Be124 OEM's Manual

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Warranty

  Bernini Design SRL (hereinafter BD) warrants that Be124 shall be free from defect in material or workmanship for a period of 3 years from the BD delivery date. BD shall, at its discretion, repair or replace the product without charge. BD shall return the Be124 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 Be124 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 Be124 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

$$C\!E$$

!! WARNING   !!

High voltage is present inside the Be124. To avoid electric-shock hazard, operating personnel must not remove the protective cover. Do not disconnect the grounding connection. The Be124 can start the engine at anytime. Do not work on equipment, which is controlled by the Be124. When servicing the engine, disconnect the battery and battery charger. We recommend that warning signs be placed on equipment indicating the above

!! WARNING   !!

Author: Bernini Mentore

!!! WARNING !!!: do not disconnect the plugs of Be124 when the engine is running. By opening the secondary circuit of the C.T.'s you can generate a dangerous voltage. Never disconnect a connection of a CT when generator is working. You can seriously damage the controller and putting yourself in a serious risk of electrical shock.

!!! WARNING !!! GENERATOR VOLTAGE IS EXPOSED WITHIN THE BE124 AND ANCILLARY CIRCUITRY EVEN WHEN THE LED INDICATORS PLACED ON THE PANEL FASCIA ARE OFF.

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!! WARNING !!

The Be124 can start the engine at anytime. Do not work on equipment, which is controlled by the Be124. When servicing the engine, disconnect the battery and battery charger. We recommend that warning signs be placed on equipment indicating the above.

GENERATOR VOLTAGE IS EXPOSED WITHIN THE Be124 AND ANCILLARY CIRCUITRY EVEN WHEN THE GREEN LEDs GCB IS TOTALLY OFF & EVEN ALL INDICATORS PLACED ON THE FRONT FASCIA ARE OFF.

Section 1.0 - INTRODUCTION

 The Be124 is a 3-Phase Generating Set & Engine controller that integrates a Data logger, an Oscilloscope and a Transient recorder. The Be124 provides visual indication by means of LEDs and graphic display for all parameters and alarms. The Be124 features programmable settings and complies with NFPA110 CAN/CSA-C282-M89 regulations. It features RS485 and isolated Can bus (SAE-J1939). The figure illustrates the layout of the front panel. If Can bus is not available, the Be124 can interface with analog sensors and configurable switches for Oil Pressure, Temperature & Fuel Level monitoring.
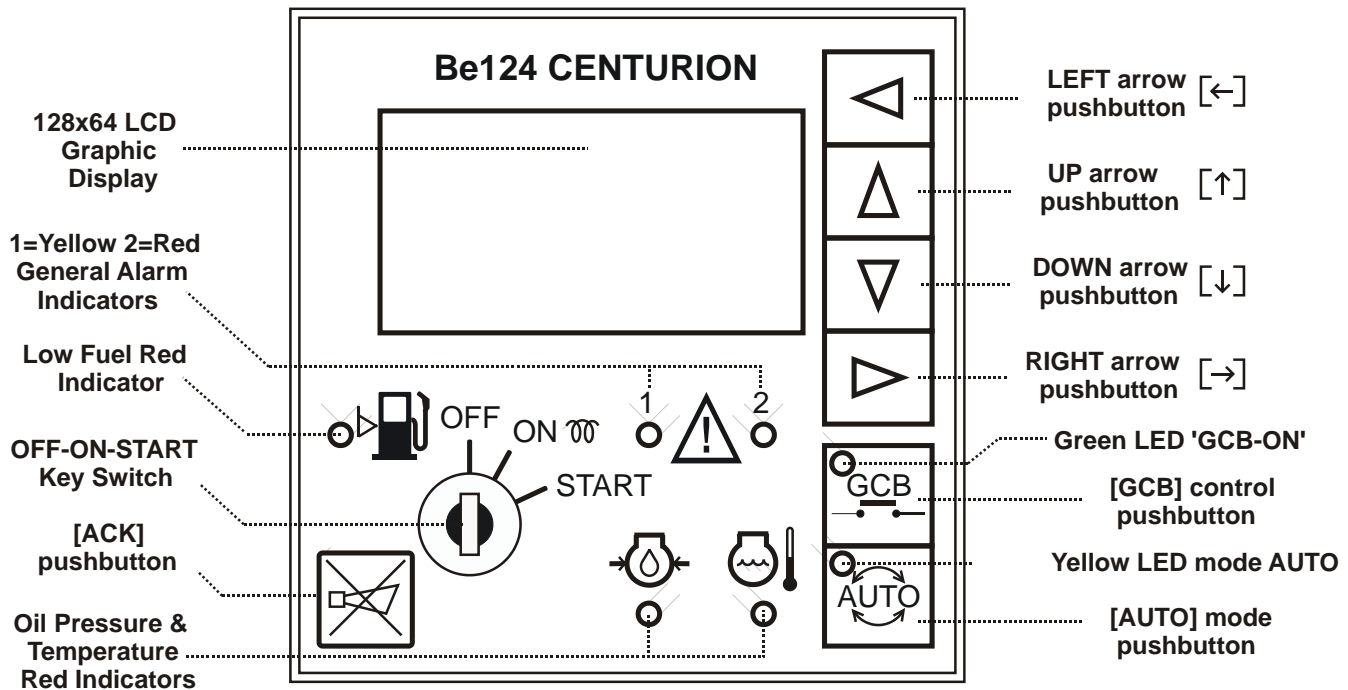
Section 2.0 -   SELECTING AN OPERATIONAL MODE

The mode of operation is selected via a key switch and an **[AUTO]** pushbutton. If the Be124 was in **TEST** or **AUTO** mode prior to power down, when you switch on the battery supply, the Be124 enters the **AUTO** mode of operation. In the other cases, you have to turn off the key and eventually restart the engine.

2.1 - OFF mode

  Turn the key to 'OFF': you switch **OFF** the Be124 and clear the fault alarms. You are allowed to program the parameters or modify the settings (see 22.0). The backlight of the display will shutdown automatically after a timeout (see 9.0). To exit the OFF mode turn the key to 'ON'.

2.2 - MANUAL mode: start & manual control of the Generator Circuit Breaker

   Turn the key to 'ON'. After the automatic self-check turn the key to 'START' until engine starts. The display will automatically open the 'Engine Status' page providing the basic information (see 5.0). During cranking, depending on the efficency of the battery, the Be124 may turn off the backlight of the display. Wait until the green LED GCB-ON starts blinking: it means that the generator is working within the settings. Push the **[GCB]** pushbutton to close the generator circuit breaker: the green LED **[GCB]** will light and remain lit. Use [↓] to browse the instrumentation (see 5.0 & 6.0). Push **[ACK]** at anytime to open the 'Engine Status' page. Push the **[GCB]** pushbutton to open the generator circuit breaker. To stop the engine, turn the key to 'OFF'; the message **[MODE OFF]** will appear on the display. The message **[STOPPING]** will appear on the display for the programmed stop time (see 11.4.7). After a complete stop, you can restart the engine.

2.3 - AUTO mode (Automatic mode of operation)

<div style="text-align:center">

!! WARNING !!   !! WARNING !!

GENERATOR VOLTAGE IS EXPOSED WITHIN THE Be124 AND ANCILLARY CIRCUITRY EVEN WHEN THE ALL LEDs ARE TOTALLY OFF

</div>

The Be124 can start the engine at anytime. Do not work on equipment, which is controlled by the Be124. When servicing the engine, disconnect the battery and battery charger. We recommend that warning signs be placed on equipment indicating the above.

   Turn the key to 'ON'. Push the **[AUTO]** pushbutton until the yellow LED **[AUTO]** illuminates. The engine starts when the Be124 detects a request of start on a configurable input (see table 11.8 options [12] & [13]). The green LED GCB blinks when the generator is working within the programmed limits. After the **[WARM UP]** time (see 11.4.6) the generator circuit breaker (GCB) will close automatically. Use [→] to browse the instrumentation (see 5.0 & 6.0). Push **[ACK]** at anytime to open the 'Engine Status' page. When there is a request to stop the engine, the Be124 opens the GCB and triggers the **[COOL DOWN]** timer (see 11.4.6). After that, the Be124 will stop the engine. In auto mode of operation, the Be124 will periodically test the engine if the scheduler is correctly programmed (see 10.2). During the test, the yellow LED **[AUTO]** will continue to blink. To stop the engine immediately turn the key to 'OFF' at anytime. The graphic display will update you about what Be124 is doing.

2.4 - TEST mode

   Turn the key to 'ON'. Push the **[AUTO]** pushbutton to enter the 'AUTO' mode. Push the **[GCB]** pushbutton to turn the Be124 in 'TEST' mode: the display indicates the message **[TEST MODE]**, the yellow LED AUTO starts to blink and Be124 will start the engine. The controller will enable the generator circuit breaker (GCB) only if not otherwise programmed by the parameter **[GCB TEST CONTROL]** (see 10.3). To exit the 'TEST' mode, push the **[AUTO]** pushbutton: the controller will enter the 'AUTO' mode of operation. To stop the engine immediately, turn the key to 'OFF'.

Section 3.0 - LEDs INDICATORS / TEST OF THE LAMPS (LEDS)

The table describes the functions of the indicators on the front panel. To test the LEDs, supposing Be124 is in 'OFF' mode of operation, turn the key to 'ON': the Be124 will turn on all indicators for a few seconds (self-check).

LED indicator	Description	LED indicator	Description
Fuel Alarm (Red)	It turns on in case of no fuel in the tank (shutdown).	Auto / Test Mode (Yellow)	- It turns on indicating the **AUTO** mode of operation (see 2.0). - It blinks indicating the **TEST** mode of operation (see 2.4). - It blinks to indicate that the scheduler is requesting the engine to run (see 10.2).
Oil Pressure Alarm (Red)	It turns on in case of Low Oil Pressure (see 11.4.11). The engine shuts down.		
Engine Temperature (Red)	It turns on in case of High Temperature (see 11.4.10). The engine shuts down.		
General Alarms	(1)Yellow indicator: it turns on in case of a warning (Can bus, low battery, etc..). (2) Red indicator: it turns on in case of an Emergency shut down.	Generator Circuit Breaker (Green)	-It turns on when the GCB is closed. -It blinks when the generator provides electrical parameters within the settings. -It turns off when GCB is open or the generator parameters are out of limits.

GENERATOR VOLTAGE IS EXPOSED WITHIN THE BE124 AND ANCILLARY CIRCUITRY EVEN WHEN THE LED INDICATORS ARE TOTALLY OFF

Section 4.00   BE124 MAIN MENU & FUNCTIONS

Push **[ACK]** and push **[←]**; the **Main Menu** takes place on display. Push **[↓]** to scroll down the functions and push **[→]** to enter the function you need. Repeatedly push **[↑]** to point to the top of the **Main Menu**.

Main menu	Section	You can: ...
ENGINE METERING **GENSET METERING** **ALARM MONITORING** **SET DATE & TIME**	5.0 6.0 7.0 8.0	... read information about the engine ... read information about the generator ... read information about active Alarms & Memory Events ... configure the real time clock (set date & time)
DISPLAY-LANGUAGE **USER PARAMETERS** **OEM PARAMETERS** **RESET AND CLEAR**	9.0 10.0 11.0 12.0	... set preferences for the display ... program & modify the User Parameters ... program & modify the OEM Parameters ... clear hour run, various counters, energy meter and others
USER PASSWORD **OEM PASSWORD** **DATA LOGGER** **OSCILLLOSCOPE**	13.0 13.0 14.0 15.0	... insert a User password ... insert a OEM password ... configure & use the data logger ... configure & use the oscilloscope
PUSHBUTTONS TEST **SWITCHES TEST** **SENSORS TEST** **OUTPUTS TEST**	16.0 17.0 18.0 19.0	... you can troubleshoot the pushbuttons ... you can troubleshoot the digital inputs ... you can troubleshoot the analogue inputs ... you can troubleshoot the digital outputs
CANBUS TEST **RS485 TEST**	20.0 20.0	... you can troubleshoot the J1939 port ... you can troubleshoot the RS485 port

Section 5.0 – ENGINE METERING & STATUS (to display it push **[ACK]** at anytime)

AUTO MODE **STARTING** **CRANK 05** **GCB ON BT 11.5V**	The Engine Status Page contains basic information about engine and generator. The display provides messages in real time indicating the count down of the main timers used in the automation of the generator. To browse all pages related to the engine push **[↓]**.		
Example: Start. The display indicates **[STARTING]** and indicates the count down of the **[CRANK]** timer.	**RUNNING** (the engine is running)	**NOT RUNNING** (the engine is not running)	**RUN ON LOAD** (the engine is running on load)
	REST (rest time in between starting attempts)	**STARTING** (Be124 is going to start the engine)	**CRANK** (Be124 is cranking the engine)
	STOPPING (Be124 is stopping the engine)	**COOLING** (the engine runs off-load in order to cool the alternator)	**WARM UP** (the engine runs off-load in order to warm up the engine)
AUTO MODE **RUN ON LOAD** **0:01:50** **GCB ON BT 13.8V**	**IDLE SPEED** (the Be124 runs the engine at idle speed)	**PREGLOW** (the Be124 is driving the Pre-glow before starting)	**PRELUBE** (the Be124 is driving the Pre-lube before starting)
Example: Run on Load. Be124 in AUTO mode, the GCB is closed, battery voltage is 13.8V, engine is running for one minute and fifty seconds.	**REMOTE START** (an external device is requesting the engine to run)	**TEST MODE** (Be124 is in Test mode of operation See 2.4)	**AUTO/MANUAL/OFF MODE** (it indicates the mode of operation)
	GCB: ON or OFF (it indicates if the generator circuit breaker is open or closed)	**SCHEDULER** (the engine runs according to the programmed scheduler timetable as explained in section 10.2)	**BT XX.XV** (it indicates the voltage of the battery)

