Deep Sea Electronics Plc

5120 AUTOMATIC MAINS FAILURE MODULE OPERATING MANUAL

Author: Anthony Manton

Deep Sea Electronics Plc
Highfield House
Hunmanby
North Yorkshire
YO14 0PH
England

Tel: +44 (0) 1723 890099
Fax: +44 (0) 1723 893303
email: Sales@Deepseaplc.com

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1 INTRODUCTION

The **DSE 5120** automatic mains failure module has been designed to allow the OEM to meet increasing demand for functionality with the genset industry. It has been primarily designed to start and stop the generator depending upon the mains supply status. External autostart from a switch and user operated manual start is also provided. Additionally, the user has the facility to view all the system operating parameters via the LCD display.

The **DSE 5120** module monitors the engine, indicating the operational status and fault conditions automatically shutting down the engine and giving a true first up fault condition of an engine failure by a flashing COMMON ALARM LED. Exact failure mode information is indicated by the LCD display on the front panel.

The powerful Microprocessor contained within the module allows for a range of demanding features to be incorporated as standard:

- *Graphical Icon based LCD display (excluding the need for translations and languages).*
- *Engine parameter monitoring and instrumentation.*
- *Generator Voltage, Frequency & Current instrumentation.*
- *Mains failure monitoring and LED indication of status.*
- *Fully configurable inputs for use as alarms or a range of different functions.*
- *Extensive range of output functions using built in relay outputs.*
- *'Front panel' configuration of ALL (V4) operating parameters.*
- *PC configurable using 5xxx configuration software for Windows™ and P810 interface module.*

The module is housed in a robust plastic case for front panel mounting. Connections to the module are via locking plug and sockets.

2 CLARIFICATION OF NOTATION USED WITHIN THIS PUBLICATION.

NOTE:	**Highlights an essential element of a procedure to ensure correctness.**
CAUTION!	**Indicates a procedure or practice which, if not strictly observed, could result in damage or destruction of equipment.**
WARNING!	**Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.**
©	**Deep Sea Electronics Plc owns the copyright to this manual, which cannot be copied, reproduced or disclosed to a third party without prior written permission.**
CE	**Compliant with BS EN 60950 Low Voltage Directive** **Compliant with BS EN 61000-6-4 EMC Directive** **Compliant with BS EN 61000-6-2 EMC Directive**
	Year 2000 Compliant

3 OPERATION

The following description details the sequences followed by a module containing the standard '*factory configuration*'. Always refer to your configuration source for the exact sequences and timers observed by any particular module in the field.

3.1 AUTOMATIC MODE OF OPERATION

This mode is activated by pressing the AUTO pushbutton. An LED indicator beside the button confirms this action.

When the mains supply fails (or **Remote Start** signal (if configured) is applied) the following sequence is initiated:-

The mains available LED extinguishes (if the sequence was started by mains failure) and the relevant mains over/under voltage LED will illuminate.

The **Remote Start Active** indicator illuminates if the sequence is started by the remote start input.

To allow for short term mains supply brownouts or false start signals the Start Delay timer is initiated. After this delay, if the pre-heat output option is selected then the pre-heat timer is initiated, and the corresponding auxiliary output (if configured) will energise.

NOTE:- If the Remote Start signal is removed (or the mains supply returns if the start sequence was started by mains failure) during the Start Delay timer, the unit will return to a stand-by state.

After the above delays the **Fuel Solenoid** is energised, then one second later, the **Starter Motor** is engaged.

The engine is cranked for a pre-set time period. If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Should this sequence continue beyond the set number of attempts (fixed at 3), the start sequence will be terminated and

Fail to Start fault will be displayed accompanied by a flashing shutdown symbol.

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency from the Alternator output. Alternatively a Magnetic Pickup mounted on the flywheel housing can be used for speed detection (This is selected using the front panel editor or PC).

After the starter motor has disengaged, the **Safety On** timer is activated, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.
Once the engine is running, the **Warm Up** timer, if selected is initiated, allowing the engine to stabilise before accepting the load.
If the mains supply returns (or the remote start signal is removed if the start sequence was initiated by remote start), before the warm up timer has expired, the mains supply is kept on load and the return timer will begin.

At the end of the warming timer, If the mains supply is still failed, or the remote start signal is still active, the load is transferred to the generator - First the mains load switching device is opened, then ¾ second later, the **close generator** output is activated.

NOTE:-A load transfer will not be initiated until the Oil Pressure has risen. Thus preventing excessive wear on the engine.

On return of the mains supply the mains in limit LED will illuminate, and the under/overvolts LEDs will extinguish. Additionally (or upon removal of the **Remote Start** signal if the start was initiated by remote start), the **return** delay timer is initiated after which the **load Transfer** signal is de-energised, removing the load. ¾ second later, the mains load switch is closed, returning the mains on load.

If the generator set has been on load, The **Cooling** timer is then initiated, allowing the engine a cooling down period off load before shutting down.
Once the **Cooling** timer expires the **Fuel Solenoid** is de-energised, bringing the generator to a stop.

Should the mains supply fail, or **Remote Start** signal be re-activated during the cooling down period, the set will return on load.

NOTE:- If the set does not take load, the Cooling Timer is bypassed as there is no requirement to allow the set to cool before stopping.

3.2 MANUAL OPERATION

To initiate a start sequence in **MANUAL**, press the  pushbutton. When the controller is in the manual mode (indicated by an LED indicator beside the button), pressing the **START** (I) button will initiate the start sequence.

NOTE:- There is no Start Delay in this mode of operation.

If the **pre-heat** output option is selected this timer is then initiated, and the auxiliary output selected is energised.

After the above delay the **Fuel Solenoid** is energised, then the **Starter Motor** is engaged.

The engine is cranked for a pre-set time period. If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Should this sequence continue beyond the set number of attempts (fixed at 3), the start sequence will be terminated and

Fail to Start  fault will be displayed accompanied by a flashing shutdown  indicator.

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency from the Alternator output. Alternatively a Magnetic Pickup mounted on the flywheel housing can be used for speed detection (This is selected using the front panel editor or PC).
After the starter motor has disengaged, the **Safety On** timer is activated, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.

Once the engine is running, the **Warm Up** timer, if selected is initiated, allowing the engine to stabilise before it can be loaded.

The generator will run off load, unless the mains supply fails, or a **Remote Start** signal is applied.
The generator will continue to run **On** load regardless of the state of the mains supply and/or remote start input until the **Auto** mode is selected, the **Stop** button is pressed, or an electrical trip or shutdown alarm is detected.

Selecting **STOP (O)** de-energises the **FUEL SOLENOID**, bringing the generator to a stop.

3.3 TEST OPERATION

To enter **TEST** mode, press the  pushbutton, this will be confirmed by the LED indicator beside the button. Pressing the **START** (I) button will initiate the start sequence.

NOTE:- There is no Start Delay in this mode of operation.

If the **pre-heat** output option is selected this timer is then initiated, and the auxiliary output selected is energised.

After the above delay the **Fuel Solenoid** is energised, then the **Starter Motor** is engaged.

The engine is cranked for a pre-set time period. If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Should this sequence continue beyond the set number of attempts (fixed at 3), the start sequence will be terminated and

Fail to Start  fault will be displayed accompanied by a flashing shutdown  indicator.

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency from the Alternator output. Alternatively a Magnetic Pickup mounted on the flywheel housing can be used for speed detection (This is selected using the front panel editor).
After the starter motor has disengaged, the **Safety On** timer is activated, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.

Once the engine is running, the **Warm Up** timer, if selected is initiated, allowing the engine to stabilise before it can be loaded.

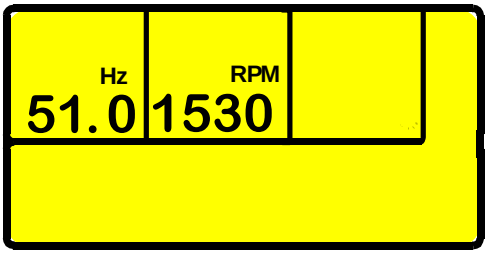
The load will be transferred automatically to the generator.
The generator will continue to run **On** load regardless of the state of the mains supply and/or remote start input until the **Auto** mode is selected, the **Stop** button is pressed, or an electrical trip or shutdown alarm is detected.

Selecting **STOP (O)** de-energises the **FUEL SOLENOID**, bringing the generator to a stop.

4 PROTECTIONS

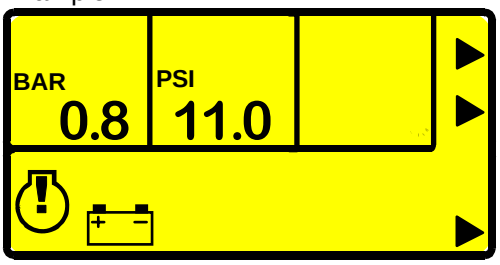
The module will indicate that an alarm has occurred in several ways;

The “Common alarm” LED will illuminate (**Warning** = *Red steady*, **Shutdown** = *Red Flashing)*	
If appropriate, the LCD display or LED indicators will display the appropriate alarm icon i.e. for battery charging failure :	



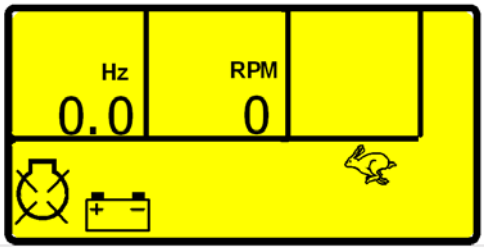
If no alarms are present the LCD will extinguish any alarm icons.

In the event of a warning alarm the LCD will display the appropriate icon. If a shutdown then occurs the module will display the appropriate icon. The original warning alarm icon will remain displayed.
Example:-



Charge alternator warning (all symbols steady)

Followed by….



Charge alternator warning indicator still present, common alarm indicator has changed to a shutdown symbol and is now flashing.
Also present is the flashing overspeed LED.

Overspeed and Shutdown alarm Icons are displayed flashing. The original warning will remain displayed as long as the triggering conditions remain. Any subsequent warnings or shutdowns that occur will be displayed steady, therefore only the first-up shutdown will appear flashing.

4.1 WARNINGS

Warnings are non-critical alarm conditions and do not affect the operation of the generator system, they serve to draw the operators attention to an undesirable condition.

In the event of a warning alarm the LCD will display:-

BATTERY CHARGE FAILURE, if the module does not detect a voltage from the warning light terminal on the auxiliary charge alternator the  icon will illuminate.

FAIL TO STOP, If the module detects the engine is still running when the 'Fail to stop timer' expires, then the module will display:-

NOTE:- 'Fail to Stop' could indicate a faulty oil pressure sender - If engine is at rest check oil sender wiring and configuration.

AUXILIARY INPUTS, if an auxiliary input has been configured as a warning the appropriate LCD segment will be displayed:-

4.2 SHUTDOWNS

Shutdowns are latching and stop the Generator. The alarm must be cleared, and the fault removed to reset the module.

In the event of a shutdown alarm the LCD will display:-

 (flashing).

The appropriate icon will also be displayed flashing

NOTE:- The alarm condition must be rectified before a reset will take place. If the alarm condition remains it will not be possible to reset the unit (The exception to this is the Low Oil Pressure alarm and similar 'delayed alarms', as the oil pressure will be low with the engine at rest). Any subsequent warnings or shutdowns that occur will be displayed steady, therefore only the first-up shutdown will appear flashing.

FAIL TO START, if the engine does not fire after the pre-set number of attempts has been made a shutdown will be initiated.

The  icon will illuminate.

EMERGENCY STOP, removal of the **Positive DC** Supply from the Emergency Stop input initiates the following sequence, firstly it will initiate a controlled shutdown of the Generator and prevent any attempt to restart the Generator until the Emergency Stop push-button has been reset. Secondly it removes the **Positive DC** supply from both the Fuel Solenoid and Starter Solenoid.

The  icon will illuminate.

NOTE:- The Emergency Stop Positive signal must be present otherwise the unit will shutdown.

LOW OIL PRESSURE, if the module detects that the engine oil pressure has fallen below the low oil pressure trip setting level after the **Safety On** timer has expired, a shutdown will occur.

The  icon will illuminate.

HIGH ENGINE TEMPERATURE if the module detects that the engine coolant temperature has exceeded the high engine temperature trip setting level after the **Safety On** timer has expired, a shutdown will occur.

The  icon will illuminate.

OVERSPEED / OVERFREQUENCY, if the engine speed exceeds the pre-set trip a shutdown is initiated.

The  icon will illuminate.

Overspeed is not delayed, it is an **immediate shutdown**.

NOTE:- During the start-up sequence the overspeed trip logic will allow for a small amount of overshoot. This temporarily raises the overspeed trip point during the safety delay timer. This is used to prevent nuisance tripping on start-up.

UNDERSPEED / UNDERFREQUENCY, if the engine speed falls below the pre-set trip after the Safety On timer has expired, a shutdown is initiated.

The  icon will illuminate.

