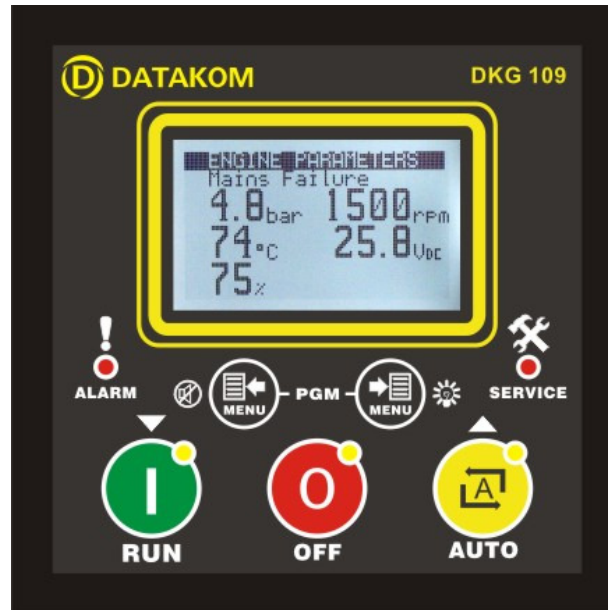




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## DKG-109 AUTOMATIC MAINS FAILURE UNIT



## FEATURES

**Automatic mains failure**  
**Engine control**  
**Generator protection**  
**Built in alarms and warning**  
**Dual genset mutual standby operation**  
**Load shedding, dummy load**  
**Gas engine support**  
**Engine idle speed control**  
**3 phase mains voltage inputs**  
**1 phase genset voltage inputs**  
**1 phase genset CT inputs**  
**Engine oil pressure measurement**  
**Engine coolant temperature measurement**  
**Fuel level measurement**  
**Genset active power measurement**  
**Genset power factor measurement**  
**Engine rpm display**  
**Remote Start operation available**  
**Mains simulation input**  
**Engine Idle speed control**  
**Periodic maintenance request**  
**Engine hours counter**  
**Event logging with complete measurement values**  
**Stores last 100 events**

**Statistical counters**  
**3 level password protection**  
**Programmable parameters**  
**All parameters field adjustable**  
**Return to factory settings enabled**  
**Logic level serial port**  
**Firmware downloadable from serial port**  
**Free MS-Windows Remote monitoring SW:**  
   - monitoring and control  
   - download of parameters  
**GSM-SMS sending in case of alarm**  
**Modem call in case of alarm**  
**MODBUS communication**  
**128x64 graphic LCD display**  
**Triple language support**  
**Customer logo display capability**  
**Configurable analogue inputs: 3**  
**Configurable digital inputs: 5**  
**Configurable digital outputs: 2**  
**Total digital outputs: 6**  
**Survives cranking dropouts**  
**Sealed front panel**  
**Plug-in connection system for easy replacement**  
**Dimensions (96x96x53mm)**

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**TABLE OF CONTENTS****Section**

- 1. INSTALLATION**
  - 1.1. Introduction to the Control Panel
  - 1.2. Mounting the Unit
  - 1.3. Wiring the Unit
- 2. INPUTS AND OUTPUTS**
- 3. DISPLAYS**
  - 3.1. Led Displays
  - 3.2. Language Selection
  - 3.3. Digital Display
- 4. ALARMS AND WARNINGS**
- 5. MODES OF OPERATION**
- 6. OTHER FEATURES**
  - 6.1. Remote start operation
  - 6.2. Sender type selection
  - 6.3. Engine heating operation
  - 6.4. Engine Idle Speed Operation
  - 6.5. Engine Block Heater
  - 6.6. Fuel Pump Control
  - 6.7. Mains Simulation (Disable Start)
  - 6.8. Delayed Mains Simulation, Battery Charging
  - 6.9. Dual Genset Mutual Standby Operation
  - 6.10. Periodic Service Request Monitoring
  - 6.11. Engine Hours Meter
  - 6.12. Display of Software Version
  - 6.13. SMS message sending
  - 6.14. Remote Monitoring and Programming
  - 6.15. External Control of the Unit
  - 6.16. Resuming to factory set parameters
  - 6.17. Gas engine fuel solenoid control
  - 6.18. Load Shedding / Dummy Load
  - 6.19. Fuel Theft / Fuelling Messages
  - 6.20. Firmware Update
- 7. MODBUS COMMUNICATION**
- 8. EVENT LOGGING**
- 9. STATISTICAL COUNTERS**
- 10. MAINTENANCE**
- 11. PROGRAMMING**
- 12. TROUBLESHOOTING**
- 13. DECLARATION OF CONFORMITY**
- 14. TECHNICAL SPECIFICATIONS**
- 15. CONNECTION DIAGRAM**

