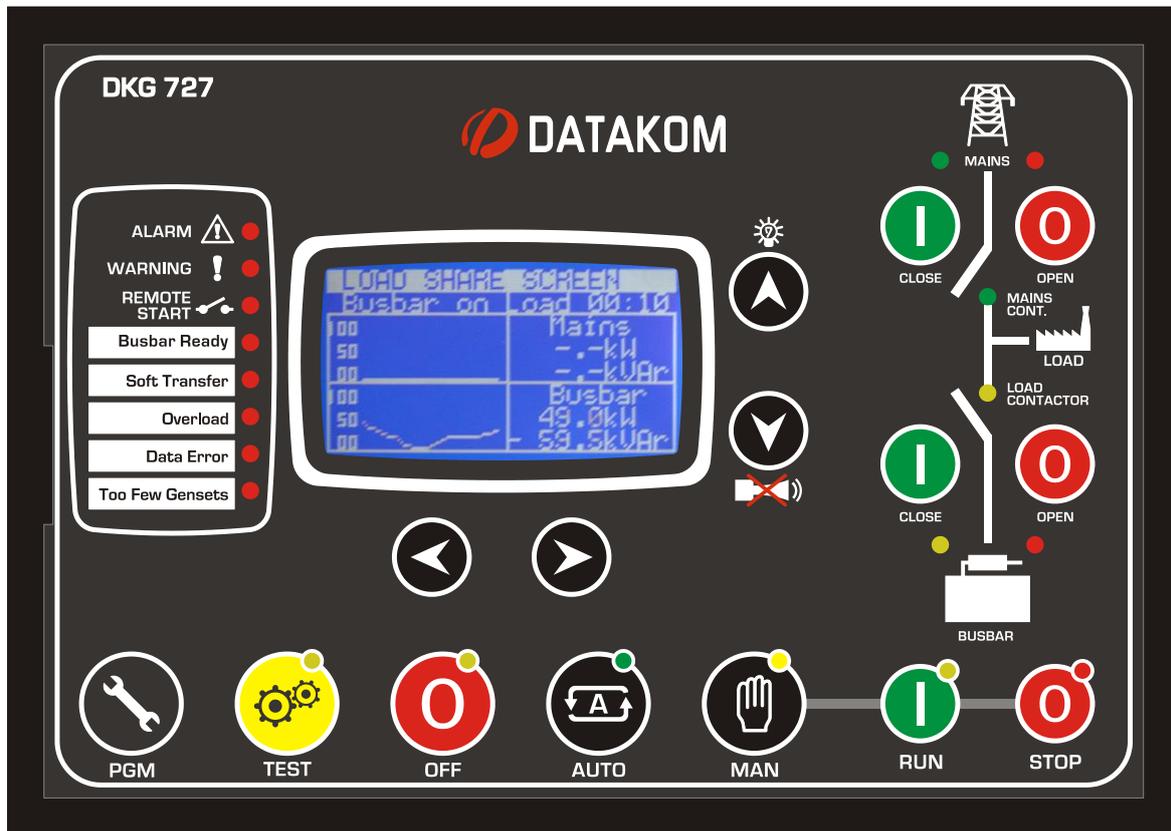




## DKG-727 MULTI GENSET PARALLELLING UNIT WITH J1939 INTERFACE



### STANDARD FEATURES

**Automatic mains failure**  
**Automatic and manual start**  
**Built in alarms and warnings**  
**True RMS measurements**  
**Complete mains power measurements**  
**Busbar voltages and frequency measurements**  
**Dead bus sensing**  
**Synchroscope**  
**No break transfer & no break load test**  
**Multi genset soft transfer to / from mains**  
**Multi genset power export to mains**  
**Multi genset peak lopping (peak shaving)**  
**G-59 mains protections**  
**External G59 protections applicable**  
**One Line Diagram monitoring on-line**  
**Load surge monitoring in programmed time scope**  
**Heavy Duty Feature**  
**Remote start operation capability**  
**Disable auto start capability**  
**Programmable Logic functions**  
**Fully isolated datalink communication port**  
**Voltage transformer ratio for MV applications**  
**Earth fault current monitoring**  
**Battery backed-up real time clock**

**Built-in daily, weekly, monthly exerciser**  
**500 event logs with time stamp and full snapshot**  
**Weekly operation schedule programs**  
**Field adjustable parameters**  
**Password protected front panel programming**  
**Upgrade software downloadable from PC (optional USB adapter needed)**  
**Free MS-Windows Remote monitoring SW:**  
   - monitoring, download of parameters  
   - download of software updates  
**High visibility, blue color 128x64 pixels graphic LCD**  
**User friendly graphic indicators and graphs**  
**Dual language support**  
**Customer logo display capability**  
**Protected semiconductor digital outputs**  
**Output expansion capability**  
**Configurable digital inputs: 12**  
**Configurable digital outputs: 8**  
**Configurable led indicators: 4**  
**Led/Relay output functions selectable from list**  
**Dimensions: 235 x 167 x 48mm (WxHxD)**  
**Sealed front panel (IP65)**  
**Plug-in connection system for easy replacement**

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# 1. INSTALLATION

## 1.1 Introduction to the Control Panel

The DKG-727 is a multi generating sets paralleling with mains unit. It has been designed to allow the user start and stop generating sets either manually or automatically. 128x64 pixels Graphic LCD display allows the visualization of measured parameters with graphic indicators and bar graphs. The unit is designed to provide user friendliness for both the installer and the user. Programming is usually fast, as the factory settings have been carefully selected to fit most applications. 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:

Busbar voltage phase L1 to neutral	Mains kW phase L2
Busbar voltage phase L2 to neutral	Mains kW phase L3
Busbar voltage phase L3 to neutral	Mains kVA phase L1
Busbar voltage phase L12	Mains kVA phase L2
Busbar voltage phase L23	Mains kVA phase L3
Busbar voltage phase L31	Mains kVAr phase L1
Busbar frequency	Mains kVAr phase L2
Busbar total kW (read from data link)	Mains kVAr phase L3
Busbar total kVAr (read from data link)	Mains pf phase L1
Busbar total pf	Mains pf phase L2
Mains voltage phase L1 to neutral	Mains pf phase L3
Mains voltage phase L2 to neutral	Mains total KW
Mains voltage phase L3 to neutral	Mains total KVA
Mains voltage phase L12	Mains total KVAr
Mains voltage phase L23	Mains total pf
Mains voltage phase L31	Synchroscope phase angle
Mains current phase L1	Voltage match mains-busbar
Mains current phase L2	Frequency match mains-busbar
Mains current phase L3	Battery voltage
Earth current	
Mains frequency	
Mains kW phase L1	

## 1.2 Mounting the Unit

The unit was 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 219x151 millimeters. Before mounting, remove mounting brackets from the unit, then pass the unit through the mounting opening. The unit will be maintained in its position by 4 plastic mounting brackets.

The DKG-727 is used in 12 or 24 V-DC operation.



**The engine body must be grounded for correct operation of the unit. Otherwise incorrect voltage and frequency measurements may occur, resulting in faulty operation.**

The output of the current transformers shall be 5 Amperes. The input current rating of the current transformers may be selected (between 50/5 and 5000/5 amps). Current transformer outputs shall be connected by separate cable pairs from each transformer, to related DKG-727 inputs. Never use common terminals or grounding. The power rating of the transformer should be at least 10 Watts. 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+**.

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  
Busbar phases: L1-L2-L3  
Mains phases: L1-L2-L3  
Battery positive: BAT(+).  
Install the fuses as nearly as possible to  
the unit in a place easily accessible for the user.  
The fuse rating should be 6 Amps.

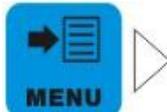


**WARNING: ELECTRICITY CAN KILL**  
**ALWAYS** disconnect the power **BEFORE** connecting the unit.



- 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<sup>2</sup>) and temperature range.

## 1.4 BUTTON DESCRIPTION

Button Icon	Function	Description
	PROGRAM MODE SELECTION	Used to enter / exit the program mode.
	TEST MODE SELECTION	Used to select TEST mode.
	OFF MODE SELECTION	Used to select OFF mode
	AUTO MODE SELECTION	Used to select AUTO mode
	MANUAL MODE SELECTION	Used to select MANUAL mode
	MENU – (LEFT ARROW)	In normal operation it is used to switch the display to the previous screen and enter event logging display. To exit from event logging display hold pressed this button. In programming mode, it saves the modified program parameter if any modification is made. If the program parameter is not modified then it will switch to the previous program parameter in the same group. Holding the button pressed for 1 second causes the display to program list.
	MENU + (RIGHT ARROW)	In normal operation it is used to switch the display to the next screen and enter event logging display. To exit from event logging display hold pressed this button. In programming mode, it saves the modified program parameter if any modification is made. If the program parameter is not modified then it will switch to the next program parameter in the same group. Holding the button pressed for 1 second causes the display to program list.

Button Icon	Function	Description
	ALARM MUTE (DOWN ARROW)	<p>In normal operation, it is used to mask alarms if exist and switch alarm to the next entries. In event logging display it is used to switch to the next event page.</p> <p>In program mode, it is used to decrease the parameter value.</p>
	LAMP TEST (UP ARROW)	<p>In normal operation, it turns on all leds of the unit and reset the LCD display. In event logging display it is used to switch to the previous event page.</p> <p>In program mode it is used to increase the parameter value.</p>
	CLOSE LOAD/MAINS CONTACTOR	Used to close the load or mains contactor in manual mode.
	OPEN LOAD/MAINS CONTACTOR	Used to open the load or mains contactor in manual mode
	MULTI GENSET MANUAL RUN	Used to run the generating set system manually in manual mode
	MULTI GENSET MANUAL STOP	Used to stop the generating set system manually in manual mode

## 2. INPUTS AND OUTPUTS

**EXTENSION CONNECTOR (OPTIONAL):** This connector is intended for optional relay extension modules. Each relay extension module provides 8 programmable 16A relay outputs. A maximum of 2 relay extension modules can be connected to the unit, increasing the total capacity to 24 relay outputs.

Term	Function	Technical data	Description
1	ANALOG OUTPUT 1 GND	Isolated ground	Analog output 1. The isolation is 1000 Volts.
2	ANALOG OUTPUT 1	Output,0-10VDC	
3	ANALOG OUTPUT 2	Output, 0-10VDC	Analog Output 2
4	ANALOG OUTPUT 2 GND	Input, 0-10VDC	Connect this terminal to the GND terminal of the controlled device.
5	SHIELD GROUND		This terminal is to be connected to the protective shield of the coaxial cable used for analog output 1 and 2. The terminal is internally connected to the <b>GND</b> (DC power supply negative terminal). <b>WARNING:</b> Ground the shield at one end only.
6	NC	No connection	
7	NC	No connection	
8	CURR_I3-	Mains current transformer inputs, 5A-AC	Connect the genset current transformer terminals to these inputs. Do not connect the same current transformer to other units than DKG-727 otherwise the unit may be damaged. 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).
9	CURR_I3+		
10	CURR_I2-		
11	CURR_I2+		
12	CURR_I1-		
13	CURR_I1+		
14	FAULT CURRENT-		
15	FAULT CURRENT-		
16	MAINS NEUTRAL	Input, 0-300V-AC	Neutral terminal for the genset phases.
17	MAINS T	Mains phase inputs, 0-300V-AC	Connect the mains phases to these inputs. The mains phase voltages upper and lower limits are programmable.
18	MAINS S		
19	MAINS R		
20	BUSBAR NEUTRAL	Input, 0-300V-AC	Neutral terminal for the busbar phases.
21	BUSBAR W	Busbar phase inputs, 0-300V-AC	Connect the busbar phases to these inputs. The busbar voltages upper and lower limits are programmable.
22	BUSBAR V		
23	BUSBAR U		
24	DATA LINK GROUND	0 VDC	Connect this terminal to the Data Link Ground
25	DATA LINK_L	Data Link -L connection	Connect this terminal to the Data Link-L terminal. All units are connected in parallel to the same data link cable.
26	DATA LINK-H	Data Link-H connection	Connect this terminal to the Data Link-H terminal. All units are connected in parallel to the same data link cable.
27	DATA LINK TERMINATION RESISTOR	120 ohm resistor	This terminal is used to enable the 120 ohms termination resistor of the Data Link. The Data Link should be terminated at 2 ends only. Thus the termination resistor will be enabled in only 2 units. In order to enable the termination resistor, this terminal should be connected to the <b>terminal-25</b> .

Term	Function	Technical data	Description
28	NC	No connection	
29	NC	No connection	
30	NC	No connection	
31	NC	No connection	
32	BATTERY POSITIVE	+12 or +24 VDC	The positive terminal of the DC Supply shall be connected to this terminal. The unit operates on both 12V and 24V battery systems.
33	DIGITAL OUT – 6	Negative pulling protected semiconductor output. 1A @ 28VDC.	This output has programmable functions, selectable from a list.
34	DIGITAL OUT – 3 (LOAD CONTACTOR OUTPUT)	Negative pulling protected semiconductor output. 1A @ 28VDC.	It is used as load contactor output.
35	DIGITAL OUT – 7	Negative pulling protected semiconductor output. 1A @ 28VDC.	This output has programmable functions, selectable from a list.
36	DIGITAL OUT – 2	Negative pulling protected semiconductor output. 1A @ 28VDC.	This output has programmable functions, selectable from a list.
37	DIGITAL OUT – 1 (REM SYS. START OUTPUT)	Negative pulling protected semiconductor output. 1A @ 28VDC.	This output has programmable function, selectable from a list. However it is factory set as system start output.
38	DIGITAL OUT – 0	Negative pulling protected semiconductor output. 1A @ 28VDC.	This output has programmable functions, selectable from a list.
39	DIGITAL OUT – 4 (ALARM OUTPUT)	Negative pulling protected semiconductor output. 1A @ 28VDC.	This output has programmable functions, selectable from a list. However it is factory set as ALARM relay output.
40	DIGITAL OUT – 5 (MAINS CONTACTOR OUTPUT)	Negative pulling protected semiconductor output. 1A @ 28VDC.	This output has programmable functions, selectable from a list.
41	NC	No connection	
42	GROUND	0 VDC	Power supply negative connection.
43	PROGRAM LOCK	Digital input	This input is used to prevent unwanted modification to programmed values. If this input is left open, program values can be modified via the front panel buttons. If this input is connected to battery negative it will not be possible to change the program values.

