BE21 Genset Controller Manual

FAX Message (++39 0386 31657), From:_____

Name:_____Company:_____Tel/Fax:_____

I would like to report the following error: _____

_____

Customer Support BERNINI DESIGN SRL ITALY

e-mail: bernini@bernini-design.com
mobile: ++39 335 7077148. Tel:++39 0386-31445 (fax 31657).

Warranty

Bernini Design SRL (hereinafter "BD") warrants that Be21 shall be free from defect in material or workmanship for a period of 3 years from the BD delivery date. BD shall, at its option, repair or replace the product without charge. BD shall return the Be21 to the buyer with the Default parameters at no extra charge. The buyer shall furnish sufficient information on any alleged defects in the product, so as to enable BD to determine their cause and existence. If the Be21 is not defective, or the product is defective for reason other than covered by this warranty, the buyer will be charged accordingly. This warranty shall not apply if the Be21 has not been used in accordance with the User Manual and other operating instruction, particularly if any defects are caused by misuse, improper repair attempts, negligence in use or handling.
This purchase is non-refundable.

This equipment complies with the EMC protection requirements CE

WARNING!! High voltage is present inside the Be21. To avoid electric-shock hazard, operating personnel must not remove the protective cover. Do not disconnect the grounding connection. The Be21 can start the engine at anytime. Do not work on equipment, which is controlled by the Be21. When servicing the engine, disconnect the battery and battery charger. We recommend that warning signs be placed on equipment indicating the above.

!! W A R N I N G !! Relays and solenoids connected to the Be21 must be suppressed using flywell diodes or suppression devices as indicated in section 14.0.

Alphabetic index

BE21 OEM's Manual - Contents

1.0 INTRODUCTION

BE21 features Automatic Mains Failure (A.M.F.) and Generating Set (hereinafter GEN-SET) control and monitoring. The BE21 provides visual indication by means of LEDs and Display Messages for the following: Fuel Level, Overload, Remote Lock, Alarm 1, Alarm 2, Low Oil Pressure, High Temperature, Mains Simulation, Periodic Test, Starting Failure, High/Low Battery voltage, Contactor status, Belt Break and Engine Running (see sections 4.0 and 5.0).
The following measurements and parameters are displayed on the front panel: Mains/Generator Voltage, Battery Voltage, Generator Current, Generator Frequency, Charger voltage and Programmable Settings. The outputs are relay controlled (START, STOP, ALARM, FUEL SOLENOID, control of the MAINS and GENERATOR CONTACTOR).
The front panel includes pushbuttons, LEDs and a 4-digit DISPLAY (section 17.0).

2.0 OPERATING MODE selection

The operating modes are indicated by means of yellow LEDs (see section 17.0). By pushing the [MODE-DOWN] pushbutton (**NOTE**), it is possible to select AUTO (section 2.2), MANUAL (section 2.3) or TEST (section 2.1) operating mode. The [MODE-UP] pushbutton allows you to return to RESET. Every time the power supply is switched on, the BE21 automatically enters into RESET operating mode. The software upgrade 1.25 allows the BE21 to enter the AUTO operating mode automatically (see section 21.0).

NOTE: The effect of the [MODE-DOWN] [MODE-UP] pushbuttons is delayed for 1 second, in order to avoid unwanted selection of the operating mode. The BE21 does not allow operating MODE selection during the STOP procedure ([MODE-DOWN] and [MODE-UP] are inhibited)

2.1 >TEST< operating mode *(use [MODE-DOWN] pushbutton to enter this mode)*

The TEST operating mode tests the GEN-SET. The BE21 starts the engine according to the programmed parameters (section 12.0, Ch.14-17) and transfers the load to the GEN-SET ***(see parameter [Ch.29] for the available options)***. The BE21 stops the engine in 'AUTO' operating mode (if the Mains is within the programmed settings) or in MANUAL operating mode (by using the [STOP] pushbutton). If you push the [STOP] pushbutton, 'ALARM2' will energize. To clear the alarm, select the 'RESET' operating mode (section 2.4).

2.2 >AUTO< operating mode *(use [MODE-DOWN]/[-UP] pushbuttons to enter this mode)*

The engine starts if the Mains fails, (*Automatic Mains Failure*) according to the Ch.0/1/2/3 parameters (section 12.0). The contactor of the MAINS opens, and the contactor of the GENERATOR (KG) closes (after the warm-up time) (Ch.4) if the Voltage and Frequency are within the settings (Ch.6/7/8/9). If the Mains restores (Ch.1), the contactor of the GENERATOR opens, and the contactor of the MAINS closes (after a 2 second delay). The Engine will stop after a cooling down time (Ch.5). In case of alarm, the KM closes after the STOP cycle independently of the Mains status. In 'AUTO' operating mode, the BE21 periodically tests the engine if the channels '26' and '27' have been programmed (section 22.0). During the periodic test, the yellow LEDs indicating the AUTO operating mode will continue to blink. The starting characteristics are programmed in the channels '14' to '17'. Channel '11' provides overload protection for the GEN-SET against Over Current (the protection is delayed by 6 seconds). In 'AUTO' operating mode, the BE21 monitors the status of the JC5 'Input 1' terminal, (according to the setting of the channel '22' (see sections 8.0 and 12.0).

2.3 >MANUAL< operating mode *(use [MODE-DOWN]/[-UP] pushbuttons to enter this mode)*

The MANUAL operating mode allows 'Off-Load' use of the Engine by means of the [START] and [STOP] pushbuttons. To start the engine, push the [START] pushbutton until engine starts (the display shuts down during the start pulse, see section 21.0). To stop the engine, push the [STOP] pushbutton until the [StOP] message appears on the display. If the engine has already stopped, it is possible to clear the 'STOP-cycle' by pressing the [STOP] pushbutton. The BE21 does not transfer the Load to 'MANUAL' operating mode. ***(To control manually the contactors see the section 22.0).***

2.4 >RESET< operating mode *(use [MODE-UP] pushbutton to enter this mode)*

This operating mode clears the fault alarms and enters the parameters for programming or reading (sections 6.1 and 6.3). If the BE21 stays in 'RESET' operating mode for more than 5 minutes, the Display and LEDs are turned off automatically. A dot on the display will begin to blink slowly (see section 3.0). Push one of the pushbuttons on the front panel to restore the Display and LEDs operating mode.

