

# Be24A Generator Auto Start Module Manual

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*e-mail: [bernini@bernini-design.com](mailto:bernini@bernini-design.com)*

*Customer Support BERNINI DESIGN SRL ITALY*

*mobile: ++0040 721 241 361*

*[www.bernini-design.com](http://www.bernini-design.com)*

## **Warranty**

Bernini Design SRL (hereinafter "BD") warrants that Be24A shall be free from failure due to components or manufacturing process for a period of 3 years from the BD delivery date. Upon any valid return by the customer, BD shall, at its discretion either repair or replace the product without charge. BD will then return the Be24A to the buyer reset to the factory 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 Be24A is not defective, or the product is defective for reason other than covered by this warranty, then the buyer will be charged accordingly. Warranty cover will not apply if the Be24A has not been used in accordance with the User Manual or other applicable operating instruction, particularly if any defects are caused by misuse, improper repair attempts, or negligence in use or handling.

This purchase is non-refundable.



This equipment complies with the EMC requirements

### **WARNING!!**

**High voltage are present inside the Be24A. To avoid the risk of electric-shock, operating personnel must not remove the protective cover. Do not disconnect the Earth (safety ground) connection. The Be24A can and will start the engine at anytime. Do not therefore work on equipment which is controlled by the Be24A without isolating it first. When servicing the engine, disconnect the battery and battery charger. We recommend that you place warning signs on the equipment indicating the above.**

**!! WARNING !! Relays and solenoids connected to the Be24A must be suppressed using flywheel diodes or appropriate suppression devices as indicated in section 13.0.**

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**- 1.0 - INTRODUCTION**

The Be24A is a Generator Auto Start Module designed for the control and protection of both engine and generator. Visual indication on the Be24A is given by means of an LED segment display and discrete LEDs in the OFF, MAN and AUTO modes. The display illuminates messages for: Low Fuel Level, Emergency Alarm, Low Oil Pressure, High Temperature, High/Low Battery Voltage, Belt Break/Charger Failure, Over/Under Frequency, Failure to start, Alternator Failure, Over/Under Voltage, Over/Under Speed, Overload and some others. By using the [UP-DOWN] pushbutton, the Be24A displays: Generator Voltage/Current/Frequency, Battery Voltage, Hour Meter, Charger Alternator Voltage, Speed (R.P.M) and 'Hours run'.

The Be24A features static outputs, for START, STOP, ALARM (or GENERATOR CONTACTOR), FUEL SOLENOID and PRE-GLOW. A set of 31 programmable parameters and calibrations functions can be adjusted from the module's front panel 6 pushbuttons.

The Be24 features a 30Amp key start that allows manual operation in harsh environment in between -30°C up to 70°C.

## - 2.0 - Selection of a MODE of operation

The Be24A has an AUTO (section 2.1), MANUAL (section 2.2) and OFF (section 2.3) mode selection. When the power supply is switched on, the Be24A reacts as follows:

- A) if the KEY-SWITCH is in the **OFF position**, the Be24A enters the OFF mode.
- B) if the KEY-SWITCH is in the **ON position**, the Be24A enters the AUTO mode. That is, if the Be24A was in AUTO prior to the supply removal. If not, the Be24A enters the MANUAL mode.

### - 2.1 - AUTO mode

The Be24A operates according to the parameters indicated in section 11.0.

The parameters [P.2]---[P.5] control the starting cycle. The Be24A initiates the starting of the engine if the 'REMOTE START' input energizes (terminal #7, section 9.0) or if parameters [P.26]-[P.27] have been programmed (see sections 11.0 and 19.0).

To enter 'AUTO' mode, use the following instructions:

- A)** - turn ON the KEY-switch; the Be24A illuminates the Display and LEDs for 1 second (**\* Note**)
- B)** - push the AUTO pushbutton, then the Be24A will indicate [uuuu] (Pre-glow cycle) or [StA-]; the yellow Led 'AUTO' also illuminates. If the REMOTE START input is not activated, the yellow LED blinks. If activated, the yellow LED illuminates continuously and a start cycle will take place after a delay period ([P.0], see also section 9.0).
- C)** - To exit the AUTO mode, push the AUTO pushbutton (the yellow Led turns OFF) or turn the KEY-switch to OFF.

**(\*) NOTE: If the display indicates a blinking message, there is an alarm; consult section 4.0**

If Automatic Periodic Test is triggered, the display indicates the message [tEst] (see application note in section 19.0).

The Be24A stores the AUTO operating mode in the memory; if the battery supply then fails and restores, the Be24A will enter the AUTO mode automatically. To clear the memory of the AUTO mode, push the AUTO pushbutton, or turn OFF the KEY-switch.

### - 2.2 - MANUAL mode

MANUAL mode gives an Engine start by means of the KEY SWITCH. Use the following instructions:

- A)** - Turn ON the KEY-switch; the Be24A illuminates the LEDs and Display **>>>> note (\*)**
- B)** - If the display shows the message [uuuu], the Be24A is counting the PRE-GLOW time ([P.13]/[P.14]); wait until the message disappears.
- C)** - When the display shows the message [StA-] turn the Key to START position until the engine starts. The Be24A indicates [ . . . ] during cranking. **>>>> note (\*\*)**
- D)** - To stop the engine, turn the KEY-switch to off.

**(\*) NOTE: If the display indicates a blinking message, there is an alarm; consult section 4.0**

**(\*\*)NOTE:** The Be24A shows the [StA-] message for 20 seconds. After this time, if the engine does not start, the Be24A shuts down the FUEL SOLENOID and displays the message [FAIL] (Fail to start, see section 4.07). To clear the alarm, turn the KEY-switch to OFF.

### **- 2.3 - OFF mode**

The OFF mode clears the alarms and turns the Display off. To select the OFF mode, turn the KEY-switch to off. In the OFF mode you can read the settings or program the controller (see sections 6.0 and 11.0).

