacity main tank (if exists), to the genset daily tank which is generally integrated in the chassis and has a limited capacity.

The fuel level reference is measured through the analog fuel level sender. When the measured fuel level falls below **Fuel Pump Low Limit** parameter, the fuel pump output function will become active. When the fuel level reaches **Fuel Pump High Limit** parameter, the output function will become passive. Thus the chassis fuel tank level will be always kept between **Fuel Pump Low Limit** and **Fuel Pump High Limit** parameters.

The fuel pump relay function may be assigned to any digital output using **Relay Definition** program parameters.

18.13. Gas Engine Fuel Solenoid Control

The unit provides a special function for the fuel solenoid control of a gas engine.

The fuel solenoid of a gas engine is different from a diesel engine. It should be opened after the cranking has been started and should be closed between crank cycles. The delay between the crank start and solenoid opening is adjusted using the **Gas Solenoid Delay** program parameter.

The gas engine fuel solenoid relay function may be assigned to any digital output using **Relay Definition** program parameters.

19. MODBUS SUPPORT

The unit offers the possibility of MODBUS communication via its RS232 serial port. The connection to the MODBUS master may be done in 3 ways:

1) RS232 connection using directly the RS232 port provided.
2) RS422/485 connection using external RS422/485 converter.
3) Modem connection using external modem.

The MODBUS mode is activated by assigning a controller address to the unit using program parameter. The possible address range is 1 to 144. Setting the address 0 will **disable** the MODBUS mode and allow communication under RAINBOW protocol.

The MODBUS properties of the unit are:

-Data transfer mode: RTU
-Serial data: 9600 bps, 8 bit data, no parity, 1 bit stop
-Supported functions:
  -Function 3 (Read multiple registers)
  -Function 6 (Write single register)
-The answer to an incoming message is sent with min 4.3ms delay after message reception.

Detailed description about the MODBUS protocol is found in the document "**Modicon Modbus Protocol Reference Guide"**. This document may be downloaded at: www.modbus.org/docs/PI_MBUS_300.pdf

19.1. Modbus Register Map

ADDRESS (hex)	R / W	DATA SIZE	COEFFICIENT	DESCRIPTION
0003	R	16bit	x10	Genset DC voltage
0004	R	16bit	x10	Battery bank DC voltage
0006	R	16bit	x10	Genset DC current
0016-0017	R	32bit	x256	Genset active power: this 24 bit signed register holds the genset active power multiplied by 256. Least significant 16 bits are in the register 0016h. Most significant 8 bits are in the LSB of the register 0017h.
0024	R / W	8bit	x1	Year as a BCD byte. Values are from 0 to 99h.
0025	R / W	8bit	x1	Month as a BCD byte. Values are from 1 to 12h.
0026	R / W	8bit	x1	Date as a BCD byte. Values are from 1 to 31h.
0027	R / W	8bit	x1	Hours as a BCD byte. Values are from 0 to 23h.
0028	R / W	8bit	x1	Minutes as a BCD byte. Values are from 0 to 59h.
0029	R / W	8bit	x1	Seconds as a BCD byte. Values are from 0 to 59h.
002A	R	16bit	x0.1	Engine speed (rpm)
002B	R	16bit	x10	Oil pressure multiplied in bars.
002C	R	16bit	x1	Coolant temperature in degrees C.
002D	R	16bit	x1	Fuel level as %
002F	R	16bit	x10	Genset Battery voltage
0030	R	8bit	x50	Charge input voltage