## 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
- Mains voltage phase L2 to neutral
- Mains voltage phase L3 to neutral
- Mains voltage phase L1-L2
- Mains voltage phase L2-L3
- Mains voltage phase L3-L1
- Gen voltage phase L1 to neutral
- Gen current phase L1
- Gen frequency
- Engine speed (rpm)
- Gen phase L1 KW
- Gen phase L1  $\cos\Phi$
- Battery voltage,
- Coolant temperature
- Oil pressure
- Fuel level
- Gen frequency
- Mains frequency

## 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. The unit fits into a standard panel meter opening of 92x92 millimeters. 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, 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.**

- 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>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.
2	<b>MAINS-L1</b>	Mains phase inputs, 0-300V-AC	Connect the mains phases to these inputs. The mains voltages upper and lower limits are programmable.
3	<b>MAINS-L2</b>		
4	<b>MAINS-L3</b>		
5	<b>MAINS NEUTRAL</b>	Input, 0-300V-AC	Neutral terminal for the mains phases.
6	<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.
7	<b>HIGH TEMP</b>		
8	<b>EMERGENCY STOP</b>		
9	<b>SPARE-2</b>		
10	<b>SPARE-1</b>		
11	<b>GENERATOR NEUTRAL</b>	Input, 0-300V-AC	Neutral terminal for the generator phase.
12	<b>GEN-L1</b>	Generator phase inputs, 0-300V-AC	Connect the generator phase to this input. The generator phase voltage upper and lower limits are programmable.
13	<b>GENERATOR CONTACTOR</b>	Relay output, 16A-AC	This output provides energy to the generator contactor. If the generator phase do not have acceptable voltage or frequency, 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.

Term	Function	Technical data	Description
14	<b>BATTERY POSITIVE</b>	+12 or 24VDC	The positive terminal of the DC Supply shall be connected to this terminal. The unit operates on both 12V and 24V battery systems.
15	<b>MAGNETIC PICKUP</b>	Inputs, 1-30V 0-10KHz	Connect the magnetic pickup signal to these inputs.
16	<b>MAGNETIC PICKUP</b>		
17	<b>GROUND</b>	0 VDC	Power supply negative connection.
18	<b>CURR_1+</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 common terminals. Do not use grounding. Correct polarity of connection is vital. If the measured power is negative, then change the polarity of the current transformer. The secondary winding rating shall be 5 Amperes. (For ex. 200/5 Amps).
19	<b>CURR_1-</b>		
20	<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 resistor value and connects to various senders.
21	<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.
22	<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.
23	<b>CHARGE</b>	Input and output	Connect the charge alternator's D+ terminal to this terminal. This terminal will supply the excitation current and measure the voltage of the charge alternator.
24	<b>FUEL RELAY</b>	Output 1A/28VDC	This relay is used for fuel solenoid control.
25	<b>START RELAY</b>	Output 1A/28VDC	This relay controls the engine cranking.
26	<b>RELAY-1 (STOP RELAY)</b>	Output 1A/28VDC	This relay has programmable function, selectable from a list.
27	<b>RELAY-2 (HORN RELAY)</b>	Output 1A/28VDC	This relay has programmable function, selectable from a list.

## 3. DISPLAYS

### 3.1 Led Displays

The unit has 5 LEDs, divided in 2 groups:

**-Group\_1:** Operating mode: This group indicates the genset function.

**-Group\_2:** Warnings and alarms: This group indicates the existence of abnormal conditions encountered during operation.

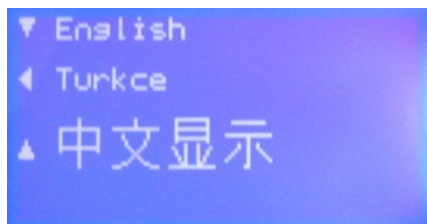
Function	Color	Description
<b>RUN</b>	Yellow	It turns on when the related operation mode is selected. One of these LEDs is always on and indicates which operation mode is selected. If the operation of the genset is disabled by the <b>weekly operation schedule</b> , then the <b>AUTO</b> led will flash.
<b>OFF</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 warning 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>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 languages. Language selection is made through program parameter CONTROLLER CONFIGURATION > LANGUAGE SELECTION. Below selections are available:

- 0: English language
- 1: Turkish language (spanish language on some models)
- 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 language 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,
- Statistical counters,
- 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, load dump or warning** occurs during operation, in other than programming mode, the display will automatically switch to **ALARM LIST** position.

