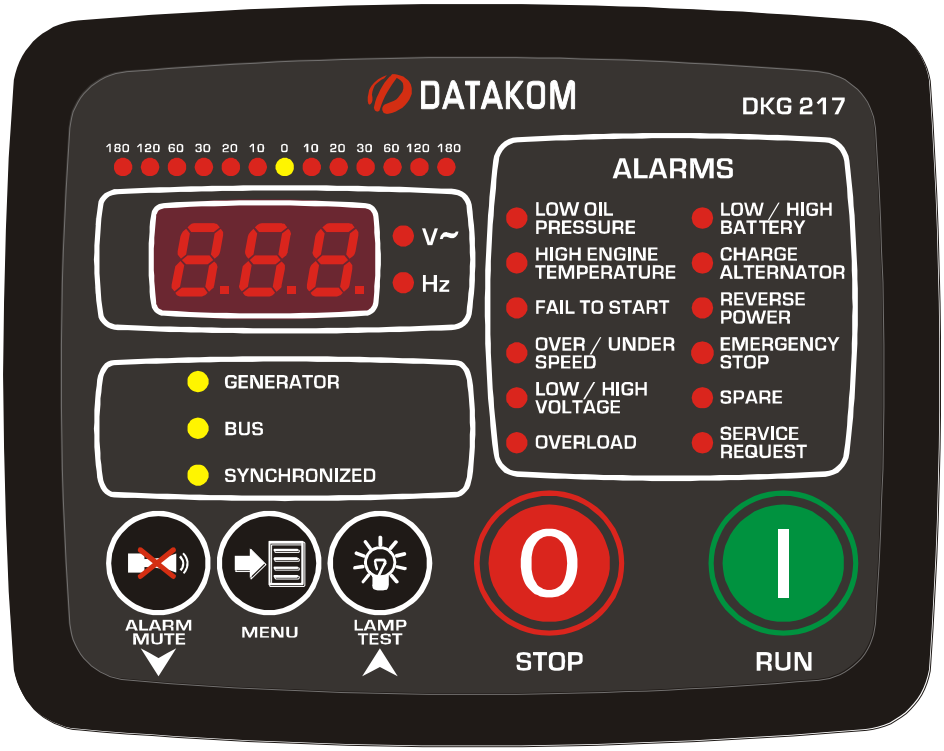
DKG-217 MANUAL AND REMOTE START UNIT WITH SYNCHROSCOPE AND CHECK SYNCH RELAY



FEATURES

Manual starting and stopping
Zero power consumption at rest
Remote Start operation available
LED bargraph synchroscope
Programmable ΔV, Δf, Δθ for check synch relay
Engine control
Generator protection
Built in alarms and warnings
3 phase genset voltage inputs
1 phase genset CT input
1 phase busbar voltage input
Engine oil pressure measurement
Engine coolant temperature measurement
Genset active power measurement (single phase)
Genset power factor measurement (single phase)
Periodic maintenance request indicator
Engine hours run counter
Event logging
Statistical counters
Front panel configurable
100+ adjustable parameters
Logic level serial port
Optional RS-232 adapter
Free MS-Windows Remote monitoring SW:
-local, LAN, IP and modem connection
-monitoring, download of parameters
LED displays
Configurable analogue inputs: 2
Configurable digital inputs: 5
Configurable relay outputs: 2
Total relay outputs: 5
Survives cranking dropouts
Sealed front panel
Plug-in connection system for easy replacement
Small dimensions (130x100x39mm)
Low cost

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1. INSTALLATION

1.1 Introduction to the Control Panel

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

The measured parameters are:

Gen voltage phase U to neutral
Gen voltage phase V to neutral
Gen voltage phase W to neutral
Gen current phase U
Gen frequency
Gen KW phase U
Gen cosΦ phase U
Battery voltage
Coolant temperature
Oil pressure
Busbar voltage
Frequency difference busbar-phase U
Voltage difference busbar-phase U
Phase angle busbar-phase U

1.2 Mounting the Unit

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

Mount the unit on a flat, vertical surface. The unit fits into a standard panel meter opening of 116x86 millimeters. Before mounting, remove the retaining steel spring and connectors from the unit, then pass the unit through the mounting opening. The unit will be maintained in its position by the steel 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 transformer shall be 5 Amperes. The input current rating of the current transformers may be selected as needed (between 10/5 and 9000/5 amps). Current transformer outputs shall be connected by separate cable pairs from each transformer, to related inputs. Never use common terminals or grounding. The power rating of the transformer should be at least 5 VA. It is recommended to use 1% precision transformers.