### **- 3.0 - DISPLAY features**

The display of the Be24A (section 14.0) shows measurements, settings and messages. The [UP-DOWN] pushbutton selects one of the following: [UXXX] (\*) Voltage - [AXXX] Current - [rPM] [XXXX] Speed - [HXXX] Frequency - [bXX.X] Battery - [cXX.X] Charger Alternator voltage and [h ] [XXXX] Hour count. In OFF mode, the Be24A turns off the display; a blinking dot indicates the presence of the power supply. The current consumption in this case is only 20mA.

The description of the display indications follows:

[AXXX] The Be24A indicates the measurement of Generator Current (00.0 up 99.9Aac and 100 up to 999 Aac). The parameter [P.10] sets the Current Transformer size, and the parameter [P.11] sets the Overload limit (section 11.0). The message [A - - - ] indicates an overflow.

[UXXX] The Voltage output of the generator is displayed from 80Vac up to 600Vac. The settings for Under/Over Voltage are the parameters [P.6] and [P.7].

[rPM][XXXX ] The message [rPM] appears momentarily, and the speed of the engine (RPM) is then indicated according to the parameter [P.23]. If [P.23] is set to [Inh.] (inhibit), the display indicates [- - - -]. The parameters [P.21]/[P.22] set the Under/Over Speed limits (see section 11.0). If a pick-up is not available you can program the poles of the alternator ([P.30]) in order to display the speed.

[HXX.X] The display shows the Frequency of the Generator (10,0-99,9Hz). The parameters [P.8] and [P.9] set the Under/Over Frequency.

[bXX.X] The Be24A indicates the Battery Voltage (see section 4.14).

[cXX.X] The Be24A indicates the Charger Alternator Voltage (see section 12.0)

[ h ] [XXXX ] The Display shows the HOUR count up to 9999h. The message [h ] appears for a moment and then the counter is displayed continuously (see section 10.0).

**(\*)NOTE: the symbol 'X' means a numerical digit.**

### **- 4.0 - ALARM messages**

The alarms are displayed by means of messages. To remove the message, turn the KEY-switch OFF. Always cancel the alarm before starting the engine. The Be24A may show the following:

**4.01 [oiL] (LOW OIL PRESSURE):** indicates the Low Oil Pressure shutdown. The input is connected to an external normally closed contact (input #3). The Oil Pressure Switch is bypassed by the [P.25] timing (section 11.0).

**4.02 [ °C ]** (HIGH ENGINE TEMPERATURE): indicates a High Temperature shutdown. The terminal #4 input is connected to a normally open or closed temperature switch. The un-energized status of the contact is selected by means of a code in the [P.18] ([n.o.] or [n.c.]). The alarm is bypassed by the [P.25] timing (section 11.0).

**4.03 [O.SPd.]** (OverSPEED) This alarm is detected from the Pick-up (or 'W' terminal of the Charger Alternator, see section 17.10). The parameters [P.22]-[P.23] allow full monitoring of the speed. The message blinks to indicate Over Speed (1 second bypass). To display the value of Speed that caused the shut down, push the [F1] pushbutton.

**4.03A [U.SPd]** (UnderSPEED) This alarm is detected from the Pick-up (or 'W' of the Charger Alternator see section 17.10). The parameters [P.21]-[P.23] allow for full monitoring of the speed. The message blinks to indicate Under Speed shut down (6-second timing bypass). To display the value of the Speed that caused the shut down, push the [F1] pushbutton.

**4.04 [bELt]** (BELT BREAK). This alarm is enabled by programming the [on] code into [P.15]. There is a 'Belt Break' alarm when the output voltage of the Charger Alternator is lower than the setting of [P.3]. A 20-second delay prevents false alarms. The [inh.] code, programmed into [P.15], inhibits the alarm.

**4.05 [ALAr]** (EMERGENCY ALARM) This message indicates the External Emergency Stop (input #5). The Be24A stops the engine immediately. The required type of EMERGENCY switch is programmed into the [P.19] ([n.o.] or [n.c.]).

**4.06 [FuEL]** (FUEL ALARM) This message indicates Low Fuel in the tank (input#6). The engine stops if the alarm persists for the programmed time ([P.31]). To clear the alarm, follow these instructions:

- a) - turn the key OFF and fill the tank
- b) - turn the key ON and select the MANUAL or AUTO mode of operation

**4.07 [FAIL]** (STARTING FAILURE). This alarm activates if the engine does not start after a programmed starting cycle, (see parameters [P.2]-3]-4]-5] in section 11.0) or if the engine stops for unknown reasons.

**4.08 [E 04]** (GENERATOR FAILURE). This message will be displayed if there is no Voltage or Frequency from the generator for 150 seconds after the engine has been started. The alarm monitoring is disabled if the [P.12] contains the [OFF] code, or the Be24A is in MANUAL operating mode.

**4.09 [E 05]** (GEN-SET OVERLOAD). The engine will stop if the Generator current rises above the setting [P.11] for 6 seconds continuously. To display the current that triggered the alarm, push the [F1] pushbutton.

**4.10 [Hi H]** (OVER FREQUENCY) The Over Frequency setting is programmed into [P.9]. The protection is delayed by about 2 seconds. The Be24A shuts down the engine. To display the Frequency that triggered the protection, push the [F1] pushbutton.

**4.11 [Lo H]** (UNDER FREQUENCY) The Under Frequency setting is programmed into [P.8]. The protection is delayed by about 6 seconds. The Be24A shuts down the engine after a cooling down time. To display the Frequency that triggered the alarm, push the [F1] pushbutton.

**4.12 [Hi U]** (OVER VOLTAGE) If the voltage rises above the [P.7] setting for more than 2 seconds, the Over-Voltage alarm energizes and the engine shuts down. To display the Voltage that triggered the alarm, push the [F1] pushbutton.

**4.13 [Lo U]** (UNDER VOLTAGE or SHORT CIRCUIT) The alarm energizes if the voltage drops under the [P.6] setting for more than 6 seconds. To display the Voltage that triggered the alarm, push the [F1] pushbutton.

**4.14 [XX.X]** (Battery voltage alarm, Blinking indication). The alarm settings are automatically fixed to 11,8/15.0V for a 12V battery and 23,6/30.0V for a 24V battery. The alarm is delayed by about 120 seconds and is ignored during Pre-Glow and starting cycle.

