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DSEPOWER®

DSE7560 MK1 Mains Control Module

Document Number 057-089

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DSE Model 7560MK1 Main Control and ATS Operators Manual

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Amendments since last publication

Amd. No.	Comments
1	Converted 7560 V8 manual to 7560 V10
2	Update to wiring diagrams (issue10.1)
3	Update to typical wiring diagram (issue10.2)

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.

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1 BIBLIOGRAPHY

This document refers to and is referred to by the following DSE publications which can be obtained from the DSE website www.deepseapl.com

1.1 INSTALLATION INSTRUCTIONS

Installation instructions are supplied with the product in the box and are intended as a 'quick start' guide only.

DSE PART	DESCRIPTION
051-157	DSE130 input expansion module installation instructions
053-040	DSE157 expansion relay board installation instructions
053-052	DSE7510 installation instructions
053-053	DSE7520 installation instructions
053-054	DSE7560 installation instructions
053-055	DSE850 installation instructions
053-062	DSE860/DSE865 installation instructions

1.2 TRAINING GUIDES

Training Guides are produced to give 'handout' sheets on specific areas of the module operation.

DSE PART	DESCRIPTION
056-001	Four Steps to Synchronising and Load Sharing
056-005	Using CTs with DSE products
056-006	Introduction to Comms
056-011	MSC Link
056-013	Load Demand Scheme
056-021	Mains Decoupling
056-022	Breaker Control
056-024	GSM Modem
056-026	kW and kVAr
056-030	Module PIN codes
056-032	Using a DSE7560 with no bus breaker

1.3 MANUALS

DSE PART	DESCRIPTION
056-047	Load Share Design and Commissioning
057-078	DSE7500 Series configuration software manual
057-088	DSE7510 operators manual
057-089	DSE7520 operators manual
057-098	Link7000 software manual

1.4 OTHER PUBLICATIONS

Additionally this document refers to the following third party publications

REFERENCE	DESCRIPTION
ISBN 1-55937-879-4	IEEE Std C37.2-1996 IEEE Standard Electrical Power System Device Function Numbers and Contact Designations. Institute of Electrical and Electronics Engineers Inc
ISBN 0-7506-1147-2	Diesel generator handbook. L.L.J.Mahon
ISBN 0-9625949-3-8	On-Site Power Generation. EGSA Education Committee.

2 INTRODUCTION

This document details the installation and operation requirements of the DSE7500 Series modules, part of the DSEPower® range of products.

The manual forms part of the product and should be kept for the entire life of the product. If the product is passed or supplied to another party, ensure that this document is passed to them for reference purposes.

This is not a *controlled document*. You will not be automatically informed of updates. Any future updates of this document will be included on the DSE website at www.deepseapl.com

The DSE7560 Mk1 controller is an update to the popular DSE7560. It maintains all the functions and flexibility of the DSE5560 while being packaged in DSE7000 series styling bringing with it the advantages of the DSE7000 series terminal compatibility easing system upgrades. The DSE7560 Mk1 controller is compatible with DSE5560 and DSE556 controllers when used in a multiple controller system, connected by the MSC (Multi-Set Communications) Link.

The **DSE 7560MK1** Module allows the OEM to meet demand for increased capability within the industry. It allows the user to start and stop the generator and if required, transfer the load to the generator either manually or automatically. The user also has the facility to view the system operating parameters via the LCD display.

Utilising the inbuilt synchronising, volts matching and paralleling functions, the controller is able to parallel with the mains supply for simple peak lopping (fixed generator output). Alternatively, the 7560MK1 can be used to parallel with other DSE 7560MK1 load sharing controllers. Up to 16 sets can be connected in paralleling and load share as a standalone (prime power) system. Additionally they can parallel with the mains supply (when used in conjunction with DSE 7560MK1).

The **DSE 7560MK1** module also monitors the engine, indicating the operational status and fault conditions, automatically shutting down the engine. Exact failure mode information is indicated by the LCD display on the front panel.

