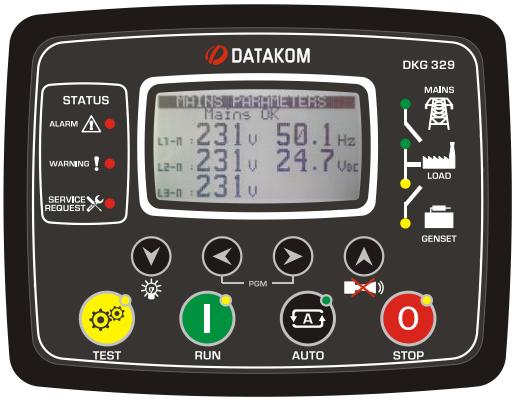
DKG-329_2G AUTOMATIC TRANSFER SWITCH CONTROLLER

2 GENSETS + MAINS



DESCRIPTION

The DKG-329 is a microprocessor controlled unit designed to control a 3-phase transfer panel featuring 1 mains and 2 gensets. It monitors 3-phase mains voltages, sends remote start commands to generating sets 1 and 2 and controls the changeover of generator and mains contactors.

The unit provides equal aging of gensets, running the next genset at each mains failure and periodically switching gensets during mains failures.

If a fault condition occurs, the unit disables the remote starting of the corresponding genset automatically and indicates the failure with led lamp and text.

The unit provides a comprehensive set of digitally adjustable program parameters. The unauthorized access to program parameters is prevented by a 3 level password system. All programs may be modified via front panel pushbuttons and do not require any 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 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.

FEATURES

True RMS measurements
Automatic contactor control for 2xGEN+1xMAINS
Equal aging of gensets
Automatic genset switching
Load shedding, dummy load
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
Multiple language support
Customer logo display capability
16 Amp contactor outputs
1 Amp DC semiconductor control outputs
Configurable digital inputs: 7
Configurable digital outputs: 2
Total digital outputs: 7
I/O expansion capability
Plug-in connection system
Sealed front panel

TABLE OF CONTENTS

1. INSTALLATION

1.1 Introduction to the Control Panel

The unit is a control and protection panel designed to monitor the 3-phase mains voltages, send remote start command to generating sets and make changeover of both generator and mains contactors. Gensets are supposed to be controlled by a “Remote Start” type control unit. It shows the measured values on its display. The unit is designed to provide user friendliness for both the installer and the user. Programming is usually simple, as the factory settings have been carefully selected to fit most applications. However programmable parameters allow the complete control over the load transfer. Programmed parameters are stored in a Non Volatile Memory and thus all information is retained even in the event of complete loss of power.

Measured parameters are:

Mains voltage phase L1-N
Mains voltage phase L2-N
Mains voltage phase L3-N
Mains voltage phase L1-L2
Mains voltage phase L2-L3
Mains voltage phase L3-L1
Mains frequency
Battery voltage

Gen 1 voltage phase L1-N
Gen 1 voltage phase L2-N
Gen 1 voltage phase L3-N
Gen 1 voltage phase L1-L2
Gen 1 voltage phase L2-L3
Gen 1 voltage phase L3-L1

Gen 2 voltage phase L1-N
Gen 2 voltage phase L2-N
Gen 2 voltage phase L3-N
Gen 2 voltage phase L1-L2
Gen 2 voltage phase L2-L3
Gen 2 voltage phase L3-L1

Load current phase L1
Load current phase L2
Load current phase L3
Gen frequency
Load total kW
Load total cosΦ

Load L1 kW
Load L2 kW
Load L3 kW
Load L1 kVAr
Load L2 kVAr
Load L3 kVAr
Load L1 cosΦ
Load L2 cosΦ
Load L3 cosΦ
Synchroscope phase angle

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.

Programmable digital inputs are compatible with both **‘normally open’** and **‘normally closed’** contacts, switching either to **BAT-** or **BAT+**.

1.3 Wiring the Unit

WARNING: THE UNIT IS NOT FUSED.
Use external fuses for Mains phases: L1,L2,L3, Generator phases: L1,L2,L3, Battery positive: BAT(+). Install the fuses as nearly as possible to the unit in a place easily accessible for the user.

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).***

Use cables of adequate current carrying capacity (at least 0.75mm^2) and temperature range.

2. INPUTS AND OUTPUTS

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

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

Term	Function	Technical data	Description
1	**GENERATOR 1 CONTACTOR**	Relay output, 16A-AC	This output provides energy to the generator 1 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 1-L1**	Generator 1 phase inputs, 0-300V-AC	Connect the generator 1 phases to these inputs. The generator 1 phase voltages upper and lower limits are programmable.
3	**GEN 1-L2**		
4	**GEN 1-L3**		
5	**GENERATOR 1 NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the generator 1 phases.
6	**GENERATOR 2 CONTACTOR**	Relay output, 16A-AC	This output provides energy to the generator 2 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.
7	**GEN 2-L1**	Generator 2 phase inputs, 0-300V-AC	Connect the generator 2 phases to these inputs. The generator 2 phase voltages upper and lower limits are programmable.
8	**GEN 2-L2**		
9	**GEN 2-L3**		
10	**GENERATOR 2 NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the generator 2 phases.
11	**MAINS NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the mains phases.
12	**MAINS-L3**	Mains phase inputs, 0-300V-AC	Connect the mains phases to these inputs. The mains voltages upper and lower limits are programmable.
13	**MAINS-L2**		
14	**MAINS-L1**		
15	**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.
16	**GROUND**	O VDC	Power supply negative connection.
17	**BATTERY POSITIVE**	+12 or 24VDC	The positive terminal of the DC Supply shall be connected to this terminal. The unit operates on both 12V and 24V battery systems.
18	**NC**		
19	**NC**		
20	**NC**		
21	**NC**		

