

“BPC960 V0” Bliss Powercom Genset Controller

Kirloskar Electric Co. Ltd

User Manual

This document applies to Product	9001-0049
Build Version	3600-0129
Firmware Version	5000-xxxx

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BPC960V0

Manual Genset Controller

1. Introduction

The BPC960V0 is an integrated Engine and AC controller for gensets.

The unit incorporates both manual and auto start initiated start and stop sequencing, monitors engine and alternator operating parameters and provides both engine and alternator protection, in a single integrated package.

The genset operating parameters are shown by scrolling screens on a backlit 128 x 64 dot Graphics LCD. Alarms and warning are also shown on the LCD and supplemented by an alarm LED and Hooter output.

The unit provides comprehensive monitoring of the engine and generator operating parameters and provides automatic shutdown of the genset in the event of damaging conditions. In addition to the usual engine safety protections the unit monitors coolant level, fuel level, canopy temperature and generator loading to provide even more comprehensive protection.

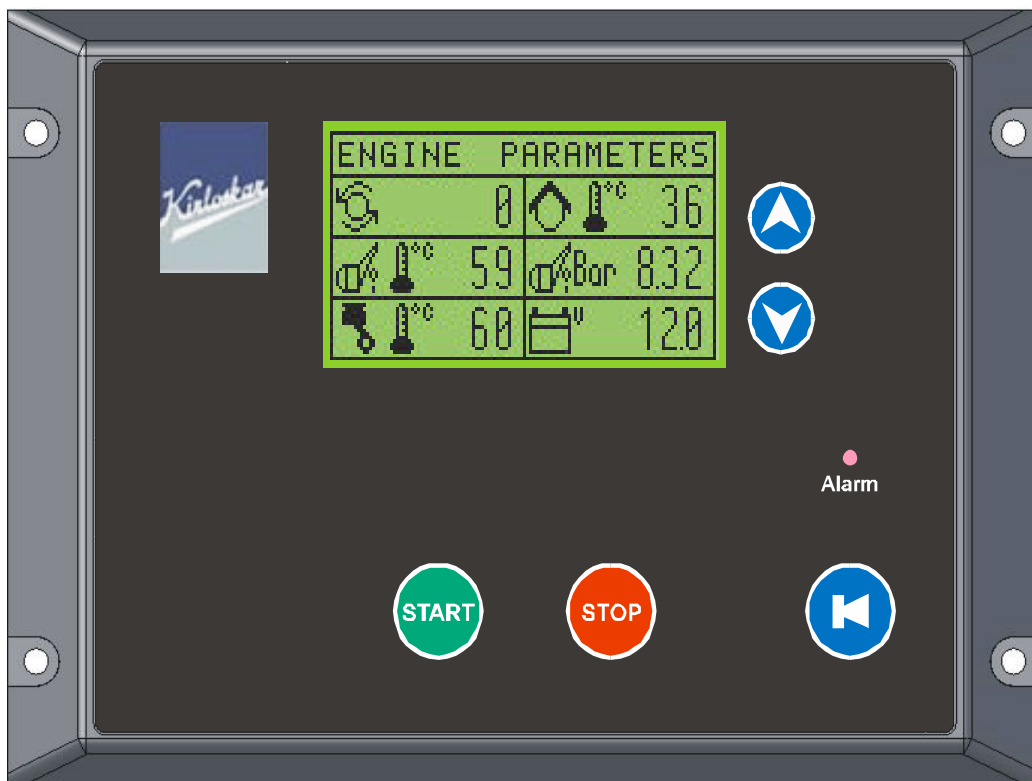
The unit incorporates a Stop Alarm Log (10 events) to give the field service engineer the operational alarm history for easier diagnostics.

In the factory environment, the unit is configured by cloning through a PC system. Field specific parameters can be adjusted by using the front panel buttons and an inbuilt menu system.