The powerful Microprocessor contained within the module allows for many features to be incorporated as standard;

- *Full Multilingual LCD display (including non-western character fonts).*
- *True R.M.Ss. voltage monitoring.*
- *Power measurement.*
- *Communications capability (RS485)*
- *Check Sync capability*
- *Automatic Sync capability*
- *Load share / control capability*
- *Fully configurable inputs for use as alarms or a range of different functions also available on P130 expansion inputs (optional)*
- *Extensive range of output functions using built in relay outputs or relay expansion available.*
- *Instrumentation and diagnostics from electronic engines when connected to an engine ECU.*

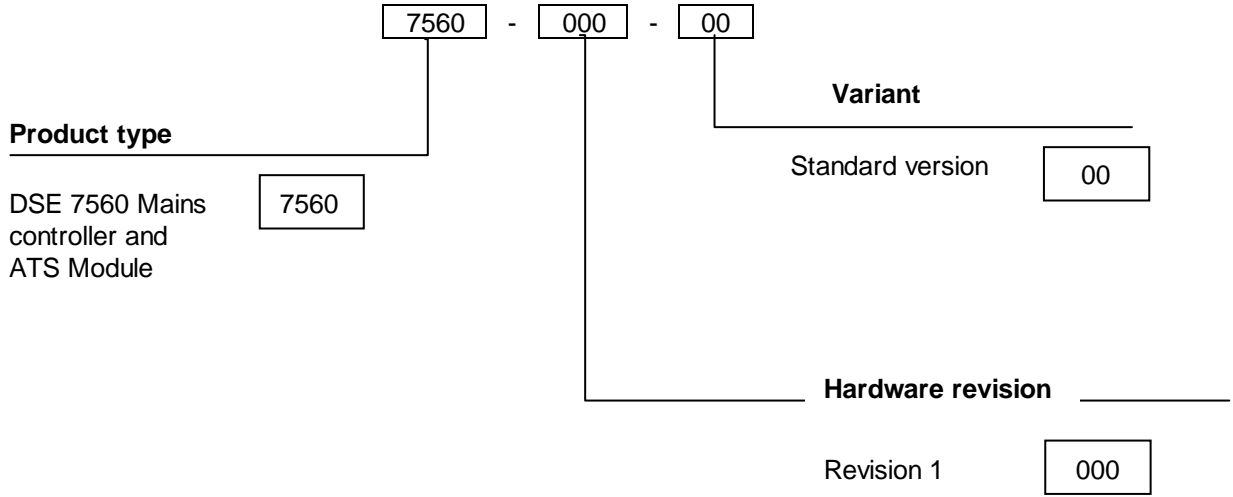
Selective operational sequences, timers and alarm trips can be altered by the customer via a PC using the 75xx For Windows™ software and 810 interface or via the integral front panel configuration editor.

Access to critical operational sequences and timers for use by qualified engineers, can be protected by a security code. Module access can also be protected by PIN code. Selected parameters can be changed from the module's 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.

3 SPECIFICATIONS

3.1 PART NUMBERING



At the time of this document production, there have been no revisions to the module hardware.

3.1.1 SHORT NAMES

Short name	Description
DSE7000	All modules in the DSE7000 Series
DSE7500	All modules in the DSE7500 sync/load share range
DSE7560	DSE7560 module

3.2 POWER SUPPLY REQUIREMENTS

Minimum supply voltage	8V continuous
Cranking dropouts	Able to survive 0V for 50mS providing the supply was at least 10V before the dropout and recovers to 5V afterwards.
Maximum supply voltage	35V continuous (60V protection)
Reverse polarity protection	-35V continuous
Maximum operating current	260mA at 24V 510mA at 12V
Maximum standby current	220mA at 24V 440mA at 12V

Plant supply instrumentation display

Range	0V-60V DC (note Maximum continuous operating voltage of 35V DC)
Resolution	0.1V
Accuracy	1% full scale

3.3 TERMINAL SPECIFICATION

Connection type	Screw terminal, rising clamp, no internal spring
Min cable size	0.5mm ² (AWG 24)
Max cable size	2.5mm ² (AWG 10)

