DKG-327 AUTO TRANSFER SWITCH
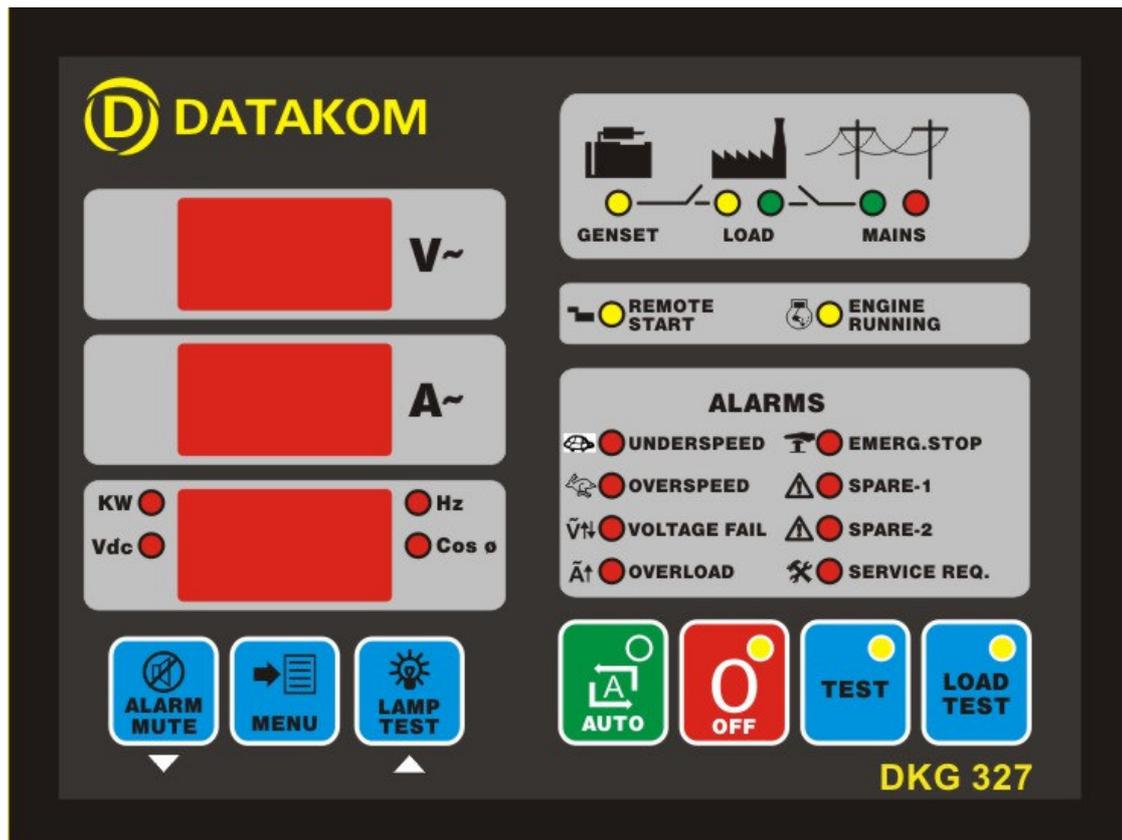
FEATURES

Automatic contactor control
Automatic motorized switch control
Remote start relay output
Electrical protections for genset
Built in alarms and warnings,
3 phase mains voltage inputs
3 phase genset voltage inputs
3 phase genset CT inputs
Load active power measurement
Load power factor measurement
Periodic maintenance request indicator
Daily / weekly / monthly exerciser
Engine hours counter
Event logging
Statistical counters
Battery backed-up real time clock
Weekly operation schedule programs

Field adjustable parameters
RS-232 serial port
Free MS-Windows Remote monitoring SW:
   -local, LAN, IP and modem connection
   -monitoring, download of parameters
LED displays
Configurable digital inputs: 4
Configurable relay outputs: 2
Total relay outputs: 4
Output expansion capability
Simulate Mains operation available
Survives cranking dropouts
Sealed front panel
Plug-in connection system for easy replacement
Small dimensions (165x125x48mm)
Low cost

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1. INSTALLATION

1.1 Introduction to the Control Panel   - 3 -

The unit is a control and protection panel designed to monitor the 3-phase mains voltages, send remote start command to the generating set and make changeover of both generator and mains contactors. The genset is supposed to be controlled by a Remote Start type control unit. 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 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.