OIL PRESSURE SENDER OPEN CIRCUIT, if the module detects a loss of signal from the oil pressure sender (open circuit) a shutdown is initiated. The LCD will indicate:-

 (Steady) (And '-----' on the engine oil pressure instrument). Sender failure is not delayed, it is an **immediate shutdown**.

AUXILIARY INPUTS, if an auxiliary input has been configured as a shutdown the appropriate LCD segment will be displayed:-

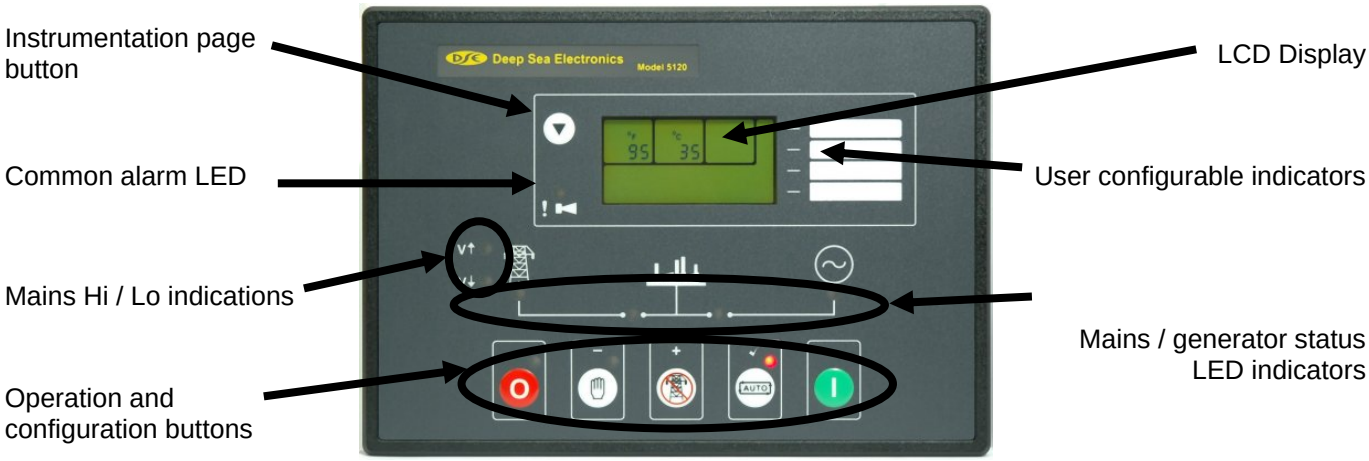
LOSS OF SPEED SIGNAL, if the speed sensing signal is lost during cranking, a shutdown is initiated.

The  icon will illuminate (Steady). As engine speed cannot be determined, the entire "fail to stop" timer is observed before the alarm can be reset and the engine restarted.

NOTE:- This will only occur if the speed sensing signal is lost during cranking or during the safety on timer. If the signal is lost during normal operation the Generator will shutdown with an Under-speed alarm.

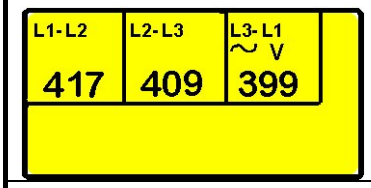
5 DESCRIPTION OF CONTROLS

The following section details the function and meaning of the various controls on the module.



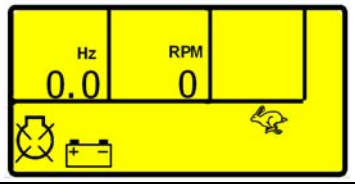
5.1 TYPICAL LCD DISPLAY SCREENS

INSTRUMENTS



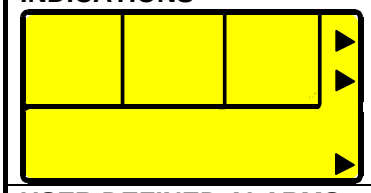
The LCD displays the various engine parameters such as **'ENGINE SPEED'**, **'OIL PRESSURE', 'HOURS RUN'**, etc. Each instrument is displayed with the appropriate units of measure. In this example, the values being displayed are Generator phase to phase AC ~ voltages V.

ALARM ICONS



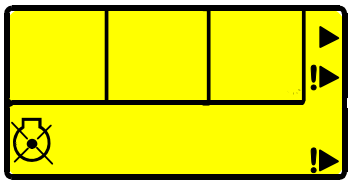
The LCD also displays the exact nature of any alarm condition that may have occurred such as **LOW OIL PRESSURE** using appropriate icons. This allows very specific alarm conditions to be brought to the operators' attention. Refer to the 'Protections' section of this manual for details of the alarms.

USER DEFINED INDICATIONS



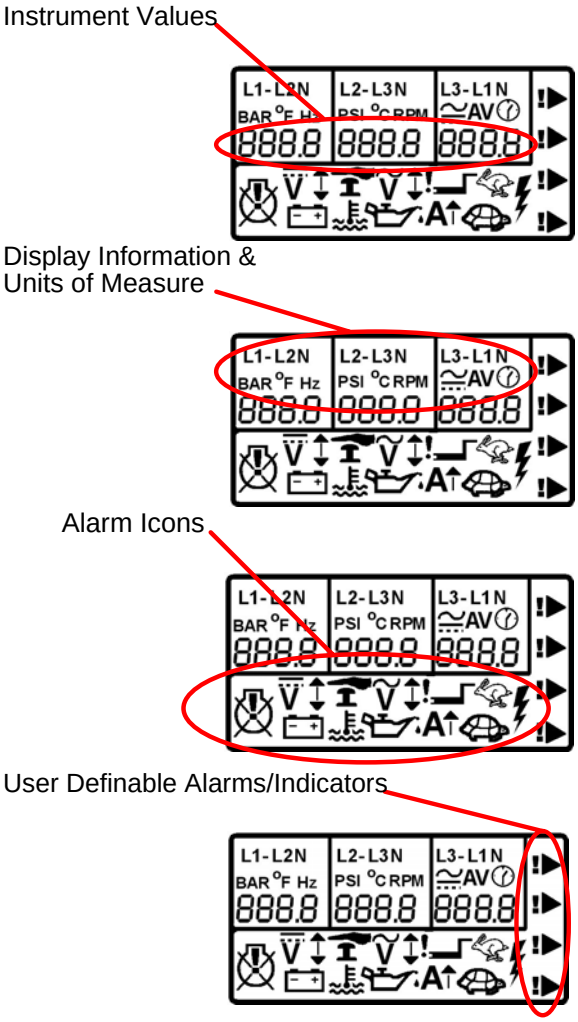
The LCD displays the user-defined indications when configured and active. The icons will illuminate and point to the appropriate text insert label. These indications can be used to indicate internal states (i.e. Engine Running, Safety On, etc).

USER DEFINED ALARMS



The LCD displays the user-defined alarms when configured and active. The icons will illuminate and point to the appropriate text insert label. These alarms can be used to indicate the operation of external alarms (i.e. 'Low Fuel Level', 'Low Coolant level' etc) or to indicate internal alarms (i.e. Fail to Stop, MPU fault, etc).

5.2 LCD DISPLAY AREAS



NOTE:- The Engine Hours Run counter will only display the accumulated hours to the nearest 12 Minutes (0.2Hr). The accumulated time will be recorded in HH:MM however.

CAUTION!:-If the DC supply to the module is interrupted the hours run counter will not remember any 'undisplayed' minutes accumulated since the last 12 Minute display update.
i.e.
10 Hours 38 Minutes accumulated before DC supply is removed…
(10.6 Hours displayed)
would become …10 Hours 36Minutes on restoration of DC supply.
(10.6 Hours still displayed)
This will only occur in the event of a total DC supply break and will NOT occur if the module is simply switched to the Stop/Reset position.

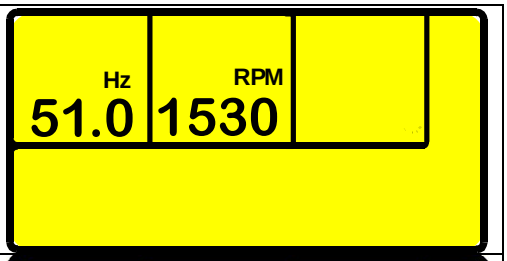
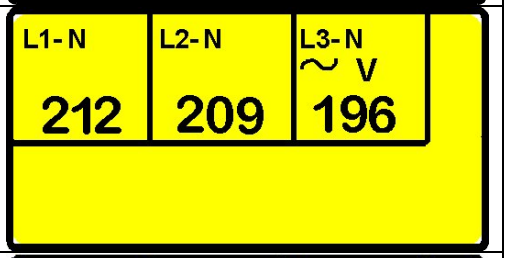
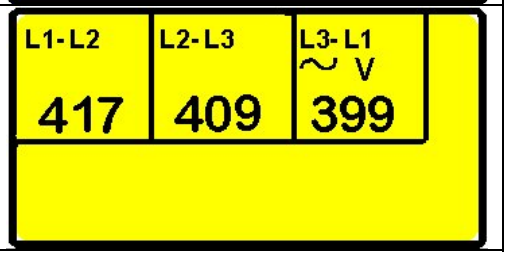
5.3 VIEWING THE INSTRUMENTS

It is possible to manually scroll to display the different instruments by repeatedly operating the scroll button. Once selected the instrument will remain on the LCD display until the user selects a different instrument or after a period of inactivity the module will revert to the initial display (Hz/RPM).

Instrument Page Order:-

- *Frequency / RPM*
  AC Voltage Line-Neutral
- *AC Voltage Line-Line*
- *AC Line Current*
- *Oil Pressure*
- *Coolant temperature*
- *Engine Hours Run*
- *DC Battery Voltage*

Manually Selecting an Instrument

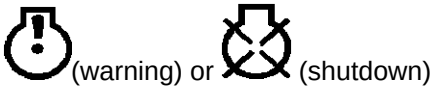
Initial display (Hz/RPM)		
Pressing the **DOWN** button the LCD will then show (Generator L-N voltages)		
Pressing the **DOWN** button the LCD will then show (Generator L-L voltages)		

Pressing the  button again will scroll through each individual instrument eventually returning to the original instrument displayed.

NOTE:-Once selected the instrument will remain on the LCD display until the user selects a different instrument or after a period of inactivity the module will revert to the initial display.

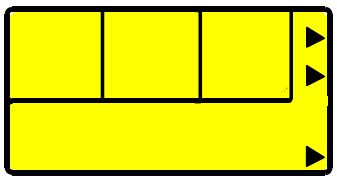
5.4 INDICATORS

COMMON ALARM LCD indicators
These indicate when an alarm condition is present. The Alarm icons or LEDs will detail the exact nature of the alarm.

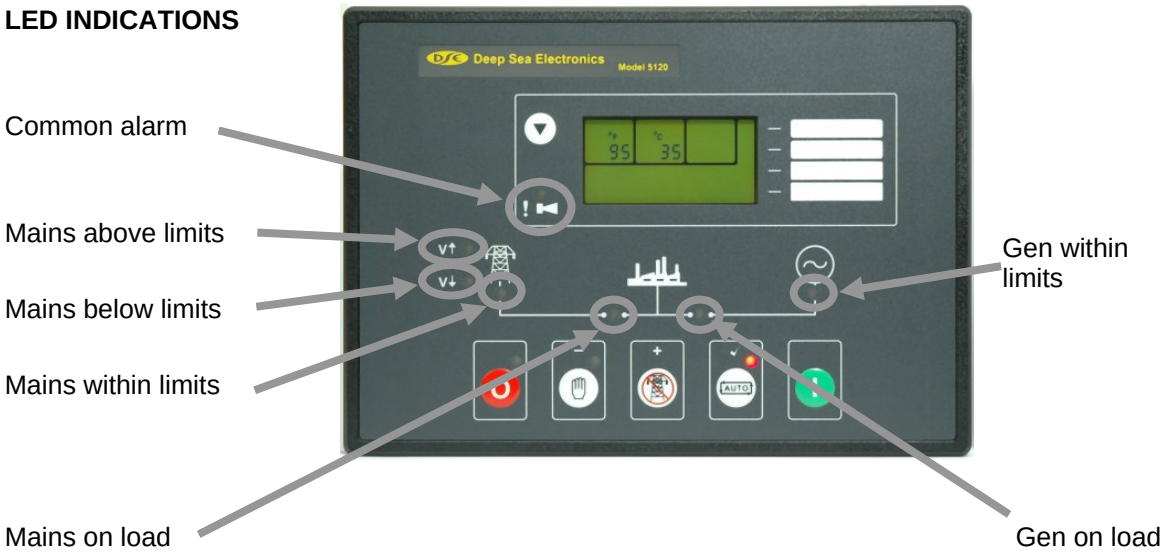

(warning) or (shutdown)

USER CONFIGURABLE LCD INDICATORS
These LCD's can be configured by the user to indicate any on of the ***different functions*** based around the following:-

