

BE22 Genset Controller Manual

The information in this document is subject to change without notice.

No part of this document may be copied or reproduced in any form or any means without the prior written consent of Bernini Design company. Bernini Design assumes no responsibility for any errors which may appear in this instruction manual or in the wiring diagrams.

Although Bernini Design has taken all possible steps to ensure that the User Manual is complete, bug free and up-to-date, we accept that errors may occur. If you encounter problems with this instruction manual, please complete this form and send it back to us.

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 Be22 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 Be22 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 Be22 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 Be22 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



!! WARNING!! Relays and solenoids connected to the Be22 must be suppressed using flywell diodes or suppression devices (e.g. RC networks), see section 14.0.



WARNING!! High voltage is present inside the Be22. To avoid electric-shock hazard, operating personnel must not remove the protective cover. Do not disconnect the grounding connection. The Be22 can start the engine at anytime. Do not work on equipment which is controlled by the Be22. When servicing the engine, disconnect the battery and battery charger. We recommend that warning signs be placed on equipment indicating the above.

Alphabetic index

Alarms	4.0, 5.0	Manual	2.3
Alarm output control	12.0 (P20)	Oil pressure	5.0, 12.0 (P18)
Alarm (emergency)	5.0, 12.0 (P25)	Output, Outputs	14.0, 20.0
Automatic	2.0, 2.2	Operating modes	2.0, 2.1-2.4
Battery, Alarms	3.0, 5.0	Overload E05	4.0, 12.0 (P11)
Belt break E02	4.0, 12.0 (P23)	Overload (external)	5.0, 15.0
Choke, control	9.0, 12.0 (P21)	Over Frequency E01	4.0, 12.0 (P9)
Calibration	19.0	Over Voltage HI-G	4.0, 12.0 (P7)
Characteristics	20.0	Parameters	12.0, 6.0
Charger Alternator	3.0, 13.0, 20.0	Parameters reading	6.3
Contactors	14.0, 2.2, 2.6	Periodic test	22.0, 12.0 (P26)
Connectors, Plugs	16.0	Program, Programming	2.5, 6.0, 6.1
Crank timing	12.0 (P14)	Pump control	11.0
Current Transformer	12.0 (P10)	Power Supply	20.0
Cooling down time	12.0 (P5)	Push buttons	17.0
Defaults	6.2	Reset	2.4
Dimensions	15.0, 18.0	Rest time	12.0 (P16)
Display	3.0, 4.0	Settings (Parameters)	12.0
Display Messages	4.0	Specification	20.0
E01-E06, Error codes	4.0	Short circuit protection	12.0, (P6)
[Err] Memory error	4.0	Software upgrade	21
Engine Running	12.0 (P15), 13.0	Start	2.5, 14.0
External Stop	5.0	Start Attempts	12.0 (P17)
Fail to Start	5.0	Starting Failure	5.0
Front Panel	17.0	Stop, Stop solenoid	2.5, 12.0 (P19)
Frequency	12.0 (P8-9)	Timers	12.0
Fuel Level	5.0	Temperature	5.0, 12.0 (P24)
Fuel Solenoid control	12.0 (P21)	Test, Remote Test	2.1, 12.0 (P22)
Generator Voltage	3.0, 20.0, 12.0	Test, Automatic test	2.2, 12.0 (P26/27)
Generator Frequency	3.0, 20.0, 12.0	Transformer, Current	3.0, 12.0 (P10)
Generator Failure E04	4.0, 12.0 (P12)	Under Voltage Lo-G	4.0, 12.0 (P6)
Glow Plugs	7.0, 12.0 (P13)	Under Frequency E06	4.0, 12.0 (P8)
Hi-G, Over Voltage	4.0, 12.0 (P7)	Voltage	3.0, 12.0 (P6/7)
Hour Counter	3.0, 10.0	Warm-Up time	12.0 (P4)
Inputs	15.0, 20.0	Wiring	14.0
LED, LEDs	5.0		
Lamp Test	5.1		
Lo-U, Under Voltage	4.0, 12.0 (P6)		
Lock, Remote Lock E03 ..	4.0		
Low Battery voltage	5.0		
Mains Failure	12.0 (P0/2/3)		
Mains Restore	12.0 (P1/2/3)		
Mains Simulation	8.0, 12.0 (P22)		
Measurements	3.0		
Memory clear, restore	19.2		
Messages (Display)	4.0		

BE22 OEM's Manual - Contents

1.0 Introduction	page 3
2.0 OPERATING MODE selection	page 4
2.1 TEST operating mode	page 4
2.2 AUTO operating mode	page 4
2.3 MANUAL operating mode	page 4
2.4 RESET operating mode	page 4
2.5 START-STOP pushbuttons	page 5
2.6 CONTACTOR controls	page 5
3.0 DISPLAY features	page 5
4.0 DISPLAY messages	page 6
5.0 LEDs for visual indication	page 7
5.1 Lamp and Display Test	page 7
6.0 PROGRAMMING instructions	page 8
6.1 Programming	page 8
6.2 Default settings programming	page 8
6.3 Reading procedure	page 8
7.0 GLOW PLUGS control (Preheat)	page 8
8.0 MAINS simulation and ENGINE TEST	page 9
9.0 CHOKE control	page 9
10.0 HOUR METER reset	page 9
11.0 PUMP set control	page 9
11.A Electronic Governor	page 9
12.0 PARAMETER description	page 10, 11, 12
13.0 ENGINE RUNNING setting [P15]	page 14
14.0 WIRING DIAGRAM	page 15
15.0 Interface module, dimensions	page 16
16.0 CONNECTORS	page 16
17.0 FRONT PANEL	page 16
18.0 CPU module, dimensions	page 16
19.0 CALIBRATION	page 17
20.0 GENERAL SPECIFICATION	page 18
21.0 SOFTWARE UPGRADE	page 19
22.0 APPLICATION NOTES	page 19
23.0 PANEL/GEN-SET BUILDER NOTES	page 19

1.0 INTRODUCTION

The BE22 features 3-Phase Automatic Mains Failure (A.M.F.) and Generating Set (hereinafter 'GEN-SET') control and monitoring. The BE22 provides visual indication by means of LEDs and Display Messages for the following: Fuel Level, Overload, Emergency, 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/R.P.M., Charger Alternator voltage and Programmable Settings. The relay outputs feature START, STOP, ALARM, FUEL SOLENOID, PREHEAT/CHOKE and MAINS/GENERATOR CONTACTOR control. The front panel includes 6 pushbuttons, LEDs and a 4-digit DISPLAY (section 17.0). The BE22 consists of two modules: CPU (panel mount) and INTERFACE (DIN rail mount). The connection of the modules is via 25 cable shielded poles (1M length).