2.5 START-STOP pushbuttons

These pushbuttons are used to control the engine in 'MANUAL' operating mode (section 2.3 and 22.2). In 'AUTO' or 'TEST' operating modes, the [STOP] pushbutton energises 'ALARM 2' (see section 5.0) to stop the engine. The [STOP] pushbutton has other functions: PROGRAMMING (see section 6.0), HOUR METER clearing (section 10.0) and CALIBRATION (section 19.0)

2.6 CONTACTOR CONTROL

In 'RESET' and 'MANUAL' operating modes, and in case of Shut Down Alarms, the Contactor of the Mains (hereinafter 'KM') is forced closed. The ***Automatic Mains Failure*** function takes place only in 'AUTO' operating mode, and the 'KM' will follow the settings of the parameters Ch.0-1-2-3. The Be21 transfers the load to the Generator in 'AUTO' and 'TEST' if the voltage and the frequency of the generator are within the limits (parameters Ch.4-6-7-8-9). In 'TEST' operating mode, the 'KG' has priority over 'KM' (section 2.1). The status of the contactors is indicated by green LEDs (see sections 5.0 and 17.0). The software version 1.3X allows manual control of the contactors. ***(see sections 21.0 and 22.2)***

3.0 DISPLAY features

The BE21 features a 4 Digit Display (section17.0) to show parameter settings, measurements and error messages. Use the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons to select one of the following menus: h/PROGRAM-CURRENT-VOLTAGE-FREQUENCY-BATTERY-V. Each menu is indicated by means of a yellow LED. If the BE21 stays in RESET operating mode for more than 5 minutes, the display and LEDs shut down and a dot on the display will start to blink. By pressing one of the pushbuttons, the display returns to normal operating mode.
The functions of the display are:

h/PROGRAM If the BE21 is in 'RESET' operating mode, the programmable parameters are displayed. The message Ch.XX (XX means a 2 digit number) appears on the display to indicate the address of the parameter. Push the [DISPLAY-UP] or [DISPLAY-DOWN] pushbutton to browse the parameters. When you push the [STOP] pushbutton the display will update itself in order to show the setting of the parameter (see section 12.0).
The Display shows the 'HOUR COUNT' if the BE21 is not in 'RESET' operating mode. The BE21 allows a maximum count of 9999h (see section 10.0 to clear the counter).

CURRENT The Generator Current measurement is displayed (00.0 up 99.9Aac and 100 up to 1000Aac). The setting of the current transformer size is the parameter Ch.10, and the Overload setting is programmed in channel '11' (see section 12.0).

VOLTAGE The Voltage of the MAINS or GEN-SET is displayed. If the fuel solenoid is energised, due to a start request, the display shows the voltage of the generator: [GXXX](*). Otherwise, the display shows the voltage of the Mains: [MXXX](*). The settings for Over/Under voltage are programmed in the parameters Ch.2/3 and Ch.6/7 (section 12.0)

FREQUENCY/R.P.M. The Frequency measurement of the Generator is displayed if the LED is illuminated continuously. When using the [DISPLAY-DOWN] pushbutton, the LED will blink to indicate the R.P.M. (see the setting of parameter Ch.28).

BATTERY/CHARGER The display indicates the Battery voltage if the LED is illuminated continuously. After you push the [DISPLAY-DOWN] pushbutton, the yellow LED will start to blink, and then the Charger Alternator voltage will be displayed. The settings of the Battery voltage alarm are indicated in section 5.0.
(*)NOTE: XXX means a 3-digit numerical field.

4.0 DISPLAY messages *(NOTE: see section 12.0 for the setting of the alarms)*

Some alarms are displayed by means of a message '[EXX]'. The 'XX' indicates a code. The message can be removed by selecting the 'RESET' operating mode (except for **[Err]**). The BE21indicates:

[E 01] (OVER-FREQUENCY). The source of the alarm comes from the voltage of the Generator. This protection is delayed by 2 seconds. The setting is included in 'Ch.9'.

[E 02] (BELT BREAK). This alarm is enabled by means of the code [on] in 'Ch.23'. There is a 'Belt Break' alarm when the Generator voltage is within the settings, but the output voltage of the charger alternator is lower than the setting of 'Ch.15'. A 20-second delay prevents a false alarm. E02 can be inhibited by the code [OFF] into 'Ch.23'.

[E 03] (BLOCKED STATE). When the input JD7 is grounded, the system goes into 'BLOCKED STATE' mode. The pushbuttons on the front panel become inoperable and the engine shuts down. The BE21 runs the normal operating modes as soon as the JD7 is opened. In AUTO operating mode, the KM (Mains contactor) follows the status of the Mains independently of the status of [E03] .

[E 04] (ALTERNATOR FAILURE). This message is displayed if the alternator is without voltage for 150 seconds after the engine has been started. The alarm monitoring is disabled if 'Ch12' contains the code [OFF], or the BE21 is in MANUAL operating mode.

[E 05] (GEN-SET OVERLOAD). If the current of the Generator is over the setting of 'Ch.11' for at least 6 seconds, the engine will be stopped after a cooling down time (Ch.5)

[E 06] (UNDER FREQUENCY) The under frequency setting is programmed in 'Ch.8'. This protection is delayed by 6 seconds, and shuts down the engine after a cooling down time.
The Under Frequency works only if the contactor is closed (AUTO or TEST operating modes).

[E 07] (FAIL TO STOP/release 1.36 and higher) This message indicates that the engine failed to STOP. ***NOTE: to avoid a false trigger of the E07 we recommend that you program the STOP time ([Ch19]) to 30 seconds at least.***

[Hi U] (OVER VOLTAGE) If the voltage rises above the 'Ch7' setting for more than 2 seconds, the Over-Voltage alarm energises and the engine shuts down. The alarm is always monitored.

[Lo U] (UNDER VOLTAGE or SHORT CIRCUIT) The alarm energises if:
- the voltage drops under the 'Ch.6' setting for more than 6 seconds
- the voltage drops under the 'Ch.6' setting (more than 20%) for more than 1 second

The BE21 opens the contactor of the Generator and stops the engine after the cooling down time. The alarm is monitored only if the contactor of the generator is closed.

[Err] (MEMORY ERROR) This message indicates an internal failure of the memory. It is possible to restore the normal operating mode of the memory by disconnecting the supply and re-applying it after a minute. If the failure persists, follow these instructions of the section 19.2
BE21 features the following messages :

[M-on] (MAINS SIMULATION). The input JC5 simulates the Mains presence (section 8.0)
[' ' ' '] (GLOW PLUGS). The BE21 is driving the GLOW PLUGS cycle ('Ch'13)
[----] (V-METER out of range). The voltage (Mains or Generator) drops under 80Vac
[rESt] (START-cycle). The BE21 is counting the rest time ('Ch16' setting)
[StOP] (STOP). The BE21 is driving the stop cycle ('Ch19' setting)

NOTE: the BE21 turns off the display when the engine cranks.

5.0 LEDs for visual indication

The red LEDs (LED=solid state lamp) indicate alarms and can be turned off by selecting the 'RESET' operating mode (see section 2.4)

LOW OIL PRESSURE Indication of Low Oil Pressure alarm. The input is connected to an external, normally closed contact (input JD1). The action of the Oil Pressure Switch is ignored during the start (Ch.18 timing, section 12.0).