3.4 GENERATOR VOLTAGE / FREQUENCY SENSING

Measurement type	True RMS conversion
Sample Rate	5KHz or better
Harmonics	Up to 10 th or better
Input Impedance	300K Ω ph-N
Phase to Neutral	15V to 333V AC (max)
Phase to Phase	25V to 576V AC (max)
Common mode offset from Earth	100V AC (max)
Resolution	1V AC phase to neutral 2V AC phase to phase
Accuracy	\pm 1% of full scale phase to neutral \pm 2% of full scale phase to phase
Minimum frequency	3.5Hz
Maximum frequency	75.0Hz
Frequency resolution	0.1Hz
Frequency accuracy	\pm 0.2Hz

3.5 INPUTS

3.5.1 DIGITAL INPUTS

Number	9
Arrangement	Contact between terminal and ground
Low level threshold	40% of DC supply voltage
High level threshold	60% of DC supply voltage
Maximum input voltage	DC supply voltage positive terminal
Minimum input voltage	DC supply voltage negative terminal
Contact wetting current	2.5mA @12V typical 5mA @ 24V typical
Open circuit voltage	Plant supply

3.6 OUTPUTS

3.6.1 OUTPUTS A & B (FUEL AND START)

Type	Fuel (A) and Start (B) outputs. Supplied from DC supply terminal 2.
Rating	3A @ 35V
Protection	Protected against over current & over temperature. Built in load dump feature.

3.6.2 CONFIGURABLE OUTPUTS C & D (LOAD SWITCHING)

Type	Fully configurable volts free relays. Output C – Normally Closed, Output D – Normally Open
Rating	8A @ 230V AC
Protection	Protected against over current & over temperature. Built in load dump feature.

3.6.3 CONFIGURABLE OUTPUTS E, F & G

Type	Fully configurable, supplied from DC supply terminal 2.
Rating	3A @ 35V
Protection	Protected against over current & over temperature. Built in load dump feature.

3.7 COMMUNICATION PORTS

810 port	For connection to the DSE810 interface only
Expansion port	For connection to DSE130, DSE157, DSE545, DSE548 expansion modules only
DSENet	DSE7510 Mk1 controller does not have DSENet expansion capability
CAN Port	Engine CAN Port Standard implementation of 'Slow mode', up to 250K bits/s Non Isolated. Internal Termination provided (120Ω)
RS485 Serial	Isolated Data connection 2 wire + common Half Duplex Data direction control for Transmit (by s/w protocol) Max Baud Rate 19200 External termination required (120R) Max common mode offset 70V (on board protection transorb) Max distance 1.2km (¾ mile)

3.8 ACCUMULATED INSTRUMENTATION

 **NOTE : When an accumulated instrumentation value exceeds the maximum number as listed below, it will reset and begin counting from zero again.**

Engine hours run	Maximum 99999 hrs 59 minutes (approximately 11yrs 4months)
Number of starts	1,000,000 (1 million)

3.9 SOUNDER

DSE7000 Series features an internal sounder to draw attention to warning, shutdown and electrical trip alarms.

Sounder level	84db @ 1m
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3.10 DIMENSIONS AND MOUNTING