2.0 OPERATING MODE selection

The operating modes are indicated by means of yellow LEDs (see section 17.0). To change an operating mode, push the [MODE-DOWN] (or [MODE-UP]) pushbutton until the BE22 illuminates the yellow LEDs (at least one second). The BE22 features AUTO (section 2.2), MANUAL (section 2.3), TEST (section 2.1) and RESET (section 2.4) operating modes.

2.1 >TEST< operating mode

The TEST operating mode tests the GEN-SET. The BE22 will start the engine according to the programmed parameters (section 12.0, P14-17) and the Load will be transferred to the GEN-SET by means of a contactor. In TEST operating mode, the GEN-SET has priority over the MAINS. To stop the engine, select the AUTO operating mode (see section 2.3) or select the MANUAL operating mode (by means of the [STOP] pushbutton). In AUTO or TEST operating modes, the [STOP] pushbutton shuts down the engine, and the EMERGENCY alarm energizes (see section 2.4).

2.2 >AUTO< operating mode

Section 12.0 describes the programmable parameters used to control the GEN-SET in **AUTO** operating mode. The contactor of the Mains opens and the engine starts, if the Mains fails according to the P0/1/2/3 parameters. The BE22 turns off the LEDs and Display during the starting attempts. If the Voltage and Frequency of the Generator are within the settings (P6/7/8/9), the contactor of the Generator (KG) will close after the warm-up time (P4). If the Mains restores (P1), the contactor of the Generator opens, and the contactor of the Mains (KM), closes, after a 2 second delay. The Engine will stop after a cooling down time (P5). If the engine shuts down, in case of alarm, the KM closes after the STOP cycle, independently of the Mains status. In AUTO operating mode, the BE22 periodically tests the engine if P26 and P27 have been properly programmed (section 22.0). During the periodic test, the yellow LEDs indicating the AUTO operating mode will continue to flash. The starting characteristics are programmed in parameters P14 to P17. The parameter P11 provides overload protection for the GEN-SET against Over Current (the protection is delayed by 6 seconds). In AUTO operating mode, the BE22 monitors the status of the JD14 terminal to allow Mains Simulation or TEST (see sections 8.0 and 12.0). The BE22 stores the AUTO operating MODE. In case of supply failure, the BE22 restores the AUTO operating mode automatically after a power on cycle.

2.3 >MANUAL< operating mode

The MANUAL operating mode allows the 'Off-Load' use of the engine. To start the engine, push the [START] pushbutton until engine starts. During the starting attempts, the BE22 turns off the LEDs and the Display. To stop the engine, push the [STOP] pushbutton until the [STOP] message appears on the display. The BE22 executes the 'STOP cycle' (P19, section 12.0). If the engine has already stopped, it is possible to clear the 'STOP cycle' by pressing the [STOP] pushbutton.

2.4 >RESET< operating mode

This operating mode clears the alarms and allows the programming of the parameters (see sections 6.1 and 6.3). If the BE22 stays in RESET operating mode for more than 5 minutes, the display and the LEDs turn off automatically; a dot on the display will illuminate (see section 3.0). When a pushbutton is pressed, the BE22 will restore the normal operating mode of the Display and LEDs.

2.5 [START]-[STOP] pushbuttons

These pushbuttons are used to control the engine in MANUAL operating mode (section 2.3). In AUTO or TEST operating modes, the [STOP] pushbutton energises the EMERGENCY alarm (see section 5.0). The [STOP] pushbutton is used, also, for: 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, the BE22 transfers the load to the MAINS. The **Automatic Mains Failure** function takes place only in AUTO operating mode. The 'KM' (Mains contactor) will follow the settings of the parameters P0-1-2-3. The BE22 enables the contactor of the Generator (hereinafter 'KG') in AUTO and TEST operating modes, if the Voltage and the Frequency are within the limits allowed by parameters P4-6-7-8-9. In TEST operating mode, the 'KG' has priority over 'KM' (section 2.1). The status of the contactor is indicated by means of a green LED (see sections 5.0 and 17.0).

3.0 DISPLAY features

The BE22 features a 4 Digit Display (section 17.0). Using the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons you may select one of the following modes: h/PROGRAM, CURRENT, VOLTAGE, FREQUENCY/RPM, and BATTERY/CHARGER ALTERNATOR. Each menu is indicated by means of a yellow LED. If the BE22 stays in RESET operating mode for more than 5 minutes, the display and LEDs shut down. One dot on the display will illuminate indicating the 'Low Power' consumption mode. By pressing a pushbutton on the front panel, the display returns to normal operating mode. During starting attempts, the BE22 turns off all LEDs and Displays. The display modes are described below.

h/PROGRAM If the BE22 is in RESET operating mode, the display shows the programmable parameters. The message **[P.XX]** (XX means a 2 digit number) appears on the display indicating the name of the parameter. By means of the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons, it is possible to select a parameter. After you push the [STOP] pushbutton, the display will show the setting of the parameter (see section 12.0). If the BE22 is not in RESET operating mode, the Display will show the [HOUR COUNT]. The BE22 allows a maximum count of [9999] h (see section 10.0 to clear the counter).

CURRENT (*NOTE1) The display shows the Generator Current measurements (00.0-99.9Aac and 100-1000Aac). The [P10] sets the size of the CTs, and the [P11] sets the Overload.

VOLTAGE (*NOTE1) The display indicates the voltage of the MAINS or GEN-SET. If the fuel solenoid is energised, the display shows the voltage of the generator ([GXXX]). Otherwise, the display shows the voltage of the Mains ([UXXX]). The settings for Over/Under voltage are programmed in the parameters P2/3 and P6/7 (section 12.0).

***NOTE1**

In order to show the 3 phases of the voltage and current, the display scans the measurements every 2 seconds, and dashes appear to indicate phase '2'([- 400]) and '3'([_ 400]).

FREQUENCY/R.P.M This menu indicates the frequency measurement of the Generator (10.0Hz /99.9 Hz). The settings for Over/Under Frequency are programmed in the parameters P8/P9 (section 12.0). After you push the [DISPLAY-DOWN] pushbutton, the yellow LED will start blinking and the display will indicate the R.P.M. of the engine, according to the setting of the parameter [P29].

