



Deep Sea Electronics Plc

5560 Operators Manual

Author – Anthony Manton

Deep Sea Electronics Plc
Highfield House
Hunmanby Industrial Estate
North Yorkshire
YO14 0PH
ENGLAND
Tel +44 (0) 1723 890099
Fax +44 (0) 1723 893303
Email : sales@deepseapl.com

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1 INTRODUCTION

The **DSE 5560** Module has been primarily designed to allow the user to start and stop a multi set system of generators, and if required, transfer the load to the generator bus either manually or automatically. The module also has the facility to run in parallel with the mains, maintaining either a fixed generator output or a fixed mains power level (kW and VAr). The 5560 also allows the system operating parameters to be viewed via the LCD display.

The **DSE 5560** module monitors the incoming AC mains supply for under or over voltage / under or over frequency and instructs the multi-set generating system to start and to supply the load. When the mains returns, the 5560 will back synchronise the multi-set system to the mains and execute a soft transfer of load back to the mains.

The powerful Micro-processor contained within the module allows for a range of complex features to be incorporated as standard;

- *True RMS voltage monitoring.*
- *Communications capability - RS485 for connection to building management system or other RS485 Modbus multidrop communications system.*
- *Fully configurable inputs for use as alarms or a range of different functions.*
- *Input expansion using P130 to give eight additional digital inputs.*
- *Extensive range output functions using built in relay outputs or the optional relay expansion unit.*

Selective operational sequences, timers and alarm trips can be altered by the customer via a PC using the 5xxx For Windows TM software and P810 interface module.

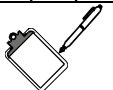
Access to critical operational sequences and timers for use by qualified engineers can be barred by a security code. Module access can be barred by PIN code. Limited operational parameters can be changed from the module front panel.

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

1.1 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.
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1.2 ICON DESCRIPTIONS

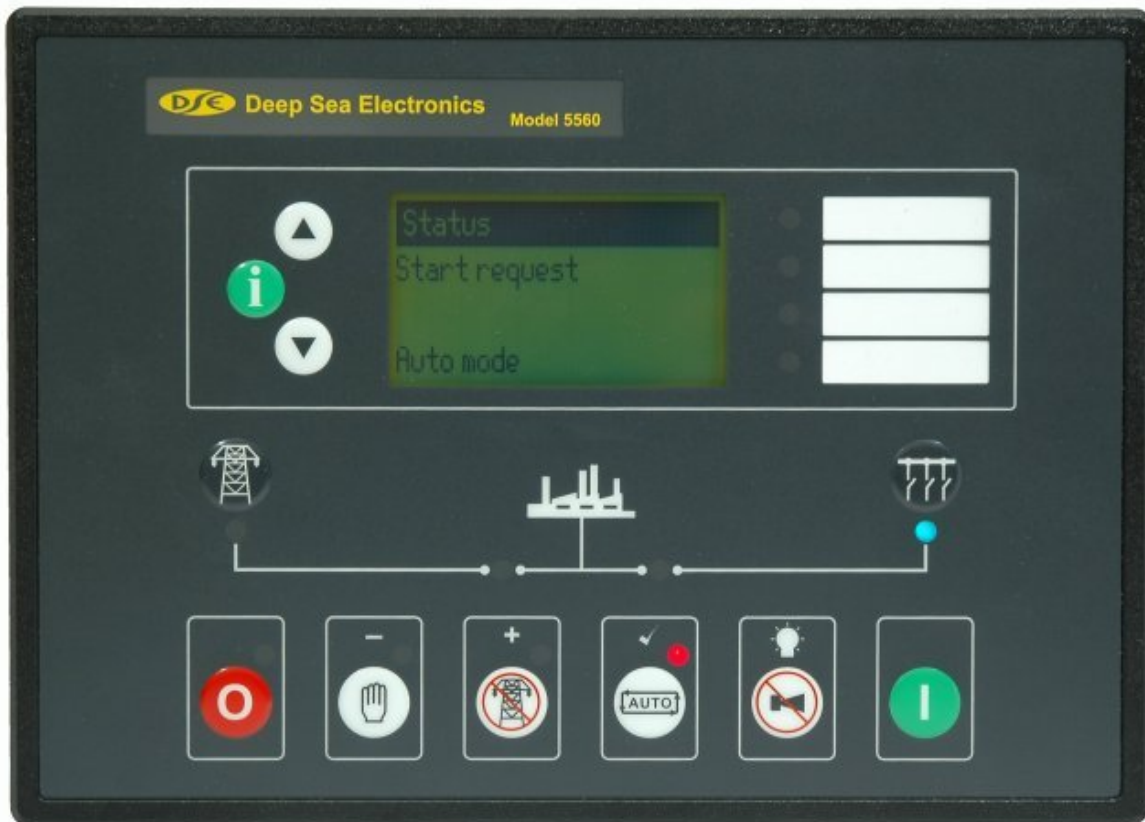
Symbol	Meaning	Description
	Stop/Reset	Stops the system generators (if the generators are in Auto mode) and reset any alarm conditions. Refer to other sections within this Manual.
	Start	Starts the system of generators (if the generators are in Auto mode and the 5560 is in manual mode).
	Auto	The controller will automatically start the system of generator (if the generators are in Auto mode) when given a remote start command, or the mains fails
	Manual	The controller will start the system of generators when the start button is pressed (if the generators are in Auto mode)
	Mains Failure Simulation (Test)	This is used to simulate a mains failure event. NOTE:- This tests the auto start/sync/load share functions of the system but will not test the mains failure detection.
	Alarm Mute	Silences the audible warning device.
	Lamp Test	Causes all indicating LED's to illuminate to test for correct operation
	Transfer to bus	Instructs the controller to transfer the load to the bus supply.
	Transfer to mains	Instructs the controller to transfer the load to the mains supply.
	Event Log	Details recorded history of operation.
	Information	Changes the display between the different information pages.
	Scroll	Scrolls the display between different items in the current information page.

2 OPERATION

2.1 CONTROL

Control of the **DSE 5560** module is via push buttons mounted on the front of the module with **STOP/RESET**, **MANUAL**, **TEST**, **AUTO**, **ALARM MUTE** and **START** functions. For normal operation, these are the only controls which need to be operated. The smaller push buttons are used to access further information such as mains voltage or to change the state of the load switching devices when in manual mode. Details of their operation are provided later in this document.

The following descriptions detail 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.



2.2 MANUAL OPERATION

Operation	Detail
To initiate a start sequence, press the 'Manual' push-button.	
The LED above the manual button will illuminate and the LCD display will then indicate:	Status Mains on load Manual mode
Then, press the START push-button. The 5560 will issue a start command to all connected 5510 controllers.	
NOTE:- If running on load demand option is set to "Start sets sequentially" then one set will start at a time as load levels rise. If configured to "start all sets initially" then all sets will start at the same time.	
The 5560 will display: Any available 5510 in auto mode will be issued with a start signal. Please refer to the 5510 operating manual for further details of the start sequence	Status Start request Manual mode
Once the Minimum number of sets (set using 5xxx software) have synchronised onto the bus, the 5560 will display:	Status Mains on load Manual mode
Pressing the transfer to bus/open mains button  will synchronise the bus to the mains. The 5560 will display:	Status Synchronise bus Manual mode
Once the bus has synchronised to the mains, the bus will close and power will be ramped onto the bus (generators). The 5560 will display:	Status Ramp onto bus 10% kW 12% kVAr Manual mode
Once the bus power / mains power level has been reached (configured using 5xxx software) the 5560 will display:	Status Continuous paralleling Manual Mode
The system will remain in this mode until further action is taken.	
Pressing the transfer to bus/open mains button  again will transfer the remaining load onto the bus (generators). The 5560 will display:	Status Ramp onto bus 10% kW 12% kVAr Manual mode
Once the mains loading has reached 0 kW the mains will open and the 5560 will display:	Status Bus on load Manual mode

The system will remain in this mode until further action is taken.

Pressing the transfer to mains/open bus button  once will synchronise the bus to the mains. The 5560 will display:	Status
	Synchronise bus
Once the bus has synchronised to the mains, the mains will close and power will be ramped off the bus (generators). The 5560 will display:	Manual mode
	Status
Once the bus power / mains power level has been reached (configured using 5xxx software) the 5560 will display:	Ramp off bus
	10% kW 12% kVAr
	Manual mode
	Status
	Continuous paralleling
	Manual Mode

The system will remain in this mode until further action is taken.

Operation	Detail
Pressing the transfer to mains/open bus button  again will transfer the remaining load onto the mains. The 5560 will display:	Status
Once the bus loading has reached 0kW the bus will open and the 5560 will display:	Ramp off bus
	10% kW 12% kVAr
Pressing the red stop button will issue a stop to all 5510s on the system	Manual mode
	
The LED above the button will illuminate and the LCD display will briefly indicate:	Status
	Mains on load
Any 5510 running in auto mode will then display: Please refer to the 5510 operating manual for further details of the 5510 stop sequence	Manual mode
	Stop mode
	RETURN DELAY
	00:50



NOTE:- Pressing the STOP/RESET button  at any time will transfer the load to the mains and stop the generators.

2.3 AUTOMATIC OPERATION

2.3.1 STARTING

Operation	Detail
If the module is placed in AUTO mode, it will monitor the incoming mains supply and remote start signal (if configured).	
The LCD display will indicate :	Status Mains on load Auto mode
The call to start can come from a number of sources (if configured) : • Mains supply failure. • Remote start input (either <i>on load</i>, <i>on load demand</i> or <i>in island mode</i>)	
Once a call to start is received, the module will initiate its 'Start Delay' timer This is used to ensure that the start event is required and not just a momentary condition. The 5560 will display:	Status Start delay 00:05 Auto mode
Once this timer has expired, any available 5510 in auto mode will be issued with a start signal, and will display: Please refer to the 5510 operating manual for further details of the 5510 start sequence.	START DELAY 00:05
The 5560 will display:	Status Start request Auto mode

2.3.2 CLOSING THE BUS BREAKER

MAINS FAILED

As the mains supply has failed, there is no requirement for synchronising. However, the 5560 will check to ensure that the load bus is 'dead' before closing the generator bus breaker onto the load. This check is made using the internal 'dead bus relay' and the functionality of the Multiset Communications Link (MSC).	Status Continuous paralleling Auto mode
Should the mains supply return, the module will first initiate a return timer to ensure that it is safe to stop the generators. The 5560 will display:	Status Return delay 00:05 Auto mode

NOTE: - Should the mains fail within this time, the module will continue to run the generators on load and ignore the fluctuating "call to stop" until such a time as it remains inactive for the duration of the stop delay timer.

MAINS AVAILABLE

If the mains supply is available when the sets are called to take load, the generator bus must first be synchronised with the mains supply. This will occur if: • The sets are started by remote start (if configured). • The sets are started due to high mains load (if configured to start upon this event) Once the Minimum number of sets (set using 5xxx software) have synchronised onto the bus, the 5560 will display:	Status Synchronise to bus Auto mode
Once the bus has synchronised to the mains, the bus load switching device will be closed and power will be ramped onto the bus (generators). The 5560 will display:	Status Ramp onto bus 10% kW 12% kVAr Auto mode
Once the bus power / mains power level has been reached (configured using 5xxx software) the 5560 will display:	Status Continuous paralleling Auto mode

2.3.3 RUNNING IN PARALLEL

RUNNING IN LOAD DEMAND

If the module is configured for *running in load demand*, sets will be started and stopped automatically on changing load levels.

 **NOTE:** - If the load is reduced to zero (0kW) then the genset(s) with the highest priority will remain running.

REMOTE START IN ISLAND MODE

If the module is configured for <i>remote start in island mode</i> , the load is then ramped fully onto the generators. The 5560 will display:	Status Ramp onto bus 76% kW 80% kVAr Auto mode
Once the mains loading has reached 0kW, the bus load switch will be opened and the 5560 will display:	Status Bus on load Auto mode
Should the remote start signal be deactivated, the module will first initiate a return timer to ensure that it is not a transient condition. The 5560 will display:	Status Return delay 00:05 Auto mode

 **NOTE:** - Should a call to start become active again, the module will continue to run the generators on load and ignore the fluctuating “call to stop” until such a time as it remains inactive for the duration of the return delay timer.