DIMENSIONS

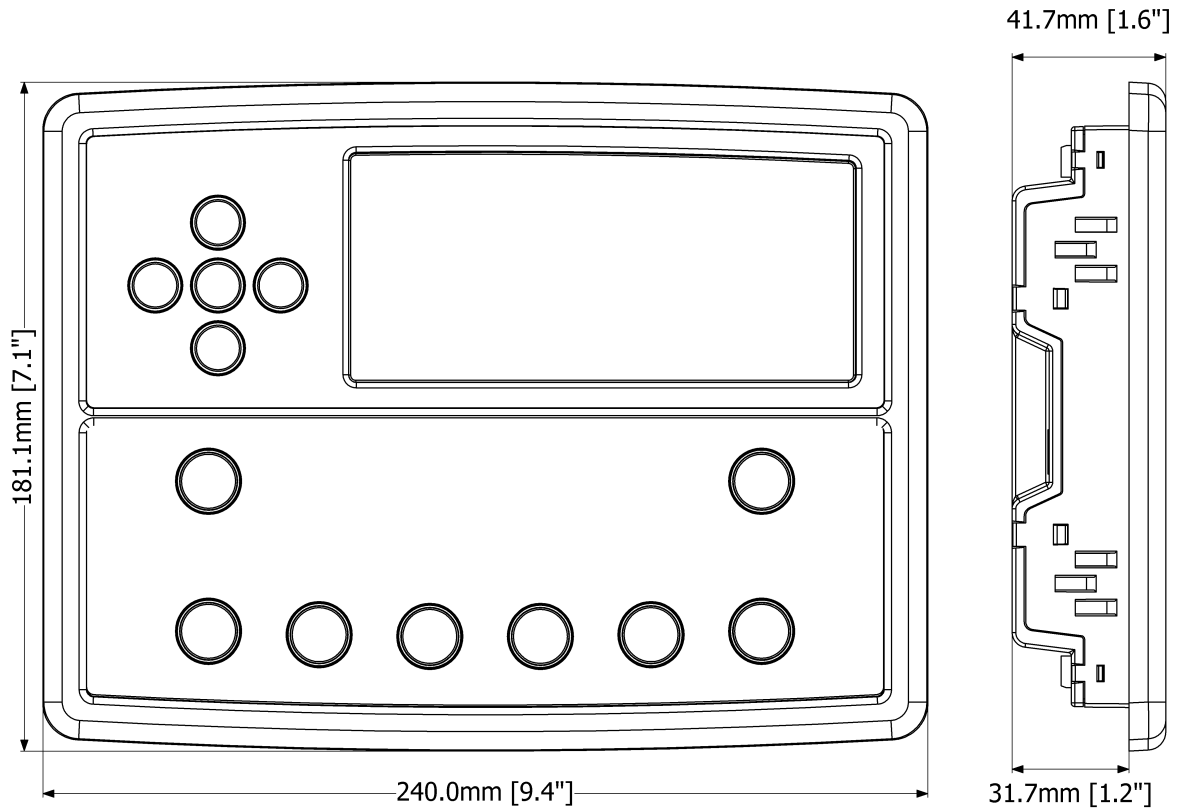
240.0mm x 181.1mm x 41.7mm (9.4" x 7.1" x 1.6")

PANEL CUTOUT

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

WEIGHT

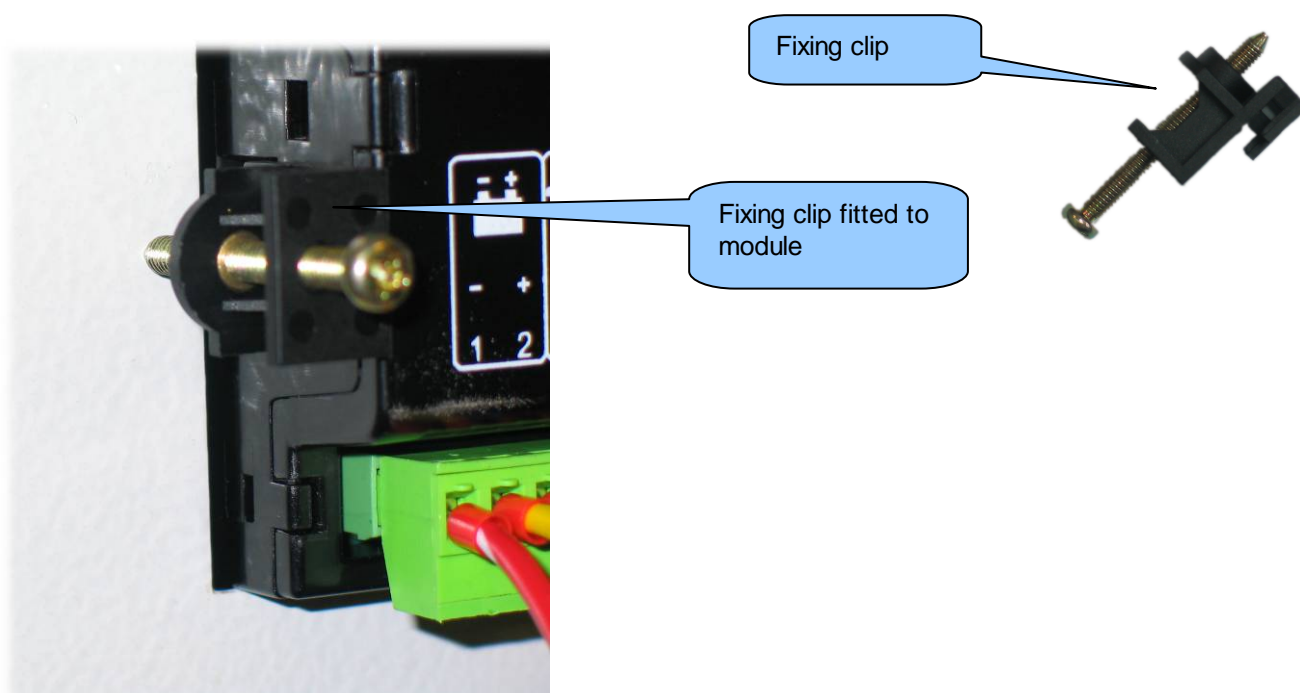
0.7kg (1.4lb)