Push **[ACK]** to open the 'Engine Status' page. Use **[↑]** or **[↓]** to browse the content of the pages.
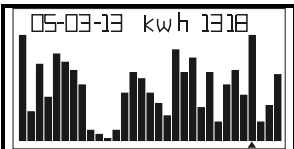
5.01 **SPEED RPM [XXXX]** **OIL BAR [XX.X]** **COOLANT °C [XXX]** **OIL °C [XXX]**	It indicates the most important parameters of the engine: Speed / Oil Pressure and Temperatures. (see note **[*]** on the bottom)	5.08 **TURBO BAR** **SPN102 [XXX]** **EXHAUST °C** **SPN173 [XXX]**	It indicates measurements about data sent by the ECU. You can find additional information in your engine user manual.
5.02 **FUEL LEVEL [XX %]** **PUMP STATUS OFF** **BATTERY (V) [XX.X]** **ALTERNATOR [XX.X]**	It indicates main information about Fuel and voltages of battery and charger alternator.	5.09 **COOLANT %** **SPN111 [XXX]** **COOLANT BAR** **SPN109 [XXXX]**	See above...
5.03 **AUX °C [XXX]** **HOURS RUN [XXXX]** **N° OF STARTS [XXXX]** **RENTAL H [XXXX]**	It indicates misc. information and the remaining hours until the Rental contract expires (see section 10.3).	5.10 **DEMANDE TORQUE** **SPN512 [XX]** **ACTUAL TORQUE** **SPN513 [XX]**	See above...
5.04 **SERVICE 1 [XXXX]** **SERVICE 2 [XXXX]** **SERVICE 3 [XXXX]**	It indicates the remaining hours before the Maintenance timers expire(see section 10.1).	5.11 **CRANKCASE BAR** **SPN101 [XXX]** **BOOST °C** **SPN105 [XXX]**	See above...
5.05 **OIL LEVEL** **SPN98 [XXX]** **WATER IN FUEL** **SPN97 [XXX]**	It indicates measurements about data sent by the ECU. You can find additional information in your engine user manual.	5.12 **INTAKE BAR** **SPN106 [XXX]** **AIR FILTER BAR** **SPN107 [XXX]**	See above...
5.06 **FUEL °C** **SPN174 [XXX]** **FUEL BAR** **SPN94 [XXX]**	See above...	5.13 **LOAD** **SPN92 [XXX]** **ECU ENGINE HOURS** ** [XXXXXXX]**	See above...
5.07 **FUEL RATE** **SPN183 [XX]** **PEDAL %** **SPN91 [XX]**	See above...	**[*] Important notes: if Can bus is connected, the display indicates OIL PRESSURE & COOLANT TEMPERATURE. If Canbus is not available you can connect a sensor (see sections 27.0 & 28.0), but is it mandatory that you set at least a warning limit in order to enable the reading on display. Otherwise, Be124 will hide the measurement (not consistent).**	

NOTE: [XXXX] indicates numerical digits or [- - - -] if measurement is not available or consistent

NOTE: depending on the kind of engine you are using, the Be124 may automatically hide some information.

Section 6.0 - GENSET METERING (INSTRUMENTATION) (to enter this page see 4.0)

Push **[ACK]** to open the 'Engine Status' page. Push **[→]** to enter the genset instumentation pages. Use **[↑]** or **[↓]** to browse the content of the pages. Push **[ACK]** at anytime to open the 'Engine Status' page.

6.01 **L1-L2 (V) [XXX]** **L2-L3 (V) [XXX]** **L3-L1 (V) [XXX]** **FREQUENCY [XX.X]**	It indicates the voltages of the generator Phase to Phase and Frequency.	6.06 **KVAR 1 [XXX]** **KVAR 2 [XXX]** **KVAR 3 [XXX]** **KVAR TOTAL [XXX]**	It indicates the Reactive Power for each Phase. A total Reactive Power measurement is also indicated.
6.02 **L1-N (V) [XXX]** **L2-N (V) [XXX]** **L3-N (V) [XXX]** **SEQUENCE [XXX]**	Voltages of the generator Phase - N and sequence of the phases (CW / CCW). In single phase mode the Be124 indicates [- - - -].	6.07 **PF 1 [XX.X]** **PF 2 [XX.X]** **PF 3 [XX.X]** **PF TOTAL [XX.X]**	It indicates the Power Factor for each Phase. A total Power Factor Measurement is also indicated.
6.03 **CURRENT 1 [XXX]** **CURRENT 2 [XXX]** **CURRENT 3 [XXX]** **EARTH FAULT [XXX]**	It indicates the currents of the generator including the measurement of the current in case of a 'Ground Fault' (a proper C.T. is required (see 11.3.12).	6.08 **TOTAL ENERGY** **[XXXXXXX] KWH** **31 DAYS ENERGY** **[↓] [XXXXXXX] KWH**	It indicates the total KWh amount and the amount of energy of the last 31 days. Push the **[↓]** button to open the 31-day Data Logger page.
6.04 **KVA 1 [XXX]** **KVA 2 [XXX]** **KVA 3 [XXX]** **KVA TOTAL [XXX]**	It indicates the Apparent Power for each Phase. A total Apparent Power Measurement is also provided.	05-03-13 kwh 1318	Push the **[←]** or **[→]** to move the cursor on a particular day. The display will indicate the date and the Total Kwh of the day. Push **[↑]** to exit.
6.05 **KW 1 [XXX]** **KW 2 [XXX]** **KW 3 [XXX]** **KW TOTAL [XXX]**	It indicates the Active Power for each Phase. A total Active Power Measurement is also provided.	6.09 Note: the last line indicates the total Kwh from hour 00:00 until the hour you opened the screen. Be124 updates the log every hour.	You can clear the log by pushing (and hold) the **[ACK]** button for at least 5 seconds (the display will show the instructions)

NOTE: [XXXX] indicates numerical digits or [- - - -] if measurement is not available or consistent

NOTE: depending on the kind of alternator you are using, the Be124 may automatically hide some parameters.

Section 7.0 - ALARM MONITORING & EVENT LOG

This menu can contain up to 9 pages of active alarms tagged with clock and 500 pages of recorded events. A typical alarm page is indicated below (see section 23.0 for the list of all alarms):

Typical alarm page: instructions (to enter this page see section 4.0)	
ALARMS PAGE 1/9 **LOW OIL PRESSURE** **WARNING 0,8 BAR** **DD/MM/YY HH:MM:SS**	Use **[↑]** or **[↓]** to browse the content of the pages. This page opens automatically in case of alarm(s). The alarms are also recorded in the Event History memory. To return, push the **[←]** pushbutton. To open the pages of the Event History simply repeatedly use the **[↓]** pushbutton. Push **[ACK]** at anytime to open the 'Engine Status' page (see 5.0).
EVENT PAGE 1 **LOW OIL PRESSURE** **WARNING 0,8 BAR** **DD/MM/YY HH:MM:SS**	The Be124 records up to 500 events providing date & time information for warnings, shutdowns and other events. Use **[↑]** or **[↓]** to browse the content of the pages. To return push the **[←]** pushbutton. Push **[ACK]** at anytime to exit and open the 'Engine Status' page (main page of the engine).
	Note: to cancel the Event History, use **[CLEAR EVENTS]** (see section 12.0).

Section 8.0 - SET DATE & TIME (REAL TIME CLOCK)

Push **[ACK]** to display the 'EngineStatus' page. Push **[←]** to open the **Main Menu**. Repeatedly push **[↓]** to select
[SET DATE & TIME]. Push **[→]** to open the list of the functions.

Display	Instructions
TIME 00:00:00 DATE 01/01/00 FORMAT DD/MM/YY SAVE [→]	Use [↑] or [↓] to select a function. Push [→] to enter the numerical field. Push [↑] or [↓] to set a value. Push [←] to return. If you want to change the format, choose [**FORMAT**] and push [→]. Select the proper option by using [↑] or [↓]. Push [←] to return to the function. If the option [**DD/MM/YY**] is ok for you push [↓] to proceed. Push [→] to start up the clock of Be124 at the proper moment (use an external clock reference).

Section 9.0 - DISPLAY & LANGUAGE

Push **[ACK]** to display the 'Engine Status' page. Push **[←]** to open the **Main Menu**. Repeatedly push **[↓]** to select
[DISPLAY-LANGUAGE]. Push **[→]** to open the list of the functions.

Display	Instructions
LANGUAGE ENGLISH CONTRAST 7 TIMEOUT 5 min BACKLIGHT 100%	A) - Use **[↑]** or **[↓]** to select a function B) - Push **[→]** to enter the function C) - Push **[↑]** or **[↓]** to choose the proper option or set a numerical value D) - Push **[←]** to exit
Note: **[TIMEOUT]** is the time-out that turns off the backlight of the display once you are no longer using the pushbuttons (range 1-59mins). The setting **[OFF]** will always maintains the backlight active (no time-out). The setting **[BACKLIGHT]** has three possibilities: 0% (no back light), 50% (average level of back light) and 100% (maximum level of back light).	

Section 10.0 - USER PARAMETERS MENU

Use **[↑]** or **[↓]** to select this menu from the Main Menu (section 4.0) and push **[→]** to enter the menu.
The display will present the options **[READ PARAMETERS]** and **[MODIFY PARAMETER]** (access may require password).
The **[USER PARAMETERS]** menu contains the following functions:

Display	Section	Instructions
SERVICE TIMERS TEST SCHEDULER MISCELLANEOUS	10.1 10.2 10.3	Use **[↑]** or **[↓]** to select a function. Push **[→]** to enter the function.

10.1 - SERVICE TIMERS   (to access this menu see section 10.0)

Display	Instructions

MAINTENANCE 1
                OFF
MAINTENANCE 2
                OFF
 	
MAINTENANCE 3
                OFF
 	
(range 0-9999 hours)
	By using this timers you can schedule the engine maintenance (filters oil and so on). Push **[↓]** to choose the MAINTENANCE timer of your interest. To disable a timer set the option [OFF]. The Maintenance timers 1 and 2, once expired, will generate a warning. Maintenance 3 will automatically shutdown the engine. An alarm will be generated to remind you to carry out the maintenance routine.
	
	**Programming:** use **[↑]** or **[↓]** to select a function (example MAINTENANCE 2). Push **[→]** to select the numerical field. Push **[↑]** or **[↓]** to set a value (example 300h). Push **[←]** to return to the function. The timers work only when engine is running. Push **[↑]** to exit and follow the instructions on screen (save.. and so on).
	
	Once a timer is running, the remaining hours count is indicated in the 'Engine Status' page (see 5.04 SERVICE 1-2-3). When a timer expires, you are required to carry out the maintenance routine. To clear the alarm, and to restart the counter, turns the key to 'OFF'. Push & hold the button **[ACK]** for about 5 seconds. The Be124 will restart the timer.

10.2 - AUTOMATIC TEST (SCHEDULER)   (to access this menu see section 10.0)

Display	Description
⠀⠀⠀⠀**START⠀⠀STOP** **MO**⠀⠀- -:- -⠀⠀⠀- -:- - **TU**⠀⠀- -:- -⠀⠀⠀- -:- - **WE**⠀⠀- -:- -⠀⠀⠀- -:- - **TH**⠀⠀- -:- -⠀⠀⠀- -:- - **FR**⠀⠀- -:- -⠀⠀⠀- -:- - **SA**⠀⠀- -:- -⠀⠀⠀- -:- - **SU**⠀⠀- -:- -⠀⠀⠀- -:- - ⠀⠀**- -:- - = HH:MM** ⠀⠀**(Example 08:30)**	**Automatic test setting**. You can set up the time to start / stop automatically the engine on specific days of the week. You are required to set up date and time of the internal clock (see 8.0) before setting up the scheduler. In case Be124 requires a password see section 10.4 Instructions: Use **[↑]** or **[↓]** to select a day of the week. Push **[→]** to enter the START field. Use **[→]**, **[↑]** and **[↓]** to set HH:MM (*). Push **[→]** to enter the STOP field. Use **[→]**, **[↑]** and **[↓]** to set HH:MM (*). Repeatedly push **[←]** to return to the day selection. Do the same in case you want setting up an additional day of the week. Push **[←]** to exit and follow the instructions on screen (save... and so on). Automatic test triggers a start only in **AUTO** mode of operation. The yellow LED 'AUTO' blinks during the Test. By programming the option **[CB TEST CONTROL]** (see 10.3) you can choose to run the engine on load or off-load. (*) HH:MM stands for Hours:Minutes 00:00 up to 23:59

10.3 - MISCELLANEOUS   (to access this menu see section 10.0)

Display	Description
RENTAL CONTRACT OFF **GCB TEST CONTROL OFF** **RUN TIMEOUT OFF** **RS485 NODE 1**	In case Be124 requires a password see section 10.4. Use **[↑]** or **[↓]** to select a function. Push **[→]** to enter the numerical field. Push **[↑]** or **[↓]** to set a value. Push **[←]** to return to the function.