HIGH ENGINE TEMPERATURE Indication of High Temperature alarm. This input (terminal JD5) is connected to a normally open or closed temperature switch. The contact selection is made by means of a code in 'Ch24' (option [n.o.] or [n.c.]). The engine stops without cooling-down time. The action of the Oil Pressure Switch is ignored during start (Ch.18 timing, section 12.0)

STARTING FAILURE This alarm is activated if the engine does not start after a complete starting cycle (see settings of channels 14 to 17 in section 12.0).

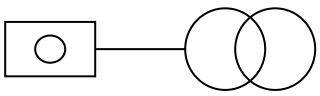
OVERLOAD If the input JD3 is connected to the battery minus, the OVERLOAD alarm energises. The contactor of the Generator will be disabled and the engine will be stopped after a Cooling Down time (Ch.5, section 12.0).

BATTERY [Yellow LED]. The alarm settings are automatically fixed to 11,8/15.0V for a12V battery or 23,6/30.0V for a 24V battery. The alarm is delayed by 120 seconds and is ignored during the Glow timing and starting cycles.

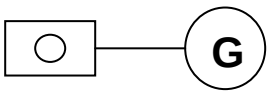
ALARM 1, ALARM 2 These are indications of general alarms. **'ALARM 1'** is by-passed by the 'Ch.18' timer after the engine has been started. **'ALARM 2'** stops the engine without delay. The polarity of the 'ALARM 2' contact is programmed in the channel 'Ch25' (option [n.o.] or [n.c.]). Alarm 2 can be activated by pushing the STOP pushbutton in AUTO or TEST operating mode.

ENGINE RUNNING [Green LED]. This LED is illuminated when the voltage of the Charger Alternator, applied to terminals JA3 and JA4, is higher than the setting of the channel 'Ch15' (section 13.0).

FUEL [Yellow LED]. This is an optical warning indication of Low Fuel in the tank. The generating set stops if the contact stays closed for at least 5 minutes continuously. The input has a 15-second bypass timing to avoid a false alarm.



CONTACTOR of the MAINS 'KM'
(green LED illuminated=CLOSED)



CONTACTOR of the GENERATOR 'KG'
(green LED illuminated=CLOSED)

5.1 Lamp and Display Test

A test of the LEDs and DISPLAYs is obtained by pushing the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons simultaneously, until the lamps energise. The LEDs and DISPLAYs remain energised as long as the pushbuttons are pressed and held together.

6.0 PROGRAMMING instructions

The section 12.0 describes the adjustable parameters. The display can show the address and the setting of the parameter. To enter programming mode, use the following instructions.

6.1 Programming

1) - Make sure the Battery voltage is over 12,0Vdc, select the h/PROGRAM display mode by using the [DISPLAY-UP] pushbutton
2) - Keep the [DISPLAY-UP] pushbutton pressed
3) - Select the RESET mode by using [MODE-UP] (wait for the end of the stop cycle)
4) - Keep the [MODE-UP] pushbutton pressed
5) - Wait until the [Pro-] message appears on the display (approximately 5 seconds)
6) - Once the [Pro-] message has been displayed, release the pushbuttons: the yellow LED 'Program' blinks, and the BE21 is ready for programming.
7) - Press the [DISPLAY-UP] or [DISPLAY-DOWN] pushbutton to select the parameter
8) - Press [STOP] and [DISPLAY-UP] (or [DISPLAY-DOWN]) simultaneously to modify the setting of the parameter (the display updates the value of the parameter)

To save the modification and quit:

9A) - Press the [STOP] and [MODE-UP] pushbuttons simultaneously until the [SAVE] message appears (approximately 5 seconds)
10A) - The message [Good] will confirm the saving procedure (*) NOTE
11A) - Select the operating mode by means of the [MODE-DOWN] pushbutton

To exit programming without saving:

9B) - Select the operating mode by means of the [MODE-DOWN] pushbutton
10B) - Remove the supply for a few moments and then re-connect to up-load the previous parameters. It is good practise to check all parameters (see section 6.3)
(*) NOTE: *the message [Err] confirms an error in the saving procedure. We recommend that you repeat step 9A). If the [Err] message remains on the display, try to cancel the memory as described in section 19.2 ([MEM]).*

6.2 Re-programming Default settings

The parameters of the BE21 are programmed with factory default settings (see section 12.0). To restore the original programming, enter the Program Mode (section 6.1) and push the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons simultaneously until the diplay blinks once. The blink of the display confirms that the recall action has been successfully performed. *To save the defaults, follow steps 9A),10A) and 11A) as explained in section 6.1*

6.3 Reading procedure

To read the parameters, follow these instructions:
1) Select the 'RESET' operating mode by using the [MODE-UP] pushbutton
2) Select the 'PROGRAM' display mode by using the [DISPLAY-UP] pushbutton
3) Select the parameter by using [DISPLAY-UP] or [DISPLAY-DOWN]. On the display, the message Ch.xx indicates the parameter address (xx= 2 digit number)
4) Press the [STOP] pushbutton: the display will indicate the setting of the parameter.

7.0 GLOW PLUGS control (Diesel engine)

To energise the Glow Plugs, the output JC7 is provided. The default programming sets the JC7 output to 'ALARM mode'. The 'pre-Glow' is obtained by inserting a timing into 'Ch13', and the code '2' into channel Ch.21 (see section 12.0). In this case, the output JC7 energises before the starting

attempt, and the 'ALARM mode' function becomes inhibited. If the system needs to use the bell, it is possible to connect the 'STOP SOLENOID' output (JC8). If set in this way, however, the bell energises every time the GEN-SET stops.

8.0 MAINS SIMULATION and ENGINE TEST

In 'AUTO' operating mode, the BE21 monitors the JC5 terminal. The BE21 simulates the Mains (***[M-on] mode***), or tests the engine (***[tESt] mode***), according to the programmable parameter Ch.22.

[M-on] mode: when the JC5 'Input1' is grounded, the BE21 simulates the presence of the Mains supply. The display will show the message [M-on] in the 'Voltage' mode. This function is used in applications where MAINS supply is not available and the user requires remote 'start' and 'stop' by means of a switch (external switch, level switch or timer switch connected to the JC5 input). In order to enable the Mains simulation mode, 'Ch22' has to be set to [M-on] (default setting).

[tESt] mode: If the setting is [tESt] mode, the 'JC5 input' can be connected to an external TEST switch. If the JC5 input terminal is connected to the battery minus, the engine starts and the BE21 will transfer the load to the generator. During the starting cycle, the contactor of the Mains (KM) is closed.