3.10.1 FIXING CLIPS

The module is held into the panel fascia using the supplied fixing clips.

- Withdraw the fixing clip screw (turn anticlockwise) until only the pointed end is protruding from the clip.
- Insert the three 'prongs' of the fixing clip into the slots in the side of the 7000 series module case.
- Pull the fixing clip backwards (towards the back of the module) ensuring all three prongs of the clip are inside their allotted slots.
- Turn the fixing clip screws clockwise until they make contact with the panel fascia.
- Turn the screws a little more to secure the module into the panel fascia. Care should be taken not to over tighten the fixing clip screws.



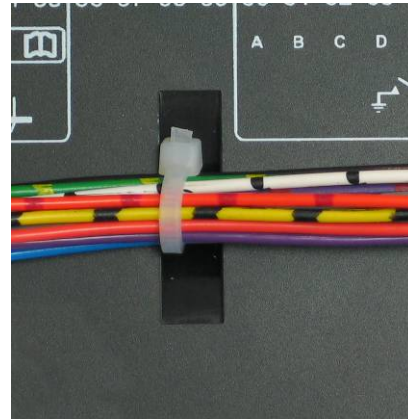
NOTE:- In conditions of excessive vibration, mount the module on suitable anti-vibration mountings.

3.10.2 CABLE TIE FIXING POINTS

Integral cable tie fixing points are included on the rear of the module's case to aid wiring. This additionally provides strain relief to the cable loom by removing the weight of the loom from the screw connectors, thus reducing the chance of future connection failures. Care should be taken not to over tighten the cable tie (for instance with cable tie tools) to prevent the risk of damage to the module case.



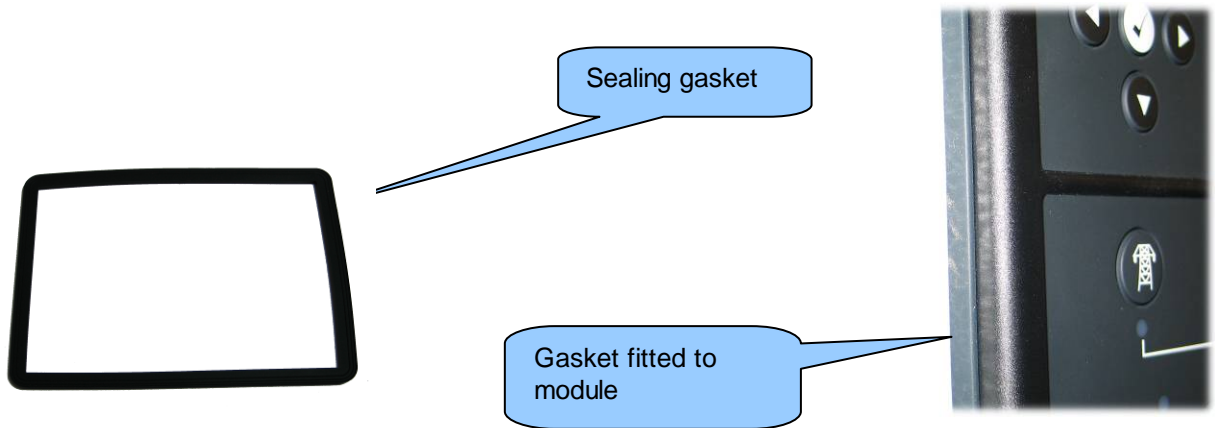
Cable tie fixing point



With cable and tie in place

3.10.3 SILICON SEALING GASKET

The supplied silicon gasket provides improved sealing between the 7000 series module and the panel fascia. The gasket is fitted to the module before installation into the panel fascia. Take care to ensure the gasket is correctly fitted to the module to maintain the integrity of the seal.