2.3.4 RE-TRANSFER TO MAINS

Once the return delay has expired, the bus is synchronised to the mains.	Status Synchronise to Mains Auto mode
The load is then ramped back onto the mains. The 5560 will display:	Status Ramp off bus 10% kW 12% kVAr Auto mode
Once the bus loading has reached 0kW, the bus load switch will be opened and the 5560 will display :	Status Mains on load Auto mode
Any 5510 running in Auto mode will be issued a stop command and will display : Please refer to the 5510 operator manual for details on the stopping sequence.	Return delay 00:05

2.4 TEST OPERATION

Operation	Detail
To place the module into 'TEST' mode press 'TEST' PUSHBUTTON . This mode is used to simulate an automatic start and will start the generators to run in continuous parallel mode.	
The LCD display will indicate	Status Mains on load Test mode
The LED above the button will illuminate and the module will start its 'Start Delay' timer This is used to ensure that the start event is required and not just a momentary transient signal. The 5560 will display:	Status Start delay Test mode 00:05
Once this timer has expired, any available 5510 in auto mode will be issued with a start signal, and will display: Please refer to the 5510 operating manual for further details of the 5510 start sequence.	START DELAY 00:05
The 5560 will display:	Status Start request Test mode
Once the Minimum number of sets (set using 5xxx software) have synchronised onto the bus, the 5560 will display:	Status Synchronise to bus Test mode
Once the bus has synchronised to the mains, the bus will close and power will be ramped onto the bus (generators). The 5560 will display:	Status Ramp onto bus 10% kW 12% kVAr Test mode
Once the bus power / mains power level has been reached (configured using 5xxx software) the 5560 will display:	Status Continuous paralleling Test mode
The system will remain in this mode until further action is taken.	
If the module is placed in 'AUTO' mode by pressing the 'AUTO' PUSHBUTTON , it will monitor the auxiliary inputs for a 'REMOTE START' signal. In addition, the module will monitor the incoming AC mains supply. For further details on operation in AUTO mode, see the relevant section elsewhere in this document.	

2.5 5560 MULTIPLE MAINS OPERATION

In a multiple mains system, the generator sets are controlled by more than one 5560 mains controller and used to provide power to multiple loads.

Should one or more of the mains supplies fail, the generators (controlled by DSE 5510 modules) are started and supply power to the load. If more than one mains supply has failed, the loads are transferred to the generators one by one.

The 5510 controllers share power equally on a percentage basis with the other generators in the system.

- If one mains supply returns, the 5560 connected to that mains supply will synchronise the generators with the mains and affect a no-break changeover. The generators continue to supply power to the remaining loads.
- If more than one mains supply returns at the same time, then the 5560 with the highest priority will take control of the generators and affect a no-break changeover back to the mains supply. The remaining 5560s will operate in priority order providing no-break returns back to their respective mains supplies.

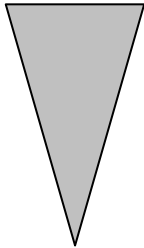
If the generators are 'peak-logging' with one mains supply, and another mains supply fails, dependant upon module configuration, the generators will either:

- Continue to peak-log as before. The load with the mains supply that has failed will remain without power.
- Cease peak-logging and backup the failed mains supply.

NOTE: - At no time are the generators paralleled with more than one mains supply at a time. Paralleling with mains supplies is always taken in turn.

2.5.1 5560 PRIORITY

Where more than one 5560 controller is present, they must determine which one is to take control over the generators. The following table shows how this priority decision is made.

Priority	Condition
HIGHEST	
	Auto mode, mains failed, bus not on load
	Auto mode, mains has returned
	Auto mode, mains failed, bus on load
	Auto mode, mains available, requesting control over generators
	Test on load mode
	Manual mode, sets running or about to run (start button has been pressed)
	Auto mode, mains available
	Manual mode, sets not running (waiting for start button to be pressed)
	Stop mode
LOWEST	

Where two or more 5560 controllers have the same conditions in the table above, the 'Set Priority' configuration setting comes into effect. If two or more 5560 controllers have the same priority number, an electrical trip alarm is generated - Priority Selection Error - and the priority numbers must be changed before the system will operate.

NOTE: - If a 5560 requests to control the generators (either automatically or manually) it will not be allowed to do so until higher priority 5560 controllers have relinquished control over them.

For typical one line diagram of a multi-mains system, see the section entitled "Typical system schematics" elsewhere in this manual.

2.5.2 5560 LOAD CT

The 5560 controller incorporates an optional (but recommended) extra CT measuring the size of the load. Used in conjunction with the CTs measuring the amount of load on the mains supply, this CT allows the 5560 to determine what portion of the load is being supplied by the generators. This allows the 5560 to remove the sets from this load when there is little or no current passing through the bus breaker. For example: When the generators are ramping off load.

3 PROTECTIONS

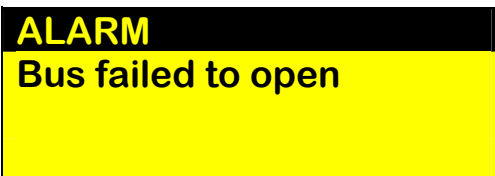
The module will indicate that an alarm has occurred in several ways;

The Audible Alarm will sound. This can be silenced by pressing the '**Mute**' button.



The LCD display will jump from the 'Status page' to display the Alarm.

The LCD will then display :
Followed by the appropriate alarm text.



If no alarms are present, the LCD will display the following message and will then return to the '**Status Display**' page.



The LCD will display multiple alarms E.g. "Bus fail to open", "Fail to synchronise" and "Mains fail to close" alarms have been triggered. These will automatically scroll round in the order that they occurred.

It is also possible to scroll to display the different alarms using the scroll buttons 

3.1 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.

BATTERY LOW VOLTAGE, if the module detects that the systems DC supply has fallen below the low volts setting level, the module will display '**WARNING LOW BATTERY VOLTAGE**' on the LCD. The **COMMON ALARM LED** will illuminate.

BATTERY HIGH VOLTAGE, if the module detects that the system DC supply has risen above the high volts setting level, the module will display '**WARNING HIGH BATTERY VOLTAGE**' on the LCD. The **COMMON ALARM LED** will illuminate.

FAILED TO SYNCHRONISE, if the module cannot synchronise within the time allowed by the Synchronising timer a warning is initiated. The LCD will indicate '**FAILED TO SYNC**' and the **COMMON ALARM LED** will illuminate.

AUXILIARY INPUTS, if an auxiliary input has been configured as a warning the appropriate LCD message will be displayed and the **COMMON ALARM LED** will illuminate.

MAINS FAILED TO CLOSE, if the mains breaker fails to close, a warning is initiated. The LCD will indicate '**MAINS FAILED TO CLOSE**' and the **COMMON ALARM LED** will illuminate.

MAINS FAILED TO OPEN, if the mains breaker fails to open, a warning is initiated. The LCD will indicate '**MAINS FAILED TO OPEN**' and the **COMMON ALARM LED** will illuminate.

INSUFFICIENT CAPACITY, if the generators reach full load when they are in parallel with the mains (utility). The LCD will indicate '**INSUFFICIENT CAPACITY**' and the **COMMON ALARM LED** will illuminate.

MINIMUM SETS NOT REACHED, if the minimum number of sets on the bus has not been reached prior to closing the generator bus load switching device, the LCD will indicate '**MINIMUM SETS NOT REACHED**' and the **COMMON ALARM LED** will illuminate.

MSC DATA ERROR, if the data on the MSC link is corrupt, then the LCD will indicate '**MSC DATA ERROR**' and the **COMMON ALARM LED** will illuminate.

MSC ID ERROR, if more than one 5560 module is connected to the same MSC link, the LCD will indicate '**MSC ID ERROR**' and the **COMMON ALARM LED** will illuminate.

MSC FAILURE, if the link breaks, the LCD will indicate '**MSC FAILURE**' and the **COMMON ALARM LED** will illuminate.

BUS FAILED TO CLOSE, if the bus breaker fails to close, the LCD will indicate '**BUS FAILED TO CLOSE**' and the **COMMON ALARM LED** will flash.

BUS FAILED TO OPEN, if the bus breaker fails to open, the LCD will indicate '**BUS FAILED TO OPEN**' and the **COMMON ALARM LED** will flash.

MAINS REVERSE POWER, if the 5560 detects that the bus is exporting more than the configured limit, the LCD will indicate '**MAINS REVERSE POWER**' and the **COMMON ALARM LED** will flash.

MSC TOO FEW SETS, if the number of modules on the MSC link falls below the **Minimum modules on Multiset comms link**, the LCD will indicate '**MSC TOO FEW SETS**' and the **COMMON ALARM LED** will illuminate.

MSC ALARMS INHIBITED, if an input has been configured as '**MSC ALARMS INHIBIT**' and is active, the LCD will indicate '**MSC ALARMS INHIBIT**' and the **COMMON ALARM LED** will illuminate.

3.2 ELECTRICAL TRIPS

Electrical trips are latching, and open the bus breaker. The alarm must be accepted and cleared, and the fault removed to reset the module.

MAINS REVERSE POWER, if the module detects a mains reverse power in excess of the pre-set trip level and time delay, an electrical trip is initiated. The LCD will indicate '**MAINS REVERSE POWER**' and the **COMMON ALARM LED** will flash.

AUXILIARY INPUTS, if an auxiliary input has been configured as an Electrical Trip the appropriate LCD message will be displayed and the **COMMON ALARM LED** will flash.

MINIMUM SETS NOT REACHED, if the minimum number of sets are not synchronised on to the bus, prior to the common bus breaker closing, an electrical trip is initiated. The LCD will indicate '**MIN. SETS NOT REACHED**' and the **COMMON ALARM LED** will flash.

BUS FAILED TO CLOSE, if the bus breaker fails to close, an electrical trip is initiated. The LCD will indicate '**BUS FAILED TO CLOSE**' and the **COMMON ALARM LED** will flash.

BUS FAILED TO OPEN, if the bus breaker fails to open, an electrical trip is initiated. The LCD will indicate '**BUS FAILED TO OPEN**' and the **COMMON ALARM LED** will flash.

INSUFFICIENT CAPACITY, if the module is configured for Mains CT and the load levels are so high that the generator is unable to supply enough load to maintain the configured mains level, insufficient capacity will be displayed and the **COMMON ALARM LED** will flash. The generator will provide 100% of its capacity and the loading on the mains will increase.

MAINS REVERSE POWER, if the module is configured for Mains CT and the amount of power being exported to the mains supply is above the setting for the 'export power level alarm' then mains reverse power is displayed and the **COMMON ALARM LED** will flash.

OLD UNITS ON BUS, if the module detects that there is one or more 5560 controllers connected to the MSC link that are not compatible with the module (for example earlier versions not supporting multiple mains supplies), Old units on bus is displayed and the **COMMON ALARM LED** will flash.

FAILED TO SYNCHRONISE, if the module cannot synchronise within the time allowed by the Synchronising timer a warning is initiated. The LCD will indicate '**FAILED TO SYNC**' and the **COMMON ALARM LED** will illuminate.

MSC TOO FEW SETS, if the 5560 detects that the number of generator sets connected module cannot synchronise within the time allowed by the Synchronising timer a warning is initiated. The LCD will indicate '**FAILED TO SYNC**' and the **COMMON ALARM LED** will illuminate.

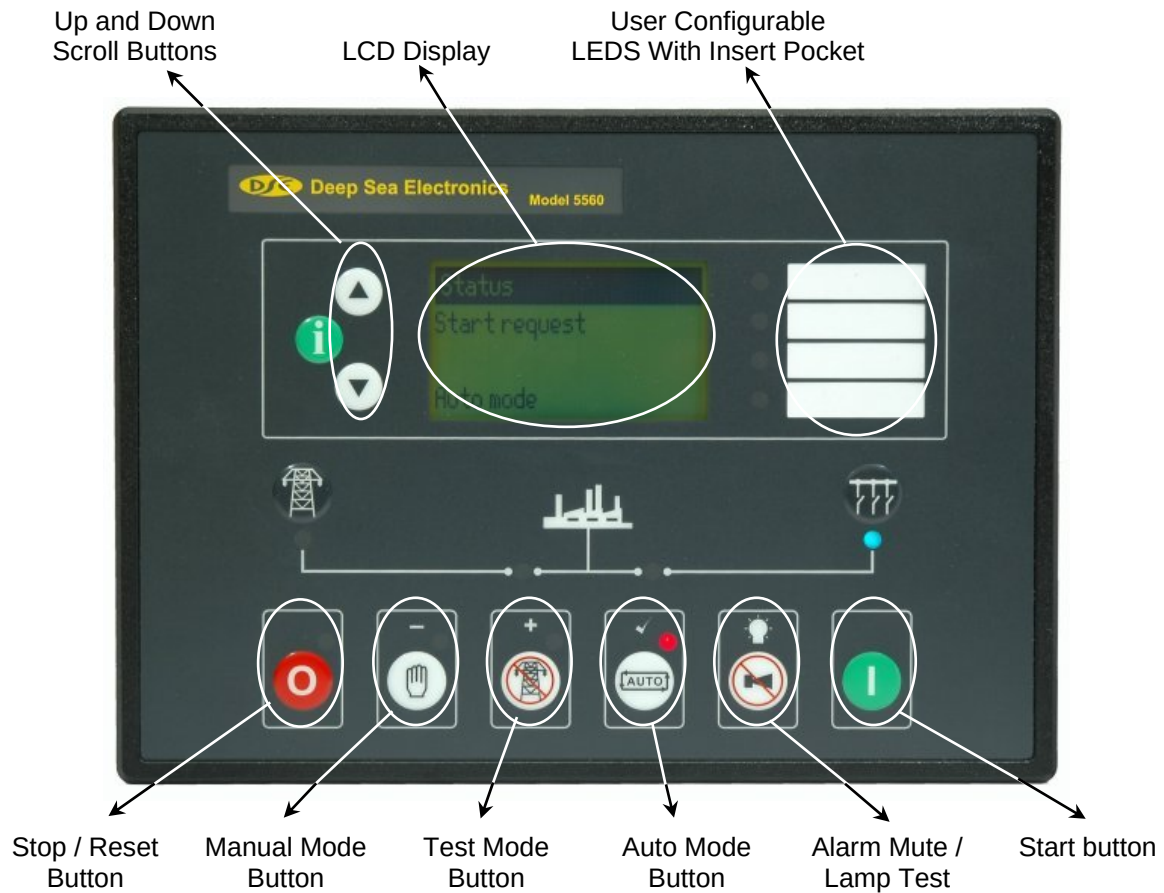
PRIORITY SELECTION ERROR, if the 5560 detects that two or more 5560 controllers share the same priority number, an electrical trip is initiated. The LCD will indicate '**PRIORITY SELECTION ERROR**' and the **COMMON ALARM LED** will illuminate.