9.0 'CHOKE' control (Gasoline engine)

To drive the engine 'CHOKE', the JC7 output is provided. The default setting of channel '21' (set to '0') provides an ALARM output mode for terminal JC7. To energize the JC7 output from the beginning of each starting attempt, program a time from 2 to 4 seconds into channel '13', and the code '1' into channel '21' (see section 12.0). The output de-energizes after the channel '13' programmed number of seconds. To inhibit the 'CHOKE' at high engine temperature, the use of an external temperature switch connected in series to the JC7 terminal is recommended. When using the 'CHOKE' function, the ALARM output is inhibited. If you desire a bell (acoustic ALARM), it is possible to use the 'STOP SOLENOID' output (JC8). If set in this way, however, the bell energises every time the engine stops.

10.0 HOUR METER reset

To clear the counter, use the following instructions:
- Press the [MODE-UP]/[MODE-DOWN] pushbuttons to select the MANUAL operating mode
- Stop the engine (if it is running)
- Press the [DISPLAY-UP] pushbutton to select the 'h/PROGRAM' display mode
- The HOUR COUNT appears on the display
- Push and hold the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons; the LEDs and Display illuminate totally; wait until the Display blinks (approximately 10 seconds)
- Release the pushbuttons; the 0 count will appear on the display.

NOTE: the software versions 1.28 (and over), allow you to clear the hour meter only if the Vdc power supply is between 16.0 and 18,0Vdc.

11.0 BE21 for PUMP SETS

The BE21 can control and protect PUMP SETs.Since the Generator is not installed in the PUMP SET, it is necessary to adapt some parameters in order to avoid unexpected engine shut downs. We recommend that you use the following settings:
[Ch.12]=[OFF] (disables 'Generator Failure' alarm), [Ch.04]=[0] (disables 'Warm Up')
[Ch.05]=[0] (disables 'Cooling-Down'), [Ch.22]=[M-on] (selects 'Mains Simulation' mode)
[Ch.26]=[0] (disables 'Automatic Periodic Test')

In order to start and stop the Pump Set in Automatic operating mode, connect a switch to the JC5 input. The engine starts if the contact opens. The engine stops if the contact closes. Program the parameters Ch.0 and Ch1 to start and stop the engine after a delay.

12.0 PARAMETERS DESCRIPTION *Note: ['] means minute(s) and ["] means second(s)]*

Display	Parameter	Display	Parameter
Ch.0	**Mains Failure Delay** Factory default: **[5"]** secs Range: 1-59 secs or 1-15 mins **(^)** Seconds or minutes of continuous Mains failure before the initiation of the automatic engine start. **(^) up to 99' for software release 1.34 and higher**	**Ch.5**	**Cooling Down Time** Factory default: **[30"]** secs Range: 0-59 secs or 1-15 mins This delay allows the cooling of the engine. During this time, the engine runs off-load (the contactor is de-energised).
Ch.1	**Mains Restore Delay** Factory default: **[5"]** secs Range: 1-59 secs or 1-15 mins **(^)** Seconds or minutes of continuous presence of the Mains before the initiation of the stop cycle. **(^) up to 99' for software release 1.34 and higher**	**Ch.6**	**Generator Under-Voltage, short-circuit** Factory default: **[190]** V Range: 80-500V (5V Step) If the voltage rises above this [setting], the BE21 enables the contactor. If the voltage drops under this [setting] for at least 6 secs or under [setting]-20% for 1 sec, the Under-Voltage protection [Lo U] energises(see section 4.0).
Ch.2	**Mains Failure (Under-voltage)** Factory default: **[190]** V Range: 80-500V (5V steps) If the Mains voltage goes below this [setting], there is a Mains failure condition. A hysteresis of 2.5% is introduced to prevent false trigger of the comparator.	**Ch.7**	**Generator Over-Voltage** Factory default: **[260]** V Range: 80-500V (5V Steps) **(^)** If the Generator voltage rises above this [setting] for at least 2 seconds, the BE21 will energise the over voltage protection [Hi U] (see section 4.0) in order to stop the engine. **(^) up to 600V for software release 1.34 and higher**
Ch.3	**Mains Failure (Over-voltage)** Factory default: **[260]** V Range: 80-500V (5V Steps) (^) If the voltage rises above this [setting] there is a Mains failure condition. **(^) up to 600V for software release 1.34 and higher**	**Ch.8**	**Generator Under-Frequency** Factory default: **[47]** Hz 0 to 99Hz (0=disables the under frequency) This protection is delayed by 6 seconds. The BE21 opens the contactor and the display will show [E06] (see section 4.0)
Ch.4	**Warm Up Time** Factory default: **[5"]** secs Range: 0-59 secs or 1-15 mins This delay allows the engine to warm up. After the delay, the BE21 will enable the contactor of the Generator.	**Ch.9**	**Generator Over-Frequency** Factory default: **[53]** Hz 45 to 99Hz (99 disables the over frequency) This protection is delayed by 2 seconds. The BE21 shuts down the engine and displays [E01] (see section 4.0)

Ch.10	**Current Transformer Size (CT)** Factory default: **[500]**/5 The range is 10/5 up to 1000/5 The settings are allowed only in steps of 10Aac.	**Ch.14**	**Crank Timing (OUTPUT JC9)** Factory default: **[5"]** secs Range:1-20 seconds Maximum insertion time for the starter. The timer is cleared if the engine starts to run.
Ch.11	**Generator Overload Setting** Factory default: **[0]** (inhibited) Range: 0 to 1000 A The BE21 opens the contactor after a delay of 6 secs and shows the message [E05].The settings are allowed in steps of 1A (CT 10/5 up to 100/5) and 10A (CT100/5 up to 1000/5).	**Ch.15**	**Engine Running Trigger (INPUT JA3-4)** Factory default: **[8.0]** V Range: 3.0V to 24.0V If the voltage of the charger alternator rises above the [setting], the *starter motor* is disconnected (see section 13.0). The programming is allowed in steps of 1V.
Ch.12	**Generator Failure Alarm** Factory default: **[on]** selection: [on] or [OFF] The code [on] enables the Generator failure alarm. The alarm energises if the voltage (or the frequency) is outside of the allowed range for more than 150 seconds. The BE21 shows the [E04] message (see section 4.0) and the engine will shut down.	**Ch.16**	**Rest Timing** Factory default: **[5"]** secs Range: 3-20 secs Time interval between starting attempts
Ch.13	**Glow Plugs/Choke Control** Factory default: **[5"]** (inhibited) Range: 1 to 99 secs The BE21 energises the output JC7 for the programmed time. Channel '21' controls the operating mode of the output JC7 (Glow or Choke section 7.0 and 9.0)	**Ch.17**	**Starting Attempts** Factory default: **[3]** attempts Range: 1-10 Number of automatic attempts included in the automatic start cycle