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

- Enter in CALIBRATION (see section 16.0)

- Clear the MEMORY (see section 16.1)

## **- 4.2 - OPERATING messages**

The Be24A features messages to inform you about the following conditions:

**[uuuu]** (PRE-GLOW). The Be24A is enabling the GLOW PLUGS ([P.13])

**[U---]** (V-METER out of range). The voltage of the Generator has fallen under 80Vac

**[StA-]** The Be24A indicates that it is ready for starting. You are required to turn the Key to START or select the AUTO mode within 20 seconds.

**[. . .]** This message indicates that Be24A is cranking the engine.

**[rEst]** The Be24A is counting the rest time ([P.4] setting)

**[tEst]** The Be24A tests the engine according to [P.26] and [P.27] (see section 19.0)

**[CAL]** (CALIBRATION): see section 16.0.

**[Cool]** Cooling down time (see section 11.0, [P29])

**[ProG]** PROGRAMMING: see section 6.1

**[StOP]** The Be24A is commanding the stop cycle ([P.16] setting)

## - 5.0 - LEDs for visual indication

The Be24A features two LEDs to indicate the following (see section 14.0):

**ENGINE RUNNING** This green led illuminates when the voltage of the Charger Alternator, terminal #1, rises above the setting programmed into [P.3] (section 11.0). If the Engine is without the Charger Alternator, the parameter [P.3] has to be set to [INH.] and [P.15] to [OFF]. In this case, the 'ENGINE RUNNING' turns on only if at least one of the following conditions is true:

- the Voltage of the Generator is over 80Vac
- the Frequency of the Generator is over 20Hz
- the speed of the engine is over the CRANK OFF ([P.24]) limit

The Be24A continuously monitors the above conditions in order to terminate the crank.

**AUTO** [Yellow] It illuminates in the AUTO operating mode. The LED blinks to indicate a standby mode. (input #7 not active). The yellow LED illuminates continuously when the REMOTE CONTROL INPUT #7 is activated (section 9.0).

Note: the two LEDs will blink simultaneously in case the Be24A is in program mode (see 6.1).

## - 5.1 - Lamp and Display Test

A test of the LEDs and DISPLAY is obtained automatically when you turn the key to ON. The LEDs and DISPLAY turn on for approximately 1 second.

## - 6.0 - PROGRAMMING instructions

Section 11.0 describes the adjustable parameters. The display shows the name (example [P.10]) and the setting of the parameter (example [500]). To enter the programming, follow these instructions:

### 6.1 Programming

- 1) - Turn the key to OFF and make sure that the power supply is over 12.0V.
- 2) - Remove the cover, connect the 'P.E.' terminal to minus and connect the supply
- 3) - Push and hold the [ENTER] button until the message [ProG] appears: the [P.0] message will indicate the first programmable parameter. The green and yellow LED indicators will blink indicating that you are in PROGRAM mode.
- 4) - Press the [UP-DOWN] pushbutton to select the parameter ([P.0] to [P.31]).
- 5) - Press [F1] to display the parameter. Push [F1] and [+] (or [-]) simultaneously to adjust the parameter.

### To save the modifications and quit:

- 6) - Press [ENTER] until the [SAVE] message appears (approximately 5 seconds)
- 7) - The message [Good] will confirm the saving procedure (**^NOTE**)
- 8) - Remove the connection of the PROGRAM terminal (# P.E.) and put the cover in place.

### To exit without saving:

- 6A) - Remove the supply, disconnect the PROGRAM terminal (# P.E.) and put the cover in place.
- 7A) - We recommend that you verify all parameters using the READ mode (see section 6.3)

**^NOTE:** The message [Err] indicates an error of the saving procedure. We recommend that you repeat the programming. If the [Err] message remains on the display, try to cancel the memory using the instructions indicated in section 16.1.

**We recommend that you disconnect the P. E. terminal if programming is not required.**

## **- 6.2 - Re-programming Default settings**

The parameters of the Be24A are factory programmed with DEFAULT settings (see section 11.0). To use the DEFAULTS, enter the Program Mode (section 6.0) and push the [+] and [-] pushbuttons simultaneously until the display blinks twice (approximately 10 seconds).

- to save the DEFAULTS, push the [ENTER] pushbutton until the messages [SAVE] and [Good] appear.
- to quit the operation, turn the key directly into the ON position without using the [ENTER] pushbutton or remove the power supply.

**We recommend that you disconnect the P. E. terminal if programming is not required.**

## **- 6.3 - Parameter reading**

When the Be24A is in the OFF mode (see section 2.3) it is possible to read the parameters. To do this, use the following procedure:

- A)** - Push the [F1] pushbutton; the display indicates the name of the first parameter ([P.0]).
- B)** - Push the [F1] pushbutton: the display will indicate the value of the parameter.
- C)** - Push the [UP-DOWN] pushbutton to select a parameter, and push [F1] to display the setting.
- D)** - If you do not use the pushbuttons, the display turns off automatically after 2 minutes.

## **- 7.0 - GLOW PLUGS control (Diesel engine)**

Output #11 controls the Glow Plugs. Factory programming (defaults) makes the output inoperative (parameter [P.14]=0). The 'Pre-Glow' is obtained by programming a time value into [P.13], and setting the code [2] into [P.14] (section 11.0). The output will energize prior to starting the engine.

## **- 8.0 - 'CHOKE' control (Petrol engine)**

Output #11 controls the CHOKE. The default programming disables the output (parameter [P.14]=0). If you wish output number #11 to energize at the beginning of each starting attempt, program a time from 2 to 4 seconds into [P13], and program either the code [1] or [3] into [P.14] (see section 11.0). The output will de-energize after a [P.13] programmed number of seconds. To inhibit the CHOKE at high engine temperature, an external temperature switch connected in series with the #11 terminal is recommended. NOTE:

- with option [1], the choke opens when the engine is running
- with option [3], the choke opens only after the programmed time, independently of the engine running condition.