The measured parameters are:

Mains voltage phase R to neutral
Mains voltage phase S to neutral
Mains voltage phase T to neutral
Mains voltage phase R-S
Mains voltage phase S-T
Mains voltage phase T-R
Battery voltage

Gen voltage phase U to neutral
Gen voltage phase V to neutral
Gen voltage phase W to neutral
Gen voltage phase U-V
Gen voltage phase V-W
Gen voltage phase W-U
Load current phase U
Load current phase V
Load current phase W
Gen frequency
Gen total KW
Gen total cosΦ

1.2 Mounting the Unit

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

Mount the unit on a flat, vertical surface. The unit fits into an opening of 151x111 millimeters. Before mounting, remove the retaining plastic brackets and connectors from the unit, then pass the unit through the mounting opening. Install and tighten the brackets.

> ⚠ **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.

The 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: R-S-T** **Generator phase: U-V-W** **Battery positive: BAT(+).** **Install the fuses as nearly as possible to** **the unit in a place easily accessible for the user.** **The fuse rating should be 6 Amps.**
	WARNING: ELECTRICITY CAN KILL **ALWAYS disconnect the power BEFORE connecting the unit.**
	1) *ALWAYS remove the plug connectors when inserting wires with a screwdriver.* 2) *ALWAYS refer to the National Wiring Regulations when conducting installation.* 3) *An appropriate and readily accessible set of disconnection devices (e.g. automatic fuses) MUST be provided as part of the installation.* 4) *The disconnection device must NOT be fitted in a flexible cord.* 5) *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).* 6) *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 CONTACTOR NORMALLY OPEN (NO) TERMINAL**	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	**GENERATOR CONTACTOR NORMALLY CLOSED (NC) TERMINAL**	Relay output, 16A-AC	This output provides energy to the rearming terminal of the genset motorized switch.
3	U	Generator phase inputs, 0-300V-AC	Connect the generator phases to these inputs. The generator phase voltages upper and lower limits are programmable.
4	V		
5	W		
6	**GENERATOR NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the generator phases.

Term	Function	Technical data	Description
7	**MAINS NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the mains phases.
8	**T**	**Mains phase inputs, 0-300V-AC**	**Connect the mains phases to these inputs. The mains voltages upper and lower limits are programmable.**
9	**S**		
10	**R**		
11	**MAINS CONTACTOR NORMALLY CLOSED (NC) TERMINAL**	**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.**
12	**MAINS CONTACTOR NORMALLY OPEN (NO) TERMINAL**	**Relay output, 16A-AC**	**This output provides energy to the rearming terminal of the genset motorized switch.**
13	**GROUND**	**O VDC**	**Power supply negative connection.**
14	**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.**
15	**RELAY-1(REMOTE START) NORMALLY OPEN (NO) TERMINAL**	**Output 10A/28VDC**	**This relay has programmable function, selectable from a list.**
16	**RELAY-1(REMOTE START) NORMALLY CLOSED (NC) TERMINAL**		**When the relay output is active, the normally open (NO) terminal will supply the battery positive. When the relay ouput is passive, the normally open (NO) terminal is open circuit.**
17	**RELAY-1(REMOTE START) NORMALLY OPEN (NO) TERMINAL**		**When the relay output is active, the normally closed (NC) terminal is open circuit. When the relay ouput is passive, the normally closed (NC) terminal will supply the battery positive.**
18	**RELAY-1(REMOTE START) NORMALLY CLOSED (NC) TERMINAL**		
19	**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.**
20	**SPARE-2**		
21	**PROGRAM LOCK**		
22	**SPARE-1**		
23	**CURR_3+**	**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).**
24	**CURR_3-**		
25	**CURR_2+**		
26	**CURR_2-**		
27	**CURR_1+**		
28	**CURR_1-**		