BATTERY This menu indicates the Battery Voltage or Charger Alternator voltage. The display shows the battery voltage if the yellow LED is illuminated. The Charger Alternator voltage is displayed by pushing the [DISPLAY-DOWN] pushbutton (the yellow LED will blink).

4.0 DISPLAY messages

Some alarms are displayed by means of [EXX] messages. 'E' indicates error (or alarm) and 'XX' indicates a number or a code. The message is removed by selecting the RESET operating mode (except for [Err]). The BE22 will show one of the following:

[E 01] (OVER FREQUENCY) The source of the alarm is the frequency of the Generator voltage. This protection is delayed by 2 seconds. The setting is the parameter [P9].

[E 02] (BELT BREAK) The alarm is enabled by means of the code [on] in [P23]. There is a 'Belt Break' alarm when the engine is running, but the output voltage of the Charger Alternator is lower than the setting of P15. A 20-second delay prevents a false alarm. [E02] can be inhibited by the code [OFF] in P23.

[E 03] This Message is not used

[E 04] (ALTERNATOR FAILURE) This message will be displayed if the alternator is without voltage or frequency for 150 seconds after the engine has been started. The alarm monitoring is disabled if [P12] contains the code [OFF], or the BE22 is in MANUAL operating mode.

[E 05] (GEN-SET OVERLOAD) If the current of one phase is greater than [P11] for at least 6 seconds, the engine will shut down after a cooling down timing (P5).

[E 06] (UNDER FREQUENCY) [P8] sets the under frequency limit. This protection is delayed by 6 seconds. The engine stops after a cooling down time.

[Hi G] (OVER VOLTAGE) If the voltage of one phase rises above the [P8] setting for more than 2 seconds, the Over Voltage alarm energises, and the engine shuts down. The alarm is monitored in all operating modes.

[Lo G] (UNDER VOLTAGE or SHORT CIRCUIT) The alarm energises if:

- the voltage drops under the [P6] setting for more than 6 seconds
- the voltage drops under the [P6] minus 20% for more than 1 second

The BE22 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. To restore the normal operating mode of the memory, disconnect the supply and re-apply the supply after a minute. If the failure persists, follow the instructions of section 19.2.

The BE22 indicates additional messages on the display:

[U-on] (MAINS SIMULATION). The input JD14 simulates the Mains presence (section 8.0)
[' ' ' '] (PRE-GLOW). The BE22 is driving the GLOW PLUGS cycle ([P13] setting)
[----] (V - METER out of range). The voltage (Mains or Generator) falls under 70Vac
[StOP] (STOP). The BE22 is driving the stop cycle ([P19] setting)
[rEst] (REST TIMING). The BE22 is waiting for a starting attempt ([P16] setting)

DURING THE STARTING ATTEMPTS (MANUAL OR AUTOMATIC), THE BE22 TURNS OFF THE LEDs AND DISPLAYS IN ORDER TO SAVE ENERGY FOR THE INTERNAL CIRCUITS.

5.0 LEDs for visual indication

The following red LEDs (LED=solid state lamps) indicate alarms. To turn off the indicators, select the RESET operating mode (see section 2.4).

LOW OIL PRESSURE [Red LED]. Indication of Low Oil Pressure alarm. The input is connected to a normally closed contact Pressure Switch (input JD11). During the starting sequence, the alarm is by-passed by means of the [P18] timing (section 12.0).

HIGH ENGINE TEMPERATURE [Red LED]. Indication of High Temperature alarm. This input, terminal JD12, is connected to a normally open or closed temperature switch. The contact selection is done by a code in [P24] (option [n.o.] or [n.c.]). The engine stops immediately. During the starting sequence, the alarm is by-passed by means of the [P18] timing (section 12.0)

STARTING FAILURE [Red LED]. This alarm is activated if the engine does not start after a complete starting cycle (see settings of [P14] to [P17] in section 12.0).

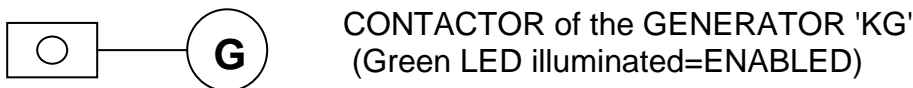
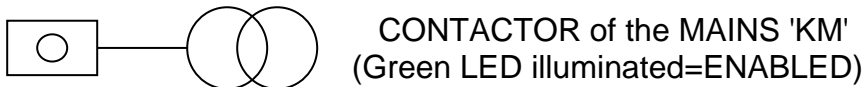
OVERLOAD [Red LED]. The OVERLOAD alarm energises if the input JD10 is connected to the battery minus. The BE22 disables the contactor of the Generator, and stops the engine after the programmed Cooling Down time ([P5], section 12.0).

BATTERY [Yellow LED]. The alarm settings are automatically fixed to 11.8/15.0V for a 12V battery or 23.6/30.0V for a 24V battery. This alarm is ignored during the Pre-Glow timing and starting cycle. A delay of 120 seconds prevents false alarms.

EMERGENCY [Red LEDs]. The EMERGENCY input (JD13) stops the engine immediately. The polarity of the switch contact is programmed into [P25] (option [n.o.] or [n.c.]). The EMERGENCY alarm is also activated by the [STOP] pushbutton in AUTO and TEST operating modes.

ENGINE RUNNING [Green LED]. This LED illuminates when the voltage of the Charger Alternator (terminals JD15 and JD16) is greater than the setting of the parameter [P15] (section 13.0).

FUEL [Yellow LED]. This LED indicates Low Fuel in the tank. The engine stops if the contact (terminal JD9) stays closed for more than 5 minutes continuously. The level switch (terminal JD9) is bypassed for 15 seconds to avoid false alarms.



5.1 Lamp and Display Test

A test of the LEDs/DISPLAY is obtained by pushing the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons simultaneously. The LEDs and DISPLAY illuminate as long as the pushbuttons are pressed and held together.

6.0 PROGRAMMING instructions

Section 12.0 lists and describes the adjustable parameters. The display shows the name and the setting of the parameter. To enter the program mode, follow the instructions described in sections 6.1 and 6.2.