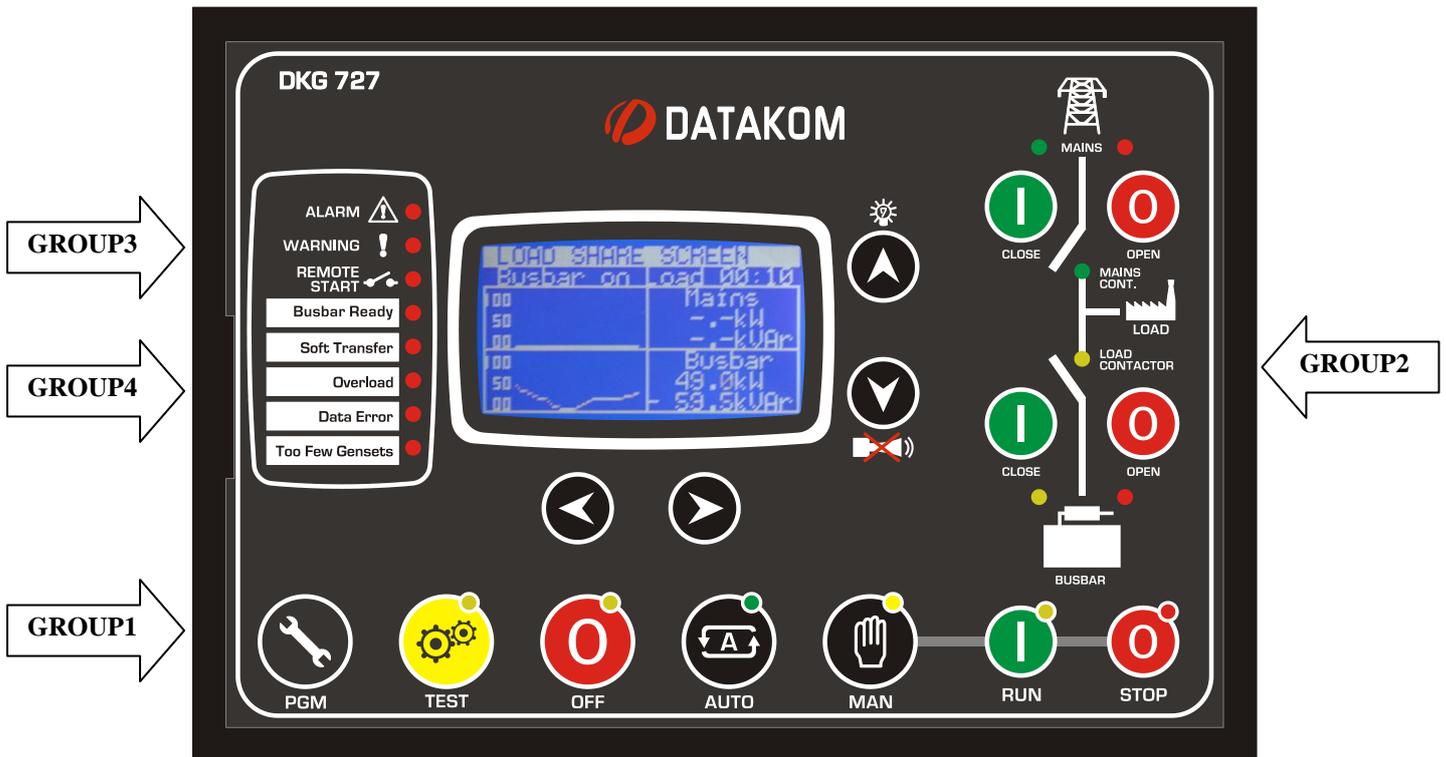
Term	Function	Technical data	Description
44	DIGITAL INPUT-11 Reset Alarms	Digital inputs	These inputs have programmable functions, selectable from a list via the program menu. Each input may be driven by a 'normally closed' or 'normally open' contact, switching either to battery+ or battery-. The effect of the switch is also selectable from a list. See PROGRAMMING section for more details.
45	DIGITAL INPUT-10 Alarm Mute		
46	DIGITAL INPUT-9 Manual Stop		
47	DIGITAL INPUT-8 Manual Run		
48	DIGITAL INPUT-7 Force Test		
49	DIGITAL INPUT-6 Force Off		
50	DIGITAL INPUT-5 Force Auto		
51	DIGITAL INPUT-4 Force Manual		
52	DIGITAL INPUT-3 Mains CB Feedback		
53	DIGITAL INPUT-2 Load CB Feedback		
54	DIGITAL INPUT-1 Ready Input		
55	DIGITAL INPUT-0 Emergency Stop		
56	NC	No connection	
57	NC	No connection	
58	NC	No connection	
59	NC	No connection	
60	NC	No connection	

### 3. DISPLAY

#### 3.1 Led Displays

The DKG-727 has 20 leds, divided in 4 groups:

- Group\_1:** Operating mode: This group indicates the genset function.
- Group\_2:** Mimic diagram: This group indicates the current status of the busbar/mains voltages, busbar/mains contactor status and busbar alive/dead status.
- Group\_3:** Warnings and alarms: This group indicates the existence of abnormal conditions encountered during operation.
- Group\_4:** User programmable LED indicators.



Function	Color	Description
<b>BUSBAR ON</b>	Yellow	The LED will turn on when all 3 busbar phase voltages and the busbar frequency are within the limits.
<b>BUSBAR OFF</b>	Red	The LED will turn on when at least one of the busbar phase voltages or the busbar frequency are outside limits.
<b>BUSBAR ON LOAD</b>	Yellow	It turns on when the LOAD contactor is activated.
<b>MAINS OK</b>	Green	The LED will turn on when all 3 mains phase voltages are within the programmed limits.
<b>MAINS FAIL</b>	Red	The LED will turn on when at least one of the mains phase voltages or the mains frequency are outside limits.
<b>MAINS ON LOAD</b>	Green	It turns on when the MAINS contactor is activated.
<b>GENSET SYSTEM MANUAL RUN BUTTON</b>	Yellow	It turns on when manual start key pressed in MANUAL mode. If the unit is not in MANUAL mode, this button has no function.
<b>GENSET SYSTEM MANUAL STOP BUTTON</b>	Red	It turns on when manual stop key pressed in MANUAL mode. If the unit is not in MANUAL mode, this button has no function.
<b>MAN</b>	Yellow	It turns on when the related operation mode is selected. One of these LEDs is always on and indicates the selected operation mode. If the operation of the genset is disabled by the <b>weekly operation schedule</b> , then the <b>AUTO</b> led will flash.
<b>AUTO</b>	Green	
<b>OFF</b>	Yellow	
<b>TEST</b>	Yellow	
<b>ALARM</b>	Red	It turns on when an engine shutdown alarm is occurred.
<b>WARNING</b>	Red	It turns on when an engine warning condition is occurred.
<b>REMOTE START</b>	Red	It turns on when the unit send a remote start signal to multi generating set.
<b>BUSBAR READY</b>	Red	It turns on when the unit receive a busbar ready signal from multi generating set.
<b>SPARE LED 1</b>	Red	These leds turn on when the programmed function is active. The function is selectable from a list of 196 entries.
<b>SPARE LED 2</b>	Red	
<b>SPARE LED 3</b>	Red	
<b>SPARE LED 4</b>	Red	

## 3.2 Digital Display

The graphic LCD is 128x64 pixels wide.

It shows:

- The software version and release date,
- Device communication parameters,
- The generating sets status,
- Measured parameters,
- Alarm information,
- Company LOGO,
- Graphical synchronization and load sharing displays,
- Date and time,
- Logged events,
- Program parameters.

During power on, the display shows company LOGO for 3 second.

The display has basically two modes:

- Normal operation,
- Programming mode.

The programming mode will be explained later in this document.

The display is driven by a menu system. The navigation between different screens is made with the MENU+ and MENU- buttons. Each depression of the MENU+ button switches the display to the next screen. Each depression of the MENU- button switches the display to the previous screen.

The last screen is the event logging display. In the event logging display each depression of the MENU+ button switches to the next event. Each depression of the MENU- button switches to the previous event.



To exit from event logging display please hold pressed **MENU+** or **MENU-** button.

Navigation between previous or next event pages in the event logging display is made with the ARROW UP (LAMPTEST) and the ARROW DOWN (ALARM MUTE) buttons.

During operation, the DKG-727 will switch automatically between different screens, displaying always the most important parameters for the current situation.

If an alarm or warning occurs during operation, in other then programming mode, the display will automatically switch to ALARM LIST position. The MENU+ or MENU- buttons will not function. To enable display navigation and mask alarms, press ALARM MUTE button first. If there is more than one alarm, the next alarm is displayed by pressing the MENU+ button. Thus all existing alarms can be scanned.

After a delay the display will automatically revert to the last screen before alarm.

Screen	Description	Contents
1	Basic Mains Parameters	Mains Voltages L1-L2-L3, Mains Currents L1-L2-L3, Mains Total Active Power (kW), Mains Total Apparent Power (kVA), Mains Total Reactive Power (kVAr), Mains Total Power Factor (cos $\Phi$ ), Mains Frequency, Battery Voltage
2	Basic Mains Parameters	Mains Voltages L12-L23-L31, Mains Currents L1-L2-L3, Mains Total Active Power (kW), Mains Total Apparent Power (kVA), Mains Total Reactive Power (kVAr), Mains Total Power Factor (cos $\Phi$ ), Mains Frequency, Battery Voltage
3	Basic Mains Parameters (Large Fonts)	Mains Voltages L1-L2-L3, Mains Currents L1-L2-L3
4	Basic Mains Parameters (Large Fonts)	Mains Voltages L12-L23-L31, Mains Currents I1-I2-I3
5	Basic Mains Parameters (Large Fonts)	Mains Powers L1-L2-L3
6	Basic Mains Parameters (Large Fonts)	Mains Powers Factors L1-L2-L3
7	Basic Mains Parameters (Mixed-Large Fonts)	Mains Phase Voltage L1, Mains Phase Current L2, Mains Total Active Power (kW), Mains Total Power Factor (cos $\Phi$ ), Mains Frequency, Battery Voltage
8	Basic Busbar Parameters (Large Fonts)	Busbar Voltages L1-L2-L3, Busbar Total Active Power (kW), Busbar Total Power Factor (cos $\Phi$ ), Busbar Frequency
8	Basic Busbar Parameters (Large Fonts)	Busbar Voltages L12-L23-L31, Busbar Total Active Power (kW), Busbar Total Power Factor (cos $\Phi$ ), Busbar Frequency
9	Synchroscope (Large Fonts)	Bar Synchroscope Graph Synchronization Timer, Mains-Busbar voltage difference, Mains-Busbar frequency difference, Mains-busbar phase angle (degrees)
10	Synchroscope-2 (Circular)	Circular Synchroscope Graph, Synchronization Timer, Mains-Busbar voltage difference, Mains-Busbar frequency difference, Mains-busbar phase angle (degrees)
11	Soft Transfer Screen	Soft Transfer Timer, Mains Total Active Power (kW), Mains Total Reactive Power (kVAr), Busbar Total Active Power (kW), Busbar Total Reactive Power (kVAr), Active Power Soft Transfer Ramp (kW), Busbar Target Active Power (kW)

Screen	Description	Contents
12	Load Sharing Screen	Mains Total Active Power (kW), Mains Total Power Factor (cosΦ), Busbar Total Active Power (kW), Busbar Total Power Factor (cosΦ), Mains Total Load Surge (Graphical 0-100%) Busbar Total Load Surge (Graphical 0-100%)
13	Power Counters Screen	Total Active Power Counter (kWh) Total Reactive Power Counter (kVArh)
14	Screen Saver	Mains Total Active Power (kW), Busbar Total Active Power (kW), Mains Contactor Status, Load Contactor Status, Generating Sets Contactor statuses
15	DATA LINK SCREEN	The operating software version, Date and time, Device address, device priority, Data link Valid and Failed message counters.
16	Company LOGO	Customized company LOGO. Customers can create own LOGO and download into the unit by LOGO_DOWNLOADER program. LOGO size must be 128x64 pixels.
17	Alarm list	If no alarm exists this screen will display 'END OF ALARM LIST'. Existing alarms and warnings will be displayed as one screen for each entry. Switching to the next entry will be made with the down (alarm mute) button.
18	EVENT RECORDS	Event records display mode is started by switching this screen .
19	Factory Test Screen	Mains Voltages L1,L2,L3, Busbar Voltages L1,L2,L3, Mains Currents I1,I2,I3, Battery Voltage, Earth Current Digital Inputs.

Screen	Description	Contents
1-512/A	Event Records Page 1	This group displays last 512 recorded events A page: Date And Time Event type Device Operating State Device Mode
1-512/B	Event Records Page 2	This group displays last 512 recorded events B page: Mains Voltages L1,L2,L3, Mains Currents I1,I2,I3, Mains Total Active Power (kW), Mains Total Power Factor (cosΦ), Mains Frequency, Battery Voltage
1-512/C	Event Records Page 3	This group displays last 512 recorded events C page: Busbar Voltages L1,L2,L3, Busbar Total Active Power (kW), Busbar Total Power Factor (cosΦ), Busbar Frequency
1-512/D	Event Records Page 3	This group displays last 512 recorded events D page: Digital Inputs Digital Outputs

## 4. ALARMS

Alarms indicate an abnormal situation in the generating set.

The alarms are divided into 2 priority level:

- 1- **SHUTDOWN ALARMS:** These are the most important alarm conditions and cause:
  - The load contactor to be released immediately,
  - The generating sets to be stopped,
  - The alarm relay output to operate,
  - The **ALARM** led to turn on,
  - The LCD display to switch to alarm display mode (except when programming).
- 2- **WARNINGS:** These conditions cause:
  - The alarm relay output to operate,
  - The **WARNING** led to turn on.

Most of the alarms are of LATCHING type. Even if the alarm condition is removed, the alarms will stay on and disable the operation of the generating set system.

The existing alarms may be canceled by pressing one of the operating mode buttons (**TEST / OFF / AUTO / MANUAL**).

If the **ALARM MUTE** button is pressed or alarm mute input is activated the alarm relay output will be deactivated; however the existing alarms will persist and disable the operation of the unit.

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

The digital inputs are programmable and may be set to provide a large variety of alarms and warnings. See the programming chapter for digital input programming.

The alarms may be cancelled either by pressing any of the front panel mode selection buttons, by a change in external mode force inputs or by reset alarms input .



**The alarm can not be canceled without the alarm source removed.**



**The alarm resetting can lead to a start sequence. Be careful before resetting alarms.**

## 4.1 Shutdown Alarms

Definition	Source	Description
Spare Alarm 0-11	Digital Input	These shutdown alarms are set depending on the digital input settings. The related program parameters are <b>P_700</b> to <b>P_7B6</b> .
High Battery Voltage	Battery	Set if the battery voltage goes over the <b>High Battery Voltage Shutdown (P_617)</b> limit.
Busbar Phase Sequence Fail	U-V-W	Set if the busbar phase sequence is not correct and <b>Ignore Phase Order (P_625)</b> parameter is '0'.
Busbar Low Voltage	U-V-W	Set if any of the genset phase voltages goes under the <b>Busbar Low Limit (P_606)</b> voltage.
Busbar High Voltage	U-V-W	Set if any of the genset phase voltages goes over the <b>Busbar High Limit (P_607)</b> voltage.
Busbar Low Frequency	Phase U	Set if the busbar frequency goes under the <b>Busbar Low Frequency Shutdown (P_610)</b> limit for <b>Frequency Timer (P_613)</b> period.
Busbar High Frequency	Phase U	Set if the busbar frequency goes over the <b>Busbar High Frequency Shutdown (P_612)</b> limit for <b>Frequency Timer (P_613)</b> period.
Fail To Start	Internal	Set if the busbar ready signal has not received after <b>Start Fail Timeout (P_504)</b> .
Minimum Genset Not Available	Internal	Set if number of available gensets on datalink does not reach items that defined in this parameter.
Earth Current Fault	Internal	Set if the earth current exceeds the earth fault limit. ( <b>P_620</b> ) There is no action when limit set as 0.
Genset Phase Sequence Fail	R-S-T	Set if the mains phase sequence is not correct. This alarm may be cancelled also by programming the <b>Ignore Phase Order</b> parameter ( <b>P_625</b> ) to 1.
Mains CB Fail to Open	Internal	Set if at mains contactor does not open when <b>Mains Contactor Timer (P_509)</b> expired. This alarm is enabled by enabling one of digital inputs as MC auxiliary contactor feedback.
Ready Signal Fail	Internal	Set if ready signal disappears during <b>Ready Signal Fail Timeout (P_511)</b> after load contactor operated.
Address Conflict	Internal	Set if more then one unit uses the same address in the Data Link.
Data Link Error	Data Link Comm.	Set if the device encounters a Data Link physical layer problem.
Invalid Address Number	Internal	Set if the device has an invalid address number (below then 32 or over then 35) Address numbers must be within 32 and 35.

