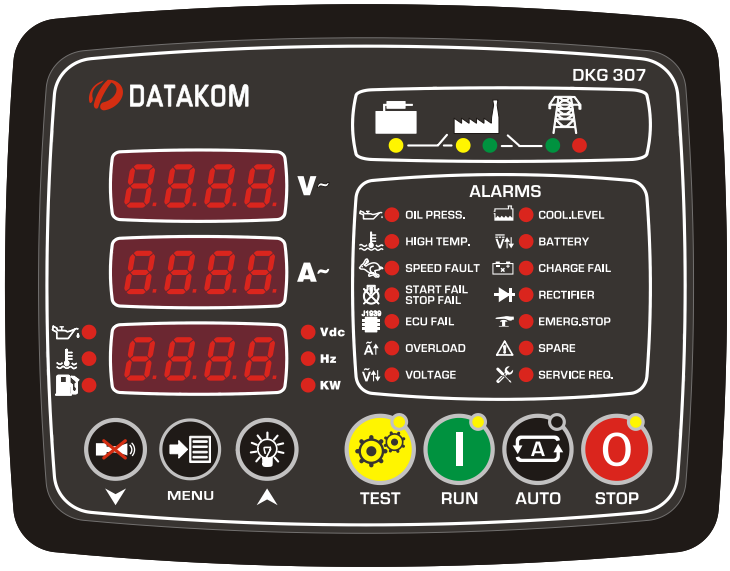
DKG-307 AUTOMATIC MAINS FAILURE UNIT

CANBUS AND MPU VERSIONS



DESCRIPTION

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

The unit is available with MPU or CANBUS versions. The CANBUS version connects to ECU controlled electronic engines providing engine control, protection and instrumentation without extra senders.

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

The unit provides a comprehensive set of digitally adjustable timers, threshold levels, input and output configurations, operating sequences and engine types. 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 date-time 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.

FEATURES

True RMS measurements
ECU connection through J1939 CAN option
MPU input option
Dual genset mutual standby operation
Event logging with time stamp and measurements
Battery backed-up real time clock
Built in daily / weekly / monthly exerciser
Weekly operation schedule programs
Field adjustable parameters
RS-232 serial port
Free MS-Windows Remote monitoring SW
GSM and PSTN modem support
GSM SMS message sending on fault
MODBUS communications
Customer logo display capability
10ADC relay outputs
Configurable analogue inputs: 4
Configurable digital inputs: 7
Configurable relay outputs: 2
Total relay outputs: 6
I/O expansion capability
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
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 voltage phase L2 to neutral
Gen voltage phase L3 to neutral
Gen voltage phase L1-L2
Gen voltage phase L2-L3
Gen voltage phase L3-L1
Gen current phase L1
Gen current phase L2
Gen current phase L3
Gen frequency
Engine speed (rpm)
Gen total kW
Gen total pf
Battery voltage,
Coolant temperature
Oil pressure
Oil temperature
Fuel level

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).***

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	**GENERATOR CONTACTOR**	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	**GEN-L1**	Generator phase inputs, 0-300V-AC	Connect the generator phases to these inputs. The generator phase voltages upper and lower limits are programmable.
3	**GEN-L2**		
4	**GEN-L3**		
5	**GENERATOR NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the generator phases.
6	**MAINS NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the mains phases.
7	**MAINS-L3**	Mains phase inputs, 0-300V-AC	Connect the mains phases to these inputs. The mains voltages upper and lower limits are programmable.
8	**MAINS-L2**		
9	**MAINS-L1**		
10	**MAINS CONTACTOR**	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	**GROUND**	O VDC	Power supply negative connection.
12	**BATTERY POSITIVE**	+12 or 24VDC	The positive terminal of the DC Supply shall be connected to this terminal. The unit operates on both 12V and 24V battery systems.
13	**FUEL LEVEL SENDER**	Input, 0-5000 ohms	Analogue fuel level sender connection. Do not connect the sender to other devices. The input has programmable ohms for VDO senders.
14	**OIL PRESSURE SENDER**	Input, 0-5000 ohms	Analogue oil pressure sender connection. Do not connect the sender to other devices. The input has programmable characteristics and connects to any kind of sender.
15	**COOLANT TEMP. SENDER**	Input, 0-5000 ohms	Analogue high temperature sender connection. Do not connect the sender to other devices. The input has programmable characteristics and connects to any kind of sender.

Term	Function	Technical data	Description
16	**CHARGE**	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.
17	**RELAY-2 (HORN RELAY)**	Output 10A/28VDC	This relay has programmable function, selectable from a list.
18	**RELAY-1 (STOP RELAY)**	Output 10A/28VDC	This relay has programmable function, selectable from a list.
19	**START RELAY**	Output 10A/28VDC	This relay controls the engine cranking.
20	**FUEL RELAY**	Output 10A/28VDC	This relay is used for fuel solenoid control.
21	**EMERGENCY STOP**	Digital inputs	These inputs have programmable characteristics selected via the program menu. Each input may be driven by a 'normally closed' or 'normally open' contact, switching either battery+ or battery-. The effect of the switch is also selectable from a list. See PROGRAMMING section for more details.
22	**SPARE-2**		
23	**PROGRAM LOCK**		
24	**SPARE-1**		
25	**COOLANT LEVEL**		
26	**HIGH TEMP**		
27	**LOW OIL PRESSURE**		
28	**RECTIFIER FAIL**		
29	**CURR_1+**	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 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).
30	**CURR_1-**		
31	**CURR_2+**		
32	**CURR_2-**		
33	**CURR_3+**		
34	**CURR_3-**		
35	**OIL TEMP. SENDER**	Input, 0-5000 ohms	Analogue oil temperature sender connection. Do not connect the sender to other devices. The input has programmable characteristics and connects to any kind of sender.

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

MPU INPUT VERSIONS			
36	**MPU -**	Analog input, 0.5 to 30V-AC	Connect the MPU unit to these inputs Use a twisted cable pair or coaxial cable for best results.
37	**MPU +**		

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
MAINS ON	Green	The LED will turn on when all 3 mains phase voltages are within the limits.
MAINS OFF	Red	The LED will turn on when at least one of the mains phase voltages is outside limits.
LOAD MAINS	Green	It turns on when the mains contactor is activated.
LOAD GENERATOR	Yellow	It turns on when the generator contactor is activated.
GENERATOR	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.
TEST	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 **weekly operation schedule**, then the **AUTO** led will flash.
RUN	Yellow	
STOP	Yellow	
AUTO	Green	
WARNINGS & ALARMS	Red	If a fault condition resulting to the engine shutdown or loaddump condition has occurred, the related 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.
SERVICE REQUEST	Red	Engine periodic maintenance request indicator. It turns on when the preset engine hours or time duration after previous service has elapsed.

3.2 Digital Displays

The unit has 3 seven segment displays. They show:
-Measured parameters,
-Service counters,
-Statistical counters,
-Program parameters.

The navigation between different screens in a group is made with the **MENU►** button. Holding the **MENU►** button pressed for 1 second makes the display to switch to the next group.

VOLTAGE DISPLAY: This display shows:
-phase R voltage if the load is on mains
-Phase U voltage if the load is on the genset

By pressing the MENU key, below values may be displayed:

-(L1-L2-L3) mains phase to neutral voltages
-(L1-L2-L3) generator phase to neutral voltages
-(L12-L23-L31) mains phase to phase voltages
-(L12-L23-L31) generator phase to phase voltages

If the service counters group is displayed, then this display will show the counter name.
In programming mode it displays (**PGM**).