If there is more than one alarm, the next alarm is displayed by pressing the ◀**MENU** or **MENU**▶ buttons. Thus all existing alarms can be scanned. 'END OF ALARM LIST' will be displayed when there is no more alarm to display.

As long as alarms are not muted, only the ALARM LIST is displayed. In order to mute alarms and enable display navigation, long-press ◀**MENU(ALARM MUTE)** button first.



Screen	Description	Contents
1	Mains parameters (phase to neutral)	Genset status Mains Volts L1, Mains Frequency Mains Volts L2, Battery Voltage Mains Volts L3, Coolant Temperature
2	Mains parameters (phase to phase)	Genset status Mains Volts L1-L2, Mains Frequency Mains Volts L2-L3, Battery Voltage Mains Volts L3-L1, Coolant Temperature
3	Genset parameters	Genset status Engine rpm, Genset Frequency Genset Current L1, Genset Volts L1 Genset power factor, Genset Active Power (KW)
4	Engine parameters	Genset status Oil Pressure, Engine rpm Coolant Temperature, Battery Voltage Fuel Level,
5	Complete Genset parameters	Genset status Engine rpm, Genset Frequency, Genset Volts L1, Oil Pressure Genset Current L1, Coolant Temperature Genset Active Power (KW), Fuel Level Genset power factor, Battery Voltage
6	Graphical Genset parameters	Genset status  Genset Active Power (%), Genset Volts L1 Genset Current L1 Genset Frequency Oil Pressure Coolant Temperature Fuel Level
7	Company Logo	
8	Alarm List	If no alarm exists, 'END OF ALARM LIST' will be displayed. Existing alarms, load_dumps, warnings will be displayed as one screen for each entry. Switching to the next entry will be made with the ▼ button.
9	Software Version	Operating software version.
10	Statistical Counters 1 / 3	Engine Hours Run Total Genset Active Power (KW-h)
11	Statistical Counters 2 / 3	Engine Hours to Service Time to Service
12	Statistical Counters 3 / 3	Total Engine Cranks Total Engine Runs
13	Event Records	The unit provides information about last <b>100</b> events, starting from the most recent one. Please review chapter 10 for detailed information about event logging.

## 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 long 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 ( **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 the the fuel level measured from the sender is below the programmed limit. Warning and alarm limits are separately programmable for the fuel level sender input.

**EMERGENCY STOP:** Set if a signal is detected at the emergency stop input.

**SPARE-1 / SPARE-2:** Set if a signal is detected from the related spare fault input.

**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 the genset phase current goes over the **Overcurrent Limit** for **Overload Timer**. If the current goes below the limit before expiration of the timer then no alarm will be set.

**EXCESS POWER (load dump):** Set if the genset phase 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 AUTO mode is selected when genset is running at RUN mode, if mains phase voltages are present then the genset will stop.

**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 **STOP** mode.

## 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.

## 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 Ohms** is also programmable.

## 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 and cooldown. 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 Periodic Service Request Monitoring

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 function 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 function will be inoperative.

When the engine hours **OR** the time limit is over, the **SERVICE REQUEST** warning will occur and the display will switch to the **ALARM LIST**.

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 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.

## 6.12 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.

The software version number represents the operating software version of the unit.

## 6.13 SMS Message Sending

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



If **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.

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)

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.



**A logic level to RS-232 converter is necessary in order to connect the unit to modem.**

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

## 6.14 Remote Monitoring and Programming

Thanks to its logic level serial port, the unit offers the remote monitoring and programming feature.



**A logic level to RS-232 converter is necessary in order to connect the unit to the PC.**

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.

## 6.15 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 OFF mode
- Force AUTO mode
- Force TEST mode
- Force LOAD 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.

## 6.16. 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.**

## 6.17. 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.

## 6.18. 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.

## 6.19. 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.

## 6.20. Firmware Update

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



**A logic level to RS-232 converter is necessary in order to connect the unit to the PC.**

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.

## 7. MODBUS COMMUNICATION

The unit offers the possibility of MODBUS communication via its logic level serial port.



**A logic level to RS-232 converter is necessary in order to connect the unit to the PC.**

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
0006	R	16bit	x1	Genset Phase L1 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
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_4: auto mode bit_5: stop mode bit_6: run mode

## 8. 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.

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.

In the event display mode, each depression of the **◀MENU** button switches the display to the next page of the current event. After the last page of the current event, the first page of the previous event is displayed.

Each depression of the **MENU▶** button switches the display to the previous page of the current event. After the first page of the current event, the last page of the next event is displayed.