ADDRESS (hex)	R / W	DATA SIZE	COEFFICIENT	DESCRIPTION
0032	R	16bit	-	Shutdown alarm bits bit_0: oil pressure switch shutdown alarm bit_1: high temperature switch shutdown alarm bit_2: coolant level switch shutdown alarm bit_3: rectifier fail shutdown alarm bit_4: emergency stop shutdown alarm bit_5: spare-1 input shutdown alarm bit_6: spare-2 input shutdown alarm bit_7: low fuel switch shutdown alarm bit_8: oil pressure sender shutdown alarm bit_9: high temperature sender shutdown alarm bit_10: under speed shutdown alarm bit_11: over speed shutdown alarm bit_12: genset low voltage shutdown alarm bit_13: genset high voltage shutdown alarm bit_14: fail to start shutdown alarm bit_15:low fuel sender shutdown alarm
0033	R	8bit	-	Shutdown alarm bits bit_0: oil temp sender shutdown alarm bit_1:canopy temp sender shutdown alarm bit_3: high battery voltage shutdown alarm bit_4: charge fail shutdown alarm bit_5: ECU fail shutdown alarm
0034	R	16bit	-	Loaddump alarm bits bit_0: oil pressure switch loaddump alarm bit_1: high temperature switch loaddump alarm bit_2: coolant level switch loaddump alarm bit_3: rectifier fail loaddump alarm bit_4: emergency stop loaddump alarm bit_5: spare-1 input loaddump alarm bit_6: spare-2 input loaddump alarm bit_7: low fuel switch loaddump alarm bit_8: oil pressure sender fail loaddump alarm bit_9: temperature sender fail loaddump alarm bit_10: fuel level sender fail loaddump alarm bit_11: oil temp sender fail loaddump alarm bit_12: canopy temp sender fail loaddump alarm
0035	R	8bit	-	Loaddump alarm bits bit_0: overcurrent loaddump alarm bit_1: excess power loaddump alarm bit_2: reverse power loaddump alarm
0036	R	16bit	-	Warning bits bit_0: oil pressure switch warning bit_1: high temperature switch warning bit_2: coolant level switch warning bit_3: rectifier fail warning bit_4: emergency stop warning bit_5: spare-1 input warning bit_6: spare-2 input warning bit_7: low fuel switch warning bit_8: oil pressure sender warning bit_9: high temperature sender warning bit_10: under speed warning bit_11: over speed warning bit_13: low coolant temp sender warning bit_14: fail to stop warning bit_15:low fuel sender warning

ADDRESS (hex)	R / W	DATA SIZE	COEFFICIENT	DESCRIPTION
0037	R	8bit	-	Warning bits bit_0: service request warning bit_2:low engine battery voltage fail bit_3: high engine battery voltage warning bit_4: charge fail warning bit_5: ECU fail warning
0038	R	16bit	-	Warning bits bit_0: genset low voltage warning bit_1: genset high voltage warning bit_2:reverse power warning bit_3: high oil temp sender warning bit_4: high canopy temp sender warning bit_8: oil pressure sender fail warning bit_9: temperature sender fail warning bit_10: fuel level sender fail warning bit_11: oil temp sender fail warning bit_12: canopy temp sender fail warning
0039	R	8bit	-	Relay output statuses bit_0: load contactor bit_1: crank relay bit_2: spare_2 bit_3: spare_1 bit_5: fuel
003A	R	16bit	-	Relay extension module, relay statuses bit_0: module_1, relay_1 status bit_1: module_1, relay_2 status bit_2: module_1, relay_3 status bit_3: module_1, relay_4 status bit_4: module_1, relay_5 status bit_5: module_1, relay_6 status bit_6: module_1, relay_7 status bit_7: module_1, relay_8 status bit_8: module_2, relay_1 status bit_9: module_2, relay_2 status bit_10: module_2, relay_3 status bit_11: module_2, relay_4 status bit_12: module_2, relay_5 status bit_13: module_2, relay_6 status bit_14: module_2, relay_7 status bit_15: module_2, relay_8 status
003B	R	16bit	-	Relay function statuses bit_0: fuel bit_1: alarm bit_2: crank bit_3: stop bit_4: load contactor bit_6: choke bit_7: preheat bit_8: shutdown alarm bit_9: shutdown or loaddump bit_10: shutdown or loaddump or warning bit_11: automatic ready bit_12: weekly schedule On time bit_13: exerciser on bit_14: load dump alarm

ADDRESS (hex)	R / W	DATA SIZE	COEFFICIENT	DESCRIPTION
003C	R	16bit	-	Relay function statuses bit_0: battery bank voltage below threshold bit_1: block heater on bit_2: service request bit_5: flashing relay output bit_6: gas solenoid bit_7: fuel pump bit_10: idle speed operation bit_11: fan control
003D	R	8bit	-	Operating mode bit_4: auto mode bit_5: off mode bit_6: test mode bit_7: load test mode
003E	R	16bit	x1	Operation timer. Different actions are taken when this register switches from 1 to 0.
003F	R	8bit	-	Genset operating status: (unsigned byte) 0:load on mains 1:waiting before fuel 2:waiting before/between cranks 3:cranking 4:engine heating 5:load contactor timer 6:load on genset 8:cooldown operation 9:stopping
0040	R / W	8bit	-	Last pressed key. This byte is also used in order to change operation mode through MODBUS. bit_0: - bit_1: - bit_2: - bit_3: - bit_4: auto mode bit_5: off mode bit_6: test mode bit_7: load test mode
0057-0058-0059	R	40bit	0.01	Engine run hours coded in 5 bytes. First 2 bytes (register 0057h) contain binary flags. Last 3 bytes contain engine hours multiplied by 0.16 hours. The number of zeros in the first 2 bytes multiplied by 0.01h should be added to the total in order to get the correct engine hours in 0.01h steps. **Example:** 0057 = 65472d=FFC0h= 1111.1111.1100.0000b 0058 = 355d (0163h) 0059 = 02d The number of zeros in the register 0057 is 6. Thus the engine hours is 6x0.01 + 355x0.16 + 2x65536x0.16=21028.38 hours.