- **WARNINGS** and **SHUTDOWNS** - Specific indication of a particular warning or shutdown condition, backed up by LCD indication (!)- *Such as Low Oil Pressure Shutdown, Low Coolant level, etc.*
- **STATUS INDICATIONS** - Indication of specific functions or sequences derived from the modules operating state - *Such as Safety On, Pre-heating, Generator Available, etc.*



LED INDICATIONS

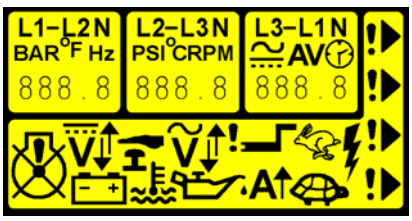


5.5 CONTROLS

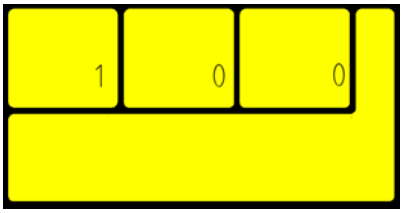
STOP/RESET This button places the module into its **Stop/reset** mode. This will clear any alarm conditions for which the triggering criteria have been removed. If the engine is running and this position is selected, the module will automatically instruct the changeover device to unload the generator *('**Load transfer**' becomes inactive (if used))*. The fuel supply will be removed and engine will be brought to a standstill. Should a **remote start signal** be present while operating in this mode, a remote start will not occur.	O
MANUAL This mode is used to allow manual control of the generator functions. Once in **Manual mode** the module will respond to the start (I) button and start the engine and run off load. If the engine is running off-load in the **Manual mode** and either **remote start signal** becomes present or the mains supply fails, the module will automatically instruct the changeover device to place the generator on load *('**Load transfer**' becomes active (if used))*. Should the **remote start signal** then be removed the generator will remain on load until either the **'STOP/RESET'** or **'AUTO'** positions is selected.	
AUTO This button places the module into its **'Automatic'** mode. This mode allows the module to control the function of the generator automatically. The module will monitor the **remote start input** and the mains supply and once a start condition is signalled the set will be automatically started and placed on load *('**Load transfer**' becomes active (if used))*. If the starting signal is removed or the mains supply returns, the module will automatically transfer the load from the generator and shut the set down observing the **stop delay timer** and **cooling timer** as necessary. The module will then await the next start event. *For further details please see the more detailed description of 'Auto Operation' earlier in this manual.*	
TEST This mode is used to allow on load test of the generator functions. Once in **Test mode** the module will respond to the start (I) button and start the engine and run on load until either the **'STOP/RESET'** or **'AUTO'** positions is selected.	
START This button is only active in MANUAL  or TEST  modes. Pressing this button in manual mode will start the engine and run off load. If the generator is running off-load in the **Manual mode** and a **remote start signal** becomes present or the mains supply returns, the module will automatically instruct the changeover device to place the generator on load *('**Load transfer**' becomes active (if used))*. Should the **remote start signal** then be removed the generator will remain on load until either the **'STOP/RESET'** or **'AUTO'** positions is selected.	I

6 POWER UP LCD DISPLAY

When DC power is first applied to the 5120 controller, a short LCD test is performed that illuminates all LCD segments.



After this, the module's software revision number is shown briefly. For example, this display is showing software revision 1.00



7 FRONT PANEL CONFIGURATION

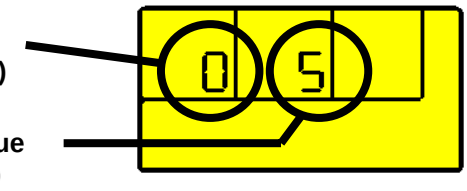
NOTE:- PC Configuration is possible on the 5120 controller in addition to the Front Panel Configuration. PC configuration offers additional settings such as oil pressure / sender curve editing and the ability to load / save configuration files to disk.

7.1 ENTERING CONFIGURATION MODE

NOTE:- Configuration mode can ONLY be entered when the module is in the STOP mode and the engine is at rest.

Press the **DOWN** and **STOP** buttons to enter configuration mode.

The first configurable parameter is displayed. In this example, the Start delay timer (parameter 0) is currently set to 5s.



7.2 EDITING AN ANALOGUE VALUE

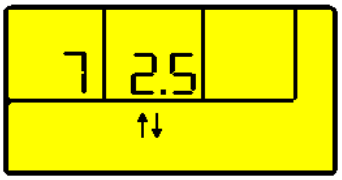
Enter the front panel configuration editor as described previously. Press the ✓ button to enter adjust mode.

When in adjust mode (indicated by the flashing ↑↓ icons in the module display), pressing the + or – buttons will change the selected parameter to the desired value. Press the ✓ button to 'save' the value. The ↑↓ icons will stop flashing to confirm that it has been saved.

To select the next parameter to edit, press the + button. Continuing to press the + / – buttons will cycle through the adjustable parameters in the order shown in the following lists.

Timers display in seconds up to 59 seconds, then in minutes up to the timer's maximum value.

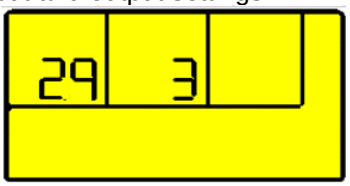
For instance, the parameter being displayed in this example is the cooling timer (parameter 7). It's current value is 2.5mins (2mins 30secs).



7.3 EDITING A 'LIST' VALUE

Some configuration parameters have a list of options to select from. These include input and output settings.

This example shows the setting for LCD indicator 3 (parameter 29). It's current setting is 3 ('Close Generator' from the lists shown below.).



⚠NOTE:- When in adjust mode (indicated by the flashing ↑↓ icons in the module display), pressing the ⊙ (stop mode) button will cancel any changes made to the current parameter, reverting to the last 'saved' value. This also exits adjust mode.

⚠NOTE:- To exit the front panel configuration editor at any time press the STOP ⊙ button. Ensure you save any changes you have made by pressing the ✓ button first if necessary.

7.4 TIMERS & ANALOGUE SETTINGS (V4)

Parameter	Type	Default	Max
0 - Start delay	Timer	***5s***	60s
1 - Preheat	Timer	***0s***	60s
2 - Crank attempt	Timer	***10s***	60s
3 - Crank rest	Timer	***10s***	60s
4 - Safety delay	Timer	***8s***	60s
5 - Warming up	Timer	***0s***	60m
6 - Return delay	Timer	***30s***	60m
7 - Cooling run	Timer	***60s***	60m
8 - E.T.S. solenoid hold	Timer	***0s***	60s
9 - Sensor fail delay	Timer	***2s***	5s
10 - Fail to Stop Delay	Timer	***60s***	60s
11 - Low Oil Pressure	Trip	***15PSI***	150PSI
12 - High Temperature	Trip	***95°C***	150°C
13 - Under Speed	Trip	***1250RPM***	3600RPM
14 - Over Speed	Trip	***1750RPM***	5000RPM
15 - Gen Under frequency	Trip	***40Hz***	60Hz
16 - Gen Over frequency	Trip	***57Hz***	72Hz
17 - Charge Alt Failure	Warning	***8V DC***	25V DC
18 - Flywheel teeth	Value	***0***	300
19 - CT Primary	Value	***500A***	6000A

NOTE:- Setting a timer to zero (0) will disable it. Timer settings increment from 0 to 60s in steps of 1s and from 1 minute to the maximum value in steps of 30 seconds (0.5 minutes) (where applicable)

NOTE:- Setting Flywheel teeth to zero (0) will disable magnetic pickup speed sensing. In this instance, engine speed is derived from the alternator output frequency.

NOTE:- CT values increment from 10-100 in steps of 10A, and from 100 to 6000A in steps of 50A. CT secondary must be 5A.

7.5 LIST ITEM SETTINGS (V4)

Factory default settings are in ***bold italicised*** text.

Parameter	Selections
20 - Alternator poles	0,2,***4***,6,8
21 - Oil pressure input	0 - Not used
	1 - Digital, close for low pressure
	2 - Digital, open for low pressure
	3 - VDO 0-5bar
	4 - VDO 0-10bar
	5 - Datcon 5bar
	6 - Datcon 10bar
	7 - Datcon 7bar
	8 - Murphy 7bar
	9 - User configured
22 - Coolant temp input	0 - Not used
	1 - Digital, close for high temperature
	2 - Digital, open for high temperature
	3 - VDO 40°C to 120°C
	4 - Datcon High
	5 - Datcon Low
	6 - Murphy
	7 - Cummins
	8 - PT100
	9 - User configured

Parameter	Selections
23 - Fast loading	***0 - No***
enabled	1 - Yes
24 - AC system	***0 - 3 phases 4 wires***
	1 - 1 phase 2 wire
	2 - 3 phases 3 wires
	3 - 2 phases 3 wires
25 - Oil pressure	***0 - Bar/PSI***
display units	1 - kPa

7.6 CONFIGURABLE OUTPUTS (V4)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
26 – Output 1	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 – Close Generator
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
27 – Output 2	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

7.7 CONFIGURABLE OUTPUTS (CONTINUED) (V4)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
28 – Output 3	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- The 'preheat modes' selectable for configurable outputs and LCD indicators perform the following actions :

Preheat mode 0 - Preheat during preheat timer, ceasing at end of preheat timer.
Preheat mode 1 - Preheat during preheat timer and continue until engine stops cranking.
Preheat mode 2 - Preheat during preheat timer and continue until the safety delay timer has expired.
Preheat mode 3 - Preheat during preheat timer and continue until the warming timer has expired.

In addition, in all preheat modes, preheat takes place during the crank rest timer between crank cycles.

7.8 LCD INDICATORS (V4)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
29 - LCD 1	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
30 - LCD 2	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

LCD INDICATORS (CONTINUED) (V4)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
31 - LCD 3	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
32 - LCD 4	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- The 'preheat modes' selectable for configurable outputs and LCD indicators perform the following actions :

Preheat mode 0 - Preheat during preheat timer, ceasing at end of preheat timer.
Preheat mode 1 - Preheat during preheat timer and continue until engine stops cranking.
Preheat mode 2 - Preheat during preheat timer and continue until the safety delay timer has expired.
Preheat mode 3 - Preheat during preheat timer and continue until the warming timer has expired.

In addition, in all preheat modes, preheat takes place during the crank rest timer between crank cycles.

7.9 CONFIGURABLE INPUTS (V4)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
33 – Input 1	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 -Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Remote Start, close to activate
	9 - Remote Start, open to activate
34 – Input 2	***0 - Delayed, Warning, close to activate***
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Electrical trip, close to activate
	9 - Electrical trip, open to activate
35 – Input 3	0 - Warning, Delayed, close to activate
	1 - Warning, Delayed, open to activate
	2 - Warning, Immediate, close to activate
	3 - Warning, Immediate, open to activate
	4 - Shutdown, Delayed, close to activate
	5 - Shutdown, Delayed, open to activate
	6 - Shutdown, Immediate, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Lamp test, close to activate
	9 - Lamp test, open to activate
36 – Input 4	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activat***e***
	7 - Immediate, Shutdown, open to activate
	8 - Simulate mains available, close to activate
	9 - Simulate mains available, open to activate
37 - Input 5	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Oil pressure switch, Shutdown, open for low oil pressure
	9 - Oil pressure switch, Shutdown, close for low oil pressure

7.10 MAINS SETTINGS (V4)

Factory default settings are in ***bold italicised*** text.

Parameter	Selections
38 - Immediate mains dropout	***0 - disabled***
	1 - enabled

Parameter	Type	***Default***
39 - Under voltage	Trip	(50-333V) ***184V***
40 - Under voltage	Return	(50-333V) ***207V***
41 - Over voltage	Return	(50-333V) ***253V***
42 - Over voltage	Trip	(50-333V) ***276V***

8 EVENT LOG

Model 5120 features an integral 15 item event log. This log contains the last 15 shutdown alarms registered by the controller.

8.1 ENTERING EVENT LOG VIEWER

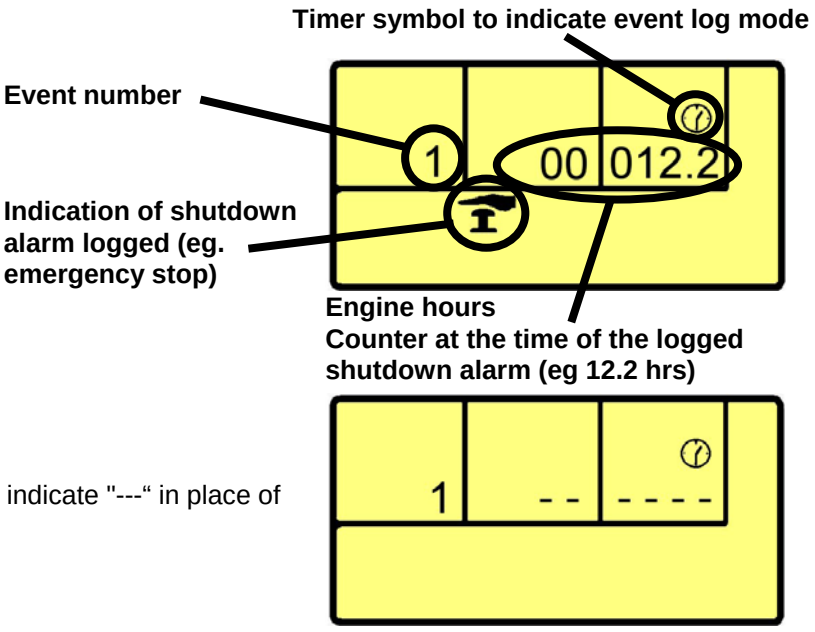
NOTE:- Entering the event log will place the module into STOP mode, shutting down the engine if it is already running.