## 4.3 Warnings

Definition	Source	Description
Spare Warning 0-11	Digital Input	These warnings are set depending on the digital input settings. The related program parameters are <b>P_700</b> to <b>P_7B6</b> .
High Battery Voltage	Internal	Set if the battery voltage goes over the <b>High Battery Voltage Warning (P_616)</b> limit.
Low Battery Voltage	Internal	Set if the battery voltage goes under the <b>Low Battery Voltage Warning (P_618)</b> limit.
Busbar Low-Frequency	Phase-U	Set if the busbar frequency goes under the <b>Busbar Low Frequency Warning (P_609)</b> limit for <b>Frequency Timer (P_613)</b> period.
Busbar High-Frequency	Phase-U	Set if the busbar frequency goes over the <b>Busbar High Frequency Warning (P_611)</b> limit for <b>Frequency Timer (P_613)</b> period.
Address Not Claimed	Serial comm.	Set if the Device address claim operation is failed.
Fail To Stop	Internal	Set if the ready signal keeps receiving after starting the stop sequence during <b>Stop Fail Timeout (P_508)</b> .
Load CB Fail to Close	Internal	Set if the load contactor did not operate when <b>Load Contactor Timer (P_510)</b> is expired. This alarm is enabled by programming one of digital inputs as LC auxiliary contact feedback.
Load CB Fail to Open	Internal	Set if the load contactor did not open when <b>Load Contactor Timer (P_510)</b> is expired. This alarm is enabled by programming one of digital inputs as LC auxiliary contact feedback.
Mains CB Fail to Close	Internal	Set if the mains contactor does not operate when <b>Mains Contactor Timer (P_509)</b> is expired. This alarm is enabled by enabling one of digital inputs as MC auxiliary contact feedback.
Parallel Mains Fail	Internal	This general warning is set if any of the protection functions have detected a mains failure during <b>parallel with mains</b> operation.
Mains Reverse Power	Internal	In <b>parallel with mains</b> operation and after the parallel check timeout delay ( <b>P_A15</b> ) has elapsed, this warning will be set if the mains power is negative and over the reverse power limit defined in <b>P_A16</b> . There is no action when limit set as 0.
Mains Frequency Fail	R	In parallel with mains operation and after the parallel check timeout delay ( <b>P_A15</b> ) has elapsed, this warning will be set if the mains frequency is out of the limits defined in <b>P_614</b> and <b>P_615</b> for 4 consecutive cycles.
No Mains Frequency	R	In parallel with mains operation and after the parallel check timeout delay ( <b>P_A15</b> ) has elapsed, this warning will be set if the mains frequency disappears for more than 2,5 periods.
ROCOF (df/dt) Fail	R	In parallel with mains operation and after the parallel check timeout delay ( <b>P_A15</b> ) has elapsed, this warning will be set if the mains frequency change exceeds the limit defined in <b>P_A17</b> for 4 consecutive cycles. There is no action when limit set as 0.
Vector Shift (df/dt) Fail	R	In parallel with mains operation and after the parallel check timeout delay ( <b>P_A15</b> ) has elapsed, this warning will be set if the phase of the mains measured on last 2 cycles jumps over the limit defined in <b>P_A18</b> on the phase measured on last 4 <sup>th</sup> and 5 <sup>th</sup> period. There is no action when limit set as 0.
Data Link Comm. Lost	Data Link	Set if the Data Link communication is interrupted.

## 5. MODES OF OPERATION

The modes of operation are selected via push buttons mounted on the front panel. Modes can also be selected by external mode selection inputs. External inputs will override the front panel selection. If none of the external inputs is active, the unit resumes to the mode selected by the front panel. Following selected mode, the DKG-727 will have different behavior.

### 5.1 OFF mode

In this mode the mains contactor will be energized if mains phase voltages and frequency are within the programmed limits. Generating sets will be stopped if running, and will not respond to run commands. The yellow led on the OFF pushbutton will turn on.



If a digital input configured as panel lock input and activated, changing the mode of unit will not be possible.

### 5.2 AUTO mode

It is used for generating sets controlled with DKG-707 and mains automatic transfer. If at least one of the mains phase voltages or the mains frequency is outside limits, the mains contactor will be deactivated. The remote start signal will be sent (via digital outputs or message) to multi genset system when programmed time period expired (**P\_503**). Multi generating sets run, close genset contactors to the busbar. And ready signal will be sent back to DKG-727 by master device. If DKG-727 does not receive the busbar ready signal during start fail timeout (**P\_504**), at the end of this period unit stops the start sequence and fail to start alarm is displayed. Once busbar ready signal receive (via digital inputs or message) the load contactor is activated immediately. When all the mains phase voltages and the mains frequency are within the limits, the multi generating sets will continue to run for the mains waiting period (**P\_507**). At the end of this period the DKG-727 will start synchronizing sequence if programmed. No break transfer or interrupted transfer will be done from generating sets to mains. DKG-727 corrupts the remote start signal. And multi generating sets start the stop sequence. Master DKG-707 corrupts the busbar ready signal. However DKG-727 is still keep receiving the busbar ready signal during stop fail timeout (**P\_508**), at the end of this period fail to stop warning is displayed. Genset contactors will be deactivated immediately. If a cooling period is given, the generating sets will continue to run during cooling period. At the end of the period, the fuel solenoids will be de-energized and the diesels will stop. The unit will be ready for the next mains failure. If the operation of the DKG-727 is disabled by the weekly schedule, then the AUTO led will flash, and the operation of the unit will be as in the OFF mode.

This mode is activated by pressing the **AUTO** pushbutton or by activating the signal input which is assigned as **FORCE AUTO MODE**. The green led on the pushbutton will turn on.



If the operation of a genset is disabled by the **weekly schedule**, then the **AUTO** led will flash, and the operation of this genset will be as in the **OFF** mode.



If a digital input configured as panel lock input and activated, changing the mode of unit will not be possible.

## 5.3 TEST mode

It is used to test gensets in the multi genset paralleling with mains system.

TEST mode is entered by pressing the TEST pushbutton, but it may be activated by the automatic exerciser or the FORCE TEST MODE signal input also. When TEST mode is selected, the yellow led on the TEST pushbutton will turn on.



If a digital input configured as panel lock input and activated, changing the mode of unit will not be possible.

Once the test mode is activated, the DKG-727 sends a remote start signal to multi generating sets. If **Test on load (P\_517)** parameter is set to 1, once the DKG-727 receive busbar ready signal, activates the load contactor in order to enable load transfer. However **P\_517** is set to **0**, multi generating sets runs off load. It may still be provided depending on the **Emergency Backup Operation** parameter (**P\_518**).

If **Test on load** is disabled and the **Emergency Backup** operation (**P\_518**) is enabled and mains failure occurs, then the DKG-727 activates the load contactor.



There is no Start Delay in this mode.

Test mode will be automatically terminated **after 6 minutes** if entered by pressing the TEST button. When the TEST mode is terminated, the multi generating sets starts the stop sequence as described in AUTO mode.

## 5.4 MANUAL mode

The manual mode allows the user to control the operation of the unit, and provides fault finding and diagnostic testing of the various functions automatically performed in Auto mode.

This mode is activated by pressing the **MANUAL** pushbutton. When the MANUAL mode is selected, the yellow led on the MAN pushbutton will turn on.



If a digital input configured as panel lock input and activated, changing the mode of unit will not be possible.

If the **RUN (I)** button is pressed, then the unit will initiate a start sequence. There is no start delay in this operation mode. Multi genset system runs off load.

If the busbar voltages and frequency are not within limits, then the load contactor **CLOSE(I)** and open **OPEN(O)** pushbuttons will have no effect. Otherwise load contactor **CLOSE(I)** and **OPEN(O)** pushbuttons will have below effects:

1. Mains Failure and mains contactor de-activated:
  - a. When load contactor **CLOSE(I)** pushbutton pressed, load contactor will be closed immediately.
  - b. When load contactor **OPEN(O)** pushbutton pressed, load contactor will be opened immediately.

2. Mains voltages and frequency are within limits and mains contactor activated:
- a. When load contactor **CLOSE(I)** pushbutton pressed, mains contactor will be deactivated and load contactor will be closed immediately if no break transfer not enabled.
  - b. When load contactor **CLOSE(I)** pushbutton pressed, synchronizing sequence is started by DKG-727. When voltage, frequency and phase angle difference are between the limits the load contactor will be closed automatically and soft load transfer will be done from mains to busbar during soft transfer timeout. At the end of this period mains contactor will be deactivated automatically. if soft transfer not enabled mains contactor will be de-activated immediately.
  - c. When load contactor **OPEN(O)** pushbutton pressed, load contactor will be deactivated and mains contactor will be closed immediately if no break transfer not enabled.
  - d. When load contactor **OPEN(O)** pushbutton pressed, synchronizing sequence is started by DKG-727. When voltage, frequency and phase angle difference are between the limits the mains contactor will be closed automatically and soft load transfer will be done from busbar to mains during soft transfer timeout (**P\_A04**). When busbar power goes under soft transfer low limit (**P\_A14**) or at the end of this period load contactor will be de-activated automatically. if soft transfer not enabled mains contactor will be de-activated immediately.

Mains voltages and frequency are not within limits mains contactor **CLOSE(I)** and open **OPEN(O)** push buttons will have no effect. Otherwise mains contactor **CLOSE(I)** and **OPEN(O)** pushbuttons will have below effects:

1. Load contactor de-activated:
  - a. When mains contactor **CLOSE(I)** pushbutton pressed, mains contactor will be closed immediately.
  - b. When mains contactor **OPEN(O)** pushbutton pressed, mains contactor will be opened immediately.

If load contactor activated, function of the mains contactor **CLOSE(I)** pushbutton and load contactor **OPEN(O)** pushbutton is same and function of the mains contactor **OPEN(O)** pushbutton and load contactor **CLOSE(I)** pushbutton is same.

## 5.5 External Switching of the Operation Mode

The Mode of operation of the unit may also be selected by external inputs instead of front panel keys. For this, at least one of the digital inputs should be programmed as an input to force one of the 3 operating modes (Manual, Auto, Off, Test modes). The corresponding input's **P\_7x0** parameter should be set to **5, 6, 7** or **8** accordingly. The mode selection signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using parameters **P\_7x5** and **P\_7x6**.

The external selection input has a higher level of priority than the front panel keys. Thus if the operating mode is forced by the external input, this will override the selection made by the front panel keys. However, when the external selection signal is removed, the unit will resume to the mode selected by the front panel keys.

If a front panel mode selection key is pressed while the external mode select input is active, then the key selection will be stored and when the external selection signal is removed, the unit will resume to this mode.

## 6. SYNCHRONIZING WITH MAINS

### 6.1 INTRODUCTION

The DKG-727 offers the possibility of synchronizing the multi genset system with the mains

The synchronization comprises frequency, phase and voltage matching features.

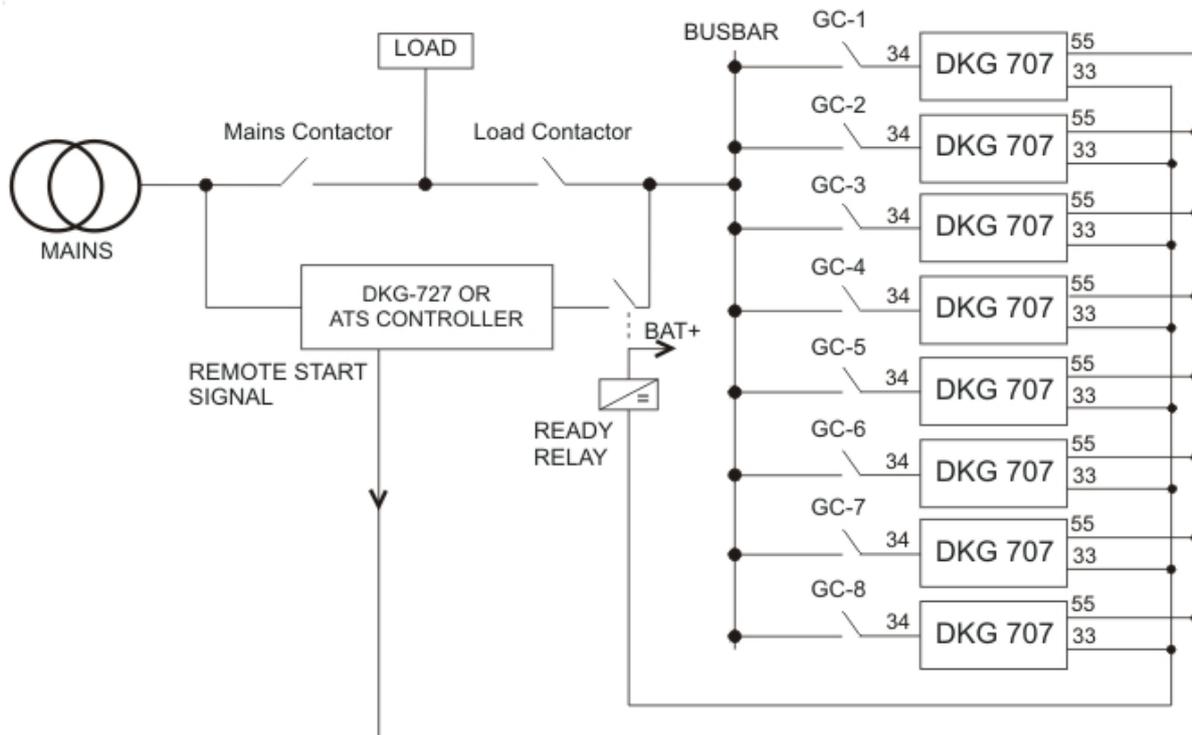
The synchronization properties of the unit are adjusted with program parameters.



These parameters are reserved for factory and qualified installation personal use and must not be modified by end users or non-qualified service personal. Otherwise severe damage may occur!

When DKG-727 detects a mains failure, it will send a remote start signal to the multi genset system. The remote start signal will cause gensets to run. When the master genset is ready, it will close its genset contactor. Then slaves will synchronize to the busbar and close their genset contactors in turn. When all gensets have closed their contactors, the master will activate the READY output at the end of ready delay timeout and the DKG-727 will close the load contactor.

#### Basic scheme:



## 6.2 Synchronization

### Phase Matching

The phase matching is locking the frequency and the phase of the busbar to the mains. In order to achieve this, the DKG-727 compares the frequency and the phase of the busbar voltage (**phase L1**) with the mains voltage (**phase L1**) and sends measurements to master DKG-707. Also frequency lock gain parameters are sent by DKG-727. Master device dominates the system frequency for synchronizing.