## **- 9.0 - REMOTE START**

The Be24A monitors the REMOTE START input only in AUTO mode. Input #7 can be operated normally closed or normally open (see [P.20]). In the following example the REMOTE START input is programmed in [n.o.] mode.

### **- 9.1 - To enter the AUTO mode, use the following instructions:**

- A) - Turn the KEY to on; the Display and LEDs will illuminate for 1 sec (LAMP TEST).
- B) – After the LAMP TEST, push the AUTO pushbutton (otherwise, after 20 seconds the Be24A activates the STARTING FAILURE); The yellow LED 'AUTO' will illuminate as described in section 9.2.

### **- 9.2 - REMOTE START SWITCH (normally open Mode):**

If the REMOTE START input is closed, the yellow LED 'AUTO' illuminates continuously and the display will indicate timer count down [P.0] by means of the message [MM.SS] (Minutes and seconds). The engine will start after this programmed [P.0] delay time.

If the REMOTE START switch opens, the Be24A triggers the [P.1] timer (STOP DELAY TIME). The display will indicate the count down by means of the message [MM.SS] (Minutes and seconds), and the AUTO yellow LED will blink. After the [P.1] timing, the engine will stop.

## **- 10.0 - HOUR METER reset**

To clear the hour counter, follow these instructions:

- Connect the PROGRAM ENABLE terminal (#P.E.) to Battery minus
- Start the engine in manual mode (see section 2.2)
- Press the [UP-DOWN] pushbutton to select the 'h' menu (HOUR METER mode display)
- The message [h ] will appear for a moment and the HOUR METER (for example [9657]) will be displayed continuously.
- Push and hold the [+] and [-] pushbuttons simultaneously, approximately 10 seconds, until the display blinks twice.
- Release the pushbuttons; the [ 0 ] count will appear on the display.
- Turn off the Key-switch in order to stop the engine

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

Display	Parameter
[P.0] [ 1"]	<b>Remote Start Delay Timing (Input #7)</b> Range: 1-59 secs or 1-99 minutes Continuous seconds or minutes delay of REMOTE START command until the initiating of the automatic engine start.
[P.1] [ 1"]	<b>Remote Stop Delay Timing (Input #7)</b> Range: 1-59 secs or 1-99 minutes Continuous seconds or minutes of the absence of the REMOTE START command to initiate the stop cycle.
[P.2] [ 5"]	<b>Crank Timing (Output #10)</b> Range: 1-20 seconds Maximum <i>Starter Motor</i> operating period. The timer is cleared if the engine fires.
[P.3] [ 8.0]	<b>Crank termination (Input #1)</b> Range: [inh], 3V-24V If the voltage of the Charger Alternator rises above the [setting], the <i>Starter Motor</i> is disconnected (see section 12.0). Program the [inh] if the engine is not fitted with Charger Alternator.
[P.4] [ 3"]	<b>Rest Timing</b> Range: 3 - 20 secs Time interval between starting attempts
[P. 5] [ 3 ]	<b>Starting Attempts</b> Range: 1-10 This parameter sets the number of attempts of the automatic start cycle.
[P.6] [ inh.]	<b>Generator Under-Voltage</b> Range: 80-400V If the voltage falls below the [setting], the Be24A enables the protection.
[P.7] [Inh.]	<b>Generator Over-Voltage</b> Range: 110-550V or [inh.] If the Generator voltage rises above the [setting] for at least 2 seconds, the Be24A will energize the over voltage protection [Hi U] (see section 4.0) to stop the engine. The [inh.] code inhibits the over voltage.
[P.8] [Inh.]	<b>Generator Under-Frequency</b> Range: [inh.] to 99Hz This protection is delayed by about 6 seconds. The Be24A shuts down the engine and the display will show the [Lo H] message (see section 4.11). The option [inh] disables the under frequency.
[P.9] [Inh.]	<b>Generator Over-Frequency</b> Range: 45 to [inh.] This protection is delayed by about 2 seconds. The Be24A shuts down the engine and displays [Hi H] (see section 4.10). The option [inh.] disables the over frequency.
[P.10] [500]	<b>Current Transformer Size</b> Range: 10/5 up to 1000/5 The settings are allowed only in steps of 10A.
[P.11] [inh.]	<b>Generator Overload Setting</b> Range: [inh.] to 1000 A The Be24A shuts down the engine and shows the message [E05]. The setting is allowed in increments of 1A (CT 10/5 up to 100/5) and 10A (CT100/5 up to 1000/5).



Display	Parameter
[P.21] [Inh.]	<p><b>Under Speed setting</b> Range: [Inh.] or 100-4000 r.p.m..</p> <p>The Be24A bypasses the protection by 6 seconds to avoid false alarms. The [Inh.] code (setting &lt;100 r.p.m.) disables the Under Speed shut down.</p>
[P.22] [Inh.]	<p><b>Over Speed setting</b> Range: 100-4000 rpm or [Inh.].</p> <p>The Be24A provides a one second bypass delay. The [Inh.] code (&gt;4000 r.p.m.) disables the Over Speed shut down.</p>
[P.23] [Inh.]	<p><b>Number of Teeth of the Flywheel</b> Range: [Inh.] or 1-500 teeth</p> <p>The [Inh.] code (setting &lt;1 ) disables the reading of the Speed (section 3.0), the Over/Under Speed alarms, and the Crank cycle termination (see [P.24]).</p>
[P.24] [Inh.]	<p><b>Crank OFF</b> Range: 100-800 rpm</p> <p>If the speed rises above the setting, the Be24A terminates the crank cycle. One second delay avoids false termination. The allowed range is 100 up to 800 R.P.M. The code [Inh.] inhibits the crank cycle termination (see also [P.23]).</p>
[P.25] [ 6"]	<p><b>Low Oil Pressure / High engine temperature alarms Bypass</b></p> <p>Range: 0-99 secs</p> <p>Bypass Delay to ignore the engine alarms during the engine starting cycle.</p>
[P.26] [inh.]	<p><b>Automatic Periodic Test Cycle</b> Range: [inh.], 1-99 days</p> <p>This is the interval time between the automatic periodic tests of the engine. The code [inh.] disables the Automatic Periodic Test (see section 19.0)</p>
[P.27] [ 5']	<p><b>Automatic Engine Test Duration</b> Range: 1-99 minutes</p> <p>This is the duration of the automatic engine test (see section 19.0).</p>
[P.28] [ 5"]	<p><b>Generator warm-up timing</b> Range: [inh.] 1-59 secs or 1-15 mins</p> <p>The warm up time will expire before closing the contactor of the generator. The option [inh.] inhibits this warm up period (see section 19.3)</p>
[P.29] [ 5"]	<p><b>Generator cooling timing</b> Range: [inh.] 1-59 secs or 1-15 mins</p> <p>The cooling down time will run after opening the contactor of the generator. The option [inh.] inhibits the cooling down period (see section 19.3)</p>
[P.30] [ Inh. ]	<p><b>Number of poles of the Alternator</b> Options: 2 or 4</p> <p>If the Pick-up (or W) is not connected to the Be24A, we recommend that you select one of the following options: [2] two-pole Alternator, [4] four-pole Alternator.</p>
[P.31] [ 5' ]	<p><b>Fuel Level Shut Down control</b> Range: [inh.] 1 - 99 minutes</p> <p>The setting [Inh.] provides only optical/acoustical warning. The setting [1'] up to [99'] shuts down the engine after this programmable period of time.</p>