[RENTAL CONTRACT] You can set up to 9999 hours. When the remaining hours drop to less than 48, the **[RENTAL WARNING]** alarm sets off. At zero hours, the engine will shutdown. You are required to re-program the timer. Option **[OFF]** disables the **[RENTAL CONTRACT]** function (section 5.03 to read the hours remaining).

[GCB TEST CONTROL] The option **[ON]** will enable the GCB when TEST mode is active. The option **[OFF]** will allow you to run the engine off-load.

[RUN TIMEOUT] Maximum time allowed for running the engine in case of remote start via MODBUS or SMS (1 min. up to 24 hours). The option **[OFF]** disables the time-out and the engine will run until a stop is required. This function is a sort of protection in case you forget to stop the engine by remote.

[RS485 NODE] It allows you to select the node address on the Modbus network. Factory setting is [1] but you can choose a node in the range 1-127.

Section 11.0 - OEM PARAMETERS & ENGINE TYPE

Use **[↑]** or **[↓]** to select **[OEM PARAMETERS]** from the **Main Menu** (section 4.0). Push **[→]** to enter the menu.

OEM PARAMETERS	see:	Instructions
READ PARAMETERS **MODIFY PARAMETERS** **ENGINE TYPE**	11.1 11.1 11.2	The display will present the options **[READ PARAMETERS]** (to read only), **[MODIFY PARAMETERS]** (read/write) and **[ENGINE TYPE]** (read/write). We recommend that you limit the access by inserting an OEM password (see section 13.0).

11.1 - READ/MODIFY PARAMETERS

Use **[↑]** or **[↓]** to select this menu from the **[OEM PARAMETERS]** (see above). Push **[→]** to enter the menu.

OEM PARAMETERS	see:		OEM PARAMETERS	see:		OEM PARAMETERS	see:
GENERATOR PARAM. **ENGINE PARAM.** **SPEED PARAMETERS** **FUEL PARAMETERS**	11.3 11.4 11.5 11.6		**HOURS-HORN** **INPUTS PARAM.** **OUTPUTS PARAM.** **T SENSOR**	11.7 11.8 11.9 11.10		**FUEL SENSOR** **PRESSURE SENSOR** **RESTORE DEFAULTS**	11.10 11.10 11.11

11.2 - ENGINE TYPE SELECTION

Use **[↑]** or **[↓]** to select this Menu from the **[OEM PARAMETERS]** (section 4.0). Push **[→]** to enter the menu.

Engine type selection	Instructions
[←]EXIT / SAVE / BACK **CONVENTIONAL** **USE [↑] or [↓]** **EXIT** **BACK** **[←]** **SAVE** **[→]**	A)- Use the **[↑]** or **[↓]** to select the type of engine that matches your application. B)- Push the **[←]** to open the page of confirmation. C)- Push the **[←]** to quit or ⊠ to save the configuration (or **[→]** to return to the engine type selection page). D)- After saving, we recommend that you remove the supply for a few seconds. When you reconnect the supply verify the welcome message on the display: it must indicate the type of the engine you programmed before.

Table 11.2 List of engine types (the list is subject to change without prior notice)					
[1]	Conventional	[9]	Perkins '03 '08	[17]	Iveco Vector
[2]	Standard J1939	[10]	Perkins 1100	[18]	MTU
[3]	Volvo EDC3	[11]	Cummins 850	[19]	Kubota
[4]	Volvo EDC4	[12]	Cummins PCC13XX	[20]	Isuzu
[5]	Volvo EMS2	[13]	Deutz EMR2	[21]	Yanmar
[6]	Scania EMS	[14]	Deutz EMR3	[22]	Daimler Crysler
[7]	Scania EMS2	[15]	Detroit Diesel	[23]	Not used
[8]	John Deere	[16]	Iveco Cursor	[24]	Not used

(^) **[CONVENTIONAL]:** the Be124 disables all circuits and software of the Can bus port. You are required to configure properly the analogue and digital inputs in a way to protect the engine. To display Oil Pressure, Coolant Temperature and Fuel Level, you are required to program at least an alarm on the settings (see section 11.4 & 11.6). If you program all alarms to 'OFF', the Be124 will automatically configure the inputs as digital and the display will not indicate a measurement.

11.3 - GENERATOR PARAMETERS

See section 11.0 for setting up the menu. After that, use **[↑]** or **[↓]** to select a parameter. Push **[→]** to enter the numerical field. Push **[↑]** or **[↓]** to set a value. Push **[←]** to return to the parameter list.

Generator Parameters	Notes	Generator Parameters	Notes
11.3.1 ┌─────────────┐ │ UNDER VOLTAGE │ │ 320 VAC │ │ BYPASS DELAY │ │ 6 sec │ └─────────────┘ (limits 60-999V /1-15secs)	These parameters define operating limits for the generator voltage & frequency. If a parameter falls below a limit, the Be124 triggers the alarm and opens the **GCB**. The engine will stop after a cooling down time (see 11.4.6). During **[BYPASS DELAY]** ,Be124 ignores the alarm.	11.3.2 ┌─────────────┐ │ OVER VOLTAGE │ │ 500 VAC │ │ BYPASS DELAY │ │ 6 sec │ └─────────────┘ (limits 60-999V /1-15secs)	These parameters define operating limits for the generator voltage & frequency. If a parameter rises above the limit, the Be124 triggers the alarm and opens the **GCB**. The engine will stop immediately. **[BYPASS DELAY]** allows Be124 to ignore the alarm for a programmable time.
11.3.3 ┌─────────────┐ │ UNDER HZ │ │ 47 Hz │ │ BYPASS DELAY │ │ 6 sec │ └─────────────┘ (20.0-70.0Hz /1-15secs)		11.3.4 ┌─────────────┐ │ OVER HZ │ │ 53 Hz │ │ BYPASS DELAY │ │ 6 sec │ └─────────────┘ (20.0-70.0Hz /1-15secs)	
11.3.5 ┌─────────────┐ │ WARNING CURRENT │ │ OFF │ │ BYPASS DELAY │ │ 6 sec │ └─────────────┘ (limits 1-2000A /1s-15mins)	These parameters define operating limits for the generator current. If the current rises above a limit, the Be124 triggers the alarm and opens the **GCB**. **WARNING CURRENT** provides a prealarm only, but **SHORT CIRCUIT** will shut down the engine after cooling down the generator (see 11.4.6). **[BYPASS DELAY]** allows Be124 to ignore the alarm for a programmable time.	11.3.6 ┌─────────────┐ │ OVER CURRENT │ │ OFF │ │ BYPASS DELAY │ │ 6sec │ └─────────────┘ (limits 1-2000A /1s-15mins)	If the current rises above the limit for over the **[BYPASS DELAY]** time, the Be124 triggers the alarm, opens the **GCB** and stop the engine after cooling the generator.
11.3.7 ┌─────────────┐ │ SHORT CIRCUIT │ │ OFF │ │ BYPASS DELAY │ │ 0.5 sec │ └─────────────┘ (limits 1-2000A /0.0s-15secs)		11.3.8 ┌─────────────┐ │ ALTERNATOR FAIL │ │ OFF │ │ PHASE MODE │ │ 3 PHASE │ └─────────────┘ **[PHASE MODE]** options: **[1]=** single Phase Mode **[3]=** 3Phase Mode **[3+CW]=** 3Ph Clock Wise **[3+CCW]=** 3Ph Counter Clock Wise **If you set CW or CCW the engine will stop in case of wrong phase sequence. The display indicates the sequence (see 6.02)**	**[ALTERNATOR FAIL]** The Be124 shutdowns the engine if Voltage or Frequency is outside of the operating range for over 150 seconds (*). This alarm is enabled only in 'AUTO' mode of operation. In 'MAN' mode, the engine is allowed to run for unlimited time **except in case of Over Frequency or Over Voltage.** (*)The 150 seconds timer starts to count when you start the engine.
11.3.9 ┌─────────────┐ │ KVA SHUTDOWN │ │ OFF │ │ BYPASS DELAY │ │ 30 sec │ └─────────────┘ (limits 10-999kVA 1s / 99mins)	If the power rises above the **[KVA SHUTDOWN]** limit for over the **[BYPASS DELAY]** time, the Be124 opens the contactor and shuts down the engine after cooling the generator (see 11.4.6).		
11.3.10 ┌─────────────┐ │ REVERSE POWER │ │ OFF │ │ BYPASS DELAY │ │ 1 sec │ └─────────────┘ (limits 10-999kW 0.1-15 secs)	If the active power becomes negative and exceeds the limit for over the **[BYPASS DELAY]** time, the Be124 opens the **GCB** and shutdowns the engine after cooling the generator.	11.3.11 ┌─────────────┐ │ PHASE UNBALANCE │ │ OFF │ │ BYPASS DELAY │ │ 15 sec │ └─────────────┘ (limits 60-999V /1-15secs)	If the difference of voltage between phases rises above the setting for over **[BYPASS DELAY]** seconds, the Be124 opens the **GCB** and shutdowns the engine immediately.
11.3.12 ┌─────────────┐ │ EARTH FAULT │ │ OFF │ │ BYPASS DELAY │ │ 1.0 sec │ └─────────────┘ (1-2000A /0.0s-15sec)	Provides Earth Fault Protection. The engine stops immediately. (During **[BYPASS DELAY]**, the Be124 ignores the alarm).	11.3.13 ┌─────────────┐ │ CT SIZE L1 L2 L3 │ │ 500 │ │ CT SIZE EARTH │ │ 50 │ └─────────────┘ (limits 10-2000 / 5A)	It defines the size of the CTs for the phases L1-2-3 of the generator and the size of the CT for earth current monitoring.

11.4 - ENGINE PARAMETERS

See section 11.0 for setting up the menu. After that, use **[↑]** or **[↓]** to select a parameter. Push **[→]** to enter the numerical field. Push **[↑]** or **[↓]** to set a value. Push **[←]** to return to the parameter list.
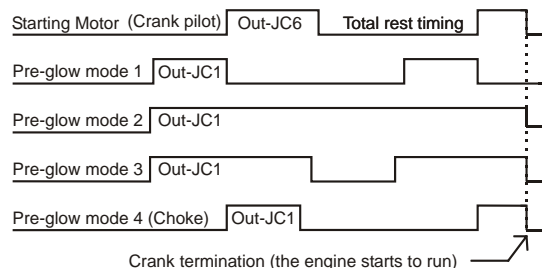
Engine Parameters	Notes	Engine Parameters	Notes

11.4.1
 	
PRE-LUBE
    1 sec
CRANK TIME
    5 sec
 	
(limits 1-15 seconds)
	It energizes the Pre-lube pump (option [14] table 11.9) or simply it could be used to delay the crank if necessary. **CRANK TIME** limits the coupling of the starter motor.	11.4.2
		
		CRANK REST TIME
		    5 sec
		START ATTEMPTS
		    3
		
		(3-15secs /3-15 att.)
			These parameters define the start sequence of the engine: rest time and maximum number of attempts.

11.4.3
 	
CRANK VDC
    8.0 VDC
CRANK VAC
    60 AC
 	
(3-30VDC /60-999VAC)
	The Be124 terminates the crank when voltage of the charger alternator or voltage of the generator rises above the setting. The option **OFF** disable the monitoring.	11.4.4
		
		CRANK HZ
		    25.0 Hz
		CRANK RPM
		    300rpm
		
		(limits 20-70 /100-800)
			The Be124 terminates the crank when frequency of the generator or speed of the engine rises above the setting. The option **OFF** disable the monitoring.

11.4.5
 	
PREGLOW TIME
    OFF
PREGLOW MODE
    1
 	
(1sec-15mins)
	Choose (figure 11.4) the proper working logic for Pre-glow. Option [12] is provided to drive the pre-glow relay by a configurable output as indicated in table 11.9.	11.4.6
		
		WARM UP TIME
		    15 sec
		COOLING TIME
		    15 sec
		
		(limits 0-15mins)
			The Generator Circuit Breaker (GCB) will automatically close after **[WARM UP TIME]**. The Engine will automatically stop after **[COOLING TIME]**.

11.4.7
 	
GAS PURGE
    1 sec
STOP SOLENOID
    2 sec
 	
(1-15sec /1s-15mins)
	[GAS PURGE] allows you the use of gas-fuelled engine (see option [11] on table 11.9).
	
	[STOP SOLENOID]: you are requested to program an output with option [23] (see table 11.9).
		11.4.8
		
		BELT BREAK
		    8.0 VDC
		FAIL TO STOP
		    OFF
		
		(limits 3-30Vdc)
			Setting to detect a belt break condition. The option OFF disable the alarm. **[FAIL TO STOP]:** option ON triggers the alarm in case Be124 fails to stop the engine.

