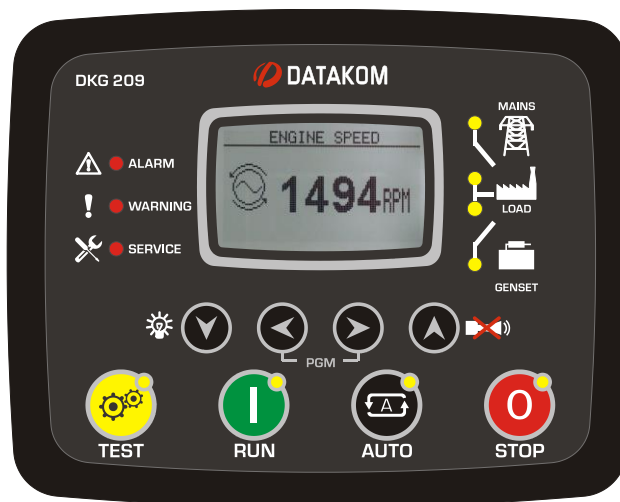




# DKG-209 AUTOMATIC MAINS FAILURE UNIT



## DESCRIPTION

The controller is a comprehensive low cost AMF unit for single genset standby or dual genset mutual standby operations.

The unit is able to initiate modem calls and send SMS messages in fault conditions through external modem.

The unit provides a comprehensive set of digitally adjustable timers, threshold levels, input and output configurations and operating sequences. All programs may be modified via front panel pushbuttons, and do not require an external unit.

Last 100 faults are stored in the event log file. The event log includes not only the engine-hours information, but also a comprehensive list of measured genset parameters at the time that the fault has occurred.

The WINDOWS based RAINBOW program allows remote monitoring and control.

The unit supports MODBUS protocol enabling communication with PLCs and building management systems. The MODBUS protocol is also supported through GSM and PSTN modems.

The unit offers multiple language support.

## FEATURES

- **Low cost**
- **True RMS measurements**
- **Dual genset mutual standby operation**
- **Event logging with engine run hours stamp and measurements**
- **Field adjustable parameters**
- **Logic level 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**
- **1A protected semiconductor outputs**
- **Configurable analogue inputs: 3**
- **Configurable digital inputs: 5**
- **Configurable relay outputs: 1**
- **Total relay outputs: 5**
- **Plug-in connection system**



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# 1. INSTALLATION

## 1.1 Introduction to the Control Panel

The unit is a control and protection panel used in gensets. It shows the measured values on its displays. The unit is designed to provide user friendliness for both the installer and the user. Programming is usually unnecessary, as the factory settings have been carefully selected to fit most applications. However programmable parameters allow the complete control over the generating set. Programmed parameters are stored in a Non Volatile Memory and thus all information is retained even in the event of complete loss of power.

The measured parameters are:

Mains voltage phase L1 to neutral	Gen current phase L1
Mains voltage phase L2 to neutral	Gen current phase L2
Mains voltage phase L3 to neutral	Gen current phase L3
Mains voltage phase L1-L2	Gen frequency
Mains voltage phase L2-L3	Gen kW phase L1
Mains voltage phase L3-L1	Gen kW phase L2
Mains current phase L1	Gen kW phase L3
Mains current phase L2	Gen pf phase L1
Mains current phase L3	Gen pf phase L2
Mains frequency	Gen pf phase L3
Mains kW phase L1	Gen kVA phase L1
Mains kW phase L2	Gen kVA phase L2
Mains kW phase L3	Gen kVA phase L3
Mains pf phase L1	Gen kVA phase L1
Mains pf phase L2	Gen kVA phase L2
Mains pf phase L3	Gen kVA phase L3
Mains kVA phase L1	Gen average Current
Mains kVA phase L2	Gen average Voltage
Mains kVA phase L3	Gen total kW
Mains kVA phase L1	Gen total kVA
Mains kVA phase L2	Gen total pf
Mains kVA phase L3	Gen kWh
Mains average Current	Gen kVA
Mains average Voltage	Battery voltage
Mains total kW	Min. Battery voltage
Mains total pf	Coolant temperature
Gen voltage phase L1 to neutral	Oil pressure (bar/kPa)
Gen voltage phase L2 to neutral	Engine temperature (C/F)
Gen voltage phase L3 to neutral	Fuel level
Gen voltage phase L1-L2	Engine speed (rpm)
Gen voltage phase L2-L3	
Gen voltage phase L3-L1	

## 1.2 Mounting the Unit

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. The unit will be maintained in its position by the mounting brackets spring.



**Engine body must be grounded for correct operation of the unit, otherwise incorrect voltage and frequency measurements may occur.**

The output of the current transformers shall be 5 Amperes. The input current rating of the current transformers may be selected as needed (between 10/5 and 9000/5 amps). Current transformer outputs shall be connected by separate cable pairs from each transformer, to related inputs. Never use common terminals or grounding. The power rating of the transformer should be at least 5 VA. It is recommended to use 1% precision transformers.

If analogue senders (e.g. temperature, oil pressure or fuel level) are connected to the unit, it is not possible to use auxiliary displays, otherwise the unit may be damaged. If temperature or oil pressure or fuel level displays are already present on the generator control panel, do not connect the senders to the unit. The unit is factory programmed for VDO type senders. However different types of senders are selectable via programming menu. Please check the programming section.

The programmable digital inputs are compatible with both '**normally open**' and '**normally closed**' contacts, switching either to **BAT-** or **BAT+**.

The charge alternator connection terminal provides also the excitation current, thus it is not necessary to use an external charge lamp.

## 1.3 Wiring the Unit



**WARNING: THE UNIT IS NOT FUSED.**

Use external fuses for Mains phases: L1,L2,L3, Generator phase: L1,L2,L3, Battery positive: BAT(+). Install the fuses as nearly as possible to the unit in a place easily accessible for the user.

The fuse rating should be 6 Amps.



**WARNING: ELECTRICITY CAN KILL**

**ALWAYS** disconnect the power **BEFORE** connecting the unit. The fuse rating should be 6 Amps.

- 1) *ALWAYS* remove the plug connectors when inserting wires with a screwdriver.
- 2) An appropriate and readily accessible set of disconnection devices (e.g. automatic fuses) **MUST** be provided as part of the installation.
- 3) The building mains supply **MUST** incorporate appropriate short-circuit backup protection (e.g. a fuse or circuit breaker) of High Breaking Capacity (HBC, at least 1500A).
- 4) Use cables of adequate current carrying capacity (at least 0.75mm<sup>2</sup>) and temperature range.

## 2. INPUTS AND OUTPUTS

**RS-232 SERIAL PORT:** This connector provides serial data input and output for various purposes like remote monitoring and remote programming.

**EXTENSION CONNECTOR:** This connector is intended for the connection to output extension modules. The optional relay extension module provides 8 programmable 16A relay outputs. The unit allows the use of up to 2 I/O extension modules.

Term	Function	Technical data	Description
1	<b>GENERATOR CONTACTOR</b>	Relay output, 16A-AC	This output provides energy to the generator contactor. If the generator phases do not have acceptable voltage or frequency values, the generator contactor will be de-energized. In order to provide extra security, the normally closed contact of the mains contactor should be serially connected to this output.
2	<b>GEN-L1</b>	Generator phase inputs, 0-300V-AC	Connect the generator phases to these inputs. The generator phase voltages upper and lower limits are programmable.
3	<b>GEN-L2</b>		
4	<b>GEN-L3</b>		
5	<b>GENERATOR NEUTRAL</b>	Input, 0-300V-AC	Neutral terminal for the generator phases.
6	<b>MAINS NEUTRAL</b>	Input, 0-300V-AC	Neutral terminal for the mains phases.
7	<b>MAINS-L3</b>	Mains phase inputs, 0-300V-AC	Connect the mains phases to these inputs. The mains voltages upper and lower limits are programmable.
8	<b>MAINS-L2</b>		
9	<b>MAINS-L1</b>		
10	<b>MAINS CONTACTOR</b>	Relay output, 16A-AC	This output provides energy to the mains contactor. If the mains phases do not have acceptable voltages, the mains contactor will be de-energized. In order to provide extra security, the normally closed contact of the generator contactor should be serially connected to this output.
11	<b>BATTERY POSITIVE</b>	+12 or 24VDC	The positive terminal of the DC Supply shall be connected to this terminal. The unit operates on either 12V or 24V battery systems.
12	<b>GROUND</b>	0 VDC	Power supply negative connection.
13	<b>FUEL RELAY</b>	Output 1A/28VDC	This output is used for fuel solenoid control.
14	<b>CRANK RELAY</b>	Output 1A/28VDC	This output controls the engine cranking.
15	<b>ALARM RELAY</b>	Output 1A/28VDC	This output has programmable function, selectable from a list.
16	<b>CHARGE</b>	Input and output	Connect the charge alternator's D+/WL terminal to this terminal. This terminal will supply the excitation current and measure the voltage of the charge alternator.
17	<b>FUEL LEVEL SENDER</b>	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.