3. DISPLAYS

3.1 Led Displays

The unit has 23 LEDs, divided in 5 groups:
-Group_1: Operating mode: This group indicates the transfer unit's function.
-Group_2: Mimic diagram: This group indicates the current status of the mains and genset voltages and contactors.
-Group_3: Indicates the Remote Start signal status and the genset operation.
-Group_4: Warnings and alarms: This group indicates the existence of abnormal conditions encountered during operation.
-Group_5: Unit: This group indicates the unit of the value displayed in the bottom display.

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.
GENERATOR	Yellow	The LED will turn on when all 3 generator phase voltages are within the programmed limits.
LOAD GENERATOR	Yellow	It turns on when the generator contactor is activated.
REMOTE START	Yellow	It turns on when the remote start output is active.
ENGINE RUNNING	Yellow	It turns on when the genset frequency is over 10Hz or the genset voltage is over 100V.
LOAD MAINS	Green	It turns on when the mains contactor is activated.
REMOTE START	Yellow	It turns on when the remote start output is active.
ENGINE RUNNING	Yellow	It turns on when the genset frequency is over 10Hz or the genset voltage is over 100V.
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.
TEST	Yellow	
OFF	Yellow	
AUTO	Green	If the operation of the genset is disabled by the **weekly operation schedule**, then the **AUTO** led will flash.
SERVICE REQUEST	Red	Engine periodic maintenance request indicator. It turns on when the preset engine hours or time duration after previous service has elapsed.
ALARM GROUP	Red	If a fault condition resulting to the engine shutdown has occurred, the related alarm led turns on steadily. If a warning condition has occurred, the related led flashes. The alarms work on a first occurring basis. The occurrence of a fault will disable other faults of lower or equal priority.
UNIT GROUP	Red	This group indicates the unit of the value displayed in the bottom display. When the engine is running the unit displays the genset frequency, otherwise it displays the battery voltage. Different values may be scrolled by pressing the **MENU** key.

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:

- -(R-S-T) mains phase to neutral voltages
- -(U-V-W) generator phase to neutral voltages
- -(RS-ST-TR) mains phase to phase voltages
- -(UV-VW-WU) 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:
- -generator frequency (Hz)
- -generator cosΦ
- -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 2 priority levels:

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

2- **WARNINGS:** These conditions cause:
- The related alarm led to flash,
- The **Horn** and **Alarm+Warning** relay outputs to operate, (if selected via programming menu)

If the **ALARM MUTE** button is pressed, the Horn relay 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 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 settable alarm limits.

UNDERSPEED: Set if the generator frequency is below programmed limits. This fault will be monitored with holdoff timer (**P_023**) delay after the engine is running. Different low limits for warning and alarm are separately programmable. (P_008/P_010)

OVERSPEED: Set if the generator frequency is above programmed limits. This fault will be monitored with holdoff timer (**P_023**) delay after the engine is running. Different high limits for warning and alarm are separately programmable. (P_009/P_011)

OVERLOAD: Set if at least one of the load phase currents goes over the **Overcurrent Limit (P_002)** or if the power (KW) supplied to the load goes over the **Excess Power (P_003)** limit for **Overcurrent** / **Excess Power Timer (P_24)**. If the currents and power goes below the limits before expiration of the timer then no alarm will be set. The overload alarm will be enabled only when the genset contactor is active.

VOLTAGE: Set if any of the generator phase voltages goes outside programmed limits (P_006/P_007). This fault will be monitored with holdoff timer (**P_023**) delay after the engine is running.

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

SPARE-1: Set if a signal is detected in one of the Spare-1 fault input.