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

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

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

1.3 Wiring the Unit

WARNING: THE UNIT IS NOT FUSED.
Use external fuses for Mains phases: U, V, W, Busbar phase, Battery positive: BAT(+).
Install the fuses as nearly as possible to the unit in a place easily accessible for the user.
The fuse rating should be 6 Amps.

WARNING: ELECTRICITY CAN KILL
ALWAYS disconnect the power BEFORE connecting the unit.The fuse rating should be 6 Amps.

1) ***ALWAYS remove the plug connectors when inserting wires with a screwdriver.***
2) ***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)***

2. INPUTS AND OUTPUTS

SERIAL DATA: This connector provides logic level serial data input and output for various purposes like remote monitoring and remote programming. In order to connect to a PC, an RS-232 adapter module is needed.

Term	Function	Technical data	Description
1	**CHECK SYNCH**	Relay output, 16A-AC	This output provides energy to the generator paralleling contactor. If the genset phase voltages are not within programmed limits, or if the genset phase U voltage, frequency and phase angle are not within the programmed limits compared to the busbar, this relay will not be energized. If the busbar is not powered up, synch checking may be overridden with the **DEAD BUS ENABLE** input signal.
2	**U**	Generator phase input, 0-300V-AC	Connect the generator phases to these inputs. The generator phase voltages upper and lower limits are programmable.
3	**V**		
4	**W**		
5	**GENERATOR NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the generator phases.
6	**BUSBAR NEUTRAL**	Input, 0-300V-AC	Neutral terminal for the busbar phase.
7	**R**	Busbar phase input, 0-300V-AC	Connect the busbar phase to this input. The busbar voltage upper and lower limits are programmable.
8	**unused**	-	no connection
9	**REMOTE START**	Input	The battery positive voltage applied to this input will cause the engine to run and synch checking to be enabled. **WARNING: Do not connect a voltage greater than the battery positive to this input, otherwise permanent damage may occur.**
10	**OIL PRESSURE SENDER**	Input, 0-5000 ohms	Analogue oil pressure sender connection. Do not connect the sender to other devices. The input has programmable characteristics and connects to any kind of sender.
11	**COOLANT TEMP. SENDER**	Input, 0-5000 ohms	Analogue high temperature sender connection. Do not connect the sender to other devices. The input has programmable characteristics and connects to any kind of sender.
12	**BATTERY POSITIVE**	+12 or 24VDC	The positive terminal of the DC Supply shall be connected to this terminal. The unit operates on both 12V and 24V battery systems.
13	**GROUND**	O VDC	Power supply negative connection.
14	**RELAY-1 (STOP RELAY)**	Output 10A/28VDC	This relay has programmable function, selectable from a list.
15	**START RELAY**	Output 10A/28VDC	This relay controls the engine cranking.
16	**FUEL RELAY**	Output 10A/28VDC	This relay is used for fuel solenoid control. It is internally connected to terminal **17** for supplying the charge alternator's excitation current.

Term	Function	Technical data	Description
17	**CHARGE**	Input and output	Connect the charge alternator's D+ terminal to this terminal. This terminal will supply the excitation current and measure the voltage of the charge alternator.
18	**RELAY-2 (ALARM RELAY)**	Output 10A/28VDC	This relay has programmable function, selectable from a list.
19	**LOW OIL PRESSURE**	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	**HIGH TEMP**		
21	**DEAD BUS ENABLE**		
22	**EMERGENCY STOP**		
23	**SPARE**		
24	**PROGRAM LOCK**		
25	**CURR_U+**	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 secondary winding rating shall be 5 Amperes. (For ex. 200/5 Amps).
26	**CURR_U-**		

3. DISPLAYS

3.1 Led Displays

The unit has 30 LEDs, divided in 4 groups:
-Group_1: Synchronoscope: this group indicates the instantenous phase angle between busbar and genset phase U voltages.
-Group_2: Status: This group indicates the current status of the busbar and genset voltages and the check synch output.
-Group_3: Warnings and alarms: This group indicates the existence of abnormal conditions encountered during operation.
-Group_4: Unit: This group indicates the unit of the value displayed in the bottom display.

Function	Color	Description
SYNCHROSCOPE	Red and Yellow	When both busbar and genset voltages are within programmed limits, the busbar led graph will illuminate automatically. Only one of the leds turns on at a time. The led indicates the phase angle between the busbar phase and the genset phase U. If the right hand side of the graph is illuminated, this means that the genset phase is leading (in advance) the busbar. If the left hand side of the graph is illuminated, this means that the genset phase is lagging (in retard). A left to right scrolling of the led graph means that the genset frequency is higher than the busbar frequency. A right to left scrolling of the led graph means that the genset frequency is lower than the busbar frequency.
GENERATOR	Yellow	The LED will flash when the generator is requested to run. It turns on when both genset phase voltages are within the programmed limits.
BUS	Yellow	The LED will turn on when the busbar voltage is within the limits.
SYNCHRONIZED	Yellow	The LED will flash when the synch checking is enabled. It turns on when the check synch relay is energized.
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 warning condition has occurred, the related led flashes. If a fault condition resulting to the engine shutdown has occurred, the related alarm led turns on steadily. 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 digital display. When the engine is running the unit displays the genset frequency, otherwise it displays the busbar voltage. Different values may be scrolled by pressing the **MENU** key.