Term	Function	Technical data	Description
22	**RELAY-1 GEN 1 ALARM**	Output 1A/28VDC	This relay is used for GEN 1 Alarm output.
23	**RELAY-2 GEN 2 ALARM**	Output 1A/28VDC	This relay is used for GEN 2 Alarm output.
24	**RELAY-4 GEN 2 REMOTE START**	Output 1A/28VDC	This relay is used for GEN 2 remote start signal.
25	**RELAY-3 GEN 1 REMOTE START**	Output 1A/28VDC	This relay is used for GEN 1 remote start signal.
26	**DIGITAL INPUT - 1: EMERGENCY STOP**	Digital inputs	These inputs have programmable characteristics selected via the program menu. Each input may be driven by a 'normally closed' or 'normally open' contact, switching either battery+ or battery-. The effect of the switch is also selectable from a list. See PROGRAMMING section for more details.
27	**DIGITAL INPUT - 2: GEN 1 ALARM**		
28	**PROGRAM LOCK**		
29	**DIGITAL INPUT - 3: GEN 2 ALARM**		
30	**DIGITAL INPUT - 4: 2nd VOLT/FREQ**		
31	**DIGITAL INPUT - 5: FAULT RESET**		
32	**DIGITAL INPUT - 6: ALARM MUTE**		
33	**DIGITAL INPUT - 7: PANEL LOCK**		
34	**CURR_1+**	Current transformer inputs, 5A-AC	Connect the load 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).
35	**CURR_1-**		
36	**CURR_2+**		
37	**CURR_2-**		
38	**CURR_3+**		
39	**CURR_3-**		

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.
LOAD 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.
TEST	Yellow	
OFF	Yellow	
AUTO	Green	
ALARM	Red	If a fault condition resulting to the engine shutdown has occurred, the alarm led turns on steadily. If a loaddump condition occurs, this led will flash. Alarms work on a first occurring basis. The occurrence of a fault will disable other faults of lower or equal priority.
WARNING	Red	If a warning condition has occurred, this led turns on steadily. The warnings work on a first occurring basis. The occurrence of a warning will disable other warnings, however shutdown and loaddump alarms are still allowed.
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 Language Selection

The unit is able to display information in 3 languages. Language selection is made through program parameter CONTROLLER CONFIGURATION > LANGUAGE SELECTION. Below selections are available:

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

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

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

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

3.3 Digital Display

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

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

Navigation between different screens s made with the ◄**MENU** and **MENU**► buttons. Each depression of the **MENU**► button switches the display to the next screen. Each depression of the ◄**MENU** button switches the display to the previous screen.

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

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

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

Screen	Description	Contents
1	Mains parameters (phase to neutral)	Genset status Mains Volts L1, Mains Frequency Mains Volts L2 , Battery Voltage Mains Volts L3,
2	Mains parameters (phase to phase)	Genset status Mains Volts L1-L2, Mains Frequency Mains Volts L2-L3, Battery Voltage Mains Volts L3-L1,
3	Genset 1 parameters (phase to neutral)	Genset 1 status Genset 1 Volts L1, Genset 1 Frequency Genset 1 Volts L2, Battery Voltage Genset 1 Volts L3,
4	Genset 1 parameters (phase to phase)	Genset 1 status Genset 1 Volts L1-L2, Genset 1 Frequency Genset 1 Volts L2-L3, Battery Voltage Genset 1 Volts L3-L1,
5	Genset 2 parameters (phase to neutral)	Genset 2 status Genset 2 Volts L1, Genset 2 Frequency Genset 2 Volts L2, Battery Voltage Genset 2 Volts L3,
6	Genset 2 parameters (phase to phase)	Genset 2 status Genset 2 Volts L1-L2, Genset 2 Frequency Genset 2 Volts L2-L3, Battery Voltage Genset 2 Volts L3-L1,
7	Load parameters (currents)	Genset status Load Current L1, Load Frequency Load Current L2, Load Active Power (kW) Load Current L3, Load Power Factor
8	Load Phase Power parameters	Genset status Genset Phase L1 : Active Power(kW) / Power Factor Genset Phase L2 : Active Power(kW) / Power Factor Genset Phase L3 : Active Power(kW) / Power Factor
9	Load Phase Power parameters	Genset status Genset Phase L1 : Reactive Power(kVAr) Genset Phase L2 : Reactive Power(kVAr) Genset Phase L3 : Reactive Power(kVAr)
8	Synchroscope	Phase Angle Voltage difference mains_L1 – gen_L1 Frequency difference mains-gen Angle difference mains-gen
10	Company Logo	DATAKOM
11	Alarm List	If no alarm exists, ‘END OF ALARM LIST’ will be displayed. Existing alarms, load_dumps and warnings will be displayed as one screen for each entry. Switching to the next entry will be made with the ▼ button.
12	Date-Time, Software Version	Date and time. Operating software version. Active Genset
13	Statistical Counters 1 / 2	Active Time Engine 1 Hours Run Engine 2 Hours Run
14	Statistical Counters 2/ 2	Mains kwh Gen 1 kwh Gen 2 kwh
15	Event Records	The unit provides information about last 100 events, starting from the most recent one. Please review chapter 10 for detailed information about event logging.