Term	Function	Technical data	Description
18	<b>OIL PRESSURE SENDER</b>	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.
19	<b>COOLANT TEMP. SENDER</b>	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.
20	<b>CURR_COMMON</b>	Current transformer inputs, 5A-AC	Connect the generator current transformer terminals to these inputs. Do not connect the same current transformer to other instruments otherwise a unit fault will occur. Connect each terminal of the transformer to the unit's related terminal. Do not use grounding. Correct polarity of connection is vital. If the measured power is negative, then change the polarity of each 3 current transformers. The rating of the transformers should be the same for each of the 3 phases. The secondary winding rating shall be 5 Amperes. (For ex. 200/5 Amps).
21	<b>CURR_1</b>		
22	<b>CURR_2</b>		
23	<b>CURR_3</b>		
24	<b>LOW OIL PRESSURE</b>	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.
25	<b>HIGH TEMP</b>		
26	<b>EMERGENCY STOP</b>		
27	<b>FUEL LEVEL</b>		
28	<b>SPARE-1</b>		

## 3. DISPLAYS

### 3.1 Led Displays

The unit has **12** LEDs, divided in 3 groups:

- Group\_1:** Operating mode: This group indicates the genset function.
- Group\_2:** Mimic diagram: This group indicates the current status of the mains and genset voltages and contactors.
- Group\_3:** Warnings and alarms: This group indicates the existence of abnormal conditions encountered during operation.

Function	Color	Description
<b>MAINS ON</b>	Yellow	The LED will turn on when all 3 mains phase voltages are within the limits.
<b>MAINS OFF</b>	Red	The LED will turn on when at least one of the mains phase voltages is outside limits.
<b>LOAD MAINS</b>	Yellow	It turns on when the mains contactor is activated.
<b>LOAD GENERATOR</b>	Yellow	It turns on when the generator contactor is activated.
<b>GENERATOR</b>	Yellow	The LED will flash when the engine is running. It will turn on steadily when all 3 generator phase voltages are within the programmed limits.
<b>TEST</b>	Yellow	It turns on when the related operation mode is selected. One of these LEDs is always on and indicates which operation mode is selected.
<b>RUN</b>	Yellow	
<b>STOP</b>	Yellow	
<b>AUTO</b>	Yellow	
<b>ALARM</b>	Red	If a fault condition resulting to the engine shutdown has occurred, the alarm led turns on steadily. If a loaddump condition occurs, this led will flash. Alarms work on a first occurring basis. The occurrence of a fault will disable other faults of lower or equal priority.
<b>WARNING</b>	Red	If a warning condition has occurred, this led turns on steadily. The warnings work on a first occurring basis. The occurrence of a warning will disable other warnings, however shutdown and loaddump alarms are still allowed.
<b>SERVICE REQUEST</b>	Red	Engine periodic maintenance request indicator. It turns on when the preset engine hours or time duration after previous service has elapsed.

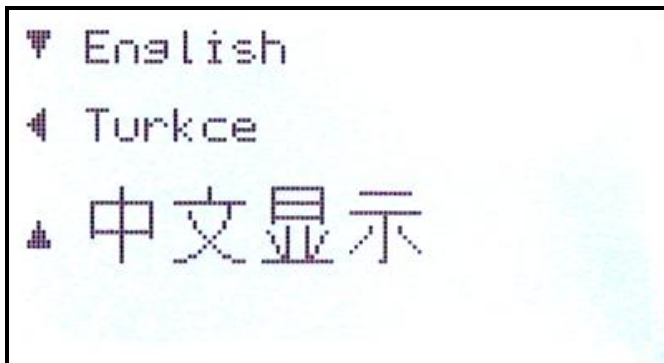


## 3.2 Language Selection

The unit is able to display information in 3 or 4 languages, following versions. Language selection is made through program parameter CONTROLLER CONFIGURATION > LANGUAGE SELECTION. Below selections are available in the standard version:

- 0: English language
- 1: Turkish language
- 2: Chinese language
- 3: ask selection at power-up

If language is set to 3, below screen will come at power on:



Left / Up / Down arrow pushbuttons will select the screen language. The language will be asked everytime power is turned on.

With selections of 0,1,2 this screen will not appear and the selected language is enabled.

## 3.3 Digital Display

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

- Measured parameters,
- The company logo,
- The alarm list
- Software version,
- Event records,
- Program parameters.

Navigation between different screens is made with the ◀MENU and MENU▶ buttons. Each depression of the MENU▶ button switches the display to the next screen. Each depression of the ◀MENU 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 ◀MENU or MENU▶ buttons will not function. To enable display navigation and mute the internal buzzer, 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. 'END OF ALARM LIST' will be displayed when there is no more alarm to display.


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 9 hours to allow power economy.

Group	Screen	Contents	Description
<b>GENSET PARAMETERS</b>	<b>1</b>	Genset Volts L1, Genset Volts L2, Genset Volts L3,	Genset Volts L1-L2, Genset Volts L2-L3, Genset Volts L3-L1, Presented as a table.
	<b>2</b>	Genset Current L1, Genset Current L2, Genset Current L3,	Genset Frequency Presented as a table.
	<b>3</b>	Genset kW phase L1, Genset kW phase L2, Genset kW phase L3,	Genset pf phase L1 Genset pf phase L2 Genset pf phase L3 Presented as a table.
	<b>4</b>	Genset kVA phase L1, Genset kVA phase L2, Genset kVA phase L3,	Genset kVAr phase L1 Genset kVAr phase L2 Genset kVAr phase L3 Presented as a table.
	<b>5</b>	Genset average Current Genset average Voltage Genset Frequency	Genset total kW Genset total pf Genset total kVA Presented as a table.
	<b>6</b>	Genset L1 current	Genset Phase L1 Current, large characters
	<b>7</b>	Genset L2 current	Genset Phase L2 Current, large characters
	<b>8</b>	Genset L3 current	Genset Phase L3 Current, large characters
	<b>9</b>	Genset frequency	with large size characters
	<b>10</b>	Genset active power	with large size characters
	<b>11</b>	Genset average voltage	with large size characters
	<b>12</b>	Genset kWh	8 digit counter
	<b>13</b>	Genset kVArh	8 digit counter

Group	Screen	Contents	Description
<b>ENGINE PARAMETERS</b>	<b>1</b>	Oil Pressure	Displayed in bars and kPa, large font. If PSI display is enabled by program parameter, then displayed in bars and psi.
	<b>2</b>	Engine Temperature	Displayed in degrees C and degrees F, large characters
	<b>3</b>	Fuel Level	Displayed in % of full tank capacity. If Fuel Consumption per Hour parameter is not zero, then also displayed in engine hours. If Fuel Tank Capacity parameter is not zero, then also displayed in liters.
	<b>4</b>	Engine Speed	Displayed in RPMs
	<b>5</b>	Battery Voltage, Minimum battery voltage	Displayed in Volts DC. The Minimum Battery Voltage is reset before each engine crank cycle. Thus the displayed value reflects the most recent status.
	<b>6</b>	Engine Hours, Total Starts	The engine hours is displayed up to 999'999.9 hours. Total start count is displayed up to 9999

Group	Screen	Contents	Description
<b>MAINS PARAMETERS</b>	<b>1</b>	Mains Volts L1, Mains Volts L2, Mains Volts L3,	Mains Volts L1-L2, Mains Volts L2-L3, Mains Volts L3-L1, Presented as a table.
	<b>2</b>	Mains Current L1, Mains Current L2, Mains Current L3,	Mains Frequency Presented as a table.
	<b>3</b>	Mains kW phase L1, Mains kW phase L2, Mains kW phase L3,	Mains pf phase L1 Mains pf phase L2 Mains pf phase L3 Presented as a table.
	<b>4</b>	Mains kVA phase L1, Mains kVA phase L2, Mains kVA phase L3,	Mains kVAr phase L1 Mains kVAr phase L2 Mains kVAr phase L3 Presented as a table.
	<b>5</b>	Mains average Current Mains average Voltage Mains Frequency	Mains total kW Mains total pf Presented as a table.
	<b>6</b>	Mains L1 current	Mains Phase L1 Current, large characters
	<b>7</b>	Mains L2 current	Mains Phase L2 Current, large characters
	<b>8</b>	Mains L3 current	Mains Phase L3 Current, large characters
	<b>9</b>	Mains frequency	Mains Phase L1 Current, large characters
	<b>10</b>	Mains active power	with large size characters
	<b>11</b>	Mains average voltage	with large size characters

Group	Screen	Description
ALARM LIST	1	If no alarm exists, then END OF ALARM LIST is displayed. Otherwise the first alarm is displayed. Each depression of the ▼ button will cause the screen to switch to the next alarm.