6.1 Programming

- 1) - Select the h/PROGRAM display mode by using the [DISPLAY-UP] pushbutton
- 2) - Select the RESET operating mode by using the [MODE-UP] pushbutton. If a STOP cycle takes place, wait until the message [StOP] disappears.
- 3) - Push and hold the [DISPLAY-UP] and the [MODE-UP] pushbuttons simultaneously
- 4) - Wait until the [Pro-] message appears on the display (approximately 3 seconds)
- 5) - When the [Pro-] message is displayed, release the pushbuttons: the yellow LED 'h/PROGRAM' will blink indicating that the BE22 is ready for programming.
- 6) - Press the [DISPLAY-UP] (or [DISPLAY-DOWN]) pushbuttons to select the parameter
- 7) - Press the [STOP] and [DISPLAY-UP] (or [DISPLAY-DOWN]) pushbuttons simultaneously to modify the parameter (the display will indicate the parameter).

To save the modification and quit:

8A) - Press [STOP] and [MODE-UP] simultaneously until the message [Save] appears (approximately 5 seconds).

9A) - The message [GOOd] will confirm the saving procedure (* NOTE).

10A) - Select the MANUAL operating mode by means of the [MODE-DOWN] pushbutton.

11A) - Remove the supply for at least 20 seconds, and then re-connect. It is good practise to check all parameters (see section 6.3).

To exit without saving:

8B) - Select the MANUAL operating mode by means of the [MODE-DOWN] pushbutton.

9B) - Remove the supply for at least 20 seconds, and then re-connect. It is good practise to check all parameters (see section 6.3).

(* NOTE): the message [Err] indicates an error in the saving procedure. We recommend that you repeat step 8). 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 BE22 are programmed in factory with 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 display blinks once. To save the defaults, follow steps 8A) to 11A) as explained in section 6.1

6.3 Reading procedure

To read the parameters use the following instructions:

- 1) Select the RESET operating mode by using the [MODE-UP] pushbutton
- 2) Select the h/PROGRAM display mode by using the [DISPLAY-UP] pushbutton
- 3) Select the parameter by using [DISPLAY-UP] or [DISPLAY-DOWN]. The message [P.XX] will indicate the parameter address (XX= 2 digit number, see section 12.0)
- 4) Press the [STOP] pushbutton: the display will indicate the setting of the parameter.

7.0 Pre-Glow control

Output JA5 energises the Pre-glow. The factory settings leave the JA5 output inoperative. 'Pre-Glow' is enabled by programming a timing in [P13], and by programming the code '2' into [P21] (see section 12.0). The output JA5 energises before the starting attempt. During the rest time, the JA5 output remains energized independent of the [P13] timing. We recommend that you extend the rest timing of [P16] up to at least 15 seconds.

8.0 MAINS SIMULATION and ENGINE TEST

The BE22 features 'Mains Simulation' or 'Test', by monitoring the input JD14 in AUTO operating mode. The BE22 will operate according to the P22 setting (see section 12.0).

[P22] setting = [U-on] To enable the 'Mains simulation' mode, set the [P22] to [U-on] (default setting). When the JD14 is grounded, the BE22 simulates the presence of the Mains. The display will show the message [U-on] in the Voltage menu. This function is used if the user requires remote 'start' and 'stop' by means of a switch (external switch, level switch or timer switch).

[P22] setting= [tESt] To enable the 'TEST MODE', set the [P22] to [tESt]. If the JD14 input terminal is grounded (by means of an external switch) the engine starts and the BE22 will transfer the load to the GEN-SET. During the starting cycle, the contactor of the Mains (KM) remains closed.

9.0 'CHOKE' control (gasoline engine)

The JA5 output drives the engine 'CHOKE'. The default setting of the P21 (set to '0') provides an inoperative output mode for the terminal JA5. To energize the JA5 output at the beginning of each starting attempt, program a time from 2 to 4 seconds into [P13], and the code '1' into [P21] (see section 12.0).

10.0 HOUR METER reset

To clear the counter, use the following instructions:

- Press the [MODE-UP] (or [MODE-DOWN]) pushbutton to select MANUAL mode.
- Stop the engine by means of the [STOP] pushbutton.
- Press the [DISPLAY-UP] pushbutton to select the 'h/PROGRAM' mode (the HOUR COUNT will appear on the display).
- Push the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons simultaneously: the LEDs and Display illuminate (Lamp Test).
- Wait until the Display blinks once (approximately 10 seconds).
- Release the pushbuttons, the [0] hour-count will appear on the display.

11.0 PUMP SETS CONTROL

The BE22 can control and protect PUMP SETs.

It is necessary to adapt some parameters in order to avoid unexpected engine shut downs.

Set the following parameters as indicated below (see section 6.0 for programming):

[P12] = [OFF] (disables 'Generator Failure' alarm), [P4]=[0] (disables 'Warm Up')

[P05] = [0] (disables 'Cooling-Down'), [P22] = [M-on] (selects 'Mains Simulation' mode)

[P26] = [0] (disables 'Automatic Periodic Test')

In order to start and stop the Pump Set, in AUTO operating mode, connect the Level Switch (or Pressure Switch) to the JD14 terminal. The engine starts if the contact opens. The engine stops if the contact closes. The BE22 will start and stop the engine according to the settings of the parameter [P0] and [P1].

The parameter [P0] delays the starting of the engine. The parameter [P1] delays the stopping of the engine.

11.A ELECTRONIC GOVERNOR

The BE22 can delay the starter motor up to 5 seconds. Follow the instructions:

- supply the electronic governor using the FUEL SOLENOID output (JA2).
- program the parameter [P13] to 5 seconds (default)
- program [P21] in mode [2]
- leave the output Pre-glow (JA5) unconnected.

As soon as the BE22 enters the start cycle, the Fuel solenoid will energize first. In this way, the Electronic governor starts up.

After a 5 second delay, the BE22 will energize the output JA3 in order to start the engine.