3.11 APPLICABLE STANDARDS

BS 4884-1	This document conforms to BS4884-1 1992 Specification for presentation of essential information.
BS 4884-2	This document conforms to BS4884-2 1993 Guide to content
BS 4884-3	This document conforms to BS4884-3 1993 Guide to presentation
BS EN 60068-2-1 (Minimum temperature)	-30°C (-22°F)
BS EN 60068-2-2 (Maximum temperature)	+70°C (158°F)
BS EN 60950	Safety of information technology equipment, including electrical business equipment
BS EN 61000-6-2	EMC Generic Immunity Standard (Industrial)
BS EN 61000-6-4	EMC Generic Emission Standard (Industrial)
BS EN 60529 (Degrees of protection provided by enclosures)	IP65 (front of module when installed into the control panel with the supplied sealing gasket) IP42 (front of module when installed into the control panel WITHOUT being sealed to the panel)
UL508 NEMA rating (Approximate)	12 (Front of module when installed into the control panel with the supplied sealing gasket). 2 (Front of module when installed into the control panel WITHOUT being sealed to the panel)
IEEE C37.2 (Standard Electrical Power System Device Function Numbers and Contact Designations)	<p>Under the scope of IEEE 37.2, <i>function numbers can also be used to represent functions in microprocessor devices and software programs.</i> The 7000 series controller is device number 11L-7000 (Multifunction device protecting Line (generator) – 7000 series module).</p> <p>As the module is configurable by the generator OEM, the functions covered by the module will vary. Under the module's factory configuration, the device numbers included within the module are :</p> <p>2 – Time delay starting or closing relay 27AC – AC undervoltage relay 27DC – DC undervoltage relay 30 – annunciator relay 42 – Running circuit breaker 50 – instantaneous overcurrent relay 51 – ac time overcurrent relay 52 – ac circuit breaker 59AC – AC overvoltage relay 59DC – DC overvoltage relay 62 – time delay stopping or opening relay 74– alarm relay 81 – frequency relay 86 – lockout relay</p>