CURRENT DISPLAY: This display will show the current values measured using the current transformers. Using the programming menu, current transformers within the range of 10/5A to 9000/5A may be programmed.
In programming mode it displays the program number.

MULTIFUNCTION DISPLAY: By pressing the MENU key below values may read:
-oil pressure (bar)
-coolant temperature (ºC)
-fuel level
-generator frequency (Hz)
-generator active power (KW)
-battery voltage (V-DC),
In programming mode it displays the program value.

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:
- Therelated **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:
- Therelated **ALARM** led to be on steadily,
- 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:
- Therelated **ALARM** led to flash,
- 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 the oil pressure alarm led will flash. 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 blow the **Engine Heating Temperature** limit.

LOW SPEED / HIGH SPEED: Set if the generator frequency or rpm is outside programmed limits. These faults will be monitored with **Holdoff Timer** delay after the engine is running. Low and high limits for warning and alarm are separately programmable. Another high 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**.

ECU FAIL (warning): Set when an engine fault code is received from the ECU of the electronic engine. This fault will not cause an engine stop. If necessary, the engine will be stopped by the ECU.
ECU FAIL (alarm): Set if no information has been received during 3 seconds from the ECU of the electronic engine. This fault condition is only controlled if fuel is on.

OVERLOAD (load_dump): Set if at least one of the genset phase currents goes over the **Overcurrent Limit** for **Overload Timer**. If currents go 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 COOLANT LEVEL: Set if a signal is detected at the low coolant level input.

HIGH BATTERY VOLTAGE: Set if the battery voltage goes above programmed limits. Both warning and alarm levels for high battery voltage are programmable.
LOW BATTERY VOLTAGE (warning): Set if the battery voltage goes below the programmed limit. During engine cranking this fault is not monitored.

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

RECTIFIER FAIL: Set if a signal is detected at the rectifier fail input. This input is only monitored when mains voltages are present.

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

SPARE: Set if a signal is detected from the related spare fault input.

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 TEST mode is selected when genset is running at RUN 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.
If the operation of the genset is disabled by the **weekly schedule**, then the **AUTO** led will flash, and the operation of the genset will be as in the **OFF** mode.

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. The **SPARE-2** input may be assigned as **Remote Start Input** using the program parameter **P_083**.

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 **SPARE-2** 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.

Oil 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

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. The SPARE-2 digital input may be assigned as **Simulate Mains** using program parameter **P_084.**

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. The **SPARE-2** digital input may be assigned as **Simulate Mains** using program parameter **P_084.**

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 (**P_085**) 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 **P_086 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.

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 Date & Time Display

The date & time display is provided for verification.

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.
The software version of the unit is displayed together with the data – time information.
The software version consists of 2 numbers. The first number represent the operating software version of the unit.

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.

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 iniate 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.

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** 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 Exerciser

The unit offers automatic exerciser operation. The exercise operation may be done on a daily, weekly or monthly basis.

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

Program parameters related to the exerciser are:
Exercise start day and hour
Exercise duration
Exercise off_load/on_load
Exerciser Period (Daily / Weekly / Monthly)

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

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

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

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

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

Using the daily exercise mode, the unit may feed the load from the genset during predefined hours of the day. This operation may be used in high tariff periods of the day.

6.18. 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,
-"**FACT RSET**" 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 and "**FACT RSET DONE**" will be displayed during 5 seconds.

It is not possible to restore user parameters.

6.19. 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.

6.20. 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.

6.21. 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.

6.22. 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 percentage counter 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.

6.23. Changing the Default Engine Speed in Volvo Engines

Volvo engines equipped with **EMS-II** engine control unit have the engine speed selectable through the J1939 – CANBUS. The unit offers the possibility to the user to switch between the primary and secondary speed using the programming menu.

If the program parameter **Volvo Speed Toggle** is increased, the unit will freeze for a few seconds and switch the engine to 1800 rpm, which is generally the secondary speed. When the parameter is decreased, the speed is set to the primary speed, which is generally 1500 rpm.

The unit must be in OFF mode, otherwise the speed switching will not be performed.

Daha
mümk

Please note also that a fine adjustment of the engine speed in the ± 8 % range may be done using the program parameter **J1939 Speed Adjust**.

6.24. Engine Control Mode

In engine control mode, the unit is supposed to control an engine without alternator.

The engine control mode is activated by a program parameter in the **Controller Configuration** group.

When the **Engine Control Mode** is activated:

-the unit will not display genset AC parameters (volts, amps, kW and pf).
-genset voltage and frequency protections are disabled. However engine rpm protections will be active.

It is strongly recommended to enter correct low and high rpm limit values in order to enable engine speed protection.

Daha
mümk

6.25. 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 usefull in dual voltage or frequency gensets for easy switching between 2 operating conditions.

The switching to the second set of limit values is performed by applying signal to the SPARE-1 digital input.

In order to assign this functionality to the SPARE-1 input, the program parameter **P_092 Secondary Volt/Freq** should be set to 1.

Below parameters are available for second voltage-frequency selection:

Mains Low Voltage Limit
Mains High Voltage Limit
Mains Low Frequency Limit
Mains High Frequency Limit

Genset Low Voltage Shutdown Limit
Genset Low Voltage Warning Limit
Genset High Voltage Warning 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

6.26. Single Phase Operation

If the unit is used in a single phase electrical network, it is advised t 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.

6.27. Password Operation (applicable only to DKG-317CAN/MPU)

The unit is capable to be programmed to ask for a password when AUTO or RUN mode is selected.

The password is adjusted with parameter P_115. If the password is set to zero, then the unit will not ask for password.

When the unit asks for password, enter the password with ▼and ▲ buttons, then acknowledge with **MENU** button.

7. J1939 ENGINE MONITORING AND CONTROL PORT (ONLY CANBUS VERSIONS)

The unit offers a special J1939 port in order to communicate with electronic engines controlled by an **ECU** (electronic control unit).

The J1939 port consists of 2 terminals which are **J1939+** and **J1939-**. The connection between the unit and the engine should be made with either a twisted cable pair or a coaxial cable. If a coaxial cable is used, the external conductor should be grounded at one end only.

The **120 ohms** termination resistor is included inside the unit. Please do not connect external resistor.

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

If the J1939 port is enabled then the **oil pressure**, **coolant temperature** and the **engine rpm** information are picked up from the **ECU** unit. Other available measurements have no effect on engine operation. In total, the unit is capable of receiving 21 parameters from the J1939.

The J1939 measurements are also available for Modbus operation. Please check chapter 8 for more details.

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

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

The electronic engine **fault codes** are displayed within the alarm list table **in text**, together with their **SPN-FMI** codes. A maximum of 8 fault codes can be displayed.

The complete list of fault codes is given in the engine manufacturer’s user manual.

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

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

Below is a basic list of FMI codes.

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

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

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

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. WEEKLY OPERATION SCHEDULE

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

The unit has one programmable turn-on/turn-off time pairs for each day of week. These programmable parameters allow the genset to operate automatically only in allowed time limits.

The weekly operation schedule is **only active in AUTO** mode. In other modes it will not affect the genset operation.

In **AUTO** mode, if the operation of the genset is disabled by the weekly schedule, then **the AUTO led will flash** (instead of a steady on state).

Each turn-on/turn-off time is defined in 10 minute steps.

Unused programs should be set to 24:00.

An example setup may be as follows:

```
Monday    Turn_on  07:00
Monday    Turn_off 18:00
Tuesday   Turn_on  07:00
Tuesday   Turn_off 18:00
Wednesday Turn_on  07:00
Wednesday Turn_off 18:00
Thursday  Turn_on  07:00
Thursday  Turn_off 18:00
Friday    Turn_on  07:00
Friday    Turn_off 18:00
Saturday  Turn_on  07:00
Saturday  Turn_off 13:00
Sunday    Turn_on  24:00 (Sunday no turn on time, last operation mode continues)
Sunday    Turn_off 24:00 (Sunday no turn off time, last operation mode continues)
```

If the same time is used for turn on and turn off, then it will be considered as a turn-on time.