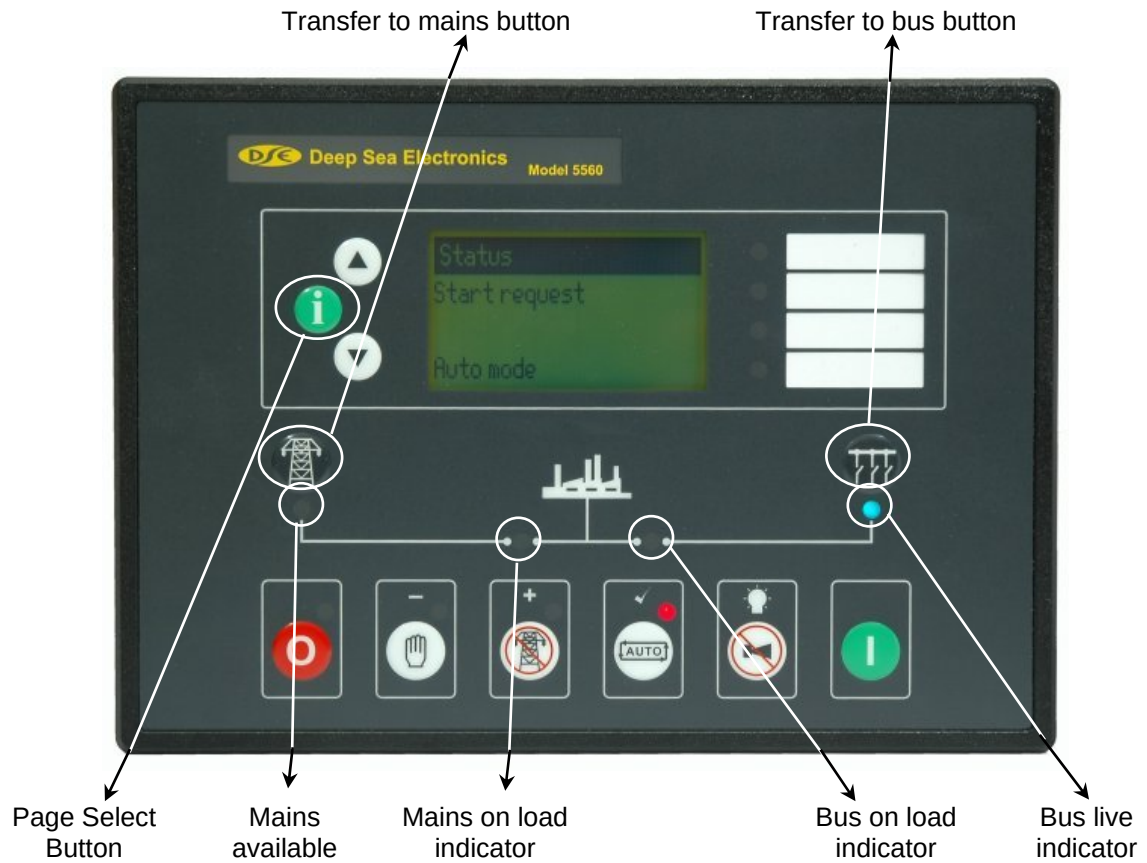
BUS PHASE SEQUENCE WRONG, if the module detects a bus phase rotation error, an electrical trip is initiated. The LCD will indicate '**BUS PHASE SEQ WRONG**' and the **COMMON ALARM LED** will illuminate.

MAINS PHASE SEQUENCE WRONG, if the module detects a mains phase rotation error, an electrical trip is initiated. The LCD will indicate '**MAINS PHASE SEQ WRONG**' and the **COMMON ALARM LED** will illuminate.

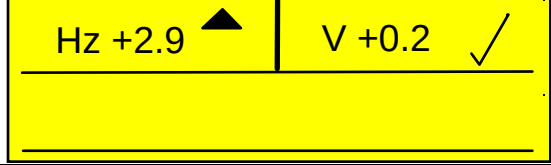
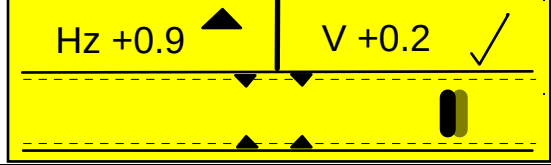
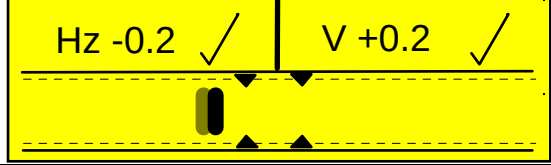
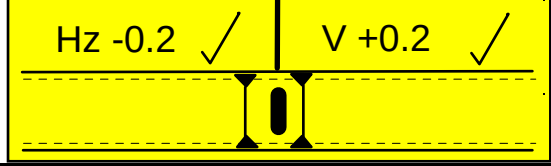
4 DESCRIPTION OF CONTROLS

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





4.1.1 SYNCHROSCOPE OPERATION

	Initial stage of Synchronising display will only show the difference between the Mains Supply and the Generator Output. Here the display is showing a frequency mismatch of +2.9Hz - The genset frequency is too high (indicated by the arrow) and should be reduced. The voltage is +0.2 volts high, but is within the limits set for synchronising.
	Once the difference between the Mains and the Generator frequency has been reduced, the 'Synchroscope' display will become active. The moving bar will roll from one side to the other showing the phase of the two supplies. The area in the centre of the scope indicates the set limits for synchronising to occur.
	Synchronising will only occur when both the Frequency and the voltage differences are within acceptable limits - Indicated by 'Tick' marks on the top of the display. Then the moving bar display will show the phase difference. The engine speed will be automatically adjusted, altering the phase, until the moving bar enters the centre of the scope.
	Once the Mains and generator supplies are synchronised, the module will initiate a breaker close signal to load the generator onto the Mains. Should synchronism be broken the moving bar will pass out of the synchronising window.

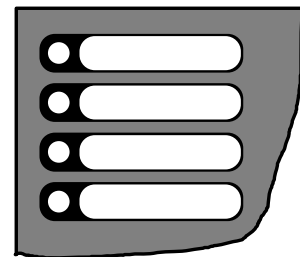
Note: - If the module display is showing the status page when the synchronising process begins, the module will automatically switch to the Synchroscope page. The ramp progress will also be displayed on the screen once paralleling has taken place.

4.2 LED INDICATORS

USER CONFIGURABLE LED's

These LED can be configured by the user to indicate any one of **100+ different functions** based around the following:-

- **INDICATIONS** - Monitoring of a digital input and indicating associated functioning user's equipment - *Such as Battery Charger On or a G59 trip, etc.*
- **WARNINGS and ELECTRICAL TRIPS** - Specific indication of a particular warning or electrical trip condition, backed up by LCD indication - *Such as Bus failed to open, etc.*
- **STATUS INDICATIONS** - Indication of specific functions or sequences derived from the modules operating state – *Mains failed, Bus live, etc.*



4.3 COMPLETE INSTRUMENTATION LIST

4.3.1 BASIC INSTRUMENTATION

Bus volts (L1-N, L2-N, L3-N)

Bus volts (L1-L2, L2-L3, L3-L1)

Bus Hz

Bus kW

Bus kVAr



These values are calculated by reading the information from the modules via the MultiSet Communications (MSC) link

Bus phase sequence

Load Amps, pf

Load kW, kVA, kVAr

Mains Volts (L1-N, L2-N, L3-N)

Mains Volts (L1-L2, L2-L3, L3-L1)

Mains Hz

Mains Amps

Mains kW

Mains kVA

Mains pf

Mains kVAr

Mains kWh

Mains kVAh

Mains kVArh

Mains phase sequence

Synchroscope

4.4 FRONT PANEL CONFIGURATION EDITOR

Entering configuration mode will place the module into STOP/RESET mode. If the set(s) are running, they will be taken off load and stopped before configuration mode is entered.

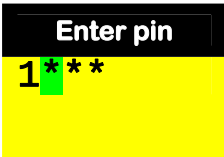
Operation	Detail
To enter the 'Operator configuration mode' press both the INFO and STOP buttons together.	

4.4.1 ENTERING THE PIN NUMBER

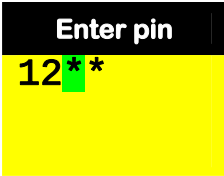
If the module PIN number has been set, the PIN number request is then shown. The configuration cannot be viewed or changed until the PIN number is correctly entered. If no PIN has been set, then skip to the next section.



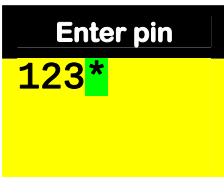
The first * is flashing. Press + or – buttons to adjust it to the correct value for the first digit of the PIN number.
Press ✓ when the first digit is correctly entered.



The second * is now flashing. Press + or – buttons to adjust it to the correct value for the second digit of the PIN number.
Press ✓ when the second digit is correctly entered.



The third * is now flashing. Press + or – buttons to adjust it to the correct value for the third digit of the PIN number.
Press ✓ when the third digit is correctly entered.



The fourth * is now flashing. Press + or – buttons to adjust it to the correct value for the fourth digit of the PIN number. Press ✓ when the fourth digit is correctly entered.

 **NOTE:-** When ✓ is pressed after editing the final PIN digit, the PIN is checked for validity. If the number is not correct, the editor is automatically exited. To retry you must re-enter the editor as described above.

4.4.2 EDITING VALUES

If the PIN number has not been set, or has been correctly entered :

The LCD will then display:



To view the different configuration functions press the + or - buttons.

The LCD will then display:



Pressing the ✓ button will enter edit mode :

The parameter being changed will flash.

Pressing + or – buttons will change the parameter to the desired value.



Press ✓ to save the change. The parameter will stop flashing as the edit mode is exited.

NOTE: - If STOP button is pressed BEFORE the value is saved, the current edit is cancelled, the change is not saved, and the previous value is restored.

To view the different configuration functions press the + or - buttons.

To exit the '**Operator configuration mode**' save your current value change if you haven't already done so (press ✓ to exit the flashing edit mode), then press Stop/Reset to exit configuration mode.

The module will then return to the '**Status Page**' display.

4.4.3 LIST OF ADJUSTABLE PARAMETERS

(Factory default settings are shown in bold italicised text)

Section	Parameter as shown on display	Values
Timers	Mains Transient Delay	0-10s (2s)
	Start Delay	0 -60m (5s)
	Transfer Delay	0-10s (0.75s)
	Return Delay	0 -60m (30s)
	Low Battery Delay	0-10m (1m)
	High Battery Delay	0-10m (1m)
Mains	Mains Under Voltage Alarm	50V-360V ph-N (184V)
	Mains Over Voltage Alarm	50V-360V ph-N (276V)
	Mains Under Frequency Alarm	0Hz -75Hz (45Hz)
	Mains Over Frequency Alarm	0Hz -75Hz (55Hz)
System	Plant Battery Under Volt Alarm	0-40V (10V)
	Plant Battery Over Volt Alarm	0-40V (30V)
Display	Language	ENGLISH , OTHERS (see note below)
	Contrast	□ ■
Clock	Date and Time	dd mmm yyyy hh:mm
Misc.	Auto Scroll Time	0-10s (2.0s)

NOTE: - More comprehensive module configuration is possible using the 5xxx series PC configuration software in conjunction with the P810 PC interface. Please contact us for further details.