4. ALARMS AND WARNINGS

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

1- **ALARMS:** These are the most important fault conditions and cause:
- The **ALARM** led to be on steadily,
- The genset contactor to be released immediately,
- The engine to be stopped immediately,
- The **Horn**, **Alarm**, **Alarm+Load_dump** and **Alarm+Load_dump+Warning** digital outputs to operate, (if selected via programming menu)

2- **LOAD_DUMPS:** These fault conditions cause:
- The ALARM led to flash,
- The genset contactor to be released immediately,
- The engine to be stopped after Cooldown period,
- The **Horn**, **Alarm+Load_dump** and **Alarm+Load_dump+Warning** digital outputs to operate, (if selected via programming menu)

3- **WARNINGS:** These conditions cause:
- The WARNING led to be on steadily,
- The **Horn** and **Alarm+Load_dump+Warning** digital outputs to operate, (if selected via programming menu)

If the ALARM MUTE button is 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.

EMERGENCY STOP: Set if a signal is detected at the emergency stop input.
SPARE-1 / SPARE-2: Set if a signal is detected from the related spare fault input.
MAINS CB FAIL TO CLOSE (warning): Set if the mains contactor feed back input is not active at the end of mains contactor timeout when mains contactor is activated. Enabled if one of digital inputs assigned as mains contactor feed back input.
MAINS CB FAIL TO OPEN (load_dump): Set if the mains contactor feed back input is still active at the end of mains contactor timeout when mains contactor is deactivated. Enabled if one of digital inputs assigned as mains contactor feed back input.
GENSET CB FAIL TO CLOSE (warning): Set if the genset contactor feed back input is not active at the end of genset contactor timeout when genset contactor is activated. Enabled if one of digital inputs assigned as genset contactor feed back input.
GENSET CB FAIL TO OPEN (warning): Set if the genset contactor feed back input is still active at the end of genset contactor timeout when genset contactor is deactivated. Enabled if one of digital inputs assigned as genset contactor feed back input. The mains contactor cannot operate when this warning is up.
LOW SPEED / HIGH SPEED: Set if the generator frequency is outside programmed limits. These faults will be monitored with **Holdoff Timer** delay after the engine is running. Low and high limits for warning and alarm are separately programmable. Another high frequency shutdown limit which is 12% above the high limit is always monitored and stops the engine immediately.
STOP FAIL (warning): Set if the engine has not stopped before the expiration of the **Stop Timer**.

OVERLOAD (load_dump): Set if at least one of the genset phase currents goes over the **Overcurrent Limit** for **Overload Timer**. If currents goes below the limit before expiration of the timer then no alarm will be set.
EXCESS POWER (load_dump): Set if the genset power (kW) supplied to the load goes over the **Excess Power** limit for **Overload Timer**. If the power goes below the limit before expiration of the timer then no alarm will be set.
GENSET LOW VOLTAGE: Set if any of the generator phase voltages goes outside programmed limits for **Overload Timer**. This fault will be monitored with **holdoff timer** delay after the engine is running.
GENSET HIGH VOLTAGE: Set if any of the generator phase voltages goes outside programmed limits for **Overload Timer**. This fault will be monitored with **holdoff timer** delay after the engine is running.
LOW BATTERY VOLTAGE (warning): Set if the battery voltage goes below the programmed limit.
HIGH BATTERY VOLTAGE: Set if the battery voltage goes above programmed limits. Both warning and alarm levels for high battery voltage are programmable.
MAINS PHASE ORDER FAIL (warning): Set if the mains phase order checking is enabled, mains phases are present and mains phase order is reversed. This fault prevents the Mains Contactor to close.

5. MODES OF OPERATION

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

OFF: 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 and the REMOTE START output will be activated at the end of the start wait period. 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.

Equal aging of the gensets is often required.Thus, Genset 1 Max Run Time and Genset 2 Max Run Time parameters must be adjusted accordingly. If mains failure occurs, unit will activate Remote Start output of the next genset which must complete max run hour timer. If a fault condition occurs or max run time is completed for running genset, Remote Start output for other genset will be activated.

For example, both Genset 1 Max Run Time and Genset 2 Max Run Time are adjusted as 120min. One of the mains phase voltages is outside limits, the mains contactor will be deactivated and Remote Start 1 output will be activated. Genset 1 will run for 2 hours and when the timeout occurs, Remote Start 2 output will be activated. Load will switchover from genset 1 to genset 2 and genset 1 will stop. If mains recovers 1 hour later after genset 2 running, the unit will activate Remote Start 2 output at the next mains failure to complete the remaining 1 hour. After 1 hour, Remote Start 1 output will be activated to switchover the load from genset 2 to genset 1.

It is quite clear that if any of the max run time parameters are left 0, equal aging will be disabled and genset will be running as long as any faulty condition occurs.

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 cooling period is given, the REMOTE START output will be active during the cooling period. At the end of the period, the REMOTE START output 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.

TEST: 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.

LOAD 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. LOAD TRANSFER MODES

The unit has two ways of transferring the load from genset to mains and vice versa.

These modes are:
-transfer with interruption.
-no break transfer.