The function of the frequency lock is controlled by below programmed parameters:

**P\_A05 Frequency Lock Gain:** This parameter defines the reaction speed of multi genset frequency to phase differences between busbar and mains phases during synchronization. The standard value for this parameter is 2. But it must be readjusted for the engine during commissioning. If this parameter is too high, active power unbalance between multi generating sets may occur. If it is too low, the phase locking will be slower.

**P\_A06 Frequency Lock I/P Gain:** This parameter defines the ratio of the integral gain to the proportional gain used to lock busbar frequency to the mains frequency. The standard value for this parameter is 8. But it must be readjusted for the engine during commissioning.

### Voltage Matching

While closing the load contactor, the busbar voltage should be equal to the mains voltage. If busbar and mains with different voltages are paralleled, circulating currents will flow between them. The DKG-727 compares the busbar phase L1 voltage with the mains phase L1 voltage and sends measurements to master DKG-707. Also voltage lock gain parameter is sent by DKG-727. Master device dominates the system voltage for synchronizing.

The function of the voltage lock parameter is:

**P\_A07 Voltage Lock Gain:** This parameter defines the reaction speed of the voltage lock to voltage differences between busbar and mains phases during synchronization. The standard value for this parameter is 8. But it must be readjusted for the genset during commissioning. If this parameter is too high, reactive power unbalance may occur. If it is too low, the voltage matching will be slower.

## 7. LOAD TRANSFER MODES

The DKG-727 has more than one ways of transferring the load from multi genset system to mains and vice versa.

These modes are:

- transfer with interruption,
- no break transfer, (with or without synchronization)
- soft transfer.

### 7.1 Transfer with Interruption

This is the most conventional way of transferring the load between the multi genset system and mains. There will be a power interruption period duration during the transfer. Note that the program parameters **P\_509** and **P\_510** define the power interruption period.



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

#### **Transfer from multi genset system to mains:**

- The load contactor releases,
- The unit waits for Mains Contactor Timer (**P\_509**) or mains contactor auxiliary feed back input
- The mains contactor is energized.

#### **Transfer from mains to multi genset system:**

- The mains contactor releases,
- The unit waits for Load Contactor Timer (**P\_510**) or load contactor auxiliary feed back input
- The load contactor is energized.

## 7.2 No Break Transfer

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

The maximum duration that both contactors will be active is programmable. However this process may be quicker with the use of one auxiliary contact at each contactor. Thus the changeover will be quite instantaneous, preventing any excess or reverse power condition. Normally the digital input\_3 (terminal **52**) is used for mains contactor auxiliary contact and the digital input\_2 (terminal **53**) is used for load contactor auxiliary contact.

To prevent a phase to phase short circuit below criteria must be met:

- The mains and busbar voltages must be equal,
- The mains and busbar voltages must have the same phase,
- The mains and busbar voltages must have the same phase sequence order.

The DKG-727 will allow a **No Break Transfer** only if **all** of the below conditions are fulfilled:

- Mains phase voltages within the programmed limits,
- Mains frequency within the programmed limits,
- Busbar phase voltages within the programmed limits,
- Busbar frequency within the programmed limits,
- Mains phase order correct (or phase order check must be disabled),
- Busbar phase order correct (or phase order check must be disabled),
- The difference between mains and busbar frequencies not more than programmed limit,
- The voltage difference between phase R and phase U not more than programmed limit,
- The phase angle between phase R and phase U not more than programmed limit,

When a **No Break Transfer cycle** is initiated, the DKG-727 checks all the above criteria to be satisfied. If any of the checks fail, then the unit reverts to a **Transfer with Interruption**.

If all conditions are met, the unit proceeds to the synchronization. Normally with frequencies matching at +/- 2Hz and voltages matching at +/-10 volts an **uncontrolled No Break Transfer** will be successful if auxiliary contacts of the contactors are used.

If matching is found before the expiration of the **Synchronization Fail Timeout (P\_A11)**, then both contactors will be activated. If contactor auxiliary contacts are used, the other contactor will release immediately. If contactor auxiliary contacts are not used, the other contactor will release after **mains/load contactor timeout (P\_509) or (P\_510)**.

The DKG-727 has a set of programmable parameters to define the No Break Transfer operation. These parameters are:

**P 603 Mains Low Limit:** Each of the mains phase voltages must be over this limit.

**P 604 Mains High Limit:** Each of the mains phase voltages must be below this limit.

**P 606 Busbar Low Limit:** Each of the busbar phase voltages must be over this limit.

**P 607 Busbar High Limit:** Each of the busbar phase voltages must be below this limit.

**P 609 Busbar Low Frequency Warning:** The busbar frequency must be over this limit.

**P 610 Busbar Low Frequency Shutdown:** The busbar frequency must be over this limit.

**P 611 Busbar High Frequency Warning:** The busbar frequency must be below this limit.

**P 612 Busbar High Frequency Shutdown:** The busbar frequency must be below this limit.

**P 614 Mains Frequency Low Limit:** The mains frequency must be over this limit.

**P 615 Mains Frequency High Limit:** The mains frequency must be below this limit.

**P A02 No Break Transfer:** This parameter enables/disables the No Break Transfer feature.

**P 625 Ignore Phase Order:** If set, this parameter will disable the phase order check. The phase order check should be disabled only in single phase gensets.

**P A11 Synchronization Fail Timeout:** If the phase and voltage synchronization is not successful before the expiration of this timer, then the DKG-727 renounces the **No Break Transfer** and makes a Transfer with Interruption.

**P A08 Max Frequency Difference:** This is the maximum difference between mains and busbar frequencies to enable a **NO Break Transfer**.

**P A09 Max Voltage Difference:** This is the maximum difference between the mains phase-R and the busbar phase-U voltages to enable a **NO Break Transfer**.

**P A10 Max Phase Difference:** This is the maximum phase difference between the mains phase-R and the busbar phase-U to enable a **No Break Transfer**.

**P 760 to P 766:** These parameters define the function of digital input\_2.

**P 770 to P 776:** These parameters define the function of digital input\_3.

## 7.3 Soft Transfer

In this mode, the transfer will be made without interruption like the **No Break Transfer** mode. But the load will not be transferred suddenly, instead of this it will be gradually transferred under **active and reactive power** control.

The Soft Transfer sequence starts like a No Break transfer. But when both contactors are activated, the unit starts transferring the KW and KVA<sub>r</sub> load to the mains with predefined ramps (**P\_A12, P\_A13**). The duration of the load transfer sequence is controlled by the **Soft Transfer Timer (P\_A04)**.

The unit includes a comprehensive set of protection functions to detect quickly a mains failure during parallel with mains operation. The protections are enabled after the timeout defined by the parameter **P\_A15**. These protections will be explained with more detail in the following chapter.

If a **mains failure** occurs during parallel with mains operation, the mains contactor will immediately de-energize, a general **Parallel Mains Fail** warning and a specific protection function warning will be generated.

At the end of the **Soft Transfer Timer (P\_A04)** the load contactor will be released. If any alarm is encountered during **the Soft Transfer** sequence, the DKG-727 will revert to Interrupted transfer.

The DKG-727 has a set of programmable parameters to define the Soft Transfer operation. All parameters used in No Break Transfer are also used in Soft Transfer. Additional parameters are:

**P\_A03 Soft Transfer Enable:** This parameter enables/disables the Soft Transfer feature.

**P\_A04 Soft Transfer Timer:** This is the time duration of the Soft Transfer. At the end of this timer one of the contactors will release to terminate the parallel operation.

**P\_A12 KW Ramp:** The load's active power (kW) will be transferred to the mains with this rate.

**P\_A13 KVA<sub>r</sub> Ramp:** The load's reactive power (kVA<sub>r</sub>) will be transferred to the mains with this rate.

**P\_A14 Ramp Off Low Limit:** This parameter defines low limit of soft transferring from busbar to mains.

**P\_A15 Parallel Check Timeout:** This is the delay after the mains contactor is energized (for parallel to mains) and before the protections for mains failure are enabled.

## 8. PARALLELING WITH MAINS

### 8.1 Peak Lopping

The Peak Lopping feature consists on the use of the multi genset system as a backup to the mains in cases where the mains power rating is insufficient to supply the load.

The peak lopping application is only possible with slowly varying loads.

When peak lopping is enabled and the unit is in **AUTO** mode, the multi genset system will start and enter in parallel with the mains if mains power exceeds the parameter **P\_A21** (multi genset start limit) during peak lopping start/stop delay (**P\_A23**). As the mains power limit is not exceeded it will not supply power to the load.

When the total load power exceeds the parameter **P\_A20** (mains power limit) the unit will allow the mains to deliver only **P\_A20** (mains power limit) to the load. The exceeding quantity will be supplied by the multi genset system.

When the total load power falls below the parameter **P\_A22** during peak lopping start/stop delay (**P\_A23**) the load contactor will release and the unit will start the stop sequence.

The parameter **P\_A22** should be less than the parameter **P\_A21** in order to prevent immediate stopping of the multi genset after start.

The unit includes a comprehensive set of protection functions to detect quickly a mains failure during parallel with mains operation. The protections are enabled after the timeout defined by the parameter **P\_A15**. These protections will be explained with more detail in the following chapter.

If a **mains failure** occurs during parallel with mains operation, the mains contactor will immediately de-energize, a general **Parallel Mains Fail** warning and a specific protection function warning will be generated. The load will be supplied by the multi genset system without interruption. When mains is restored again, the DKG-727 will synchronize multi genset system with the mains and resume to parallel operation.

The DKG-727 has a set of programmable parameters to define the Peak Lopping operation. All parameters used in No Break Transfer and Soft transfer are also used in Peak Lopping. Additional parameters are:

**P\_A19 Peak Lopping Enable:** This parameter enables/disables the Peak Lopping operation.

**P\_A20 Mains Power Limit:** This is maximum active power that the mains may deliver.

**P\_A21 Genset System Start Limit:** This is the mains active power limit for the start of the multi genset system.

**P\_A22 Genset System Stop Limit:** This is the total load active power for the stop of the multi genset system.

**P\_A23 Genset System Start/Stop Delay:** This is the delay time for starting/stopping of the multi genset system.

Peak Lopping can be enabled in a different way. If one of digital inputs is adjusted as peak lopping enable (**P\_7x0 = 27**), when this input is activated, peak lopping is enabled externally.

## 8.2 Power Export To Mains



The **Export to Mains** mode allows the multi genset system to supply the mains power grid under constant power factor. Thus the multi genset system will be part of the mains power supply system. The Export to Mains mode is activated by setting the program parameter **P\_A24=1**. This operating mode is not compatible with Peak Lopping. Thus **P\_A19=0** is required. When Export to Mains is enabled, the mains voltages and frequency are within limits and the DKG-727 in **AUTO** mode, unit will start the multi genset system, synchronize with mains and closed the Load Contactor. Then the output active power of the multi genset system will ramp-up with the ramp rate defined in program parameter. **P\_A12**. The reactive power is continuously adjusted in order to hold the power factor constant (defined in **P\_A26**). When the requested output power is reached, the ramping will be terminated. The requested power is defined by **P\_A25** \* multi genset system capacity (Sum of power ratings of gensets closed to the busbar). The G59 protections for mains failure in parallel are active during the Export to Mains operation, with the exception of Mains Reverse Power protection. If a mains failure is detected during paralleling, then both contactors will open, the DKG-727 start a stop sequence. If the mains is restored during the multi genset cooldown cycle, then the multi genset system will resume Export to Mains operation.

If **TEST** or **MANUAL** mode is selected during Export to Mains operation, then the multi genset system output power will ramp down until zero. Then the load contactor will open, and the multi genset system will continue to run. If **OFF** mode is selected, then the multi genset system will stop immediately. The Export to Mains operation is compatible with the **Weekly Programming Schedule**. Thus the genset can be programmed for supplying the mains only during given time intervals.

Power Export To Mains can be enabled in a different way. If one of digital inputs is adjusted as Power Export To Mains enable (**P\_7x0 = 28**), when this input is activated, Power Export To Mains is enabled externally.

## 9. PROTECTION FUNCTIONS FOR PARALLEL WITH MAINS

The DKG-727 includes a comprehensive set of protection functions to detect quickly a **mains failure** during **parallel with mains** operation.

The protections are enabled after the timeout defined by the parameter **P\_A15** (Parallel Check Timeout) in order not to detect a mains failure during transients caused by the closing of the contactors.



**WARNING:** Do not forget that the protections are disabled during Parallel Check Timeout. Set this timeout as short as possible.

**If any of the protection functions detects a mains failure during parallel with mains:**

- the mains contactor is immediately de-energized,
- a Parallel Mains Fail warning is generated,
- a specific warning to the related protection function is generated.

Separating the generator from the mains in case of a mains failure is requested as condition in most countries for connection of synchronous generators to the mains.

### 9.1 ROCOF FUNCTION (rate of change of frequency)

The ROCOF measures the frequency of the mains for each period. If the frequency change exceeds the predefined limit for 4 successive periods, the ROCOF detects a mains failure. Thus the response time of the ROCOF is approximately 4 cycles.

However the ROCOF will not detect relatively slow changes in mains frequency.

Related parameter: **P\_A17 ROCOF df/dt Limit:**

### 9.2 VECTOR SHIFT FUNCTION

The Vector Shift measure and store the period of last 5 cycles. At the end of each cycle it compares the average period of last 2 cycles with the average period of 4<sup>th</sup> and 5<sup>th</sup> cycles. If the difference exceeds the predefined limit the vector shift detects a mains failure. Thus the response time of the vector shift is 5 cycles.

However the vector shift will not detect relatively slow changes in mains frequency.

Related parameter: **P\_A18 Vector Shift Limit**

### 9.3 OVER/UNDER FREQUENCY FUNCTION

The mains frequency measures the frequency of the mains for each period. If the frequency is outside limits for 4 successive periods, it detects a mains failure. The response time of the mains frequency is approximately 4 cycles.

Related parameters:

**P\_614 Mains Frequency Low Limit**

**P\_615 Mains Frequency High Limit**

## 9.4 OVER/UNDER VOLTAGE FUNCTION

The mains phase voltages are measured twice a second and compared with predefined high and low limits. If at least one of the phase voltages is outside limits, this will mean a mains failure. The response time is approximately 500ms.

Related parameters:

**P\_603 Mains Voltage Low Limit**

**P\_604 Mains Voltage High Limit**

## 9.5 MAINS REVERSE POWER FUNCTION

The mains active power is measured for each period. If the multi genset system supplies power to mains and this power exceeds the predefined limit, this will mean a mains failure.

The mains reverse power detector has a variable response time. For a power not exceeding 2 times the predefined limit the response time is 8 cycles. The response time is reduced with larger reverse powers. It is approximately 1 cycle with a reverse power of 8 times the predefined limit.

Related parameter:

**P\_A16 Reverse Power Limit**

## 9.6 NO FREQUENCY FUNCTION

The unit counts the time after the last detection of the mains frequency pulses. If no mains pulses is detected for a period corresponding to 2,5 times the Mains Frequency Low Limit (**P\_614**), a mains failure alarm is generated.

Related parameter:

**P\_614 Mains Frequency Low Limit**

## 9.6 External G59 Protections

Vector shift and R.O.C.O.F protections are applicable externally. If vector shift and R.O.C.O.F. protection limits (**P\_A17**, **P\_A18**) set as 0, in case of parallel fail, unit don't care of them. However if one of digital inputs function is adjusted as vector shift or R.O.C.O.F (**P\_7X0 = 15, 16**) when input activate parallel fail occurs in one mains cycle.