Display	Parameter
Ch.18	**Low Oil Pressure Alarm, Alarm 1 and Temperature alarm(*) By-Pass** Factory default: **[6"]** secs Range: 0-99 secs By-Pass Delay to ignore the Oil Pressure(JD1)/Alarm1(JD9) during the engine starting cycle. (*) software 1.30
Ch.19	**Stop Solenoid Timing** Factory default: **[15"]** secs Range: 2-99 secs Duration of the Stop cycle (output JC8). The stop solenoid will remain energised for the programmed time.
Ch.20	**Alarm Output Timing** Factory default: **[1']** minute 0-59 secs 1-15 mins and [cont] Time-out of the alarm output JC7. The code [cont] disables the time-out, and the alarm will remain energised waiting for a RESET. The Ch.21 setting over-rides the alarm timing (see sections 7.0, 9.0 and Ch.21).
Ch.21	**JC7 Output Control** Factory default:**[0]** (alarm mode) The following possibilities are available: **[0] Alarm output** (see Ch.20) **[1] Choke Control** (section 9.0) **[2] Glow Plugs Control** (see section 7.0)
Ch.22	**Input 1 Control (INPUT JC5)** Default:**[M-on]** (Mains simulation) Selection: [M-on] or [tESt] The mode '[M-on]' simulates the Mains presence (section 8.0). The mode '[tESt] allows a TEST of the engine (section 8.0)

Display	Parameter
Ch.23	**Belt Break Control** Factory default: **[OFF]** (inhibited) Selection: [on] or [OFF] The Belt Break (or charger alternator failure) alarm is indicated by means of the message [E02] (see section 4.0)
Ch.24	**Temperature Switch (INPUT JD5)** Factory default: **[n.o.]** (normally open) Selection: [n.o.] or [n.c.] **[n.o.]** normally open contact: the engine shuts down if the contact closes **[n.c.]** normally closed contact: the engine shuts down if the contact opens
Ch.25	**ALARM 2 Control (INPUT JD8)** Factory default: **[n.o.]** (normally open) Selection: [n.o.] or [n.c.] **[n.o.]** normally open contact: the engine shuts down if the contact closes **[n.c.]** normally closed contact: the engine shuts down if the contact opens
Ch.26	**Automatic Periodic Test Cycle** Factory default: **[0]** (inhibited) Range: 0-99 days Time between the automatic periodic test of the engine. The code [0] disables the Automatic Periodic Test. See the application note in section 22.1
Ch.27	**Automatic Engine Test Duration** Factory default: **[10']** mins Range: 1-99 minutes Duration of the automatic engine test. The load is transferred to the GEN-SET if the Mains fails.
Ch.28	**Number of POLES (Generator)** Factory default: **[4]** poles options [2] or [4] to control the R.P.M. display
Ch.29 (software release 1.34 and higher)	**Contactor control** Factory default: **[on]** (options [on] or [off]) The option [off] inhibits the transfer of the load to the generator in TEST operating mode and when the JC5 TEST input is used.
Ch.30 (software release 1.37 and higher)	**Fail to Stop alarm control** Factory default: **[E07]** (options [E07] or [inhibit]) The option [inh] inhibits the fail to stop alarm.

13.0 ENGINE RUNNING setting

The Be21 inhibits the start output when the engine starts running.
When the engine is not running, the D+/WL (input JA3-4) voltage is 0V. As the BE21 starts the engine (manual attempt or automatic cycle), a current of a few hundred mA flows into the D+ terminal.
At this moment the engine is not running, but a voltage appears in the D+/WL terminal (0,8 to 2,5V). When the engine starts running, the voltage of the D+/WL terminal increases by up to 3V-6V. When the engine runs, the voltage reaches the nominal 14V (28V) needed to charge the battery. The safest point to disconnect the starter motor is between 6V to 10V.
The default parameter of Ch.15 is 8.0V. This value is recommended for engines using 12V batteries. For 24V batteries, we recommend that you set the threshold to 16V.
For a safe calibration, be sure that the green 'ENGINE RUNNING' LED on the front panel is off during all of the starting attempts.

NOTE : the Charger Alternator voltage can be displayed in the 'BATTERY' display mode. If you push the [DISPLAY-DOWN] pushbutton, the yellow LED will start blinking and the display will indicate the Charger Alternator voltage. The accuracy of the display is guaranteed to within 5% of a standard charger alternator. For other chargers, (FlyWheel Generator) the reading is not accurate. The Ch.15 setting, in this case, expresses only a proportional factor.

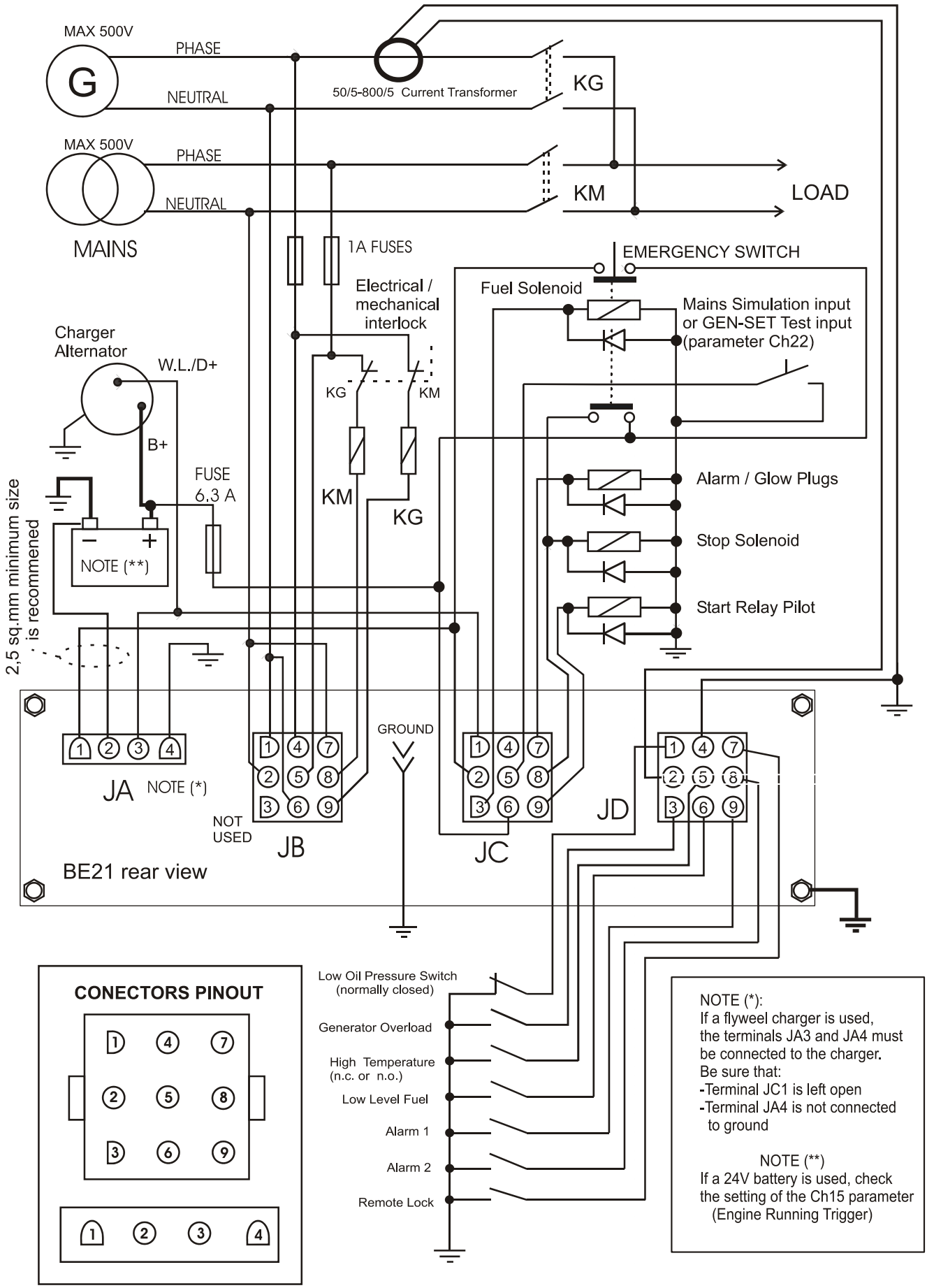
The BE21 uses the Gen-Set (main alternator) voltage to protect against unwanted insertion of the starter motor. When the voltage reaches 80Vac, the starter insertion is inhibited. This input does not affect the status of the green 'ENGINE RUNNING' LED on the front panel. The insertion of switches or breakers in series to the terminals JB1 and JB4 is not recommended.