SPARE-2: Set if a signal is detected in one of the Spare-2 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 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 (P_004/P_005), the mains contactor will be deactivated and the REMOTE START output will be activated at the end of the wait period (**P_026**). The engine will run without load during engine heating period (P_029). After this, if alternator phase voltages and frequency are within limits, then the unit will wait for the generator contactor period (P_032) 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 (P_030). At the end of this period the generator contactor is deactivated and the mains contactor will be energized. If a cooling period is given (P_031), 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 (P_041). 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. OTHER FEATURES

6.1 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 operation of the device.**

The unit has both programmable engine hours and maintenance time limit. The engine hours is programmable with 50-hour steps (**P_044**), the time limit is programmable between with 1 month steps (**P_045**). 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.

To turn off the led, and reset the service period, press together the ALARM MUTE and LAMP TEST keys for 5 seconds. The upper display will show "**SER**".

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

The remaining time and engine hours to service may be checked via the statistics menu selected by pressing the **MENU** key for **1 second**.

For the engine hours, the upper display will show "**HtS**" (hours to service). The mid display will show the first 3 digits of the engine hours to service and the bottom display the last 3 digits.

For the time, the upper display will show "**ttS**" (time to service). The mid display will show the first 3 digits of days to service and the bottom display the last 3 digits.

6.2 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 modified by power supply failures.

The engine hours may be displayed via the statistics menu selected by pressing the **MENU** key for **1 second**.

For the engine hours, the upper display will show "**EnH**" (engine hours). The mid display will show the first 3 digits of the engine hours and the bottom display the last 3 digits.

6.3 Modem Connection

The unit offers the remote monitoring and programming features over the telephone network via a modem connection. The program used for remote monitoring and programming is the RAINBOW software as RS-232 connection.

If the modem is connected, the program parameter P_043 should be set to 1, otherwise faulty operation may occur.

6.4 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 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)

6.5 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.

The program parameters related to the exerciser are:

P_155: Exercise start day and hour
P_156: Exercise duration
P_157: Exercise off_load/on_load
P_158: Daily / Weekly / Monthly Exercise

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 **REMOTE START** signal will become active. When the engine runs, 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 parameter **P_041** to 1. Thus it is highly recommended that the Emergency Backup mode be enabled with off-load exerciser.

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

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

Using the 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.

6.6 Simulate Mains

The unit offers an optional **SIMULATE MAINS** signal input. If the program parameter **P_050** is set to **1** then the **SPARE_2** (**20**) input will be used for mains simulation.

It is also necessary to set the program parameter **P_119** to **3** in order to prevent any alarm 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 program parameter P_050 is set to 1 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.

7. 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. These parameters are defined in the parameters P_051 to P_064. On the display, the parameters are shown with 3 digits, the first 2 digit are the hour and the last digit is the first digit of the minutes. For example 19.3 will mean 19:30.

Unused programs should be set to 24.0.

An example setup may be as follows:

P_051: 07.0 (Monday morning 07:00 turn on)
P_052: 18.0 (Monday evening 18:00 turn off)
P_053: 07.0 (Tuesday morning 07:00 turn on)
P_054: 18.0 (Tuesday evening 18:00 turn off)
P_055: 07.0 (Wednesday morning 07:00 turn on)
P_056: 18.0 (Wednesday evening 18:00 turn off)
P_057: 07.0 (Tuesday morning 07:00 turn on)
P_058: 18.0 (Tuesday evening 18:00 turn off)
P_059: 07.0 (Friday morning 07:00 turn on)
P_060: 18.0 (Friday evening 18:00 turn off)
P_061: 07.0 (Saturday morning 07:00 turn on)
P_062: 13.3 (Saturday noon 13:30 turn off)
P_063: 24.0 (Sunday no turn on time, last operation mode continues)
P_064: 24.0 (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 program parameter **P_046**. For more details check the programming section.

8. EVENT LOGGING

The unit keeps records of the last 12 events in order to supply information for the service personal.

The events are recorded with a date and time stamp. The date and time information comes from the internal battery backed-up real time clock circuit of the unit. The real time clock circuit will continue its operation even in power failures. The real time clock is precisely trimmed using the program parameter **P_046**. For more details check the programming section.