Press and hold the **STOP** button for five seconds to enter the event log viewer

The latest shutdown event is displayed.

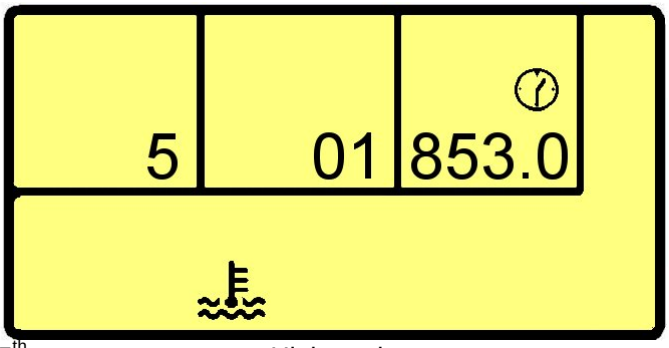
Pressing the scroll button will cycle through the events, returning to the first one, once the end of the list is reached.

Press the **STOP** button at any time to exit the event log viewer.

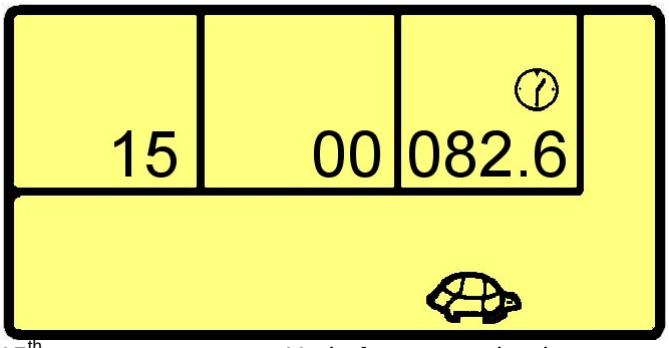


If no shutdown event is logged, the display will indicate "---“ in place of the hours counter.

8.2 EVENT LOG EXAMPLES



5th most recent event - High engine temperature shutdown when engine hours counter was 1853 hrs

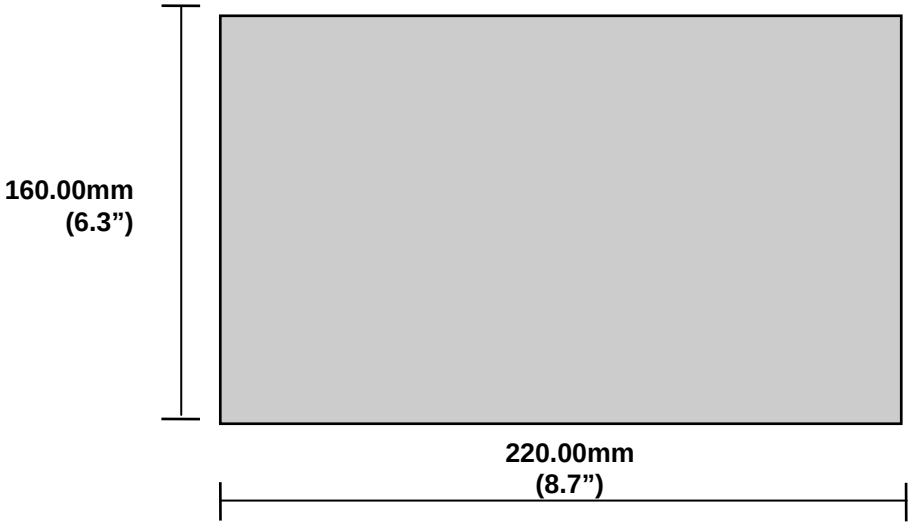


15th most recent event - Underfrequency shutdown when engine hours counter was 82.6 hrs

9 INSTALLATION INSTRUCTIONS

The model **DSE 5120** Module has been designed for front panel mounting. Fixing is by 4 clips for easy assembly.

9.1 PANEL CUT-OUT

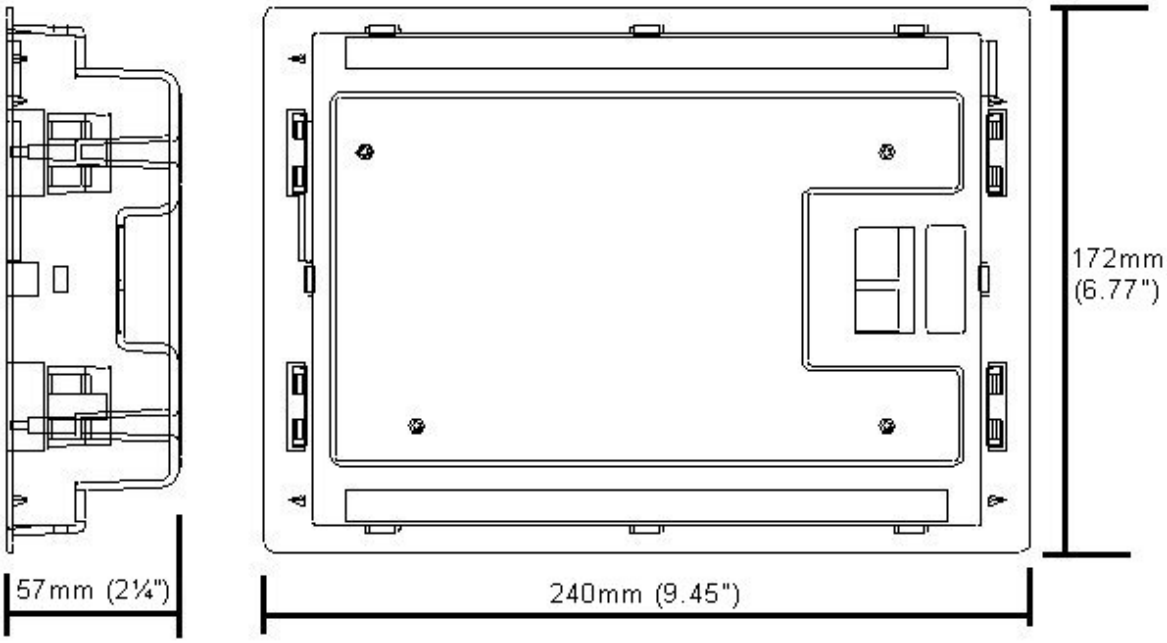


Maximum panel thickness – 8mm (0.3")
In conditions of excessive vibration the module should be mounted on suitable anti-vibration mountings.

9.2 COOLING

The module has been designed to operate over a wide temperature range **-30 to +70º C**. Allowances should be made for the temperature rise within the control panel enclosure. Care should be taken **NOT** to mount possible heat sources near the module unless adequate ventilation is provided. The relative humidity inside the control panel enclosure should not exceed **95%**.

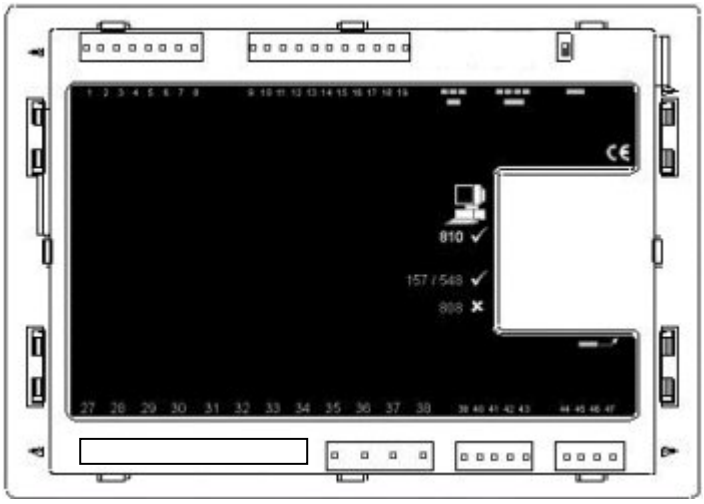
9.3 UNIT DIMENSIONS



Panel cutout 220mm x 160mm (8.7" x 6.3")

9.4 FRONT PANEL LAYOUT

9.5 REAR PANEL LAYOUT



10 ELECTRICAL CONNECTIONS

Connections to the Module are via plug and sockets.

10.1 CONNECTION DETAILS

The following describes the connections and recommended cable sizes to the 7 plugs and sockets on the rear of the Module. See rear panel layout **FIG 6**.

10.1.1 PLUG "A" 8 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
1	DC Plant Supply Input (Negative)	2.5mm² (13 AWG)	
2	DC Plant Supply Input (Positive)	2.5mm² (13 AWG)	(Recommended Maximum Fuse 21A)
3	Emergency Stop Input	2.5mm² (13 AWG)	Plant Supply Positive. Also supplies fuel & start outputs. (Recommended Maximum Fuse 32A)
4	Fuel relay Output	2.5mm² (13 AWG)	Plant Supply Positive from pin 3. 16 Amp rated.
5	Start relay Output	2.5mm² (13 AWG)	Plant Supply Positive from pin 3. 16 Amp rated.
6	Auxiliary Output relay 1	1.0mm² (18 AWG)	Plant Supply Positive. 5 Amp rated.
7	Auxiliary Output relay 2	1.0mm² (18 AWG)	Plant Supply Positive. 5 Amp rated.
8	Auxiliary Output relay 3	1.0mm² (18 AWG)	Plant Supply Positive. 5 Amp rated.

10.1.2 PLUG "B" 11 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
9	Charge fail / excite	2.5mm² (13 AWG)	Do not connect to ground (battery Negative)
10	Auxiliary input 1	0.5mm² (20 AWG)	Switch to Negative
11	Auxiliary input 2	0.5mm² (20 AWG)	Switch to Negative
12	Auxiliary input 3	0.5mm² (20 AWG)	Switch to Negative
13	Auxiliary input 4	0.5mm² (20 AWG)	Switch to Negative
14	Auxiliary input 5	0.5mm² (20 AWG)	Switch to Negative
15	Not connected	-	
16	Functional Earth	2.5mm² (13 AWG)	Connect to a good clean earth point
17	Magnetic pickup Positive	0.5mm² (20 AWG)	Connect to Magnetic Pickup device
18	Magnetic pickup Negative	0.5mm² (20 AWG)	Connect to Magnetic Pickup device
19	Not connected	-	

NOTE:- Ensure magnetic pickup screen is connected to ground at one end only.

NOTE:- Terminal numbers 20-26 are not fitted to the 5120 controller

10.1.3 PLUG "E" 8 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
27	Mains loading relay	2.5mm² (13 AWG)	Volts free contact, switches to terminal 28
28	Mains loading relay	2.5mm² (13 AWG)	Volts free contact, switches to terminal 27
29	Generator loading relay	2.5mm² (13 AWG)	Volts free contact, switches to terminal 30
30	Generator loading relay	2.5mm² (13 AWG)	Volts free contact, switches to terminal 29
31	Mains L1 voltage monitoring input	1.0mm² (18 AWG)	Connect to mains L1 (AC) (Recommend 2A fuse)
32	Mains L2 voltage monitoring input	1.0mm² (18 AWG)	Connect to mains L2 (AC) (Recommend 2A fuse)
33	Mains L3 voltage monitoring input	1.0mm² (18 AWG)	Connect to mains L3 (AC) (Recommend 2A fuse)
34	Mains Neutral input	1.0mm² (18 AWG)	Connect to mains Neutral terminal (AC)

10.1.4 PLUG "F" 4 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
35	Generator L1 voltage monitoring input	1.0mm² (18 AWG)	Connect to generator L1 output (AC) (Recommend 2A fuse)
36	Generator L2 voltage monitoring input	1.0mm² (18 AWG)	Connect to generator L2 output (AC) (Recommend 2A fuse)
37	Generator L3 voltage monitoring input	1.0mm² (18 AWG)	Connect to generator L3 output (AC) (Recommend 2A fuse)
38	Generator Neutral input	1.0mm² (18 AWG)	Connect to generator Neutral terminal (AC)

10.1.5 PLUG "G" 5 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
39	CT Secondary for L1	2.5mm² (13 AWG)	Connect to secondary of L1 monitoring CT
40	CT Secondary for L2	2.5mm² (13 AWG)	Connect to secondary of L2 monitoring CT
41	CT Secondary for L3	2.5mm² (13 AWG)	Connect to secondary of L3 monitoring CT
42	CT secondary common	2.5mm² (13 AWG)	Connect to secondary of all monitoring CT's
43	Not connected	-	

10.1.6 PLUG "H" 4 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
44	Oil Pressure Input	0.5mm² (20 AWG)	Connect to Oil pressure sender
45	Coolant Temperature Input	0.5mm² (20 AWG)	Connect to Coolant Temperature sender
46	Not connected	-	
47	Sender Common Return	0.5mm² (20 AWG)	Return feed for senders (see note below)

NOTE:- If using single terminal senders refer to connection diagram. If using earth return type senders connect return terminals to pin 47 and also connect pin 47 to earth. This is detailed in the Appendix section entitled "Sender wiring recommendations" elsewhere in this manual.