Group	Screen	Contents	Description
GENSET STATUS	1	Genset Status	Ascii explanation of the current status.
	2	Company Logo	 DATAKOM
	3	Site Id String	The generator site id string, displayed in large characters.
	4	Software Version	The unit firmware version number displayed in large characters.
	5	Maintenance Counters	Time to maintenance (days) and engine hours to maintenance.

## 4. ALARMS AND WARNINGS

Alarms indicate an abnormal situation in the generating set are divided into 3 priority levels:

- 1- **ALARMS:** These are the most important fault conditions and cause:
  - The **ALARM** led to be on steadily,
  - The genset contactor to be released immediately,
  - The engine to be stopped immediately,
  - The **Horn, Alarm, Alarm+Load\_dump** and **Alarm+Load\_dump+Warning** digital outputs to operate, (if selected via programming menu)
  
- 2- **LOAD\_DUMPS:** These fault conditions cause:
  - The ALARM led to flash,
  - The genset contactor to be released immediately,
  - The engine to be stopped after Cooldown period,
  - The **Horn, Alarm+Load\_dump** and **Alarm+Load\_dump+Warning** digital outputs to operate, (if selected via programming menu)
  
- 3- **WARNINGS:** These conditions cause:
  - The WARNING led to be on steadily,
  - The **Horn** and **Alarm+Load\_dump+Warning** digital outputs to operate, (if selected via programming menu)

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

Alarms operate in a first occurring basis:

- If an alarm is present, following alarms, load\_dumps and warnings will not be accepted,
- If a load\_dump is present, following load\_dumps and warnings will not be accepted,
- If a warning is present, following warnings will not be accepted.

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. The existing **alarms may be canceled** by pressing one of the operating mode buttons (**LOAD TEST / TEST / OFF / AUTO**).

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

**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 (warning) :** Set if the coolant temperature value measured from the sender is below 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:** Set if a signal is detected from the related spare fault input.

**LOW SPEED / HIGH SPEED:** Set if the generator frequency 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 frequency shutdown limit which is 12% above the high limit is always monitored and stops the engine immediately.

**START FAIL (alarm):** Set if the engine is not running after programmed number of start attempts.

**STOP FAIL (warning):** Set if the engine has not stopped before the expiration of the **Stop Timer**.

**OVERLOAD (load dump):** Set if at least one of the genset phase currents goes over the **Overcurrent Limit** for **Overload Timer**. If currents goes below the limit before expiration of the timer then no alarm will be set.

**EXCESS POWER (load dump):** 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.

**GENSET LOW VOLTAGE:** Set if any of the generator phase voltages goes outside programmed limits for **Overload Timer**. This fault will be monitored with **holdoff timer** delay after the engine is running.

**GENSET HIGH VOLTAGE:** Set if any of the generator phase voltages goes outside programmed limits for **Overload Timer**. This fault will be monitored with **holdoff timer** delay after the engine is running.

**LOW BATTERY VOLTAGE (warning):** Set if the battery voltage goes below the programmed limit. During engine cranking this fault is not monitored.

**HIGH BATTERY VOLTAGE:** Set if the battery voltage goes above programmed limits. Both warning and alarm levels for high battery voltage are programmable.

**CHARGE:** Set if a charge alternator failure (or broken belt) occurs. This fault condition may result to a **warning** or **alarm** following programming.

**MAINS PHASE ORDER FAIL (warning):** Set if the mains phase order checking is enabled, mains phases are present and mains phase order is reversed. This fault prevents the Mains Contactor to close.

## 5. MODES OF OPERATION

The modes of operation are selected by pushing the front panel keys. Changing the operation mode while the genset is running will result into a behavior suitable for the new operating mode. For example, if the LOAD TEST mode is selected when genset is running at TEST mode, then the genset will take the load.

**STOP:** In this mode, the mains contactor will be energized if mains phase voltages are within the programmed limits. The engine will be stopped.

**AUTO:** It is used for genset and mains automatic transfer. If at least one of the mains phase voltages is outside limits, the mains contactor will be deactivated.

The diesel will be started for programmed times after the preheat timer. When the engine runs, the crank relay will be immediately deactivated. The engine will run without load during engine heating period. After this, if alternator phase voltages and frequency are within limits, then the unit will wait for the generator contactor period and the generator contactor will be energized.

When all the mains phase voltages are within the limits, the engine will continue to run for the mains waiting period. At the end of this period the generator contactor is deactivated and the mains contactor will be energized. If a cooldown period is given, the generator will continue to run during cooldown period. At the end of the period, the fuel solenoid will be de-energized and the diesel will stop. The unit will be ready for the next mains failure.

**RUN:** It is used to test the generator when the mains are on, or keep the generator running in the emergency backup mode. The operation of the generator is similar to the AUTO mode, but the mains contactor will not be deactivated if the mains are not off. If the mains are off, mains contactor will be deactivated and the generator contactor will be activated. When the mains are on again, a changeover to the mains will be made, but the engine will be kept running unless another mode is selected. To stop the engine, select **AUTO** or **OFF** mode.

**TEST:** It is used to test the genset under load. Once this mode is selected, the engine will run and the load will be transferred to the genset. The genset will feed the load indefinitely unless another mode is selected.

## 6. OTHER FEATURES

### 6.1 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.

In this mode the mains phases are not monitored. If the REMOTE START signal is present then the mains will be supposed to fail, inversely if the REMOTE START signal is absent, then mains voltages will be supposed to be present. The front panels mimic diagram's mains LEDs will reflect the status of the REMOTE START input.

### 6.2 Sender type Selection

The unit has the ability to adapt to any type of oil pressure and temperature senders. The commonly used standard sender characteristics are recorded in memory and selectable from a list. However non standard senders may also be used by entering their characteristics to the table.

#### **Oil Pressure Sender Type Selection:**

Selectable sender types are:

**0:** 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)

#### **Temperature Sender Selection:**

Selectable sender types are:

**0:** Sender characteristics are defined in **Sender Characteristics** table.

**1:** VDO

**2:** DATCON DAH type

**3:** DATCON DAL type

#### **Fuel Level Sender Selection:**

The **Fuel Level Sender** characteristic is programmable through table.

## 6.3 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.

## 6.4 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 of the spare relay outputs may be assigned as **IDLE output** using **Relay Definition** program parameters. Also relays on an extension module may be assigned to this function.

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

## 6.5 Engine Block Heater

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

The block heater relay function may be assigned to spare relays using **Relay Definition** program parameters. Also relays on an extension module may be assigned to this function.

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**.



## 6.6 Fuel Pump Control

The unit is able to provide a relay output 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 relay output will operate. When the fuel level reaches **Fuel Pump High Limit** parameter, the relay will turn off. 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 spare relays using **Relay Definition** program parameters. Also relays on an extension module may be assigned to this function.

## 6.7 Mains Simulation (Disable Start)

The unit offers an optional **SIMULATE MAINS** signal input. Any digital input may be assigned as **Simulate Mains** 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 **SIMULATE MAINS** 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 **Simulate Mains** input is defined and the input signal is active, the mains phases are not monitored and supposed to be inside limits. This will prevent the genset from starting even in case of a mains failure. If the genset is running when the signal is applied, then usual Mains Waiting and Cooldown cycles will be performed before engine stop. When the **SIMULATE MAINS** signal is present, the front panels mimic diagram's mains LEDs will reflect the mains voltages as present.

When the signal is passive, the unit will revert to normal operation and monitor the mains voltage status.



**The REMOTE START operation overrides SIMULATE MAINS and FORCE TO START operations.**

## 6.8 Delayed Mains Simulation, Battery Charging

The Delayed Mains Simulation feature is used in battery backed up telecom systems where batteries are able to supply the load during a certain period. The genset is requested to run only when battery voltage drops below the critical level. Once the engine runs, the rectifier system starts charging the batteries and the battery voltage goes up immediately. Thus the engine should continue to run a programmed period for effective charging. The critical battery voltage level will be detected by an external unit which provides the digital Simulate Mains signal for the genset control unit.

The unit offers an optional **SIMULATE MAINS** signal input. Any digital input may be assigned as **Simulate Mains** 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 **SIMULATE MAINS** 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 **Delayed Simulate Mains** program parameter is set to 1 and the input signal is active when the genset is not feeding the load, the mains phases are not monitored and supposed to be inside limits. This will prevent the genset from starting when the simulate mains signal is present (batteries charged). The genset will start when mains voltages are out of limits and the simulate mains signal not present.