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

The events are only displayed on the PC screen using the remote monitoring and programming software. They can not be displayed on the unit.

The event sources are:

-Genset on load,
-Genset off load,
-Alarms,
-Warnings.

9. STATISTICAL COUNTERS

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

The counters consist on:

-total genset runs,
-total genset on load.

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

The statistical counters are only displayed on the PC screen using the remote monitoring and programming software. They can not be displayed on the unit.

10. MAINTENANCE

⚠	**DO NOT OPEN THE UNIT** **There are NO serviceable parts inside the unit.**

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

10. PROGRAMMING

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

To **enter the program mode**, press the **MENU** button for 5 seconds. The program mode is only allowed if the **PROGRAM LOCK** input (terminal_21) 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**.

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

When the program mode is entered, the upper display will show "**PGM**". The central display will show the program parameter number and the lower display the program parameter value. The first program number is "**000**"

Each depression of the **MENU** key will cause the display to switch to the next program parameter. If the **MENU** key is hold pressed the program numbers will increase by steps of 10. After the last parameter, the display switches back to the first parameter. The displayed parameter value may be increased or decreased using "▲" and "▼" keys. If these keys are hold pressed, the program value will be increased/decreased by steps of 10.

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.

Pgm	Definition	Unit	Std Val	Description
0	Current Transformer Primary	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. For values over 990A use 10% of the value. These values will be displayed as K-Amperes. (for ex. 1.85KA) Values under 100A may be used by multiplying with 10 in order to enable the current display with 0.1A precision. (for ex: 35.7A)
1	Current Transformer Decimal Point		0	This parameter determines the display range of current and active power: 0: 000-999 1: 0.00-9.99 2: 00.0-99.9
2	Overcurrent Limit	A	0	If the current goes above this limit, during the period defined in P_024 an OVERLOAD alarm will be generated. Enter this information with the same format as parameter P_000. If this parameter is set to 0, then the Overcurrent check will be disabled.
3	Excess Power Limit	KW	0	If the active power goes above this limit, during the period defined in P_024 an OVERLOAD alarm will be generated. Enter this information with the same format as parameter P_000. If this parameter is set to 0, then the Excess Power check will be disabled.
4	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** and **TEST** modes.
5	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** and **TEST** modes.

Pgm	Definition	Unit	Std Val	Description
6	Gen. Voltage Low Limit	V	180	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a **VOLTAGE** alarm and the REMOTE START output will be deactivated.
7	Gen. Voltage High Limit	V	270	If one of the generator phase voltages goes over this limit when feeding the load, this will generate a **VOLTAGE** alarm and the REMOTE START output will be deactivated.
8	Low Freq. Alarm	Hz	30	If the genset frequency goes under this limit, an **UNDERSPEED** alarm will be generated and the REMOTE START output will be deactivated.. This alarm will be monitored after delay defined in **P_023** when the engine runs.
9	Low Freq. Warning	Hz	40	If the genset frequency goes under this limit, an **UNDERSPEED** warning will be generated. This warning will be monitored after delay defined in **P_023** when the engine runs.
10	High Freq. Warning	Hz	54	If the genset frequency goes over this limit, an **OVERSPEED** warning will be generated. This warning will be monitored after delay defined in **P_023** when the engine runs.
11	High Freq. Alarm	Hz	57	If the genset frequency goes over this limit, an **OVERSPEED** alarm will be generated and the REMOTE START output will be deactivated.This alarm will be monitored after the delay defined in **P_023** when the engine runs.
12	Not used			
13	Not used			
14	Not used			
15	Not used			
16	Not used			
17	Not used			
18	Not used			
19	Not used			
20	Not used			
21	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 **P_004**. When the mains fail, the low limit will be used as **P_004+P_021**. It is advised to set this value to 8 volts.
22	Not used			
23	Holdoff timer	sec	8	This parameter defines delay after the engine runs and before the fault monitoring is enabled.
24	Overcurrent / Excess Power / Frequency Timer	sec	3	This is the period between the current or active power goes over the limits **(P_002/P_003)** and **OVERLOAD** alarms occurs. This is also the period between the frequency goes out of the limits **(P_008/P_011)** and **SPEED FAULT** alarm occurs.
25	Wait before Remote Start	min	0	This is the time between the mains fails and the Remote Start output turns on before starting the genset. It prevents unwanted genset operation in battery backed-up loads.
26	Not used			