10.2 CONNECTOR FUNCTION DETAILS

The following describes the functions of the 3 connectors on the rear of the module. See rear panel layout **FIG 5**.

10.2.1 PLUG "A" 8 WAY

PIN No	DESCRIPTION
1	DC Supply Negative. System DC negative input. (Battery Negative).
2	DC Supply Positive. System DC positive input. (Battery Positive).
3	Emergency Stop input. Internally linked to Starter and Fuel outputs. If this input is not connected to positive the module will be locked out, and if the engine is running it will shutdown immediately. The Positive Supply is also removed from Starter and Fuel outputs, therefore only a single pole Emergency Shutdown button is required.
4	Fuel Relay output. Plant Supply Positive from pin 3. Used to control the fuel solenoid or engine fuel control system.
5	Starter Relay output. Plant Supply Positive from pin 3. Used to control the Starter Motor.
6	Auxiliary Relay output 1. Plant Supply Positive. Configurable output, see section entitled "Front Panel Configuration" elsewhere in this manual for options available.
7	Auxiliary Relay output 2. Plant Supply Positive. Configurable output, see section entitled "Front Panel Configuration" elsewhere in this manual for options available.
8	Auxiliary Relay output 3. Plant Supply Positive. Configurable output, see section entitled "Front Panel Configuration" elsewhere in this manual for options available.

10.2.2 PLUG "B" 11 WAY

PIN No	DESCRIPTION
9	Charge Fail input / Excitation output. Supplies excitation to the Plant Battery Charging Alternator, also an input for the Charge Fail detection circuitry.
10	Auxiliary input 1. This is a negative switched configurable input, see Calibration Manual for options available. It is possible to configure the input to be a normally closed signal or a normally open signal.
11	Auxiliary input 2. This is a negative switched configurable input, see Calibration Manual for options available. It is possible to configure the input to be a normally closed signal or a normally open signal.
12	Auxiliary input 3. This is a negative switched configurable input, see section entitled "Front Panel Configuration" elsewhere in this manual for options available. It is possible to configure the input to be a normally closed signal or a normally open signal.
13	Auxiliary input 4. This is a negative switched configurable input, see section entitled "Front Panel Configuration" elsewhere in this manual for options available. It is possible to configure the input to be a normally closed signal or a normally open signal.
14	Auxiliary input 5. This is a negative switched configurable input, see section entitled "Front Panel Configuration" elsewhere in this manual for options available. It is possible to configure the input to be a normally closed signal or a normally open signal.
15	Not connected
16	Functional Earth - Ensure connection to a good clean earth point.
17	Magnetic Input Positive. An AC signal from the magnetic pickup Positive for speed sensing.
18	Magnetic Input Negative. An AC signal from the magnetic pickup –ve for speed sensing.
19	Not connected

NOTE:- Ensure magnetic pickup screen is connected to ground at one end only.

NOTE:- Terminal numbers 20-26 are not fitted to the 5120 controller

10.2.3 PLUG "E" 8 WAY

PIN No	DESCRIPTION
27	Mains loading relay. Volts free contact, switches to terminal 28
28	Mains loading relay. Volts free contact, switches to terminal 27
29	Generator loading relay. Volts free contact, switches to terminal 30
30	Generator loading relay. Volts free contact, switches to terminal 29
31	Mains L1 sensing input. Connect to alternator L1 output.
32	Mains L2 sensing input. Connect to alternator L2 output.
33	Mains L3 sensing input. Connect to alternator L3 output.
34	Mains N sensing input. Connect to alternator N output.

10.2.4 PLUG "F" 4 WAY

PIN No	DESCRIPTION
35	Generator L1 sensing input. Connect to alternator L1 output.
36	Generator L2 sensing input. Connect to alternator L2 output. If using single phase only do not connect this terminal.
37	Generator L3 sensing input. Connect to alternator L3 output. If using single phase only do not connect this terminal.
38	Generator N sensing input. Connect to alternator N output.

10.2.5 PLUG "G" 5 WAY

PIN No	DESCRIPTION
39	Generator L1 current transformer connection.
40	Generator L2 current transformer connection. If single phase is used do not connect this pin.
41	Generator L3 current transformer connection. If single phase is used do not connect this pin.
42	Generator current transformer common connection and CT earth connection.
43	Not used. Do not connect to this terminal.

10.2.6 PLUG "H" 4 WAY

PIN No	DESCRIPTION
44	Oil Pressure sensing input. Connect to resistive type oil pressure sender. Refer to connection diagram for details.
45	Coolant Temperature sensing input. Connect to resistive type coolant temperature sender. Refer to connection diagram for details.
46	Not used. Do not connect to this terminal.
47	Sender Common connection. Return feed from sender units - refer to connection diagram for details.

10.2.7 PURCHASING ADDITIONAL CONNECTOR PLUGS FROM DSE

If you require additional plugs from DSE, please contact our Sales department using the part numbers below.

5110 Terminal	Connector	Plug description	DSE Part number
1-8	A	BL08 8way 5.08mm spacing connector plug	007-125
9-19	B	BL11 11way 5.08mm spacing connector plug	007-135
27-34	E	BL08 8way 10.16mm spacing connector plug	007-410
35-38	F	BL04 4way 10.16mm spacing connector plug	007-003
39-43	G	BL05 5way 5.08mm spacing connector plug	007-329
44-47	H	BL04 4way 5.08mm spacing connector plug	007-100

NOTE:- Connectors C & D are not fitted to the 5120 remote start module.

11 SPECIFICATION

DC Supply	8.0V to 35V Continuous.
Cranking Dropouts	Able to survive 0V for 50mS, providing supply was at least 10V before dropout and supply recovers to 5V*. This is achieved without the need for internal batteries.*
Max. Operating Current (all inputs & outputs active except fuel / start)	320mA at 12V, 215mA at 24V
Max. Standby Current (all inputs & outputs active except fuel / start)	175mA at 12V, 95mA at 24V
Mains/Alternator Input Range **Single phase 2 wire system** **3Phase 4Wire System**	15V AC - 300 V AC (ph-N) (+20%) 15V AC - 300 V AC (ph-N) (+20%)
Mains/Alternator Input Frequency	50Hz - 60Hz nominal
Magnetic Input Range (if fitted)	+/- 0.5V to 70V Peak
Magnetic Input Frequency	10,000Hz (max) at rated engine speed.
Start Relay Output	16 Amp DC at supply voltage.
Fuel Relay Output	16 Amp DC at supply voltage.
Auxiliary Relay Outputs	5 Amp DC at supply voltage.
Dimensions	240mm x 172mm x 57mm (9.5” x 6.8” x 2.3”)
Panel cut-out	220mm x 160mm (8.7” x 6.3”) Maximum panel thickness 8mm (0.3”)
Charge Fail / Excitation Range	0V to 35V
Operating Temperature Range	-30 to +70°C
C.T. Burden	2.5VA (see note)
C.T. Secondary	5A
C.T. Class	Class 1 or better recommended
Electromagnetic Compatibility	**BS EN 61000-6-4** EMC Generic Emission Standard (Industrial) **BS EN 61000-6-2 EMC** Generic Immunity Standard (Industrial)
Electrical Safety	BS EN 60950 Safety of I.T. equipment, including electrical business equipment.
Cold Temperature	BS EN 60068-2-1 to -30 ^{o}C
Hot Temperature	BS EN 60068-2-2 to +70^{o}C
Humidity	BS EN 60068-2-38 to 93% RH @ 40°C for 48 Hours
Vibration	BS EN60068-2-6 10 sweeps at 1 octave/minute in each of 3 major axes. 5Hz to 8Hz @ +/-7.5mm constant displacement 8Hz to 500Hz @ 2gn constant acceleration
Shock	BS EN 60068-2-27 3 Half sine shocks in each of 3 major axes 15gn amplitude, 11mS duration

NOTE:- Although the 5120’s burden on the measurement C.T.’s is 2.5VA, the required C.T. rating will need to be higher depending upon the type and length of cabling used. For further details see the Appendix section entitled "Choosing the correct C.T.’s” elsewhere in this manual.

Compliant with BS EN 60950 Low Voltage Directive

COMMISSIONING

11.1.1 PRE-COMMISSIONING

Before the system is started, it is recommended that the following checks are made:-

7.1. The unit is adequately cooled and all the wiring to the module is of a standard and rating compatible with the system.

7.2. The unit **DC** supply is fused and connected to the battery and that it is of the correct polarity.

7.3. The Emergency Stop input is wired to an external normally closed switch connected to **DC** positive.

NOTE:- If Emergency Stop feature is not required link this input to the DC Positive. The module will not operate unless either the Emergency Stop is fitted correctly OR Pin 3 is connected to DC positive (Positive)

7.4. To check the start cycle operation take appropriate measures to prevent the engine from starting (disable the operation of the fuel solenoid). After a visual inspection to ensure it is safe to proceed, connect the battery supply. Select **"MANUAL"** and press START (I) the unit start sequence will commence.

7.5. The starter will engage and operate for the pre-set crank period. After the starter motor has attempted to start the engine for the pre-set number of attempts the LCD will display its icon indicating; '*Failed to start*'  . Select the **STOP/RESET** position to reset the unit.

7.6. Restore the engine to operational status (reconnect the fuel solenoid), again select **"MANUAL"** and press START(I) this time the engine should start and the starter motor should disengage automatically. If not then check that the engine is fully operational (fuel available, etc.) and that the fuel solenoid is operating. The engine should now run up to operating speed. If not and an alarm is present, check the alarm condition for validity, then check input wiring. The engine should continue to run for an indefinite period. It will be possible at this time to view the engine and alternator parameters - refer to the 'Description of Controls' section of this manual.

7.7. Select **"AUTO"** on the front panel, the engine will run for the pre-set cooling down period, then stop. The generator should stay in the standby mode. If not check that there is not a signal present on the **Remote start** input and that the mains supply is healthy.

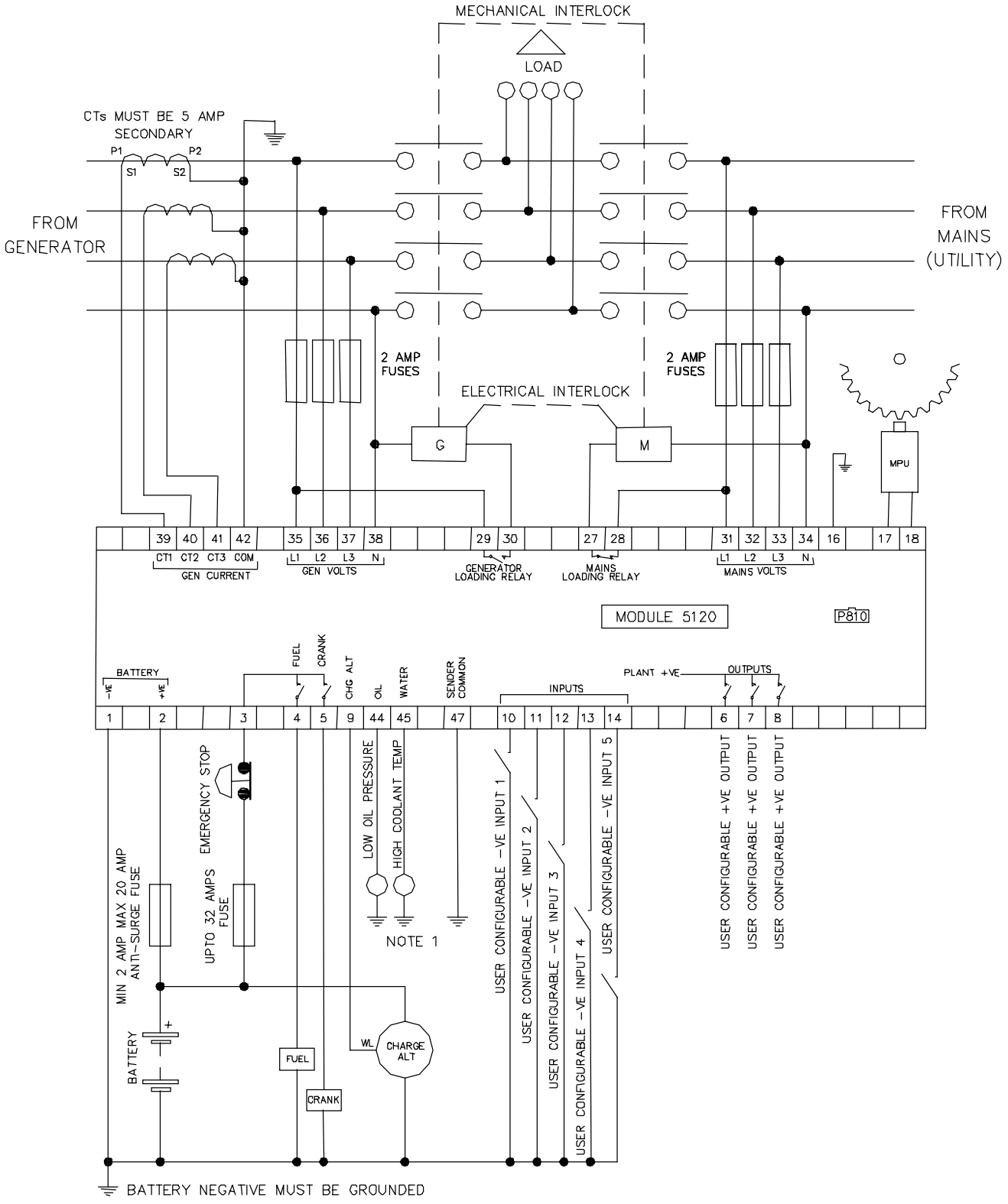
7.8. Initiate an automatic start by supplying the remote start signal. The start sequence will commence and the engine will run up to operational speed. Once the generator is available a load transfer will take place, the Generator will accept the load. If not, check the wiring to the Generator Contactor Coil *(if used)*. Check the Warming timer has timed out.