3.2 Digital Display

The unit has a three digit seven segment display. It shows:

-Measured parameters,
-Parameter names,
-Service counters,
-Program parameters.

The navigation between different screens in a group is made with the **MENU** button. When the MENU key is pressed, the parameter name will be displayed.

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

-busbar phase to neutral voltage
-generator phases U,V,W to neutral voltage
-generator phase-U current
-generator frequency
-generator cosΦ phase U
-generator active power phase U
-oil pressure (bar)
-coolant temperature (ºC)
-battery voltage
-frequency difference busbar to genset phase U
-voltage difference busbar to genset phase U
-phase angle busbar to genset phase U (degrees)

Holding the **MENU** button pressed for 1 second makes the display to switch to the service counters group:

-total engine hours,
-engine hours to service,
-time to service.

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 turn on steadily,
   - The check synch to be released immediately,
   - The engine to be stopped immediately,
   - The **Horn**, **Alarm** and **Alarm+Warning** relay outputs 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 (**RUN / STOP**).

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

LOW OIL PRESSURE: Set if a signal is detected at the Low Oil Pressure Switch input or the oil pressure value measured from the sender is below the programmed limit. **Warning** (**P_015**) and **alarm** (**P_016**) limits are separately programmable for the oil pressure sender input. This fault will be monitored with holdoff timer (**P_023**) delay after the engine is running. Also if the oil pressure switch is open at the beginning of a start attempt, then the engine will not be started and the oil pressure led will flash. When the oil pressure switch closes, normal operation will be resumed.

HIGH ENGINE TEMPERATURE: Set if a signal is detected at the High Temperature Switch input or the coolant temperature value measured from the sender is above the programmed limit. **Warning** (**P_017**) and **alarm** (**P_018**) limits are separately programmable for the temperature sender input.

OVER / UNDER SPEED: Set if the generator frequency is outside programmed limits (overspeed/Underspeed). This fault will be monitored with holdoff timer (**P_023**) delay after the engine is running. Different low and high limits for warning and alarm are separately programmable. (P_008/P_009/P_010/P_011)

FAIL TO START: Set if the engine is not running after programmed number of start attempts. (**P_035**)

OVERLOAD: Set if the genset phase current goes over the **Overcurrent Limit (P_002)** or if the genset power (KW) measured on phase-U goes over the **Excess Power (P_003)** limit for **Overcurrent / Excess Power Timer (P_511)**. If the currents and power goes below the limits before expiration of the timer then no alarm will be set. If the **Overcurrent Limit (P_002)** or **Excess Power (P_003)** limit is set to zero then the corresponding check will be omitted.

LOW / HIGH 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.

LOW / HIGH BATTERY: Set if the battery voltage goes outside programmed limits. During engine cranking this fault is not monitored. Warning level for low battery voltage (**P_012**) and both warning (**P_013**) and alarm (**P_014**) levels for high battery voltage are programmable.

CHARGE ALTERNATOR: Set if a charge alternator failure (or broken belt) occurs. This fault condition may result to a **warning** or **alarm** following programming. (**P_038**)

REVERSE POWER: Set if the genset power (KW) measured on phase-U is negative and goes over the **Reverse Power (P_042)** limit for **Overcurrent / Excess Power Timer (P_511)**. If the reverse power goes below the limit before expiration of the timer then no alarm will be set. If the **Reverse Power (P_042)** limit is set to zero then the reverse power check will be omitted.

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

SPARE: Set if a signal is detected in one of the spare fault input.

5. MODES OF OPERATION

The unit will power-up when the front panel **RUN** button is pressed. It will turn-off if the **STOP** button is pressed. If no key is pressed it will power down automatically after approximately 5 minutes. If needed, the automatic power-down feature may be disabled with the program parameter **P_050**.