2. Benefits

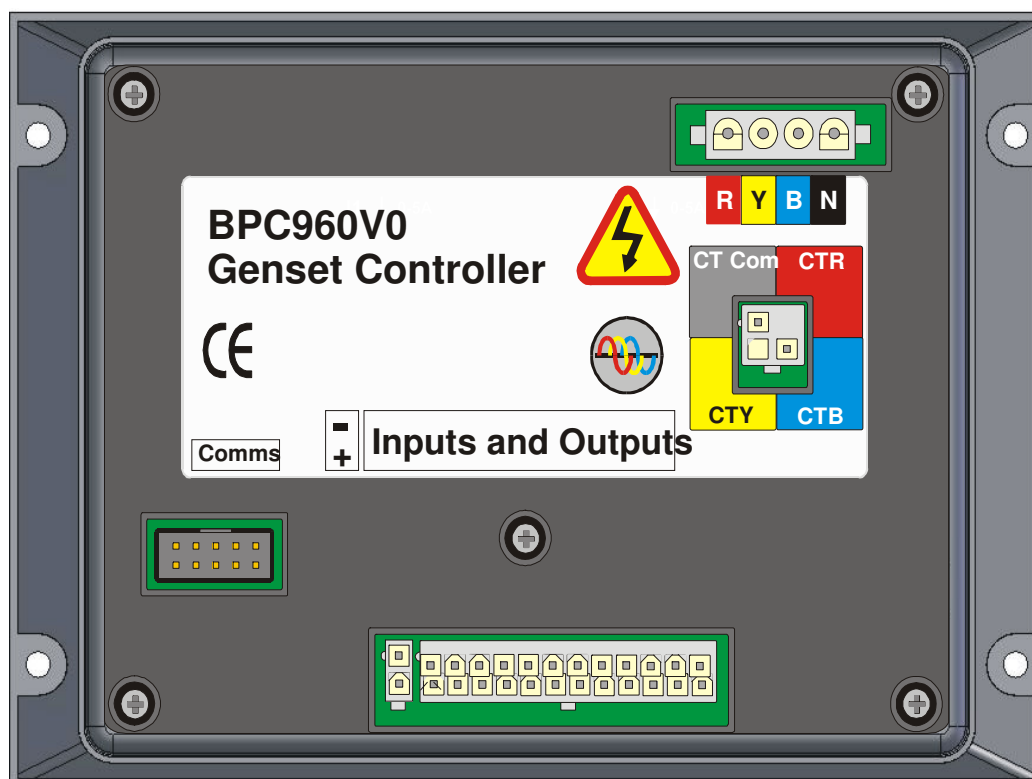
- Reduces system cost:
- Integrates engine gauges and AC metering into one unit.
- Minimises control panel wiring offering reduced material and labour costs.
- Reduces warranty costs by providing comprehensive engine and generator protection and a maintenance due timer.
- Flexible, the unit can be customised by PC cloning with application codes for individual genset model characteristics and fitments.

3. Physical Form



Front View

4.



Functions

1. Operation

Front Layout

Buttons

Button	Function Description
	Start button / Menu Previous - Used to initiate generator start sequence - Used as system menu previous button
	Stop button / Menu Next - Used to initiate generator stop sequence - Used as system menu next button
	Accept button / Setup Menu Entry - Used to accept system events and silence the sounder - Used to enter the Setup mode
	Screen Scroll up / Setup menu up Button - Screen Scroll up Button - Used as the system menu up and value increment button
	Screen Scroll down / Setup menu down Button - Screen Scroll up - Used as the system menu down and value decrement button

LED

Button	Function Description
 Alarm	Alarm Indicates system alarm

Initial Power Up

On power up, the unit displays the Logo.

The unit then displays the Serial number, Application Code and Firmware version.

After the initialisation process is complete, the unit waits for a Start request (Start Button,

Or Auto Start Input), during which time it will display 'READY'.

Ready

When the unit is in READY all measuring systBPC and display systBPC are turned on. The unit remains on for 1 minute and if the genset is not started in that time the unit goes into sleep mode to conserve battery power. In this mode the unit wakes periodically to check for any unusual conditions and if it finds none it goes back to sleep, otherwise it alarms accordingly. Where 'awake' mode has been selected the system parameters are continuously scrolled.

Any activity on the buttons immediately wakes the unit and the appropriate action is taken.

Pressing the STOP button while the unit is asleep immediately wakes the unit and scrolls all engine and generator parameter screens. This allows reading of battery voltage, fuel level, run hours KWH etc.

Manual Operation**To start the genset**

When the display is showing READY, press the start button momentarily to start the genset. The READY state implies the engine and generator parameters are as expected for a stationary genset. If the conditions are not as expected, an appropriate warning or alarm is displayed on the LCD. The warning or alarm condition must be cleared before the genset can be started.

The unit will perform the starting sequence as follows:

- FUEL-ON.
 - If ETR (Energise To Run) fuel control is configured, the unit will control the fuel output and display FUEL ON and the proceeds to the CRANK state.
 - For ETS (Energise To Stop) the sequence does not activate the output but proceeds after a short delay to the CRANK state.
- CRANK.
 - The crank output is activated and the display shows 'Cranking' with a count down time.
 - The crank output is deactivated when the unit has detected a speed signal above the crank disconnect speed specified in the settings, or has detected oil pressure above the minimum oil pressure specified in the settings or Excitation is present
 - If the genset does not start, the LCD will show 'Stopping', control the Fuel and Crank outputs accordingly, and return to READY. No retries are done.
 - If the unit loses power due to battery voltage drop during cranking, and the engine fires, then on regaining adequate battery voltage, the unit will continue to allow the engine to run. This typically ONLY happens with ETS fuel systBPC.
- RUN UP.
 - When the engine starts, the display shows 'Run Up' with a count down in seconds. This allows the engine measurement system to stabilise. Over speed and loss of speed signal are the only parameters checked during Run Up.
- WARM UP
 - Allows the engine to stabilise at full speed before going on load. Oil pressure and Over-speed are monitored. The display shows 'Warm Up' with a countdown time.
- RUNNING

- The display shows 'Running'. Operating parameters are scrolled onto the display.