ADDRESS (hex)	R / W	DATA SIZE	COEFFICIENT	DESCRIPTION
005A-005B-005C	R	40bit	0.01	Engine run hours since last service, coded in 5 bytes. First 2 bytes (register 005Ah) contain binary flags. Last 3 bytes contain engine hours multiplied by 0.16 hours. The number of zeros in the first 2 bytes multiplied by 0.01h should be added to the total in order to get the correct engine hours in 0.01h steps. Example: 005A = 65472d=FFC0h= 1111.1111.1100.0000b 005B = 355d (0163h) 005C = 02d The number of zeros in the register 0057 is 6. Thus the engine hours is 6x0.01 + 355x0.16 + 2x65536x0.16=21028.38 hours.
005D-005E-005F	R	40bit	-	Time since last service in minutes, coded in 5 bytes. First 2 bytes (register 005Dh) contain binary flags. Last 3 bytes contain time multiplied by 16 minutes. The number of zeros in the first 2 bytes should be added to the total in order to get the correct time since last service in minutes. Example: 005A = 65472d=FFC0h= 1111.1111.1100.0000b 005B = 355d (0163h) 005C = 02d The number of zeros in the register 0057 is 6. Thus the time is 6 + 355x16 + 2x65536x16=2102838 minutes. (1460 days)
0060	R	16bit	x8	J1939: Engine speed
0061	R	16bit	x1	J1939: Coolant temperature (-40°C offset)
0062	R	16bit	x10	J1939: Oil pressure
0063-0064	R	16bit	x20	J1939: Total engine hours
0065	R	16bit	x100	J1939: Air filter differential pressure
0066	R	16bit	x50	J1939: Boost pressure in bars
0067	R	16bit	x10	J1939: Fuel pressure in bars
0068	R	16bit	x1	J1939: Fuel Temperature (-40°C offset)
0069	R	16bit	x10	J1939: Fuel rate (lt/hr)
006A	R	16bit	x1	J1939: Instantaneous fuel economy
006B	R	16bit	x1	J1939: Oil temperature (-40°C offset)
006C	R	16bit	x1	J1939: Ambient air temperature (-40°C offset)
006D	R	16bit	x1	J1939: Air inlet temperature (-40°C offset)
006E	R	16bit	x1	J1939: Intake manifold_1 temperature (-40°C offset)
006F	R	16bit	x1	J1939: exhaust gas temperature
0070	R	8bit	x1	J1939 warning_1_FMI
0071	R	16bit	x1	J1939 warning_1_SPN
0072	R	8bit	x1	J1939 warning_2_FMI
0073	R	16bit	x1	J1939 warning_2_SPN
0074	R	8bit	x1	J1939 warning_3_FMI
0075	R	16bit	x1	J1939 warning_3_SPN
0076	R	8bit	x1	J1939 warning_4_FMI
0077	R	16bit	x1	J1939 warning_4_SPN
0078	R	8bit	x1	J1939 warning_5_FMI
0079	R	16bit	x1	J1939 warning_5_SPN
007A	R	8bit	x1	J1939 warning_6_FMI
007B	R	16bit	x1	J1939 warning_6_SPN
007C	R	8bit	x1	J1939 warning_7_FMI
007D	R	16bit	x1	J1939 warning_7_SPN
007E	R	8bit	x1	J1939 warning_8_FMI
007F	R	16bit	x1	J1939 warning_8_SPN