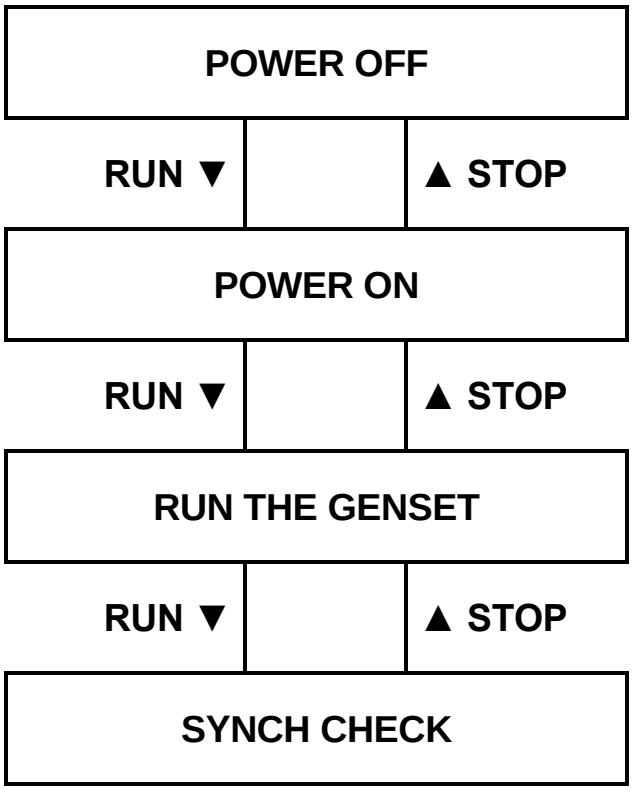
When the unit is powered up, if the **RUN** button is pressed again, then the **GENERATOR** led (yellow) will flash and the genset will run. When both genset phase voltages are within programmed limits the **GENERATOR** led will turn on steadily. If the **STOP** button is pressed the genset will stop, but the unit will stay powered-up. If the **STOP** button is pressed again or no key is pressed during 5 minutes then it will power-down automatically.

When the genset is running, if the **RUN** button is pressed again, then the **SYNCHRONIZED** led (yellow) will flash and the unit will start to monitor the synchronization between the busbar and the genset. If the busbar is not powered up, the check synch relay may be forced to operate using the **DEAD BUS ENABLE** signal. If the busbar is powered and all synchronization conditions (ΔV, Δf, Δθ) are satisfied, then the **CHECK SYNCH** relay will operate and the **SYNCHRONIZED** led (yellow) will turn on steadily. If the **STOP** button is pressed then the **CHECK SYNCH** relay will be deenergized and the **SYNCHRONIZED** led will turn off, however the genset will continue to run. It may be stopped by another depression of the **STOP** button.

The synchronization checking is not timed. The unit will continue checking until synch checking is verified or the process terminated manually (or by the Remote Start signal)

If an alarm occurs during any operation status, the **CHECK SYNCH** relay will be deenergized, the genset will stop and the related alarm led will turn on steadily. The unit will not power down until the alarm is cancelled with the **STOP** button.

The **REMOTE START** (**9**) input is always enabled and does not need any programming. Please check the following section for the remote start operation.



6. OTHER FEATURES

6.1 Remote Start Operation

The unit offers the possibility of **REMOTE START** mode of operation. The **REMOTE START** (**9**) input is always enabled and does not need any programming. The Remote Start signal should be connected to the **REMOTE START (9)** input.

The **REMOTE START** signal is always the battery positive voltage. Due to the **zero power at rest** structure, power should be supplied to this input in order to wake-up the unit.

Do not connect a voltage greater than the battery positive to this input, otherwise permanent damage to the unit may occur.

The **REMOTE START** signal is equivalent to 3 successive depressions of the **RUN** button. This means that, upon arrival of the **REMOTE START** signal the unit:

-will power up
-will run the engine
-will check the synchronization and operate the CHECK SYNCH relay.

If the unit is to close on an unpowered bus, this can be enabled with the **DEAD BUS ENABLE** signal. However even if the dead bus closing is enabled to a bus which is powered up, the unit will not close and will check the synchronization.

6.2 Synchronization Checking

The unit will check the synchronization when both genset and bus phase voltages are within programmed limits and the **SYNCHRONIZED** led is flashing.

If both busbar and genset phase voltages are within programmed limits, then the synchroscope led bargraph will illuminate. The bargraph will show the phase angle between busbar and genset phase U.

The synchronization checking consists of the verification of below conditions during 4 consecutive busbar cycles:

-the busbar voltage should be between limits set by **P_004** and **P_005**
-both genset phase voltages should be between limits set by **P_006** and **P_007**
-the frequency difference between the busbar and genset phase U should not exceed the limit set by **P_039**
-the voltage difference between the busbar and genset phase U should not exceed the limit set by **P_040**
-the phase angle between the busbar and genset phase U should not exceed the limit set by **P_041**

If all above conditions are satisfied for 4 consecutive busbar cycles then the **CHECK SYNCH** relay will be immediately energized.
If above conditions are denied for 8 consecutive busbar cycles then the **CHECK SYNCH** relay will be immediately deenergized.