11.4.9
 	
ALARMS BYPASS
    10 sec
HIGH COOLANT SD
    OFF
 	
(2-99 secs / 1-250°C)
	The **[ALARM BYPASS]** timer allows Be124 to ignore the Oil Pressure /Temperature & Configurable Input alarms (see 11.8). **[HIGH COOLANT SD]** The engine stops if temperature rises above the limit.	11.4.10
		
		HIGH COOLANT WRN
		    OFF
		LOW COOLANT WRN
		    OFF
		
		(limits 1-250 °C)
			Engine (coolant) Tempeature. You can set a Low / High limit (source: Canbus or analog input JC6).
			
			note (*)

11.4.11
 	
LOW BAR WARNING
    OFF
LOW BAR SHUTDOWN
    OFF
 	
(limits 0.1-20Bar)
	You can set a Low Oil Pressure warning and/or shutdown. If you use a Pressure Switch, program the parameters to [OFF]. **note (*)**	11.4.12
		
		HIGH OIL °C WRN
		    OFF
		HIGH OIL °C SD
		    OFF
		
		(Limits 1-250 °C)
			Oil Temperature settings. The measurement must be provided by Canbus.

11.4.13
 	
HIGH AUX °C WRN
    OFF
HIGH AUX °C SD
    OFF
 	
(limits 1-250°C)
	You can monitor an Auxiliary Temperature by setting a warning and/or a shutdown. You are required to connect a sensor to terminal JC6 (supposing that is not used for the Coolant Temperature). **note (*)**		**note (*)** the alarm is ignored during **[ALARMS BYPASS]** (see 11.4.9). If you use an ECU, the Be124 will pickup the measurements from Canbus. If a non-ECU engine is used, you can connect a sensor to inputs JC6 & JC7 (see 27.0). If sensor(s) is(are) not available, set thel alarms to [OFF] in a way to enable the digital mode (you can connect a Pressure/Temperature swtich to protect the engine).

Figure 11.4: Pre-glow modes timing diagram

Starting Motor (Crank pilot) | Out-JC6 | Total rest timing

Pre-glow mode 1 | Out-JC1

Pre-glow mode 2 | Out-JC1

Pre-glow mode 3 | Out-JC1

Pre-glow mode 4 (Choke) | Out-JC1

Crank termination (the engine starts to run)

11.5 - SPEED PARAMETERS

See section 11.0 for setting up the menu. After that, use **[↑]** or **[↓]** to select a parameter. Push **[→]** to enter the numerical field. Push **[↑]** or **[↓]** to set a value. Push **[←]** to return to the parameter list.

Speed Parameters	Notes	Speed Parameters	Notes
11.5.1 **UNDERSPEED** OFF **BYPASS DELAY** 6 sec (I100-4000/1-15 sec)	Operating low-limit for the engine speed. This protection in only enabled in 'AUTO' mode of operation. The engine will stop after a cooling down time.	11.5.2 **OVERSPEED** OFF **BYPASS DELAY** 1 sec (100-4000/1-15 sec)	Operating high-limit for the engine speed. This protection works in all modes of operation. The engine will stop immediately.
11.5.3 **DROOP SETTING %** OFF **NUMBER OF POLES** 4 (0.1-10% / 2-4 Poles)	Setting of the 'droop' for parallel applications. Set the **[NUMBER OF POLES]** of the alternator if Pickup or Canbus is not available. It allows you to read the speed of the engine.	11.5.4 **IDLE TIME** OFF **IDLE SPEED** OFF (10-4000 /1-59mins)	In 'AUTO' mode, the engine runs at **[IDLE SPEED]** then, after the **[IDLE TIME]**, it will reach the nominal speed. During **[IDLE TIME]** the Be124 activates an output if with option [16] is used.
11.5.5 **NOMINAL SPEED** 1500 **PICKUP / W RATIO** OFF (100-4000 / 10.0-500)	**NOMINAL SPEED** is a mandatory setting when you connect Be124 to an ECU. If ECU is not available, you can set a **PICKUP / W RATIO** and connect a pick-up or the 'W' terminal of the charger alternator. The 'ratio' has a range of 10.0-99.9 and 100-500. If Canbus, Pickup (or 'W') is not available we recommend that you set the number of poles of the alternator (see 11.5.3). In this way you can read the RPM calculated from the frequency of the generator.		

11.6 - FUEL PARAMETERS

See section 11.0 for setting up the menu. After that, use **[↑]** or **[↓]** to select a parameter. Push **[→]** to enter the numerical field. Push **[↑]** or **[↓]** to set a value. Push **[←]** to return to the parameter list.

Fuel Parameters	Notes	Fuel Parameters	Notes
11.6.1 **TANK EMPTY LEVEL** OFF **TANK EMPTY DELAY** OFF (1-99%/15s-59mins-OFF)	The engine shuts down if the level drops below the **[TANK EMPTY LEVEL]** limit for over the **[TANK EMPTY DELAY]** time. Be124 monitors a sensor or switch connected to input JC-5 (see note 1).	11.6.3 **TANK PUMP START** OFF **TANK PUMP STOP** OFF (limits 1-99%)	Program an output with option [13] (table 11.9) to drive a pump to fill the tank. A delay of 15 seconds for the start and stop of the pump is provided.
11.6.2 **LOW FUEL WARNING** OFF **HIGH FUEL WRN** OFF (limits 1-99%)	Be124 monitors the fuel level providing a warning. By programming at least one limit, you enable the JC-5 to work with a sensor (see note 1) and you will obtain a reading on display.	11.6.4 **TANK FILL TIME** OFF (limits 1-59mins)	The Be124 disables the pump if the **[PUMP TIMEOUT]** time is exceeded. An alarm of timeout is provided also. The pump is disabled when you turn the key to OFF.

(Note 1) If a fuel sensor is not available, you can connect a fuel level switch to Input JC-5 but you have to set the option OFF into **[TANK EMPTY LEVEL]**, **[LOW FUEL WARNING]** & **[HIGH FUEL WRN]**. As option, you can configure one programmable input (JC10-9-8) with option **[10]** (see 11.8).The timer **[TANK EMPTY DELAY]** starts to count when the switch closes the contacts. The engine shuts down when the timer expires. If you set the **[TANK EMPTY DELAY]** into **[OFF]** mode, the Be124 generates only a warning. Be124 is able to monitor simultaneously two Level Switches (one connected to JC-5 and one connected to one of the configurable inputs). The section 23.6 provides additional information about the Fuel Level alarms.

11.7 - HOUR-HORN SETTINGS   (See section 11.0 for setting up the menu)

Hour Counter & Horn Timeout	Notes
HOUR COUNTER SET 0 **HORN TIMEOUT** 20 sec (limits 5sec-59mins)	You can preset the **[HOUR COUNTER]** (up to 65.534h) overwriting the old value. To cancel the counter, put **[0]**. It does not affect the hour run counter provided by **ECU**. See section 5.03 to display the current content of the hour counter of the Be124 and section 5.13 to display the 'Hour Count' set by ECU (if connected). **[HORN TIMEOUT]** In case of alarm, the Horn (output JF-6) will automatically shutdown after a time out. Program the option **[OFF]** in order to disable the timeout; in this case the only way to silence the horn, is via the **[ACK]** pushbutton.

11.8 - CONFIGURABLE DIGITAL INPUTS

See section 11.0 for setting up the menu. After that, use **[↑]** or **[↓]** to select an input. Push **[→]** to enter the numerical field. Push **[↑]** or **[↓]** to set a value. Push **[←]** to return to the input list.

Configurable Input 1 (JC-10)	Configurable Input 2 (JC-9)	Configurable Input 3 (JC-8)

INPUT 1   OPTION
                    1
INPUT 1 CONTACT
                    N.O.
	INPUT 2 OPTION
	                    12
	INPUT 2 CONTACT
	                    N.O.
		INPUT 3 OPTION
		                    13
		INPUT 3 CONTACT
		                    N.O.

For each programmable input you can choose option (see the table 11.8) and the type of the contact: Normally Open or Closed. Normally Open means that it triggers a function when you close the switch. Normally Closed means that it triggers a function when you open the switch. Factory programming is N.O.. You can edit the text of the INPUT 1(2)(3) by using a computer. Factory programming names are INPUT 1, INPUT 2 & INPUT 3.

Table 11.8 -   List of options for CONFIGURABLE DIGITAL INPUTS

Option	Description	Option	Description
[0]	Disables the input. The Be124 will ignore the input.	**[7]**	Remote **LOCK**. It disables the generator and stops the engine. The Be124 indicates the alarm REMOTE LOCK (see 23.2). When you turn off the switch (if a N.O. contact is used), the engine may start automatically and Be124 will automatically clear the alarm.
[1]	Shutdown Input Mode. It stops the engine immediately and the display will indicate SHUTDOWN alarm (see 23.2)	**[8]**	Oil Pressure Switch option (program option N.C. if you use a Pressure Switch that closes the contacts in case of Low Oil Pressure). The Be124 will shut down the engine in case of low oil pressure. (see 23.7). The alarm is ignored during the Alarms Bypass time. This option can be used if the JC-7 input is already used in analog mode (for sensor) and you need extra-protection by using a pressure switch connected on a digital input.
[2]	It shutdowns the engine but the Be124 ignores the input during the Alarms Bypass Timing (See 11.4.9 to program the Alarms Bypass Time). The display will indicate SHUTDOWN alarm (see 23.2)	**[9]**	Coolant Temperature Switch option (program option N.O. if the temperature switch closes the contacts in case of high temperature). The Be124 will shut down the engine (see 23.5). The alarm is ignored during Alarms Bypass time. This option can be used if the JC-6 input is already used in analog mode (for sensor) and you need extra-protection by using a temperature switch connected on a digital input.
[3]	It stops the engine after a Cooling Down time (see 11.4.6). The display will indicate SHUTDOWN alarm (see 23.2).	**[10]**	Fuel Level Switch option (program option N.O. if level switch closes the contacts in case of low fuel). The Be124 will shut down the engine after the TANK EMPTY DELAY time-out (see 11.6.1). In case you set the timer in OFF mode, the Be124 will provide a warning only. Use this option if the JC-5 input is already used in analog mode (for sensor) and you need extra-protection by using a level switch connected on a digital input.
[4]	Be124 ignores the input during the Alarms Bypass and will stop the engine after a Cooling Time. The display will indicate SHUTDOWN alarm (see 23.2)	**[11]**	Idle Speed option (it holds the engine at IDLE speed). If the engine is running at nominal speed, the Be124 will open the GCB and orders the governor to run at IDLE speed. Vice versa. Be124 will run the engine at nominal speed and will close the GCB.
[5]	Warning Input Mode. The display will indicate the INPUT WARNING message (see section 23.2). The engine will continue to run,	**[12]**	Remote Engine Start. Be124 monitors the input only in 'AUTO' mode of operation (see 2.4). If you program option N.O., the engine will start when you connect the input to battery minus. Be124 stops the engine when you open the switch. Program the option N.C. if you want to reverse the logic.
[6]	As above but the Be124 ignores the input during the Alarms Bypass Timing (See 11.4.9).	**[13]**	Remote Genset Start (It starts the engine and enables the GCB). Be124 monitors the input only in AUTO mode of operation (see 2.4). If you program option N.O., the engine will start when you connect the input to battery minus. Be124 opens the GCB and stops the engine when you open the switch. Program the option N.C. if you want to reverse the logic.

11.9 - CONFIGURABLE DIGITAL OUTPUTS

Select this menu from the **[OEM PARAMETERS]** (see section 11.0), by using [↑] or [↓]. Push [→] to enter the menu. Be124 features programmable Output 1& 2. The following table indicates the factory settings.

Configurable Outputs	Note
OUTPUT 1 OPTION **12** **OUTPUT 2 OPTION** **21** (Available options: 1-25)	- Push [→] to enter the option field. - Push [↑] or [↓] to set an option. Push [←] to return to the function. Factory programming is option [12] (=Pre-glow) for Output 1 (terminal JF4) Factory programming is option [21] (=ECU supply mode) for Output 2 (terminal JF3) See all available options on the table 11.9

Table 11.9 - List of the options for the CONFIGURABLE DIGITAL OUTPUTS

Options & description		Options & description	
[0]	The Output is disabled. The Be124 disables the output.	[13]	Pump to fill the tank. You can connect a relay to drive the Fuel Pump. You can find all details for programming in section 11.6.3-4.
[1]	Common Speed & Frequency alarms. It energizes in case of Under/Over Frequency or Speed.	[14]	Prelube. You can connect a pump to prelubricate the engine before starting (see 11.4.1).
[2]	Common generator alarms. It energizes in case of Under/Over Frequency, Speed and in case of any alarm of the generator (Over Current/ Over/Under Voltage etc..).	[15]	Auto Mode Status. It informs an external equipment that Be124 is working in Auto mode of operation. You can connect a relay or an external lamp.
[3]	Common oil pressure alarms. It energizes in case of any alarm related to the engine oil pressure.	[16]	Idle speed control. You can connect this output (via a relay) to a governor in a way to control the Nominal/Idle speed (see 11.5.4).
[4]	Common temperature alarms. It energizes in case of any alarm related to the engine temperature (Oil / Coolant / aux. etc.).	[17]	Maintenance service required. This output energizes when a timer (1-2-3) expires. You have to carry out the maintenence routine (see 10.1).
[5]	Low / High battery voltage. It energizes in case of battery voltage out of limits: 11.5-15.5 (12 V battery) and 23-31V (24 V battery). To trigger the alarm Be124 needs to detect an abnormal condition for at least 2 minutes.	[18]	Presence of nominal generator parameters (voltages/frequency/phase rotation etc..). Used to interface other controllers or a PLC.
[6]	Common fuel alarms. It energizes in case of any fuel level alarm.	[19]	CANBUS Communication Failure. It energizes in case of communication failure.
[7]	Fail to start / Fail to stop. It energizes in case of starting failure or stopping failure.	[20]	**ECU** Enable 1 (Active when Fuel solenoid and Stop are activated). It could be used to supply the ECU.
[8]	Common of all warnings. It energizes in case of any warning.	[21]	**ECU** enable 2 (Active in MAN, AUTO, TEST modes and during the stop solenoid time). It could be used to supply the ECU.
[9]	Common of all shutdowns. It energizes in case any shutdown.	[22]	**ECU** STOP command. To be used in case the ECU requires a hardware command to stop the engine.
[10]	Common of all warnings and shutdowns. It energizes in case of any warning or shutdown.	[23]	Stop Solenoid output (see 11.4.7). Used in case you require an energized to stop solenoid.
[11]	Purge (gas engine valve control). You are required to connect a driver relay for the GAS valve. See section 11.4.7 for programming.	[24]	Not used (for a custom application only).
[12]	Preglow output. You are required to connect a driver realy for preglow. See section 11.4.5 for programming.	[25]	Not used (for a custom application only).