Pgm	Definition	Unit	Std Val	Description
27	Start Timer	sec	40	This is the maximum time allowed for the genset to start.
28	Not used			
29	Engine Heating Timer	sec	3	This is the period used for engine heating following the program parameter **P_037**.
30	Mains Waiting Timer	min	0.5	This is the time between the mains voltages entered within the limits and the generator contactor is deactivated.
31	Cooling Timer	min	0.0	This is the period that the generator runs for cooling purpose after the load is transferred to mains.
32	Generator Contactor Timer	sec	1	This is the period after the mains contactor has been deactivated and before the generator contactor has been activated.
33	Mains Contactor Timer	sec	1	This is the period after the generator contactor has been deactivated and before the mains contactor has been activated.
34	Not used			
35	Not used			
36	Horn Timer	sec	10	This is the period during which the **HORN** relay is active. If the period is set to 0, this will mean that the period is unlimited.
37	Not used			
38	Not used			
39	Genset L-L Voltages	-	0	**0:** Display genset Line to Neutral voltages, **1:** Display genset Line to Line voltages.
40	Mains L-L Voltages	-	0	**0:** Display mains Line to Neutral voltages, **1:** Display mains Line to Line voltages.
41	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.
42	Not used			
43	Modem Connection	-	0	**0:** No modem connection, the serial port is connected to PC **1:** Modem connected.
44	Maintenance Period (Engine Hours)	hours	200	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.
45	Maintenance Period (Months)	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
46	Real Time Clock trimming	-	0	This parameter is intended to trim precisely the real time clock speed. 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.
47	Not used			
48	Not used			
49	Not used			
50	Simulate Mains Operation	-	1	**0: Not SIMULATE MAINS** mode, the engine runs when the mains fail. **1: SIMULATE MAINS** mode, the unit does not monitor mains voltages, the engine stops when a signal from the SIMULATE MAINS (20) comes.

The parameters from P_051 to P_064 program the weekly operation schedule feature. For each day of week, one turn_on time and one turn_off time are provided. Times are defined with 10 minute steps and are shown in the 3 digit display as the hours and the first digit of the minutes. If no operation is needed for a certain day of week, then the related time will be defined as 24.0; thus the last definition will continue to be valid. For example if the turn_on and turn_off times for Sunday are given as 24.0 then the unit will not operate automatically from Saturday turn_off time to Monday turn_on time. If the AUTO mode is disabled by the weekly operation schedule, then the AUTO led will flash, otherwise it is steadily on.

Pgm	Definition	Unit	Std	Description
51	Monday turn_on	-	24.0	
52	Monday turn_off	-	24.0	
53	Tuesday turn_on	-	24.0	
54	Tuesday turn_off	-	24.0	
55	Wednesday turn_on	-	24.0	
56	Wednesday turn_off	-	24.0	
57	Thursday turn_on	-	24.0	
58	Thursday turn_off	-	24.0	
59	Friday turn_on	-	24.0	
60	Friday turn_off	-	24.0	
61	Saturday turn_on	-	24.0	
62	Saturday turn_off	-	24.0	
63	Sunday turn_on	-	24.0	
64	Sunday turn_off	-	24.0	

The parameters from P_065 to P_082 define the functions of relay outputs. The unit has 6 relay outputs and 2 of them have programmable functions. The fixed function relays are Mains Contactor and Generator Contactor.

The relays may be extended up to 20 using **Relay Extension Modules**. RELAY-1 and RELAY-2 with programmable functions are inside the unit. Other relays are in the optional Extension Modules.