NOTE: - Languages are subject to change as the modules are updated. Please contact our us for the list of latest supported languages.

4.5 DISPLAY SETTINGS EDITOR

The settings in the display editor can be changed at any time, including when the engine is running.

Press the   buttons simultaneously to enter the editor.

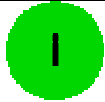
Press  button to cycle round the available parameters.

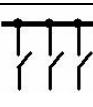
Press   to change the visible parameter.

To exit select Abandon or Save changes and exit and press either   button.

Parameter	Values
Contrast	□ ■
Language	ENGLISH, OTHERS
Abandon changes & exit	
Save changes & exit	

4.6 CONTROL PUSH-BUTTONS

STOP/RESET This push-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 engines are running and this push-button is operated, the module will automatically instruct the change-over device to unload the bus. Should a remote start signal or mains failure be present while operating in the Stop/reset mode, a remote start will <u>not</u> occur.	
MANUAL This push button is used to allow manual control of the bus functions. Entering this mode from another mode will initially not cause any change of operating state, but allows further push-buttons to be used to control the bus operation. For example, once in Manual mode it is possible to start the generators by using the 'START' push-button (providing the 5510 modules are in the AUTO mode). If the bus is available off-load in the Manual mode and a remote start signal becomes present, the module will automatically instruct the changeover device to place the bus on load. Should the remote start signal then be removed the bus will remain on load until either the 'STOP/RESET' or 'AUTO' push buttons are operated.	
START This push button is used to start the generators. The module must first be placed in the 'MANUAL' mode of operation. The 'START' button should then be operated. The generators will then automatically attempt to start. To stop the generators the 'STOP/RESET' button should be operated.  NOTE:-Different modes of operation are possible - Please refer to your configuration source for details.	
AUTO This push-button places the module into its 'Automatic' mode. This mode allows the module to control the function of the bus automatically. The module will monitor the remote start input and mains supply and once a start condition is signalled, the generating sets will be automatically started and synchronised together. The 5560 will then synchronise the bus with the mains supply (if available) and close the bus load switching device. If the reason for starting is removed, the module will automatically transfer the load from the bus and shut the sets down observing stop delay timer, synchronisation and cooling timer as necessary. The module will then await the next start event. <i>For further details, please see the more detailed description of 'Auto Operation' earlier in this manual.</i>	

TEST This push button places the module into its 'Test' mode. This mode is used to test the function and timing of the bus generators start and load sequence. The mode is initiated by pressing the 'Start' button and the bus will be automatically started, synchronised with the mains supply (if still available) and placed on load. The sets will run on load continuously. To test the off-loading and stopping sequence return the set to the 'Auto' mode, the module will automatically transfer the load from the bus and shut the set down observing the stop delay timer and cooling timer as necessary. The module will then await the next start event. <i>For further details, please see the more detailed description of 'Test Operation' earlier in this manual.</i>	
ALARM MUTE This push button is used to silence the internal alarm sounder and also any external sounder devices fed from the audible alarm output. Any further alarm conditions will reactivate the sounder. Once the alarm has been muted and investigated, it may then be cleared. <i>Refer to the 'Protections' section of this manual for details.</i> When the Alarm Mute is operated a Lamp test function will also be implemented and all LED indicators will be illuminated.	
TRANSFER TO BUS  NOTE:- This button is only active in MANUAL mode. This push button is used to control the closure of the bus load switching device and has three modes of operation : 1. Pressing this button when the bus is available off load and the mains supply is not available will cause the mains load switch to be opened if required. After a delay (load transfer time), the generator load switch is closed. Further presses of this button will have no effect. 2. Pressing this button when the bus is available and the mains supply is available will instruct the controller to volts match and synchronise the bus with the mains supply. The bus load switch is then closed in parallel with the mains supply. 3. Pressing this button when the bus is running in parallel with the mains supply will open the mains load switch (transferring the load fully to the generator supply).	

TRANSFER TO MAINS

This push button is used to control the closure of the mains load switching device and has three modes of operation :



NOTE: - This button is only active in MANUAL mode.

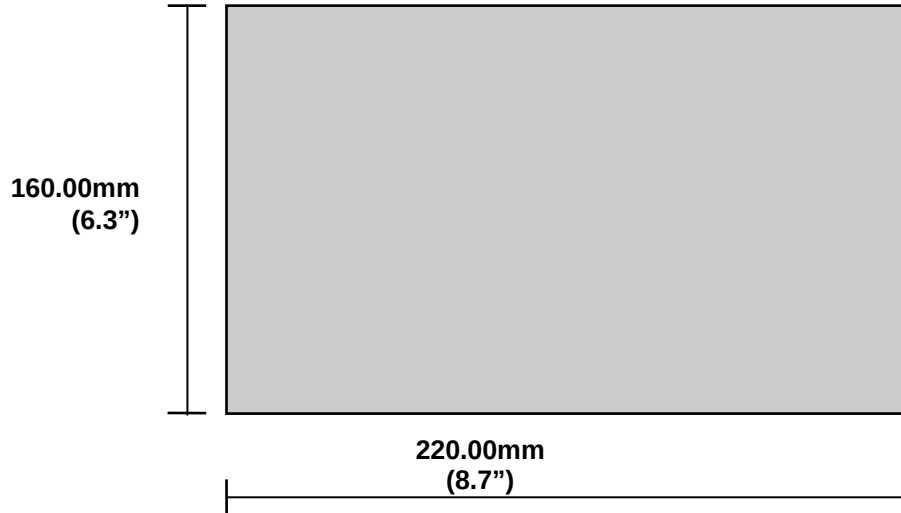
1. Pressing this button when the bus is on load and the mains supply is not available will open the generator load switch.
2. Pressing this button when the bus is on load and the mains supply is available will cause the controller to volts match and synchronise the bus with the mains supply. The bus load switch is then closed in parallel with the mains supply.
3. Pressing this button when the bus is in parallel with the mains supply will open the generator load switch, transferring the load fully back to the mains supply.



5 INSTALLATION INSTRUCTIONS

The model **DSE 5560** Module has been designed for front panel mounting. Fixing is by 4 clips for easy assembly.

5.1 PANEL CUT-OUT



Maximum panel thickness – 8mm (0.3")

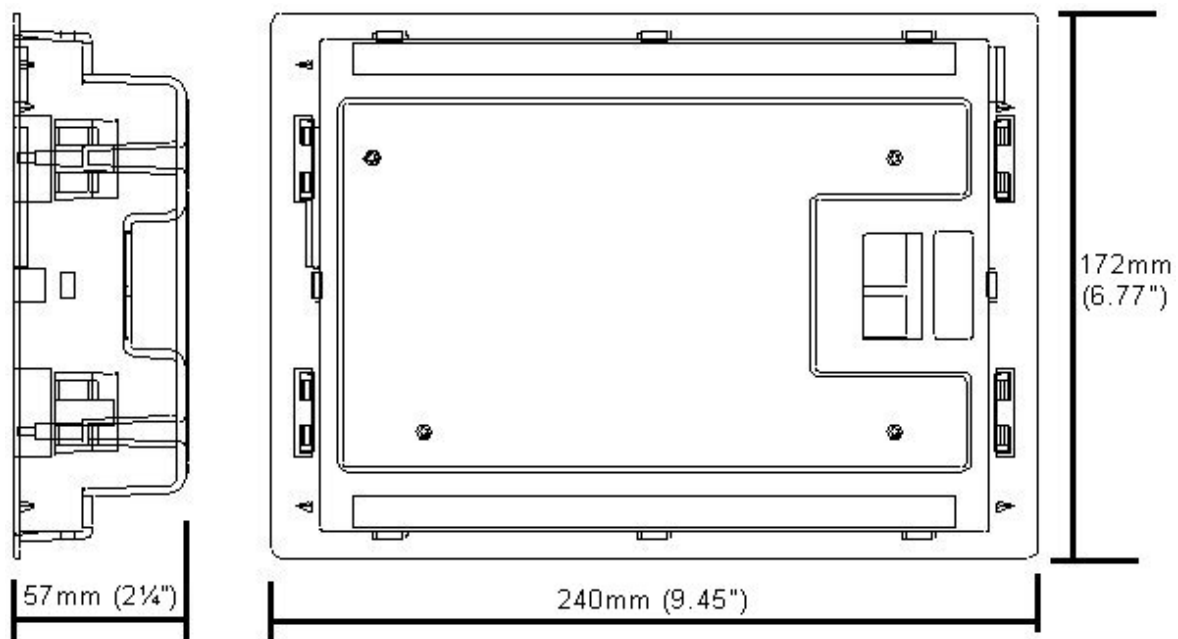
In conditions of excessive vibration, the module should be mounted on suitable anti-vibration mountings.

5.2 COOLING

The module has been designed to operate over a wide temperature range **-30°C to +70°C**.

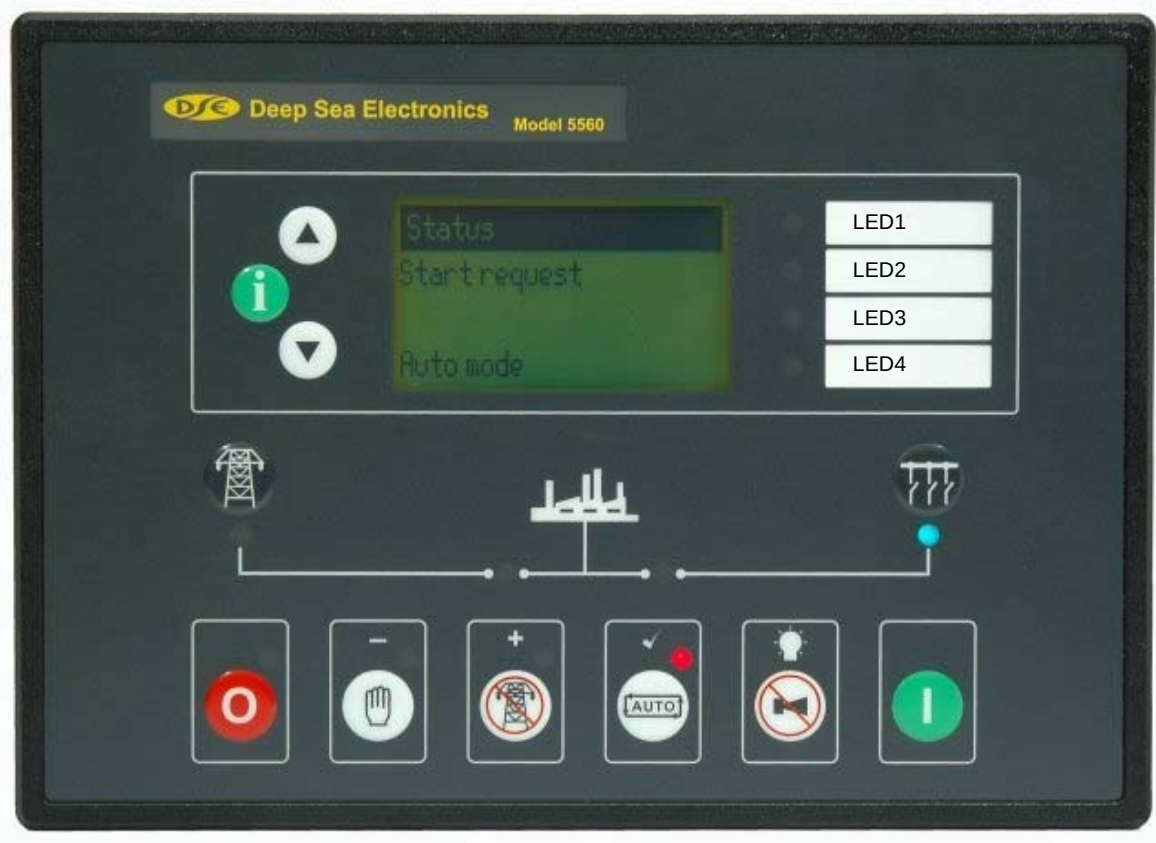
Allowances should be made for the temperature rise within the control panel enclosure. Care should be taken **NOT** to mount possible heat sources near the module unless adequate ventilation is provided. The relative humidity inside the control panel enclosure should not exceed **95%**.