It is the responsibility of the panel builder to use a quickly closing contactor.

6.3 Sender type Selection

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

Oil Pressure Sender Type Selection:
The oil pressure sender is selected using parameter **P_019**. The selectable sender types are:
0: The sender characteristics are defined in table using parameters **P_131** to **P_142**.
1: VDO 0-7 bars (10-180 ohms)
2: VDO 0-10 bars (280-20 ohms)
3: DATCON 0-7 bars (240-33 ohms)
4: DATCON 0-10 bars (240-33 ohms)
5: DATCON 0-7 bars (0-90 ohms)
6: DATCON 0-10 bars (0-90 ohms)
7: DATCON 0-7 bars (75-10 ohms)

Temperature Sender Selection:
The temperature sender is selected using parameter **P_020**. The selectable sender types are:
0: The sender characteristics are defined in table using parameters **P_143** to **P_154**.
1: VDO
2: DATCON DAH type
3: DATCON DAL type

6.4 Engine Heating Operation

Especially on engines without a body heater, or with a failing one, it may be desired that the genset should not take the load before reaching a suitable temperature. The unit offers 2 different ways of engine heating.

1. Timer controlled heating:
This operation mode is selected when the parameter **P_037** is set to **0**. In this mode, the engine will run during parameter **P_029**, and then the synchronization checking will be enabled.

2. Timer and temperature controlled heating:
This operation mode is selected when the parameter **P_037** is set to **1**. In this mode, at first the engine will run during parameter **P_029**, then it will continue to run until the measured coolant temperature reaches the limit defined in parameter **P_022**. When the requested temperature is reached, the synchronization checking will be enabled. This operation mode may be used as a backup to the engine body heater. If the engine body is warm the heating will be skipped.

6.5 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 (**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 display will show "**SER**".

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

When the MENU key is pressed the display will show "**HtS**" (hours to service). When the MENU key is released it will show the first 3 digits of the engine hours to service. When the MENU key is pressed again, the display will show "**HtS**" (hours to service). When the MENU key is released it will show the last 3 digits of the engine hours to service.

When the MENU key is pressed the display will show "**ttS**" (time to service). When the MENU key is released it will show the first 3 digits of the remaining days to service. When the MENU key is pressed again, the display will show "**ttS**" (time to service). When the MENU key is released it will show the last 3 digits of the remaining days to service.

6.6 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 by power supply failures.

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

When the MENU key is pressed the display will show "**EnH**" (engine hours). When the MENU key is released it will show the first 3 digits of the engine hours. When the MENU key is pressed again, the display will show "**EnH**" (engine hours). When the MENU key is released it will show the last 3 digits of the engine hours.

6.7 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 same as the program used for RS-232 connection.

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

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)

6.8 Remote Monitoring and Programming

Thanks to its standard serial port, the unit offers the remote monitoring and programming feature.
The serial port has logic level outputs and is connected to the PC or modem with a RS-232 adapter.
The remote monitoring and programming PC software may be downloaded from **www.datakom.com.tr** internet site.

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.

7. STATISTICAL COUNTERS

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

The counters consist on:

-total engine cranks,
-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.

8. 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.

9. 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_24) 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.

In program mode, when the **MENU** key is pressed the display will show the program parameter number, when the **MENU** key is released the display will show 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 the current transformer. 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 the parameter is set to 0 then the Overcurrent checking will be disabled.
3	Excess Power Limit	KW	0	If the active power measured on phase-U 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 the parameter is set to 0 then the Excess Power checking will be disabled.
4	Busbar Voltage Low Limit	V	100	If the busbar phase voltage goes under this limit, it means that the busbar is not energized.
5	Busbar Voltage High Limit	V	500	If the busbar phase voltage goes over this limit, it means that the busbar is not energized.