11.10 - CONFIGURABLE SENSORS

By using [↑] or [↓], select the item you need **[T SENSOR...FUEL SENSOR...]** from the **[OEM PARAMETERS]** list (see11.1). Push [→] to enter the item. Use [→] [↑] [↓] to select and modify the parameter you need. Push [←] to return. The following table indicates the factory settings.

Temperature Sensor	Fuel Level Sensor	Oil Pressure Sensor	Notes
POINT 1 DEGREE 128°C POINT 1 OHM 19 OHM	POINT 1 LEVEL 0% POINT 1 OHM 10 OHM	POINT 1 BAR 0.0 BAR POINT 1 OHM 10 OHM	**Temperature Sensor Response Curve** To make the response curve you can edit 6 points for Temperature (0-250°C) and resistance (0-1000 OHM). Factory programming complies with VDO sensor. Temperature Sensor must be connected to JC-6. To enable the sensor mode you are required to program al least one setting of Low or High Coolant temperature (does not matter if warning or shutdown). See section 11.4.9 &10. If you set all temperature alarms to OFF, the Be124 will consider the input JC-6 as digital. In this case you are requested to connect a Temperature Switch to protect the engine (see 27.0 & 28.0).
POINT 2 DEGREE 115°C POINT 2 OHM 26 OHM	POINT 2 LEVEL 0% POINT 2 OHM 10 OHM	POINT 2 BAR 2.0 BAR POINT 2 OHM 51 OHM	
POINT 3 DEGREE 90°C POINT 3 OHM 46 OHM	POINT 3 LEVEL 0% POINT 3 OHM 10 OHM	POINT 3 BAR 4.0 BAR POINT 3 OHM 86 OHM	**Oil Pressure Sensor Response Curve** To make the response curve you can edit 6 points for Pressure (0-250°C) and resistance (0-1000 OHM). Factory programming complies with VDO sensor. Oil Pressure Sensor must be connected to JC-7. To enable the sensor mode you are required to program a setting of Low Oil Pressure alarm (does not matter if warning or shutdown). See section 11.4. If you set all Oil Alarm alarms to OFF, the Be124 will consider the input JC-7 as digital. In this case you are requested to connect a Pressure Switch to protect the engine (see 27.0 & 28.0).
POINT 4 DEGREE 80°C POINT 4 OHM 67 OHM	POINT 4 LEVEL 0% POINT 4 OHM 10 OHM	POINT 4 BAR 6.0 BAR POINT 4 OHM 122 OHM	
POINT 5 DEGREE 70°C POINT 5 OHM 95 OHM	POINT 5 LEVEL 50% POINT 5 OHM 95 OHM	POINT 5 BAR 8.0 BAR POINT 5 OHM 152 OHM	**Fuel Level Sensor Response Curve** To make the response curve you can edit 6 points for Fuel Level (0-99%) and resistance (0-1000 OHM). Factory programming complies with VDO sensor. Fuel Level Sensor must be connected to JC-5. To enable the sensor mode you are required to program a setting of Low or High level fuel (see 11.6). If you set all Level Alarm parameters to OFF, the Be124 will consider the input JC-5 as digital. In this case you are requested to connect a Level Switch to provide a Low Fuel alarm (see 27.0 & 28.0).
POINT 6 DEGREE 40°C POINT 6 OHM 287 OHM	POINT 6 LEVEL 99% POINT 6 OHM 180 OHM	POINT 6 BAR 10.0 BAR POINT 6 OHM 180 OHM	

Important note: Be124 monitors the above sensors into 'analog mode' if you set at least one alarm (see sections 11.4 & 11.6). If program option 'OFF', the Be124 considers the input as general switch input (e.g. digital mode) and display will not provide a measurement.

11.11 - RESTORE DEFAULT

This command allows you to restore the factory settings. Select **[OEM PARAMETERS]** then **[MODIFY PARAMETERS]** menu.
Repeatedly push [↓] until you select the **[RESTORE DEFAULTS]** item. Push **[→]** to enter. Follow the instructions:

Display	Instructions for restoring the factory settings (Defaults)
RESTORE DEFAULTS **HOLD** ✉ **5sec** **[←]** **EXIT** **RESTORE DEFAULTS** **DONE**	A) - Push **[ACK]** pushbutton for at least 5 seconds to restore the factory programming; a count down will appear on display before triggering the operation. B) - You can quit the procedure at anytime by pushing **[←]** (you exit the function). C) - After writing the factory settings, the display confirms the operation via the message **[RESTORE DEFAULTS DONE]**. ***Note: we recommend that you remove the supply for a few seconds. After reconnecting the supply check the parameters; a programming of some parameters may be required according to your generator (see section 22.0).***

Section 12.0 - RESET AND CLEAR

Select the function **[RESET AND CLEAR]** from the **Main Menu** (see section 4.0). Push **[→]** to enter the menu. It
contains the following functions.

Display	Instructions
CLEAR ALL MEMORY **CLEAR ALL EVENTS** **CLEAR KWH COUNT** **CLEAR NR STARTS** **CLEAR ....** **HOLD ACK 5 sec** **[←]** ✉ **EXIT ACK**	A) - Choose the function you need by using **[↑]** or **[↓]** and push **[→]** to enter; the screen that indicates the available options will appear. B) - Push and hold the **[ACK]** button for 5 seconds to trigger the function. You can interrupt the operation at anytime before expiring the 5 seconds timer (push **[←]** to quit). C) - After clearing, the display confirms the operation with a message (example **[CLEAR EVENTS DONE]**. *Description of the functions* **CLEAR ALL MEMORY:** it cancels the all Memory and restore the factory settings. **CLEAR EVENTS:** it cancels only the memory of the Events. **CLEAR ENERGY:** it clears the Energy Counter only. **CLEAR NR STARTS:** it clears the counter of the number of starts.
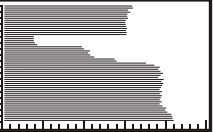
Section 13.0 -   USER & OEM PASSWORD

To access this menu turn the key to 'OFF' then push **[←]** until **[ENGINE & FUEL]** appears on the top of the display (Main Menu). Repeatedly push **[↓]** to select **[USER PASSWORD]** (or **[OEM PASSWORD]**). Push **[→]** to enter the Menu.

Display	Instructions
PASSWORD CLEAR PASSWORD	The display will present the option **[PASSWORD]** (to insert a new password) and **[CLEAR PASSWORD]** (to cancel a previous password)**.** Use **[↑]** or **[↓]** to select a function and push [→] to enter the function. Insert a password a) Use **[↑]** and **[↓]** to choose a number in between 0 to 9 on the first digit (left). b) Push **[→]** to move right to the second digit from the left. c) Repeat step a) and step b) until you program the all 4 digits. d) Password [0000] is not allowed. Push **[→]** to confirm the password. e) By now on, programming will be password protected. Note that using the OEM password you are authorized to access the USER parameters bypassing the USER password. Remove (clear) a password a) To clear a password you are required to type the password first. b) The display indicates the available options: EXIT (**[←]**) or CLEAR (**[ACK]**) c) Push and hold the **[ACK]** button continuously for at least 5 seconds. d) The display will indicate the message **[CLEAR PASSWORD DONE]**. e) By now on, you will no longer need a password to program the Be124.
INSERT PASSWORD BACK 0 * * * OK [←] [→]	
CLEAR PASSWORD HOLD ✉ 5 sec [←] EXIT	

Section 14.0 - DATA LOGGER

Push **[ACK]** to display the Engine Status Page. Push **[←]** to open the **Main Menu**. Repeatedly push **[↓]** to select **[DATA LOGGER]**. Push **[→]** to display the list of the **[DATA LOGGER]** functions.

| Display	Instructions

FUNCTION TO LOG
          BATTERY V
SAMPLING RATE
                  200ms
	A) - Push **[→]** to enter the **[FUNCTION TO LOG]** option field (default is **BATTERY V**) .
	
	B) - Use **[↑]** and **[↓]** to choose a measurement from the list (Battery V, Charger Alternator V, Speed RPM, Fuel %, Auxiliary °C, Coolant °C, Oil Bar, Frequency, Power KVA, VL1, C1 etc...). Once selected, push **[←]** to confirm.

LOW LIMIT
             6.0VDC
HIGH LIMIT
             16.0VDC
	C) - Push **[↓]** to select the **[SAMPLING RATE]**. Use **[↑]** and **[↓]** to choose 200ms, 500ms, 1s ....1h...or day. Push **[←]** to confirm. The Be124 will draw a line according to the Sampling Rate. Use option **[AUTO]** to enables the Transient Recorder Mode (Be124 will automatically set the Sampling Rate and will synchronize the Data Logger with the start of the engine).

MIN 7⁴ **VDC** 14⁴ The display provides Min./Max. & Avg measurements. The last recorded value before stopping the logger is indicated on the bottom.	**D)** - Push **[↓]** to set the **LOW LIMIT** of the scale and push **[→]** to enter. Use **[↑]** and **[↓]** to change the value. When you choose a measurement, the Be124 uses a factory setting (6.0 V) but you can change the limit at anytime. For example, if you use a 24V battery, Be124 will automatically set the lower limit to 12V. You can set the limit to 18.0V. Push **[←]** to confirm the setting (see example on the right side). **E)** - Push **[↓]** to select the **HIGH LIMIT** of the scale and push **[→]** to enter. Use **[↑]** and **[↓]** to change the high limit. When you choose a measurement, the Be124 uses a factory setting (16.0 V) but you can change the limit at anytime. If you use a 24V battery, Be124 will set the upper limit to 30V but you can set the upper limit to 32V. Push **[←]** to confirm the setting. **F) -** Finally push **[↓]** to open the data logger page. The data logger can draw 60 lines. On the left you see an example of battery monitoring during crank.

Functions of the pushbuttons.

[↓]: use it to start and stop the data logger. When you push stop, the Be124 stores the data into memory (*)

[→]: push and hold it for at least 5 seconds to cancel the screen; a prompt will warn you about this operation.

[↑]: push it to return back to data logger settings; you can change the settings at anytime (rate, scale, etc.).

[ACK]: push it to display the Engine Status Page (see 5.0) and exit. The data logger will continue to run in background.

(*): this pushbutton is ignored when using the Transient Recorder Mode (Sampling Rate = Auto)

Example of Auxiliary Temperature logging

 (Sampling rate 1min / Limits 20°C - 70°)

The display prints a line every minute. The screen can record the variation of the temperature of one hour (60 lines = 1 h). The data logger works in background even if you exit the screen. The display toggles, with a rate of about one second, the indications of the MIN (minimum), MAX (maximum) and AVG (average) recorded temperatures. The data logger is free running and, on the bottom, appears a new line every minute with the indication of latest temperature sample. If you set the sampling rate to one day, the Be124 draws a line every 24 hours. You will record the temperature for a total of 60 days.

MIN
MAX **MAX** **58** **°C** **45**
AVG
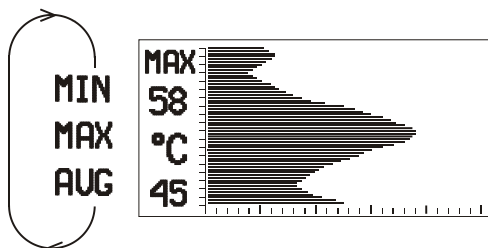
Example of Speed Transient Recorder

 (Sampling: AUTO / Limits: 1100 RPM - 1600 RPM)

The display prints a line every 200ms for a total record of about 12 seconds . The data logger starts when engine starts to run. The data logger stops automatically after drawing about 50 lines. In this way you can capture the variation of the speed after starting the engine. The display indicates the MIN (minimum), MAX (maximum) speed and the latest recorded measurement.