**- 12.0 - ENGINE RUNNING setting**

The Be24A inhibits the START output when the engine fires.

When the engine is not running, the D+/WL (input #1) voltage is 0V. As soon as the Be24A starts the engine (manually or automatically), a current of a few hundred mA flows into the D+/W.L. terminal.

At this moment the engine is not running, but a voltage appears in the D+/WL terminal (0,8 to 2,5V).

As soon as the engine starts to run, the voltage of the D+/WL terminal increases by up to 3V-6V.

When the engine is running, the voltage reaches the nominal 14V needed to charge the battery. The safest point to disconnect the starter motor is between 6V and 10V.

The default parameter of the [P.3] is [8.0]V. This value is recommended for engines using 12V batteries. For a 24V battery, a setting of 16V is recommended.

The setting is good if the green 'ENGINE RUNNING' LED, on the front panel, remains off during the starting attempts cycle.

**NOTE :** to display the Charger Alternator voltage push the [UP-DOWN] pushbutton until the message [cXX.X] appears (section 3.0). The accuracy of the display is guaranteed to within 5% using a standard Charger Alternator. For other chargers (Flywheel Generator) the reading is not accurate. The [P.3] setting, in this case, expresses only a proportional factor.

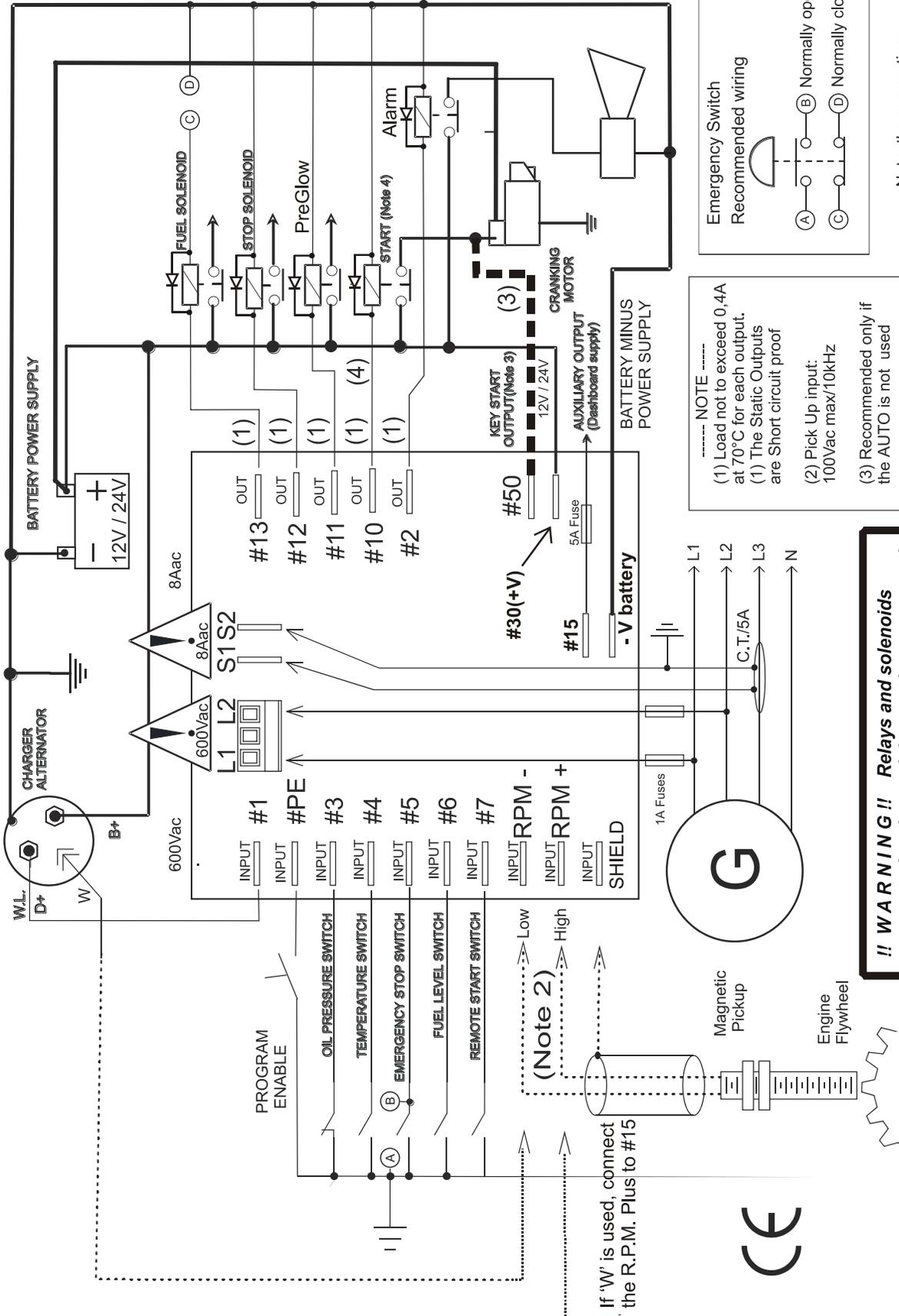
The Be24A monitors the Generator voltage to protect against unwanted insertion/operation of the starter motor when running. Once the voltage rises above 80Vac, the starter operation will be inhibited. For mechanical safety, we do not recommend the insertion of switches (or breakers) in series to the Vac measurement wires of the Be24A.