5.3 UNIT DIMENSIONS



Panel cut-out 220mm x 160mm (8.7" x 6.3")

5.4 FRONT PANEL LAYOUT AND LED IDENTIFICATION



6 LED INDICATORS AND LOGO INSERT

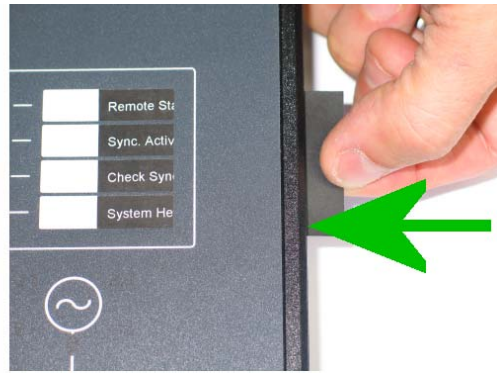
USER CONFIGURABLE LED's

These LEDs can be configured by the user to indicate any one of **100+ different functions** based around the following:-

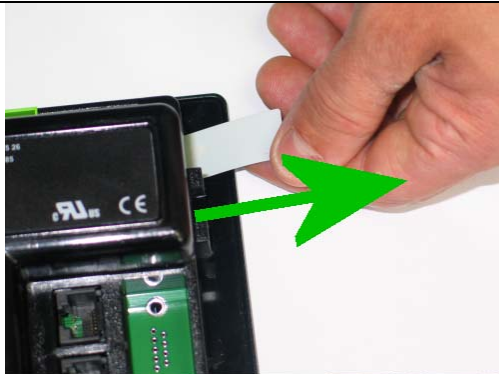
- **INDICATIONS** - Monitoring of a digital input and indicating associated functioning user's equipment - *Such as Battery Charger On or Louvre Open, etc.*
- **WARNINGS and SHUTDOWNS** - Specific indication of a particular warning or shutdown condition, backed up by LCD indication - *Such as Low Oil 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, Panel Locked, Generator Available, etc.*

These LEDs are annunciated using a removable insert card. Additionally the module's logo can be changed to suit generator manufacturer's requirements. This can be used for instance to give custom branding to the module, or even include the service telephone number.

DSE have produced the 'insert card creator' software, shipped with the DSE Software CD to ease the production of text and logo insert cards to suit your application.



Removal and insertion of the LED text insert card



Removal and insertion of the Logo insert card

7 ELECTRICAL CONNECTIONS

Connections to the Module are via plug and sockets.

7.1 CONNECTION DETAILS

The following describes the connections and recommended cable sizes to the 8 plugs and sockets on the rear of the Module.

7.1.1 PLUG "A" 8 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
1	DC Plant Supply Input (negative)	2.5mm	
2	DC Plant Supply Input (positive)	2.5mm	(Recommended Fuse 20A Max.)
3	Unused		Do not connect
4	Unused		Do not connect
5	Unused		Do not connect
6	Auxiliary Output relay 1	1.0mm	Plant Supply positive. 5 Amp rated.
7	Auxiliary Output relay 2	1.0mm	Plant Supply positive. 5 Amp rated.
8	Auxiliary Output relay 3	1.0mm	Plant Supply positive. 5 Amp rated.

7.1.2 PLUG "B" 11 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
9	Unused		Do not connect
10	Auxiliary Input 1	0.5mm	Switch to negative
11	Auxiliary Input 2	0.5mm	Switch to negative
12	Auxiliary Input 3	0.5mm	Switch to negative
13	Auxiliary Input 4	0.5mm	Switch to negative
14	Auxiliary Input 5	0.5mm	Switch to negative
15	Auxiliary Input 6	0.5mm	Switch to negative
16	Auxiliary Input 7	0.5mm	Switch to negative
17	Auxiliary Input 8	0.5mm	Switch to negative
18	Auxiliary Input 9	0.5mm	Switch to negative
19	Functional Earth	2.5mm	Connect to system earth

7.1.3 PLUG "C" 9 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
20	Unused		Do not connect
21	Unused		Do not connect
22	Unused		Do not connect
23	Unused		Do not connect
24	Unused		Do not connect
25	Unused		Do not connect
26	Multiset communications link (MSC) GND	0.5mm	See note below
27	Multiset communications link (MSC) H	0.5mm	See note below
28	Multiset communications link (MSC) L	0.5mm	See note below

 **NOTE:-** Screened 120Ω impedance cable specified for use with CANBUS must be used for the SAE J1939 link.
DSE stock and supply Belden cable 9841 which is a high quality 120Ω impedance cable suitable for CANbus use (DSE part number 016-030)

7.1.4 PLUG “D” 3 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
29	RS485 SCREEN	0.5mm	Screen for RS485
30	RS485 B	0.5mm	120Ω impedance RS485 cable
31	RS485 A	0.5mm	120Ω impedance RS485 cable

NOTE:- Screened 120Ω impedance cable specified for use with RS485 must be used. DSE stock and supply Belden cable 9841 which is a high quality 120Ω impedance cable suitable for RS485 use (DSE part number 016-030)

7.1.5 PLUG “E” 5 WAY

Plug E is not fitted to 5560 controllers.

7.1.6 PLUG “F” 8 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
37	Mains Loading Relay Normally Closed Contact	2.5mm	Connect to mains contactor coil feed supply.
38	Mains Loading Relay Normally Closed Contact	2.5mm	Connect to mains contactor coil.
39	Bus Loading Relay Normally Open Contact	2.5mm	Connect to generator contactor coil feed supply.
40	Bus Loading Relay Normally Open Contact	2.5mm	Connect to generator contactor coil.
41	Bus volts L1	1.0mm	Connect to Bus L1
42	Bus volts L2	1.0mm	Connect to Bus L2
43	Bus volts L3	1.0mm	Connect to Bus L3
44	Bus volts N	1.0mm	Connect to Bus N

7.1.7 PLUG “G” 4 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
45	Mains volts L1	1.0mm	Connect to Mains L1
46	Mains volts L2	1.0mm	Connect to Mains L2
47	Mains volts L3	1.0mm	Connect to Mains L3
48	Mains volts N	1.0mm	Connect to Mains N

7.1.8 PLUG “H” 12 WAY

PIN No	DESCRIPTION	CABLE SIZE	NOTES
49	CT Secondary for mains L1	2.5mm	Connect to secondary of mains L1 monitoring CT (s1)
50	CT Secondary for mains L2	2.5mm	Connect to secondary of mains L2 monitoring CT (s1)
51	CT Secondary for mains L3	2.5mm	Connect to secondary of mains L3 monitoring CT (s1)
52	Not used		Do not connect
53	Mains CT secondary common	2.5mm	Connect to secondary of all mains CT's (s2)
54	Load CT	2.5mm	Connect to secondary of load CT (s2)
55	Load CT	2.5mm	Connect to secondary of load CT (s1)
56	Not used		Do not connect
57	Not used		Do not connect

WARNING!:- Do not disconnect plug ‘H’ when the mains is on load. Disconnection will open circuit the secondary of the CT’s and dangerous voltages may then develop. Always ensure the mains is off load before making or breaking connections to the module.

7.1.9 PC CONFIGURATION INTERFACE CONNECTOR

	 810 ✓	8-way connector allows connection to PC via 810 configuration interface. Module can then be re-configured utilising the 5xxx for Windows™ software.
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7.1.10 EXPANSION INTERFACE CONNECTOR

130 / 157 / 545 / 548 ✓ 808 ✗	4-way connector allows connection to the 130 input expansion, 157 relay expansion module or 545/548 LED expansion modules. A maximum of 2 relay or LED expansion modules may be connected in series to this port.
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⚠ CAUTION! - Do not connect the 808 configuration interface to this port, as it is not possible to use the 808 software to configure the 5560 module.

7.2 CONNECTOR FUNCTION DETAILS

The following describes the functions of the connectors on the rear of the module. See rear panel layout.

7.3 CONNECTION DETAILS

The following describes the connections and recommended cable sizes to the 8 plugs and sockets on the rear of the Module.

7.3.1 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	Unused
4	Unused
5	Unused
6	Auxiliary Relay output 1. Plant Supply positive. Configurable output, see Calibration Manual for options available.
7	Auxiliary Relay output 2. Plant Supply positive. Configurable output, see Calibration Manual for options available.
8	Auxiliary Relay output 3. Plant Supply positive. Configurable output, see Calibration Manual for options available.

7.3.2 PLUG “B” 11 WAY

PIN No	DESCRIPTION
9	Unused
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 Calibration 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 Calibration 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 Calibration Manual for options available. It is possible to configure the input to be a normally closed signal or a normally open signal.
15	Auxiliary input 6. 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.
16	Auxiliary input 7. 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.
17	Auxiliary input 8. 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.
18	Auxiliary input 9. 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.
19	Functional earth

7.3.3 PLUG “C” 4 WAY

Terminals 20-24 are not fitted to 5560 controllers.

PIN No	DESCRIPTION
25	Unused
26	Multiset communications link (MSC) Gnd
27	Multiset communications link (MSC) H
28	Multiset communications link (MSC) L

 **NOTE:-** Screened 120Ω impedance cable specified for use with CANBUS must be used for both the electronic engine link and the Multiset comms link. DSE stock and supply Belden cable 9841 which is a high quality 120Ω impedance cable suitable for CANbus use (DSE part number 016-030)

7.3.4 PLUG “D” 3 WAY

(if fitted)

PIN No	DESCRIPTION
29	RS485 SCREEN
30	RS485 B. For connection to other RS485 controllers in a multidrop RS485 communications system.
31	RS485 A. For connection to other RS485 controllers in a multidrop RS485 communications system.

 **NOTE: -** Screened 120Ω impedance cable specified for use with RS485 must be used. DSE stock and supply Belden cable 9841 which is a high quality 120Ω impedance cable suitable for RS485 use (DSE part number 016-030)

7.3.5 PLUG “E” 5 WAY

Plug E is not fitted to 5560 controllers.

7.3.6 PLUG “F” 8 WAY

PIN No	DESCRIPTION
37	Mains Loading Relay, Normally closed. Volts free contacts to 38. Used to connect to Mains contactor or circuit breaker.
38	Mains Loading Relay, Normally closed. Volts free contacts to 37. Used to connect to Mains contactor or circuit breaker.
39	Bus Loading Relay, Normally open. Volts free contacts to 40. Used to connect to generator contactor or circuit breaker.
40	Bus Loading Relay, Normally open. Volts free contacts to 39. Used to connect to generator contactor or circuit breaker.
41	Bus volts L1. Used for sensing the voltage/frequency of Bus L1.
42	Bus volts L2. Used for sensing the voltage/frequency of Bus L2.
43	Bus volts L3. Used for sensing the voltage/frequency of Bus L3.
44	Bus volts N. Used for sensing the Bus voltage/frequency.

7.3.7 PLUG “G” 4 WAY

PIN No	DESCRIPTION
45	Mains volts L1. Used for sensing the voltage/frequency of Mains L1.
46	Mains volts L2. Used for sensing the voltage/frequency of Mains L2.
47	Mains volts L3. Used for sensing the voltage/frequency of Mains L3.
48	Mains volts N. Used for sensing the voltage/frequency of the Mains output.

! CAUTION!:- Refer to Typical wiring Diagram for different wiring topologies.

7.3.8 PLUG “H” 9 WAY

PIN No	DESCRIPTION
49	CT Secondary for mains I1 (s1)
50	CT Secondary for mains I2 (s1)
51	CT Secondary for mains I3 (s1)
52	Unused
53	Generator CT secondary common (s2)
54	CT Secondary for Load I1 (s2)
55	CT Secondary for Load I1 (s1)
56	Unused
57	Unused

⚠ WARNING!:- Do not disconnect plug ‘H’ when the mains is on load. Disconnection will open circuit the secondary of the CT’s and dangerous voltages may then develop. Always ensure the mains is off load before making or breaking connections to the module.