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

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 a time stamp which comes from the internal real time clock circuit of the unit.

The events are stored in a circular memory. This means that a new coming event will erase the oldest recorded event.

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

Events are not visible on the device display. They can be downloaded to the computer and saved in an Excel file.

Event sources are:

-Shutdown alarms, Load dump alarms, Warnings
-Engine crank starts
-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
J1939 VAlues (if applicable)

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**, hold pressed the **MENU►** button for 5 seconds.

When the program mode is entered, the upper display will show “PRGM” and the mid display will indicate the program parameter number. The lower display will show the parameter value.

If the **PROGRAM LOCK** 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**.

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

Navigation between program parameters is performed via the **MENU►** button. Holding the button pressed will cause the program parameter number to increase faster.

Parameter value may be increased and decreased with **▼** and **▲** buttons. If these keys are held pressed, the program value will be increased/decreased faster.

When a program parameter is modified, it is automatically saved in memory.

If **MENU►** button is pressed, next parameter 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 parameters are organized in 2 groups as low and high levels. Entering the program mode by pressing the **MENU►** button will allow access to only low level parameters.

In order to access all parameters please hold **OFF** and **MENU►** buttons pressed.

PGM	Parameter Definition	Unit	Fact.Set	Description
P_000	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.
P_001	Overcurrent Limit	A	0	If the current goes above this limit, during the period defined in **Overload Timeout** then a **Overcurrent Load Dump** alarm will be generated. If this parameter is 0 then Overcurrent check is disabled.
P_002	Excess Power Limit	KW	0	If the active power goes above this limit, during the period defined in Overload Timeout then an **Excess Power Load Dump** alarm will be generated. If this parameter is 0 then Excess Power check is disabled.
P_003	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 **AUTO** mode.
P_004	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 **AUTO** mode.
P_005	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 **AUTO** mode.
P_006	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 **AUTO** mode.
P_007	Genset Low Voltage Shutdown Limit	V	190	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a **GENSET LOW VOLTAGE** shutdown alarm and the engine will stop.
P_008	Genset Low Voltage Warning Limit	V	200	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a **GENSET LOW VOLTAGE** warning.
P_009	Genset High Voltage Warning Limit	V	250	If one of the generator phase voltages goes above this limit when feeding the load, this will generate a **GENSET HIGH VOLTAGE** warning.
P_010	Genset High Voltage Shutdown Limit	V	260	If one of the generator phase voltages goes over this limit when feeding the load, this will generate a **GENSET HIGH VOLTAGE** alarm and the engine will stop.
P_011	Low Frequency Shutdown	Hz	30	If the genset frequency goes under this limit, a **GENSET LOW SPEED** alarm is generated and the engine stops.
P_012	Low Frequency Warning	Hz	35	If the genset frequency goes under this limit, a **GENSET LOW SPEED** warning is generated.
P_013	High Frequency Warning	Hz	54	If the genset frequency goes over this limit, a **GENSET HIGH SPEED** warning is generated.
P_014	High Frequency Shutdown	Hz	55	If the genset frequency goes over this limit, a **GENSET HIGH SPEED** alarm is generated and the engine stops.
P_015	Low Battery Voltage Warning	V	9.0	If the battery voltage falls below this limit, this will generate a **LOW BATTERY** warning.
P_016	High Battery Voltage Warning	V	31.0	If the battery voltage goes over this limit, this will generate a **HIGH BATTERY** warning.
P_017	High Battery Voltage Shutdown	V	33.0	If the battery voltage goes over this limit, this will generate a **HIGH BATTERY** shutdown alarm and the engine will stop.

PGM	Parameter Definition	Unit	Fact.Set	Description
P_018	Low Oil Pressure Warning	bar	1.4	If the oil pressure measured from the analog input falls below this limit, this will generate a **LOW OIL PRESSURE SENDER** warning.
P_019	Low Oil Pressure Shutdown	bar	1.0	If the oil pressure measured from the analog input falls below this limit, this will generate a **LOW OIL PRESSURE SENDER** alarm is generated and the engine stops.
P_020	High Temperature Warning	°C	95	If the coolant temperature measured from the analog input goes over this limit, this will generate a **HIGH TEMPERATURE SENDER** warning.
P_021	High Temperature Shutdown	°C	98	f the coolant temperature measured from the analog input goes over this limit, this will generate a **HIGH TEMPERATURE SENDER** alarm and the engine will stop.
P_022	Low Fuel Warning	%	20	If the fuel level measured from the analog input falls below this limit, a **LOW FUEL LEVEL SENDER** warning is generated.
P_023	Low Fuel Shutdown	%	10	the fuel level measured from the analog input falls below this limit, a **LOW FUEL LEVEL SENDER** shutdown alarm is generated and the engine stops.
P_024	High Oil Temperature Warning	°C	100	If the oil temperature measured from the analog input goes over this limit, this will generate a HIGH OILTEMPERATURE SENDER warning.
P_025	High Oil Temperature Shutdown	°C	120	f the oil temperature measured from the analog input goes over this limit, this will generate a HIGH OIL TEMPERATURE SENDER alarm and the engine will stop.
P_026	Oil Pressure Sender type	-	1	This parameter selects the oil pressure sender type. **0:** Non standard sender. The sender characteristics are defined in **Sender Characteristics** table. **1:** VDO 0-7 bars (10-180 ohms) **2:** VDO 0-10 bars (10-180 ohms) **3:** DATCON 0-7 bars (240-33 ohms) **4:** DATCON 0-10 bars (240-33 ohms) **5:** DATCON 0-7 bars (0-90 ohms) **6:** DATCON 0-10 bars (0-90 ohms) **7:** DATCON 0-7 bars (75-10 ohms)
P_027	Coolant Temp. Sender Type	-	1	This parameter selects the temperature sender type: **0:** The sender characteristics are defined in **Sender Characteristics** table. **1:** VDO **2:** DATCON DAH type **3:** DATCON DAL type
P_028	Oil Temp. Sender Type	-	1	This parameter selects the temperature sender type: **0:** The sender characteristics are defined in **Sender Characteristics** table. **1:** VDO **2:** DATCON DAH type **3:** DATCON DAL type

PGM	Parameter Definition	Unit	Fact.Set	Description
P_029	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.
P_030	Engine Heating Temperature	°C	0	If it is requested that the engine runs without load until reaching a certain temperature, this parameter defines the temperature. If the coolant temperature falls below this parameter, an **Engine Low Temperature** warning will occur.
P_031	Fault Holdoff Timer	sec	12	This parameter defines the delay after the engine runs and before the fault monitoring is enabled.
P_032	Overload Timeout	sec	5	This is the period between the current or active power go over the limits and **OVERCURRENT** or **EXCESS POWER** Load Dump alarms occur. This is also the period between the frequency goes out of the limits and **OVERSPEED** or **UNDERSPEED** alarms occur. This is also the period between the genset voltage goes out of the limits and **HIGH VOLTAGE** or **LOW VOLTAGE** alarms occur.
P_033	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.
P_034	Preheat Timer	sec	1	This is the time after the fuel solenoid is energized and before the genset is started. During this period the **PREHEAT** relay output is energized (if assigned by **Relay Definitions**)
P_035	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).
P_036	Gas Solenoid Delay	sec	5	The gas solenoid of the gas engine will be opened after this delay during cranking.
P_037	Crank Timer	sec	10	This is the maximum start period. Starting will be automatically cancelled if the genset fires before the timer.
P_038	Wait Between Starts	sec	10	This is the waiting period between two start attempts.
P_039	Idle Speed Timer	sec	0	When the engine runs, the Idle output relay function will be active during this timer.
P_040	Engine Heating Timer	sec	4	This is the period used for engine heating following the program parameter.
P_041	Mains Waiting Timer	min	0.5	This is the time between the mains voltages entered within the limits and the generator contactor is deactivated.
P_042	Cooldown Timer	min	1.0	This is the period that the generator runs for cooling purpose after the load is transferred to mains.