6.1 Transfer with Interruption

This is the most conventional way of transferring the load between the genset and mains. There will be a power interruption period duration during the transfer. Note that the program parameters **Mains Contactor Timer** and **Genset Contactor Timer** define the power interruption period.

If this transfer method is used, it is advised to make an electrical interlock between contactors to prevent a phase to phase short circuit.

Transfer from genset to mains:
-The generator contactor releases,
-The unit waits for Mains Contactor Timer
-The mains contactor is energized.

Transfer from mains to genset:
-The mains contactor releases,
-The unit waits for Genset Contactor Timer
-The generator contactor is energized.

6.1 No Break Transfer

In this mode, the transfer will be made **without power interruption**. This implies that both of the mains and generator contactors will be active during transfer.

The maximum duration that both contactors will be activated is programmable. However this process may be quicker with the use of one auxiliary contact at each contactor. Thus the changeover will be quite instantaneous, preventing any excess or reverse power condition. Any digital input can be programmed for genset contactor auxiliary contact and mains contactor auxiliary contact.

To prevent a phase to phase short circuit below criteria must be met:
-The mains and generator voltages must be equal,
-The mains and generator voltages must have the same phase,
-The mains and generator voltages must have the same phase sequence order.

The unit will allow a **No Break Transfer** only if **all** of the below conditions are fulfilled:
-Mains phase voltages within the programmed limits,
-Mains frequency within the programmed limits,
-Genset phase voltages within the programmed limits,
-Genset frequency within the programmed limits,
-Mains phase order correct (or phase order check must be disabled),
-Genset phase order correct (or phase order check must be disabled),
-The difference between mains and genset frequencies not more than programmed limit,
-The voltage difference between mains_L1 and genset_L1 not more than programmed limit,
-The phase angle between mains_L1 and genset_L1 not more than programmed limit,

When a **No Break Transfer cycle** is initiated, the unit checks all the above criteria to be satisfied as long as the **Synchronization Fail Timeout** is not expired.

Normally with frequencies matching at +/- 2Hz and voltages matching at +/-10 volts an **uncontrolled No Break Transfer** will be successfull.

If synchronization conditions are not met at the expiration of the **Synchronization Fail Timeout**, then the unit reverts to a **Transfer with Interruption**.

If matching is found before the expiration of the **Synchronization Fail Timeout,** then both contactors will be activated. If contactor auxiliary contacts are used, the other contactor will release immediately. If contactor auxiliary contacts are not used, the other contactor will release after **contactor timeout.**

The unit has a set of programmable parameters to define the No Break Transfer operation. These parameters are:

Mains Voltage Low Limit (Electrical Parameters): Each of the mains phase voltages must be over this limit.

Mains Voltage High Limit (Electrical Parameters): Each of the mains phase voltages must be below this limit.

Mains Frequency Low Limit (Electrical Parameters): The mains frequency must be over this limit.

Mains Frequency High Limit (Electrical Parameters): The mains frequency must be below this limit.

Genset Voltage Low Limit (Electrical Parameters): Each of the genset phase voltages must be over this limit.

Genset Voltage High Limit (Electrical Parameters): Each of the genset phase voltages must be below this limit.

Low Frequency Shutdown (Engine Parameters): The genset frequency must be over this limit.

Low Frequency Warning (Engine Parameters): The genset frequency must be over this limit.

High Frequency Shutdown (Engine Parameters): The genset frequency must be below this limit.

High Frequency Warning (Engine Parameters): The genset frequency must be below this limit.

Genset Phase Order Enable(Electrical Parameters): If set , this parameter will enable the phase order check for genset. The phase order check should be disabled only in single phase gensets.

Mains Phase Order Enable(Electrical Parameters): If set, this parameter will enable the phase order check for mains.

No Break Transfer(Controller Config Parameters): This parameter enables/disables the No Break Transfer feature.

Max Frequency Difference(Controller Config Parameters): This is the maximum difference between mains and genset frequencies to enable a **NO Break Transfer**.

Max Voltage Difference(Controller Config Parameters): This is the maximum difference between the mains_L1 and genset_L1 voltages to enable a **NO Break Transfer**.

Max Phase Difference(Controller Config Parameters): This is the maximum phase difference between the mains_L1 and genset_L1 to enable a **No Break Transfer**.

Synchronization Fail Timeout (Controller Config Parameters): If the phase and voltage synchronization is not successful before the expiration of this timer, then the unit terminates the **No Break Transfer** and makes a Transfer with Interruption.

Contactor Timeout (Controller Config Parameters): This is the maximum time duration in which both contactors are active in case of **No Break Transfer**.

Any digital input may be assigned as mains and genset contactor feedback input for faster transfer. For this, "**digital input function select parameter group"** is used to select the function and "**input configuration parameter group**" is used to configure digital inputs. The **action** parameter should be set to **3** and "**always active**" option should be selected for both contactor feedback inputs. **NC** type must be selected for mains contactor feedback input.(Pls refer to programming chapter for more detailed explanation)

7. OTHER FEATURES

7.1 Remote Start Operation

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

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

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

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

7.2 Mains Simulation (Disable Start)

The unit offers an optional **SIMULATE MAINS** signal input. Any digital input may be assigned as **Simulate Mains** using **Input Function Select** program parameters**.**

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

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

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

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

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

7.3 Delayed Mains Simulation, Battery Charging

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

The unit offers an optional **SIMULATE MAINS** signal input. Any digital input may be assigned as **Simulate Mains** using **Input Function Select** program parameters**.**

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

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

If the **Delayed Simulate Mains** program parameter is set to 1 and the input signal is active when the genset is not feeding the load, the mains phases are not monitored and supposed to be inside limits. This will prevent the genset from starting when the simulate mains signal is present (batteries charged). The genset will start when mains voltages are out of limits and the simulate mains signal not present.