**IMPORTANT: VERIFY THAT THE 'ENGINE RUNNING' LED ILLUMINATES WHEN THE ENGINE RUNS. THE USE OF THE ENGINE WITHOUT THIS INDICATION MAY BE DANGEROUS.**

In case of a diesel engine, we recommend that you enable the BELT BREAK protection. This is accomplished by programming the code [on] in [P.15] (see section 11.0). To test the protection, it is necessary to disconnect the terminal D+ (W.L.) from the charger alternator, and to connect to ground the #1 terminal (leaving the terminal D+/W.L. open on the Charger Alternator). This protection is delayed by about 15 seconds.

**WARNING High voltages are present inside the Be24A. To avoid the risk of electric shock, operating personnel must not remove the protective cover. Do not disconnect the safety earth (ground) connection. Any interruption of this earth connection could create an electric shock hazard. Before making external connections, always ground the PANEL first by connecting the control panel to the safety earth.**

# Section 13.0: Typical Wiring Diagram



Emergency Switch Recommended wiring

(A) Normally open  
(B) Normally open  
(D) Normally closed

Note: the connections require female Plugs for 1/4" x 0.8mm Blade terminal

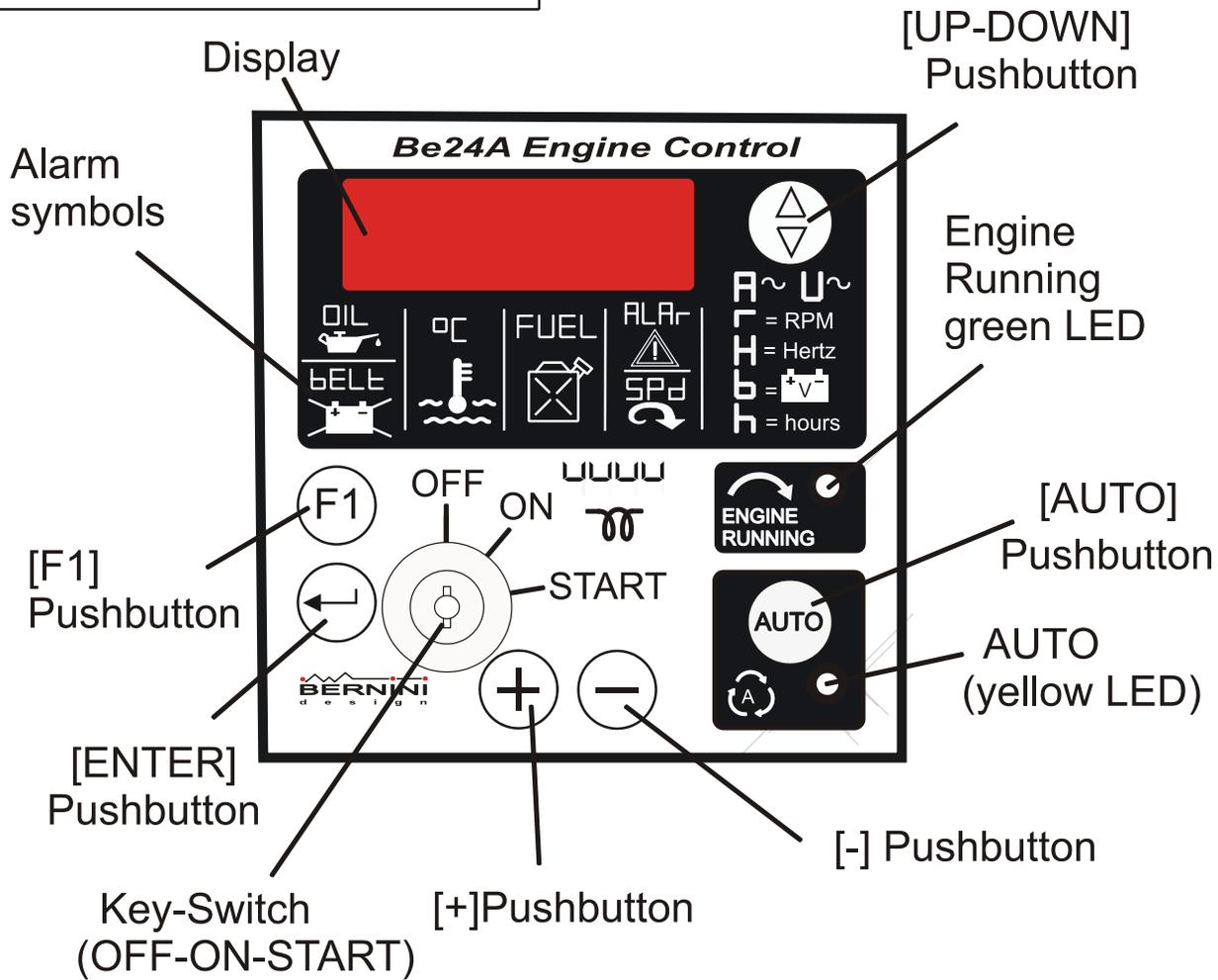
NOTE ----  
(1) Load not to exceed 0,4A at 70°C for each output.  
(1) The Static Outputs are Short circuit proof  
(2) Pick Up input: 100Vac max/10kHz  
(3) Recommended only if the AUTO is not used  
(4) Recommended in case of AUTO and MANUAL operating modes

**!! WARNING !!** Relays and solenoids connected to the module must be suppressed using flywell diodes or suppression devices as indicated in the wiring diagram