MAX **MAX** **1575**
↓ **RPM**
MIN **1500**
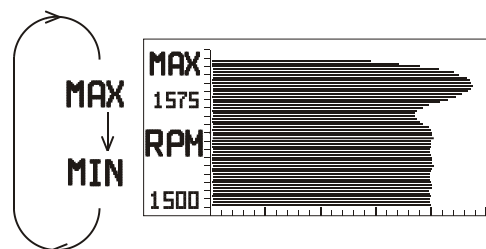
Note In case you analyze the battery voltage or charger alternator voltage, the data logger will start recording when you start the engine and will stop as soon as engine is running. In this way you can observe voltage variations during crank.

Section 15.0 - OSCILLOSCOPE

Push **[ACK]** to display the 'Engine Status' page. Push **[←]** to open the **Main Menu**: **[ENGINE & FUEL]** will appear on the top of the display. Repeatedly push **[↓]** to select **[OSCILLOSCOPE]**. Push **[→]** to activate the oscilloscope.

Oscilloscope Instructions
Push **[↓]** or **[↑]** to select AUTO, POSITIVE or NEGATIVE mode.   Push **[→]** or **[←]** to select a measurement (VL1-N, C1, VL2-N, C2, VL3-N, C3 or Earth Current)   Repeatedly push **[←]** to return to the Main Menu.   Push **[ACK]** to exit and open the 'Engine Status' page.

The oscilloscope embedded into Be124 is able to analyze the waveform of the voltages and currents. True RMS voltages, currents and frequency measurements are indicated on the top of the display also.

The BE124, by means of software, provides automatic setup in a way to optimize the display of the waveform (auto trigger, auto range etc.).

In case you want to see details about the peaks of the waveforms, you can use the buttons **[↓][↑]** to display the positive peaks or negative peaks (POS= positive and NEG=negative). The Be124 will optimize the resolution automatically.

When you start the oscilloscope, internal setting is 'AUTO' (both positive and negative on the same screen). But you can change the display mode at anytime.

On the right side you see examples of display for voltage VL1 to Neutral.
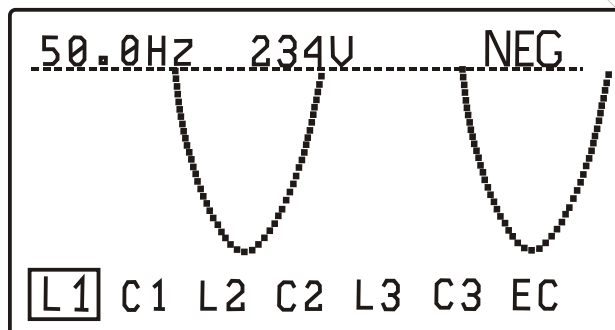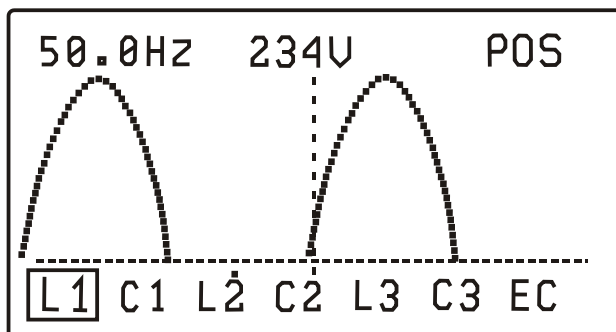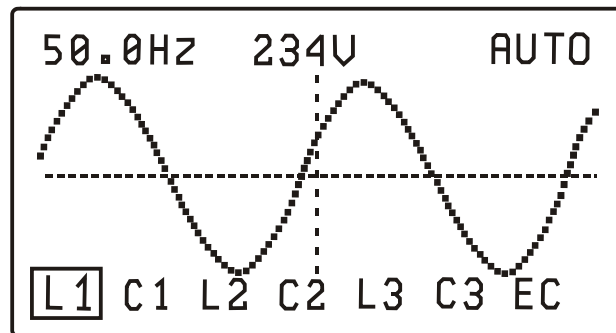
Section 16.0 - PUSHBUTTONS TEST

This procedure should be carried out by qualified personnel only; engine may start.

Display	Instructions (to enter this menu, read the procedure on the top of section 4.0)
PUSHBUTTONS TEST KEY OFF (START) GCB OFF (ACK) AUTO OFF [↓][↑][→] By pushing a button you will only trigger a message on the display. You will only test the push buttons.	Turn the key to 'OFF'. This function allows you to test the pushbuttons on the front panel. a) Push the **[GCB]** button; the display should indicate the message **[GCB ON]**. b) Push the **[AUTO]** button; the display should indicate the message **[AUTO ON]**. c) Push the **[ACK]** button; the display should indicate the message (**[ACK]**). d) Turn the key to 'ON'; the display should indicate the message **[KEY ON]**. e) Turn the key to START'; the display should indicate the message (**[START]**). f) Push one the **[↓][↑][→]** pushbuttons; the display should indicate the proper message. Push the **[←]** button at anytime to exit the test. If a button fails to provide you a feedback, the controller is damaged and should be returned for repair to Bernini Design.

Section 17.0 -   SWITCHES TEST (DIGITAL INPUTS TEST)

Display	Instructions (to enter this menu, read the procedure on the top of section 4.0)
SWITCHES TEST JC10 IN.1 OPEN JC9 IN.2 OPEN JC8 IN.3 OPEN . SWITCHES TEST JC7 OIL OPEN JC6 °C OPEN JC5 FUEL OPEN	Turn the key to 'OFF'. This function allows you to test all configurable digital inputs. a) Connect to battery minus the terminal JC-10: the display indicates the message **[CLOSED]**. b) Connect to battery minus the terminal JC-9: the display indicates the message **[CLOSED]**. c) Connect to battery minus the terminal JC-8: the display indicates the message **[CLOSED]**. d) Proceed in the same way to test the rest of the inputs (supposing configured as digital). e) Push the **[←]** button at anytime to exit the test. You can run this test on field and the display will indicate the status of the inputs. There is the possibility, in case inputs are connected, that you find a message **[CLOSED]** on one or more inputs.

Section 18.0 - SENSORS TEST (ANALOG INPUTS)

Display	Instructions (to enter this menu, read the procedure on the top of section 4.0)
SENSORS TEST JC7 OIL 2500 ohm JC6 °C 2500 ohm JC5 FUEL 2500 ohm Note: 2500 ohm is the indication provided on 'Open Input' condition (e.g. full scale).	Turn the key to 'OFF'. This function allows you to test the analog inputs. We recommend that you use a resistor of a known value in the range 100 - 500 OHM (+/-1%). It is mandatory that you connect JC-4 (ground compensation) to the battery minus. a) Connect the resistor to battery minus and terminal JC-7 (Oil Pressure analog input). b) Connect the resistor to battery minus and terminal JC-6 (Oil Temperature analog input). c) Connect the resistor to battery minus and terminal JC-5 (Fuel Level analog input). Each time you connect the resistor, the display should indicate a proper value (+/-3%). If Be124 fails to indicate the expected value, you have to return the Be124 to Bernini Design for service. By running this test on field you can read the value in OHM of the sensors that are connected to the Be124. If you fail to connect the ground compensation the Be124 will indicate a warning message.

Section 19.0 - OUTPUTS TEST (DIGITAL OUTPUTS)

This procedure should be carried out by qualified personnel only; engine may start.

Display	Instructions (to enter this menu, read the procedure on the top of section 4.0)
OUTPUTS TEST [↓] JF4 OUT1 (§) [→] OFF JF3 OUT2 (§) OFF JF8 FUEL (*) OFF	Turn the key to 'OFF'. To test the digital outputs you can use a 2-3W lamp or the relays already connected to the Be124. a) Connect the lamp to battery minus and terminal JF4. Push the **[↓]** button to select **[JF4 OUT1]**. When the cursor points to the message **[OFF]** push the **[→]** button; the message turns to **[ON]** and the lamp should light. (see next page) **(*)** (see next page)

OUTPUT TEST [↓] **JF7 START (*) OFF** **JF5 GCB (*) OFF** **JF6 HORN (*) OFF**	(see instuctions on the previous page) b) Push the **[↓]** button for selecting an other output. Use the same procedure described above. Connect the lamp to the proper terminal to carry out a test. c) Push the **[←]** button at anytime to exit the test. If an output fails to work, you have to return the Be124 to Bernini Design for service. **(*) NOTE!!! TO ACTIVATE THIS OUTPUT TURN THE KEY SWITCH TO ON. (§)** Depending on settings, you may find OUT1 (or 2) already turned on (see table 11.9).

Section 20.0 - SAE1939 TEST & RS485 TEST

CANBUS TEST	**Instructions** (to enter this menu, read the procedure on the top of section 4.0)
CANBUS TEST **[ENGINE TYPE]** **DISCONNECTED** **CANBUS TEST** **STANDARD J1939** **CONNECTED** **RX TX**	This function allows you to test the Can bus communication port JD1-2-3-4. We recommend that you connect a compatible ECU SAE J1939 ECU according to the engine manufacturer engine wiring diagram. You are required to program an Engine Type that matches your engine (see instructions on section 11.2). Once the communication is running, the display should indicate the type of engine you programmed (in the example on the right **[STANDARD J1939]**) and the status of the connection including the blinking messages **[TX] [RX]**. If, despite all your efforts in making the connection, the test fails to work, you have to return the Be124 to Bernini Design for service.
RS485 TEST	**Instructions** (to enter this menu, read the procedure on the top of section 4.0)
RS485 TEST **CLIENT N.** **DISCONNECTED** **RS485 TEST** **CLIENT N. 1** **CONNECTED** **RX TX**	This function allows you to test the MODBUS communication via the RS485 port JB1-2-3-4. We recommend that you connect a computer using the Bernini Design USB/RS485 converter. You are required to run a software for Modbus communication (you can find demo versions on internet). Basic settings are: Baud rate=9600 / Node=1 / No parity / Data Bits= 8 / Stop bit=1 / TX mode= RTU / Flow control=none / silent interval=4 character. You are required to read the input register with address 30039 (Battery Voltage). The display should indicate the node address (Client nr.) and the blinking messages RX/TX. If If the test fails to work, you have to return the Be124 to Bernini Design for service.

Section 21.0 - READING OEM/USER PARAMETERS

Turn the key to 'OFF'. Repeatedly push **[←]** until the message **[ENGINE & FUEL]** appears on the top of the display. Repeatedly push **[↓]** to select the function **[USER PARAMETERS]** or **[OEM PARAMETERS]**. Push **[→]**; the following screen will appear (the following example shows **[OEM PARAMETERS]**)
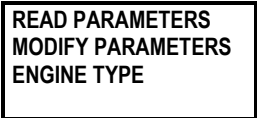
Example: OEM parameters	Instructions
READ PARAMETERS **MODIFY PARAMETERS** **ENGINE TYPE**	A) - Push **[→]** to enter directly the read mode. B) - The list of the parameters or sub-menus will appear. C) - Choose an item by using **[↑]** or **[↓]**. D) - Push **[→]** to read details about the item. E) - Repeatedly push **[←]** to return or exit.

Section 22.0 - PROGRAMMING OEM/USER PARAMETERS

We recommend that you use a computer for programming the controller. Be124 however, allows programming using the push buttons on the front panel as indicated below.

22.1   Preliminary operation

Turn the key to 'OFF'. Repeatedly push **[←]** until the message **[ENGINE & FUEL]** appears on the top of the display. Repeatedly push **[↓]** to select the function [**USER PARAMETERS**] or [**OEM PARAMETERS**]. Push **[→]**; the following screen will appear (the following example refers to the [**OEM PARAMETERS**])

Display	Instructions
READ PARAMETERS MODIFY PARAMETERS ENGINE TYPE	A) - Push **[↓]** to select the item **[MODIFY PARAMETERS]** B) - Push **[→]** to enter the programming or push **[↓]** and then **[→]** if you want to modify the type of engine (section 11.2) **See section 10.0 if you are looking for User Parameters list or section 11.0 if you are looking for OEM Parameters list.**

22.2 Type the Password

If a password was inserted, the Be124 will present a screen to ask for password as indicated below, otherwise follow directly the instructions on section 22.3.

Display Indication	How to insert a password
INSERT PASSWORD BACK 0 * * * OK [←] [→]	**A) -** Use [←] or [→] to select a digit of the password. **B) -** Push [↑] or [↓] to edit a number (0-9). **C) -** Repeat steps A) and B) in order to edit the 4-digit password. **D) -** Select OK using the [→] button (the [OK] backlights when selected). **E) -** Push the [→] button to confirm the password.

22.3   Select a parameter

Choose the MENU of your interest by using the **[↑]** or **[↓]** pushbuttons and then push **[→]** ; the list of the parameters will appear.

22.4   Programming a parameter (general guide)

- Select a parameter by using the **[↑]** or **[↓]** pushbuttons.
- Push the **[→]** button to enter the numerical or option field of the parameter.
- Modify the parameter value or modify the option by using the **[↑]** or **[↓]** pushbutton.
- Exit the numerical/option field using the **[←]** pushbutton (return to the parameter list).
- You can modify another parameter by repeating the previous steps
- Repeatedly push the **[←]** pushbutton; the Be124 will present you 3 possibilities:

EXIT [←]   **SAVE**   **BACK [→]**

Choose the option you need. After saving, we recommend that you disconnect the supply for a few seconds, re-apply the supply and verify that the modifications have been saved in a way that Be124 operates according to your needs.