NOTE: THE 'ENGINE RUNNING' LED HAS TO BE LIT WHEN THE ENGINE RUNS. THE USE OF THE ENGINE WITHOUT THIS SIGNAL MAY BE DANGEROUS.

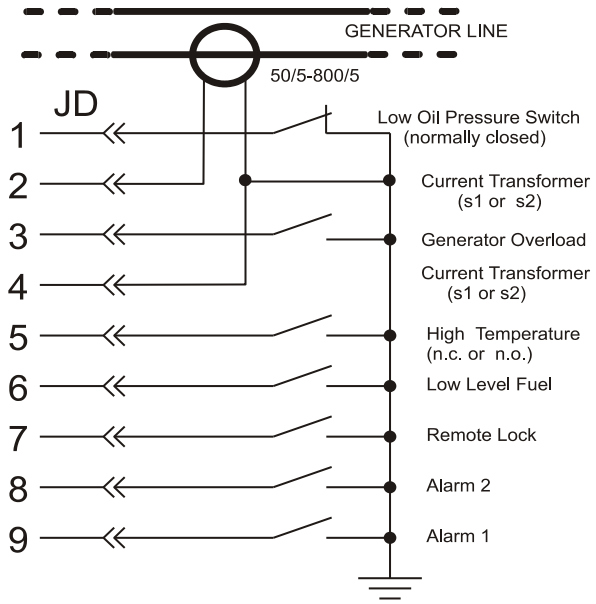
Normally, using a diesel engine, we recommend enabling the BELT BREAK protection. This is accomplished by programming the code [on] in channel Ch23 (see section 12.0). To test this protection, it is necessary to disconnect the terminal D+ from the charger alternator and connect to ground the JA3 terminal (leave the terminal D+ open on the charger alternator). This protection is delayed by 15 seconds.

WARNING High voltage is present inside this instrument. To avoid electric-shock hazard, operating personnel must not remove the protective cover. Do not disconnect the grounding connection. Any interruption of the grounding connection can create an electric shock hazard. Before making external connections, always ground the BE21 first by connecting the control panel to ground.