Pgm	Definition	Unit	Std Val	Description
6	Gen. Voltage Low Limit	V	180	If the generator phase voltage goes under this limit when feeding the load, this will generate a **VOLTAGE** alarm and the engine will stop.
7	Gen. Voltage High Limit	V	270	If the generator phase voltage goes over this limit when feeding the load, this will generate a **VOLTAGE** alarm and the engine will stop.
8	Low Freq. Alarm	Hz	30	If the genset frequency goes under this limit, an **OVER / UNDER SPEED** alarm will be generated and the engine will stop. 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, a **OVER / UNDER SPEED** 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, a **OVER / UNDER SPEED** 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, a **OVER / UNDER SPEED** alarm will be generated and the engine will stop. This alarm will be monitored after delay defined in **P_023** when the engine runs.
12	Low Battery Voltage Warning	V	9.0	If the battery voltage falls below this limit, this will generate a **LOW / HIGH BATTERY** warning.
13	High Battery Voltage Warning	V	31.0	If the battery voltage goes over this limit, this will generate a **LOW / HIGH BATTERY** warning.
14	High Battery Voltage Alarm	V	33.0	If the battery voltage goes over this limit, this will generate a **LOW / HIGH BATTERY** alarm and the engine will stop.
15	Low Oil Pressure Warning	Bar	1.5	If the oil pressure measured from the analog input falls below this limit, this will generate an **LOW OIL PRESSURE** warning. This input will be monitored after delay defined in **P_023** when the engine runs.
16	Low Oil Pressure Alarm	Bar	1.0	If the oil pressure measured from the analog input falls below this limit, this will generate an **LOW OIL PRESSURE** alarm. This input will be monitored after delay defined in **P_023** when the engine runs.
17	High Temperature Warning	ºC	90	If the coolant temperature measured from the analog input goes over this limit, this will generate a **HIGH ENG. TEMP.** warning.
18	High Temperature Alarm	ºC	98	If the coolant temperature measured from the analog input goes over this limit, this will generate a **HIGH ENG.TEMP.** alarm and the engine will stop.

Pgm	Definition	Unit	Std Val	Description
19	Oil pressure sender type	-	1	This parameter selects the oil pressure sender type. **0:** Non standard sender. The sender characteristics are defined in table using parameters **P_131** to **P_142**. **1:** VDO 0-7 bars (10-180 ohms) **2:** VDO 0-10 bars (10-180 ohms) **3:** DATCON 0-7 bars (240-33 ohms) **4:** DATCON 0-10 bars (240-33 ohms) **5:** DATCON 0-7 bars (0-90 ohms) **6:** DATCON 0-10 bars (0-90 ohms) **7:** DATCON 0-7 bars (75-10 ohms)
20	Temperature sender type	-	1	This parameter selects the temperature sender type: **0:** The sender characteristics are defined in table using parameters **P_143** to **P_154**. **1:** VDO **2:** DATCON DAH type **3:** DATCON DAL type
21	Hysteresis Voltage	V	8	This parameter provides the busbar and genset voltage limits with a hysteresis feature in order to prevent faulty decisions. For example, when the busbar is present, the busbar voltage low limit will be used as the programmed low limit **P_004**. When the busbar fails, the low limit will be used as **P_004+P_021**. It is advised to set this value to 8 volts.
22	Engine Heating Temperature	ºC	50	If it is requested that the engine runs without load until reaching a certain temperature, this parameter defines the temperature.
23	Holdoff timer	sec	8	This parameter defines the delay after the engine runs and before the fault monitoring is enabled.
24	Overcurrent / Excess Power / Reverse 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. This is also the period between the negative active power goes over the limit **(P_042)** and **REVERSE POWER** alarms occurs.
25	Not used			
26	Preheat timer	sec	1	This is the time after the fuel solenoid is energized and before the genset is started. During this period the **PREHEAT** relay output is energized (if defined by programming)
27	Start Timer	sec	6	This is the maximum start period. Starting will be automatically cancelled if the genset fires before the timer.
28	Wait between Starts	sec	10	This is the waiting period between two start attempts.
29	Engine Heating Timer	sec	3	This is the period used for engine heating following the program parameter **P_037**.

Pgm	Definition	Unit	Std Val	Description
30	Not used	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	1.0	This is the period that the generator runs for cooling purpose after the unloading.
32	Not used			
33	Not used			
34	Stop Timer	sec	10	This is the maximum time duration for the engine to stop. During this period the STOP relay output is energized (if defined by programming).
35	Start Attempts	-	3	This is the maximum number of start attempts.
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	Engine Heating Type	-	0	This parameter defines the engine heating method. The genset will not take the load before engine heating is completed. **0:** engine is heated during the period defined by the **Engine Heating Timer (P_029)**. **1:** engine is heated until the coolant temperature reaches the temperature defined by **Engine Heating Temperature (P_022)** and at least during the period defined by the **Engine Heating Timer (P_029)**.
38	Charge input alarm	-	0	**0:** The charge input generates **CHARGE** warning, and does not stop the engine. **1:** The charge input generates **CHARGE** alarm, and stops the engine.
39	Frequency difference	Hz	1.0	If the frequency difference between the busbar and the genset phase U voltages are above this limit, then the synchronization will not be accepted.
40	Voltage difference	V	10	If the difference between the busbar and the genset phase U voltages are above this limit, then the synchronization will not be accepted.
41	Phase angle	deg.	5	If the phase angle between the busbar and the genset phase U voltages are above this limit, then the synchronization will not be accepted.
42	Reverse Power Limit	KW	0	If the active power measured on phase-U is negative and goes above this limit, during the period defined in **P_024,** a **REVERSE POWER** alarm will be generated. Enter this information with the same format as parameter P_000. If the parameter is set to 0 then the Reverse Power checking will be disabled.
43	Modem Connection	-	0	**0:** No modem connection, the serial port is connected to PC **1:** Modem connected.