PGM	Parameter Definition	Unit	Fact.Set	Description
P_043	Genset Contactor Timer	sec	1	This is the period after the mains contactor has been deactivated and before the generator contactor has been activated.
P_044	Mains Contactor Timer	sec	1	This is the period after the generator contactor has been deactivated and before the mains contactor has been activated.
P_045	Stop Solenoid Timer	sec	10	This is the maximum time duration for the engine to stop. During this period the STOP relay output is energized (if assigned by **Relay Definitions**). If the genset has not stopped after this period, a **FAIL TO STOP** warning occurs.
P_046	Number of Starts	-	3	This is the maximum number of start attempts.
P_047	Mains Phase Order Enable	-	0	**0:** mains phase order checking disabled **1:** if mains phase order is faulty, then a warning is given and mains contactor deenergized.
P_048	Genset Phase Order Loaddump	-	0	**0:** genset phase order checking disabled **1:** if genset phase order is faulty, then a loaddump is generated and the genset stops after cooldown.
P_049	RPM from genset frequency	-	1	This parameter is used in the conversion of the genset frequency to engine rpm. 0: read rpm from the optional MPU input 1: convert frequency to rpm (using crank teeth count)
P_050	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.
P_051	Low rpm Shutdown	rpm	0	If the engine speed goes under this limit, a **GENSET LOW SPEED** alarm is generated and the engine stops.
P_052	Low rpm Warning	rpm	0	If the engine speed goes under this limit, a **GENSET LOW SPEED** warning is generated.
P_053	High rpm Warning	rpm	0	If the engine speed goes over this limit, a **GENSET HIGH SPEED** warning is generated.
P_054	High rpm Shutdown	rpm	0	If the engine speed goes over this limit, a **GENSET HIGH SPEED** alarm is generated and the engine stops.
P_055	Alarm Relay Timer	sec	60	This is the period during which the **ALARM** relay is active. If the period is set to 0, this will mean that the period is unlimited.
P_056	Intermittent Alarm Relay	-	0	**0:** continuous **1:** intermittent (turns on and off every second)
P_057	Service Engine Hours	hour	50	The **SERVICE REQUEST** led indicator will turn on after this quantity of engine hours from the last service. If the period is set to ‘0’ no **SERVICE REQUEST** will be generated depending on engine hours.
P_058	Service Period	month	6	The **SERVICE REQUEST** led indicator will turn on after this amount of time from the last service. If the period is set to ‘0’ no **SERVICE REQUEST** will be indicated depending on time.

Following parameters are in “high” priority group.

PGM	Parameter Definition	Unit	Fact.Set	Description
P_059	Reverse power warning limit	KW	0	If the genset power is negative and goes above this limit then a **REVERSE POWER** warning will be generated.
P_060	Reverse power loaddumpg limit	KW	0	If the genset power is negative and goes above this limit then a **REVERSE POWER** loaddump will be generated.
P_061	Load Shedding Low Limit	KW	0	If the genset power goes below this limit then the load shedding relay will be deactivated.
P_062	Load Shedding High Limit	KW	0	If the genset power goes above this limit then the load shedding relay will be activated.
P_063	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.
P_064	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.
P_065	Fan turn-on temp	°C	90	If the coolant temp is above this limit then the fan relay function will become active.
P_066	Fan turn-off temp	°C	80	If the coolant temp is below this limit then the fan relay function will become inactive.
P_067	Engine Heating Method	-	0	This parameter defines the engine heating method. The genset will not take the load before engine heating is completed. **0:** engine is heated during **Engine Heating Timer**. **1:** engine is heated until the coolant temperature reaches the **Engine Heating Temperature** and at least during the **Engine Heating Timer**.
P_068	Crank Cut Frequency	Hz	10.0	When the genset frequency reaches this limit, the engine is supposed running and the crank output will release.
P_069	Crank Stop with Oil Pressure	-	0	**0:** no crank stop with oil pressure **1:** cranking is stopped when oil presure switch is open or the oil pressure measured is above shutdown limit.
P_070	Crank Stop with Charge	-	0	**0:** no crank stop with charge input **1:** cranking is stopped when the charge alternator voltage is established.
P_071	Charge Alternator Shutdown	-	0	**0:** The charge input generates **CHARGE FAIL** warning, and does not stop the engine. **1:** The charge input generates **CHARGE FAIL** alarm, and stops the engine.
P_072	Line-to-Line Voltages	-	0	**0:** Display Line to Neutral voltages as default **1:** Display Line to Line voltages as default
P_073	Oil Pressure in psi	-	0	**0:** oil pressure display in bars **1:** oil pressure display in psi
P_074	Temperature in °F	-	0	**0:** temperature display in degrees C **1:** temperature display in degrees F

PGM	Parameter Definition	Unit	Fact.Set	Description
P_075	Single phase Enable	-	0	**0:** 3-phase system **1:** Single phase system
P_076	Emergency Backup Operation	-	0	**0:** In TEST mode, the load will not be transferred to the genset even if the mains fail. **1:** In TEST mode, the load will be transferred to the genset if the mains fail.
P_077	Modem Enable	-	0	**0:** No modem connection, the serial port is connected to PC **1:** Modem connected.
P_078	SMS Enable	-	0	**0:** SMS not enabled **1:** SMS enabled
P_079	MODBUS Address	-	0	**0:** RAINBOW communication protocol. **1-144:** MODBUS communication. This parameter is also the MODBUS controller address of the unit.
P_080	SMS on Mains Change	-	0	This parameter controls SMS sending when mains voltages status is changed. No warning is generated. **0:** no SMS when mains failed or restored **1:** SMS sent when mains failed or restored
P_081	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.
P_082	Real Time Clock Adjust	-	117	This parameter trims precisely the real time clock circuit. Values from 0 to 63 speed up the clock with 0.25sec/day steps. Values from 127 to 64 slow down the clock with 0.25sec/day steps.
P_083	Remote Start Enable	-	0	**0:** no Remote Start signal **1:** SPARE-2 input is Remote Start signal
P_084	Simulate Mains Enable	-	0	**0:** no Simulate Mains signal **1:** SPARE-2 input is Simulate Mains signal
P_085	Delayed Simulate Mains	-	0	**0:** The **SPARE-2** input has normal function **1:** The **SPARE-2** input has delayed simulate mains function. See chapter 6.8 for more info.
P_086	Flashing Relay Timer	hours	0	**Delayed Simulate Mains Operation:** max genset running time after Simulate Mains signal disappears. **Dual Genset Systems:** flashing relay toggle timer. Please contact DATAKOM for dual genset mutual stanby operation.