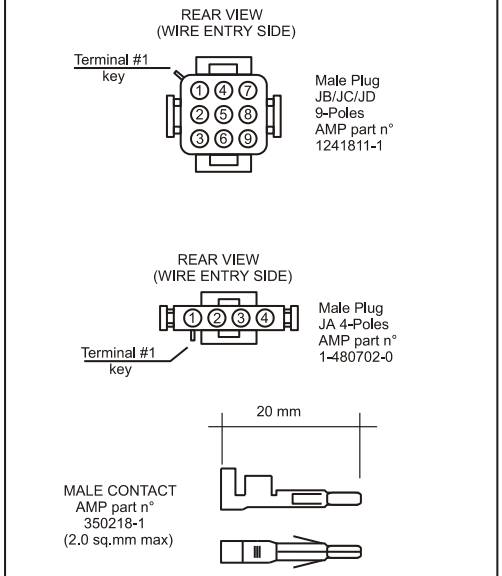
SECTION 14 - Wiring diagram 1



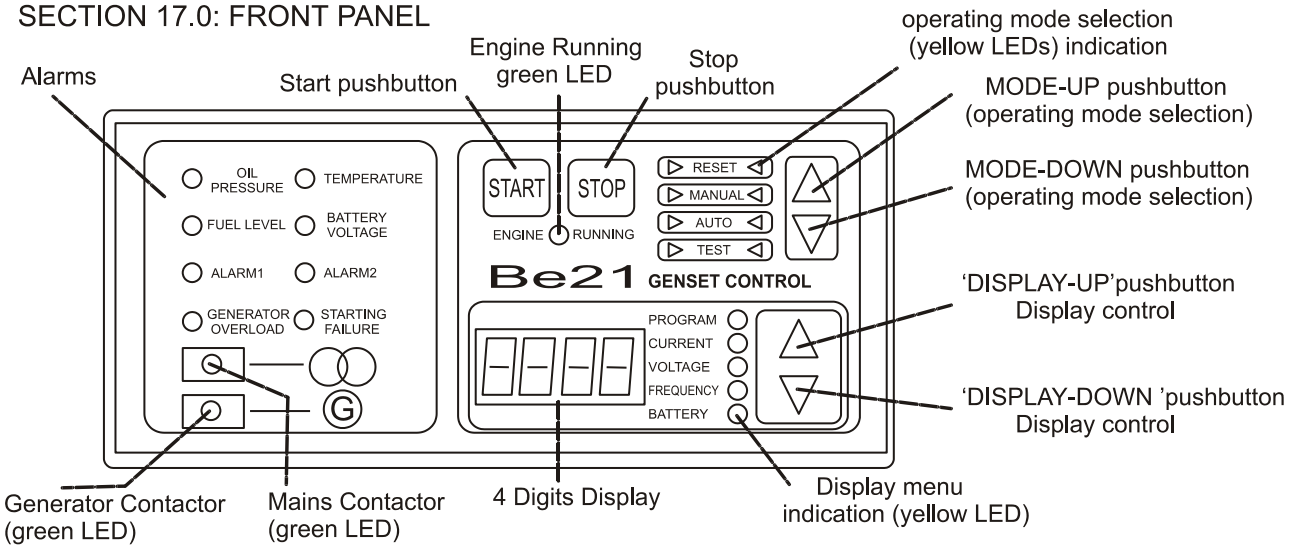
SECTION 15.0: WIRING 2



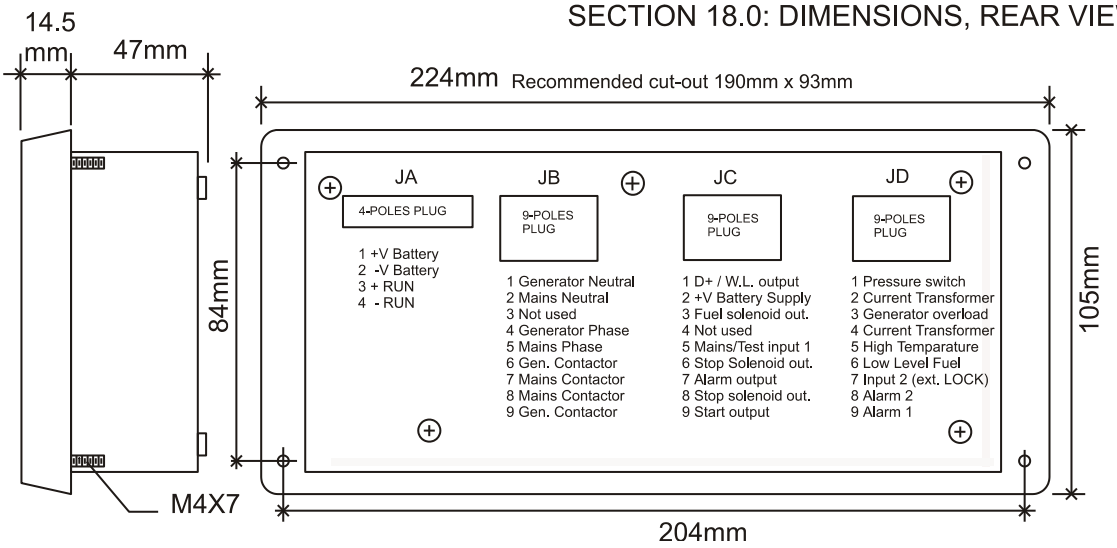
SECTION 16.0: CONNECTORS



SECTION 17.0: FRONT PANEL



SECTION 18.0: DIMENSIONS, REAR VIEW



SECTION 19.0 CALIBRATION

To enter into Calibration, press and hold the [STOP] pushbutton during the power on cycle. The message [CAL] appears on the display (*). By means of the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons, the user selects the following:

DISPLAY	*MEASUREMENT / FUNCTION*	RECOMMENDED VALUES
[M.1]	**Mains Voltage (GAIN)**	200Vac up to 250Vac
[L.1]	**Generator Voltage (GAIN)**	200Vac up to 250Vac
[OFFS]	**Generator Current (OFFSET)**	GEN-SET not running (I=0)
[Curr]	**Generator Current (GAIN)**	80% of the C.T. size
[-Ucc]	**Battery Voltage (GAIN)**	12V-14V or 24-28V
[-Fr]	**Generator Frequency** *(software upgrade 1.09)*	49Hz-51Hz or 58Hz-62Hz
[Ad c.]	**A/D calibration** *(software upgrade 1.13)*	Disconnect all plugs except the power supply (JA)
[-MEM]	**Memory Clear Procedure**	

(*) ***NOTE:*** if the display shows the message [Err], push the [STOP] pushbutton and follow the instructions described in section 19.2.

19.1-To calibrate a measurement:

- Push the [DISPLAY-UP] or [DISPLAY-DOWN] pushbutton to select the measurement.
- Apply a source of known and stable value to the input. Better accuracy is obtained using the value indicated in table 1 (recommended values).
- Push the [STOP] and [DISPLAY-UP] (or [DISPLAY-DOWN]) pushbuttons simultaneously to update the measurement. The reading increases or decreases by a small step each time the pushbutton is pressed.
- When the reading is stable, and it has the desired accuracy, push the [STOP] and [MODE-UP] pushbuttons simultaneously for at least 5 seconds (to save the calibration).
- The display will confirm the operation by means of the [SaVE] and [Good] messages **(**)**.
- Disconnect the supply for a few seconds.
- Apply the supply, and using MAN or AUTO/TEST modes, verify the measurements.

(**)NOTE: the message [Err] confirms an error in the saving procedure. Press the [STOP] and [MODE-UP] pushbuttons simultaneously in order to retry a memory writing cycle. If the [Err] message remains on the display, follow the instructions described in section 19.2. If the problem persists, the BE21 is damaged and must be returned for repair.

19.2-To clear the memory *(use only in case of memory error or failure)*:

- Push the [DISPLAY-UP] or [DISPLAY-DOWN] pushbutton to select the **[MEM]** message.
- Push the [STOP] pushbutton for at least 20 seconds, until the message [Init] appears: the BE21 downloads the default settings (see section 12.0), clears the hour-count, and then removes the calibrations.
- Remove the power supply, and after a few seconds, re-apply the supply and enter the programming as described in the section 6.0.

19.3-To calibrate the A/D converter *(use only after the memory clear action)*:

- Disconnect the JB, JC, and JD plugs.
- Push the [DISPLAY-UP] or [DISPLAY-DOWN] pushbutton to select the **[Ad c.]** mode.
- Push the [START] push button for at least 2 seconds, and wait for the [--] message.
- Push [STOP] and [MODE-UP] simultaneously, and wait for the [SavE] and [good] messages.
- Disconnect the supply, restore the connections, and select an operating mode.
- Check the accuracy of the measurements, and, if necessary, enter the CALIBRATION mode to adjust the measurements.