7.9. Remove the remote start signal, the return sequence will start. After the pre-set time period, the load will be removed from the generator. The generator will then run for the pre-set cooling down period, then shutdown into it's standby mode.

7.10. If despite repeated checking of the connections between the **5120** and the customer's system, satisfactory operation cannot be achieved, then the customer is requested to contact the factory for further advice on:-

INTERNATIONAL TEL: +44 (0) 1723 890099
INTERNATIONAL FAX: +44 (0) 1723 893303
E-mail: Support@Deepseaplc.com
Website : www.deepseaplc.com

12 TYPICAL WIRING DIAGRAM



TERMINALS SUITABLE FOR 22-16 AWG (0.6mm - 1.3mm) FIELD WIRING

TIGHTENING TORQUE = 0.8Nm (7lb-in)

NOTE 1

THESE GROUND CONNECTIONS MUST BE ON THE ENGINE BLOCK, AND MUST BE TO THE SENDER BODIES.

THE GROUND WIRE TO TERMINAL 47 MUST NOT BE USED TO PROVIDE A GROUND CONNECTION TO ANY OTHER DEVICE

13 FAULT FINDING

SYMPTOM	POSSIBLE REMEDY
Unit is inoperative	Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse.
Unit shuts down	Check DC supply voltage is not above 35 Volts or below 9 Volts Check the operating temperature is not above 70 °C. Check the DC fuse.
Unit locks out on Emergency Stop	If an Emergency Stop Switch is not fitted, ensure that a positive is connected to the Emergency Stop input. Check emergency stop switch is functioning correctly. Check Wiring is not open circuit.
Intermittent Magnetic Pick-up sensor fault	Ensure that Magnetic pick-up screen is only connected at one end, if connected at both ends, this enables the screen to act as an aerial and will pick up random voltages.
Low oil Pressure fault operates after engine has fired	Check engine oil pressure. Check oil pressure switch/sender and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sender is compatible with the 5110 Module and is correctly configured.
High engine temperature fault operates after engine has fired.	Check engine temperature. Check switch/sender and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sender is compatible with the 5120 Module.
Shutdown fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Warning fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Fail to Start is activated after pre-set number of attempts to start	Check wiring of fuel solenoid. Check fuel. Check battery supply. Check battery supply is present on the Fuel output of the module. Check the speed sensing signal is present on the 5120 inputs. Refer to engine manual.
Continuous starting of generator when in **AUTO**	Check that there is no signal present on the “Remote Start” input. Check configured polarity is correct. Check the mains supply levels.
Generator fails to start on receipt of Remote Start signal.	Check Start Delay timer has timed out. If remote start fault, check signal is on “Remote Start” input. Confirm input is configured to be used as “Remote Start”.
Pre-heat inoperative	Check wiring to engine heater plugs. Check battery supply. Check battery supply is present on the Pre-heat output of module. Check pre-heat has been selected in your configuration.
Starter motor inoperative	Check wiring to starter solenoid. Check battery supply. Check battery supply is present on the Starter output of module. Ensure that the Emergency Stop input is at Positive.
Engine runs but generator will not take load	Check Warm up timer has timed out. Ensure generator load inhibit signal is not present on the module inputs. Check that the generator output is within the voltage limits of the module’s configuration.
Incorrect reading on Engine gauges	Check engine is operating correctly. Check sender and wiring paying particular attention to the wiring to terminal 47 (refer to appendix). Check that sender is compatible with the 5120 Module and is correctly configured.

NOTE:- The above fault finding is provided as a guide check-list only. As it is possible for the module to be configured to provide a wide range of different features always refer to the source of your module configuration if in doubt.

14 FACTORY DEFAULT SETTINGS (V4)

Modules are shipped from the factory with parameters set to the following values. These can be user adjusted via the front panel configuration editor. For further details on adjustment via the front panel editor, see the section entitled “Front panel configuration” elsewhere within this manual.

Parameter	Default
0 - Start delay	5s
1 - Preheat	0s
2 - Crank attempt	10s
3 - Crank rest	10s
4 - Safety delay	8s
5 - Warming up	0s
6 - Return delay	30s
7 - Cooling run	60s
8 - E.T.S. solenoid hold	0s
9 - Sensor fail delay	2s
10 - Fail to Stop Delay	60s
11 - Low Oil Pressure	15PSI
12 - High Temperature	95°C
13 - Under Speed	1250RPM
14 - Over Speed	1750RPM
15 - Underfrequency	40Hz
16 - Overfrequency	57Hz
17 - Charge Alt Failure	8V DC
18 - Flywheel teeth	0 (magnetic pickup disabled)
19 - CT Primary	500A
20 - Alternator poles	4
21 - Oil Pressure transducer	3 - VDO 0-10bar
22 - Coolant temp transducer	2 - VDO 0-120°C
23 - Fast loading enabled	0 - No
24 - AC system	0 - 3 phase 4 wire
25 - Oil pressure display units	0 - Bar/PSI
26 - Output 1	1 - Preheat mode 0
27 - Output 2	17 - Common alarm
28 - Output 3	5 - Engine running
29 - LCD 1	8 - Auxiliary input 1 active
30 - LCD 2	9 - Auxiliary input 2 active
31 - LCD 3	11 - Auxiliary input 4 active
32 - LCD 4	12 - Auxiliary input 5 active
33 - Input 1	8 - Remote Start, close to activate
34 - Input 2	0 - Delayed, Warning, close to activate
35 - Input 3	8 - Lamp test, close to activate
36 - Input 4	4 - Delayed, Shutdown, close to activate
37 - Input 5	6 - Immediate, Shutdown, close to activate
38 - Immediate Mains Dropout	0 - disabled
39 - Under voltage trip	184V
40 - Under voltage return	207V
41 - Over voltage return	253V
42 - Over voltage trip	276V

15 ICONS AND LCD IDENTIFICATION

15.1 PUSH BUTTONS

Display	Description	Display	Description	Display	Description
	*Stop/Reset*		*Auto mode*		*Manual mode*
I	*Start (when in manual mode)*		*Test mode*		*Scroll*

15.2 STATUS / MEASUREMENT UNITS

Display	Description	Display	Description	Display	Description
L1	*Phase*	L2	*Phase*	L3	*Phase*
L1- N	*Phase - Neutral*	L2- N	*Phase - Neutral*	L3- N	*Phase -Neutral*
L1- L2	*Phase - Phase*	L2- L3	*Phase - Phase*	L3- L1	*Phase - Phase*
BAR	*Pressure*	HPa	*KPa Oil Pressure Units*	PSI	*Pressure*
V	*Voltage*	°F	*Temperature*	Hz	*Frequency*
A	*Amperes*	°C	*Temperature*	RPM	*Speed*
	*Hours Run*		*AC*		*Parameter being adjusted*
			*DC*		

15.3 ALARM INDICATIONS

Display	Description	Display	Description	Display	Description
	Warning Alarm		*Shutdown Alarm*		*Electrical Trip*
			*Low Oil Pressure*		*Over-speed*
	Charge Fail		*High Coolant Temperature*		*Under-speed*
	Emergency Stop		*Fail to start (Over-crank)*		Auxiliary Indication
			*Auxiliary Alarm (Warning or Shutdown)*		

16 APPENDIX

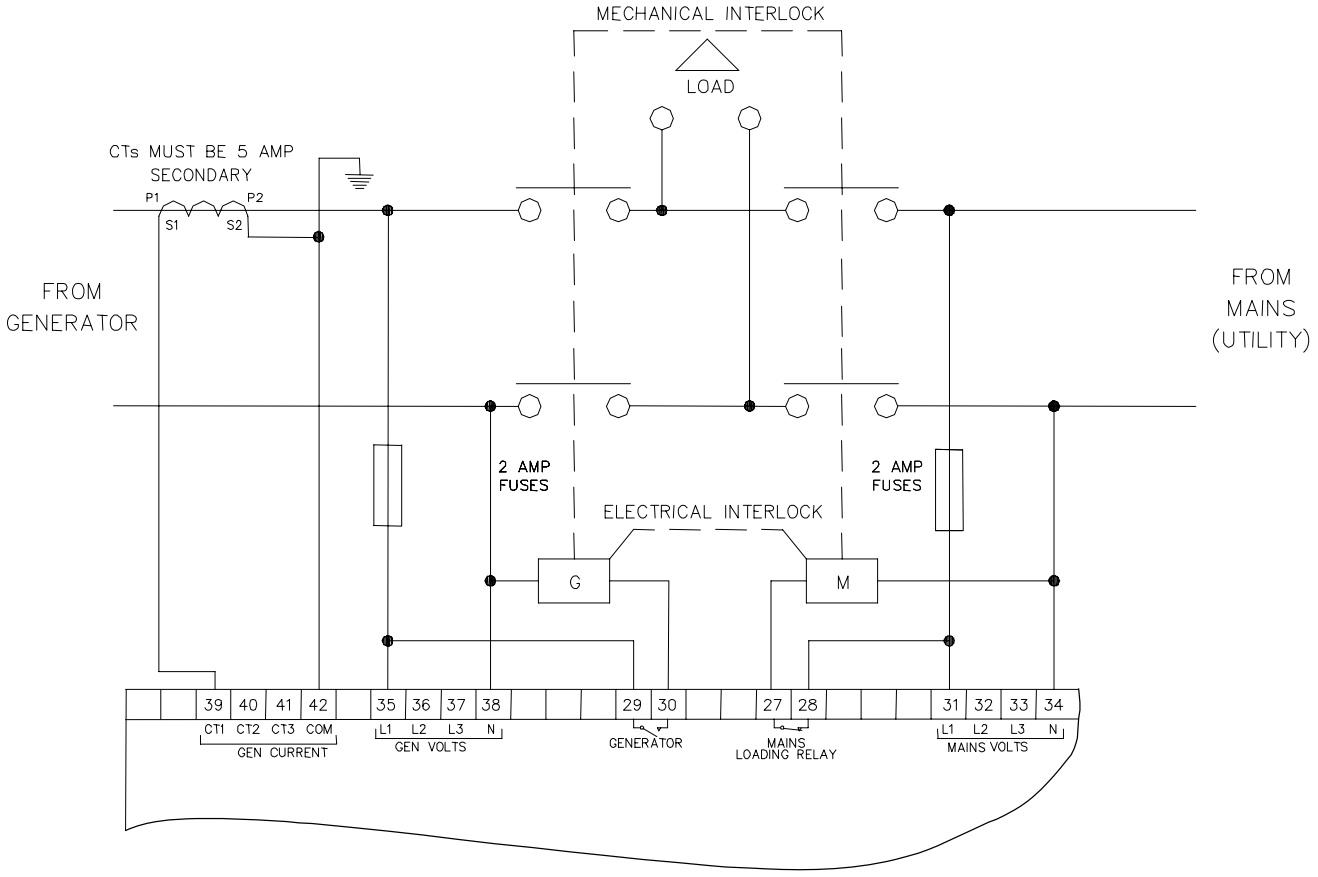
16.1 ALTERNATIVE WIRING TOPOLOGIES

The 5120 series controllers can support different wiring topologies (AC systems) to suit the systems in use world-wide. The 'Typical connection diagram' details how to connect the module when used in a 3 phase, 4 wire system (3 phase star connected alternators). Changes to this typical wiring diagram for other AC systems are detailed below.

NOTE:- The factory default configuration for the 5120 module is for use with the 3 phase, 4 wire AC system. If another system is to be used, the controller must be reconfigured using the front panel editor detailed elsewhere within this manual.