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

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

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

The RE
FORCE

7.4 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.

7.5 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.

7.6 Date & Time Display

The date & time display is provided for verification.

7.7 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.

7.8 Modem Connection

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

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

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

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

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

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

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

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

Please note that the modem operation is also compatible with the MODBUS communication. Thus the unit can iniate and receive calls to/from a MODBUS master station. Please review chapter_8 for more details on MODBUS communication.

7.9 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)

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

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

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

A sample GSM SMS message is given below:

DKGxxx <SITE-ID>
STOP : EMERGENCY STOP.
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.

7.10 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.

7.11 External Control of the Unit

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

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

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

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

7.12 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 **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.

The unit will test both of the gensets one by one. When exercise day and time have come, Remote Start 1 output will be activated firstly. When timeout of exercise duration occurs for genset 1, the unit will activate Remote Start 2 output to test genset 2 and genset 1 will stop.

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.

7.13. Resuming to factory set parameters

In order to resume to the factory set parameter values:

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

It is not possible to restore user parameters.

7.14. 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.

7.15. Firmware Update

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

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

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

The firmware update operation will take around 3 minutes.

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

7.16. Pre-Transfer Signal

The controller is able to provide a pre-transfer digital output function.

This function is designed for elevator systems, in order to bring the cabin to a floor and open cabin doors before transfer.

The duration where this output is active is adjusted with the **Pre-Transfer Delay** parameter.

If the Pre-transfer Delay parameter is not zero, this will delay transfers by the same amount.

The Pre-Transfer signal may be assigned to any digital output.

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 1 Phase L1 voltage
0004	R	16bit	x1	Genset 1 Phase L2 voltage
0005	R	16bit	x1	Genset 1 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
0009	R	16bit	x1	Genset 2 Phase L1 voltage
000A	R	16bit	x1	Genset 2 Phase L2 voltage
000B	R	16bit	x1	Genset 2 Phase L3 voltage
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 1 Phase L12 voltage
0010	R	16bit	x1	Genset 1 Phase L23 voltage
0011	R	16bit	x1	Genset 1 Phase L31 voltage
0012	R	16bit	x10	Mains frequency
0013	R	16bit	x10	Genset 1 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.
0019	R	16bit	x1	Genset 2 Phase L12 voltage
001A	R	16bit	x1	Genset 2 Phase L23 voltage
001B	R	16bit	x1	Genset 2 Phase L31 voltage
001C	R	16bit	x1	Genset 2 frequency
002F	R	16bit	x10	Battery voltage
003D	R	8bit	-	Operating mode bit_3: manual bit_5: off bit_7: load test bit_4: auto bit_6: test

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. The events are always displayed starting from the most recent one.

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

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

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

To exit event record pages please hold pressed ◄MENU or MENU► buttons.

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

Event sources are:

-Shutdown alarms, Load dump alarms, Warnings
-Operating mode change (OFF, AUTO, etc…)
-Periodic records.

Event record contents are:

Event type (alarms, mode change, periodic, etc…)
Date and time
Operating mode (AUTO, MANUAL,OFF,TEST, LOAD TEST)
Genset 1 state (mains ok, running, cooldown etc…)
Genset 2 state (mains ok, running, cooldown etc…)
Genset 1 phase voltages L1-L2-L3
Genset 1 frequency
Genset 2 phase voltages L1-L2-L3
Genset 2 frequency
Load phase currents L1-L2-L3
Load active power (kW)
Load power factor
Battery voltage
Mains phase voltages L1-L2-L3
Mains frequency
Digital input statuses

11. STATISTICAL COUNTERS

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

The counters consist on:
-Engine 1 run hours
-Engine 2 run hours
-Mains kWh
-Gen 1 kWh
-Gen 2 kwh

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

12. MAINTENANCE

DO NOT OPEN THE UNIT

There are NO serviceable parts inside the unit.

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

13. PROGRAMMING

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

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

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

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

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

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

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

Passwords can only be modified through Rainbow program.

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

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

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

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

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

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

Program Group: Controller Configuration

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) LCD Contrast	-	22	This parameter is used to set LCD contrast. Adjust for the best viewing angle.
(2) Language	-	0	**0:** English language selected. **1:** Turkish language selected. This language may depend on the country where the unit is intended to be used. **2:** Chinese language selected **3:** The unit will ask for manual language selection at power-on.
(2) Line-to-Line Voltages	-	0	**0:** Display Line to Neutral voltages as default **1:** Display Line to Line voltages as default
(1) Genset Default Display	-	0	This parameter selects the screen which is displayed during genset on load operation. **0:** screen 3 (or 4) electrical, large characters **1:** screen 5 engine parameters, large characters **2:** screen 6 (or 7) maximum information, small characters **3:** screen 8 (or 9) Details of each screen are explained in chapter 3.2
(2) Fault Holdoff Timer	sec	12	This parameter defines the delay after the engine runs and before the fault monitoring is enabled.
(1) Alarm Relay Timer	sec	60	This is the period during which the **ALARM** relay is active. If the period is set to 0, this will mean that the period is unlimited.
(1) Intermittent Alarm Relay	-	0	**0:** continuous **1:** intermittent (turns on and off every second)
(1) Emergency Backup Operation	-	0	**0:** In TEST mode, the load will not be transferred to the genset even if the mains fail. **1:** In TEST mode, the load will be transferred to the genset if the mains fail.
(1) Exercise Day and Time	-	168	This parameter defines the start day and hour of the exerciser. Values higher or equal to 168 mean that the exerciser is off. The exercise may be selected to start at the beginning of the any hour of the week. The parameter value is the hour count of the start time. Examples: 0 = exercise starts at Monday 00:00 8 = exercise starts at Monday 08:00 24 = exercise starts at Tuesday 00:00 167 = exercise starts at Sunday 23:00 168 = exerciser off If a daily exercise is selected, then the day information is don't care and the exercise will be performed every day regardless of the day selection. If the monthly exerciser is selected, then the exercise will be performed during the first 7 days of each month at the programmed day and hour.