7.4 ORDERING REPLACEMENT CONNECTORS FROM DSE

Connector	Description	DSE Part No.
A	BL08 (8 way connector 5.08mm)	007 - 125
B	BL11 (11 way connector 5.08mm)	007 - 135
C	BL04 (4 way connector 3.81mm)	007 - 408
D	BL03 (3 way connector 3.81mm)	007 - 409
E	Plug E is not fitted to 5560 controllers	N/A
F	BL08 (8 way connector 10.16mm)	007 - 410
G	BL04 (4 way connector 10.16mm)	007 - 003
H	BL09 (9 way connector 5.08mm)	007 - 339

8 SPECIFICATION

DC Supply	Continuous voltage rating : 8V to 35V
	Cranking dip protection : 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
	Charge Fail/ Excitation: 0V to 35V fixed power source 25W
	Max. Standby Current: 375mA at 12V. 200mA at 24V.
	Max. Operating Current: 460mA at 12V. 245mA at 24V
Alternator Input	Range: 5V - 277(ph-N) (+20%) 50Hz - 60Hz (Minimum 15V AC Ph-N)
	Accuracy: 1% of full scale True RMS sensing
	Supported topologies: 3 Phase 4wire Wye 3 phase 3 wire Delta 3 phase 3 wire Edison Delta Single phase 2 wire 2 Phase 3wire L1 & L2 2 Phase 3 wire L1 & L3
Mains and Bus Input	Range: 15V - 277(ph-N) (+20%) 50Hz - 60Hz
	Accuracy: 1% of full scale True RMS sensing
	Supported topologies: 3 Phase 4wire Wye 3 phase 3 wire Delta 3 phase 3 wire Edison Delta Single phase 2 wire 2 Phase 3 wire L1 & L2 2 Phase 3 wire L1 & L3
CTs	Burden: 0.5VA
	Primary rating: 1A - 6000A (user selectable)
	Secondary rating: 1A or 5A secondary (user selectable)
	Accuracy of measurement: 1% of full load rating (when using 0.5% or better CTs with 5A secondary winding) Lower class CTs will reduce the overall accuracy of the reading
	Recommendations: Class 1 required for instrumentation Protection class required if using for protection
Relay outputs	Auxiliary outputs 1,2,3: 5A DC at supply voltage
	Output 4 (Generator bus loading relay) Voltage free, normally open, 8 Amp 250V AC RMS rated
	Output 5 (Mains loading relay) Voltage free, normally closed, 8 Amp 250V AC RMS rated
Digital inputs	Contact whetting provided: 7mA at 12V (regardless of 12V/24V supply voltage)
Dimensions	Overall: 240mm x 172 mm x 57mm (9 1/2" x 6 3/4" x 2 1/4")
	Panel cut-out: 220mm x 160mm (8.7" x 6.3") Max panel thickness 8mm (0.3")

Electrical Safety /Electromagnetic Compatibility	BS EN 60950 Safety of information technology equipment, including electrical business equipment		
	BS EN 61000-6-2 EMC Generic Emission Standard (Industrial)		
	BS EN 61000-6-4 EMC Generic Emission Standard (Industrial)		
Environmental	BS EN 60068-2-1 Cold Temperature -30°C		
	BS EN 60068-2-2 Hot Temperature +70°C		
	BS2011-2-1 Humidity 93% RH@40°C for 48 Hours		
	BS EN 60068-2-6 Vibration 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		
	BS EN 60068-2-27 Shock 3 Half sine shocks in each of 3 major axes 15gn amplitude, 11mS duration		
	BS EN 60529 Degrees of protection provided by enclosures: IP55 (Front of module when module is installed into the control panel with the optional sealing gasket). IP42 (front of module when module is installed into the control panel WITHOUT being sealed to the panel)		
	NEMA Rating (Approximate) 12 (Front of module when module is installed into the control panel with the optional sealing gasket). 2 (front of module when module is installed into the control panel WITHOUT being sealed to the panel)		
Product Certification	 European CE approved.	 UL approved C-UL / CSA approved.	 Russia and other CIS countries approved
	 BS EN 2002/95/EC Restriction of Hazardous Substances (RoHS)	 BS EN 2002/96/EC Waste Electrical and Electronic Equipment (WEEE)	 CAN interface certified by MTU for use with MDEC engines
Relevant Company Certification	 BS EN ISO 9001:2000 Applicable to Design, marketing, assembly, service and repair of electronic control modules		

In line with our policy of continual development, Deep Sea Electronics, reserve the right to change specification without notice.

9 COMMISSIONING

9.1.1 PRE-COMMISSIONING

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

- 6.1. The unit is adequately cooled and all the wiring to the module is of a standard and rating compatible with the system.
- 6.2. The unit **DC** supply is fused, connected to the DC supply and that it is of the correct polarity.
- 6.1. To check the start cycle operation, fully test all 5510s that are on the system, ensuring that the breakers will only close when it is in synchronism with the bus or a dead bus is present. After a visual inspection to ensure it is safe to proceed, make sure that the 5510s on the system are in Auto mode. Press the **"MANUAL"** pushbutton, and then press the **'START'** pushbutton for a short time. The unit will issue a start to all the 5510s that are available and in Auto mode.
- 6.2. The first generator to start will close onto a dead bus; the remainder will synchronise and close as they reach running conditions. The generators will then run in parallel sharing zero KW and zero VAr
- 6.3. Select **"AUTO"** on the front panel, the system will run for the pre-set return delay, all the generator breakers will then open and all generators will cool down for their pre-set cooling time before stopping. The 5560 will stay in the standby mode. If not, check that there is no signal present on the **Remote Start** input, and that the mains is within acceptable parameters.
- 6.4. Initiate an automatic start by supplying the remote start signal. The start sequence will commence and once the pre set number of generators is running in parallel, the 5560 will synchronise the bus to the mains and the Bus breaker will be closed. The load will be ramped on to the Bus until the pre-set KW and KVA_r levels have been reached.
- 6.5. Remove the remote start signal, the return sequence will start. After the pre-set return time has elapsed, the load will be ramped off the Bus and the Bus breaker will be opened once the Bus load has reached zero. The generators will then run for the pre-set cooling down period, and stop.
- 6.6. Now the mains fail test can be carried out. Fail the mains and the system should start, the mains breaker will open and then the Bus breaker will close.
- 6.7. When the mains returns, the Bus will be synchronised to the mains after the return time has expired and the Bus breaker will close. The Bus power will be ramped to the pre-set level, then to zero. Once the Bus power is down to zero the Bus breaker will open and the generators will be stopped after their cooling time has expired.

! CAUTION!:- Before any breaker is closed onto a live system for the first time, extensive checks must be carried out to make sure that the breaker will not close out of synch.

- 6.8. If despite repeated checking of the connections between the **5560** and the customer's system, satisfactory operation cannot be achieved, then the customer is requested to contact the factory for further advice on:-

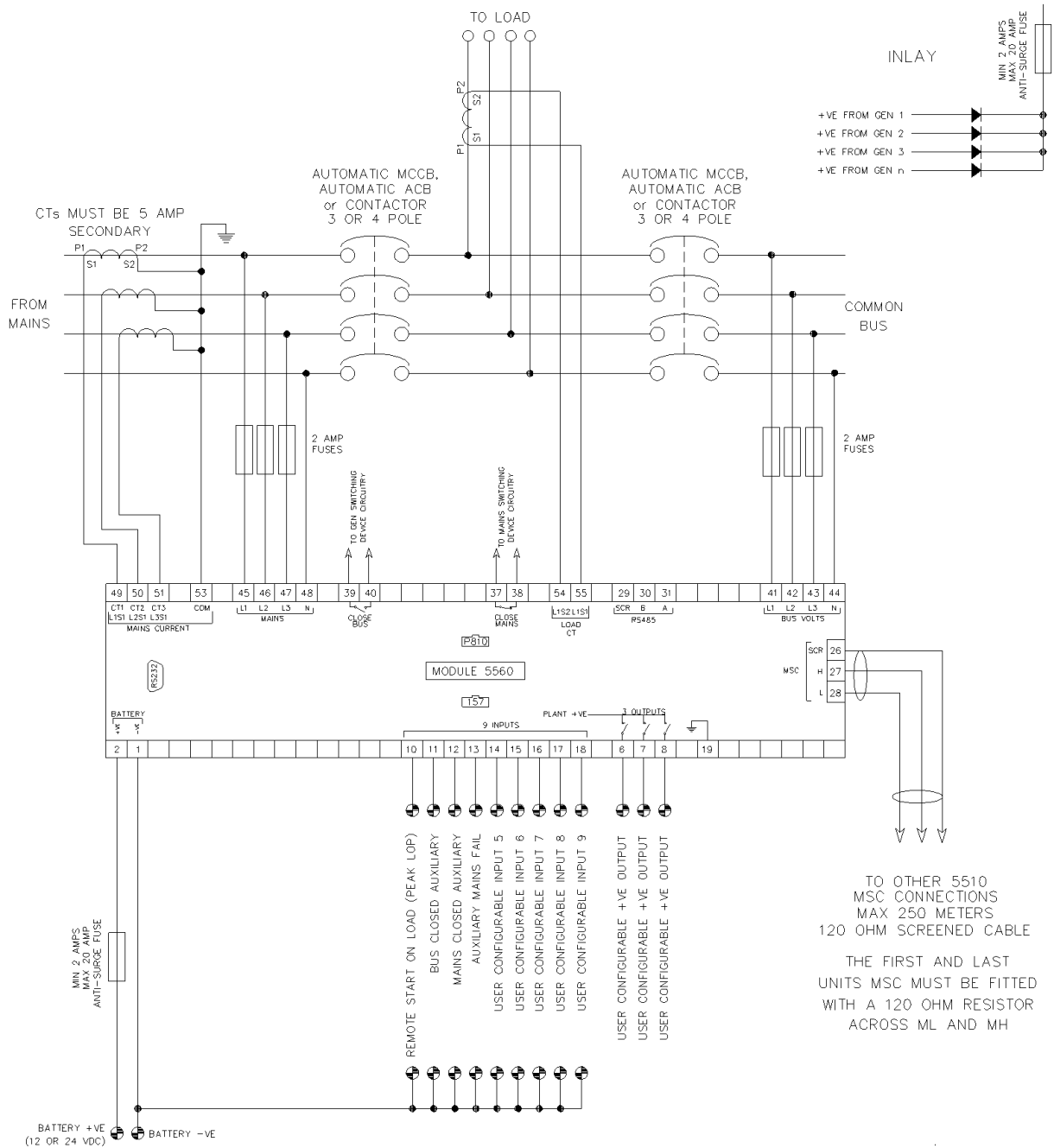
INTERNATIONAL TEL: 44 (0) 1723 890099
 INTERNATIONAL FAX: 44 (0) 1723 893303
 LO-CALL (UK only) Tel. 0845 260 8900
 LO-CALL (UK only) Fax. 0845 260 8901
 E-mail: support@deepseapl.com

10 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 when the module is operating. Run the system through a complete test and check the voltage remains within these limits consistently. Check the operating temperature is not above 70°C. Check the DC fuse.
Warning fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Continuous starting of generators when in AUTO	Check that there is no signal present on the "Remote Start" input. Check configured polarity is correct. Check that the mains supply is within limits and load level on the mains is not above the configured level for mains "import/export".