## 10. OTHER FEATURES

### 10.1. Return to factory settings

The DKG-727 has hundreds of programmable parameters that may affect the operation of the unit. It is often required to restart programming from the initial factory set values of program parameters.

The DKG-727 offers the possibility of returning to factory set values of parameters. In order to return to factory settings it is sufficient to set the program parameter **P\_B11=1**.

This parameter is not stored, instead of this, a return to factory settings operation is performed.

### 10.2. Dual Language Support

The unit is able to communicate with the user in 2 different languages. The first language is the primary language and is always the English. The secondary language is the local language and may vary following the country in which the unit is intended to be used. Please contact DATAKOM for the available languages.

The switching between primary and secondary languages is made using the program parameter **P\_502**.

### 10.3. Weekly Operation Schedule

In **AUTO** mode, the unit offers the capability of defining a weekly schedule of operation.

The unit has 8 programmable turn-on/turn-off time pairs. These programmable parameters allow the multi genset system to operate automatically only in allowed time limits.

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

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

In AUTO mode, if the operation of the DKG-727 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 15 minute steps. These parameters are defined in the program group\_4, parameters 400 to 415. An example setup may be as follows:

P\_400: Turn on: MO 07:00  
P\_401: Turn off: MO 18:00  
P\_402: Turn on: TU 07:00  
P\_403: Turn off: TU 18:00  
P\_404: Turn on: WE 07:00  
P\_405: Turn off: WE 18:00  
P\_406: Turn on: TH 07:00  
P\_407: Turn off: TH 18:00  
P\_408: Turn on: FR 07:00  
P\_409: Turn off: FR 18:00  
P\_410: Turn on: SA 07:00  
P\_411: Turn off: SA 13:00  
P\_412: Turn on: SA 13:00  
P\_413: Turn off: SA 13:00  
P\_414: Turn on: SA 13:00  
P\_415: Turn off: SA 13:00

If the same time is used in more than one parameter, only the first encountered one is considered. In the above example, SATURDAY 13:00 will be a **turn-off** time.

## 10.4. Built-in Exerciser

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



**WARNING:** The exerciser is only operational in AUTO mode.

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\_514:** Exercise start day and hour

**P\_515:** Exercise duration

**P\_516:** Daily / Weekly / Monthly Exercise

**P\_517:** Exercise off-load / on load

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 **TEST** mode. The device will start multi genset system and if the on load exercise (**P\_517**) is selected then the load will be transferred to the multi genset system.

If a mains failure occurs during the off-load exercise, the load will not be transferred to the multi genset system unless the **Emergency Backup Operation** is allowed by setting the parameter **P\_518** to 1. Thus it is highly recommended that the Emergency Backup mode enabled with off-load exerciser.



**WARNING:** If any mode push button pressed except test mode push button exerciser will be terminated immediately and a stop sequence will be initiated. In case of test push button pressing exerciser will be terminated but stop sequence will be initiated at the end of time limited test.

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

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.

## 10.5. Event Logging

The DKG-727 keeps records of the last 512 events in order to supply information for the service personal. The genset status information and a comprehensive track of measured values are stored within the event memory.

The events are recorded with a time stamp. The date and time information comes from the internal real time clock of the unit.

The events are stored in a circular memory. This means that a new coming event will erase the oldest recorded event. The events are always displayed starting from the most recent one. Events are kept in a non-volatile memory and are not affected from power failures.



**WARNING:** Entering and exiting the event logging display is performed by long-pressing **MENU>** or **MENU<** buttons.

When the **Event Logging screen** is displayed, each depression on the **DOWN** button makes the display switch to the next event page and **UP** button makes the display switch to the previous event page. Each event is displayed in 4 screens.

Thus a total of 2048 screens are available for the event display.

### Event sources are:

- Shutdown alarms,
- Warnings
- Operating mode change (OFF, AUTO, etc...)
- Unit status change (starting, synchronizing, stopping etc.)
- Periodic records.

### Event record contents are:

- Event type (alarms, mode change, periodic, etc...)
- Date and time
- Unit operating mode (AUTO, MANUAL, OFF, TEST)
- Unit operation state (starting, synchronizing, stopping etc.)
- Busbar phase voltages L1-L2-L3
- Mains phase voltages L1-L2-L3
- Mains phase currents I1-I2-I3
- Mains active power (kW)
- Busbar active power (kW)
- Mains total power factor
- Busbar total power factor
- Busbar frequency
- Mains frequency
- Battery voltage
- Digital inputs
- Digital outputs

## 10.6. User Defined Input Strings

The unit provides capability for user defined strings on three digital inputs. The assigned string is displayed when a fault condition is generated from this input.

The strings are programmed in programming P\_3XX menu.

User string 1 programming area (P\_320-339)

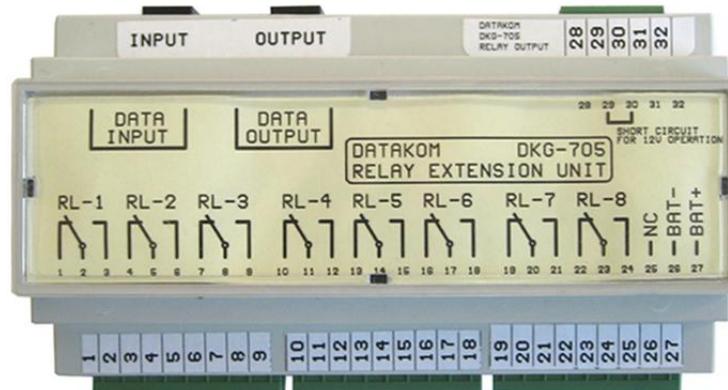
User string 2 programming area (P\_340-359)

User string 3 programming area (P\_360-379)

When the user has defined the string, this string can be assigned to any digital inputs' function. The corresponding input's **P\_7x0** parameter should be set to **29, 30** or **31** accordingly.

## 10.7. Relay Extension

The DKG-727 offers 8 internal digital outputs with totally programmable functions. In addition to this, 16 external relays may be added and their function selected from the list of 196 entries.



Relay outputs are provided by the Relay Extension Module shown in the above photograph. Each extension module offers 8 free contact relay outputs. Both NC and NO contacts are provided. Relay output ratings are 16 Amps / 28VDC or 250VAC.

A maximum of 2 extension modules may be added, thus carrying the total digital output capacity to 24 relays.

## 10.8. Programmable Logic Functions

Programmable logic functions provide the user with the flexibility to build complex logic functions and assign them to digital outputs. Outputs from previous logic functions can be reused in following functions, thus flexibility is increased.

The DKG-727 offers 16 programmable logic functions that can be assigned to any of 24 digital outputs or 4 front panel leds.

Every logic function has 4 parameters. The first parameter is the first input of the function. It can be selected from the relay function list, including 196 entries. (Please check Program Group\_8 in the PROGRAMMING section for the complete list of available parameters).

The second parameter is the second input of the function. It can be selected from the same list as the first input.

The third parameter is the logic operation performed on the inputs. 6 different logic operators are available, namely: OR, AND, XOR (exclusive OR), NOT, NAND and NOR. Please note that for the NOT operation, only the first input is taken into consideration.

The last parameter is function delay and 0-15 seconds delay can be assigned.

## 10.9. Remote Start

The unit offers the possibility of **REMOTE START** mode of operation. In this mode the mains phases are not monitored. If the REMOTE START signal is present then the mains will be supposed to fail, inversely if the REMOTE START signal is absent, then mains voltages will be supposed to be present. The front panel mimic diagram's mains LEDs will reflect the status of the REMOTE START input. Any of the digital inputs may be programmed as a REMOTE START input. For this the corresponding input's **P\_7x0** parameter should be set to **0**. The REMOTE START signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using parameters **P\_7x5** and **P\_7x6**. alarm level parameter (**P\_7x1**) of this input should be set to **3** in order to prevent alarms.

## 10.10. Disable Auto Start

The unit offers the possibility of disable auto start (Mains Simulation) using one of the digital inputs. If the Simulate Mains input signal is active, the mains phases are not monitored and supposed to be inside limits. This will prevent the multi genset system from starting even in case of a mains failure. If the multi genset system is running when the signal is applied, then usual Mains Waiting and Cooldown cycles will be performed before engine stop. When the DISABLE AUTO START 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. Any of the digital inputs may be programmed as a DISABLE AUTO START input. For this, the corresponding input's **P\_7x0** parameter should be set to **21**. The DISABLE AUTO START signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using parameters **P\_7x5** and **P\_7x6**. The alarm level parameter (**P\_7x1**) of this input should be set to **3** in order to prevent alarms.

## 10.11. Heavy Duty

This feature offers to user capability of full capacity usage. If one of digital input function adjust as Heavy Duty (**P\_7x0 = 26**), when it activates unit will send a command to master DKG-707 and all available gensets in AUTO MODE run and close genset contactors to common busbar. Then master genset will send back to DKG-727 all available gensets on busbar signal. Then DKG-727 will close the load contactor. If multi genset system run in manual mode, after minimum genset number is reached providing prime power master DKG-707 will send all genset on busbar signal to DKG-727 then it close the load contactor.

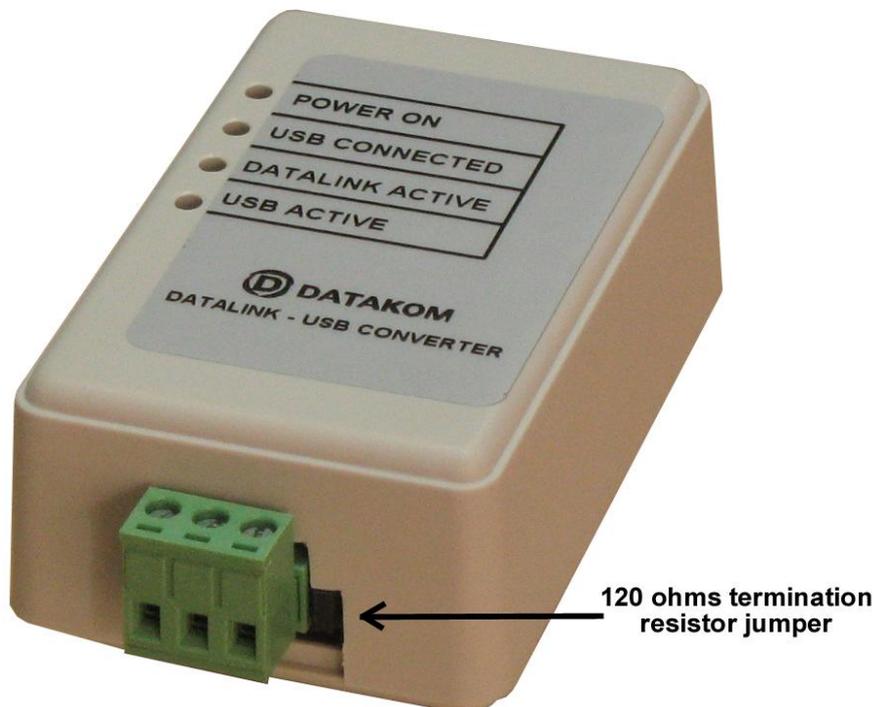
## 10.12. Load Surge Monitoring

Plant load surge is monitoring in load share screen (**Screen 11**). In addition, the monitoring time scope can be extended by programming parameter defined in **P\_513**. Load surge can be monitored in last 15 seconds default. This time scope can be extended up to 45 minutes if needed.

## 10.13. Screen Saver

Screen 11 displays one line diagram of system and both of busbar and mains powers. In addition this screen can be assigned a screen saver if requested. If screen saver delay (**P\_512**) is adjusted as a value except 0, when there is no key action during this period displayed screen is switched to screen saver screen automatically.

## 11. REMOTE MONITORING AND PROGRAMMING



The communication between the PC and the multi-genset synchronization system is established using the DATALINK-USB adapter module shown in the left picture.

The DATALINK-USB adapter module must be used every time communication with PC is necessary.

The DATALINK-USB adapter is inserted in the communication link between units, thus termination resistors are necessary at both ends of the DATALINK circuit.



**An optional 120 ohms termination resistor is provided inside the unit. In order to put the resistor into service install the jumper. Otherwise remove the jumper.**

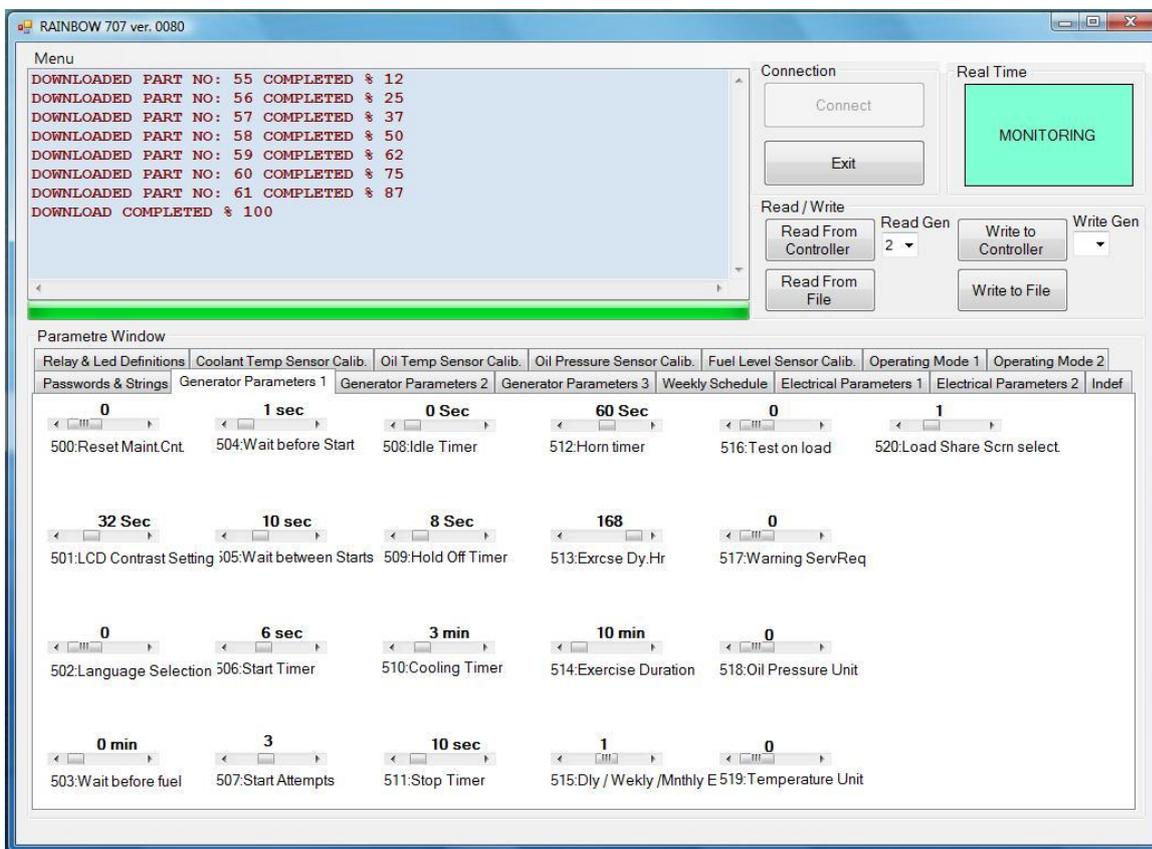
The PC program is called RAINBOW-707. The program is able to communicate with any of the DKG-707 and DKG727 modules, without affecting system operation.