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

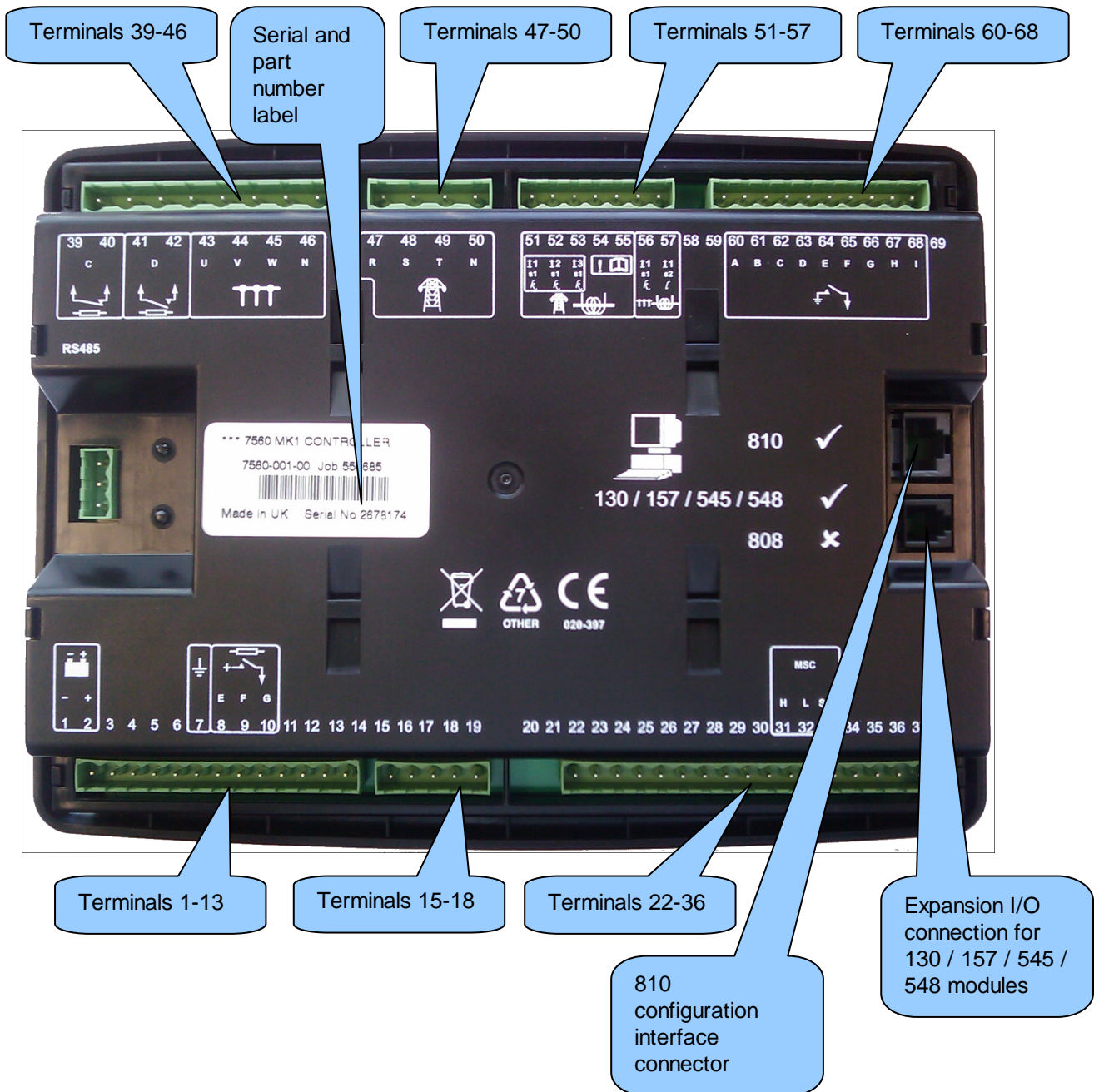
4 INSTALLATION

The DSE7000 Series module is designed to be mounted on the panel fascia. For dimension and mounting details, see the section entitled *Specification, Dimension and mounting* elsewhere in this document.

4.1 USER CONNECTIONS




To aid user connection, icons are used on the rear of the module to help identify terminal functions. An example of this is shown below.

NOTE : Availability of some terminals depends upon module version. Full details are given in the section entitled *Terminal Description* elsewhere in this manual.




4.2 TERMINAL DESCRIPTION

4.2.1 DC SUPPLY, FUEL AND START OUTPUTS, OUTPUTS E,F,G

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	1	DC Plant Supply Input (Negative)	2.5mm ² AWG 13	
	2	DC Plant Supply Input (Positive)	2.5 mm ² AWG 13	(Recommended Maximum Fuse 15A anti-surge) Supplies the module (2A anti-surge requirement) and Output relays E,F,G & H
	7	Functional Earth	2.5mm ² AWG 13	Connect to a good clean earth point.
	8	Output relay E	1.0mm ² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.
	9	Output relay F	1.0mm ² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.
	10	Output relay G	1.0mm ² AWG 18	Plant Supply Positive. from terminal 2. 3 Amp rated.


 **NOTE:-** Terminals 3 to 6 and 11 to 14 are not fitted to the DSE7560 MK1 controller.

 **NOTE:-** Terminals 11 to 30 are not fitted to the DSE7560 MK1 controller.




4.2.2 MSC, MAGNETIC PICKUP, CAN AND EXPANSION

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
MSC	31	MSC H	0.5mm ² AWG 20	Use only 120Ω CAN approved cable
	32	MSC L	0.5mm ² AWG 20	Use only 120Ω CAN approved cable
	33	MSC SCREEN	0.5mm ² AWG 20	Use only 120Ω CAN approved cable