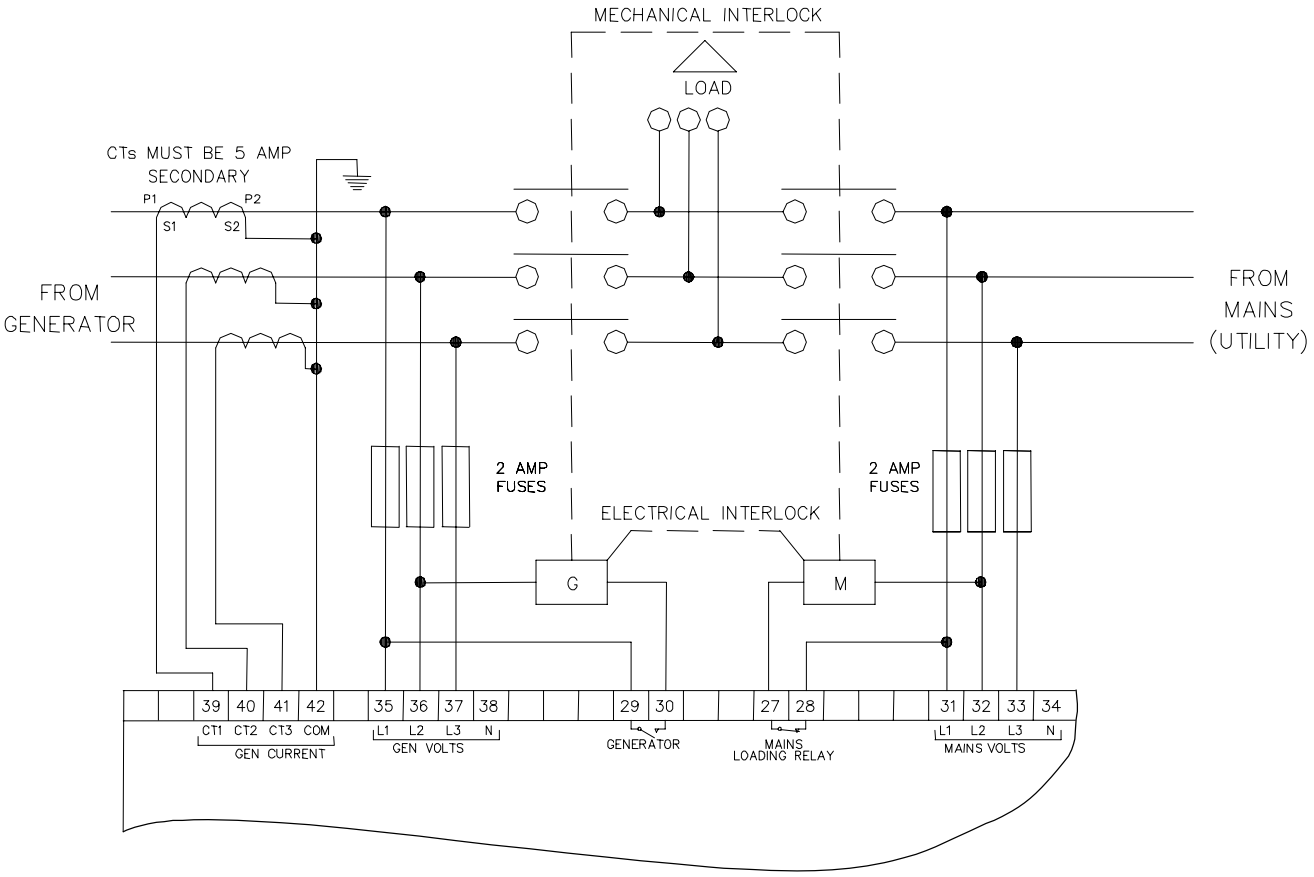
16.1.1 1 PHASE, 2 WIRE

Single phase alternator with neutral conductor.

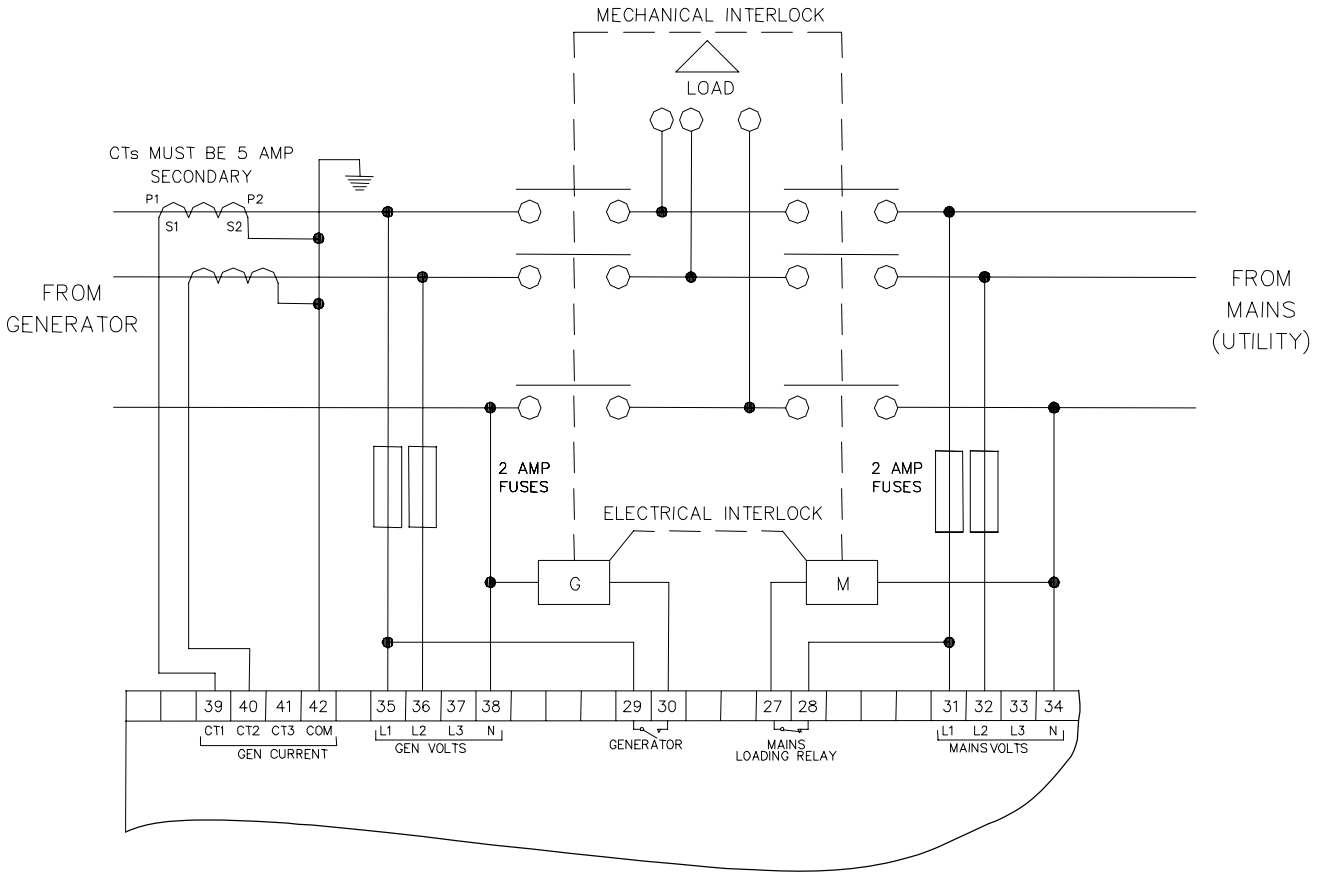


16.1.2 3 PHASE, 3 WIRE

Three phase DELTA wired alternator.



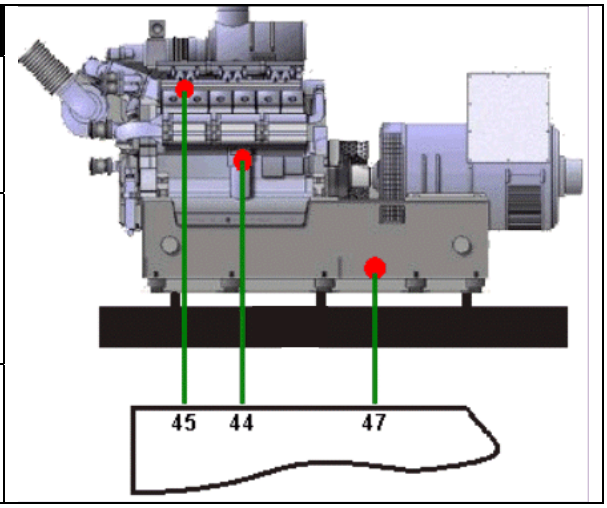
16.1.3 2 PHASE, 3 WIRE



16.2 SENDER WIRING RECOMMENDATIONS

16.2.1 EARTH RETURN SENDERS

Connection Name	Terminal Number
Oil pressure Sender	44
Coolant temperature sender	45
Sender common	47

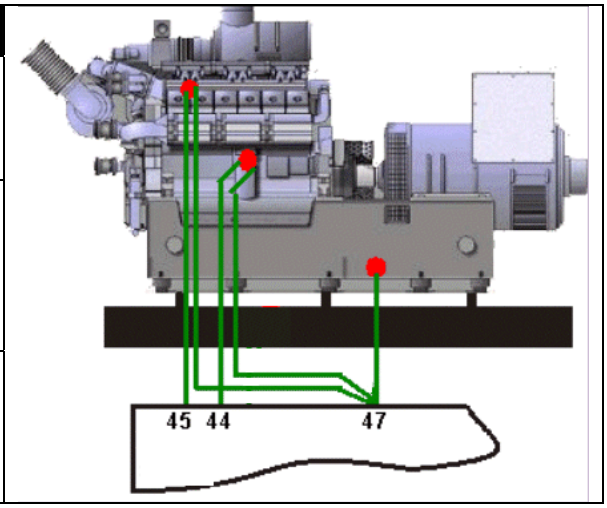


NOTE:- . It is important that terminal 47 (sender common) is soundly connected to an earth point on the ENGINE BLOCK, not within the control panel, and must be a sound electrical connection to the sender bodies.

NOTE:- . If you use PTFE insulating tape on the sender thread when using earth return senders, ensure you do not insulate the entire thread as this will prevent the sender body from being earthed via the engine block.

16.2.2 INSULATED RETURN SENDERS

Connection Name	Terminal Number
Oil pressure Sender	44
Coolant temperature sender	45
Sender common	47



NOTE:- . It is important that terminal 47 (sender common) is soundly connected to an earth point on the ENGINE BLOCK, not within the control panel .

16.3 CHOOSING THE CORRECT C.T.S

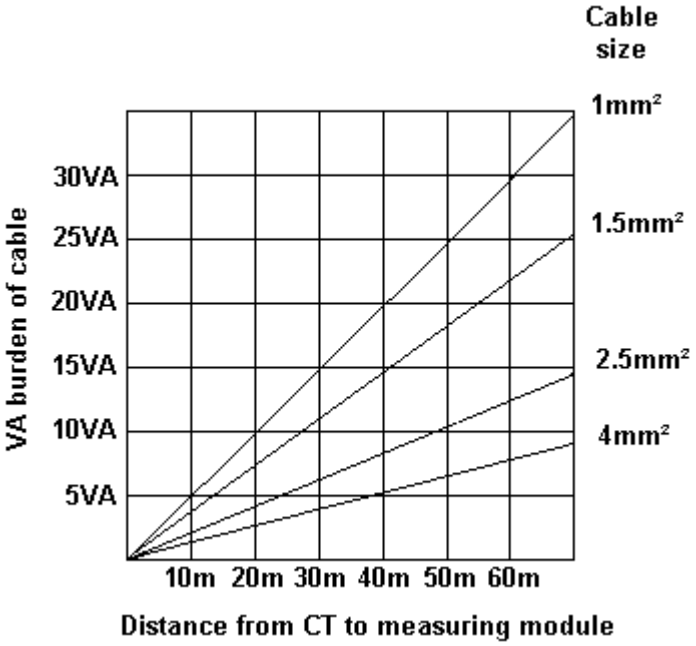
The VA burden of the 5120 on the measurement CTs (Current transformers) is 2.5VA. However depending upon the type and length of cabling between the CTs and the modules, CTs with a greater VA rating than 2.5VA are required.

DETAILS

The distance between the CTs and the measuring module should be estimated and cross-referenced against the chart opposite to find the VA burden of the cable itself.

The star point (common) of the CTs MUST be connected to system ground (earth) as close as possible to the CTs. This minimises the length of cable used to connect the CTs to the DSE module.

Example.
If 1.5mm² cable is used and the distance from the CT to the measuring module is 20m, then the burden of the cable alone is approximately 7.5VA. As the burden of the DSE controller is 2.5VA, then a CT with a rating of at least 7.5+2.5V = 10VA must be used.
If 2.5mm² cable were used over the same distance of 20m, then the burden of the cable on the CT would be approximately 4VA. CT's required in this instance is at least 6.5VA (4+2.5).