If the genset is running when the signal is applied, then **MAINS SIMULATION** will be prevented during **Flashing Relay Timer** program parameter. After this, usual Mains Waiting and Cooldown cycles will be performed before engine stop. When the **SIMULATE MAINS** signal is present, the front panels mimic diagram's mains LEDs will reflect the mains voltages as present.

When the signal is passive, the unit will revert to normal operation and monitor the mains voltage status.



**The REMOTE START operation overrides DELAYED SIMULATE MAINS operation. When both parameters “Remote Start Operation” and “Delayed Simulate Mains” are set then REMOTE START operation mode is performed.**

## 6.9 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 Timer** program parameter. 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 Timer**. Each time the period programmed using **Flashing Relay Timer** elapses, the relay output will change position.

The flashing relay function may be assigned to spare relays using **Relay Definition** program parameters. Also relays on an extension module may be assigned to this function.

The dual genset intermittent operation uses also the **Mains Simulation** feature. Please review chapter **6.7** 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 at every mains failure. 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 after each mains failure. 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.**

## 6.10 Service Request Display

This led is designed to help the periodic maintenance of the genset to be made consistently.

The periodic maintenance is basically carried out after a given engine hours (for example 200 hours), but even if this amount of engine hours is not fulfilled, it is performed after a given time limit (for example 12 months).



**The SERVICE REQUEST led has no effect on the genset operation.**

The unit has both programmable engine hours and maintenance time limit. The engine hours is programmable with 50-hour steps, the time limit is programmable with 1 month steps. If any of the programmed values is zero, this means that the parameter will not be used. For example a maintenance period of 0 months indicates that the unit will request maintenance only based on engine hours, there will be no time limit. If the engine hours is also selected as 0 hours this will mean that the SERVICE REQUEST display will be inoperative.

When the engine hours **OR** the time limit is over, the **SERVICE REQUEST** led (red) will start to flash and the service request relay function will be active.

The service request relay function may be assigned to spare relays using **Relay Definition** program parameters. Also relays on an extension module may be assigned to this function.



**To turn off the SERVICE REQUEST led, and reset the service period, press together the ALARM MUTE and LAMP TEST keys for 5 seconds.**

The remaining engine hours and the remaining time limit are kept stored in a non-volatile memory and are not affected from power supply failures.

The time and engine hours to service are displayed in the **STATISTICAL COUNTERS** menu.

## 6.11 Engine Hour Meter

The unit features a non-erasable incremental engine hour meter. The hour meter information is kept in a non-volatile memory and is not affected from power supply failures.

The engine hours may be displayed **STATISTICAL COUNTERS** menu.

## 6.12 -

This chapter is intentionally left blank.

## 6.13 Software Version Display

Some additional features are installed within consecutive software releases. In order to be sure of the validity of the status of the unit, the software version needs to be known.

## 6.14 Modem Connection

The unit is capable of making modem calls in case of alarm, as well as answering modem calls made from a remote location. **GSM** modems and classic cable network (**PSTN**) modems are acceptable.

If the modem is connected to the unit, the **Modem Enable** program parameter should be set to 1, otherwise faulty operation may occur.

A maximum of 2 telephone numbers can be defined for outgoing modem calls. In case of alarm, the unit will attempt to reach control centers associated with each number. In case of modem connection failure, the call will be repeated up to 30 times with 2 minute intervals.

When the modem call is in progress, a telephone icon (☎) will appear at the upper right corner of the screen.



**If Modem Enable or SMS Enable or MODBUS Address parameters are different from zero, the local PC connection will not work.**

Advised modems are DATAKOM types which are powered up from the same DC battery voltage than the unit. Most of other desktop modems with standard AT commands are also usable, but it is the user's responsibility to provide an uninterrupted AC supply source to the modem. The necessary modem cable will be supplied by DATAKOM.

Modem calls are always terminated by the central RAINBOW software. However the unit does not allow connection durations exceeding 2 minutes, and hangs up the modem when this period expires.

The PC program used for remote monitoring and programming is the same RAINBOW software used for RS-232 connection.

Please note that the modem operation is also compatible with the MODBUS communication. Thus the unit can initiate and receive calls to/from a MODBUS master station. Please review chapter\_8 for more details on MODBUS communication.

## 6.15 SMS Message Sending

The GSM SMS sending is activated by setting the **SMS Enable** program parameter to 1.



If **Modem Enable** or **SMS Enable** or **MODBUS Address** parameters are different from zero, the local PC connection will not work.

When a fault condition occurs, the unit will compose an SMS message and will send it to up to 6 phone numbers. If modem is enabled, only 4 telephone numbers are available for SMS sending.

The unit is also able to send SMS messages in below conditions, without creating a visible alarm or warning:

**Mains Fail, Mains Restored** (enabled via **SMS on Mains Change** program parameter)

**Fuel Theft, Fuelling** (enabled by setting the **Fuel Consumption / Hour** parameter to other than 0)

If both modem and SMS are enabled, the unit will send SMS messages first and attempt modem connection afterwards.

When SMS sending is in progress, an (**SMS**) icon will appear at the upper right corner of the screen.

The maximum number of alarms transmitted in a SMS message is 4. This limitation is due to the maximum length of an SMS message which is 160 characters.

A sample GSM SMS message is given below:

```
DKGxxx <SITE-ID>  
STOP :LOW OIL PRESSURE SW.  
END OF ALARM LIST
```

The first line of the message carries information about the unit type and the site identity string. This line is intended for the identification of the genset sending the SMS message.

Each following line will give one fault information. The message will always be terminated by the "END OF ALARM LIST" string.

When the message is sent, the existing alarms will be masked, causing the audible alarm relay to release and preventing consecutive GSM SMS messages. Any new upcoming alarm will result in a new GSM SMS message. The new message will indicate all existing alarms, even masked ones.

The necessary GSM modem cable will be supplied by DATAKOM. This is the same cable as PSTN (land) modems.

## 6.16 Remote Monitoring and Programming

Thanks to its standard serial RS-232 port, the unit offers the remote monitoring and programming feature.

The remote monitoring and programming PC software is called RAINBOW and may be downloaded from [www.datakom.com.tr](http://www.datakom.com.tr) internet site with **password login**.

The modem, SMS and Modbus modes are not compatible with the local PC connection. **Modem Enable**, **SMS Enable** and **MODBUS Address** program parameters should be set to 0 before connection.

The RAINBOW software allows the visualization and recording of all measured parameters. The recorded parameters may then be analyzed graphically and printed. The software also allows the programming of the unit and the storage of the program parameters to PC or the downloading of stored parameters from PC to the unit.

For PCs without a serial port, below USB to serial adapters are tested and approved :

DIGITUS USB 2.0 TO RS-232 ADAPTER (PRODUCT CODE: DA70146 REV 1.1)

DIGITUS USB 1.1 TO RS-232 ADAPTER (PRODUCT CODE: DA70145 REV 1.1)

FLEXY USB 1.1 TO SERIAL ADAPTER (PRODUCT CODE BF-810)

CASECOM USB TO SERIAL CONVERTER (MODEL: RS-01)

The necessary PC connection cable will be supplied by DATAKOM. The cable length should not be over 3 meters.

## 6.17 External Control of the Unit

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

- Force STOP mode
- Force AUTO mode
- Force RUN 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 keys. 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.

## 6.18 -

This chapter is intentionally left blank.

## 6.19. Resuming to factory set parameters

### 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.



**It is not possible to restore user parameters.**

## 6.20. 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 spare relays using **Relay Definition** program parameters. Also relays on an extension module may be assigned to this function.

## 6.21. Load Shedding / Dummy Load

The load shedding feature consists on the disconnection of the least crucial loads when the genset power approaches to its limits. These loads will be supplied again when the genset power falls below the programmed limit. The internal Load Shedding function is always active. Any of the auxiliary relays may be used as the load shedding output.

The dummy load function consists on the connection of a dummy load if the total genset load is below a limit and to disconnection of the dummy load when the total power exceeds another limit. The dummy load function is the inverse of the load shedding function, thus the same output may be used for both purposes.

The parameters used in Load Shedding feature are in the Electrical Parameters Group:

**Load Shedding Low Limit:** If the genset active power output goes below this limit, then the Load Shedding relay will be deactivated.

**Load Shedding High Limit:** If the genset active power output goes above this limit, then the Load Shedding relay will be activated.



## 6.22. Fuel Theft / Fuelling Messages

The unit is able to send SMS messages in fuel theft or fuelling conditions.

These SMS messages are sent without creating visible fault condition.