Section 23.0 - ALARMS: WARNINGS & SHUTDOWNS

The Be124 features:

A) - A yellow LED that turns on in case of a warning and a red LED that turns on in case of a shutdown.
B) - Symbols and LEDs, indicating the alarms for Low Fuel, Low Oil Pressure and High Temperature.
C) - A horn output **(°)** and two configurable outputs for remote repetition of alarms.
D) - Descriptive messages for alarms with date, time and measurement information.
E) - Event History Memory capable of recording 500 alarms and events (see section 7.0).
F) - An **[ACK]** pushbutton to silence the Horn.

(°) The terminal JF-6 drivers a horn via a relay. To silence the horn, push the **[ACK]** pushbutton or wait for the **[HORN TIMEOUT]** to expire (see section 11.7). If the **[HORN TIMEOUT]** is set to **[OFF]**, the only way to silence the horn is by using the **[ACK]** pushbutton (in other words, no time-out).

Instructions in case of alarm(s):

1) Look at the front panel and take note of LED indicators and messages on display.
2) Some alarms, in order to cool down the engine, shutdown the engine after a programmable delay. We recommend that you wait the complete stop of the engine.
3) Push the **[ACK]** pushbutton to silence the horn. Turn the key to 'OFF' to cancel the alarm.
4) Consult the following sections for further information.
5) Remove the cause of the alarm and restart the engine if necessary.

The list of the alarms is indicated below on the left side. Additional information are provided on the right side. Shutdowns are latching alarms and stop the engine; warnings are pre-alarms and allow the engine to run.

23.1 - Clock and periodic test alarms		Section
CLOCK ERROR WARNING	Real time clock failure or wrong programming	8.0
PARAMETER ERROR	Error in a parameter	**This is a fatal error. Consult Bernini Design for support**
MEMORY ERROR	Failure of the memory	
CAN BUS ERROR WARNING	Failure of the Canbus communication	

23.2 - Emergency Input alarms & warnings		Section
INPUT 1 WARNING **INPUT 1 SHUTDOWN**	Input 1 Warning or Shutdown (input JC-10). You can edit the text 'INPUT1' by using a computer (max. 9 characters A-Z & 0-9).	
INPUT 2 WARNING **INPUT 2 SHUTDOWN**	Input 2 Warning or Shutdown (input JC-9). You can edit the text 'INPUT2' by using a computer (max. 9 characters A-Z & 0-9).	11.8
INPUT 3 WARNING **INPUT 3 SHUTDOWN**	Input 3 Warning or Shutdown (input JC-8). You can edit the text 'INPUT3' by using a computer (max. 9 characters A-Z & 0-9).	
REMOTE LOCK	An input programmed with option [7] is active. The Be124 shuts down the engine if running. When you disable the input, the alarm resets automatically and Be124 will operate normally.	11.8 [7]

23.3 - Miscellaneous engine alarms		Section
SPEED ERROR SHUTDOWN	Failure in detecting the signal from Pickup or 'W'	11.5
OVER SPEED SHUTDOWN	Over Speed shutdown	
UNDER SPEED SHUTDOWN	Under Speed shutdown	
LOW BATTERY WARNING **HIGH BATTERY WARNING**	Battery Voltage Limits: 11,8V/15,5V (12V battery) and 23,6V/31V (24V battery). A bypass delay of 2 minutes is provided. In case of warning, check connections or status of the battery plant.	28.0 27.0
FAIL TO START SHUTDOWN	Fail to start shutdown	**High Severity Alarm: check the charger alternator or the settings for the engine running conditions. See section 24.0**
FAIL TO STOP SHUTDOWN	Fail to stop shutdown	
BELT BREAK SHUTDOWN	Engine Belt break (or Charger failure) shutdown. You can disable the alarm by setting the option OFF into BELT BREAK parameter.	11.4.8

23.4 - Alternator alarms		Section	
UNDER VOLTAGE SHUTDOWN	The voltage of one or more phases has risen/fallen the pre-set limit.	11.3.1	**These could be high severity or critical Alarms. The Be124 opens the Generator Circuit Breaker (GCB) in a way to protect the generator itself.** **Under voltage / Under frequency may be symptoms of overload. The engine will shut down after a cooling down time.** **The Be124 provides a shutdown to protect the load and the generator. Check the settings of the parameters and set properly the bypass timing of each alarm.**
OVER VOLTAGE SHUTDOWN		11.3.2	
UNDER FREQUENCY SHUTDOWN	The frequency has risen/fallen the pre-set limit.	11.3.3	
OVER FREQUENCY SHUTDOWN		11.3.4	
OVER KVA SHUTDOWN	The power has exceeded the pre-set limit.	11.3.9	
OVER CURRENT WARNING	The current has exceeded the pre-set limit. The Be124 provides a warning and then, if the current rises above certain limit, will open the GCB and shuts down the engine after a cooling down time.	11.3.5	
OVER CURRENT SHUTDOWN		11.3.6	
SHORT CIRCUIT SHUTDOWN		11.3.7	
EARTH CURRENT SHUTDOWN		11.3.12	
ALTERNATOR FAILURE	The alternator has failed to provide the electrical parameters within the programmed settings. In case of doubts verify the settings.	11.3.8	**These are High Severity and Critical Alarms. The Be124 opens the Generator Circuit Breaker in a way to protect the load and stops the engine immediately.**
REVERSE POWER SHUTDOWN		11.3.10	
PHASE SEQUENCE SHUTDOWN		11.3.8	
PHASE UMBALANCE SHUTDOWN		11.3.11	

23.5 - Temperature alarms		Section
LOW COOLANT °C WARNING **HIGH COOLANT °C WARNING** **HIGH COOLANT °C SHUTDOWN**	You can set a Low/High limit. The alarms are ignored during Alarms-Bypass timing (see 11.4.9). Coolant temperature information is provided by CAN bus or by a sensor connected to input JC-6. Settings for alarms are indicated in section 11.4.9 &10. If you use JC-6 to monitor the **COOLANT TEMPERATURE**, do not set any **AUXILIARY TEMPERATURE** alarm (this will avoid conflicts).	11.4.9 11.4.10 27.0
TEMPERATURE SW SHUTDOWN	'SW' stands for Temperature Switch (input JC-6 or one of the digital Input 1-2-3 configured with option [9]). To make the JC-6 working in digital mode (for switch) simply set LOW/HIGH temperature alarm settings to OFF.	
OIL TEMPERATURE WARNING **OIL TEMPERATURE SHUTDOWN**	Abnormal Temperature of the Oil; Warning or / and Shutdown. Oil temperature information is provided by the CAN bus only.	11.4.12 11.4.13 11.8
AUX °C SENSOR WARNING **AUX °C SENSOR SHUTDOWN**	Auxiliary Temperature: you can set Warning /Shutdown as indicated in section 11.4.13. You are required to connect a sensor to input JC-6. In this case you are no longer allowed to use JC-6 for **COOLANT TEMPERATURE** (it must be provided by CAN bus or a temperature switch connected to a general purpose digital input).	
AUX °C SENDER OPEN	It indicates the failure of the temperature sensor connected to JC-6 (resistance over 2100 Ohm)	27.0
GND COMPENSATION	It indicates the failure of the connection of the terminal JC-4. The reading of temperature may be not accurate.	

23.6 - Fuel Level alarms		Section
LOW FUEL LEVEL WARNING	The Be124 monitors the level of the fuel in the tank. You can set warnings about level limits. Be124 shuts down the engine if the level drops (level sensor) below the limit for more than the programmed time. To enable the analog mode for input JC-5 you are required to set at least a Low or High level limit (see section 11.6)	11.6
HIGH FUEL LEVEL WARNING		
TANK EMPTY SHUTDOWN		
FUEL RESERVE WARNING	This warning energizes during the TANK EMPTY DELAY. It indicates that fuel is going to finish.	27.0
PUMP TIMEOUT WARNING	This warning energizes if the PUMP to fill the tank remains activated for more than the programmed time.	28.0
FUEL SENDER OPEN	Failure of the Fuel Sensor (input JC-5). The Be124 detects a resistance over 2100 OHM (e.g. open circuit).	
GND COMPENSATION	Indicates the failure of the connection of the terminal JC-4. The reading of level fuel may be not accurate.	

23.7 - Oil Pressure alarms		Section
LOW OIL PRESSURE WARNING	These alarms are ignored during **ALARMS BYPASS** timing (see 11.4.9). Oil Pressure information is provided via CAN bus or by a sensor connected to input JC-7. Settings for alarms are indicated in section 11.4.11. If you do not set an alarm, the Be124 will consider the input JC-7 as digital input. You are required to connect a Pressure Switch that closes the contacts when oil pressure is low.	11.4.11 11.4.9
LOW OIL PRESSURE SHUTDOWN		
OIL BAR SENDER OPEN	Failure of the Oil Pressure Sensor (JC-7 input). The Be124 detects a resistance over 2100 Ohm when the input is configured as 'analog sensor'.	
GND COMPENSATION	Indicates the failure of the connection of the terminal JC-4. The reading of the Oil Pressure may be not accurate.	27.0

23.8 - Maintenance and Rental contract alarms		Section
SERVICE 1 WARNING	Maintenance 1 & 2 provide a warning after timeout. Service 3 provides a shutdown after timeout. To cancel the alarm, turn the key to 'OFF' and push **[ACK]** for at least 5 seconds.	10.1
SERVICE 2 WARNING		
SERVICE 3 SHUTDOWN		
RENTAL 48h WARNING	Less than 48 hours remaining before engine shutdown.	10.3
RENTAL EXPIRED SHUTDOWN	Rental period termination. To cancel the alarm, reprogram the RENTAL or simply enter & exit the **[TEST & RENTAL]** program menu to restart the previous setting of the counter.	
MAXIMUM RUNTIME SHUTDOWN	Time expired. This timer allows the engine to run a limited number of hours in case of test launched by a remote computer or SMS (mobile phone). In case of alarm, verify the general status of the engine, cancel the alarm and restart the engine.	

Section 24.0 - DETECT ENGINE RUNNING

   The Be124 terminates the crank when the engine starts running. When the engine is not running, the voltage of the D+/W.L. connection on the charger alternator is 0V. When the engine starts running, the voltage of the D+/WL increases (Be124 delivers a current into D+/WL to help exciting the alternator). The point to terminate the crank is in between 6V to 10V. The default parameter of **[CRANK VDC]** (section 11.4.3) is 8.0V. For 24V batteries, we recommend that you set the threshold to 16V. The Be124 monitors the generator parameters providing additional safeties in terminating the crank. See the **[CRANK VAC]** and **[CRANK HZ]** parameters in sections 11.4.3 /11.4.4. In case you use a pick-up or 'W' you can terminate the crank by setting up the parameter **[CRANK RPM]** (see 11.4.4).

 For a safe start we recommend that you carry out this simple test.

- Disconnect the fuel in a way that engine can not start. Turn the key to 'START' and hold it.
- Push twice the [↓] button and read on the display the Charger Alternator voltage (see 5.02). The voltage should be lower than **[CRANK VDC]** setting. Make sure that Be124 does not terminate the crank. Do not hold, anyway, the key into 'START' for more than 20 seconds. Turn the key to 'OFF'.
- Reconnect the fuel, and start the engine in MAN mode. You have to obtain the message ENGINE RUNNING on display.
- Push twice the [↓] button and read on the display the Charger Alternator voltage (see 5.02). The voltage measurement should be a little bit over the battery voltage measurement (the indication of battery voltage is in the same display screen).

Section 25.0 - GENERAL SPECIFICATIONS

Supply Voltage: 5.5Vdc to 36Vdc, 10-150mA. **Protection:** internal 300mA thermal fuse.

Dimensions: 96mm X 96mm X 87,5mm. **Panel Cut-out:** 91mm X 91mm, indoor operation

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

Weight: 550 grams. **General design:** ECC 89/336, 89/392, 73/23, 93/68, IEC 68-2-6. **Certification:** CE

Static Outputs Characteristics: positive logic with 300mA output current (Vbatt -0,7Vdc), short circuit proof.

Generator Sensing: nominal voltage input 70 Vac up to 600Vac (any phase). Over voltage: 4KVac phase - phase. Measurement precision: +/- 1% F.S.. Input impedance: 2 MOhm. Resolution: 1Vac. Frequency resolution 0,1HZ (25-99Hz)

Current Sensing: 5/5Aac up to 2000/5aac. Maximum permanent current on the Be124 AC inputs: 7Aac. Measurement precision: +/- 2%. Internal resistance: 0.05 Ohm. Resolution 0,1Aac (<100/5), 1Aac (>100/5).

Digital Inputs: open circuit voltage of about 4,5V - Trigger level: < 2Vdc (max 5mA). Maximum Overvoltage +/-100V 1 s. Permanent short circuit to Bt+ and Bt- allowed for unlimited time.