Program Group: Controller Configuration (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(1) Exercise Duration	min	10	This parameter defines the exercise duration and programmed in 10 minute steps up to 24 hours.
(1) Exercise Off/On Load	-	0	**0:** Exercise at **TEST** mode **1:** Exercise at **LOAD TEST** mode
(1) Exercise Period	-	1	**0:** exercise every day (the exercise will be performed every day regardless of the day selection of Exercise Dat and Time parameter). **1:** exercise once per week **2:** exercise once per month (the exercise will be performed during the first 7 days of each month at the programmed day and hour).
(2) Delayed Simulate Mains	-	0	**0:** The **SPARE-2** input has normal function **1:** The **SPARE-2** input has delayed simulate mains function. See chapter 7.3for more info.
(2) Modem Enable	-	0	**0:** No modem connection, the serial port is connected to PC **1:** Modem connected.
(2) SMS Enable	-	0	**0:** SMS not enabled **1:** SMS enabled
(2) MODBUS Address	-	0	**0:** RAINBOW communication protocol. **1-144:** MODBUS communication. This parameter is also the MODBUS controller address of the unit.
(1) Real Time Clock Adjust	-	117	This parameter trims precisely the real time clock circuit. Values from 0 to 63 speed up the clock with 0.25sec/day steps. Values from 127 to 64 slow down the clock with 0.25sec/day steps.
(2) Hysteresis Voltage	V	8	This parameter provides the mains and genset voltage limits with a hysteresis feature in order to prevent faulty decisions. For example, when the mains are present, the mains voltage low limit will be used as the programmed low limit. When the mains fail, the low limit will be incremented by this value. It is advised to set this value to 8 volts.
(2) 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
(2) Minimum ready input number for transfer	-	0	This parameter defines minimum activated input number required to start transfer the load from mains to genset.
(2) Ready bypass timeout	-	0	0: The unit will wait undefinitely until the minimum number of gensets (defined in above parameter) are ready before transfer. 1 to 255: The unit will transfer the load at the expiration of this timer, even if the minimum number of ready gensets is not reached.

Program Group: Controller Configuration (continued)

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(3) No Break Transfer Enable	-	0	0: No break transfer disabled. 1: No break transfer enabled.
(3) Max Voltage Difference	V	10	This is the maximum difference between the mains phase-L1 and the genset phase-L1 voltages to enable a **NO Break Transfer**.
(3) Max Frequency Difference	Hz	2.0	This is the maximum difference between mains and genset frequencies to enable a **NO Break Transfer**.
(3) Max Phase Angle Difference	Deg	10	This is the maximum phase difference between the mains phase-L1 and the genset phase-L1 to enable a **NO Break Transfer**.
(3) Synchronization fail Timeout	Sec	30	If the phase and voltage synchronization is not successful before the expiration of this timer, then a **Synchronization Fail Warning** is given and the unit reverts to **No Break Transfer** making a conventional changeover.
(3) Contactor Timeout	Sec	1	This is the maximum time duration in which both contactors are active in case of **No Break Transfer**. It is advised to set this timer to 1sec maximum.
(2) CT Location	-	0	**0:** CTs at genset side **1:** CTs at load side **2:** CTs at mains side
(2) Pre-Transfer Delay	Sec	0	If this parameter is not zero, the unit will activate the **Pre-Transfer** output function during this timer, before initiating a load transfer. This function is designed for elevator systems, in order to bring the cabin to a floor and open doors before transfer.
(2) Genset 1 Max Run Time	Min	1	This is the maximum running time of genset 1. At the end of this timer, Remote Start 2 output will be activated and genset contactor 1 output will be released.
(2) Genset 2 Max Run Time	Min	0	This is the maximum running time of genset 2. At the end of this timer, Remote Start 1 output will be activated and genset contactor 2 output will be released.