PGM	Parameter Definition	Unit	Fact.Set	Description
P_087	Exercise Day and Time	-	168	This parameter defines the start day and hour of the exerciser. Values higher or equal to 168 mean that the exerciser is off. The exercise may be selected to start at the beginning of the any hour of the week. The parameter value is the hour count of the start time. Examples: 0 = exercise starts at Monday 00:00 8 = exercise starts at Monday 08:00 24 = exercise starts at Tuesday 00:00 167 = exercise starts at Sunday 23:00 168 = exerciser off If a daily exercise is selected, then the day information is don't care and the exercise will be performed every day regardless of the day selection. If the monthly exerciser is selected, then the exercise will be performed during the first 7 days of each month at the programmed day and hour.
P_088	Exercise Duration	min	10	This parameter defines the exercise duration and programmed in 10 minute steps up to 24 hours.
P_089	Exercise Off/On Load	-	0	**0:** Exercise at **TEST** mode **1:** Exercise at **LOAD TEST** mode
P_090	Exercise Period	-	1	**0:** exercise every day (the exercise will be performed every day regardless of the day selection of Exercise Dat and Time parameter). **1:** exercise once per week **2:** exercise once per month (the exercise will be performed during the first 7 days of each month at the programmed day and hour).
P_091	Language Selection	-	0	This is the language used in SMS messages. **0:** english **1:** turkish **2:** french **3:** russian
P_092	Secondary Volt/Freq	-	0	**0:** Use primary voltage/frequency limits **1:** When signal is applied to the SPARE-1 input, use secondary voltage/frequency limits
P_093	Engine Control Only	-	0	0: Genset control 1: Engine control (no alternator

Below parameters are applicable to J1939 enabled versions only.

PGM	Parameter Definition	Unit	Fact.Set	Description
P_094	J1939 Enable	-	0	0: The J1939 port is inoperative. 1: The analog measurements (oil, temp, rpm) are picked_up from the ECU. If the ECU communication is lost, then the engine will be stopped.
P_095	J1939 Engine Type	-	0	**00:** GENERIC ENGINE TYPE **16:** CUMMINS CM850 **32:** DETROIT DIESEL **48:** DEUTZ Generic **49:** DEUTZ EMR2 **50:** DEUTZ EMR3 **64:** JOHN DEERE **80:** PERKINS **81:** PERKINS ADEM 3 **82:** PERKINS ADEM 1.3 **96:** VOLVO (with CIU unit) **97:** VOLVO EMS2 **98:** VOLVO EDC4 **112:** CATERPILLAR ADEM II/III **128:** SCANIA S6 **129:** SCANIA Single Speed **130:** SCANIA All Speed **144:** IVECO **160:** MTU MDEC 302 **161:** MTU MDEC 201 **162:** MTU MDEC 303 **163:** MTU MDEC 304 **164:** MTU MDEC 505 **176:** BOSCH Generic **177:** BOSCH EDC 731 **178:** BOSCH EDC 9.3 **Other values:** Reserved. Do not use.
P_096	J1939 Speed Adjust	%	50	This parameter adjusts the speed of an ECU controlled engine by +/- 8%.
P_097	VOLVO Speed Toggle	-	-	This program parameter is not stored, but only used in order to activate the primary or secondary speed selection operation of a Volvo EMS-II engine control unit. 0: Initiate the primary speed select operation 1: Initiate the secondary speed select operation

PGM	Parameter Definition	Unit	Fact.Set	Description
P_098	2nd Overcurrent Limit	A	0	**When secondary volt/freq limits are active:** If the current goes above this limit, during the period defined in **Overload Timeout** then a **Overcurrent Load Dump** alarm will be generated. If this parameter is 0 then Overcurrent check is disabled.
P_099	2nd Mains Voltage Low Limit	*V*	84	**When secondary volt/freq limits are active:** 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 **AUTO** mode.
P_100	2nd Mains Voltage High Limit	V	136	**When secondary volt/freq limits are active:** 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 **AUTO** mode.
P_101	2nd Mains Frequency Low Limit	Hz	55	**When secondary volt/freq limits are active:** If the mains frequency goes under this limit, it means that the mains are off and it starts the transfer to the genset in **AUTO** mode.
P_102	2nd Mains Frequency High Limit	Hz	65	**When secondary volt/freq limits are active:** If the mains frequency goes above this limit, it means that the mains are off and it starts the transfer to the genset in **AUTO** mode.
P_103	2nd Genset Low Voltage Shutdown Limit	V	90	**When secondary volt/freq limits are active:** If one of the generator phase voltages goes under this limit when feeding the load, this will generate a **GENSET LOW VOLTAGE** shutdown alarm and the engine will stop.
P_104	2nd Genset Low Voltage Warning Limit	V	94	**When secondary volt/freq limits are active:** If one of the generator phase voltages goes under this limit when feeding the load, this will generate a **GENSET LOW VOLTAGE** warning.
P_105	2nd Genset High Voltage Warning Limit	V	130	**When secondary volt/freq limits are active:** If one of the generator phase voltages goes above this limit when feeding the load, this will generate a **GENSET HIGH VOLTAGE** warning.
P_106	2nd Genset High Voltage Shutdown Limit	V	136	**When secondary volt/freq limits are active:** If one of the generator phase voltages goes over this limit when feeding the load, this will generate a **GENSET HIGH VOLTAGE** alarm and the engine will stop.
P_107	2nd Low Frequency Shutdown	Hz	40	**When secondary volt/freq limits are active:** If the genset frequency goes under this limit, a **GENSET LOW SPEED** alarm is generated and the engine stops.
P_108	2nd Low Frequency Warning	Hz	45	**When secondary volt/freq limits are active:** If the genset frequency goes under this limit, a **GENSET LOW SPEED** warning is generated.
P_109	2nd High Frequency Warning	Hz	65	**When secondary volt/freq limits are active:** If the genset frequency goes over this limit, a **GENSET HIGH SPEED** warning is generated.
P_110	2nd High Frequency Shutdown	Hz	69	**When secondary volt/freq limits are active:** If the genset frequency goes over this limit, a **GENSET HIGH SPEED** alarm is generated and the engine stops.

PGM	Parameter Definition	Unit	Fact.Set	Description
P_111	2nd Low rpm Shutdown	rpm	0	**When secondary volt/freq limits are active:** If the engine speed goes under this limit, a **GENSET LOW SPEED** alarm is generated and the engine stops.
P_112	2nd Low rpm Warning	rpm	0	**When secondary volt/freq limits are active:** If the engine speed goes under this limit, a **GENSET LOW SPEED** warning is generated.
P_113	2nd High rpm Warning	rpm	0	If the engine speed goes over this limit, a **GENSET HIGH SPEED** warning is generated.
P_114	2nd High rpm Shutdown	rpm	0	**When secondary volt/freq limits are active:** If the engine speed goes over this limit, a **GENSET HIGH SPEED** alarm is generated and the engine stops.
P_115	Engine Run Password	-	0	**Applicable only to the DKG-317 model:** If this parameter is set to a value other than zero, then when AUTO or RUN mode is selected, the unit will ask for this password.

Date - Time

P_116	Date	-		Current day of the month.
P_117	Month	-		Current month.
P_118	Year	-		Last two digits of the current year.
P_119	Hours	-		Current hour of the day.
P_120	Minutes	-		Current minute of the hour.
P_121	Seconds	-		Current second of the minute.