These features are enabled by setting the program parameter **Engine Parameters > Fuel Consumption / Hour** to a value other than 0%.

The **Fuel Consumption / Hour** parameter should be set to a value clearly greater than the maximum fuel consumption of the engine.

If the fuel level measured from the sender input is decreased more than this parameter in 1 hour period, then a FUEL THEFT sms message is sent to programmed telephone numbers.

If the fuel level measured from the sender input is increased more than this parameter in 1 hour period, then a FUELLING sms message is sent to programmed telephone numbers.

## 6.23. Firmware Update

The unit offers possibility of updating the firmware in the field. The firmware is updated through the RS-232 serial port using Rainbow or a special DOS program.

The unit will go to firmware download mode with a special command from the PC program. In download mode, the display of the unit will show "**DL-V1.00**"

During firmware update process, the progress is visible through a completion bar on the screen.

The firmware update operation will take around 3 minutes.

After completion of the update a special command will set back the unit to normal operation mode.

## 6.24. -

This chapter is intentionally left blank.

## 6.25. -

This chapter is intentionally left blank.

## 6.26. Dual Voltage and Frequency

The unit offers 2 sets of voltage and frequency protection limit values. The user is allowed to switch between these 2 sets anytime.

This feature is especially useful in dual voltage or frequency gensets for easy switching between 2 operating conditions.

**The switching to the second set of limit values can be done in 2 ways:**

- by setting the program parameter **Secondary Volt/Freq** to 1
- with digital input signal

Thus the user has full flexibility for manual or external switching.

If switching is done with digital input signal, one of digital inputs has to be defined as “**2<sup>nd</sup> Volt-Freq Select**” using “**INPUT FUNCTION SELECT**” program group.

Below parameters are available for second voltage-frequency selection:

Mains Low Voltage Limit	Genset Low Voltage Shutdown Limit
Mains High Voltage Limit	Genset Low Voltage Warning Limit
Mains Low Frequency Limit	Genset High Voltage Warning Limit
Mains High Frequency Limit	Genset High Voltage Shutdown Limit
	Genset Low Frequency Shutdown Limit
	Genset Low Frequency Warning Limit
	Genset High Frequency Warning Limit
	Genset High Frequency Shutdown Limit
	Genset Low RPM Shutdown Limit
	Genset Low RPM Warning Limit
	Genset High RPM Warning Limit
	Genset High RPM Shutdown Limit

## 6.27. Single Phase Operation

If the unit is used in a single phase electrical network, it is advised to set the **Single Phase Enable** program parameter in **CONTROLLER CONFIGURATION** group to 1.

When **Single Phase Enable** is set to 1, then the unit will measure electrical parameters only on phases **L1** of genset and mains.

Voltage and overcurrent checks will be performed on phases **L1** only.

Phases **L2** and **L3** parameters, as well as phase-to-phase voltages are removed from display screens.

## 7. -

This chapter is intentionally left blank.

## 8. MODBUS COMMUNICATION

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 **MODBUS Address** program parameter. The possible address range is 1 to 144. Setting the address to 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)

Detailed description about the MODBUS protocol is found in the document “**Modicon Modbus Protocol Reference Guide**”. The web address is: [www.modbus.org/docs/PI\\_MBUS\\_300.pdf](http://www.modbus.org/docs/PI_MBUS_300.pdf)

Below is a limited shortlist of readable registers. For the detailed **Modbus Application Manual** and a complete list of registers please contact DATAKOM.

ADDRESS (hex)	R / W	DATA SIZE	COEFFICIENT	DESCRIPTION
0000	R	16bit	x1	Mains Phase L1 voltage
0001	R	16bit	x1	Mains Phase L2 voltage
0002	R	16bit	x1	Mains Phase L3 voltage
0003	R	16bit	x1	Genset Phase L1 voltage
0004	R	16bit	x1	Genset Phase L2 voltage
0005	R	16bit	x1	Genset Phase L3 voltage
0006	R	16bit	x1	Genset Phase L1 current
0007	R	16bit	x1	Genset Phase L2 current
0008	R	16bit	x1	Genset Phase L3 current
000C	R	16bit	x1	Mains Phase L12 voltage
000D	R	16bit	x1	Mains Phase L23 voltage
000E	R	16bit	x1	Mains Phase L31 voltage
000F	R	16bit	x1	Genset Phase L12 voltage
0010	R	16bit	x1	Genset Phase L23 voltage
0011	R	16bit	x1	Genset Phase L31 voltage
0012	R	16bit	x10	Mains frequency
0013	R	16bit	x10	Genset frequency
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.
0018	R	8bit	x100	Power factor multiplied by 100 (signed byte). Negative values indicate a capacitive power factor.
002A	R	16bit	x1	Engine speed (rpm)
002B	R	16bit	x10	Oil pressure in bars.
002C	R	16bit	x1	Coolant temperature in degrees C.
002D	R	16bit	x1	Fuel level as %
002F	R	16bit	x10	Battery voltage
003D	R	8bit	-	Operating mode bit_3: manual mode bit_4: auto mode bit_5: off mode bit_6: test mode bit_7: load test mode

**9. -**

This chapter is intentionally left blank.

**10. EVENT LOGGING**

The unit keeps record of the last **100** events in order to supply information for the service personal.

The genset status information and a comprehensive set of measured values are stored within the event memory. The events are recorded with an engine run-hours stamp.

The events are stored in a circular memory. This means that a new coming event will erase the oldest recorded event. The events are always displayed starting from the most recent one.

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

Switching from one menu screen to another is made with the ◀**MENU** and **MENU**▶ buttons.

Events are visible inside the Programming menu. Correct password **must** be entered in order to display events.

When the **EVENT RECORD** screen is displayed, each depression on the ◀**MENU** button makes the display switch to the previous event and **MENU**▶ button makes the display switch to the next event.

Each event is displayed in **4** pages. Event and page numbers are shown at the top right corner of the display. Events are numbered starting from 1, number 1 being the latest one. Pages are listed from **A** to **D**. Navigation between different pages of the same event is done with ▼ and ▲ buttons.

**Event sources are:**

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

**Event record contents are:**

- Event type (alarms, mode change, periodic, etc...)
- Date and time
- Genset operating mode (AUTO, MANUAL, OFF, TEST, LOAD TEST)
- Genset operation status (mains ok, running, cooldown etc...)
- 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

## 11. STATISTICAL COUNTERS

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

The counters consist on:

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

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

## 12. 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

## 13. PROGRAMMING

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

To **enter the program mode**, press together **◀MENU** and **MENU▶** buttons for 1 second. The program mode is only allowed if the **PROGRAM LOCK** input is left open. If this input is tied to **GROUND**, the program value modification will be disabled to prevent unauthorized intervention. It is advised to keep the **PROGRAM LOCK** input tied to **GROUND**.

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 unit stores 3 different passwords. Each password allows access to a different level of program parameters.

The password level-1 allows access to field adjusted parameters. The level-2 allows access to factory setup. The password level-3 is reserved to Datakom and allows access to calibration parameters.

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

Passwords can only be modified through Rainbow program.

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

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

Program parameters are kept in a non-volatile memory and are not affected from power failures.

To **exit the program mode** press one of the mode selection keys. If no button is pressed during 1 minute the program mode will be cancelled automatically.