To stop the genset

Push the  button briefly.

The unit will perform a stopping sequence as follows:

- **STOPPING**
 - The display will show 'Stopping' with a countdown time.
 - If ETR fuel control has been selected the Fuel output will be de-energised.
 - If ETS fuel control has been selected then the Fuel output will be energised for the Max Fuel Time or until the engine stops. The stopping process will retry if the engine fails to stop the first time. During the 'ETS Rest period' the Fuel output is deactivated.
 - The fuel output is controlled until the engine stops rotating and oil pressure decays. If the Oil Pressure has not decayed by the end of the 'Max Fuel Time', the fuel output is deactivated and the controller waits until the oil pressure has decayed, or for the remainder of the 'Stop Time'. The speed must remain at zero and the oil pressure must be below the alarm set point for the 'Stop Rest Time' before the engine is considered stopped.
 - If the genset does not stop then the alarm output is activated and 'STOP FAIL' is displayed on the LCD.
- **READY**
 - The engine has stopped and is ready to start again as required.

3. Display Operation

When the genset is running

When the genset is starting and stopping, the display shows the state of the sequence together with the time remaining before the next state will commence.

Once the genset is fully running or if the genset is stopped and in 'READY', the running parameters are displayed. This includes generator and engine parameters simultaneously on separate displays. The unit sequentially scrolls through screens as shown below :

Screen – 1

ENGINE STATUS
Ready
Manual

Screen – 2

ENGINE SPEED	
	0 RPM

Screen -3

OIL PRESSURE	
	346 Bar 346 Kg/cm²

Screen – 4

ENGINE TEMPERATURE	
	89 °C 192 °F

Screen – 5

BATTERY VOLTAGE	
	12.0 Volts
	0.0 Volts

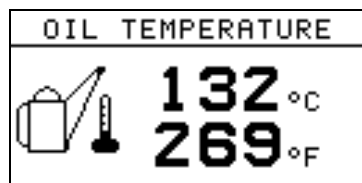
Screen – 6

FUEL STATUS	
	55% 550LTS 139Hrs

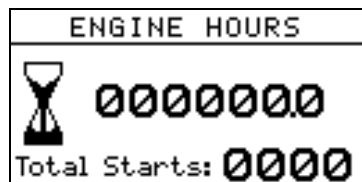
Screen – 7

CANOPY TEMPERATURE		
	59 °C	138 °F

Screen – 8



Screen – 9



Screen – 10

GEN	VOLTS	L to L
R	0	-Y 0
Y	0	-B 0
B	0	-R 0

Screen – 11

GEN	AMPS	Hertz
R	0.0	0.0
Y	0.0	0.0
B	0.0	0.0

Screen – 12

GEN	KW	KVA
R	+ 0.0	0.0
Y	+ 0.0	0.0
B	+ 0.0	0.0

Screen – 13

GEN	KVAR	PF
R	+ 0.0	+1.0
Y	+ 0.0	+1.0
B	+ 0.0	+1.0

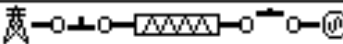
Screen – 14

GEN		Total
	KW	+ 0.0
	KVA	+ 0.0
	KVAR	+ 0.0

Screen – 15

GEN	AUG	P.F.
L→N	0	+1.0
L→L	0	Accumulated
AMP	0.0	

Screen – 16

GEN	KWHours
	00000000
	CONTACTORS
	

Then returns to start scroll

If Warnings or Alarms are present, the associated messages are included in the LCD scroll list, and are shown after the last screen has been displayed.

4. Alarms and Warnings

In the event of abnormal operating conditions the unit will issue a warning or an alarm and shut the genset down as required. The LCD shows an appropriate message indicating the nature of the condition. To draw operator attention to the condition the flashing general alarm LED is used.

In most cases, Warnings do not stop the genset and are self resetting. Alarms will normally stop the genset and require the operator to clear the alarm by pressing the Stop or Accept button. The genset can not be started if an alarm exists.

Warnings are indicated by slow flashing of the alarm LED and displaying the appropriate message on the LCD as follows.

Alarms are indicated by fast flashing of the ALARM LED and displaying the appropriate message on the bottom LCD.

Message	Function description
Oil Pressure Low	The oil pressure went below the alarm setpoint while running. Check oil level and replenish. Check for blocked oil filter.
Oil Temperature High	The oil temperature went above the alarm setpoint while the engine was running. Check for over loading. Check cooling air flows, check coolant and oil level.
Engine Temp High Coolant Temp High	The Engine / Coolant temperature went above the alarm setpoint while the genset was running.