Program Group: Electrical Parameters

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) Current Transformer Ratio	A	500	This is the rated value of current transformers. All transformers must have the same rating. The secondary of the transformer will be 5 Amps.
(2) Overcurrent Limit	A	0	If the current goes above this limit, during the period defined in **Overload Timeout** then a **Overcurrent Load Dump** alarm will be generated. If this parameter is 0 then Overcurrent check is disabled.
(2) Excess Power Limit	kW	0	If the active power goes above this limit, during the period defined in Overload Timeout then an **Excess Power Load Dump** alarm will be generated. If this parameter is 0 then Excess Power check is disabled.
(2) Overload Timeout	sec	5	This is the period between the current or active power go over the limits and **OVERCURRENT** or **EXCESS POWER** Load Dump alarms occur. This is also the period between the 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.
(2) Multi Genset Fault Delay	sec	30	If the "**minimum ready input number**" for transfer parameter is set to more than 1, (multi genset system) this parameter is used for voltage or frequency shutdown fault delay instead of **Overload Timeout,** in order to allow the system survive in case of failure on one genset. If another genset can start and feed the load before the expiration of this timer then no alarm condition will be generated.
(1) Mains Voltage Low Limit	V	170	If one of the mains phases goes under this limit, it means that the mains are off and it starts the transfer to the genset in **AUTO** mode.
(1) Mains Voltage High Limit	V	270	If one of the mains phases goes over this limit, it means that the mains are off and it starts the transfer to the genset in **AUTO** mode.
(2) Genset Low Voltage Shutdown Limit	V	170	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.
(2) Genset Low Voltage Warning Limit	V	180	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a **GENSET LOW VOLTAGE** warning.
(2) Genset High Voltage Warning Limit	V	260	If one of the generator phase voltages goes above this limit when feeding the load, this will generate a **GENSET HIGH VOLTAGE** warning.
(2) Genset High Voltage Shutdown Limit	V	270	If one of the generator phase voltages goes over this limit when feeding the load, this will generate a **GENSET HIGH VOLTAGE** alarm and the engine will stop.

Program Group: Electrical Parameters (continued)

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

Program Group: Engine Parameters

Parameter Definition, (Password Level)	Unit	Factory Set	Description
(2) Low Frequency Shutdown	Hz	30	If the genset frequency goes under this limit, a **GENSET LOW SPEED** alarm is generated and the engine stops.
(1) Low Frequency Warning	Hz	35	If the genset frequency goes under this limit, a **GENSET LOW SPEED** warning is generated.
(1) High Frequency Warning	Hz	54	If the genset frequency goes over this limit, a **GENSET HIGH SPEED** warning is generated.
(2) High Frequency Shutdown	Hz	55	If the genset frequency goes over this limit, a **GENSET HIGH SPEED** alarm is generated and the engine stops.
(2) Engine Start Delay	sec	0	This is the time between the mains fails and the fuel solenoid turns on before starting the genset. It prevents unwanted genset operation in battery backed-up loads.
(2) Start Request Timer	sec	60	This is the waiting timer between the Remote Start output activates and the phase voltages / frequency become within limits.
(1) Engine Heating Timer	sec	4	This is the period used for engine heating following the program parameter.
(1) Cooldown Timer	min	1.0	This is the period that the generator runs for cooling purpose after the load is transferred to mains.
(1) Stop Solenoid Timer	sec	10	This is the maximum time duration for the engine to stop. During this period the STOP relay output is energized (if assigned by **Relay Definitions**). If the genset has not stopped after this period, a **FAIL TO STOP** warning occurs.
(1) Service Engine Hours	hour	50	The SERVICE REQUEST led indicator will turn on after this quantity of engine hours from the last service. If the period is set to ‘0’ no SERVICE REQUEST will be generated depending on engine hours.
(1) Service Period	month	6	The SERVICE REQUEST led indicator will turn on after this amount of time from the last service. If the period is set to ‘0’ no SERVICE REQUEST will be indicated depending on time.

Program Group: Adjust Date and Time (password level-2)

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

Program Group: Weekly Schedule (password level-2)

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

Program Group: Input Configuration (Emergency Stop) (password level-2)

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

Program Group: Input Configuration (Genset 1 Alarm Input) (password level-2)

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

Program Group: Input Configuration (Genset 2 Alarm Input) (password level-2)

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

Program Group: Input Configuration (2nd Volt/Freq Select Input) (password level-2)

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

Program Group: Input Configuration (Fault Reset) (password level-2)

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

Program Group: Input Configuration (Alarm Mute) (password level-2)

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

Program Group: Input Configuration (Panel Lock) (password level-2)

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

The parameters below define the functions of relay outputs. The unit has 6 relay outputs. The fixed function relays are Remote Start 1, Remote Start 2, Mains Contactor, Generator Contactor 1 and Generator Contactor 2. 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)

Parameter Definition	Unit	Fac.Set	Description
Relay 01 Definition		10	RELAY-1 function selected from list
Relay 02 Definition		27	RELAY-2 function selected from list
Relay 03 Definition		0	RELAY-3 function (expansion module) selected from list
Relay 04 Definition		2	RELAY-4 function (expansion module-1) selected from list
Relay 05 Definition		4	RELAY-5 function (expansion module-1) selected from list
Relay 06 Definition		5	RELAY-6 function (expansion module-1) selected from list
Relay 07 Definition		0	RELAY-7 function (expansion module-1) selected from list
Relay 08 Definition		2	RELAY-8 function (expansion module-1) selected from list
Relay 09 Definition		4	RELAY-9 function (expansion module-1) selected from list
Relay 10 Definition		5	RELAY-10 function (expansion module-1) selected from list
Relay 11 Definition		0	RELAY-11 function (expansion module-2) selected from list
Relay 12 Definition		2	RELAY-12 function (expansion module-2) selected from list
Relay 13 Definition		4	RELAY-13 function (expansion module-2) selected from list
Relay 14 Definition		5	RELAY-14 function (expansion module-2) selected from list
Relay 15 Definition		0	RELAY-15 function (expansion module-2) selected from list
Relay 16 Definition		2	RELAY-16 function (expansion module-2) selected from list
Relay 17 Definition		4	RELAY-17 function (expansion module-2) selected from list
Relay 18 Definition		5	RELAY-18 function (expansion module-2) selected from list