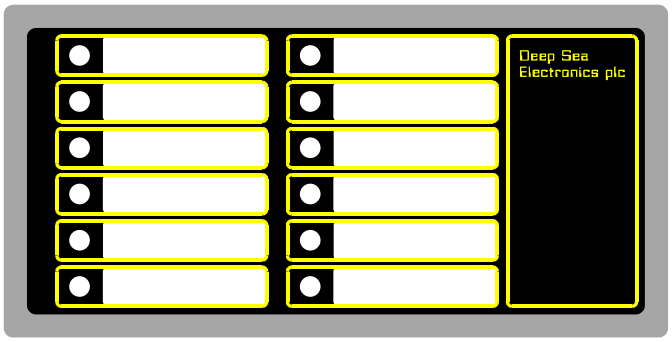
NOTE:- Details for 4mm² cable are shown for reference only. The connector on the DSE modules are only suitable for cables up to 2.5mm².

NOTE:- C.T.'s with 5A secondary windings must be used with the 5120 module. Ratios from 10A : 5A up to 6000A : 5A can be used.

As the C.T.'s are used purely for instrumentation purposes (not protection) within the 5120 module, protection class C.T.'s are not required. To match the specification of the 5120 module, it is recommended that C.T.'s of Class 0.5 be used to give the best possible measurement accuracy.

16.4 INPUT EXPANSION

It is possible to increase the number of monitored inputs available by utilising a DSE 54x Protection Expansion/Annunciator. Please refer to our Technical department for details.



17 5120 V3 CONFIGURATION MENU

17.1 TIMERS & ANALOGUE SETTINGS

Parameter	Type	Default	Max
0 - Start delay	Timer	***5s***	60s
1 - Preheat	Timer	***0s***	60s
2 - Crank attempt	Timer	***10s***	60s
3 - Crank rest	Timer	***10s***	60s
4 - Safety delay	Timer	***8s***	60s
5 - Warming up	Timer	***0s***	60m
6 - Return delay	Timer	***30s***	60m
7 - Cooling run	Timer	***60s***	60m
8 - E.T.S. solenoid hold	Timer	***0s***	60s
9 - Sensor fail delay	Timer	***2s***	5s
10 - Fail to Stop Delay	Timer	***60s***	60s
11 - Low Oil Pressure	Trip	***15PSI***	150PSI
12 - High Temperature	Trip	***95°C***	150°C
13 - Under Speed	Trip	***1250RPM***	3600RPM
14 - Over Speed	Trip	***1750RPM***	5000RPM
15 - Gen Under frequency	Trip	***40Hz***	60Hz
16 - Gen Over frequency	Trip	***57Hz***	72Hz
17 - Charge Alt Failure	Warning	***8V DC***	25V DC
18 - Flywheel teeth	Value	***0***	300
19 - CT Primary	Value	***500A***	6000A

NOTE:- Setting a timer to zero (0) will disable it. Timer settings increment from 0 to 60s in steps of 1s and from 1 minute to the maximum value in steps of 30 seconds (0.5 minutes) (where applicable)

NOTE:- Setting Flywheel teeth to zero (0) will disable magnetic pickup speed sensing. In this instance, engine speed is derived from the alternator output frequency.

NOTE:- CT values increment from 10-100 in steps of 10A, and from 100 to 6000A in steps of 50A. CT secondary must be 5A.

17.2 LIST ITEM SETTINGS

Factory default settings are in ***bold italicised*** text.

Parameter	Selections
20 - Alternator poles	0,2,***4***,6,8
21 – Fast loading enabled	***0***,1
22 - AC system	***0 - 3 phases 4 wire***
	1 - Single phase 2 wire
	2 - 3 phases 3 wire
	3 - 2 phases 3 wires
23 - Oil pressure display units	***0 - Bar/PSI***
	1 - kPa

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.3 CONFIGURABLE OUTPUTS

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
24 – Output 1	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 – Close Generator
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
25 – Output 2	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.4 CONFIGURABLE OUTPUTS (CONTINUED)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
26 – Output 3	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- The 'preheat modes' selectable for configurable outputs and LCD indicators perform the following actions :

Preheat mode 0 - Preheat during preheat timer, ceasing at end of preheat timer.
Preheat mode 1 - Preheat during preheat timer and continue until engine stops cranking.
Preheat mode 2 - Preheat during preheat timer and continue until the safety delay timer has expired.
Preheat mode 3 - Preheat during preheat timer and continue until the warming timer has expired.

In addition, in all preheat modes, preheat takes place during the crank rest timer between crank cycles.

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.5 LCD INDICATORS

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
27 - LCD 1	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
28 - LCD 2	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

LCD INDICATORS (CONTINUED)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
29 - LCD 3	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
30 - LCD 4	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- The 'preheat modes' selectable for configurable outputs and LCD indicators perform the following actions :

Preheat mode 0 - Preheat during preheat timer, ceasing at end of preheat timer.
Preheat mode 1 - Preheat during preheat timer and continue until engine stops cranking.
Preheat mode 2 - Preheat during preheat timer and continue until the safety delay timer has expired.
Preheat mode 3 - Preheat during preheat timer and continue until the warming timer has expired.

In addition, in all preheat modes, preheat takes place during the crank rest timer between crank cycles.

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.6 CONFIGURABLE INPUTS

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
31 – Input 1	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 -Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Remote Start, close to activate
	9 - Remote Start, open to activate
32 – Input 2	***0 - Delayed, Warning, close to activate***
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Electrical trip, close to activate
	9 - Electrical trip, open to activate
33 – Input 3	0 - Warning, Delayed, close to activate
	1 - Warning, Delayed, open to activate
	2 - Warning, Immediate, close to activate
	3 - Warning, Immediate, open to activate
	4 - Shutdown, Delayed, close to activate
	5 - Shutdown, Delayed, open to activate
	6 - Shutdown, Immediate, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Lamp test, close to activate
	9 - Lamp test, open to activate
34 – Input 4	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activat***e***
	7 - Immediate, Shutdown, open to activate
	8 - Simulate mains available, close to activate
	9 - Simulate mains available, open to activate
35 - Input 5	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Oil pressure switch, Shutdown, open for low oil pressure
	9 - Oil pressure switch, Shutdown, close for low oil pressure

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.7 MAINS SETTINGS

Factory default settings are in ***bold italicised*** text.

Parameter	Selections
36 - Immediate mains dropout	***0 - disabled***
	1 - enabled

Parameter	Type	***Default***
37 - Under voltage	Trip	(50-333V) ***184V***
38 - Under voltage	Return	(50-333V) ***207V***
39 - Over voltage	Return	(50-333V) ***253V***
40 - Over voltage	Trip	(50-333V) ***276V***

17.8 TIMERS & ANALOGUE SETTINGS

Parameter	Type	Default	Max
0 - Start delay	Timer	***5s***	60s
1 - Preheat	Timer	***0s***	60s
2 - Crank attempt	Timer	***10s***	60s
3 - Crank rest	Timer	***10s***	60s
4 - Safety delay	Timer	***8s***	60s
5 - Warming up	Timer	***0s***	60m
6 - Return delay	Timer	***30s***	60m
7 - Cooling run	Timer	***60s***	60m
8 - E.T.S. solenoid hold	Timer	***0s***	60s
9 - Sensor fail delay	Timer	***2s***	5s
10 - Fail to Stop Delay	Timer	***60s***	60s
11 - Low Oil Pressure	Trip	***15PSI***	150PSI
12 - High Temperature	Trip	***95°C***	150°C
13 - Under Speed	Trip	***1250RPM***	3600RPM
14 - Over Speed	Trip	***1750RPM***	5000RPM
15 - Gen Under frequency	Trip	***40Hz***	60Hz
16 - Gen Over frequency	Trip	***57Hz***	72Hz
17 - Charge Alt Failure	Warning	***8V DC***	25V DC
18 - Flywheel teeth	Value	***0***	300
19 - CT Primary	Value	***500A***	6000A

NOTE:- Setting a timer to zero (0) will disable it. Timer settings increment from 0 to 60s in steps of 1s and from 1 minute to the maximum value in steps of 30 seconds (0.5 minutes) (where applicable)

NOTE:- Setting Flywheel teeth to zero (0) will disable magnetic pickup speed sensing. In this instance, engine speed is derived from the alternator output frequency.

NOTE:- CT values increment from 10-100 in steps of 10A, and from 100 to 6000A in steps of 50A. CT secondary must be 5A.

17.9 LIST ITEM SETTINGS

Factory default settings are in ***bold italicised*** text.

Parameter	Selections
20 - Alternator poles	0,2,***4***,6,8
21 – Fast loading enabled	***0***,1
22 - AC system	***0 - 3 phases 4 wire***
	1 - Single phase 2 wire
	2 - 3 phases 3 wire
	3 - 2 phases 3 wires
23 - Oil pressure display units	***0 - Bar/PSI***
	1 - kPa

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.10 CONFIGURABLE OUTPUTS

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
24 – Output 1	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 – Close Generator
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
25 – Output 2	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.11 CONFIGURABLE OUTPUTS (CONTINUED)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
26 – Output 3	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- The 'preheat modes' selectable for configurable outputs and LCD indicators perform the following actions :

Preheat mode 0 - Preheat during preheat timer, ceasing at end of preheat timer.
Preheat mode 1 - Preheat during preheat timer and continue until engine stops cranking.
Preheat mode 2 - Preheat during preheat timer and continue until the safety delay timer has expired.
Preheat mode 3 - Preheat during preheat timer and continue until the warming timer has expired.

In addition, in all preheat modes, preheat takes place during the crank rest timer between crank cycles.

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.12 LCD INDICATORS

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
27 - LCD 1	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
28 - LCD 2	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

LCD INDICATORS (CONTINUED)

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
29 - LCD 3	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm
30 - LCD 4	0 - Unused
	1 - Preheat mode 0
	2 - Air flap
	3 - Load transfer
	4 - Energise to stop
	5 - Engine running
	6 - Shutdown alarm
	7 - System in auto
	8 - Auxiliary input 1 active
	9 - Auxiliary input 2 active
	10 - Auxiliary input 3 active
	11 - Auxiliary input 4 active
	12 - Auxiliary input 5 active
	13 - Preheat mode 1
	14 - Preheat mode 2
	15 - Preheat mode 3
	16 - Warning alarm
	17 - Common alarm

NOTE:- The 'preheat modes' selectable for configurable outputs and LCD indicators perform the following actions :

Preheat mode 0 - Preheat during preheat timer, ceasing at end of preheat timer.
Preheat mode 1 - Preheat during preheat timer and continue until engine stops cranking.
Preheat mode 2 - Preheat during preheat timer and continue until the safety delay timer has expired.
Preheat mode 3 - Preheat during preheat timer and continue until the warming timer has expired.

In addition, in all preheat modes, preheat takes place during the crank rest timer between crank cycles.

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.13 CONFIGURABLE INPUTS

Factory default settings are in ***bold italicised*** text.

Parameter	Selection
31 – Input 1	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 -Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Remote Start, close to activate
	9 - Remote Start, open to activate
32 – Input 2	***0 - Delayed, Warning, close to activate***
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Electrical trip, close to activate
	9 - Electrical trip, open to activate
33 – Input 3	0 - Warning, Delayed, close to activate
	1 - Warning, Delayed, open to activate
	2 - Warning, Immediate, close to activate
	3 - Warning, Immediate, open to activate
	4 - Shutdown, Delayed, close to activate
	5 - Shutdown, Delayed, open to activate
	6 - Shutdown, Immediate, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Lamp test, close to activate
	9 - Lamp test, open to activate
34 – Input 4	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activat***e***
	7 - Immediate, Shutdown, open to activate
	8 - Simulate mains available, close to activate
	9 - Simulate mains available, open to activate
35 - Input 5	0 - Delayed, Warning, close to activate
	1 - Delayed, Warning, open to activate
	2 - Immediate, Warning, close to activate
	3 - Immediate, Warning, open to activate
	4 - Delayed, Shutdown, close to activate
	5 - Delayed, Shutdown, open to activate
	6 - Immediate, Shutdown, close to activate
	7 - Immediate, Shutdown, open to activate
	8 - Oil pressure switch, Shutdown, open for low oil pressure
	9 - Oil pressure switch, Shutdown, close for low oil pressure

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.

17.14 MAINS SETTINGS

Factory default settings are in ***bold italicised*** text.

Parameter	Selections
36 - Immediate mains dropout	***0 - disabled***
	1 - enabled

Parameter	Type	***Default***
37 - Under voltage	Trip	(50-333V) ***184V***
38 - Under voltage	Return	(50-333V) ***207V***
39 - Over voltage	Return	(50-333V) ***253V***
40 - Over voltage	Trip	(50-333V) ***276V***

NOTE:- This section is for V3 configuration only. For configuration of later versions ie. V4 please refer elsewhere in this manual.