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

RELAY FUNCTİON LIST

Pgm	Description	Std
65	RELAY-1 function	00
66	RELAY-2 function	01
67	RELAY-3 function	16
68	RELAY-4 function	17
69	RELAY-5 function	18
70	RELAY-6 function	19
71	RELAY-7 function	20
72	RELAY-8 function	21
73	RELAY-9 function	22
74	RELAY-10 function	23
75	RELAY-11 function	24
76	RELAY-12 function	25
77	RELAY-13 function	26
78	RELAY-14 function	27
79	RELAY-15 function	28
80	RELAY-16 function	29
81	RELAY-17 function	30
82	RELAY-18 function	31

00	Remote Start	24	-
01	Horn	25	Underspeed alarm
02	-	26	Overspeed alarm
03	-	27	-
04	Gen. Contactor	28	-
05	Mains Contactor	29	Overload alarm
06	-	30	Voltage alarm
07	-	31	-
08	Alarm	32	-
09	Warning	33	-
10	Alarm+Warning	34	-
11	Automatic ready	35	-
12	Week. on time	36	Emerg Stop warn.
13	Exerciser on	37	Spare-1 warning
14	-	38	Spare-2 warning
15	-	39	-
16	-	40	-
17	-	41	Underspeed warn.
18	-	42	Overspeed warning
19	-	43	-
20	Emerg.Stop alarm	44	-
21	Spare-1 Alarm	45	-
22	Spare-2 Alarm	46	-
23	-	47	-

Parameters from P_083 to P_106 are not used.

Pgm	Description	Std	
83	Not used		
84	Not used		
85	Not used		
86	Not used		
87	Not used		
88	Not used		
89	Not used		
90	Not used		
91	Not used		
92	Not used		
93	Not used		
94	Not used		
95	Not used		
96	Not used		
97	Not used		
98	Not used		
99	Not used		
100	Not used		
101	Not used		
102	Not used		
103	Not used		
104	Not used		
105	Not used		
106	Not used		

Parameters from P_107 to P_130 program the functions of the digital inputs. The programmable properties of digital inputs are:
    -action to be taken upon arrival of the fault signal (alarm, warning,etc...),
    -when the fault monitoring will be enabled,
    -latching of the fault signal,
    -contact type (NO/NC)
    -switching (bat+, bat-)
    -response delay

EMERGENCY STOP INPUT

Pgm	Description	Std	
107	Operation	0	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
108	Fault monitoring	0	**0:** Always **1:** After holdoff timer **2:** When mains present
109	Latching	0	**0:** Non latching **1:** Latching
110	Contact type	0	**0:** Normally open **1:** Normally closed
111	Switching	0	**0:** Battery negative **1:** Battery positive
112	Response delay	0	**0:** No delay **1:** Delayed (4sec)

SPARE-1 FAULT INPUT

Pgm	Description	Std	
113	Operation	0	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
114	Fault monitoring	0	**0:** Always **1:** After holdoff timer **2:** When mains present
115	Latching	0	**0:** Non latching **1:** Latching
116	Contact type	0	**0:** Normally open **1:** Normally closed
117	Switching	0	**0:** Battery negative **1:** Battery positive
118	Response delay	0	**0:** No delay **1:** Delayed (4sec)

SPARE-2 FAULT INPUT

Pgm	Description	Std	
119	Operation	2	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
120	Fault monitoring	0	**0:** Always **1:** After holdoff timer **2:** When mains present
121	Latching	0	**0:** Non latching **1:** Latching
122	Contact type	0	**0:** Normally open **1:** Normally closed
123	Switching	0	**0:** Battery negative **1:** Battery positive
124	Response delay	0	**0:** No delay **1:** Delayed (4sec)

PROGRAM LOCK INPUT

Pgm	Description	Std	
125	Operation	3	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
126	Fault monitoring	0	**0:** Always **1:** After holdoff timer **2:** When mains present
127	Latching	0	**0:** Non latching **1:** Latching
128	Contact type	0	**0:** Normally open **1:** Normally closed
129	Switching	0	**0:** Battery negative **1:** Battery positive
130	Response delay	0	**0:** No delay **1:** Delayed (4sec)

Parameters from P_131 to P_154 are not used.