Weekly Schedule Programs

PGM	Parameter Definition	Unit	Factory Set	Description
P_122	Monday Turn_on	hh:mm	24:00	Please review chapter 9 for a detailed description of weekly programming schedule operation.
P_123	Monday Turn_off	hh:mm	24:00	
P_124	Tuesday Turn_on	hh:mm	24:00	
P_125	Tuesday Turn_off	hh:mm	24:00	
P_126	Wednesday Turn_on	hh:mm	24:00	
P_127	Wednesday Turn_off	hh:mm	24:00	
P_128	Thursday Turn_on	hh:mm	24:00	
P_129	Thursday Turn_off	hh:mm	24:00	
P_130	Friday Turn_on	hh:mm	24:00	
P_131	Friday Turn_off	hh:mm	24:00	
P_132	Saturday Turn_on	hh:mm	24:00	
P_133	Saturday Turn_off	hh:mm	24:00	
P_134	Sunday Turn_on	hh:mm	24:00	
P_135	Sunday Turn_off	hh:mm	24:00	

Oil Pressure Sender Characteristics

PGM	Parameter Definition	Unit	Factory Set	Description
P_136	Oil Pressure Sender Ohms -1	ohm	10	Oil Pressure Sender point 1, ohm value
P_137	Oil Pressure Value -1	bar	0.0	Oil Pressure Sender point 1, bar value
P_138	Oil Pressure Sender Ohms -2	ohm	52	Oil Pressure Sender point 2, ohm value
P_139	Oil Pressure Value -2	bar	2.0	Oil Pressure Sender point 2, bar value
P_140	Oil Pressure Sender Ohms -3	ohm	90	Oil Pressure Sender point 3, ohm value
P_141	Oil Pressure Value -3	bar	4.0	Oil Pressure Sender point 3, bar value
P_142	Oil Pressure Sender Ohms -4	ohm	140	Oil Pressure Sender point 4, ohm value
P_143	Oil Pressure Value -4	bar	7.0	Oil Pressure Sender point 4, bar value
P_144	Oil Pressure Sender Ohms -5	ohm	156	Oil Pressure Sender point 5, ohm value
P_145	Oil Pressure Value -5	bar	8.0	Oil Pressure Sender point 5, bar value
P_146	Oil Pressure Sender Ohms -6	ohm	184	Oil Pressure Sender point 6, ohm value
P_147	Oil Pressure Value -6	bar	10.0	Oil Pressure Sender point 6, bar value

Coolant Temperatıre Sender Characteristics

PGM	Parameter Definition	Unit	Factory Set	Description
P_148	Temperature Sender Ohms -1	ohm	38	Temperature Sender point 1, ohm value
P_149	Temperature Value -1	°C	100	Temperature Sender point 1, °C value
P_150	Temperature Sender Ohms -2	ohm	51	Temperature Sender point 2, ohm value
P_151	Temperature Value -2	°C	90	Temperature Sender point 2, °C value
P_152	Temperature Sender Ohms -3	ohm	134	Temperature Sender point 3, ohm value
P_153	Temperature Value -3	°C	60	Temperature Sender point 3, °C value
P_154	Temperature Sender Ohms -4	ohm	322	Temperature Sender point 4, ohm value
P_155	Temperature Value -4	°C	39	Temperature Sender point 4, °C value
P_156	Temperature Sender Ohms -5	ohm	650	Temperature Sender point 5, ohm value
P_157	Temperature Value -5	°C	20	Temperature Sender point 5, °C value
P_158	Temperature Sender Ohms -6	ohm	1630	Temperature Sender point 6, ohm value
P_159	Temperature Value -6	°C	02	Temperature Sender point 6, °C value

Fuel Level Sender Characteristics

PGM	Parameter Definition	Unit	Factory Set	Description
P_160	Fuel Level Sender Ohms -1	ohm	4	Fuel Level Sender point 1, ohm value
P_161	Fuel Level Value -1	%	0	Fuel Level Sender point 1, % value
P_162	Fuel Level Sender Ohms -2	ohm	31	Fuel Level Sender point 2, ohm value
P_163	Fuel Level Value -2	%	25	Fuel Level Sender point 2, % value
P_164	Fuel Level Sender Ohms -3	ohm	67	Fuel Level Sender point 3, ohm value
P_165	Fuel Level Value -3	%	50	Fuel Level Sender point 3, % value
P_166	Fuel Level Sender Ohms -4	ohm	110	Fuel Level Sender point 4, ohm value
P_167	Fuel Level Value -4	%	75	Fuel Level Sender point 4, % value
P_168	Fuel Level Sender Ohms -5	ohm	180	Fuel Level Sender point 5, ohm value
P_169	Fuel Level Value -5	%	100	Fuel Level Sender point 5, % value
P_170	Fuel Level Sender Ohms -6	ohm	1000	Fuel Level Sender point 6, ohm value
P_171	Fuel Level Value -6	%	100	Fuel Level Sender point 6, % value

Program Group: Sender Characteristics (password level-2)

PGM	Parameter Definition	Unit	Fact.Set	Description
P_172	Oil Temperature Sender Ohms -1	ohm	38	Temperature Sender point 1, ohm value
P_173	Oil Temperature Value -1	°C	100	Temperature Sender point 1, °C value
P_174	Oil Temperature Sender Ohms -2	ohm	51	Temperature Sender point 2, ohm value
P_175	Oil Temperature Value -2	°C	90	Temperature Sender point 2, °C value
P_176	Oil Temperature Sender Ohms -3	ohm	134	Temperature Sender point 3, ohm value
P_177	Oil Temperature Value -3	°C	60	Temperature Sender point 3, °C value
P_178	Oil Temperature Sender Ohms -4	ohm	322	Temperature Sender point 4, ohm value
P_179	Oil Temperature Value -4	°C	39	Temperature Sender point 4, °C value
P_180	Oil Temperature Sender Ohms -5	ohm	650	Temperature Sender point 5, ohm value
P_181	Oil Temperature Value -5	°C	20	Temperature Sender point 5, °C value
P_182	Oil Temperature Sender Ohms -6	ohm	1630	Temperature Sender point 6, ohm value
P_183	Oil Temperature Value -6	°C	02	Temperature Sender point 6, °C value

Low Oil Pressure Switch Input Configuration

PGM	Parameter Definition	Unit	Fac.Set	Description
P_184	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
P_185	Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
P_186	Latching		1	**0:** Non latching **1:** Latching
P_187	Contact type		0	**0:** Normally open **1:** Normally closed
P_188	Switching		0	**0:** Battery negative **1:** Battery positive
P_189	Response delay		0	**0:** No delay **1:** Delayed (4sec)

High Temperature Switch Input Configuration

PGM	Parameter Definition	Unit	Fac.Set	Description
P_190	**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
P_191	**Sampling**		1	**0:** Always **1:** After holdoff timer **2:** When mains present
P_192	**Latching**		1	**0:** Non latching **1:** Latching
P_193	**Contact type**		0	**0:** Normally open **1:** Normally closed
P_194	**Switching**		0	**0:** Battery negative **1:** Battery positive
P_195	**Response delay**		0	**0:** No delay **1:** Delayed (4sec)

Coolant Level Switch Input Configuration

PGM	Parameter Definition	Unit	Fac.Set	Description
P_196	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
P_197	Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
P_198	Latching		1	**0:** Non latching **1:** Latching
P_199	Contact type		0	**0:** Normally open **1:** Normally closed
P_200	Switching		0	**0:** Battery negative **1:** Battery positive
P_201	Response delay		1	**0:** No delay **1:** Delayed (4sec)

Rectifier Fail Input Configuration

PGM	Parameter Definition	Unit	Fac.Set	Description
P_202	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
P_203	Sampling		2	**0:** Always **1:** After holdoff timer **2:** When mains present
P_204	Latching		1	**0:** Non latching **1:** Latching
P_205	Contact type		0	**0:** Normally open **1:** Normally closed
P_206	Switching		0	**0:** Battery negative **1:** Battery positive
P_207	Response delay		0	**0:** No delay **1:** Delayed (4sec)

Emergency Stop Input Configuration

PGM	Parameter Definition	Unit	Fac.Set	Description
P_208	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
P_209	Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
P_210	Latching		0	**0:** Non latching **1:** Latching
P_211	Contact type		0	**0:** Normally open **1:** Normally closed
P_212	Switching		0	**0:** Battery negative **1:** Battery positive
P_213	Response delay		0	**0:** No delay **1:** Delayed (4sec)

Spare–1 Input Input Configuration

PGM	Parameter Definition	Unit	Fac.Set	Description
P_214	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
P_215	Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
P_216	Latching		0	**0:** Non latching **1:** Latching
P_217	Contact type		0	**0:** Normally open **1:** Normally closed
P_218	Switching		0	**0:** Battery negative **1:** Battery positive
P_219	Response delay		0	**0:** No delay **1:** Delayed (4sec)

Spare-2 Input Input Configuration

PGM	Parameter Definition	Unit	Fac.Set	Description
P_220	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
P_221	Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
P_222	Latching		0	**0:** Non latching **1:** Latching
P_223	Contact type		0	**0:** Normally open **1:** Normally closed
P_224	Switching		0	**0:** Battery negative **1:** Battery positive
P_225	Response delay		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.