**To exit event record pages please hold pressed **◀MENU** or **MENU▶** buttons.**

Each event is displayed in **3** 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**.

### Event sources are:

- Shutdown alarms, Load dump alarms, Warnings
- Operating mode change (STOP, AUTO, RUN)
- Periodic records.

### Event record contents are:

- Event type (alarms, mode change, periodic, etc...)
- Genset operating mode (STOP, AUTO, RUN)
- Genset operation status (mains ok, running, cooldown etc...)
- Genset phase voltage L1
- Genset phase current L1
- 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



## 9. 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.

## 10. MAINTENANCE



**DO NOT OPEN THE UNIT**

**There are NO serviceable parts inside the unit.**

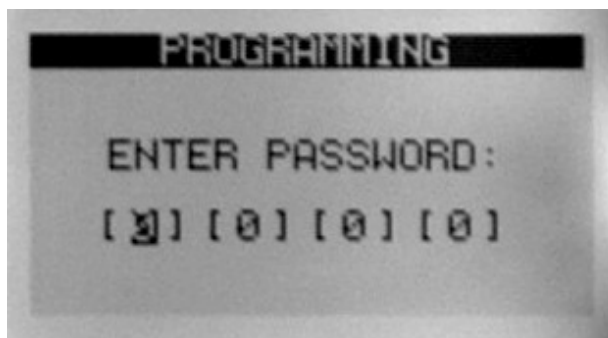
Wipe the unit, if necessary with a soft damp cloth. Do not use chemical agents

## 11. 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'.**  
**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	-	22	This parameter is used to set LCD contrast. Adjust for the best viewing angle.
(2) Language	-	0	<p><b>0:</b> English language selected.</p> <p><b>1:</b> Turkish language selected. This language may depend on the country where the unit is intended to be used.</p> <p><b>2:</b> Chinese language selected</p> <p><b>3:</b> The unit will ask for manual language selection at power-on.</p>
(2) Line-to-Line Voltages	-	0	<p><b>0:</b> Display Line to Neutral voltages as default</p> <p><b>1:</b> 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><b>0:</b> screen 3 electrical, large characters</p> <p><b>1:</b> screen 4 engine parameters, large characters</p> <p><b>2:</b> screen 5 maximum information, small characters</p> <p><b>3:</b> screen 6 analog power-meter</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><b>0:</b> continuous</p> <p><b>1:</b> intermittent (turns on and off every second)</p>
(2) Charge Alternator Shutdown	-	0	<p><b>0:</b> The charge input generates <b>CHARGE FAIL</b> warning, and does not stop the engine.</p> <p><b>1:</b> The charge input generates <b>CHARGE FAIL</b> alarm, and stops the engine.</p>
(1) Emergency Backup Operation	-	0	<p><b>0:</b> In RUN mode, the load will not be transferred to the genset even if the mains fail.</p> <p><b>1:</b> In RUN mode, the load will be transferred to the genset if the mains fail.</p>
(2) Delayed Simulate Mains	-	0	<p><b>0:</b> The <b>SPARE-2</b> input has normal function</p> <p><b>1:</b> The <b>SPARE-2</b> input has delayed simulate mains function. See chapter 6.8 for more info.</p>

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

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) SMS Enable	-	0	<b>0:</b> SMS not enabled <b>1:</b> SMS enabled
(2) MODBUS Address	-	0	<b>0:</b> RAINBOW communication protocol. <b>1-144:</b> MODBUS communication. This parameter is also the MODBUS controller address of the unit.
(1) Oil Pressure in psi	-	0	<b>0:</b> oil pressure display in bars <b>1:</b> oil pressure display in psi
(1) Temperature in °F	-	0	<b>0:</b> temperature display in degrees C <b>1:</b> temperature display in degrees F
(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 stanby 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) RPM from genset frequency	-	1	This parameter is used in the conversion of the genset frequency to engine rpm. <b>0:</b> read rpm from the optional MPU input <b>1:</b> convert frequency to rpm (using crank teeth count)
(2) Crank Teeth Count	-	30	This is the number of pulses generated by the magnetic pickup sensing unit in one turn of the flywheel. This parameter is also used in the conversion of the genset frequency to engine rpm. The frequency in Hz is multiplied with this parameter during conversion to rpm.
(2) SMS on 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.

### Program Group: Electrical Parameters

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) Current Transformer Ratio	A	500	This is the rated value of the current transformer. The secondary of the transformer will be 5 Amps.
(2) Overcurrent Limit	A	0	If the current goes above this limit, during <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 Overload Timeout 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) Genset Voltage Low Limit	V	170	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a <b>GENSET LOW VOLTAGE</b> alarm and the engine will stop.
(2) Genset Voltage High 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

Parameter Definition, (Password Level)	Unit	Factory 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) 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.