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

[P. 0]	Mains Failure Delay Factory default: [5"] secs Range: 1-59 secs or 1-15 mins Seconds or minutes of continuous Mains failure (see P2-P3) to initiate the automatic engine start.
[P. 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 (see P2-P3) to initiate the stop sequence.
[P. 2]	Mains Under-Voltage Factory default: [320] Range: 80-500V (5V steps) If the Mains voltage falls below the [setting], there is a Mains failure condition. An hysteresis of 8Vac is introduced to prevent a false condition.
[P. 3]	Mains Over-Voltage Factory default: [500] Range: 80-500V (5V Steps) If the voltage rises above the [setting], there is a Mains failure condition.
[P. 4]	Warm Up time Factory default: [5"] Range: 0-59 secs or 1-15 mins This delay allows the engine to warm up. After the delay, the BE22 will enable the contactor of the Generator.
[P. 5]	Cooling Down time Factory default: [30"] Range: 0-59 secs or 1-15 mins This delay cools the engine. During this time the engine runs off-load (the contactor is de-energised).
[P. 6]	Generator Under-Voltage Default: [320] Range: 80-500V (5V Step) If the voltage rises above the [setting], the BE22 enables the contactor. If the voltage drops under the [setting] for at least 6 secs or under [setting]-20% for 1 sec, the Under-Voltage protection [Lo G] energises (see section 4.0).
[P. 7]	Generator Over-Voltage Default: [500] Range: 80-500V (5V Steps) If the Generator voltage rises above the [setting] for at least 2 seconds, the BE22 will energise the Over Voltage protection [Hi G] (see section 4.0) in order to stop the engine
[P. 8]	Generator Under-Frequency Default: [47] Range: 0 to 99Hz The protection is delayed by 6 seconds. The BE22 opens the contactor and the display will show the [E06] message (see section 4.0). The code [0] disables the under frequency)
[P. 9]	Generator Over-Frequency Default: [53] Range: 45 to 99Hz The protection is delayed by 2 seconds. The BE22 shuts down the engine and displays [E01] (see section 4.0). The code [99] disables the over frequency alarm.
[P. 10]	Current Transformer Size Default: [500] Range: 10/5 up to 1000/5 The settings are allowed only in steps of 10.
[P. 11]	Generator Overload Setting Default: [0] Range: 0 to 1000 A If the current rises above the setting by 6 seconds, the BE22 opens the contactor and shows the message [E05].The settings are allowed in steps of 5A. The engine will stop after the cooling down time.
[P. 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 lower than the setting for more than 150 seconds. The BE22 shows the [E04] message (see section 4.0) and the engine will shut down.
[P. 13]	Pre-glow / Choke Control Factory default: [5"] Range: 1 to 99 secs The BE22 energises the JA5 output for the programmed time. The code [0] in the P21 disables the function. The channel P21 controls the way to energise the output (Glow or Choke: see sections 7.0 and 9.0).

[P. 14]	Crank Timing Default: [5"] Range: 1-20 seconds This is the insertion time-out for the starter. The timer is cleared if the engine starts to run
[P. 15]	Engine Running Default: [8.0] Range: 3.0V to 24.0V If the voltage of the charger alternator (input JD15-16) rises above the [setting], the BE22 disconnects the starter motor (see section 13). The programming is allowed in steps of 1V.
[P. 16]	Rest Timing Default: [5"] Range: 3-20 secs This time interval turns off the starter. The display shows the message [rEst] or the message [""] according to the parameter P21.
[P. 17]	Starting Attempts Default: [3] Range: 1-10 The parameter counts down the number of automatic starting attempts in case of the automatic start cycle. If the engine does not start after the programmed number of attempts, the BE22 will energize the Fail to Start alarm.
[P.18]	Engine Alarms By-Pass Default: [6"] secs Range: 0-99 secs This delay allows the Oil Pressure and Temperature alarms, during the engine starting cycle, to be ignored.
[P.19]	Stop Solenoid Timing (Output JA4) Default: [15"] secs Range: 2-99 secs The stop solenoid will remain energised for the programmed time.
[P.20]	Alarm Output Timing (Output JA6) Default: [1'] Range: 0-59secs/1-15mins/[cont.] The ALARM output turns off automatically after this timing. The code [cont.] requires the RESET operating mode to turn off the ALARM output.
[P.21]	JA5 Output Control Default: [0] (Inhibit) Options: [0], [1] or [2] The following possibilities are available: [0] Inhibits the JA5 output [1] Choke Control Mode (see section 9.0) [2] Glow Plugs Mode (see section 7.0, and the parameter P13)
[P.22]	JD14 Input Control Mode Default:[U-on] Options: [U-on] or [tEst] By means of the [U-on] mode, the JD14 simulates the Mains presence (section 8.0). The [tEst] mode allows the TEST of the engine (section 8.0)
[P.23]	Belt Break Alarm Default: [OFF] (inhibited) Options: [on] or [OFF] The Belt Break (or Charger Alternator Failure) alarm is indicated by means of the message [E02] (see section 4.0).
[P.24]	Temperature Switch (Input JD12) Default: [n.o.] Options: [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.
[P.25]	Emergency Control (Input JD13) Default: [n.o.] Options: [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.
[P.26]	Automatic Periodic Test Cycle Default: [0] (inhibited) Range: 0-99 days This is the interval time between the automatic periodic tests of the engine. The code [0] disables the Automatic Periodic Test (see section 22.0).

[P.27]	Automatic Test Duration Default: [10'] mins This is the duration of the Automatic Periodic Test. The load is transferred to the GEN-SET only if the Mains fails (see section 22.0).	Range: 1-99 minutes
[P.28]	Phases Selection Default: [3Ph.] For single Phase mode, connect the BE22 as indicated below: - Generator Current: terminals 19-20-21-22 to GND. Terminals 17 and 18 to the CT. - Generator Voltage: terminal 23 to Neutral, 25 and 27 to the Generator Phase. - Mains Voltage: terminal 29 to Neutral, 31 and 33 to the Mains Phase.	Options: [1 Ph.]/[3Ph.]
[P.29]	Alternator Poles Default: [4] The setting allows the reading of R.P.M. according to the format of the alternator.	Options: [2]/[4]
[P.30]	Test Options Default: [on] You can choose to switch (option=[on]) or not (option=[OFF]) the Load in TEST operating mode. The TEST can be initiated from the front panel or by means of the JD-14 input. If the Mains fails, the load will be transferred to the generator even if the option is = [OFF].	Options: [on] or [OFF]
[P.31]	Fail To Stop Options Default: [Inh] The option [OFF] disables the FAIL to STOP alarm.	Options: [Inh]/[E07]

13.0 ENGINE RUNNING setting (P15)

The Be22 terminates the crank when the engine is able to run without the aid of the starter motor. When the engine is not running the D+/WL (input JD15-16) voltage is 0V. As soon as the BE22 starts the engine (manual attempt or automatic cycle) a current will flow into the D+/WL terminal.

At this moment, the engine is not running, but a voltage appears in the D+/WL terminal (0.8 to 2.5V). As soon as the engine starts running, the voltage of the D+/WL terminal increases up to 3V-6V. When the engine runs, the voltage reaches the nominal 14 -15V to charge the battery. The threshold to disconnect the starter motor is between 6V to 10V.

The default parameter of the [P15] 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 setting, be sure that the green 'ENGINE RUNNING' LED on the front panel is off during the cranking cycle.