SECTION 20.0 GENERAL SPECIFICATION

Supply Voltage: 7Vdc to 33Vdc. Protection: **internal 300mA thermal fuse. Supply Current:** 50 mA up to 100mA
Dimensions: 224mm X 105mm X 68mm, **Panel Cut-out:** 190mm X 93mm, indoor operation
Operating Temperature range: -30 deg C to +70 deg C. **Humidity Range:** 5% up to 95% non-condensing
Weight: 850 gr., **Vibration:** 40mm/sec
General Design: 89/336 EEC, 89/392 EEC, 73/23 EEC, 93/68 EEC, IEC 68-2-6 **Certification:** CE
DC Relay Outputs Characteristics (Engine Control)
Output Current: 8A/30Vdc (internal AUTO-reset 4A Fuse is provided **[*].** Output Voltage: Battery Voltage
AC Relay Outputs Characteristics (Mains and Generator)
Output Current: 8A/250Vac, an external 1A fuse must be provided. Output Voltage: dry contacts, voltage free
Mains and Generator Voltage Input
Nominal Voltage input: 240Vac**.** Maximum Voltage: 500Vac continuously
Over voltage: 2KVac phase to neutral. Maximum Display error: +/- 3% **[**]**. Input impedance: 4 Mega Ohm
Current Transformer
Current Transformer Size: 10/5Aac up to 1000/5Aac. Maximum Current: 8Aac for 10 seconds.
Maximum Display error: +/- 3% **[**]**. Internal resistance: 0.05 Ohm
Digital Inputs
Open circuit voltage: 10Vdc (12V supply) or 22Vdc (24V supply)-Closed circuit current: 15mAdc maximum.
Charger Alternator Monitoring
Operating Voltage up to 36Vdc. Vdc reading accuracy +/- 5% .Threshold: 3Vdc-24Vdc (programmable). Excitation Power: max 3W
[*]*NOTE: THE TOTAL OUTPUT CURRENT (JC3+JC7+JC9) MAY NOT EXCEED 4A at 60°C*
[**]*NOTE: ERRORS CAN BE REDUCED BY USING CALIBRATION (SECTION 19.0)*

21.0 SOFTWARE UPGRADES

-1.03 The 'GLOW PLUGS' output (diesel engine), and the 'CHOKE' output (petrol/gasoline engine), share the ALARM output JC7, depending on the status of the parameters Ch.13 and Ch.21. (The BE21 may not be used as a replacement part for the AMT9XX/BE11XX if the 'CHOKE' feature is used).
-1.09 The BE21 allows the calibration of the Frequency (see section 19.0).
-1.10 to 1.12 Update of the internal diagnostic functions (no modifications on the user side).
-1.13 The BE21 is able to display 0.1Aac up to 99.9 Aac if the C.T. size is below 100/5. The OVERLOAD settings (Ch.11) allow steps of 1Aac (if the C.T. size is below 100/5). The automatic calibration of the internal 10 bitA/D converter has been introduced (section 19.3).
-1.13 to 1.20 Update of the software to meet some NFPA-110 specifications.
-1.21/22 The BE21 is able to show the R.P.M. (the parameter Ch.28 has been introduced)
-1.23 The BE21 inhibits programming if the Vdc supply is lower than 12V
-1.24 The BE21 shuts down the display when the engine cranks
-1.25/1.26 The BE21 saves the AUTO operating mode in the memory, and automatically re-enters the AUTO operating mode after a DC power supply failure, or after a CPU reset cycle.
-1.27 Software modification improves the accuracy of the HOUR-meter. Hardware modifications improve EMC insensitivity.
-1.28 Hour counter can be cleared only if the supply voltage is within 16,0-18,0VDC
-1.29 The BE21 inhibits programming if the Vdc supply is lower than 12V
-1.30 The temperature alarm is disabled during the starting cycle. The Be21 monitors the alarm after the timeout programmed in parameter Ch.18. The KEYBOARD has been modified. A shield made of Silver film provides protection for the pushbuttons.
-1.31 A bug in the yellow LED control, during the Automatic Periodic TEST, has been deleted.
-1.34 The following features have been introduced (Serial number 24975 up to 26924):
a) - manual control of the contactor (see section 22.2), programming of overvoltage up to 600Vac
b) - programming up to 99 minutes of the Ch.0 and Ch.1 (see section 12.0)
c) - options for TEST operating mode (see section12.0 [Ch.29])
-1.36 The [E07] fail to stop alarm has been introduced (see section 4.0)
-1.37/1.38 The parameter [Ch.30] has been introduced in order to inhibit the fail to stop alarm.

-2.40----2.44 Conformal coating material is applied to electronic circuitry in order to improve performances in high humidity environments

22.0 APPLICATION NOTES

22.1 Automatic Periodic Test

The BE21 does not use a clock to count the programmed days (Ch.26 setting, section 12.0). The maximum error and drift of the counter is +/-0,5%. The user could experiment with shifting the periodic tests. To avoid error accumulation, we recommend the following procedures.

22.1A)First time programming of the Automatic Periodic Testing (A.P.T.)

---------- example: 7 days/20 minutes ----------

- enter the 'Program Mode' and set Ch.26 to 7 (section 6.0)
- set Ch.27 to 20 and save the programming
- select the AUTO operating mode

The BE21 will energise the GEN-SET after 7 days (or other desired value). The engine will run OFF-LOAD for 20 minutes. If the Mains fails during the A.P.T., the BE21 will transfer the load to the generator.

22.1B) To adjust the starting moment:

- disconnect the Vdc supply and wait for the desired start time (external clock reference)
- apply the power supply to the BE21 and select the 'AUTO' operating mode

The BE21 will energise the GEN-SET after the programmed days . The engine will run OFF-LOAD for 20 minutes. If the Mains fails during the A.P.T., the BE21 will transfer the load to the generator.

IMPORTANT NOTE

If the supply (battery voltage) is removed, the BE21 looses the accumulated counts. If the supply restores, the BE21 starts to count the A.P.T. according to the programmed parameters Ch.26 and Ch.27. Therefore, it is important to synchronize the power on sequence with the desired A.P.T (see 22.1B).

22.2) MANUAL CONTROL OF THE CONTACTORS (software release 1.34 and higher)

To close the contactor in Manual operating mode follow the instructions:

A- select the Manual operating mode and start the engine (see section 2.3).
B - as soon as the voltage and frequency are within the settings (see Ch6.-7-8-9-) push the [START] and [DISPLAY-DOWN] pushbuttons simultaneously.

To open the contactor push the [START] and [DISPLAY-UP] pushbuttons simultaneously.

,

22.3) EO7- FAIL TO STOP ALARM

The BE21 detects the fail to stop condition if the engine runs after a complete STOP cycle (stop cycle duration is programmed in the parameter Ch.19).
In order to maintain the compatibility with previous software versions, the default timing of the STOP cycle is 15 seconds. In case of false trigger of the [E07] alarm, we recommend that you program a longer timing in the parameter Ch.19 (example 30 seconds). In case you need to run the engine using external equipment (e.g. emergency start), we recommend that you program the parameter [Ch.30] with the option [inh.]

23.0 Panel/Gen-set Builders Notes