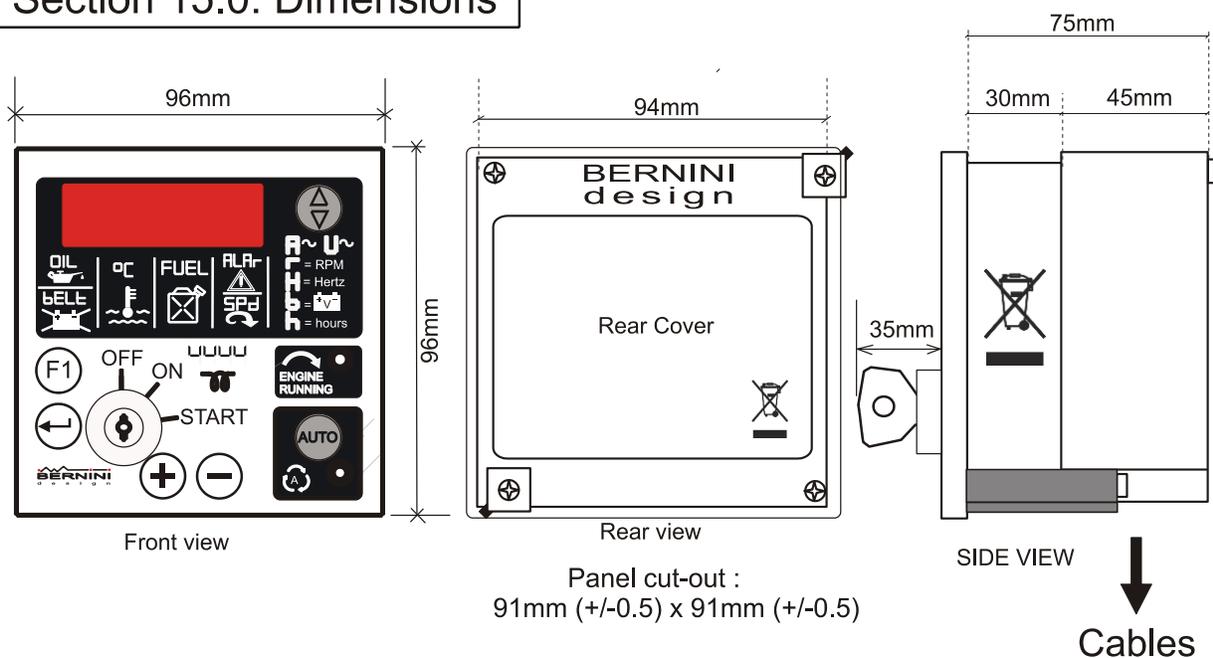
If 'W' is used, connect the R.P.M. Plus to #15



**Section 14.0: Front Panel**



**Section 15.0: Dimensions**



## - 16.0 - CALIBRATION

To enter the Calibration, follow these instructions:

- 1) - Turn the key-switch OFF and disconnect the supply. Connect the P.E. terminal to ground; verify that the power supply is over 12.0V. Connect the supply (battery).
- 2) - Start the engine manually (see section 2.2)
- 3) - Push and hold the [ENTER] button until the message [CAL] appears on the display.
- 4) - Release the [ENTER] pushbutton: the message [L.1] indicates the first parameter. The Be24A is now ready for calibration. The adjustable parameters are indicated below.

DISPLAY	MEASUREMENT / FUNCTION	RECOMMENDED VALUES
[L.1]	<b>Generator Voltage</b>	200Vac up to 250Vac
[Curr]	<b>Generator Current</b>	80% of the C.T. size
[ Ucc]	<b>Battery Voltage</b>	12V-14V or 24-28V
[ Fr]	<b>Generator Frequency</b>	49Hz-51Hz or 58Hz-62Hz
[ rPM]	<b>Engine Speed</b>	around nominal speed
[ MEM]	<b>Memory Clear Procedure (see 16.1)</b>	

- 5) - Push the [UP-DOWN] pushbutton to select the measurement (see above).
- 6) - Use a precision instrument (V-meter, A-meter). Provide the signal amplitude recommended on the right side of the table.
- 7) - To modify the indication of the display, push [F1] and [+] (or [-]) pushbuttons simultaneously. The reading increases (decreases) by a small amount each time the pushbutton is pressed.

### **TO SAVE follow the instructions:**

- Push and hold the [ENTER] pushbutton until the [SAVE] and [Good] messages appear on display.

### **TO EXIT without saving, use the following instructions:**

- Turn the KEY-switch to OFF; the Be24A enters the OFF mode without affecting the calibration.

### **- 16.1 - To clear the memory (to use in case of memory error):**

- Enter the CALIBRATION (see 16.0).
- Push the [UP-DOWN] pushbutton until you select the [ MEM] message.
- Push and hold the [F1] pushbutton (for about 45 seconds) until the message [Init] appears: the Be24A downloads the default settings (see section 11.0), clears the hour-count and removes calibrations.
- Turn the KEY-switch to OFF and remove the supply. Re-connect the supply; If the memory error persists, the Be24A must be returned for repair. If the Be24A works properly, program the parameters according to your needs.

## - 17.0 - GENERAL SPECIFICATION

**Supply Voltage:** 5Vdc to 36Vdc. **Reverse polarity:** protected for unlimited time.  
**Supply Ripple:** 15% up to 65 Hz, **Over Voltage:** 50V (60 secs) at 40 deg. C  
**V Battery Display error:** 3% [\*\*]. **Protection:** internal 300mA /60V thermal fuse on the supply line  
**Supply Current Consumption:** 20 mA (OFF mode) up to 150mA maximum

**Dimensions:** 96mm X 96mm X 75mm (includes connectors and rear cover)  
**Panel Cut-out:** 91mm X 91mm, indoor operation  
**Operating Temperature range:** -30deg C to +70 deg C. **Humidity Range:** 5% up to 95% non-condensing  
**Weight:** 450 gr., **Vibration:** 40mm/sec  
**General Design:** 89/336 EEC, 89/392 EEC, 73/23 EEC, 93/68 EEC, IEC 68-2-6  
**Certification:** CE

### **Static Outputs Characteristics (Engine Control)**

Surge Output Current: 12Adc/30Vdc, an internal thermal PTC limits the output to 400mA [\*]  
 Output Voltage: Battery Voltage

### **Be24A key-switch**

Output Current: 50Adc/ 20 seconds.