Message	Function description
	Check for over loading. Check cooling air flows, Check coolant level.
Canopy Temp High	The Canopy Temperature went above the alarm setpoint. Check cooling air flows. Check for overloading.
Fuel Level Low	The Fuel Level is below the alarm setpoint. The engine is stopped to prevent air and dirt infiltration to the engine. Replenish the fuel.
Battery Voltage High	The battery voltage went above the setpoint. High battery voltage usually indicates that the battery charging alternator has failed and it is producing a voltage which might damage the battery, control relays or the controller. Engine shutdown is recommended to minimise the risk of damage and fire.
Under Speed	The engine was running below the under speed setpoint. Check for overloading. Check fuel system.
Over Speed	The engine was running above the setpoint. Check governor system. Check power takeoff couplings.
Hirev Alarm	The speed signal indicates the engine is grossly over speed. Check Governor system.
Coolant Level Low	The radiator water level is below the required level. The water level needs topping up.
Start Fail	The engine has failed to start. Check Fuel supply, check battery condition, check air filters.
Stop Fail	The engine has failed to stop. Check stop solenoid, check rack operation.
Belt Broken	If the belt break detector has been activated. Check the belts
Oil-P Fault	The Oil Pressure sensor system is not functioning as expected. Check oil pressure sensor and associated wiring.
Oil-T Fault	The Oil Temperature sensor system is not functioning as expected. Check oil temperature sensor and associated wiring.
Eng-T Fault	The Engine Temperature Sensor is not functioning as expected. Check engine temperature sensor and associated wiring.
Can-T Fault	The Canopy Temperature Sensor is not functioning as expected. Check the canopy temperature sensor and associated wiring.
Fuel-L Fault	The Fuel Level Sensor is not functioning as expected. Check the Fuel Level Sensor and associated wiring.
Speed Fault	The Speed Sensing system is not working as expected. Check the associated speed sensor wiring and external influences such as poorly operating battery chargers and poorly filtered UPS systBPC

Message	Function description
	connect to the load.
Speed Detected	Speed signal is unexpectedly present. Check the associated speed sensor wiring and external influences such as poorly operating battery chargers and poorly filtered UPS system connected to the load. Check electrical safety earthing system. Check associated communications networks are isolated and not part of an unexpected earth loop.
Oil Detected	Oil Pressure is unexpectedly present. Check the Oil Pressure Sensors and associated wiring. Check the Oil filter system is not blocked. Check the engine is not running with a failed speed sensing system.
E-S Lock-out	The emergency stop input has been activated. Deactivate the emergency stop input, then press the stop button to clear this alarm.
Can Door	The canopy door input has been activated and the canopy door unexpectedly open
Fire Alarm	The Fire Alarm input has been activated. The genset will be shutdown as an emergency stop. Investigate the source of the alarm then press the stop button to clear this alarm

Alarms are indicated by fast flashing of the alarm LED and displaying the appropriate message on the LCD.

Message	Function description
Oil Pressure Low	The oil pressure went below the alarm setpoint while running. Check oil level and replenish. Check for blocked oil filter.
Oil Temperature High	The oil temperature went above the alarm setpoint while the engine was running. Check for over loading. Check cooling air flows, check coolant and oil level.
Engine Temp High	The engine temperature went above the alarm setpoint while the engine was running. Check for over loading. Check cooling air flows, Check coolant level.
Canopy Temp High	The Canopy Temperature went above the alarm setpoint. Check cooling air flows. Check for overloading.
Fuel Level Low	The Fuel Level is below the alarm setpoint. The engine is stopped to prevent air and dirt infiltration to the engine. Replenish the fuel.
Battery Voltage High	The battery voltage went above the setpoint. High battery voltage usually indicates that the battery charging alternator has failed and it is producing a voltage which might damage the battery, control relays or the controller. Engine shutdown is recommended to minimise the risk of damage and fire.
Under Speed	The engine was running below the under speed setpoint.