 **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.

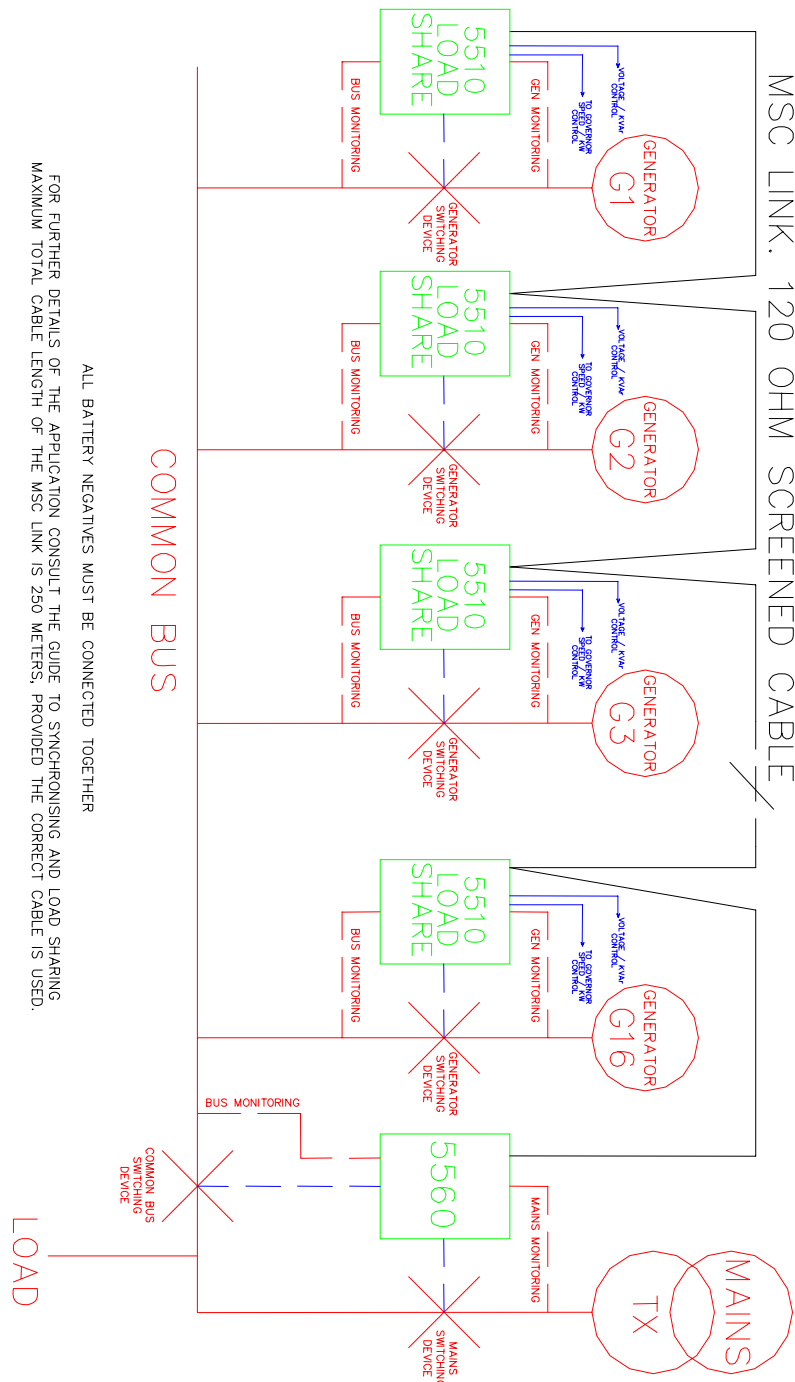
11 TYPICAL WIRING DIAGRAM

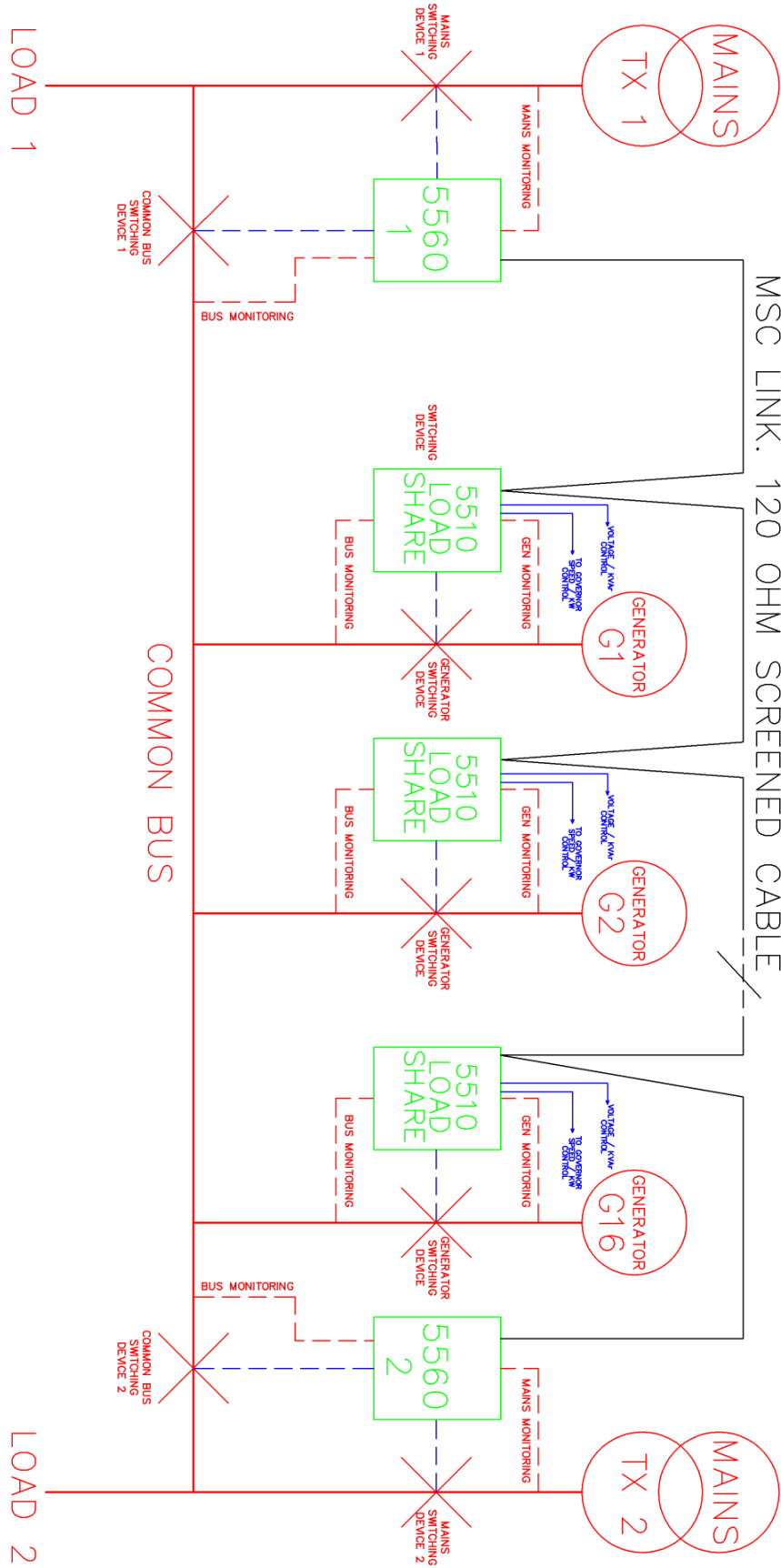


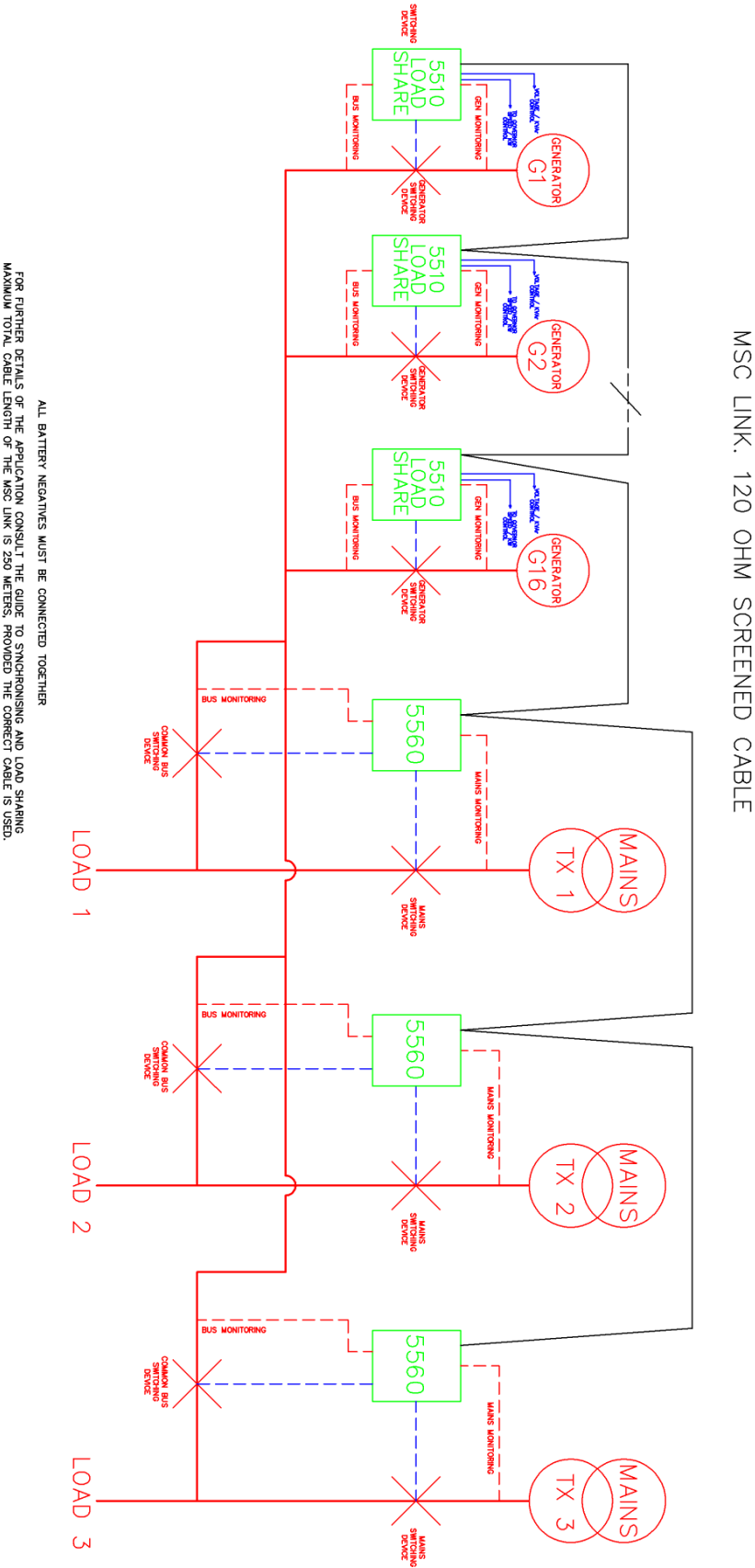
12 TYPICAL SYSTEM SCHEMATICS

NOTE 1: - The 120Ω terminator must be installed on the first and last devices on the communications bus. See section header **MSC Settings** in the Guide to synchronising and load sharing manual for further details.

NOTE 2: - It is important that the MultiSet Communications Link cable is run from one module to the next in a 'bus' fashion. 'Spurs' off this bus should be avoided where possible, but where a spur is unavoidable, its length should be kept less than 1m from the bus cable.







13 FACTORY DEFAULT CONFIGURATION

Filename - 5560a.ycf

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Module settings

Base module 5560 ATS / Mains controller module
Module version 6.00

Miscellaneous settings

AC System 3 phase, 4 wire
Enable mains phase sequence alarm Yes
Phase sequence L1 L2 L3
Enable running on load demand Yes
All warnings are latched No
Enable immediate mains dropout No
Single list instrument display Yes
Enable forced 'peak lop inhibit' Yes

Input settings

Digital Inputs
1 Remote start on load Close to activate
2 Bus closed auxiliary Close to activate
3 Mains closed auxiliary Close to activate Warning
4 Auxiliary mains fail Close to activate
5 User configured Close to activate Indication Never active
Activation delay 0.0s Active text : Digital input 5
6 User configured Close to activate Indication Never active
Activation delay 0.0s Active text : Digital input 6
7 User configured Close to activate Indication Never active
Activation delay 0.0s Active text : Digital input 7
8 User configured Close to activate Indication Never active
Activation delay 0.0s Active text : Digital input 8
9 Panel lock Close to activate

Expansion input settings

PI30 expansion enabled No

Output settings

Module relays
1 Energise Sufficient sets available
2 Energise Common alarm
3 Energise System in auto mode
4 Energise Close bus
5 Energise Close mains

Expansion Outputs A

1 Energise Output not used
2 Energise Output not used
3 Energise Output not used
4 Energise Output not used
5 Energise Output not used
6 Energise Output not used
7 Energise Output not used
8 Energise Output not used

Expansion Outputs B

1 Energise Output not used
2 Energise Output not used
3 Energise Output not used
4 Energise Output not used
5 Energise Output not used
6 Energise Output not used
7 Energise Output not used
8 Energise Output not used

LED settings

1 Lit Output not used
2 Lit Output not used
3 Lit Output not used
4 Lit Output not used

Timer settings

Starting/stopping timers
Mains transient delay 2s
Start delay 5s
Transfer time 0.7s
Breaker close pulse 0.5s
Breaker trip pulse 0.5s
Return delay 30s
Digital input 2 is assigned to bus auxiliary contact
Bus close timer 0.5s
Bus open timer 0.5s
Digital input 3 is assigned to mains auxiliary contact
Mains fail to close 1.3s
Mains fail to open 1.3s

Other timers

Batt low volts delay 1m
Batt high volts delay 1m
LCD auto scroll timer 2s
LCD page timer 5m
Export power limit timer 0s

Mains settings**Volts and frequency alarms**

Under volts trip	Trip 184V Ph-N	Return 207V Ph-N
Over volts trip	276V Ph-N	253V Ph-N
Under frequency trip	46.0 Hz	48.0 Hz
Over frequency trip	56.0 Hz	52.0 Hz

Current / Power

CT primary	600 A	
CT secondary	5 A	
Mains full load rating	192 kW (240 KVA)	
Mains full kVAR rating	144 kVAR (0.80 pf)	
Export power limit alarm	0.0 kW	Electrical trip

Generator settings**Nominals**

Nominal generator voltage	230V Ph-N	
Nominal generator frequency	50.0 Hz	
Alternative voltage select	No	230v norm / 115v alt
Alternative frequency select	No	50Hz norm / 60Hz alt

Synchronising (check sync) settings

Enable synchronising	Yes	
Dead bus relay	20V Ph-N	
Check sync lower frequency	-0.1 Hz	
Check sync upper frequency	0.2 Hz	
Check sync RMS voltage	2.0V Ph-N	
Check sync phase angle	5°	
Sync advance time	0 mS	
Fail to sync time	3m	Warning

Multi-set system settings

MultiSet comms failure action	Warning
Too few modules action	Warning
Minimum modules on MultiSet comms link	1
MultiSet comms alarms disabled action	Warning
Starting options	Start all sets initially
Balance engine hours	<Disabled>
Load level for less sets to run	70%
Load level for more sets to run	80%

Load control

Load ramp rate	2.0 percent per second
----------------	------------------------

System settings

Minimum number of sets	1
Minimum number of sets	Warning
Action	1m 30s
Delay time	

Insufficient capacity

Action	Warning
Delay time	1m

Load CT

Load CT enabled	No
-----------------	----

Min. mains level to open bus	150 kW
------------------------------	--------

Plant battery settings

Under volts warning	Trip 10.0V DC	Return 10.5V DC
Over volts warning	30.0V DC	29.5V DC

Exercise scheduler settings

Enable exercise scheduler	No
---------------------------	----

Language settings

Default language	English (UK)
User defined language 1	Chinese (Simplified)
User defined language 2	French (France)
User defined language 3	Spanish (International)
User defined language 4	Not used

14 APPENDIX

14.1 OUTPUT EXPANSION

There are several methods of output expansion available for the 5560 module:-

14.1.1 RELAY OUTPUT EXPANSION (157)

An expansion module is available, which connects to the expansion socket, and enables the 5560 to use eight additional relays on the 157 relay module, providing Volt-free contacts for customer connection. A maximum of 2 off 157 relays modules can be connected, they are identified as 'A' and 'B' and give a total of 16 extra relay outputs.