Sensor Inputs: resistance range 0 up to 1000Ohm. Current at zero Ohm: 5mA. Overvoltage +/-100V 1 s. Accuracy: 2%

Charger Alternator Monitoring: operating voltage up to 36Vdc/3W. Vdc reading accuracy +/- 2%.

Magnetic Pickup Input: 0,5V-50VRMS, 10-15KHz. RPM reading accuracy +/- 1%. Teeth Count: 10.0/99,9 and 100-500.

CAN Port: fully isolated. 250Kb/second. Internal 120 Ohm impedance available for connection. Supports SAE1939 protocol.

RS485 Port: support Modbus Protocol and drives 1000 Metres twisted cable, ESD 2KV & drives up to 128 nodes.

Section 26.0 - SOFTWARE UPGRADES & REVISIONS

Firmware Versions	Date	Description

Section 27.0 - TERMINAL SPECIFICATION   (1 OF 2)

!! WARNING !! ANY INTERRUPTION OF THE PROTECTIVE GROUND OR DISCONNECTION OF THE PROTECTIVE EARTH IS LIKELY TO MAKE THE Be124 DANGEROUS

Connector JA: 4 Poles (Phoenix P.N. 1767025 / 7.62mm) Generator Voltage Inputs			
JA-1	Generator	L1(U)	You are required to connect these terminals to the generator. We recommend that you protect the cables and connections by using 1A (fast blow) fuses.
JA-2	Voltage	L2 (V)	
JA-3	600Vac max	L3 (W)	
JA-4	Phase-Phase	N	

Connector JB: 4 Poles (Phoenix P.N. 1745917 / 3.81mm) RS485-Modbus RTU		
JB-1	Common Ground	RS485 serial interface Port. Consult the Be-485/USB converter User Manual for further information. We recommend that you use Belden 9841(or similar) twisted pair cable.
JB-2	SIGNAL B	
JB-3	SIGNAL A	
JB-4	Termination 120 OHM	

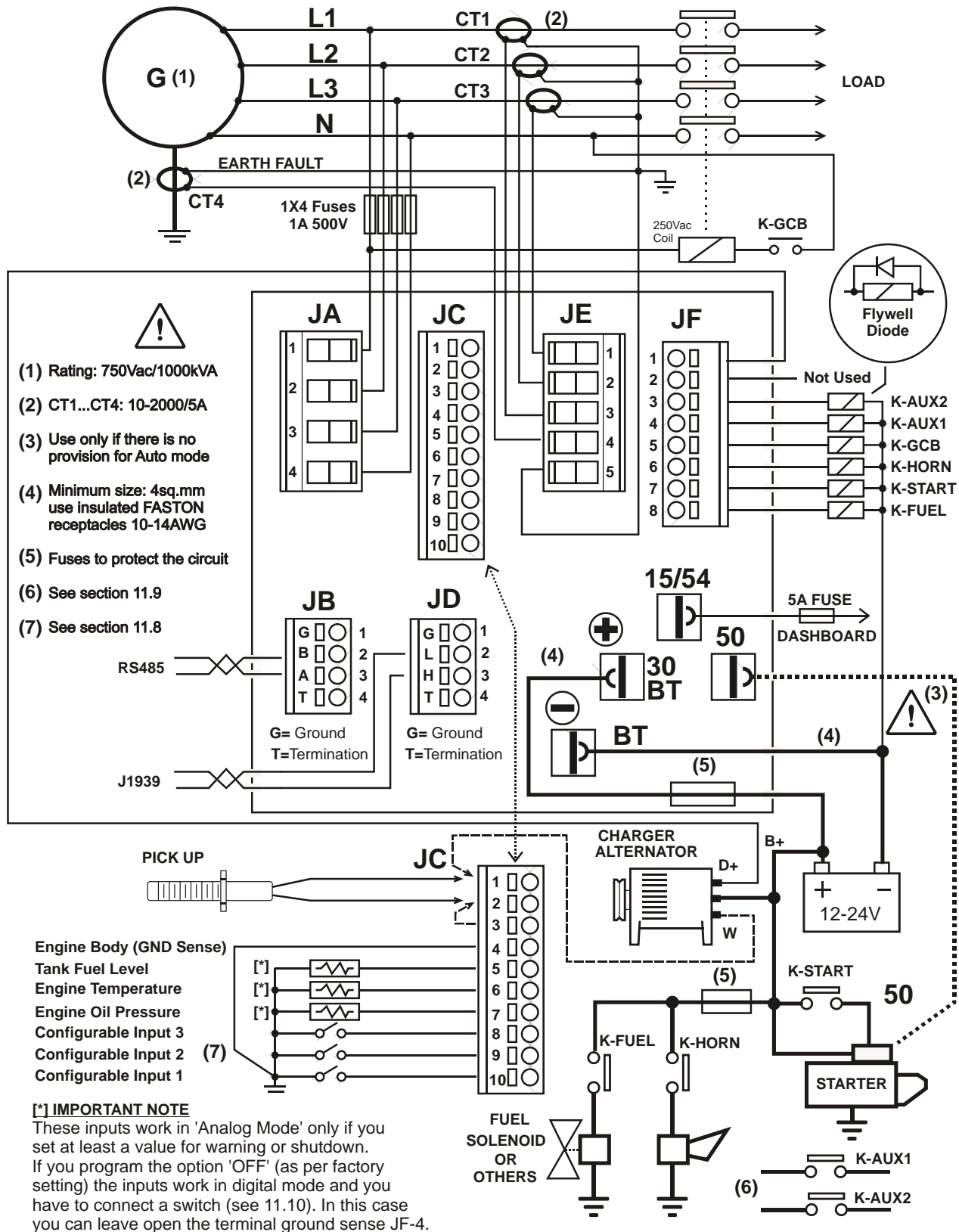| Connector JC: 10 Poles (Phoenix P.N. 1748053 / 3.81mm) Analog & Digital Inputs		
JC-1	Magnetic Pickup (-)/W	You can connect a magnetic pickup to detect the speed of the engine. As option, if pickup is not available you can connect the 'W' terminal of the charger alternator to JC-1. In this case connect together terminals JC-2 & JC-3 by using a short wire. You are required to set the number of teeth in the parameter **[PICKUP RATIO]** (see section11.5).
JC-2	Magnetic Pickup (+)	
JC-3	W Enable	
JC-4	GND Compensation	This is a mandatory connection if the Be124 is far as much as 5 meters from the body of the engine. You are required to connect terminal JC-4 to the body of the engine (a solid connection is required). If the engine is close to the Be124 you can connect JC-4 to battery minus (see the application wiring diagram). If you do not use an analog sensor (only digital inputs) you can leave this terminal open.
JC-5	Fuel Level Sensor or Switch	This input monitors the Fuel Level sensor. See section 11.6 to set an alarm and table 11.10 for the programmable response curve. Factory programming makes the input working digital (you are required to connect a switch). To enable the analog mode (for a sensor) you are required to set at least one of the alarm (low/high fuel) and to connect terminal JC-4 (compensation).
JC-6	Temperature Sensor or Switch	This input monitors the Temperature sensor. See section 11.4.10-11 to set an alarm and table 11.10 for the programmable response curve. Factory programming makes the input to working digital (you are required to connect a switch). To enable the analog mode (for a sensor) you are required to set at least one of the alarm (low/high temperature) and to connect terminal JC-4 (compensation).
JC-7	Oil Pressure Sensor or Switch	This input monitors the Oil Pressure sensor. See section 11.4.11 to set an alarm and table 11.10 for the programmable response curve. Factory programming makes the input to working digital (you are required to connect a switch). To enable the analog mode (for a sensor) you are required to set at least one of the alarm (low pressure warning or shutdown) and to connect terminal JC-4 (compensation).
JC-8	Configurable Digital Input 3	You can connect switches. Each input can be configured via software: see table 11.8 for the available options. You have options for normally closed or normally open contacts also. The other side of the switches must be connected to battery minus (or ground supposing that battery minus is grounded). You can edit the text for the Configurable input if used with one of the following options: [1] [2] [3] [4] [5] [6] (see details about the configurable inputs on section 11.8).
JC-9	Configurable Digital Input 2	
JC-10	Configurable Digital Input 1	

Section 27.0 - TERMINAL SPECIFICATION   (2 OF 2)

Connector JD: 4 Poles **(Phoenix P.N. 1745917 / 3.81mm)**	Canbus Port	
JD-1	Common Ground	Canbus serial interface port (consult your engine manufacturer for the connections)
JD-2	Signal L	
JD-3	Signal H	
JD-4	Termination 120 OHM	

Connector JE: 5 Poles **(Phoenix P.N. 1754504 / 5.0mm)**	Current Inputs	
WARNING! do not disconnect this plug when the engine is running. By opening the secondary circuit of the C.T.'s you can generate a dangerous voltage. Never disconnect a connection of a CT when generator is working. You can seriously damage the controller and putting yourself in a serious risk of electrical shock.		
JE-1	Current Transformer L1 (S1)	Inputs for the Current Transformers. The nominal Current is 5A. To program the size see section 11.3.12 (section 11.3)
JE-2	Current Transformer L2 (S1)	
JE-3	Current Transformer L3 (S1)	
JE-4	Earth Fault sensing C.T. (S1)	
JE-5	Current Transformer Common (S2's)	S2 terminal of each CT must be grounded

Connector JF: 8 Poles **(Phoenix P.N. 1748437 / 3.81mm)**	PNP Static Outputs	
JF-1	D+ / W Input/Output	It provides 3W excitement for the charger alternator and at the same time monitors the voltage of the charger alternator.
JF-2	Not Connected	Not to be used
JF-3	Configurable Output 2	It drives an auxiliary relay with configurable function (see 11.9)
JF-4	Configurable Output 1	It drives an auxiliary relay with configurable function (see 11.9)
JF-5	GCB Output	It drives the auxiliary relay of the Generator Circuit Breaker
JF-6	Alarm Output	It drives the Horn via an auxiliary relay
JF-7	Start Pilot output	It drives the Starting Motor via a start pilot relay
JF-8	Fuel Solenoid output	Energized to run output for Fuel solenoid and ancillary circuitry

6,3x0,8mmTerminals **(Use Insulated Faston Receptacles for 10-14AWG wire)** Supply & Power connections		
30	Plus Battery Vdc supply (DC plant supply)	An internal Electronic 300mA Thermal Protection is provided. If you have provision to use the Manual Start (terminal 50) we recommend that you provide a proper size of the cable (4.0 up 6.0 sq.mm or 10-14AWG).
-BT	Battery minus supply (DC plant supply)	Should be connected straight to the battery minus. We recommend that you use a wire with minimum size of about 2.5 sq.mm.
15/54	Auxiliary Supply Output	It could be used for ancillary circuits (dashboard). We recommend that you protect this connection using a 5A fuse (fast blow). It provides a voltage only when you turn the key to 'ON'.
50	Start (30Amps) output	This should be connected in case you use **_only_** the manual mode (no provision of AUTO mode). The simultaneous use of terminal '50' and a 'Start Pilot Relay' (connected to JF-7) **_may severely damage the engine._**

Section 28.0 - TYPICAL WIRING DIAGRAM

(1) Rating: 750Vac/1000kVA

(2) CT1...CT4: 10-2000/5A

(3) Use only if there is no provision for Auto mode

(4) Minimum size: 4sq.mm use insulated FASTON receptacles 10-14AWG

(5) Fuses to protect the circuit

(6) See section 11.9

(7) See section 11.8

JB
G= Ground
T=Termination

JD
G= Ground
T=Termination

[*] IMPORTANT NOTE
These inputs work in 'Analog Mode' only if you set at least a value for warning or shutdown. If you program the option 'OFF' (as per factory setting) the inputs work in digital mode and you have to connect a switch (see 11.10). In this case you can leave open the terminal ground sense JF-4.

Section 29.0 - REAR VIEW AND DIMENSIONS

The following figure shows how the connectors are arranged on the back of the controller. The Phoenix codes of the removable female connectors are also provided on the left. See section 27.0 for detailed terminals description. Each controller comes with a full set of connectors, fixing accessories and 2 keys.

JA	Phoenix 1767025	4-Poles 7.62
JB	Phoenix 1745917	4-Poles 3.81mm
JC	Phoenix 1748053	10-poles 3,81mm
JD	Phoenix 1745917	4-Poles 3,81mm
JE	Phoenix 1754504	5-poles 5.0mm
JF	Phoenix 1748437	8-Poles 3,81mm

JA VAC Inputs — L1 L2 L3 L4 — HIGH VOLTAGE

JC Misc. Inputs — 1 2 3 4 5 6 7 8 9 10

JE AAC Inputs — 1 C1 2 C2 3 C3 4 E.C. 5 Com.

JF PNP Outputs — 1 2 3 4 5 6 7 8

15/54

JB RS485 — GND B A TR.

JD Canbus — GND L H TR

+ 30 +BT

− -BT

START 50

Power Connections (blade terminals 0,8x6,3)

Front view — 96mm — 96mm

Be124 CENTURION

OFF ON 1 2 START GCB AUTO

Rear view — 90.5mm

BERNINI design

Rear Cover

Side view

87,5 mm — 8.0 mm — 42.5 mm — 45 mm — 35mm

Cables outlet

Panel cut-out :
91mm (+/-0.5) x 91mm (+/-0.5)