Message	Function description
	Check for overloading. Check fuel system.
Over Speed	The engine was running above the setpoint. Check governor system. Check power takeoff couplings.
Hirev Alarm	The speed signal indicates the engine is grossly over speed. Check Governor system.
Water Level Low	The radiator water level is below the required level. The water level needs topping up.
Start Fail	The engine has failed to start. Check Fuel supply, check battery condition, check air filters.
Stop Fail	The engine has failed to stop. Check stop solenoid, check rack operation.
Oil-P Fault	The Oil Pressure sensor system is not functioning as expected. Check oil pressure sensor and associated wiring.
Oil-T Fault	The Oil Temperature sensor system is not functioning as expected. Check oil temperature sensor and associated wiring.
Eng-T Fault	The Engine Temperature Sensor is not functioning as expected. Check engine temperature sensor and associated wiring.
Can-T Fault	The Canopy Temperature Sensor is not functioning as expected. Check the canopy temperature sensor and associated wiring.
Fuel-L Fault	The Fuel Level Sensor is not functioning as expected. Check the Fuel Level Sensor and associated wiring.
Speed Fault	The Speed Sensing system is not working as expected. Check the associated speed sensor wiring and external influences such as poorly operating battery chargers and poorly filtered UPS systBPC connect to the load.
Speed Detected	Speed signal is unexpectedly present. Check the associated speed sensor wiring and external influences such as poorly operating battery chargers and poorly filtered UPS systBPC connected to the load. Check electrical safety earthing systBPC. Check associated communications networks are isolated and not part of an unexpected earth loop.
Oil Detected	Oil Pressure is unexpectedly present. Check the Oil Pressure Sensors and associated wiring. Check the Oil filter system is not blocked. Check the engine is not running with a failed speed sensing system.
E-S Lock-out	The emergency stop input has been activated. Deactivate the emergency stop input, then press the stop button to clear this alarm.
Fire Alarm	The Fire Alarm input has been activated. The genset will be shutdown as an emergency stop. Investigate the source of the alarm then press the stop button to clear this alarm

Message	Function description
A-S Lock-out	If the Stop button is pressed while running in auto mode, it is considered an emergency stop and the unit will stop the engine and enter the Autostart Lockout state. This prevents the engine from starting again, while the Autostart input remains activated. The Autostart Lockout state is self resetting upon deactivation of the Autostart input. If the engine was stopped for a real emergency, then the emergency stop switch should also be activated to ensure the engine will not start inadvertently. If the unit is in the Autostart Lockout state, the engine can be restarted by pressing the Start button. This is not considered a manual start but rather a release from the Autostart Lockout condition. The contactors will be controlled in the appropriate way.
AGF Phase Reversal	The generator has a phase reversal or the wiring is incorrect
AGF Low V1 Volts	Voltage on Alternator Phase V1 is Low
AGF Low V2 Volts	Voltage on Alternator Phase V2 is Low
AGF Low V3 Volts	Voltage on Alternator Phase V3 is Low
AGF High V1 Volts	Voltage on Alternator Phase V1 is High
AGF High V2 Volts	Voltage on Alternator Phase V2 is High
AGF High V3 Volts	Voltage on Alternator Phase V3 is High
AGF High Frequency	Alternator frequency is high
AGF Low Frequency	Alternator frequency is low

5. Inputs Electrical Specification

Input	Type	Comment
Battery + Volts	Power	Nominal 12VDC or 24VDC or Station Battery Supply Max 6-36VDC
0V Common	Power	0VDC, Common
Fuel Level Sensor	Analog/Digital	Suitable for either resistive or switch C.O.F senders
Coolant Temperature Sensor	Analog/Digital	Suitable for either resistive or switch C.O.F. senders
Canopy Temperature	Analog/Digital	Suitable for analog use with BPC08 temperature sensor or switch C.O.F input
Oil Pressure Sensor	Analog	Suitable for either resistive or switch senders. Optionally for protection or display only.
Oil Temperature Sensor	Analog/Digital	Suitable for either resistive or switch C.O.F senders
Low Water Level	Digital	Suitable for probe or switch input. Open Circuit = Active
Autostart	Digital	Suitable for switch input. Connect to 0V = Active

Input	Type	Comment
Emergency Stop	Digital	Suitable for switch input. Connect to 0V = Active
Oil Pressure Switch	Digital	Used for backup Oil Pressure protection. Configurable for N.O or N.C. operation
Digital Input 1	Digital	Suitable for switch input. Connect to 0V = Active
Digital Input 2	Digital	Suitable for switch input. Connect to 0V = Active
Digital Input 3	Digital	Suitable for switch input. Connect to 0V = Active
Digital Input 4	Digital	Suitable for switch input. Connect to 0V = Active
Excitation	Internal	High Impedance input
Battery Voltage	Internal	High Impedance
GL1	Voltage	Generator Phase 1 Volts Max 350VRMS
GL2	Voltage	Generator Phase 2 Volts Max 350VRMS
GL3	Voltage	Generator Phase 3 Volts Max 350VRMS
GN	Voltage	Generator Neutral Max 350VRMS
I1	Amps	Phase 1 Amps CT Loop Max 5A peak
I2	Amps	Phase 2 Amps CT Loop Max 5A peak
I3	Amps	Phase 3 Amps CT Loop Max 5A peak
I Com		Common CT connection for S1 terminals.
SPA	Voltage	Speed A magnetic pickup input 3V – 70V peak at >500 to 10KHz Speed A Battery Alternator input 2V to 70V peak at 20Hz to 1KHz
SPB	Voltage	Speed B magnetic pickup input 3V – 70V peak at >500 to 0KHz Speed B Battery Alternator input. Connect to common.
SPCom	Voltage	Speed Common 0VDC