NOTE

The Charger Alternator voltage can be displayed in the 'BATTERY' display mode: push the [DISPLAY-DOWN] pushbutton and the BE22 removes the Battery voltage indication. It will also display the Charger Alternator voltage (the yellow LED will blink). The accuracy of the display is guaranteed within 5%, using a standard Charger Alternator. For other chargers, (Flywheel Generator) the reading is not accurate. The [P15] setting, in this case, expresses only a proportional factor.

The BE22 monitors the GEN-SET voltage to protect against unwanted insertion of the starter motor. When the voltage reaches 80VAC the starter insertion is inhibited. This voltage 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 JF23-25-27 is not recommended.

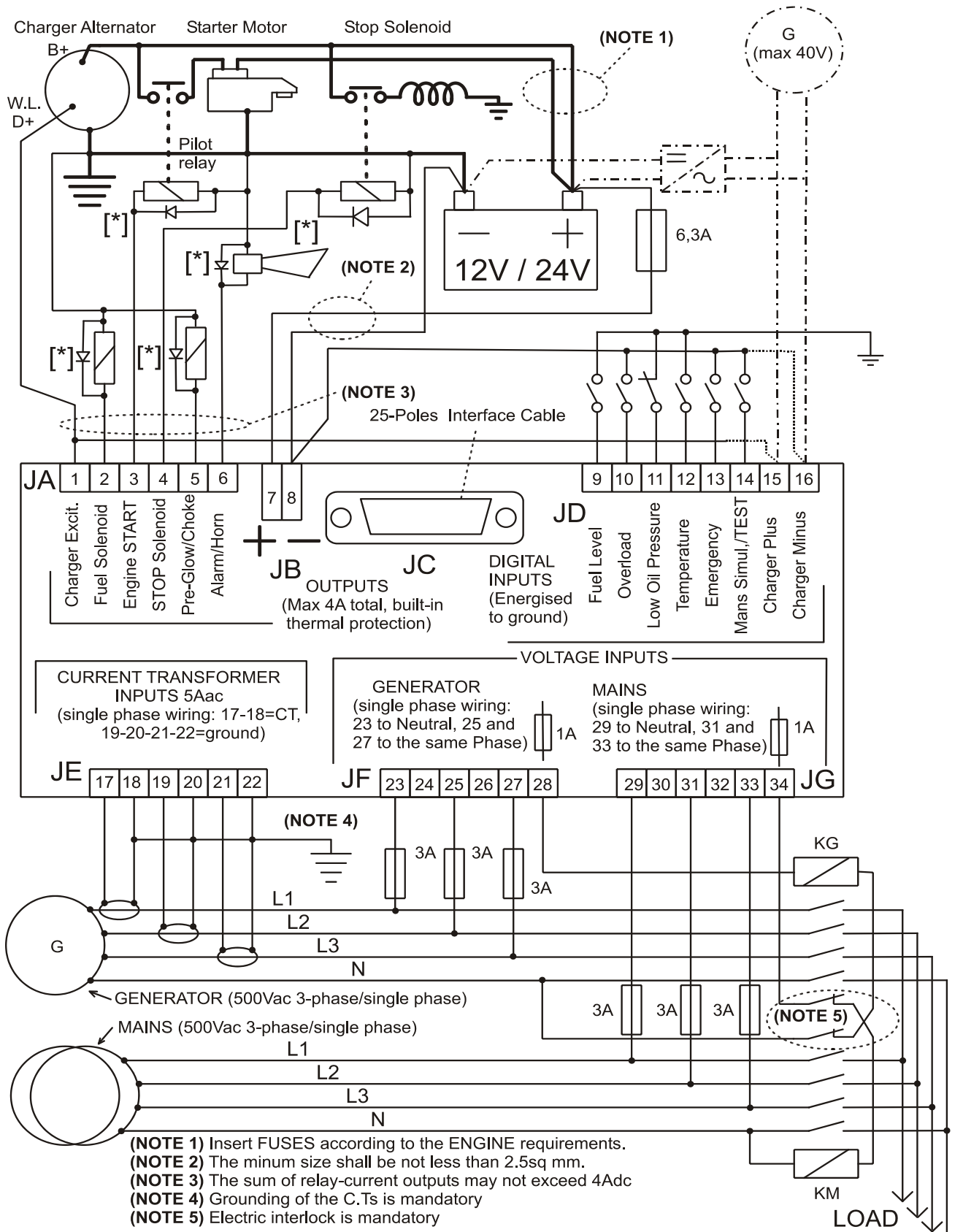
ATTENTION: THE 'ENGINE RUNNING' LED SHOULD ILLUMINATE WHEN THE ENGINE RUNS. IF THE LED REMAINS OFF, VERIFY THE SETTING OF [P15] OR VERIFY THE WIRING.

Normally, using a diesel engine, a BELT BREAK protection is recommended. This is accomplished by programming the code [on] in [P23] (see section 12.0). To test the protection, follow the instructions:

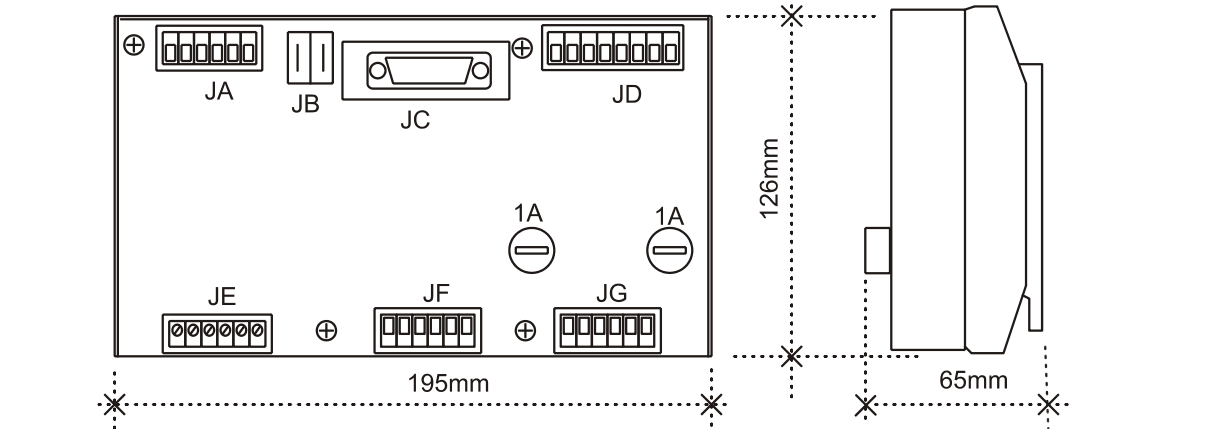
-disconnect (for safety use a switch) the terminal D+/WL from the charger alternator when the engine is running.