The relays may be extended up to 22 using **Relay Extension Modules**.. Other relays are in the optional Extension Modules.

Program Group: Relay Definitions (password level-2)

PGM	Parameter Definition	Unit	Fac.Set	Description
P_226	Relay 01 Definition		3	RELAY-1 function selected from list
P_227	Relay 02 Definition		1	RELAY-2 function selected from list
P_228	Relay 03 Definition		0	RELAY-3 function (expansion module) selected from list
P_229	Relay 04 Definition		2	RELAY-4 function (expansion module-1) selected from list
P_230	Relay 05 Definition		4	RELAY-5 function (expansion module-1) selected from list
P_231	Relay 06 Definition		5	RELAY-6 function (expansion module-1) selected from list
P_232	Relay 07 Definition		0	RELAY-7 function (expansion module-1) selected from list
P_233	Relay 08 Definition		2	RELAY-8 function (expansion module-1) selected from list
P_234	Relay 09 Definition		4	RELAY-9 function (expansion module-1) selected from list
P_235	Relay 10 Definition		5	RELAY-10 function (expansion module-1) selected from list
P_236	Relay 11 Definition		0	RELAY-11 function (expansion module-2) selected from list
P_237	Relay 12 Definition		2	RELAY-12 function (expansion module-2) selected from list
P_238	Relay 13 Definition		4	RELAY-13 function (expansion module-2) selected from list
P_239	Relay 14 Definition		5	RELAY-14 function (expansion module-2) selected from list
P_240	Relay 15 Definition		0	RELAY-15 function (expansion module-2) selected from list
P_241	Relay 16 Definition		2	RELAY-16 function (expansion module-2) selected from list
P_242	Relay 17 Definition		4	RELAY-17 function (expansion module-2) selected from list
P_243	Relay 18 Definition		5	RELAY-18 function (expansion module-2) selected from list

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

00	Fuel
01	Alarm
02	Start
03	Stop
04	Gen. Contactor
05	Mains Contactor
06	Choke
07	Preheat
08	Shutdown alarm
09	Shutdown or load_dump alarm
10	Shutdown or load_dump or warning
11	Automatic ready
12	Week. on time
13	Exerciser on
14	Load_dump alarm
15	Fuel Main winding
16	Mains Fail
17	Block Heater
18	Service Request
19	-
20	Load Shedding Relay
21	Flashing Relay
22	Gas Solenoid
23	Fuel Pump
24	Mains Phase Order Fail
25	Genset Phase Order Fail
26	Idle Speed
27	Cooler Fan
28	2nd volt-frequency
29	Crank 1/2 Selector
30	-
31	-

32	Oil switch alarm
33	Temp switch alarm
34	Coolant Level switch alarm
35	Rectifier alarm
36	Emerg.Stop alarm
37	Spare-1 Alarm
38	Spare-2 Alarm
39	-
40	Oil sender alarm
41	Temp sender alarm
42	Low speed alarm
43	High speed alarm
44	Low voltage alarm
45	High voltagealarm
46	Fail to start alarm
47	Low fuel sender alarm
48	High oil temp alarm
49	-
50	-
51	High battery voltage alarm
52	Charge fail alarm
53	-
54	-
55	-
56	Oil switch load_dump
57	Temp switch load_dump
58	Coolant Level switch load_dump
59	Rectifier load_dump
60	Emerg.Stop load_dump
61	Spare-1 load_dump
62	Spare-2 load_dump
63	-
64	-
65	-
66	-
67	-
68	-
69	-
70	-
71	-
72	Overcurrent load_dump
73	Excess power ldd
74	Reverse power ldd
75	-
76	-
77	-
78	-
79	Genset Phase Order Fail Loaddump

80	Oil switch warning
81	Temp switch warn.
82	Coolant Level switch warning
83	Rectifier warning
84	Emerg Stop warn.
85	Spare-1 warning
86	Spare-2 warning
87	-
88	Oil sender warning
89	Temp sender warn.
90	Low speed warning
91	High speed warning
92	-
93	Low temp warning
94	Fail to stop warning
95	Low fuel sender warning
96	Service request warning
97	Mains Phase Order Fail
98	Low battery warning
99	High battery warning
100	Charge fail warning
101	-
102	-
103	-
104	Gen Low voltge warn.
105	Gen High voltge warn.
106	Reverse Power warn.
107	High oil temp warn.
108	-
109	-
110	-
111	-
112	-
113	-
114	-
115	-
116	-
117	-
118	-
119	-

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.

Phase-to-Phase AC voltages are not correct although Phase to Neutral voltages are correct:

-Incorrect phase order. Please connect phase voltages in the correct order.

KW and cosΦ 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 cosΦ 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.

Programming mode can not be entered:

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

Some program parameters are skipped:

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

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

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

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.