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

00	Remote Start 1
01	Alarm
02	-
03	-
04	Gen. Contactor
05	Mains Contactor
06	Remote Start 2
07	-
08	Shutdown alarm
09	Shutdown or load_dump alarm
10	Gen 1 Alarm
11	Automatic ready
12	Week. on time
13	Exerciser on
14	Load_dump alarm
15	Pre-Transfer signal
16	Mains Fail
17	-
18	Service Request
19	-
20	Load Shedding Relay
21	-
22	-
23	-
24	Mains Phase Order Fail
25	Genset Phase Order Fail
26	-
27	Gen 2 Alarm
28	Alternate Volt/Freq Enabled
29	-
30	-
31	-
32	-
33	-
34	-
35	-
36	Emerg.Stop alarm
37	Spare-1 Alarm
38	Spare-2 Alarm
39	-
40	-

41	-
42	Low speed alarm
43	High speed alarm
44	Low voltage alarm
45	High voltagealarm
46	-
47	-
48	-
49	-
50	-
51	High battery voltage alarm
52	-
53	-
54	-
55	-
56	-
57	-
58	-
59	-
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	Mains CB Fail To Close
78	Mains CB Fail To Open
79	Genset Phase Order Fail Loaddump

80	-
81	-
82	-
83	-
84	Emerg Stop warn.
85	Spare-1 warning
86	Spare-2 warning
87	-
88	-
89	-
90	Low speed warning
91	High speed warning
92	-
93	-
94	Fail to stop warning
95	-
96	Service request warning
97	Mains Phase Order Fail
98	Low battery warning
99	High battery warning
100	-
101	-
102	-
103	Synchronization Fail
104	-
105	Gen Low voltge warn.
106	Gen High voltge warn.
107	Reverse Power warn.
108	-
109	-
110	Gen CB Fail To Close
111	Gen CB Fail To Open
112	-
113	-
114	-
115	-
116	-
117	-
118	-
119	-
120	-

The parameters below define the functions of digital inputs, selected from a list. Functions from 12 to 23 activate also the related operating sequence.

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

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

Parameter Definition	Fact. Set	Description
Input 01 Function Select	4	Emergency Stop
Input 02 Function Select	5	Gen-1 Alarm
Input 03 Function Select	6	Gen-2 Alarm
Input 04 Function Select	16	2nd Volt-Freq Select
Input 05 Function Select	21	Fault Reset
Input 06 Function Select	22	Alarm Mute
Input 07 Function Select	23	Panel Lock

Input Function Select List

Number	Description
0	Genset Contactor Sw.
1	Mains Contactor Sw.
2	Spare-1 Input
3	Spare-2 Input
4	Emergency Stop
5	Gen-1 Alarm
6	Gen-2 Alarm
7	Genset-1 Ready
8	Genset-2 Ready
9	Genset-3 Ready
10	Genset-4 Ready
11	Genset-5 Ready
12	Force AUTO Mode
13	Force OFF Mode
14	Force TEST Mode
15	Force LOAD TEST Mode
16	Spare-3 Input
17	Spare-4 Input
18	Remote Start Input
19	Disable Auto Start
20	Force to Start
21	Fault Reset
22	Alarm Mute
23	Panel Lock

Program Group: Site Id (password level-2)

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

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

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

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

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

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

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

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

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

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

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

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

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

14. TROUBLESHOOTING

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

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

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

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

kW and 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.

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.

The unit is inoperative:

Measure the DC-supply voltage between Bat+ and Bat- terrminals at the rear of the unit. If OK, turn all fuses off, then turn all 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 cannot be modified:

These parameters are reserved for factory setting and require a higher level password.

15. DECLARATION OF CONFORMITY

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

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

16. TECHNICAL SPECIFICATIONS

Alternator voltage: 0 to 300 V-AC Phase to Neutral (0 to 520 V-AC Phase to Phase)
Alternator frequency: 0-100 Hz.
Mains voltage: 0 to 300 V-AC Phase to Neutral (0 to 520 V-AC Phase to Phase)
Mains frequency: 0-100 Hz.
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: 200 mADC.
Generator/mains contactor outputs: 16 A @ 250 VAC.
DC outputs: 1A @ 28 VDC. Protected semiconductor outputs.
Current inputs: from current transformers, .../5A. Max load 0.7VA per phase.
Digital inputs: input voltage 0 - 30 VDC. Internally connected to battery positive via 4700 ohm resistor.
Measurement category: CAT II
Air category: Pollution degree II
Communication port: RS-232. 9600 bauds, no parity, 1 stop bit.
Operating temperature range: -20°C to +70°C (-4 ºF to +158 ºF)
Storage temperature range: -40°C to +80°C (-40 ºF to +176 ºF)
Maximum humidity: 95%, non-condensing
Dimensions: 171x134x46mm (WxHxD)
Panel Cut-out dimensions: 151 x 111mm minimum.
Weight: 300 g (approx.)
Case material: High temperature, self extinguishing ABS/PC (UL94-V0)
IP protection: IP65 from front panel, IP30 from the rear

17. CONNECTION DIAGRAM