Pgm	Definition	Unit	Std Val	Description
44	Maintenance Period (Engine Hours)	hours	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.
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	Not used			
47	Not used			
48	Not used			
49	Not used			
50	Disable auto power_off	0	0	**0:** if there is no alarm, the unit powers down 4 minutes after engine stop. **1:** the unit does not power_down.

The parameters P_051 and P_052 define the functions of relay outputs. The unit has 5 relay outputs and 2 of them have programmable functions. The fixed function relays are Fuel, Start and Check Synch.

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

Pgm	Description	Std
51	RELAY-1 function	03
52	RELAY-2 function	01

RELAY FUNCTİON LIST

00	Fuel	24	Oil sender alarm
01	Horn	25	Temp sender alarm
02	Start	26	Speed alarm
03	Stop	27	Start fail alarm
04	-	28	Charge alarm
05	-	29	Overload alarm
06	Choke	30	Voltage alarm
07	Preheat	31	Battery High alarm
08	Alarm	32	Oil switch warning
09	Warning	33	Temp switch warn.
10	Alarm+Warning	34	-
11	-	35	-
12	-	36	Emerg Stop warn.
13	-	37	Spare warning
14	Check Synch.	38	-
15	-	39	-
16	Oil switch alarm	40	Oil sender warning
17	Temp switch alarm	41	Temp sender warn.
18	Reverse Pow.alarm	42	Speed warning
19	-	43	-
20	Emerg.Stop alarm	44	Charge warning
21	Spare Alarm	45	Battery low warning
22	-	46	-
23	-	47	Battery high warn.

Parameters from P_053 to P_088 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

LOW OIL PRESSURE SWITCH INPUT

Pgm	Description	Std	
53	Operation	0	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
54	Fault monitoring	1	**0:** Always **1:** After holdoff timer
55	Latching	1	**0:** Non latching **1:** Latching
56	Contact type	0	**0:** Normally open **1:** Normally closed
57	Switching	0	**0:** Battery negative **1:** Battery positive
58	Response delay	1	**0:** No delay **1:** Delayed (4sec)

HIGH TEMPERATURE SWITCH INPUT

Pgm	Description	Std	
59	Operation	0	**0:** Alarm (the engine stops and horn relay operates)) **2** Warning (the horn relay operates) **3** No operation
60	Fault monitoring	0	**0:** Always **1:** After holdoff timer
61	Latching	1	**0:** Non latching **1:** Latching
62	Contact type	0	**0:** Normally open **1:** Normally closed
63	Switching	0	**0:** Battery negative **1:** Battery positive
64	Response delay	1	**0:** No delay **1:** Delayed (4sec)

DEAD BUS ENABLE

Pgm	Description	Std	
65	Operation	3	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
66	Fault monitoring	0	**0:** Always **1:** After holdoff timer
67	Latching	0	**0:** Non latching **1:** Latching
68	Contact type	0	**0:** Normally open **1:** Normally closed
69	Switching	0	**0:** Battery negative **1:** Battery positive
70	Response delay	1	**0:** No delay **1:** Delayed (4sec)

EMERGENCY STOP INPUT

Pgm	Description	Std	
71	Operation	0	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
72	Fault monitoring	0	**0:** Always **1:** After holdoff timer
73	Latching	0	**0:** Non latching **1:** Latching
74	Contact type	0	**0:** Normally open **1:** Normally closed
75	Switching	0	**0:** Battery negative **1:** Battery positive
76	Response delay	0	**0:** No delay **1:** Delayed (4sec)

SPARE FAULT INPUT

Pgm	Description	Std	
77	Operation	0	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
78	Fault monitoring	0	**0:** Always **1:** After holdoff timer
79	Latching	0	**0:** Non latching **1:** Latching
80	Contact type	0	**0:** Normally open **1:** Normally closed
81	Switching	0	**0:** Battery negative **1:** Battery positive
82	Response delay	1	**0:** No delay **1:** Delayed (4sec)