Pgm	Description	Unit	Value
131	Not used		
132	Not used		
133	Not used		
134	Not used		
135	Not used		
136	Not used		
137	Not used		
138	Not used		
139	Not used		
140	Not used		
141	Not used		
142	Not used		
143	Not used		
144	Not used		
145	Not used		
146	Not used		
147	Not used		
148	Not used		
149	Not used		
150	Not used		
151	Not used		
152	Not used		
153	Not used		
154	Not used		

Parameters from P_131 to P_154 are not used.

The parameters from P_155 to P_158 define the **exerciser operation**.

Pgm	Definition	Unit	Std Val	Description
155	Exercise start day and hour	-	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 1 = exercise starts at Monday 01:00 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 with parameter P_158=0, then the day information is **don't care** and the exercise will be performed every day regardless of the day selection. If the monthly exercise is selected with parameter P_158=2 then the exercise will be performed during the first 7 days of each month at the programmed day and hour.
156	Exercise duration	min.	10	This parameter defines the exercise duration and programmed in 10 minute steps up to 24 hours.
157	Exercise off_load/on_load	-	0	If this parameter is set to 0 the genset will not feed the load during exercise. If it is set to 1, then the load will be transferred to the genset during the exercise.
158	Daily / Weekly / Monthly Exercise	-	1	**0:** exercise every day (the exercise will be performed every day regardless of the day selection with parameter P_155). **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).

The parameters from P_159 to P_164 adjust the date and time.

Pgm	Definition	Unit	Std Val	Description
159	Year	-	00-99	Last two digits of the current year.
160	Month	-	01-12	Current month.
161	Date	-	01-31	Current day of the month.
162	Day	-	0-6	Current day of the week.(0=Monday, 1=Tuesday, 2=Wednesday, 3=Thursday 4=Friday, 5=Saturday, 6=Sunday)
163	Hour	-	00-23	Current hour of the day.
164	Minute	-	00-59	Current minute of the hour.

12. TROUBLESHOOTING

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The REMOTE START output is set while AC mains are OK or remains set 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 P_004 and P_005. Standard values are 170/270 volts.
-The hysteresis voltage may be given too excessive. Check the parameter P_021, 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.

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.**

The unit is inoperative:

Measure the DC-supply voltage between terminals 13 and 14 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.

13. DECLARATION OF CONFORMITY

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

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

14. TECHNICAL SPECIFICATIONS

Alternator voltage: 0 to 300 V-AC (Ph-N)
Alternator frequency: 0-100 Hz.
Mains voltage: 0 to 300 V-AC (Ph-N)
Mains frequency: 0-100 Hz.
Current inputs: from current transformers, .../5A. Max load 0.7VA per phase.
Digital inputs: input voltage 0 - 30 V-DC. Internally connected to battery positive via 4700 ohm resistor.
Measurement category: CAT II
Air category: Pollution degree II
DC Supply range: 9.0 V-DC to 30.0 V-DC
Cranking dropouts: survives 0 V for 100ms
Typical current consumption: 100 mA-DC.
Maximum current consumption: 300 mA-DC (Relay outputs open)
Generator/mains contactor outputs: 16 A / 250 V.
DC relay outputs: 10A / 28 V.
Max. current for each terminal: 10A-RMS.
Communication port: RS-232. 2400 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
IP protection: IP65 from front panel, IP30 from the rear
Dimensions: 165 x 125 x 48mm (WxHxD)
Mounting opening dimensions: 151 x 111mm minimum.
Mounting: Front panel mounted, retaining plastic brackets at the rear
Weight: 300 g (approx.)
Case material: High temperature, self extinguishing ABS (UL94-V0, 110 °C)

15. CONNECTION DIAGRAM