-connect to ground (for safety use a switch) the JD15 terminal for 20 seconds at least; the message [E02] appears and the engine will shut down.

WARNING High voltage is present inside the BE22. 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 BE22 first by connecting the control panel to ground.



SECTION 15.0: Interface module dimensions

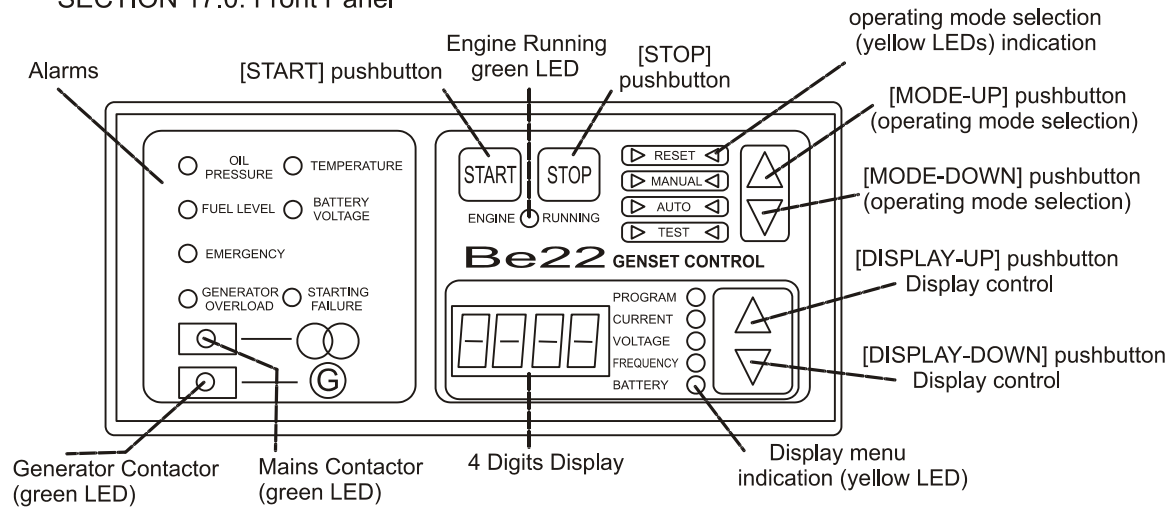


SECTION 16.0: Connectors

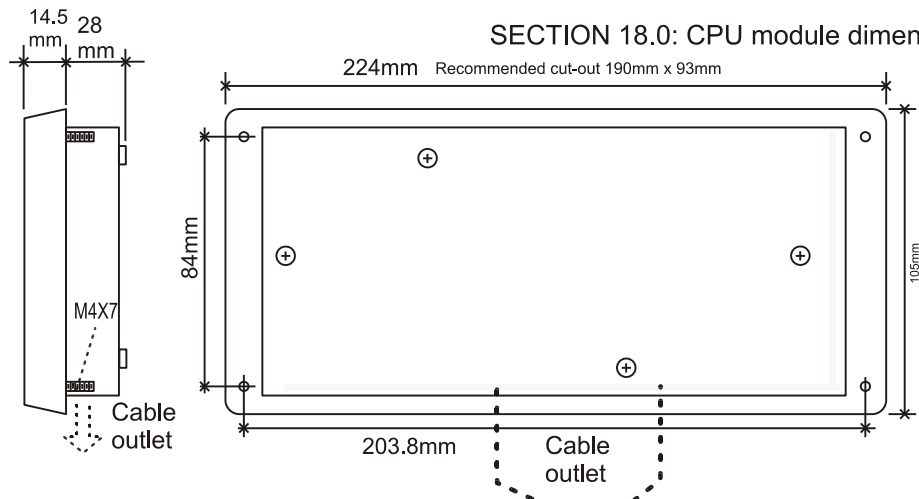
- JA 6 Poles Male/Female Block
- JB 2 Blade Male 6.3x0,8 mm(*)
- JC 25 Poles D-DUB Female
- JD 8 Poles Male/Female Block
- JE 6 Poles Terminal Block
- JF 6 Poles Male/Female Block
- JG 6 Poles Male/Female Block
- JC-CABLE 25Poles 1M lenght

(*)The 2 female connectors for blade terminals are not provided.

SECTION 17.0: Front Panel



SECTION 18.0: CPU module dimensions



19.0 CALIBRATION

To enter the Calibration, press and hold the [STOP] pushbutton during the power on of the BE22. The message [CAL] will appear on the display (*). The BE22, by means of the [DISPLAY-UP] and [DISPLAY-DOWN] pushbuttons, allows the following selections:

DISPLAY	MEASUREMENT / FUNCTION	RECOMMENDED VALUES
[U.1]..3]	Mains Voltage (GAIN)	330Vac up to 420Vac
[L.1]..3]	Generator Voltage (GAIN)	330Vac up to 420Vac
[OFFS]	Generator Current (OFFSET)	GEN-SET not running (I=0)
[C. 1]..3]	Generator Current (GAIN)	80% of the CT's size
[UCC]	Battery Voltage (GAIN)	12V-14V or 24-28V
[Fr]	Generator Frequency calibration	49Hz-51Hz or 58Hz-62Hz
[Ad c.]	A/D calibration	Disconnect all plugs except the power supply (JB/JC)
[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 How to calibrate a measurement:

- A)** - Enter the Calibration Mode (section 19.0)
- B)** - Push the [DISPLAY-UP] (or [DISPLAY-DOWN]) pushbutton to select the measurement.
- C)** - Apply a source of known and stable signal to the input. The most accurate reading is obtained by using the value indicated in table 1 (Recommended Values).
- D)** - Push simultaneously [STOP] and [DISPLAY-UP] (or [DISPLAY-DOWN]) pushbuttons to update the measurement. The reading increases (decreases) by a small amount each time the pushbutton is pressed.
- E)** - When the reading is stable, push the [STOP] and [MODE-UP] pushbuttons simultaneously until the display shows the [SaVE] message (5 seconds at least).
- F)** - Wait for the message [Good] (****NOTE**) and disconnect the supply for at least 20 seconds.
- G)** - Apply the supply and verify, using the MAN (or AUTO) operating mode, the value of the measurements.