6. Outputs Electrical Specification

Output	Type	Comment
Excitation	Current	200mA burst mode pulsed current controlled output.
Fuel Solenoid	Open Drain	300mA Open Drain protected coil drive. Max 36VDC This output is used to maintain the fuel solenoid activated for running or stopping duty.
Crank	Open Drain	300mA Open Drain protected coil drive. Max 36VDC This output is used to control the crank relay coil. The crank relay should be sized for the crank contactor current. It is recommended that the crank relay is located in the wiring loom near to the starter motor. This position removes the need for high current wiring to the control box and thus leads to lower cost.
Contactor A	Open Drain	300mA Open Drain protected coil drive. Max 36VDC This output is used to switch the load from the mains.
Contactor B	Open Drain	300mA Open Drain protected coil drive. Max 36VDC This output is used switch the load to the generator.
Hooter	Open Drain	300mA Open Drain protected coil drive. Max 36VDC This output is used for an external sounder or horn.
Common Alarm	Open Drain	300mA Open Drain protected coil drive. Max 36VDC
Spare	Open Drain	300mA Open Drain protected coil drive. Max 36VDC

7. Load Transfer and Contactor Operation

The unit provides for both Mains and Generator contactor control even though in many applications this function will not be used, instead an MCB is used to switch the generator to and from the load. Contactor outputs are controlled in both Manual and Auto operating modes.

The Mains contactor output is controlled to deactivate the Mains contactor when the start button is pressed or the autostart input is activated. The time of opening can be selected to respond immediately on an autostart input or a start button press. It can also be delayed or when the genset is running and able to take load.

The Generator contactor output will activate only after the Mains contactor has opened and only when the genset able to take load. The timing is controlled by the XFR DELAY configuration setting.

If the genset was started by activating the Autostart input, then deactivating the input will move the sequence to the "Cool Down" state. During cool down the Generator contactor output is deactivated and after a delay the Mains Contactor output is controlled to re-activate the Mains contactor.

Load transfer can also be initiated with the use of the 'Mains Transfer' and 'Genset Transfer' buttons which will initiate a transfer sequence in accordance with configuration parameters.

8. Speed Sensing

The unit can obtain speed information from one of four sources.

- Magnetic pickup unit
- Battery charging flywheel magneto
- Generator output 50/60Hz if used for genset control
- Battery charging alternator

MPU

The magnetic pickup unit usually counts teeth on the flywheel and is mounted in the bell housing. It is important to ensure the gap between the MPU face and the teeth is 1mm to 2mm, as this distance greatly affects the output of the MPU. The unit requires a minimum of 3VRMS at low speed to ensure proper crank disconnect. Setup requires calculating the number pulses per 10 revolutions and the calculated number is then entered into the menu system "Cal Value".

Calculate: Number of Teeth x 10 = Speed Pulses Per 10 Revolutions.

Eg: 125 teeth x 10 = 1250.

Enter the number 1250.

Generator

If the unit is used in a genset application the speed source can be the generator 50/60 Hz output and is connected internally within the unit from the AC input connectors. AC should not be connected directly to the speed MPU / Magneto input. For correct crank disconnect the generator must be providing a detectable output at low speed and therefore the voltage at 300 RPM must be greater than 40VRMS. This can be affected by the AVR and must be confirmed to provide suitable signals and timing for proper crank disconnect.

For setup the number of pulses per 10 revolutions must be calculated and entered into the menu system "Cal Value". The generator output frequency and standard RPM must be known.

Calculate Speed Calibration value as follows:

Cal Value = (Freq x 600) / RPM.

Eg: (50Hz x 600) / 1500 = 20

Enter the number 20.

9. Set-up

In the factory environment the unit can be setup by the BPC Cloning Utility or by the BPC Windows setup utility. In the field, adjustments to the unit can be made using the buttons on the front panel.

The BPC Windows setup utility and the BPC Cloning options are detailed elsewhere and only the field adjustment method is discussed here.

To enter set-up, when the unit is showing "Ready", press and hold the  button for 20 seconds. When the unit enters set-up mode the bottom LCD will show "Setup" and optionally request a PIN number if this option is enabled.

Navigating in the setup menu

The setup menu comprises a range of columns where each column comprises of a list of itBPC and each item has a range of settable values.

Column Headings are as follows.

System	Engine	Timers	Con A	Start/Stp	AC Setup	
AGF Setup	Testing	Manual			I/O Config	Comms
Log Viewer						

The  button is used to select the previous column, Item, or to increment a value.



The button is used to select the next column, item, or to decrement a value.



The button changes from Column to item to value editor.



The button changes from Item to column and exit setup mode.