PROGRAM LOCK INPUT

Pgm	Description	Std	
83	Operation	3	**0:** Alarm (the engine stops and horn relay operates)) **2:** Warning (the horn relay operates) **3:** No operation
84	Fault monitoring	0	**0:** Always **1:** After holdoff timer
85	Latching	0	**0:** Non latching **1:** Latching
86	Contact type	0	**0:** Normally open **1:** Normally closed
87	Switching	0	**0:** Battery negative **1:** Battery positive
88	Response delay	0	**0:** No delay **1:** Delayed (4sec)

Parameters from P_089 to P_100 define the ohm-bar characteristics of the oil pressure sender. The sender characteristics will be defined using maximum 6 points. The values should be entered in the increasing order of ohm values. For unused points, ohm values should be entered as 0. An example table is given below. The sensor characteristics used in this table are:

0.0 bar.....240 ohms
1.0 bar.....218 ohms
5.0 bar.....153 ohms
10.0 bar.....103 ohms

Pgm	Description	Unit	Value
89	Point_1 resistor	ohm	103
90	Point_1 pressure	bar	10.0
91	Point_2 resistor	ohm	153
92	Point_2 pressure	Bar	5.0
93	Point_3 resistor	Ohm	218
94	Point_3 pressure	Bar	1.0
95	Point_4 resistor	Ohm	240
96	Point_4 pressure	Bar	0.0
97	Point_5 resistor	Ohm	0
98	Point_5 pressure	Bar	0.0
99	Point_6 resistor	Ohm	0
100	Point_6 pressure	bar	0.0

Parameters from P_101 to P_116 define the ohm-degrees characteristics of the temperature sender. The sender characteristics will be defined using maximum 6 points. The values should be entered in the increasing order of ohm values. For unused points, ohm values should be entered as 0. An example table is given below. The sensor characteristics used in this table are:

38 ºC.....342 ohms
82 ºC.....71 ohms
104 ºC.....40 ohms
121 ºC.....30 ohms

Pgm	Description	Unit	Value
101	Point_1 resistor	ohm	30
102	Point_1 temperature	ºC	121
103	Point_2 resistor	ohm	40
104	Point_2 temperature	ºC	104
105	Point_3 resistor	ohm	71
106	Point_3 temperature	ºC	82
107	Point_4 resistor	ohm	342
108	Point_4 temperature	ºC	38
109	Point_5 resistor	ohm	0
110	Point_5 temperature	ºC	0
111	Point_6 resistor	ohm	0
112	Point_6 temperature	ºC	0

The parameters from P_113 to P_118 adjust the date and time.

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

10. TROUBLESHOOTING

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.

KW and cosΦ readings are negative although the Amp readings are correct:

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

Short circuit the outputs of unused Current Transformers.

When the engine is to run the unit energizes the fuel solenoid, but does not start and OIL PRESSURE led flashes:

The unit is not supplied with battery (-) voltage at the oil pressure input.
-Oil pressure switch not connected.
-Oil pressure switch connection wire cut.
-Oil pressure switch faulty.
-Oil pressure switch closes too lately. If oil pressure switch closes, the unit will start. Optionally oil pressure switch may be replaced.

The engine does not run after the first start attempt, then the unit does not start again and OIL PRESSURE led flashes:

-The oil pressure switch closes very lately. As the unit senses an oil pressure, it does not start. When oil pressure switch closes the unit will start. Optionally the oil pressure switch may be replaced.

The engine starts to run but the unit gives START FAIL alarm and then the engine stops:

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

The unit is late to remove engine cranking:

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

The unit is inoperative:

Measure the DC-supply voltage between terminals 11 and 12 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.

11. 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.

12. TECHNICAL SPECIFICATIONS

Alternator voltage: 15 to 300 V-AC (Ph-N)

Alternator frequency: 0-100 Hz.

Busbar voltage: 0 to 300 V-AC (Ph-N)

Busbar frequency: 50 / 60 Hz

Current input: from current transformer, .../5A. Max load 0.7VA

Digital inputs: input voltage 0 - 30 V-DC. Internally connected to battery positive via 4700 ohm resistor.

Analog inputs: Resistor input 0 to 5000 ohms connected to the battery negative. Sources 10 mA when closed to battery negative.

Measurement category: CAT 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

Maximum current consumption: 350 mA-DC (Relay outputs open)

Check synch relay output: 16 A / 250 V.

DC relay outputs: 10A / 28 V.

Max. current for each terminal: 10A-RMS.

Charge alternator excitation current: 54 mA-DC @ 12 V-DC.

Communication port: Logic levels. 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: 130 x 100 x 39mm (WxHxD)

Panel Cut-out dimensions: 116 x 86mm minimum.

Mounting: Front panel mounted with rear retaining steel spring

Weight: 270 g (approx.)

Case material: High temperature, self extinguishing ABS (UL94-V0, 110 °C)

13. CONNECTION DIAGRAM