### Program Group: Controller Configuration

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) LCD Contrast	-	35	This parameter is used to set LCD contrast. Adjust for the best viewing angle.
(2) Language Selection	-	0	<p>0: English language selected.</p> <p>1: Turkish language selected. This language may depend on the country where the unit is intended to be used.</p> <p>2: Chinese language selected</p> <p>3: The unit will ask for manual language selection at power-on.</p>
(2) Secondary Volt/Freq	-	0	<p>0: Use primary voltage/frequency limits</p> <p>1: Use secondary voltage/frequency limits</p>
(2) Single phase Enable	-	0	<p>0: 3-phase system</p> <p>1: Single phase system</p>
(2) Line-to-Line Voltages	-	0	<p>0: Display Line to Neutral voltages as default</p> <p>1: Display Line to Line voltages as default</p>
(1) Genset Default Display	-	0	<p>This parameter selects the screen which is displayed during genset on load operation.</p> <p>0: screen 3 (or 4) electrical, large characters</p> <p>1: screen 5 engine parameters, large characters</p> <p>2: screen 6 (or 7) maximum information, small characters</p> <p>3: screen 8 (or 9)</p> <p>Details of each screen are explained in chapter 3.2</p>
(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 <b>ALARM</b> relay is active. If the period is set to 0, this will mean that the period is unlimited.
(1) Intermittent Alarm Relay	-	0	<p>0: continuous</p> <p>1: intermittent (turns on and off every second)</p>
(2) Charge Alternator Shutdown	-	1	<p>0: The charge input generates <b>CHARGE FAIL</b> warning, and does not stop the engine.</p> <p>1: The charge input generates <b>CHARGE FAIL</b> alarm, and stops the engine.</p>
(1) Emergency Backup Operation	-	0	<p>0: In TEST mode, the load will not be transferred to the genset even if the mains fail.</p> <p>1: In TEST mode, the load will be transferred to the genset if the mains fail.</p>
(2) Delayed Simulate Mains	-	0	<p>0: The <b>SPARE-2</b> input has normal function</p> <p>1: The <b>SPARE-2</b> input has delayed simulate mains function. See chapter 6.8 for more info.</p>
(2) Modem Enable	-	0	<p>0: No modem connection, the serial port is connected to PC</p> <p>1: Modem connected.</p>
(2) SMS Enable	-	0	<p>0: SMS not enabled</p> <p>1: SMS enabled</p>
(2) MODBUS Address	-	0	<p>0: RAINBOW communication protocol.</p> <p>1-144: MODBUS communication. This parameter is also the MODBUS controller address of the unit.</p>
(1) Oil Pressure in psi	-	0	<p>0: oil pressure display in bars</p> <p>1: oil pressure display in psi</p>
(1) Temperature in °F	-	0	<p>0: temperature display in degrees C</p> <p>1: temperature display in degrees F</p>



**Program Group: Controller Configuration (continued)**

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) Flashing Relay Timer	hours	0	<b>Delayed Simulate Mains Operation:</b> max genset running time after Simulate Mains signal disappears. <b>Dual Genset Systems:</b> flashing relay toggle timer. Please contact DATAKOM for dual genset mutual standby operation.
(2) Hysteresis Voltage	V	8	This parameter provides the mains and genset voltage limits with a hysteresis feature in order to prevent faulty decisions. For example, when the mains are present, the mains voltage low limit will be used as the programmed low limit. When the mains fail, the low limit will be incremented by this value. It is advised to set this value to 8 volts.
(2) Crank Teeth Count	-	30	This parameter is 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 Mains Change	-	0	This parameter controls SMS sending when mains voltages status is changed. No warning is generated. <b>0:</b> no SMS when mains failed or restored <b>1:</b> SMS sent when mains failed or restored
(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) CT Location	-	0	0: Current transformers at alternator side 1: Current transformers at load side

### Program Group: Electrical Parameters

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) Current Transformer Ratio	A	500	This is the rated value of current transformers. All transformers must have the same rating. The secondary of the transformer will be 5 Amps.
(2) Overcurrent Limit	A	0	If the current goes above this limit, during the period defined in <b>Overload Timeout</b> then a <b>Overcurrent Load Dump</b> 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 <b>Overload Timeout</b> then an <b>Excess Power Load Dump</b> 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 <b>OVERCURRENT</b> or <b>EXCESS POWER</b> Load Dump alarms occur. This is also the period between the frequency goes out of the limits and <b>OVERSPEED</b> or <b>UNDERSPEED</b> alarms occur. This is also the period between the genset voltage goes out of the limits and <b>HIGH VOLTAGE</b> or <b>LOW VOLTAGE</b> alarms occur.
(1) Mains Voltage Low Limit	V	170	If one of the mains phases goes under this limit, it means that the mains are off and it starts the transfer to the genset in <b>AUTO</b> mode.
(1) Mains Voltage High Limit	V	270	If one of the mains phases goes over this limit, it means that the mains are off and it starts the transfer to the genset in <b>AUTO</b> mode.
(2) Mains Frequency Low Limit	Hz	45	If the mains frequency goes under this limit, it means that the mains are off and it starts the transfer to the genset in <b>AUTO</b> mode.
(2) Mains Frequency High Limit	Hz	55	If the mains frequency goes above this limit, it means that the mains are off and it starts the transfer to the genset in <b>AUTO</b> mode.
(2) Genset Low Voltage Shutdown Limit	V	180	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a <b>GENSET LOW VOLTAGE</b> shutdown alarm and the engine will stop.
(2) Genset Low Voltage Warning Limit	V	190	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a <b>GENSET LOW VOLTAGE</b> warning.
(2) Genset High Voltage Warning Limit	V	260	If one of the generator phase voltages goes above this limit when feeding the load, this will generate a <b>GENSET HIGH VOLTAGE</b> warning.
(2) Genset High Voltage Shutdown Limit	V	270	If one of the generator phase voltages goes over this limit when feeding the load, this will generate a <b>GENSET HIGH VOLTAGE</b> alarm and the engine will stop.

**Program Group: Electrical Parameters (continued)**

Parameter Definition, (Password Level)	Unit	Factor y Set	Description
(2) Low Battery Voltage Warning	V	9.0	If the battery voltage falls below this limit, this will generate a <b>LOW BATTERY</b> warning.
(2) High Battery Voltage Warning	V	31.0	If the battery voltage goes over this limit, this will generate a <b>HIGH BATTERY</b> warning.
(2) High Battery Voltage Shutdown	V	33.0	If the battery voltage goes over this limit, this will generate a <b>HIGH BATTERY</b> shutdown alarm and the engine will stop.
(1) Mains Waiting Timer	min	0.5	This is the time between the mains voltages entered within the limits and the generator contactor is deactivated.
(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.
(2) Mains Contactor Timer	sec	1	This is the period after the generator contactor has been deactivated and before the mains contactor has been activated.
(2) Mains Phase Order Enable	-	0	<b>0:</b> mains phase order checking disabled <b>1:</b> if mains phase order is faulty, then a warning is given and mains contactor deenergized.
(2) Reverse power warning limit	kW	0	If the genset power is negative and goes above this limit then a <b>REVERSE POWER</b> warning will be generated.
(2) Reverse power loaddump limit	kW	0	If the genset power is negative and goes above this limit then a <b>REVERSE POWER</b> loaddump will be generated.
(2) Load Shedding Low Limit	kW	0	If the genset power goes below this limit then the load shedding relay will be deactivated.
(2) Load Shedding High Limit	kW	0	If the genset power goes above this limit then the load shedding relay will be activated.
(2) Genset Phase Order Loaddump	-	0	<b>0:</b> genset phase order checking disabled <b>1:</b> if genset phase order is faulty, then a loaddump is generated and the genset stops after cooldown.

### Program Group: Electrical Parameters (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) 2 <sup>nd</sup> Overcurrent Limit	A	0	<b>When secondary volt/freq limits are active:</b> If the current goes above this limit, during the period defined in <b>Overload Timeout</b> then a <b>Overcurrent Load Dump</b> alarm will be generated. If this parameter is 0 then Overcurrent check is disabled.
(1) 2 <sup>nd</sup> Mains Voltage Low Limit	V	84	<b>When secondary volt/freq limits are active:</b> If one of the mains phases goes under this limit, it means that the mains are off and it starts the transfer to the genset in <b>AUTO</b> mode.
(1) 2 <sup>nd</sup> Mains Voltage High Limit	V	136	<b>When secondary volt/freq limits are active:</b> If one of the mains phases goes over this limit, it means that the mains are off and it starts the transfer to the genset in <b>AUTO</b> mode.
(2) 2 <sup>nd</sup> Mains Frequency Low Limit	Hz	55	<b>When secondary volt/freq limits are active:</b> If the mains frequency goes under this limit, it means that the mains are off and it starts the transfer to the genset in <b>AUTO</b> mode.
(2) 2 <sup>nd</sup> Mains Frequency High Limit	Hz	65	<b>When secondary volt/freq limits are active:</b> If the mains frequency goes above this limit, it means that the mains are off and it starts the transfer to the genset in <b>AUTO</b> mode.
(2) 2 <sup>nd</sup> Genset Low Voltage Shutdown Limit	V	90	<b>When secondary volt/freq limits are active:</b> If one of the generator phase voltages goes under this limit when feeding the load, this will generate a <b>GENSET LOW VOLTAGE</b> shutdown alarm and the engine will stop.
(2) 2 <sup>nd</sup> Genset Low Voltage Warning Limit	V	94	<b>When secondary volt/freq limits are active:</b> If one of the generator phase voltages goes under this limit when feeding the load, this will generate a <b>GENSET LOW VOLTAGE</b> warning.
(2) 2 <sup>nd</sup> Genset High Voltage Warning Limit	V	130	<b>When secondary volt/freq limits are active:</b> If one of the generator phase voltages goes above this limit when feeding the load, this will generate a <b>GENSET HIGH VOLTAGE</b> warning.
(2) 2 <sup>nd</sup> Genset High Voltage Shutdown Limit	V	136	<b>When secondary volt/freq limits are active:</b> If one of the generator phase voltages goes over this limit when feeding the load, this will generate a <b>GENSET HIGH VOLTAGE</b> alarm and the engine will stop.
(1) Voltage Unbalance Warning Limit	%	0	If any of the phase voltages goes over (under) this limit compared to the average voltage, then a <b>Voltage Unbalance Warning</b> will be generated. If this limit is set to <b>0</b> , then the voltage unbalance condition is not monitored.
(1) Current Unbalance Warning Limit	%	0	If any of the phase currents goes over (under) this limit compared to the average current, then a <b>Current Unbalance Warning</b> will be generated. If this limit is set to <b>0</b> , then the current unbalance condition is not monitored.