Program parameter upload / download can be done only in OFF mode.

The DATALINK-USB adapter module is powered up through the USB interface of the PC. When the adapter module is plugged and **CONNECT** button clicked on Rainbow 707 program, software will detect gensets connected to the Datalink automatically.

After connection is detected, parameters can be read from any unit, modified and rewritten by selecting the controller number in the **READ GEN** and **WRITE GEN** dialog boxes.

Program parameter modification consists on selecting the related parameter tab and changing the value in the parameter window.



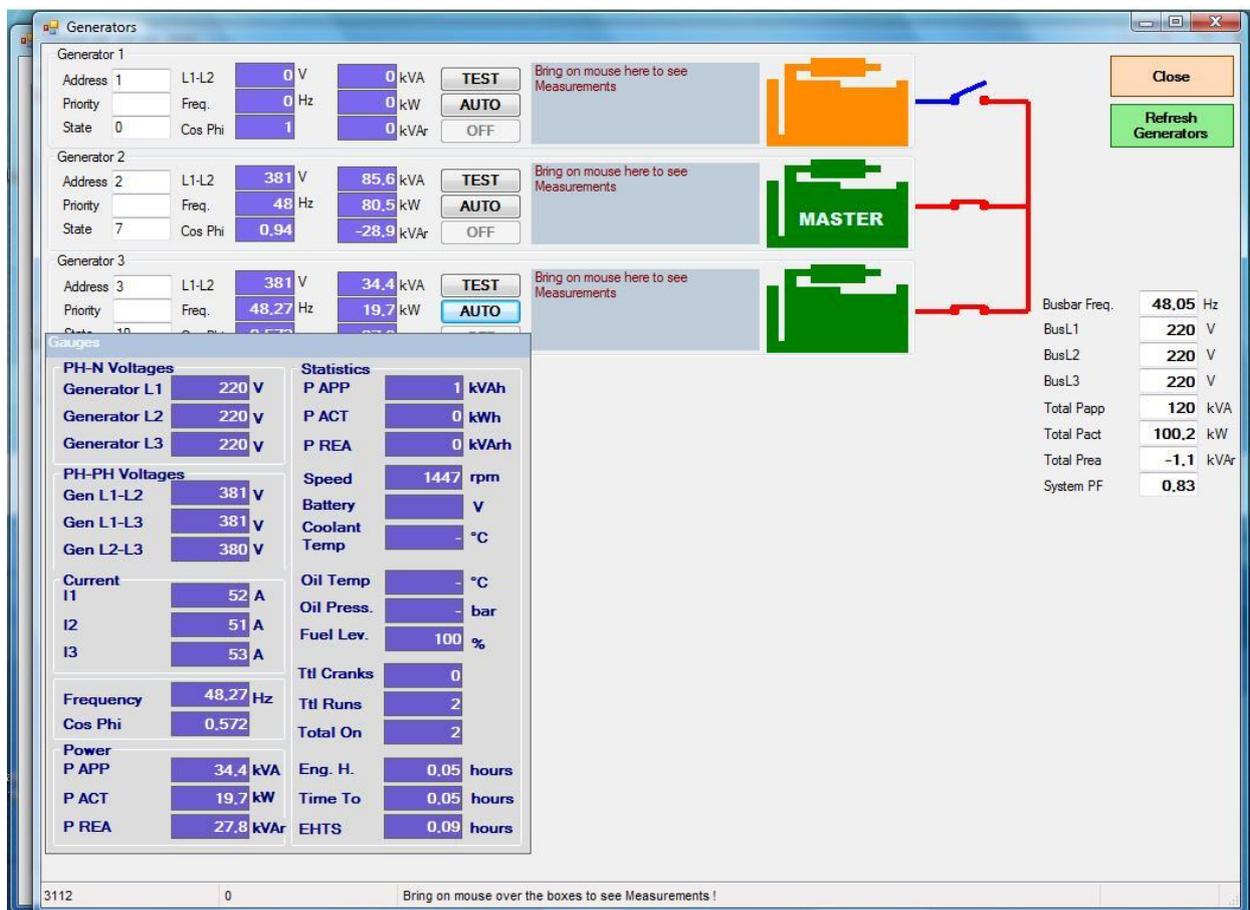
**RAINBOW-707 Parameter Modification Screen**

In monitoring mode, the RAINBOW-707 provides a maximum of information about genset statuses.

These features include:

1. Claimed address, Run/Stop Priority Level, Operating State for each connected units
2. Genset phase-to-phase voltage, frequency, pf, active, reactive and apparent power
3. Genset operating mode (the mode can be changed by clicking the mode buttons)
4. Genset alarms, loadumps and warnings displayed in genset status window
5. System mimic diagram indicating genset and contactor statuses
6. Busbar frequency, voltages, pf, active, reactive and apparent power
7. **For the selected genset:** ph-N and ph-ph voltages, phase currents, frequency, pf, active, reactive and apparent power, power statistical counters, rpm, analog sender readings, engine run statistics and engine hours to maintenance.
8. Mains phase-to-neutral voltage, frequency, pf, active, reactive power

The genset selection is made by bringing the mouse on the related genset alarm window. Thus an additional information window opens as shown in the below picture.



RAINBOW-707 monitoring screen

## 12. PROGRAMMING

The programming mode is used to program the timers, operational limits and the configuration of the unit. The programming mode is protected by a 3 level password system.

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

Upon pressing the PGM button the unit will ask the password to be entered. Enter the password using ↑ (UP) and ↓ (DOWN) buttons. Holding the button pressed will cause a fast scroll of the value enabling quick operation.

When the desired password is entered, press MENU- or MENU+ button. If MENU+ key pressed to confirm password when it pressed second time, this will cause the program list to appear. If MENU- key pressed to confirm password when it pressed second time, this will cause the last program list to appear.

The program menu is organized as program groups, each group including a set of parameters. And any of program group is selected by ↑ (UP) / ↓ (DOWN) buttons from program list.

Each depression of the MENU+ or MENU- button will cause the current program parameter to be stored to the non-volatile memory if modified; and the display to switch to the next or previous program parameter in the current group if the current parameter is not modified. This means that after modification, the MENU+ or MENU- key should be pressed twice to switch to the next or previous parameter. After the last parameter, the display switches back to the first parameter.

The displayed program parameter may be modified using ↑ (UP) and ↓ (DOWN) buttons.



The program value modification is only allowed if the **PROGRAM LOCK** input (**terminal\_43**) 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 always the **PROGRAM LOCK** input tied to **GROUND**.

Each long depression of the MENU+ / MENU- button will switch to program list

Each password is a number between 0 and 65535. They will allow different levels of program modification.

Level	Definition	Factory set	Description
1	Service password	1	Allows the modification of service parameters.
2	Factory password	3	Allows the modification of factory set parameters, service parameters and operation mode parameters.
3	Production password	10	Allows the modification of all parameters, including the calibration.

Programmed values are stored in a Non Volatile Memory, which is not affected by energy failures. **To EXIT programming**, press the PGM button or select EXIT FROM PGM form list.

## Program List

Group	Definition	Passw. Level	Description
1	Adjust Date & Time	1	Unit's internal date and time used for event logging.
2	Change Password	1	Changes password. Only the password of the current level may be changed.
3	Site ID and User Defined Input Strings	1	20 character ASCII string defining the genset location. 20x3 character ASCII string area for the user defining input (for 3 inputs) strings.
4	Weekly Schedule Programs	1	Turn-on and turn-off times for AUTO mode.
5	Timers & Unit Config.	1	Unit Configuration Parameters and Timers
6	Electrical Parameters	2	Electrical Trip Limits and Timers.
7	Input Definitions	2	The parameters which define the function of 12 programmable digital inputs.
8	Output Definitions	2	The parameters which define the function of 24 possible relays and 4 possible LEDs.
9	Programmable Logic Functions	2	The parameters which define arguments, bit operation and function delay of 16 logic functions.
A	Synchronization Parameters	2	Multi genset synchronization with mains parameters.
B	Analog Calibration Return To Factory Settings Factory Test	3	Voltage and current metering calibration. Factory Test Operation

## Program Group 1 – Set Date & Time

Group	Parameter	Definition	Min	Max	Description
1	100	Set Date	00	99	Sets date of month (1-31)
1	101	Set Month	00	99	Sets month (1-12)
1	102	Set Year	00	99	Sets year. Only the last 2 digits are used.
1	103	Set Hour	00	99	Sets hour (00-23)
1	104	Set Minute	00	99	Sets minute (00-59)
1	105	Set Second	00	99	Sets second (00-59)

## Program Group 2 – Change Password

Group	Parameter	Definition	Min	Max	Description
2	200	Change Password	0	65535	Changes the current level's password.

## Program Group 3 – Site ID and User Defined Input Strings

Group	Parameter	Definition	Min	Max	Description
3	300-319 320-339 340-359 360-379	Site ID Input Str. 0 Input Str. 1 Input Str. 2	- - - -	- - - -	Each program parameter changes one character of the SITE ID string. The parameter P_300 points to the first character of the string, the parameter P_301 points to the second character etc... User can define 3 input strings by programming this area. (Refer to User Defined Strings Section 9.19. for details)

### Program Group 4 – Weekly Schedule

Group	Parameter	Definition	Min	Max	Description
4	400, 402, 404,406, 408, 410, 412, 414	Turn on	-	-	Weekly schedule turn_on times. The day and time information is defined in 15 minute steps.
4	401, 403, 405,407, 409, 411, 413, 415	Turn off	-	-	Weekly schedule turn-off times. The day and time information is defined in 15 minute steps.

### Program Group 5 – Genset Parameters

Grp.	Param.	Definition	Set	Unit	Min	Max	Description
5	500	LCD Contrast Setting	32	-	20	63	This parameter is used to set LCD contrast
5	501	Language Selection	0	-	0	1	<b>0:</b> English language selected. <b>1:</b> Local language selected. This language may depend on the country where the unit is intended to be used.
5	502	Mains L-L Voltages	0	-	0	1	<b>0:</b> Display mains L-N voltages, <b>1:</b> Display mains L-L voltages.
5	503	Start Delay	0	Sec	0	240	This is the time between the mains failure is recognized and the remote start signal for starting the multi genset system.
5	504	Fail To Start Delay	0	Sec	0	120	This is the maximum time duration for the multi genset system to run. If DKG-727 doesn't receive busbar ready signal after send the remote start signal during this period, a <b>FAIL TO START</b> shutdown will occur.
5	505	Hold Off Timer	8.0	Sec	0.0	60.0	When the busbar alive voltage and frequency alarms is not controlled during this period.
5	506	Horn Timer	60	Sec	0	120	This is the maximum period during which the alarm relay output may stay active. If the period is set to 0, this will mean that the delay is unlimited.
5	507	Mains Waiting Timer		Min.	0.0	60.0	This is the time between the mains voltages and frequency entered within the limits and the load contactor is deactivated
5	508	Fail To Stop Delay					This is the maximum time duration for the multi genset system to stop. If DKG-727 is keep receiving busbar ready signal after corrupt the remote start signal during this period, a <b>FAIL TO STOP</b> warning will occur.
5	509	Mains Contactor Timer		Sec	0.5	15.0	This is the period of mains contactor activation or de-activation.

Grp.	Param.	Definition	Set	Unit	Min	Max	Description
5	510	Load Contactor Timer		Sec	0.5	120	This is the period of load contactor activation or de-activation.
5	511	Ready Signal Fail Timer		Sec	0	10	It defines the delay of Ready Signal Fail shutdown alarm. When the load contactor activated, if busbar ready signal does not receive during this period, Ready Signal Fail alarm will occur.
5	512	Screen Saver Delay	0	Sec	0	240	It defines screen saver delay timeout up to 45 minutes. There is no action if this parameter set as 0.
5	513	Load Share Screen Scope	0	Sec	0	3600	It defines monitoring time scope of power plant load surge. Up to last 45 minutes load surge can be monitored.
5	514	Exercise start day and hour	168	-	0	168	<p>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.</p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>0 = exercise starts at Monday 00:00</li> <li>1 = exercise starts at Monday 01:00</li> <li>8 = exercise starts at Monday 08:00</li> <li>24 = exercise starts at Tuesday 00:00</li> <li>167 = exercise starts at Sunday 23:00</li> <li>168 = exerciser off</li> </ul> <p>If a daily exercise is selected with parameter <b>P_517=0</b>, then the day information is <b>don't care</b> and the exercise will be performed every day regardless of the day selection.</p> <p>If the monthly exercise is selected with parameter <b>P_517=2</b> then the exercise will be performed during the first 7 days of each month at the programmed day and hour.</p>
5	516	Exercise duration	10	Min	10	1430	This parameter defines the exercise duration and programmed in 10 minute steps up to 24 hours.

Grp.	Param.	Definition	Set	Unit	Min	Max	Description
5	517	Daily / Weekly / Monthly Exercise	1	-	0	2	0: exercise every day (the exercise will be performed every day regardless of the day selection with parameter P_514). 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).
5	517	Test on load	0	-	0	1	0: the multi genset system will run off load. 1: the multi genset system will run on load.
5	518	Emergency Backup	0	-	0	1	If this parameter is set to 1, in the TEST mode, the load will be transferred to the multi genset system if the mains fail.
5	519	Manual Controls Enable	0	-	0	1	0: Manual control keys passive 1: Manual control keys active
5	520	Minimum Genset In System	0	-	0	8	If minimum genset number of multi genset system does not reach this limit, MINIMUM GENSET NOT AVAILABLE alarm will occur.

## Program Group 6 – Electrical Parameters

Grp	Param.	Definition	Set	Unit	Min	Max	Description
6	600	Current Transformer Primary	500	A	0	5000	This is the rated value of current transformers. All transformers must have the same rating. The secondary of the transformer will be 5 Amps.
6	601	Earth Current Transformer Primary	500	A	0	5000	This is the rated value of earth fault current transformer. The secondary of the transformer will be 5 Amps.
6	602	Voltage Transformer Ratio	1	-	0	511	This is the rated value of voltage transformers. This allows the unit to use in medium voltage plants. Be careful, all AC voltage related parameter limits are multiplied with this ratio.
6	603	Mains Voltage Low Limit	170 X P_602	V	50	240 X P_602	If one of the mains phases goes under this limit, it means that the busbar voltage is not valid.
6	604	Mains Voltage High Limit	270 X P_602	V	100	300 X P_602	If one of the mains phases goes over this limit, it means that the busbar voltage is not valid.
6	605	Mains Voltage Fail Timer	1.0	Sec	0.0	60.0	If mains voltage goes out of limits during this period it defines a mains failure.
6	606	Busbar Voltage Low Limit	170 X P_602	V	50	240 X P_602	If a busbar phase voltage goes under this limit during P_608 when feeding the load, this will generate a <b>Busbar Low Voltage Alarm</b> and the multi genset system will stop.
6	607	Busbar Voltage High Limit	270 X P_602	V	100	300 X P_602	If a busbar phase voltage goes over this limit during P_608 when feeding the load, this will generate a <b>Busbar High Voltage Alarm</b> and the multi genset system will stop.
6	608	Busbar Voltage Fail Timer	1.0	Sec	0.0	60.0	If busbar voltage goes out of limit during this period a busbar voltage alarm will occur.
6	609	Busbar Low Freq. Warning	45	Hz	10	60	If the busbar frequency goes under this limit for <b>Busbar Frequency Fail Timer (P_613)</b> period, this will generate a <b>Busbar Low Frequency Warning</b> .
6	610	Busbar Low Freq. Shutdown	40	Hz	10	60	If the busbar frequency goes under this limit for for <b>Busbar Frequency Fail Timer (P_613)</b> period, this will generate a <b>Busbar Low Frequency Alarm</b> and the multi genset system will stop.
6	611	Busbar High Freq. Warning	54	Hz	40	150	If the busbar frequency goes over this limit for for <b>Busbar Frequency Fail Timer (P_613)</b> period, this will generate a <b>Busbar High Frequency Warning</b> .
6	612	Busbar High Freq. Shutdown	57	Hz	40	150	If the busbar frequency goes over this limit for for <b>Busbar Frequency Fail Timer (P_613)</b> period, this will generate a <b>Busbar High Frequency Alarm</b> and the multi gensets will stop.