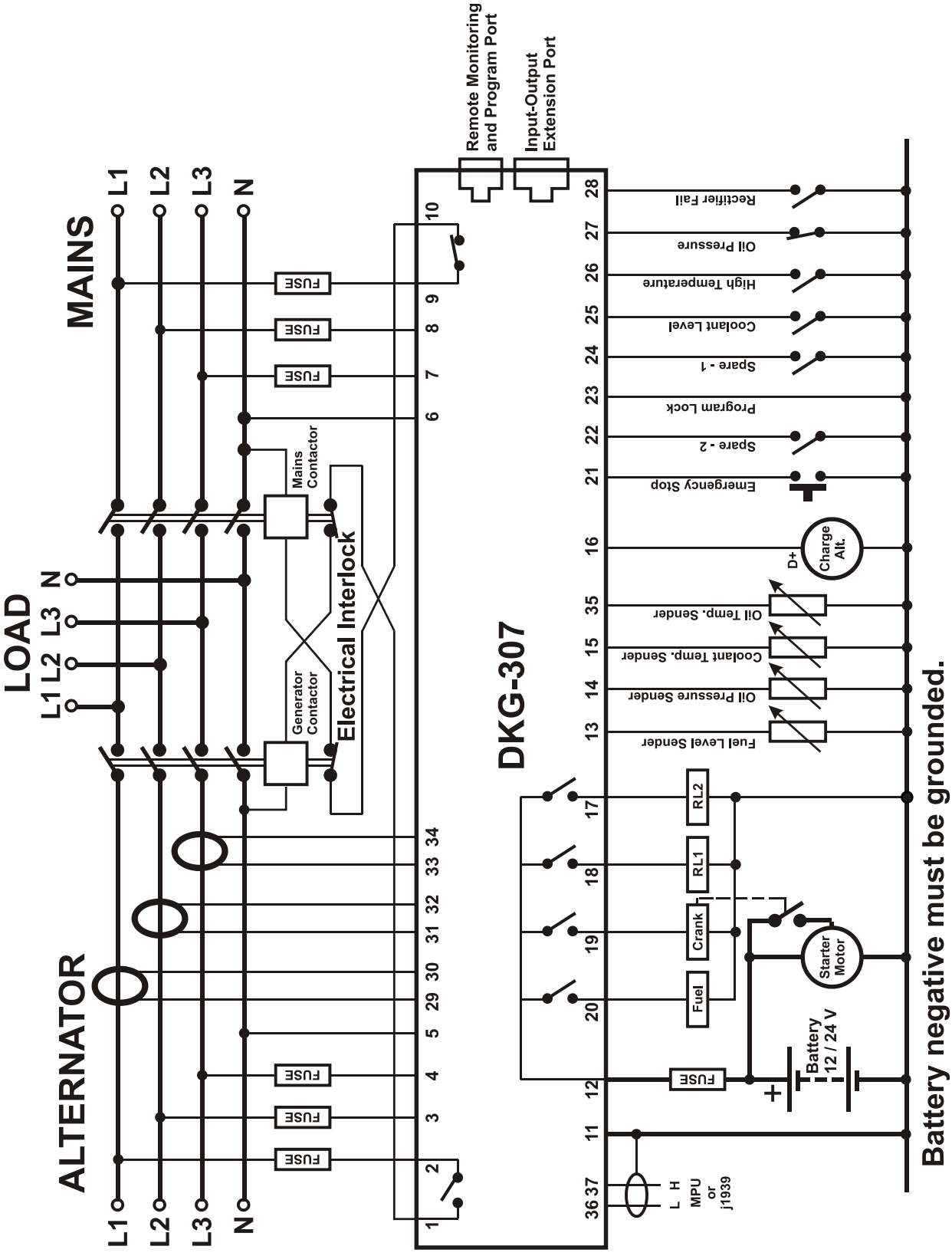
UL / CSA Conformity:

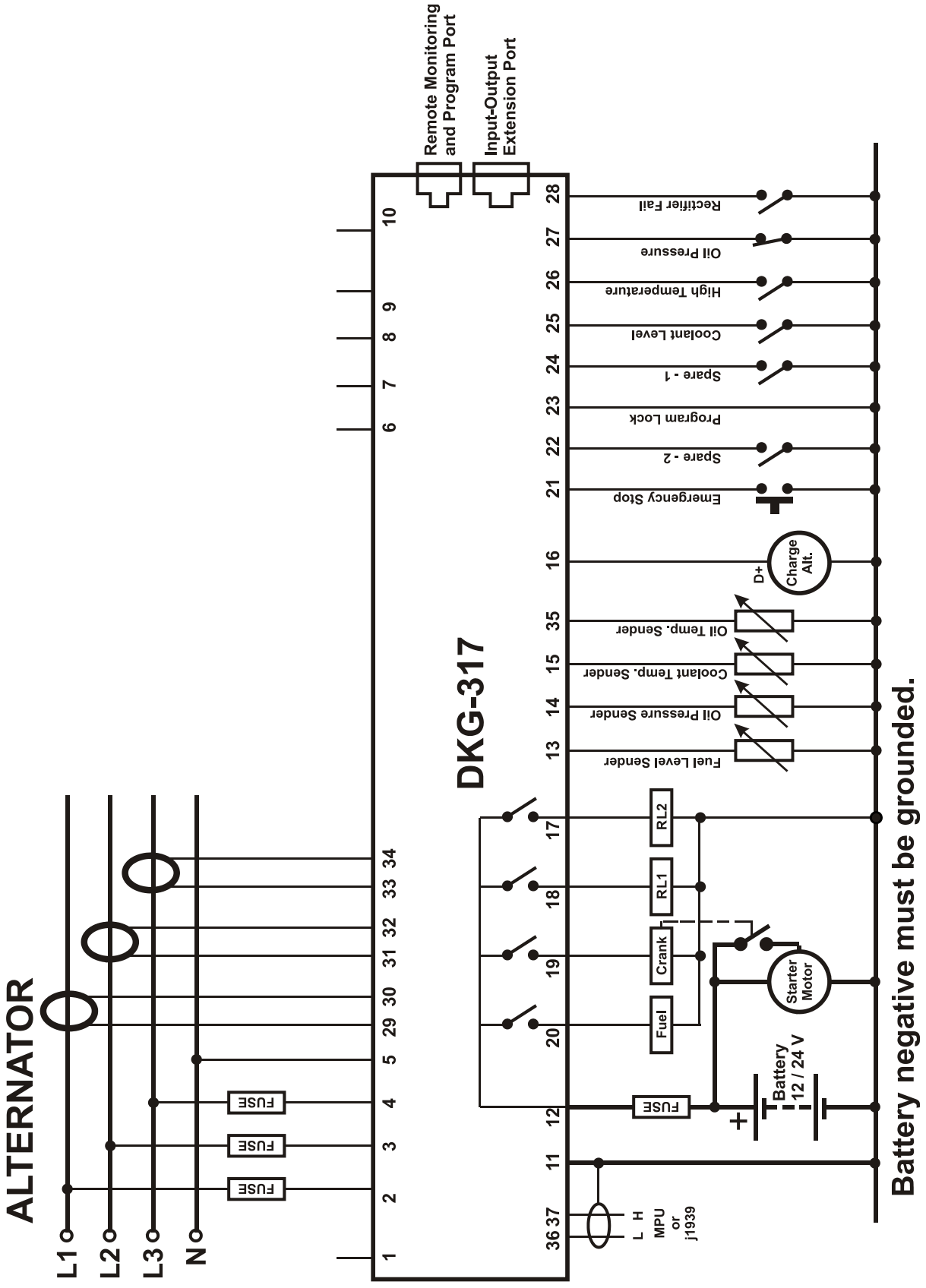
certificate # 20110527-E314374
UL 508, Edition 17
UL 2200, 1st Edition.
UL 840 Edition 3
CSA C22.2 NO. 14 - Edition 10

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.
DC Supply range: 9.0 VDC to 33.0 VDC
Cranking dropouts: survives 0 V for 100ms
Typical stand-by current consumption: 100 mADC.
Maximum current consumption: 250 mADC.
Generator/mains contactor outputs: 16 A @ 250 VAC.
DC outputs: 10A @ 28 VDC. relay outputs.
Charge alternator excitation: min 2W.
Magnetic pickup input:: 0.5 – 30 V-AC.
Magnetic pickup frequency: 10 KHz max.
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: RS-232. 9600 bauds, no parity, 1 stop bit.
Operating temperature range: -40°C to +70°C (-40 ºF to +158 ºF)
Storage temperature range: -55°C to +80°C (-67ºF to +176ºF)
Maximum humidity: 95%, non-condensing
Dimensions: 172x134x46mm (WxHxD)
Panel Cut-out dimensions: 151 x 111mm minimum.
Weight: 340 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




Remote Monitoring and Program Port
Input-Output Extension Port
DKG-317
ALTERNATOR
L1
L2
L3
N
FUSE
FUSE
FUSE
FUSE
Rectifier Fail
Oil Pressure
High Temperature
Coolant Level
Spare - 1
Program Lock
Spare - 2
Emergency Stop
D+
Charge Alt.
Oil Temp. Sender
Coolant Temp. Sender
Oil Pressure Sender
Fuel Level Sender
RL2
RL1
Crank
Fuel
Starter Motor
Battery 12 / 24 V
L H
MPU or j1939
Battery negative must be grounded.