### Program Group: Engine Parameters

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) Low Frequency Shutdown	Hz	30	If the genset frequency goes under this limit, a <b>GENSET LOW SPEED</b> alarm is generated and the engine stops.
(1) Low Frequency Warning	Hz	35	If the genset frequency goes under this limit, a <b>GENSET LOW SPEED</b> warning is generated.
(1) High Frequency Warning	Hz	54	If the genset frequency goes over this limit, a <b>GENSET HIGH SPEED</b> warning is generated.
(2) High Frequency Shutdown	Hz	55	If the genset frequency goes over this limit, a <b>GENSET HIGH SPEED</b> alarm is generated and the engine stops.
(1) Low Oil Pressure Warning	bar	1.5	If the oil pressure measured from the analog input falls below this limit, this will generate a <b>LOW OIL PRESSURE SENDER</b> 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 <b>LOW OIL PRESSURE SENDER</b> 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 <b>HIGH TEMPERATURE SENDER</b> warning.
(2) High Temperature Shutdown	°C	98	If the coolant temperature measured from the analog input goes over this limit, this will generate a <b>HIGH TEMPERATURE SENDER</b> alarm and the engine will stop.
(2) Oil Pressure Sender type	-	1	This parameter selects the oil pressure sender type. <b>0:</b> Non standard sender. The sender characteristics are defined in <b>Sender Characteristics</b> table. <b>1:</b> VDO 0-7 bars (10-180 ohms) <b>2:</b> VDO 0-10 bars (10-180 ohms) <b>3:</b> DATCON 0-7 bars (240-33 ohms) <b>4:</b> DATCON 0-10 bars (240-33 ohms) <b>5:</b> DATCON 0-7 bars (0-90 ohms) <b>6:</b> DATCON 0-10 bars (0-90 ohms) <b>7:</b> DATCON 0-7 bars (75-10 ohms)
(2) Coolant Temp. Sender Type	-	1	This parameter selects the temperature sender type: <b>0:</b> The sender characteristics are defined in <b>Sender Characteristics</b> table. <b>1:</b> VDO <b>2:</b> DATCON DAH type <b>3:</b> 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 <b>Engine Low Temperature</b> warning will occur.
(2) Engine Start Delay	sec	0	This is the time between the mains fails and the fuel solenoid turns on before starting the genset. It prevents unwanted genset operation in battery backed-up loads.
(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 <b>PREHEAT</b> relay output is energized (if assigned by <b>Relay Definitions</b> )

**Program Group: Engine Parameters (continued)**

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(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 is transferred to mains.
(1) Stop Solenoid Timer	sec	5	This is the maximum time duration for the engine to stop. During this period the STOP relay output is energized (if assigned by <b>Relay Definitions</b> ). If the genset has not stopped after this period, a <b>FAIL TO STOP</b> 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. <b>0:</b> engine is heated during <b>Engine Heating Timer</b> . <b>1:</b> engine is heated until the coolant temperature reaches the <b>Engine Heating Temperature</b> and at least during the <b>Engine Heating Timer</b> .
(1) Service Engine Hours	hour	50	The <b>SERVICE REQUEST</b> led indicator will turn on after this quantity of engine hours from the last service. If the period is set to '0' no <b>SERVICE REQUEST</b> will be generated depending on engine hours.
(1) Service Period	month	6	The <b>SERVICE REQUEST</b> led indicator will turn on after this amount of time from the last service. If the period is set to '0' no <b>SERVICE REQUEST</b> 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 <b>LOW FUEL LEVEL SENDER</b> warning is generated.
(2) Low Fuel Shutdown	%	10	the fuel level measured from the analog input falls below this limit, a <b>LOW FUEL LEVEL SENDER</b> 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.

**Program Group: Engine Parameters (continued)**

Parameter Definition, (Password Level)	Unit	Factory Set	Description
<b>(3)</b> Crank Cut Frequency	Hz	10.0	When the genset frequency reaches this limit, the engine is supposed running and the crank output will release.
<b>(2)</b> Crank Stop with Oil Pressure	-	0	<b>0:</b> no crank stop with oil pressure <b>1:</b> cranking is stopped when oil pressure switch is open or the oil pressure measured is above shutdown limit.
<b>(2)</b> Crank Stop with Charge	-	0	<b>0:</b> no crank stop with charge input <b>1:</b> cranking is stopped when the charge alternator voltage is established.
<b>(3)</b> Low rpm Shutdown	rpm	0	If the engine speed goes under this limit, a GENSET LOW SPEED alarm is generated and the engine stops.
<b>(3)</b> Low rpm Warning	rpm	0	If the engine speed goes under this limit, a GENSET LOW SPEED warning is generated.
<b>(3)</b> High rpm Warning	rpm	0	If the engine speed goes over this limit, a GENSET HIGH SPEED warning is generated.
<b>(3)</b> High rpm Shutdown	rpm	0	If the engine speed goes over this limit, a GENSET HIGH SPEED alarm is generated and the engine stops.
<b>(2)</b> Fan turn-on temp	°C	90	If the coolant temp is above this limit then the fan relay function will become active.
<b>(2)</b> Fan turn-off temp	°C	80	If the coolant temp is below this limit then the fan relay function will become inactive.

**Program Group: Engine Parameters (continued)**

<b>Parameter Definition, (Password Level)</b>	<b>Unit</b>	<b>Factory Set</b>	<b>Description</b>
<b>(2)</b> 2nd Low Frequency Shutdown	Hz	40	When secondary volt/freq limits are active: If the genset frequency goes under this limit, a <b>GENSET LOW SPEED</b> alarm is generated and the engine stops.
<b>(1)</b> 2nd Low Frequency Warning	Hz	45	When secondary volt/freq limits are active: If the genset frequency goes under this limit, a <b>GENSET LOW SPEED</b> warning is generated.
<b>(1)</b> 2nd High Frequency Warning	Hz	65	When secondary volt/freq limits are active: If the genset frequency goes over this limit, a <b>GENSET HIGH SPEED</b> warning is generated.
<b>(2)</b> 2nd High Frequency Shutdown	Hz	69	When secondary volt/freq limits are active: If the genset frequency goes over this limit, a <b>GENSET HIGH SPEED</b> alarm is generated and the engine stops.
<b>(2)</b> 2 <sup>nd</sup> Low rpm Shutdown	rpm	0	<b>When secondary volt/freq limits are active:</b> If the engine speed goes under this limit, a <b>GENSET LOW SPEED</b> alarm is generated and the engine stops.
<b>(1)</b> 2 <sup>nd</sup> Low rpm Warning	rpm	0	<b>When secondary volt/freq limits are active:</b> If the engine speed goes under this limit, a <b>GENSET LOW SPEED</b> warning is generated.
<b>(1)</b> 2 <sup>nd</sup> High rpm Warning	rpm	0	<b>When secondary volt/freq limits are active:</b> If the engine speed goes over this limit, a <b>GENSET HIGH SPEED</b> warning is generated.
<b>(2)</b> 2 <sup>nd</sup> High rpm Shutdown	rpm	0	<b>When secondary volt/freq limits are active:</b> If the engine speed goes over this limit, a <b>GENSET HIGH SPEED</b> alarm is generated and the engine stops.



**Program Group: Sender Characteristics (password level-2)**

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

**Program Group: Sender Characteristics (password level-2)**

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

**Program Group: Sender Characteristics (password level-2)**

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

### Program Group: 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)

### Program Group: 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)

### Program Group: 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		0	0: Always 1: After holdoff timer 2: When mains present
Latching		0	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)

### Program Group: Input Configuration (Fuel Level Input) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		2	0: Shutdown (the engine stops immediately) 1: Load Dump (the engine stops after cooldown) 2: Warning (the horn relay operates) 3: No operation
Sampling		2	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)

### Program Group: Input Configuration (Spare-1 Input) (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Action		2	0: Shutdown (the engine stops immediately) 1: Load Dump (the engine stops after cooldown) 2: Warning (the horn relay operates) 3: No operation
Sampling		0	0: Always 1: After holdoff timer 2: When mains present
Latching		0	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)

The parameters below define the functions of relay outputs. The unit has 5 relay outputs. The fixed function relays are Fuel, Start, Mains Contactor and Generator Contactor. ALARM RELAY has programmable functions, selected from a list.