### 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	1.4	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	10	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.
(2) Fuel Level sender Ohms	ohms	180	Fuel level sender max resistance. 180 ohms and 300 ohms senders are common.



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

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(3) Crank Cut Frequency	Hz	10.0	When the genset frequency reaches this limit, the engine is supposed running and the crank output will release.
(2) 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.
(2) 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.
(2) Low rpm Shutdown	rpm	0	If the engine speed goes under this limit, a <b>GENSET LOW SPEED</b> alarm is generated and the engine stops.
(2) Low rpm Warning	rpm	0	If the engine speed goes under this limit, a <b>GENSET LOW SPEED</b> warning is generated.
(2) High rpm Warning	rpm	0	If the engine speed goes over this limit, a <b>GENSET HIGH SPEED</b> warning is generated.
(2) High rpm Shutdown	rpm	0	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: Input Configuration (Low Oil Pressure Switch) (password level-2)

Parameter Definition	Unit	Factory 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	Factory 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 (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)

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

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

The parameters below define the functions of relay outputs. The unit has 6 relay outputs. The fixed function relays are Fuel, Start, Mains Contactor and Generator Contactor. RELAY-1 and RELAY-2 have 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
Relay 02 Definition		1	RELAY-2 function selected from list

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

00	Fuel	32	Oil switch alarm	80	Oil switch warning
01	Alarm	33	Temp switch alarm	81	Temp switch warn.
02	Start	34	-	82	-
03	Stop	35	-	83	-
04	Gen. Contactor	36	Emerg.Stop alarm	84	Emerg Stop warn.
05	Mains Contactor	37	Spare-1 Alarm	85	Spare-1 warning
06	Choke	38	Spare-2 Alarm	86	Spare-2 warning
07	Preheat	39	-	87	-
08	Shutdown alarm	40	Oil sender alarm	88	Oil sender warning
09	Shutdown or load_dump alarm	41	Temp sender alarm	89	Temp sender warn.
10	Shutdown or load_dump or warning	42	Low speed alarm	90	Low speed warning
11	Automatic ready	43	High speed alarm	91	High speed warning
12	-	44	Low voltage alarm	92	-
13	-	45	High voltagealarm	93	Low temp warning
14	Load_dump alarm	46	Fail to start alarm	94	Fail to stop warning
15	-	47	Low fuel sender alarm	95	Low fuel sender warning
16	Mains Fail	48	-	96	Service request warning
17	Block Heater	49	-	97	Mains Phase Order Fail
18	Service Request	50	-	98	Low battery warning
19	-	51	High battery voltage alarm	99	High battery warning
20	Load Shedding Relay	52	Charge fail alarm	100	Charge fail warning
21	Flashing Relay	53	-	101	-
22	Gas Solenoid	54	-	102	-
23	Fuel Pump	55	-	103	--
24	Mains Phase Order Fail	56	Oil switch load_dump		
25	-	57	Temp switch load_dump		
26	Idle Speed	58	-		
27	-	59	-		
28	-	60	Emerg.Stop load_dump		
29	-	61	Spare-1 load_dump		
30	-	62	Spare-2 load_dump		
31	-	63	-		
		64	-		
		65	-		
		66	-		
		67	-		
		68	-		
		69	-		
		70	-		
		71	-		
		72	Overcurrent load_dump		
		73	Excess power load_dump		
		74	-		
		75	-		
		76	-		
		77	-		
		78	-		
		79	-		

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	11	Spare-1 Input
Input 05 Function Select	10	Spare-2 Input

### Input Function Select List

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

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

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

**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 character (“,”) 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 character (“,”) 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.



## 12. 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:**

- The current transformer is connected with reverse polarity. Reverse the CT terminals.

### **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** 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.

## 13. 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.

## 14. 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.  
**DC Supply range:** 9.0 V<sub>DC</sub> to 30.0 V<sub>DC</sub>  
**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 current:** min 150 mADC @ 10 to 30 VDC.  
**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 4700 ohm resistor.  
**Analog inputs:** Resistor input 0 to 5000 ohms connected to the battery negative. Sources 10 mA when closed to battery negative.  
**Measurement category:** CAT III  
**Air category:** Pollution degree II  
**Communication port:** logic levels. 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:** 96x96x53mm (WxHxD)  
**Panel Cut-out dimensions:** 92x92mm 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

**15. CONNECTION DIAGRAM**