Refer to technical data sheet on the 157 relay module for further details.

14.1.2 LED OUTPUT EXPANSION (548)

An expansion module is available, which connects to the expansion socket, and enables the 5560 to use eight additional LED's on the 548 module, providing remote LED's indication up to 50 metres away. A maximum of 2 off 548 LED modules can be connected, they are identified as 'A' and 'B' and give a total of 16 extra LED outputs.

Refer to technical data sheet on the 548 LED module for further details.

It is possible to use a mix of 157 and 548 modules to give both relay and LED expansion if required (Please refer to our Technical Support department for details.).

14.2 INPUT EXPANSION

14.2.1 P130

It is possible to increase the number of monitored inputs available by utilising a 130 input expansion module to provide 8 extra digital inputs.
Connection to the 5560 is via communications cable.

 **NOTE: - The P130 has two expansion analogue inputs. These cannot be used with 5560, only the eight expansion digital inputs are available to be used with the 5560 controller.**

14.2.2 P540 / P541)

It is also possible to use the 540 / 541 protection expansion annunciator to increase the number of monitored digital inputs available. This device acts as a "multiplexer" whereby multiple inputs to the 540 / 541 device are annunciated, then fed to the 5560 controller via wired connections as one or more "common fault" outputs. I.e. the 5560 will display "Common shutdown alarm" and the 540 / 541 annunciator will display the exact fault by means of an LED and written (configurable) text.

14.3 COMMUNICATIONS OPTION

14.3.1 DESCRIPTION

The 5xxx series configuration software allows the 5520 controller to communicate with a PC. The computer can be connected to the module either directly or via an RS485 link*.

The operator is then able to remotely control the module, starting or stopping the generator, selecting operating modes, etc. The various operating parameters (such as output volts, oil pressure, etc.) on the remote generator can also be viewed.

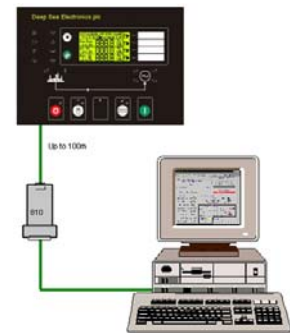
The information contained in this manual should be read in conjunction with the appropriate module documentation.

NOTE:- 5560 controller only available with RS485 communications.

14.3.2 PC TO CONTROLLER (DIRECT) CONNECTION

To connect a 5510 to a modem the following items are required: -

- Any 5560 Module
- 5xxx series configuration software (Supplied on DSE software CD).
- P810 interface (USB or RS232 as required)



14.3.3 MODEM TO CONTROLLER CONNECTION

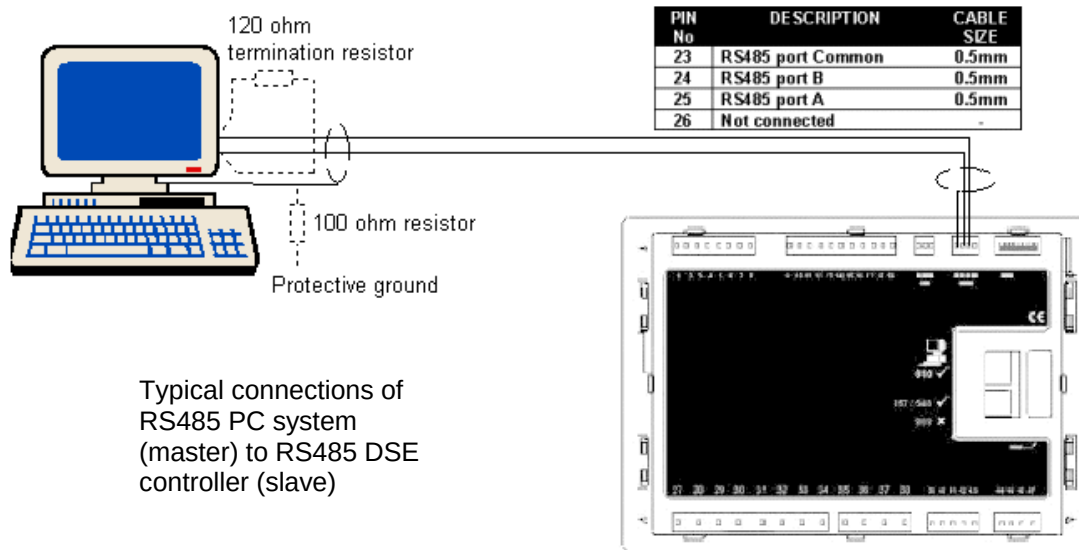
5560 is not capable of being connected to a Modem.

NOTE:- 5560 controller only available with RS485 communications.

14.3.4 RS485 LINK TO CONTROLLER

The RS485 enabled 5560 modules are able to communicate with a PC or other RS485 enabled device over a standard RS485 connection. Typical uses of RS485 are:

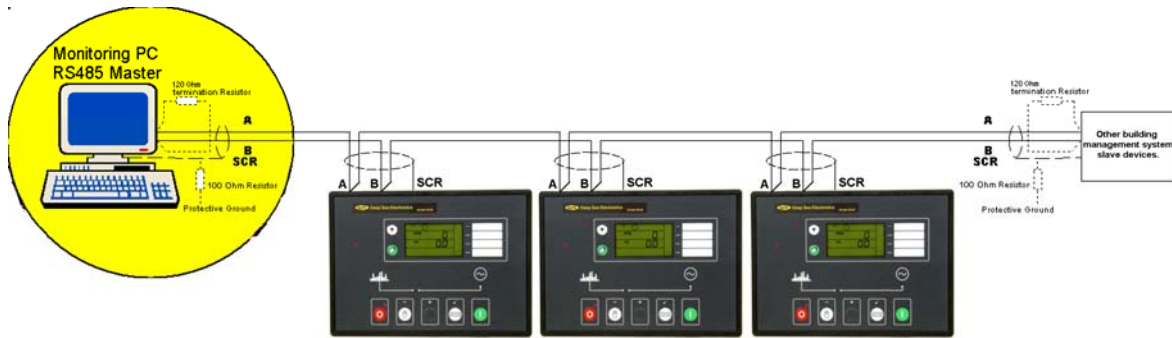
- Direct connection to a remote PC running the Link5000 software. RS485 is capable of communication over a distance of 1.2km where suitable 120Ω RS485 cable is installed.
- Connection to a building management to allow mains, generator and engine parameters/alarm conditions to be displayed along with information from other devices (air conditioning, fire alarm system etc).



NOTE: - The RS485 system will comprise of one MODBUS master (typically a PC) and up to 31 MODBUS slaves. The 5520 modules are always MODBUS slave devices. To ensure correct operation a suitable 120Ω terminal resistor must be fitted to each end of the RS485 connection bus.

Caution! - The A and B lines of the 485 network should be terminated at each end with a 120Ω resistor.

Some RS485 devices (PC cards in particular) are already fitted with a terminating resistor. However if they are not installed as an 'end of line' device then such terminating resistors must be removed. Other RS485 devices may be fitted with a 'switchable' resistor, again this must be switched out if the device is not installed as an 'end of line' device.

TYPICAL BUILDING MANAGEMENT SCHEME USING RS485 MONITORING

CAUTION! -. RS485 cabling must be 120Ω impedance cable, specified for use with RS485. 120Ω terminating resistors must be fitted to the first and last devices on the bus. Some PC RS485 cards are already fitted with this resistor, and in this case should not be fitted externally. If in doubt, consult the supplier of your PC RS485 card. If the 5560 controller is the 'last' device on the bus, then its RS485 connection must be suitably terminated with a 120Ω resistor as detailed in the specification laid out in the RS485 standard.

Recommended cable **BELDEN 9841 120Ω RS485 cable.**
DSE part number 016-030.

NOTE: - The RS485 output uses 'MODBUS' protocol. It is possible to use third party software to monitor and control the 5560 module via this protocol. Please refer to Deep Sea Electronics Plc for details.

14.3.5 MODBUS™

The RS485 output uses Modbus™ communications protocol. This uses a master-slave technique to communicate. Only the Master can initiate a packet transaction, called a 'query'. When appropriate the slave (5560 Module) responds to the query and provides the information requested by the master.

All supported data can be read and written as specified in the register table (documentation is available from Deep Sea Electronics Plc.).

When the 5560 Module receives a query it will respond by either supplying the requested register data or performing the requested action. A slave device (the 5560 module) will never initiate communications on the Modbus™ link. The 5560 can only be configured as a slave device. The Master can only query individual slaves. Refer to the Modbus™ protocol document for more details.

Refer to the Link5000plus Manual for further details on communications expansion.

NOTE:- 5560 controller only available with RS485 communications.

14.4 ENCLOSURE CLASSIFICATIONS

IP CLASSIFICATIONS

BS EN 60529 Degrees of protection provided by enclosures

First Digit	Second digit
Protection against contact and ingress of solid objects	Protection against ingress of water
0 No protection	0 No protection
1 Protected against ingress solid objects with a diameter of more than 50 mm. No protection against deliberate access, e.g. with a hand, but large surfaces of the body are prevented from approach.	1 Protection against dripping water falling vertically. No harmful effect must be produced (vertically falling drops).
2 Protected against penetration by solid objects with a diameter of more than 12 mm. Fingers or similar objects prevented from approach.	2 Protection against dripping water falling vertically. There must be no harmful effect when the equipment (enclosure) is tilted at an angle up to 15° from its normal position (drops falling at an angle).
3 Protected against ingress of solid objects with a diameter of more than 2.5 mm. Tools, wires etc. with a thickness of more than 2.5 mm are prevented from approach.	3 Protection against water falling at any angle up to 60° from the vertical. There must be no harmful effect (spray water).
4 Protected against ingress of solid objects with a diameter of more than 1 mm. Tools, wires etc. with a thickness of more than 1 mm are prevented from approach.	4 Protection against water splashed against the equipment (enclosure) from any direction. There must be no harmful effect (splashing water).
5 Protected against harmful dust deposits. Ingress of dust is not totally prevented but the dust must not enter in sufficient quantity to interfere with satisfactory operation of the equipment. Complete protection against contact.	5 Protection against water projected from a nozzle against the equipment (enclosure) from any direction. There must be no harmful effect (water jet).
6 Protection against ingress of dust (dust tight). Complete protection against contact.	6 Protection against heavy seas or powerful water jets. Water must not enter the equipment (enclosure) in harmful quantities (splashing over).

NEMA CLASSIFICATIONS

NOTE: - There is no direct equivalence between IP / NEMA ratings. IP figures shown are approximate only.

1 IP30	Provides a degree of protection against contact with the enclosure equipment and against a limited amount of falling dirt.
2 IP31	Provides a degree of protection against limited amounts of falling water and dirt.
3 IP64	Provides a degree of protection against windblown dust, rain and sleet; undamaged by the formation of ice on the enclosure.
3R IP32	Provides a degree of protection against rain and sleet;; undamaged by the formation of ice on the enclosure.
4 (X) IP66	Provides a degree of protection against splashing water, windblown dust and rain, hose directed water; undamaged by the formation of ice on the enclosure. (Resist corrosion).
12/12K IP65	Provides a degree of protection against dust, falling dirt and dripping non corrosive liquids.
13 IP65	Provides a degree of protection against dust and spraying of water, oil and non corrosive coolants.

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