### Program Group: Relay Definitions (password level-2)

Parameter Definition	Unit	Fac.Set	Description
Relay 01 Definition		3	RELAY-1 function selected from list

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

00	Fuel	40	Oil switch alarm	88	Oil switch warning
01	Alarm	41	Temp switch alarm	89	Temp switch warn.
02	Start	42	-	90	-
03	Stop	43	-	91	-
04	Gen. Contactor	44	Emerg.Stop alarm	92	Emerg Stop warn.
05	Mains Contactor	45	Spare-1 Alarm	93	Spare-1 warning
06	Choke	46	-	94	-
07	Preheat	47	Fuel Level switch alarm	95	Fuel Level switch warning
08	Shutdown alarm	48	Oil sender alarm	96	Oil sender warning
09	Shutdown or load_dump alarm	49	Temp sender alarm	97	Temp sender warn.
10	Shutdown or load_dump or warning	50	Low speed alarm	98	Low speed warning
11	Automatic ready	51	High speed alarm	99	High speed warning
12	-	52	Low voltage alarm	100	-
13	-	53	High voltagealarm	101	Low temp warning
14	Load_dump alarm	54	Fail to start alarm	102	Fail to stop warning
15	Fuel Main winding	55	Low fuel sender alarm	103	Low fuel sender warning
16	Mains Fail	56	-	104	Service request warning
17	Block Heater	57	-	105	Mains Phase Order Fail
18	Service Request	58	-	106	Low battery warning
19	-	59	High battery voltage alarm	107	High battery warning
20	Load Shedding Relay	60	Charge fail alarm	108	Charge fail warning
21	Flashing Relay	61	-	109	-
22	Gas Solenoid	62	-	110	-
23	Fuel Pump	63	-	111	-
24	Mains Phase Order Fail	64	Oil switch load_dump	112	Gen Low voltge warn.
25	Genset Phase Order Fail	65	Temp switch load_dump	113	Gen High voltge warn.
26	Idle Speed	66	-	114	Reverse Power warn.
27	Cooler Fan	67	-	115	High oil temp warn.
28	2 <sup>nd</sup> volt-frequency	68	Emerg.Stop load_dump	116	-
29	Crank 1/2 Selector	69	Spare-1 load_dump	117	-
30	Engine Running	70	-	118	-
31	Genset cooling down	71	Fuel Level switch load_dump	119	-
32	GenCB Open Pulse	72	Oil sender fail ldd	120	Oil sender fail warn
33	GenCB Close Pulse	73	Temp sender fail ldd	121	Temp sender fail warn
34	GenCB UV Coil	74	Fuel Lev sender fail ldd	122	Fuel sender fail warn
35	MainsCB Open Pulse	75	-	123	-
36	MainsCB Close Pulse	76	-	124	-
37	MainsCB UV Coil	77	-	125	-
38	-	78	-	126	-
39	-	79	-	127	-
		80	Overcurrent load_dump		
		81	Excess power ldd		
		82	Reverse power ldd		
		83	-		
		84	-		
		85	-		
		86	-		
		87	Genset Phase Order Fail Loadump		

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-.

### Program Group: Input Function Select (password level-2)

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	4	Emergency Stop
Input 04 Function Select	7	Low Fuel Switch
Input 05 Function Select	11	Spare-1 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	Belt Rupture
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	2nd Volt-Freq Select
17	Priority Input
18	Remote Start Input
19	Disable Auto Start
20	Force to Start
21	Fault Reset Input
22	Alarm Mute
23	Panel Lock

**Program Group: Site Id (password level-2)**

Parameter Definition	Factory Set	Description
Site Id String	GENERATOR 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.

**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. <b>If Modem Enabled:</b> This is the first telephone number used for modem calls. <b>If Modem Disabled:</b> 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. <b>If Modem Enabled:</b> This is the second telephone number used for modem calls. <b>If Modem Disabled:</b> 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.

## 14. TROUBLESHOOTING

### The genset operates while AC mains are OK or continues to operate after AC mains are OK:

- Check engine body grounding.
- AC mains voltages may be outside programmed limits, measure the phase voltages.
- Check the AC voltage readings by pressing the MENU button.
- Upper and lower limits of the mains voltages may be too tight. Check the parameters **Mains Voltage Low Limit** and **Mains Voltage High Limit**. Standard values are 170/270 volts.
- The hysteresis voltage may be given to excessive. The standard value is 8 volts.

### AC voltages or frequency displayed on the unit are not correct:

- Check engine body grounding, it is necessary.
- The error margin of the unit is +/- 3 volts.
- If there are faulty measurements only when the engine is running, there may be a faulty charging alternator or voltage regulator on the engine. Disconnect the charging alternator connection of the engine and check if the error is removed.
- If there are faulty measurements only when mains are present, then the battery charger may be failed. Turn off the rectifier fuse and check again.

### KW and cos $\Phi$ readings are faulty although the Amp readings are correct:

- Current transformers are not connected to the correct inputs or some of the CTs are connected with reverse polarity. Determine the correct connections of each individual CT in order to obtain correct KW and cos $\Phi$  for the related phase, and then connect all CTs.



**Short circuit the outputs of unused Current Transformers.**

### When the AC mains fails 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.



**When the AC mains fails, the engine starts to run but the unit gives START FAIL alarm and then the engine stops:**

-The generator phase voltages are not connected to the unit. Measure the AC voltage between terminals **GEN L1-L2-L3** and **Generator Neutral** at the rear of the unit while the engine is running. A fuse protecting the generator phases may be failed. A misconnection may be occurred. If everything is OK, turn all the fuses off, and then turn all the fuses on, starting from the DC supply fuse. Then test the unit again.

**The unit is late to remove engine cranking:**

-The generator voltage rises lately. Also the generator remnant voltage is below 20 volts. The unit removes starting with the generator frequency, and needs at least 20 volts to measure the frequency. If this situation is to be avoided, the only solution is to add an auxiliary relay. The coil of the relay will be between BATTERY (-) and charging alternator D+ terminal. The normally closed contact of the relay will be connected serially to the unit's START output. So the starting will also be removed when the D+ pulls to battery positive.

**The unit is inoperative:**

Measure the DC-supply voltage between terminals 19 and 22 at the rear of the unit. If OK, turn all the fuses off, then turn all the fuses on, starting from the DC supply fuse. Then test the unit again.

**Some program parameters are skipped:**

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

## 15. 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.

## 16. TECHNICAL SPECIFICATIONS

**Alternator voltage:** 0 to 300 V-AC Phase to Neutral (0 to 520 V-AC Phase to Phase)

**Alternator frequency:** 0-100 Hz.

**Mains voltage:** 0 to 300 V-AC Phase to Neutral (0 to 520 V-AC Phase to Phase)

**Mains frequency:** 0-100 Hz.

**V-A-cos Accuracy:** 1.0% + 1 digit

**kW-kVA-kVAr Accuracy:** 2.0% + 1 digit

**DC Supply range:** 9.0 VDC to 16.0 VDC

**Cranking dropouts:** survives 0 V for 100ms

**Typical stand-by current consumption:** 100 mADC.

**Maximum current consumption:** 200 mADC.

**Generator/mains contactor outputs:** 16 A @ 250 VAC.

**DC outputs:** 1A @ 28 VDC. protected semiconductor outputs

**Charge alternator excitation:** min 2W.

**Current inputs:** from current transformers, .../5A. Max load 0.7VA per phase.

**Digital inputs:** input voltage 0 - 30 VDC. Internally connected to battery positive via 47'000 ohm resistor.

**Analog inputs:** Resistor input 0 to 5000 ohms connected to the battery negative. Sources 5 mA when closed to battery negative.

**Measurement category:** CAT II

**Air category:** Pollution degree II

**Communication port:** Logic level. 9600 bauds, no parity, 1 stop bit.

**Operating temperature range:** -20°C to +70°C (-4 °F to +158 °F)

**Storage temperature range:** -40°C to +80°C (-40 °F to +176 °F)

**Maximum humidity:** 95%, non-condensing

**Dimensions:** 133x107x39mm (WxHxD)

**Panel Cut-out dimensions:** 117 x 87mm minimum.

**Weight:** 200 g (approx.)

**Case material:** High temperature, self extinguishing ABS/PC (UL94-V0)

**IP protection:** IP65 from front panel, IP30 from the rear

**17. CONNECTION DIAGRAMS**