Grp	Param.	Definition	Set	Unit	Min	Max	Description
6	613	Busbar Frequency Fail Timer	3.0	Sec	0.5	60.0	This is the period between the busbar frequency goes out of the limits and an alarm occurs.
6	614	Mains Freq Low Limit	45	Hz	0	60	If the mains frequency goes under this limit, it means that the mains failure
6	615	Mains Freq High Limit	57	Hz	44	70	If the busbar frequency goes under this limit, it means that the mains failure
6	616	High Battery Voltage Warning	30.0	V	12.0	33.0	If the battery voltage goes over this limit during P_619 delay, this will generate a <b>High Battery Voltage Warning</b> .
6	617	High Battery Voltage Shutdown	33.0	V	12.0	33.0	If the battery voltage goes over this limit during P_619 delay, this will generate a <b>High Battery Voltage Alarm</b> and shut down the engine immediately.
6	618	Low Battery Voltage Warning	10.0	V	0	28.0	If the battery voltage falls below this limit during P_619 delay, this will generate a <b>Low Battery Voltage Warning</b> .
6	619	Battery Voltage Fail Timer	3	Sec	0.0	30.5	If the battery voltage goes out the low or high limits during this period then voltage failure occurs.
6	620	Earth Current Fault	0	A	0	2500	If earth fault current exceeds the limits during P_621 period then unit opens the load contactor immediately and starts the stop sequence.
6	621	Earth Current Fault Delay					If earth fault current exceeds the limits during this period an alarm will occur
6	622	Hysteresis Voltage	8 X P_6 02	V	0	30 X P_602	This parameter provides the busbar and mains 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_606. When the busbar fails, the low limit will be used as P_607+P_622. It is advised to set this value to 10 x (P_602) volts.
6	623	Frequency Voltage Offset	20 X P_6 02	V	5 X P_6 02	50 X P_602	This parameter adjusts the sensitivity for busbar frequency reading. If the busbar frequency appears to be a non-zero value while the engine is at rest, increase this parameter. The standard value is 20V.
6	624	Dead Bus Voltage Limit	50 X P_6 02	V	50 X P_6 02	100 X P_602	If mains voltage is under this limit that means a mains failure.
6	625	Ignore Phase Order	0	-	0	1	If this parameter adjusts to 1 then unit does not control the phase order failure. And the unit can be used in 1 phase applications.

## Program Group: 7 – Input Definition Parameters

This group defines the properties of the digital inputs and comprises 84 parameters. The DKG-727 unit has 12 programmable digital inputs, each input having 7 parameters.

Thus this program group will consist on 12 blocks, each block having the same structure of 7 parameters. Check below tables for more details.

Group	Parameter	Definition	Factory Set
7	70x	Digital input 0 parameters	Emergency Stop
7	71x	Digital input 1 parameters	Busbar Ready Input
7	72x	Digital input 2 parameters	Load Contactor Feedback Input
7	73x	Digital input 3 parameters	Mains Contactor Feedback Input
7	74x	Digital input 4 parameters	Force Manual
7	75x	Digital input 5 parameters	Force Auto
7	76x	Digital input 6 parameters	Force Off
7	77x	Digital input 7 parameters	Force Test
7	78x	Digital input 8 parameters	Manual Run
7	79x	Digital input 9 parameters	Manual Stop
7	7Ax	Digital input 10 parameters	Alarm Mute
7	7Bx	Digital input 11 parameters	Reset Alarms

Group	Parameter	Definition	Min	Max	Description
7	7x0	Digital input x function	0	31	Please check the function list below.
7	7x1	Digital input x alarm level	0	3	<b>0:</b> Shutdown alarm. <b>1:</b> Shutdown alarm. <b>2:</b> Warning. <b>3:</b> No alarm given from this input
7	7x2	Digital input x delay	0	1	<b>0:</b> Delay= 1 second. <b>1:</b> Delay= 4 seconds. This is the alarm detection speed of the input. If the parameter is set to 1, the input becomes compatible with slow signals provided by coolant level senders.
7	7x3	Digital input x sampling type	0	1	<b>0:</b> Always active. The signal is continuously checked. <b>1:</b> Active on busbar alive. The signal may generate an alarm only when the engine is running and after the protection delay (8 seconds).
7	7x4	Digital input x latching	0	1	<b>0:</b> Non latching. The alarm turns off when the alarm signal is removed. <b>1:</b> Latching. The alarm will persist even if the alarm signal is removed. The alarm must be reset manually.
7	7x5	Digital input x contact type	0	1	<b>0:</b> Normally open. Open in normal operation, closed on fault. <b>1:</b> Normally closed. Closed in normal operation, open on fault.
7	7x6	Digital input x switch polarity	0	1	<b>0:</b> Battery (-) switching. The signal source pulls to battery negative (ground). <b>1:</b> Battery (+) switching. The signal source pulls to battery positive.

**Input function list:**

Group	Parameter	Value	Function Definition
7	7x0	0	Remote Start
		1	Emergency Stop
		2	Busbar Ready Input
		3	Load Contactor Feedback Input
		4	Mains Contactor Feedback Input
		5	Force Manual
		6	Force Auto
		7	Force Off
		8	Force Test
		9	Manual Run
		10	Manual Stop
		11	Manual LCB Close
		12	Manual LCB Open
		13	Spare Alarm-13
		14	Spare Alarm-14
		15	R.O.C.O.F Failure df/dt
		16	Vector Shift Failure df/dt
		17	Alarm Mute
		18	Reset Alarms
		19	Lamp Test
		20	Front Panel Lock
		21	Disable Auto Start
		22	Inhibit minimum genset not available alarm
		23	Inhibit communication lost warning
		24	Unit priority +1
		25	Unit priority +2
		26	Heavy Duty
		27	Peak Lopping Enable
		28	Power Export Enable
		29	User Defined String 0
		30	User Defined String 1
31	User Defined String 2		

## Program Group: 8

This group defines the functions of digital and LED outputs. The DKG-727 unit has 8 digital outputs. The digital outputs may be extended up to 24 using **Relay Extension Modules**. Also DKG-727 has 4 programmable leds.

The function of a given digital output may be selected from a list of 196 entries. Here are the usual functions of the digital outputs.

Group	Param.	Definition	Terminal	Description / Usual Function
8	800	Output 0 function	38	This output has programmable function,
8	801	Output 1 function	37	This output has programmable function, selectable from a list. However it is factory set as <b>REMOTE SYSTEM START</b> output.
8	802	Output 2 function	36	This output has programmable functions, selectable from a list.
8	803	Output 3 function	34	This output has programmable functions, selectable from a list. However it is factory set as <b>LOAD CONTACTOR</b> output.
8	804	Output 4 function	39	This output has programmable functions, selectable from a list. However it is factory set as <b>ALARM</b> relay output
8	805	Output 5 function	40	This output has programmable functions, selectable from a list. However it is factory set as <b>MAINS CONTACTOR</b> output.
8	806	Output 6 function	33	This output has programmable functions, selectable from a list.
8	807	Output 7 function	35	This output has programmable functions, selectable from a list.
8	808	Output 8 function	-	These outputs are found on the first <b>Relay Extension Module</b> .
8	809	Output 9 function		
8	810	Output 10 function		
8	811	Output 11 function		
8	812	Output 12 function		
8	813	Output 13 function		
8	814	Output 14 function		
8	815	Output 15 function		
8	816	Output 16 function	-	These Outputs are found on the second <b>Relay Extension Module</b> .
8	817	Output 17 function		
8	818	Output 18 function		
8	819	Output 19 function		
8	820	Output 20 function		
8	821	Output 21 function		
8	822	Output 22 function		
8	823	Output 23 function		
8	824	Led 0 function	-	Functions of these leds can be selected from a function list of 196 entries. Speed and voltage pulse outputs cannot be assigned as led function.
8	825	Led 1 function		
8	826	Led 2 function		
8	827	Led 3 function		

No:	FUNCTION
000	Output Function - 0
001	Remote System Start Output
002	Output Function - 2
003	Load Contactor Output
004	Alarm Output (timed)
005	Mains Contactor Output
006	Output Function - 6
007	Output Function - 7
008	Only Warning Output
009	Only Shutdown Output
010	Alarm Output (without timeout)
011	Busbar-Mains Parallel
012	Output Function - 12
013	Exerciser on
014	Output Function - 14
015	Output Function - 15
016	Shutdown: Digital Input_0
017	Shutdown: Digital Input_1
018	Shutdown: Digital Input_2
019	Shutdown: Digital Input_3
020	Shutdown: Digital Input_4
021	Shutdown: Digital Input_5
022	Shutdown: Digital Input_6
023	Shutdown: Digital Input_7
024	Shutdown: Digital Input_8
025	Shutdown: Digital Input_9
026	Shutdown: Digital Input_10
027	Shutdown: Digital Input_11
028	Reserved
029	Reserved
030	Reserved
031	Reserved
032	Shutdown: High Battery Voltage
033	Shutdown: Busbar Pha. Sequence Fail
034	Shutdown: Busbar Low Voltage
035	Shutdown: Busbar High Voltage
036	Shutdown: Busbar Low Frequency
037	Shutdown: Busbar High Frequency
038	Shutdown: Fail To Start
039	Shutdown: Minimum Gen.Not Available
040	Shutdown: Undefined Alarm-8
041	Shutdown: Undefined Alarm-9
042	Shutdown: Undefined Alarm-10
043	Shutdown: Undefined Alarm-11
044	Shutdown: Undefined Alarm-12
045	Shutdown: Undefined Alarm-13
046	Shutdown: Undefined Alarm-14
047	Shutdown: Undefined Alarm-15
048	Shutdown: Undefined Alarm-16
049	Shutdown: Undefined Alarm-17
050	Shutdown: Undefined Alarm-18
051	Shutdown: Undefined Alarm-19
052	Shutdown: Undefined Alarm-20
053	Shutdown: Undefined Alarm-21
054	Shutdown: Undefined Alarm-22
055	Shutdown: Undefined Alarm-23
056	Shutdown(level_2): Digital Input_0
057	Shutdown(level_2): Digital Input_1
058	Shutdown(level_2): Digital Input_2
059	Shutdown(level_2): Digital Input_3
060	Shutdown(level_2): Digital Input_4
061	Shutdown(level_2): Digital Input_5
062	Shutdown(level_2): Digital Input_6

No:	FUNCTION
063	Shutdown(level_2): Digital Input_7
064	Shutdown(level_2): Digital Input_8
065	Shutdown(level_2): Digital Input_9
066	Shutdown(level_2): Digital Input_10
067	Shutdown(level_2): Digital Input_11
068	Reserved
069	Reserved
070	Reserved
071	Reserved
072	Shutdown: Earth Current Fault
073	Shutdown: Mains Phase Sequence Fail
074	Shutdown: Load CB Fail To Close
075	Shutdown: Load CB Fail To Open
076	Shutdown: Mains CB Fail To Close
077	Shutdown: Mains CB Fail To Open
078	Shutdown: Busbar Ready Signal Fail
079	Shutdown: Undefined Alarm-31
080	Shutdown: Address Conflict
081	Shutdown: Data Link Error
082	Shutdown: Invalid Unit Address
083	Shutdown: Undefined Alarm-35
084	Shutdown: Undefined Alarm-36
085	Shutdown: Undefined Alarm-37
086	Shutdown: Undefined Alarm-38
087	Shutdown: Undefined Alarm-39
088	Shutdown: Undefined Alarm-40
089	Shutdown: Undefined Alarm-41
090	Shutdown: Undefined Alarm-42
091	Shutdown: Undefined Alarm-43
092	Shutdown: Undefined Alarm-44
093	Shutdown: Undefined Alarm-45
094	Shutdown: Undefined Alarm-46
095	Shutdown: Undefined Alarm-47
096	Warning: Digital Input_0
097	Warning: Digital Input_1
098	Warning: Digital Input_2
099	Warning: Digital Input_3
100	Warning: Digital Input_4
101	Warning: Digital Input_5
102	Warning: Digital Input_6
103	Warning: Digital Input_7
104	Warning: Digital Input_8
105	Warning: Digital Input_9
106	Warning: Digital Input_10
107	Warning: Digital Input_11
108	Reserved
109	Reserved
110	Reserved
111	Reserved
112	Warning: High Battery Voltage
113	Warning: Low Battery Voltage
114	Warning: Busbar Low Frequency
115	Warning: Busbar High Frequency
116	Warning: Undefined Warning-52
117	Warning: Undefined Warning-53
118	Warning: Undefined Warning-54
119	Warning: Undefined Warning-55
120	Warning: Address Not Claimed
121	Warning: Fail To Stop
122	Warning: Undefined Warning-58
123	Warning: Undefined Warning-59
124	Warning: Undefined Warning-60
125	Warning: Undefined Warning-61

No:	FUNCTION
126	Warning: Undefined Warning-62
127	Warning: Undefined Warning-63
128	Warning: Parallel Mains Fail
129	Warning: Mains Reverse Fail
130	Warning: Mains Frequency Fail
131	Warning: No Mains Frequency
132	Warning: R.O.C.O.F Failure df/dt
133	Warning: Vector Shift df/dt
134	Warning: Data Link Comm. Lost
135	Warning: Synchronization Fail
136	Warning: Undefined Warning_72
137	Warning: Undefined Warning_73
138	Warning: Undefined Warning_74
139	Warning: Undefined Warning_75
140	Warning: Undefined Warning_76
141	Warning: Undefined Warning_77
142	Warning: Undefined Warning_78
143	Warning: Undefined Warning_79
144	Mains Fail
145	Busbar Alive
146	No Break Transfer Enabled
147	Soft Transfer Enabled
148	Peak Lopping Enabled
49	Peak Lopping Request
150	Power Export Enabled
151	Power Export Request
152	PGM Mode Active
153	PGM Locked
154	Front Panel Locked
155	TEST Mode Selected
156	Test On Load Enabled
157	OFF Mode Selected
158	AUTO Mode Selected
159	Unit Not IN Auto Mode
160	Workout OFF Time
161	MANUAL Mode Selected

No:	FUNCTION
162	Manual Run Activated
163	Manual Run Activated
164	All Available Gensets On Busbar
165	Remote Start Input Defined
166	Disable Auto Start Input Defined
167	Heavy Duty Requested
168	Digital Input-0 Active
169	Digital Input-1 Active
170	Digital Input-2 Active
171	Digital Input-3 Active
172	Digital Input-4 Active
173	Digital Input-5 Active
174	Digital Input-6 Active
175	Digital Input-7 Active
176	Digital Input-8 Active
177	Digital Input-9 Active
178	Digital Input-10 Active
179	Digital Input-11 Active
180	Programmable Function 00
181	Programmable Function 01
182	Programmable Function 02
183	Programmable Function 03
184	Programmable Function 04
185	Programmable Function 05
186	Programmable Function 06
187	Programmable Function 07
188	Programmable Function 08
189	Programmable Function 09
190	Programmable Function 10
191	Programmable Function 11
192	Programmable Function 12
193	Programmable Function 13
194	Programmable Function 14
195	Programmable Function 15

## Program Group: 9 – Programmable Logic Functions Definition

Group	Parameter	Definition	Description
9	900-3	Programmable Func. 0 Params.	Each programmable logic function has 4 parameters. The first parameter is the first input of the function, selected from a list of 196 entries. (see programming group 8 for detailed list). The second parameter is the second input of the function, selected from the same list. The third parameter is the logic operation between two arguments. The Last parameter defines the function delay Please check chapter 10.8 for a more detailed explanation.
9	904-7	Programmable Func. 1 Params.	
9	908-11	Programmable Func. 2 Params.	
9	912-15	Programmable Func. 3 Params.	
9	916-19	Programmable Func. 4 Params.	
9	920-23	Programmable Func. 5 Params.	
9	924-27	Programmable Func. 6 Params.	
9	928-31	Programmable Func. 7 Params.	
9	932-35	Programmable Func. 8 Params.	
9	936-39	Programmable Func. 9 Params.	
9	940-43	Programmable Func. 10 Params.	
9	944-47	Programmable Func. 11 Params.	
9	948-51	Programmable Func. 12 Params.	
9	952-55	Programmable Func. 13 Params.	
9	956-59	Programmable Func. 14 Params.	
9	969-63	Programmable Func. 15 Params.	