19.2 How to clear the memory in case of memory error or failure:

- A)** - Enter the Calibration Mode (section 19.0). If the display indicates the [Err] message, push the [STOP] pushbutton.
- B)** - Push the [DISPLAY-UP] or [DISPLAY-DOWN] pushbutton to select the **[MEM]** message.
- C)** - Push and hold the [STOP] pushbutton until the display shows the message [Init.] (20 seconds at least). The BE22 will use the default settings (section 12.0), clearing the hour-count and removing calibrations.
- D)** - As soon as the [-MEM] message re-appears, disconnect the power supply and enter the programming to adjust the parameters (section 6.0). A calibration procedure might be necessary.

(NOTE:** the message [Err] indicates a memory error. Simultaneously press the [STOP] and [MODE-UP] pushbuttons in order to retry a memory writing cycle. If the [Err] message remains on the display, follow the instructions described in the section 19.2. If the problem persists, the BE22 is damaged and must be returned for repair.

19.3 -A/D converter calibration procedure:

- A)-** Disconnect all plugs except the JC cable.
- B)-** Enter the Calibration Mode (section 19.0)
- C)-** Push the [DISPLAY-UP] or [DISPLAY-DOWN] pushbutton to select [Ad c.].
- D)-** Push the [START] pushbutton for at least 2 seconds and wait for the [--] message.
- E)-** Push the [STOP] and [MODE-UP] pushbuttons simultaneously until the display shows the [SaVE] message.
- F)-** Wait for the message [Good], and disconnect the supply for at least 20 seconds.
- G)-** Check the accuracy of the measurement, and if necessary, enter CALIBRATION mode to adjust the measurements (section 19.1).

20.0 GENERAL SPECIFICATION

Supply Voltage 7Vdc to 33Vdc. **Reverse polarity:** permitted for unlimited time.

Supply Ripple: 15% up to 65 Hz, **Over Voltage:** 50V (60 secs) at 40 deg. C

V Battery Display error: 3% [**]. **Protection:** internal 300mA /60Vthermal fuse

Supply Current Consumption: 50 mA up to 150mA maximum

Supply to Reset the System: 6,0V for 5 seconds.

BE22 CPU dimensions: 224mm X 105mm X 42.5mm

Panel Cut-out: 190mm X 93mm, operation indoor

BE22 INTERFACE MODULE dimensions: 195mm X 126mm X 65mm.

Shipping (box dimensions): 255x230x80

Operating Temperature range: -25 deg C to +70 deg C. **Humidity Range:** 5% up to 95% non-condensing

Total Weight: 1500 gr. (includes cable), **Vibration:** 40mm/sec

General Design: 89/336 EEC, 89/392 EEC, 73/23 EEC, 93/68 EEC, IEC 68-2-6, EN60950

Certification: CE

DC Relay Outputs Characteristics (Engine Control)

Output Current: 8A/30Vdc, an internal thermal PTC resettable 4A Fuse is provided [*]

Output Voltage: Battery Voltage

AC Relay Outputs Characteristics (Mains and Generator)

Output Current: 8A/250Vac, 2 internal 1A fuses (5x20) are factory provided.

Mains and Generator Voltage Input Characteristics

Nominal Voltage input: 400Vac (3-Phase). Maximum allowed Voltage: 500Vac continuously Phase to Phase.

Over voltage: 2KVac Phase to Phase. Insulation to ground: 2KVac / 300 seconds

Maximum Display error: +/- 3% [**]. Input impedance: 3 Mega Ohm

Current Transformer Characteristics

Current Transformer Size: 50/5Aac up to 1000/5Aac. Maximum Current: 8Aac for 10 seconds.

Maximum Display error: +/- 5% [**]. Internal resistance: 0.1 Ohm

Digital Input Characteristics

Open circuit voltage: 10Vdc (12V supply) or 22Vdc (24V supply)

Closed circuit current: 15mAdc maximum. Over voltage: 100V/10mS

Charger Alternator Monitoring

Operating Voltage up to 33Vdc. Over voltage: 100V / 20mS

Vdc reading accuracy +/- 5% (the calibration of this parameter is not available)

Threshold: 3Vdc-24Vdc (programmable). Excitation Power: max 3W

[*]NOTE: THE TOTAL OUTPUT CURRENT (JA Plug) MAY NOT EXCEED 4A at 60°C

[**]NOTE: ERRORS CAN BE REDUCED BY MEANS OF CALIBRATION (SECTION 19.0)

Cable (Interconnection cable)

Operating voltage up to 100Vdc, operating current 200mA

Insulation 300Vac; Length: 1 meter; Type: 25 poles shielded with female D-SUB connectors

Minimum number of operation (connect/disconnect): 50

21.0 SOFTWARE UPGRADE

-1.02-1.08 Small Errors in the Periodic TEST procedures have been fixed

-1.10 The reading of the Frequency has been improved.

-1.11-1.16 The accuracy of the VOLTAGE measurements has been improved.

-1.20 The BE22 stores the AUTO operating mode in the memory.

-1.17-1.21 The accuracy of the Automatic Periodic Test has been improved.

-1.22 The alarm of the temperature is ignored during the starting cycle

-1.23 If the BE22 controls the engine with an electronic governor, the starter motor will be energized after a 5 second delay (see section 11A)

-1.24 The parameter [P.30] has been introduced in order select to switch or not the load in TEST operating mode.

-1.25, 1.26 The alarm FAIL TO STOP has been introduced .

-1.27, 1.28, 1.30 The parameter [P.31] has been introduced in order to disable the FAIL TO STOP alarm.

22.0 APPLICATION NOTES**22.1 Automatic Periodic Test**

The BE22 does not use a clock to count the programmed days (P26 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.

Programming the Automatic Periodic Testing for the first time (hereinafter 'A.P.T.')**----- Example: every 7 days for 20 minutes -----**

- enter the 'Program Mode' and set the P26 to 7 days (section 6.0)

- set the P27 to 20 (minutes)

- save the programming

- select the AUTO operating mode

The BE22 will start the engine after 7 days. The engine will run OFF-LOAD for 20 minutes. If the Mains fails during the A.P.T., the BE22 will transfer the load to the GEN-SET.

To adjust the starting moment:

- disconnect the power supply of the BE22

- wait for the expected start time (Hours:Minutes)

- apply the power supply to the BE22

- select the AUTO operating mode

The BE22 will start the engine after 7 days. The engine will run OFF-LOAD for 20 minutes. If the Mains fails during the A.P.T., the BE22 will transfer the load.

23.0 Panel/Gen-set Builders Notes