### **Generator Voltage Input Characteristics**

Nominal Voltage input: 550Vac. Maximum allowed Voltage: 600Vac continuously  
 Over voltage: 2KVac phase to neutral. Insulation to ground: 2KVac / 300 seconds  
 Maximum Display error: +/- 3% [\*\*]. Input impedance: 4 Mega Ohm

### **Current Transformer Characteristics**

Current Transformer Size: 10/5Aac up to 1000/5Aac. Maximum Current: 8Aac for 10 seconds.  
 Maximum Display error: +/- 5% [\*\*]. Internal resistance: 0.05 Ohm

### **Digital Input Characteristics**

Open circuit voltage: 10Vdc (12V supply) or 22Vdc (24V supply)  
 Closed circuit current: 15mAdc maximum. Over voltage: 100V/10mS

### **Charger Alternator Monitoring**

Operating Voltage up to 36Vdc. Over voltage: 100V / 20mS  
 Vdc reading accuracy +/- 5% (the calibration of this parameter is not available)  
 Threshold: 3Vdc-24Vdc (programmable). Excitation Power: max 3W

### **Pick-Up/'W'/'R' Characteristics**

Input voltage range: 0,7Vac up to 50Vac/Vdc. Frequency range: 0Hz up to 10kHz  
 Input impedance: 2200 OHM

[\*] NOTE: THE TOTAL CURRENT OUTPUT OF #2#10#11#12 and #13 MAY NOT EXCEED 2A at 70°C

[\*\*] NOTE: ERRORS CAN BE REDUCED BY MEANS OF CALIBRATION (SECTION 16.0)

## - 17.10 - RPM SENSING

The Be24A detects engine RPM by using one of the following:

**A) - Flywheel Pickup (Magnetic Pick-up).**                      **B) - Alternator Pickup ('W' or 'R' terminal)**  
 In order to adapt the ratio, the programmable parameter [P.23] is provided (see section 11.0). Enter the calibration mode to adjust the speed measurement (section 16.00). For the wiring, follow the instructions of section 13.0.

## - 18.0 - SOFTWARE UPGRADES

-V2.277 May 2009: first release.

-V2.XX January 2015: update software for gas fuelled engines.

## **- 19.0 - APPLICATION NOTES**

### **19.1 Periodic Test**

To trigger the Periodic Test, program the parameters [P.26] and [P.27] (section 11.0). In order to have the engine start at the desired moment, please follow these instructions:

- disconnect the power supply of the Be24A
- wait for the desired start time (external clock reference) and apply the power supply to the Be24A.
- select the 'AUTO' operating mode

The Be24A will start the engine after the programmed number of days (P.26). The engine will run for the programmed time (P.27). If the battery voltage is removed, we recommend that you synchronize the 'Power On' of the Be24A with an external clock.

### **Time remaining to start indication:**

The Be24A shows the remaining time to trigger the test: push the [ENTER] pushbutton while Be24A is in AUTO operating mode. The display will indicate days followed by hours ([DD.hh]).

## **- 19.2 - OUTPUT START RECOMMENDATION**

If the application requires only the MANUAL mode you can use the KEY switch output (output #50). If you use the terminal #10 for AUTOMATIC mode do not connect the output #50.

**CAUTION : using outputs #10 and #50 simultaneously will damage the starter motor.**

## **19.3 GENERATOR CONTACTOR CONTROL in AUTO MODE**

The Be24A can drive a contactor for the generator. The output is shared with the ALARM output. In order to use the contactor output, the setting of the parameters [P17] must be [inh.]. In this way, the ALARM OUTPUT mode is inhibited, and the contactor mode is enabled. The contactor output will energize in AUTO mode when voltage, frequency and speed are within the settings. The contactor will de-energize in case of ALARM, or when the AUTO mode is removed. In AUTO mode, the contactor de-energizes according to the REMOTE CONTROL input. The engine will shut down after a timed (programmable) cooling down period.

**- 20.0 - Description of the connections**

<b>Name</b>	<b>Type</b>	<b>Function</b>	<b>Description of the connection</b>
#1	Blade 1/4"	In./Out	Charger Excitement W.L./D+ input/output
#2	Blade 1/4"	Output	Alarm / Contactor Static Output 400mA
#3	Blade 1/4"	Input	Oil Pressure switch
#4	Blade 1/4"	Input	High Temperature switch
#5	Blade 1/4"	Input	Emergency Alarm switch
#6	Blade 1/4"	Input	Fuel Level switch
#7	Blade 1/4"	Input	Remote Start switch
#15	Blade 1/4"	Output	Dashboard Supply (max 5A dc)
-V	Blade 1/4"	Input	Be24A supply (BATTERY MINUS)
#10	Blade 1/4"	Output	START (Automatic) Static Output 400mA
#11	Blade 1/4"	Output	Pre-GLOW Static Output 400mA
#12	Blade 1/4"	Output	STOP SOLENOID Static Output 400mA
#13	Blade 1/4"	Output	FUEL SOLENOID Static Output 400mA
P.E.	Blade 1/4"	Input	PROGRAM ENABLE switch
RPM-	Blade 1/4"	Input	Magnetic Pick-Up (or 'W' connection)
RPM+	Blade 1/4"	Input	Magnetic Pick-Up (or +V Battery if 'W' is used)
GND	Blade 1/4"	Output	Pick Up shield connection
L1	Connector	Input	GENERATOR Vac (max 600Vac)
L2	Connector	Input	GENERATOR Vac (max 600Vac)
S1	Connector	Input	CURRENT TRANSFORMER /5A ac
S2	Connector	Input	CURRENT TRANSFORMER /5A ac
#30	Blade 1/4"	Input	+V Battery supply (50A dc)
#50	Blade 1/4"	Output	CRANK OUTPUT 50A dc

**21.0 Panel/Gen-set Builders Notes**

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