ADDRESS (hex)	R / W	DATA SIZE	COEFFICIENT	DESCRIPTION
1025	R	8bit	x1	Operation mode_1 bits: bit_0:engine heating method bit_1:- bit_2:charge alternator shutdown bit_3:- bit_4:L-L voltage display bit_5:emergency backup operation bit_6:- bit_7:intermittent alarm output
1026	R	8bit	x1	Operation mode_2 bits: bit_0:modem connected bit_1:exercise on load bit_3-2:- bit_4:- bit_5:rpm from genset frequency bit_6:sms enable bit_7:GPRS connectio006E
1027	R	8bit	x50	Engine hours between services
1028	R	8bit	x1	Months between services
1029	R	8bit	x1	Max running time
102A	R	8bit	x1	Exercise time
102B	R	8bit	x10	Exercise duration
102C	R	8bit	x1	Operation mode_3 bits: bit_1-0: exerciser period bit_2:J1939 enable bit_3:- bit_4:- bit_5:- bit_6:- bit_7:-
102D	R	8bit	x1	J1939 engine brand/model

20. DECLARATION OF CONFORMITY

The unit conforms to the EU directives
-2006/95/EC (low voltage)
-2004/108/EC (electro-magnetic compatibility)
Norms of reference:
EN 61010 (safety requirements)
EN 61326 (EMC requirements)

The CE mark indicates that this product complies with the European requirements for safety, health environmental and customer protection.

UL / CSA Conformity:
certification teting in progress
UL 508, Edition 17
UL 2200, 1st Edition.
UL 840 Edition 3
CSA C22.2 NO. 14 - Edition 10

21. MAINTENANCE

DO NOT OPEN THE UNIT !

There are NO serviceable parts inside the unit.

Wipe the unit, if necessary with a soft damp cloth. Do not use chemical agents

22. DISPOSAL OF THE UNIT

Following **DIRECTIVE 2002/96/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on waste electrical and electronic equipment (WEEE)**, this unit should be stored and disposed separately from the usual waste.

23. ROHS COMPLIANCE

The european ROHS directive restricts and prohibits the use of some chemical materials in electronic devices.

Following the "**DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment",** this product is listed in annex-I under category: "**Monitoring and control instruments including industrial monitoring and control instruments**" and exempted from ROHS directive.

However Datakom is not using any ROHS uncompliant electronic components in the production. Only the solder contains lead. The switching to unleaded solderin is in progress.

24. TROUBLESHOOTING GUIDE

Below is a basic list of most often encountered troubles. More detailed investigation may be required in some cases.

AUTO led flashes and the genset does not run when mains fail:

The unit is in Weekly Schedule OFF time. Please check date and time setting of the unit. Please check also Weekly Schedule program parameters.

Before start, the unit energizes the fuel solenoid, but does not start and OIL PRESSURE EXISTS ! message is displayed:

The unit is not supplied with battery (-) voltage at the oil pressure input.
-Oil pressure switch not connected.
-Oil pressure switch connection wire cut.
-Oil pressure switch faulty.
-Oil pressure switch closes too lately. If oil pressure switch closes, the unit will start. Optionally oil pressure switch may be replaced.

The engine does not run after the first start attempt, then the unit does not start again and OIL PRESSURE EXISTS ! message is displayed:

-The oil pressure switch closes very lately. As the unit senses an oil pressure, it does not start. When oil pressure switch closes the unit will start. Optionally the oil pressure switch may be replaced.

The unit is late to remove engine cranking:

-The generator voltage rises lately.
-The unit is also able to cut cranking from charge alternator voltage and oil pressure input. Please read chapter "**CRANK CUTTING**"

The unit is inoperative:

Measure the DC-supply voltage between terminals BAT+ and BAT- at the rear of the unit. If OK, turn all fuses off, then turn all the fuses on, starting from the DC supply fuse. Then test the unit again.

Programming mode can not be entered:

The program lock input disables programming mode entry. Disconnect the program lock input from battery negative before modification. Do not forget to make this connection again to prevent unauthorized program modifications.

Some program parameters are skipped:

These parameters are reserved for factory setting and cannot be modified.

The genset runs but does not take the load:

Check that the genset Yellow led is on steadily. Adjust genset voltage and frequency limits if necessary.
Check that the digital output-8 is configured as "**Genset Contactor**"
Check "**Genset Contactor Timer**" program parameter.
Check that a Genset Loading Inhibit input signal is not active. Check input functions. If an input is configured as "**Genset Loading Inhibit**" then check the signal is not present at this input.