Group	Parameter	Definition	Min	Max	Description
9	9n	Programmable Logic Function Input 1	0	195	This parameter defines first input of the programmable logic function and may be selected from the function list of 196 entries. (See programming section 8 for detailed list)
9	9n+1	Programmable Logic Function Input 2	0	195	This parameter defines the second input of the programmable logic function.
9	9n+2	Programmable Logic Function	0	5	This parameter defines logic operation between input 1 and input 2. Below functions are available: <b>0:OR</b> <b>1:AND</b> <b>2:XOR (exclusive OR)</b> <b>3:NOT</b> <b>4:NAND</b> <b>5:NOR</b>
9	9n+3	Programmable Logic Function Delay	0	15	This parameter defines logic function delay (sec)

## Program Group: 10 – Synchronization Parameters

This group of programs defines the Multi Genset Synchronization feature characteristics.



**This group is reserved for factory and qualified installation personal and must not be modified by end users or non-qualified service personal. Otherwise severe damage may occur.**

Grp.	Param.	Definition	Set	Unit	Min	Max	Description
10	A00	Data link Address	32	-	32	35	Device data link address cannot be smaller than this parameter. This parameter is used in order to force data link addresses for fault free operation with broken communication wires.
10	A01	Device Network Priority	1	-	1	4	This parameter defines the priority level of DKG-727 on the same data link.
10	A02	No Break Transfer		-	0	1	0: No break transfer disabled. 1: No break transfer enabled.
10	A03	Soft Transfer Enable		-	0	1	0: Soft transfer disabled. 1: Soft transfer enabled.
10	A04	Soft Transfer Timer		Sec.	0	60	This is the time duration of the Soft Transfer. At the end of this timer one of the contactors will release to terminate the parallel operation.
10	A05	Phase Lock Gain	2	-	0	255	This parameter defines the reaction speed of the phase lock between busbar and mains phases during synchronization. The standard value for this parameter is 2. But it must be readjusted for the engine during commissioning. If this parameter is too high, active load unbalance may occur. If it is too low, the phase locking will be slower.
10	A06	Frequency Lock I/P Gain	8	-	0	12	This parameter defines the ratio of the integral gain to the proportional gain used to lock busbar phase to the mains phase. The standard value for this parameter is 8. But it must be readjusted for the engine during commissioning.
10	A07	Voltage Lock Gain	8	-	0	255	This parameter defines the reaction speed of the voltage lock between busbar and mains phases during synchronization. The standard value for this parameter is 8. But it must be readjusted for the genset during commissioning. If this parameter is too high, reactive load unbalance may occur. If it is too low, the voltage matching will be slower.
10	A08	Max Frequency Difference	0.4	Hz	0.1	2.0	This is the maximum difference between busbar and mains frequencies to close the load contactor.

Grp.	Param.	Definition	Set	Unit	Min	Max	Description
10	A09	Max Voltage Difference	5 X P_602	V	0	20 X P_602	This is the maximum difference between the busbar phase-U and the mains phase-R voltages to close the load contactor.
10	A10	Max Phase Difference	5	Deg	0	20	This is the maximum phase difference between the busbar phase-U and the genset phase-R to close the load contactor.
10	A11	Synchronization Fail Timeout	120	Sec.	0	240	If the phase and voltage synchronization is not successful before the expiration of this timer, then a <b>Synchronization Fail</b> warning is given.
10	A12	kW Ramp	1	kW/s	0	240	In case of a soft transfer, the load's active power (KW) will be transferred to the mains with this rate vice versa.
10	A13	kVAr Ramp	1	kVAr /s	0	240	In case of a soft transfer, the load's reactive power (kVAr) will be transferred to the mains with this rate vice versa.
10	A14	Ramp Off Low Limit	0	KW	0	2500	If multi genset system total active power goes under this limit while soft transferring to mains load contactor will be de-energized.
10	A15	Parallel Check Timeout	0.2	Sec.	0.0	25.0	This is the delay after the mains contactor is energized (for parallel to mains) and before the protections for mains failure are enabled. These protections will de-energize the mains contactor in case of a mains failure in order to prevent the multi genset system from feeding the network.
10	A16	Reverse Power Limit	20	KW	0	1000	This parameter defines the sensitivity of the reverse power protection while operating in parallel with the mains. When the parallel protections are enabled, if the multi genset system supplies a power over this limit to the mains, the mains contactor will be deenergized and a warning will be generated. It is advised to set this parameter to 15% of the genset power rating.
10	A17	ROCOF df/dt Limit	5.0	Hz/Sec	1.0	25.0	This parameter defines the sensitivity of the ROCOF (rate of change of frequency) protection while operating in parallel with mains. When the parallel protections are enabled, if the mains frequency change exceeds this limit for 4 consecutive periods, the mains contactor will be de-energized and a warning will be generated. It is advised to set this parameter to 4 Hz/Sec.
10	A18	Vector Shift Limit	10	Degr	1	30	This parameter defines the sensitivity of the vector shift protection while operating in parallel with mains. When the parallel protections are enabled, if the phase of the mains measured on last 2 cycles jumps over this limit on the phase measured on last 4 <sup>th</sup> and 5 <sup>th</sup> period, the mains contactor will be de-energized and a warning will be generated. It is advised to set this parameter to 10 degrees.

Grp.	Param.	Definition	Set	Unit	Min	Max	Description
10	A19	Peak Lopping Enable	0	-	0	1	<b>0: Peak lopping disabled.</b> In AUTO mode the unit will start multi genset system only if a mains failure occurs. <b>1: Peak lopping enabled.</b> In AUTO mode, the multi genset system will start and share the load if the mains power exceeds <b>P_A21</b> (genset start power).
10	A20	Peak Lopping: Mains Power Limit	100	KW	0	5000	In <b>peak lopping</b> mode, the unit will not allow the mains to deliver to the load a power higher than this limit in order to protect the mains.
10	A21	Peak Lopping: Genset Start Limit	80	KW	0	5000	In <b>peak lopping</b> mode the multi genset system will start and enter in parallel with the mains only if the mains power exceeds this limit. However it will supply power to the load only if the load power exceeds <b>P_A20</b> (mains power limit). This parameter should be set lower than <b>P_A20</b> .
10	A22	Peak Lopping: Genset Stop Limit	60	KW	0	5000	In <b>peak lopping</b> mode the multi genset system will stop only when the total load power falls below this limit. This parameter should be set lower than <b>P_A21</b> (genset start limit).
10	A23	Peak Lopping: Start Stop Delay	10	sec	0	120	In <b>peak lopping</b> mode the multi genset system will start/stop when load power exceeds the limits during this period.
10	A24	Power Export to Mains Operation Enable	0	-	0	1	0: Normal operation. 1: Power Export to Mains operation.
10	A25	Exported active power in Power Export to Mains Operation: Output Power	80	%	0	100	This is the percentage of the multi genset system total power rating to be exported to the mains in Power Export to Mains operation mode
10	A26	Exported active power in Power Export to Mains Operation: Output Power Factor	99	-	60	140	This is the power factor of the power exported to the mains in Power Export to Mains operation mode. The usage is as below: 60..100: inductive 0.60 to 1.00 101..140: capacitive 0.99 to 0.60 Examples: 90 -> 0.90 inductive 110 -> 0.90 capacitive
10	A27	Mains Capacity	100	kW	0	50.000	It defines mains transformer rating.
10	A28	Contactors Timeout	0.5	sec.	0	5	This is the maximum time duration in which both contactors are active in case of <b>No Break Transfer</b> . It is advised to set this timer to 0.5sec.
10	A29	Default Synchroscope	0	-	0	1	0:Display Bar Synchroscope 1:Display Circular Synchroscope

## Program Group: 11 – Input Calibration

This group of programs defines the calibration coefficients for the voltage and current measurements as well return to factory set parameters and production testing.



**This group is strictly reserved for manufacturing process and must not be modified. Otherwise faulty measurements and unpredicted operation may occur.**

Group	Param.	Definition	Min	Max	Description
11	<b>B00</b>	Phase U Calibration	0	60000	Each parameter defines the sensitivity of one measurement input. If the parameter increases, the input becomes more sensitive and reads a higher value. The calibration must be verified with certified calibrated test equipment.
11	<b>B01</b>	Phase V Calibration			
11	<b>B02</b>	Phase W Calibration			
11	<b>B03</b>	Phase R Calibration			
11	<b>B04</b>	Phase S Calibration			
11	<b>B05</b>	Phase T Calibration			
11	<b>B06</b>	Current R Calibration			
11	<b>B07</b>	Current S Calibration			
11	<b>B08</b>	Current T Calibration			
11	<b>B09</b>	Earth Current Calibr.			
11	<b>B10</b>	Battery Voltage Calibration			
11	<b>B11</b>	Return to factory settings	0	1	If this parameter is set to 1, then all program parameters will be assigned with the factory set values.
11	<b>B12</b>	Factory test mode	0	1	If this parameter is set to 1, then a special device test mode is activated. <div style="border: 1px solid black; padding: 5px; display: inline-block;">  <p><b>Warning: Do not activate the factory test mode when the unit is fitted on a genset. Otherwise severe damage may occur!</b></p> </div>

### 13. 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



The module may start the engine anytime without warning due to external request. Prior to performing any maintenance on the system, it is hardly recommended that steps are taken to isolate the battery.

## 14. TROUBLESHOOTING

### **AC voltages displayed on the unit are not correct:**

Check engine body grounding.

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.

### **Frequencies displayed on the unit are not correct or unit reading frequency at rest:**

Check engine body grounding.

Increase the value of the program parameter **P\_623**.

### **Mains or Busbar OK leds do not turn on:**

Check engine body grounding.

Check the AC voltage readings on the screen.

Check the frequency readings on the screen.

Measured AC busbar (or mains) voltages or frequencies may be outside programmed limits.

Upper and lower limits of the busbar (or mains) voltages or frequencies may be too tight.

Get in the PROGRAM mode and check for the busbar and mains voltage and frequency upper and lower limits. If necessary, widen the limits.

### **KW and cos $\Phi$ 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. Check the connections of each individual CT in order to obtain correct KW and cos $\Phi$  for the related phase, then connect all CTs.



**Short circuit the outputs of unused Current Transformers.**

**When the Remote Start signal arrives, the engine starts to run but the unit gives FAIL TO START alarm and then the engine stops:**

-The busbar phase voltage is not connected to the unit. Measure the AC voltage between terminals (U) and (Busbar Neutral) at the rear of the unit while engine is running. The fuse protecting the busbar phase 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 inoperative:**

Measure the DC-supply voltage between (+) and (-) terminals 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.

**Programs are modified but not stored:**

-The modified program value is saved after the next depression on MENU button. Press MENU before exiting the program mode.

**Programs can not be modified:**

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

**Synchronization failure:**

Check the parameters **P\_A05** and **P\_A06**. If one of them is defined too low, this may delay or disable the synchronization process. A typical application may be **P\_A08=0.5Hz**, **P\_A09=5V**, **P\_A10=5°**

Check the synchronization fail timeout parameter (**P\_A11**), if necessary increase. A typical delay may be 120 seconds.

## 15. DECLARATION OF CONFORMITY

The unit conforms to the EU directives  
-2006/95/EC (low voltage)  
-2004/108/EC (electro-magnetic compatibility)

Norms of reference:  
EN 61010 (safety requirements)  
EN 61326 (EMC requirements)

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

A certification from European notified body is available on request.

## 16. TECHNICAL SPECIFICATIONS

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

**Busbar frequency:** 0-200 Hz.

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

**Mains frequency:** 0-200 Hz.

**Current Measurement:** from current transformers. .../5A. Max load 0.7 VA per phase.

**Digital inputs:** input voltage 0 to 35 V-DC. Internally connected to battery positive via 4K7 ohm resistors.

**Digital Outputs:** Protected mosfet semiconductor outputs, rated 1Amp@28V-DC

**Measurement Category:** CAT II

**Air Category:** Pollution degree II

**DC Supply Range:** 9.0 V-DC to 30.0 V-DC.

**Cranking dropouts:** survives 0V for 100ms.

**Current consumption:** 250 mA-DC max.

**Total DC Current Output Rating:** 10A-DC.

**Max. Current for each Terminal:** 10A-RMS.

**Magnetic pickup voltage:** 0.5 to 30Vpk.

**Magnetic pickup frequency:** 0 to 8000 Hz.

**Analog Output 1:** 0 – 10VDC with external reference input

**Analog Output 2:** 0 – 10VDC, fully isolated (1000 volts)

**Charge Alternator Excitation Current:** 150mA minimum, 10 to 30V

**Data Link Port:** Fully isolated serial communication, 115200 bauds, no parity, 1 stop bit. Canbus levels.

**Operating temperature range:** -20°C to 70°C (-4 to +158 °F).

**Storage temperature range:** -40°C to 80°C (-40 to +176°F).

**Maximum humidity:** 95% non-condensing.

**IP Protection:** IP65 from front panel, IP30 from the rear.

**Dimensions:** 235 x 167 x 48mm (WxHxD)

**Panel Cut-out Dimensions:** 219 x 151 mm minimum.

**Weight:** 550 g (approx.)

**Case Material:** High Temperature Self Extinguishing ABS/PC (UL94-V0)

**17. TYPICAL CONNECTION DIAGRAM**