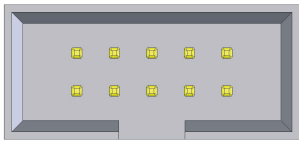
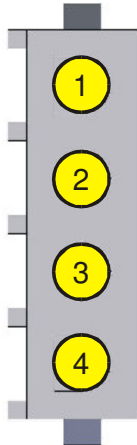
The button is used to accept value changes.

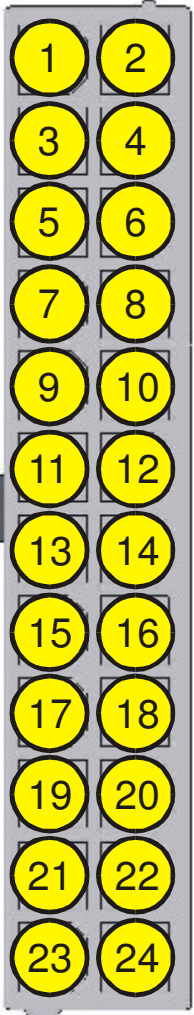
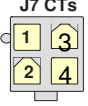
Setup mode automatically terminates if no button is pressed for 60 seconds, or when you press the



button with the column headers list visible.

Connector Detail

Connector Assignment	Connection Information	
J1: Data Port 	Programming and Auxiliary Unit data port. NB: Connect ONLY manufacturer approved equipment to this port	
J2: DC Power Supply 	Pin	Connection
	1	Common –ve. (<i>Note 1</i>)
	2	Battery +ve. (<i>Note 2</i>)
J4: Alternator AC Input 	Pin	Connection
	1	Alternator AC Phase 1 (Red)
	2	Alternator AC Phase 2 (Yellow)
	3	Alternator AC Phase 3 (Blue)
	4	Alternator AC Neutral

J6: I/O 	<table> <tr> <th>Pin</th><th>Connection</th></tr> <tr><td>1</td><td>Water Level Input</td></tr> <tr><td>2</td><td>Fuel Level Input</td></tr> <tr><td>3</td><td>Engine Temperature Input</td></tr> <tr><td>4</td><td>Canopy Temperature Input</td></tr> <tr><td>5</td><td>Oil Pressure Input</td></tr> <tr><td>6</td><td>Oil Temperature Input</td></tr> <tr><td>7</td><td>Auto Start Input</td></tr> <tr><td>8</td><td>Emergency Stop Input</td></tr> <tr><td>9</td><td>Oil Pressure Switch Input</td></tr> <tr><td>10</td><td>I/P1 VBelt Input</td></tr> <tr><td>11</td><td>I/P2 Bypass Input</td></tr> <tr><td>12</td><td>I/P4 Canopy Door Input</td></tr> <tr><td>13</td><td>I/P3 Fire Alarm Input</td></tr> <tr><td>14</td><td>I/P5 User Definable Input</td></tr> <tr><td>15</td><td>Inputs Common (0V)</td></tr> <tr><td>16</td><td>Preheat Output</td></tr> <tr><td>17</td><td>Fuel Solenoid Output</td></tr> <tr><td>18</td><td>Crank Output</td></tr> <tr><td>19</td><td>Idle Output</td></tr> <tr><td>20</td><td>Contactor A Output</td></tr> <tr><td>21</td><td>Contactor B Output</td></tr> <tr><td>22</td><td>Sounder Output</td></tr> <tr><td>23</td><td>Excitation Output</td></tr> <tr><td>24</td><td>Outputs Common (0V)</td></tr> </table>	Pin	Connection	1	Water Level Input	2	Fuel Level Input	3	Engine Temperature Input	4	Canopy Temperature Input	5	Oil Pressure Input	6	Oil Temperature Input	7	Auto Start Input	8	Emergency Stop Input	9	Oil Pressure Switch Input	10	I/P1 VBelt Input	11	I/P2 Bypass Input	12	I/P4 Canopy Door Input	13	I/P3 Fire Alarm Input	14	I/P5 User Definable Input	15	Inputs Common (0V)	16	Preheat Output	17	Fuel Solenoid Output	18	Crank Output	19	Idle Output	20	Contactor A Output	21	Contactor B Output	22	Sounder Output	23	Excitation Output	24	Outputs Common (0V)
Pin	Connection																																																		
1	Water Level Input																																																		
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10	I/P1 VBelt Input																																																		
11	I/P2 Bypass Input																																																		
12	I/P4 Canopy Door Input																																																		
13	I/P3 Fire Alarm Input																																																		
14	I/P5 User Definable Input																																																		
15	Inputs Common (0V)																																																		
16	Preheat Output																																																		
17	Fuel Solenoid Output																																																		
18	Crank Output																																																		
19	Idle Output																																																		
20	Contactor A Output																																																		
21	Contactor B Output																																																		
22	Sounder Output																																																		
23	Excitation Output																																																		
24	Outputs Common (0V)																																																		
J7 Current Transformers 	<table> <tr> <th>CT</th><th>Use</th></tr> <tr> <td>1</td><td>Phase 1 Current (Red)</td></tr> <tr> <td>2</td><td>Phase 2 Current (Yellow)</td></tr> <tr> <td>3</td><td>Phase 3 Current (Blue)</td></tr> </table>	CT	Use	1	Phase 1 Current (Red)	2	Phase 2 Current (Yellow)	3	Phase 3 Current (Blue)																																										
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Notes:

1. *This connection must be made directly to the engine crankcase for lowest electrical noise. This connection must not have currents other than the controller currents flowing and must be used exclusively for the controller.*
2. *This connection must be made directly to the positive terminal of the battery for best performance. Do not make this connection to the positive terminal on the Starting Motor.*

10. Trouble shooting

The unit displays the following messages when an alarm occurs. Alarms shut down the engine, set the alarm output and flash the alarm indicator. The alarm indications can be cleared after the genset has stopped, by pressing the stop button. The hooter can be silenced with the Hooter Button.

Message	Cause
Low Oil Pressure	Oil pressure has not reached the Oil Alarm set point (Oil Alarm) at the end of the run up time or has dropped below this value when the engine is running.
Low Fuel Level	Fuel level is less than the minimum value set point.
High Engine Temp High Water Temp	Engine temperature has exceeded the high temperature set point. The temperature icon turns on. Either message may also be shown depending on temperature system setup.
High Oil Temperature	Oil temperature has exceeded the high temperature set point. The oil pressure icon turns on.
Low Water Level	Water Level is below the water level very low level.
Under speed	Engine speed has dropped below the under speed set point.
Over speed	Engine speed has exceeded over speed set point.
High Rev	Engine has exceeded safe operating speed.
No Speed Signal	Engine has lost speed signals while running.
Start Failure	The engine has failed to start.
Stop Failure	The engine has failed to stop.
E-S Lock out	The emergency stop input has stopped the engine.
Oil Pressure Flt	The unit has detected that the Oil Pressure sender has become open circuit. Normally this indicates a faulty sender or broken wiring. This will only shut down when the Oil System is set to Sender.
Engine Temp Flt	The unit has detected that the engine temperature has not risen to 50 degrees within the first 5 minutes of running or the temperature sensor has shorted to common. Normally this indicates a faulty temperature sender or broken wiring.
Oil Temp Flt	The unit has detected that the Oil temperature sender has become open circuit.
High Canopy Temp	The unit has detected a high canopy temperature.

The following warning messages indicate potential problems. When a warning occurs, the message associated with the warning is displayed. Warnings clear automatically when the warning condition is cleared.

Message	Cause
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No Excitation	Excitation voltage is low when engine is running. This indicates a probable charging fault or the alternator belt has broken.
Low Charge Volts	Battery Voltage is below the charging voltage setpoint when the engine is running. Indicates that the alternator is not charging the battery.
Under Voltage	Battery Voltage is below the low battery setpoint.
Over Voltage	Battery Voltage is above the high battery volts setpoint. This may be due to a faulty regulator or battery charger.
Oil Lock Out	The unit has detected that the oil pressure is above the oil pressure alarm setpoint with the engine not running. This warning prevents the engine from attempting to crank with the engine potentially running. This may be due to a faulty oil sender or a very tight engine. This warning is disabled if Oil Pressure Check before Cranking is set to Off.
Tacho Lock Out	The unit has detected that a speed signal is present with the engine not running. This warning prevents the engine from attempting to crank with the engine potentially running. This warning can sometimes be caused by ripple generated by mains powered battery chargers.
Excite Lock Out	The unit has detected that Excitation is present with the engine not running. This warning prevents the engine from attempting to crank with the engine potentially running. This warning can sometimes be caused by ripple generated by mains powered battery chargers.
AutoStart On	The unit has detected an Autostart signal when not in auto mode, indicating the engine needs to be started in Auto mode.
Low Oil Pressure	The Oil Pressure has dropped below the Oil Pressure Warning set point while the engine is running. The Oil Pressure Icon is lit.
High Engine Temp	Engine temperature has exceeded the high temperature warning set point after the Temperature monitoring delay has expired.
High Canopy Temp	Canopy Temperature has exceeded the high canopy temperature setpoint after the Temperature monitoring delay has expired.
Low Fuel Level	Fuel level is less than the warning set point.
Fuel Level Flt	The unit has detected that the fuel sender is open circuit. This is only a warning, and will not shut down the engine
Can Temp Flt	The unit has detected that the canopy temperature sender is open circuit or has shorted to common.
No Speed Signal	A speed signal could not be detected after the engine had started
Maintenance	The time since the last maintenance has exceeded the maintenance time. The alarm output is not activated for this warning. The warning is cleared by pressing and holding the  button for 30 seconds. If the engine maintenance is carried out prior to the timer expiring, pressing the  button for 60 seconds will reset the timer.