 **NOTE:-** Terminals 34 to 38 are not fitted to the DSE7560 MK1 controller


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

4.2.3 LOAD SWITCHING AND MAINS VOLTAGE SENSING

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	39	Output relay C	1.0mm AWG 18	Normally configured to control mains contactor coil (Recommend 10A fuse)
	40	Output relay C	1.0mm AWG 18	Normally configured to control mains contactor coil
	41	Output relay D	1.0mm AWG 18	Normally configured to control generator contactor coil (Recommend 10A fuse)
	42	Output relay D	1.0mm AWG 18	Normally configured to control generator contactor coil
	43	Mains L1 (R) voltage monitoring	1.0mm ² AWG 18	Connect to Mains L1 (R) incoming supply (AC) (Recommend 2A fuse)
	44	Mains L2 (S) voltage monitoring	1.0mm ² AWG 18	Connect to Mains L1 (S) incoming supply (AC) (Recommend 2A fuse)
	45	Mains L3 (T) voltage monitoring	1.0mm ² AWG 18	Connect to Mains L1 (T) incoming supply (AC) (Recommend 2A fuse)
	46	Mains Neutral (N) input	1.0mm ² AWG 18	Connect to Mains N incoming supply (AC)

NOTE:- The above table describes connections to a three phase, four wire alternator. For alternative wiring topologies, please see the **ALTERNATIVE AC TOPOLOGIES** section of this manual.


4.2.4 BUS VOLTAGE SENSING

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	47	Bus L1 (U) voltage monitoring	1.0mm AWG 18	Connect to Bus L1 (U) output (AC) (Recommend 2A fuse)
	48	Bus L2 (V) voltage monitoring input	1.0mm AWG 18	Connect to Bus L2 (V) output (AC) (Recommend 2A fuse)
	49	Bus L3 (W) voltage monitoring input	1.0mm AWG 18	Connect to Bus L3 (W) output (AC) (Recommend 2A fuse)
	50	Bus Neutral (N) input	1.0mm AWG 18	Connect to Bus Neutral terminal (AC)

4.2.5 MAINS AND BUS CURRENT TRANSFORMERS


WARNING!- Do not disconnect this plug when the CTs are carrying current. Disconnection will open circuit the secondary of the C.T.'s and dangerous voltages may then develop. Always ensure the CTs are not carrying current and the CTs are short circuit connected before making or breaking connections to the module.

NOTE!- The DSE7510 MK1 module has a burden of 0.5VA on the CT. Ensure the CT is rated for the burden of the DSE7510 MK1 controller, the cable length being used and any other equipment sharing the CT. If in doubt, consult your CT supplier.

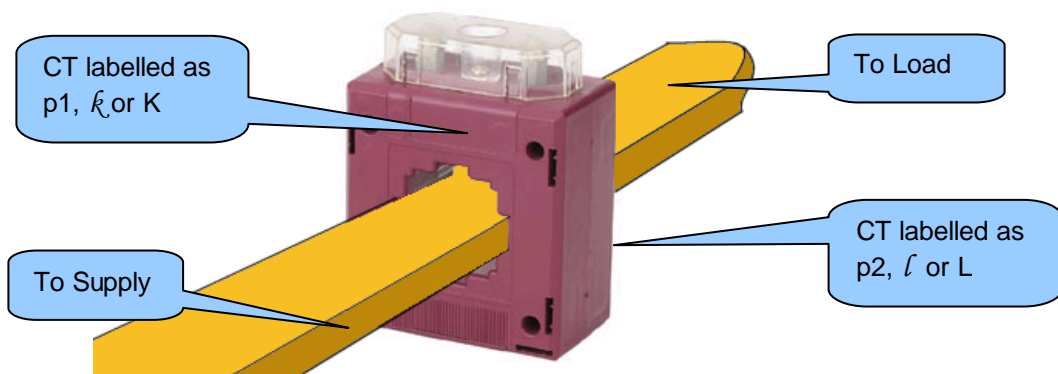
	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	51	CT Secondary for Mains L1	2.5mm ² AWG 13	Connect to s1 secondary of L1 monitoring CT
	52	CT Secondary for Mains L2	2.5mm ² AWG 13	Connect to s1 secondary of L2 monitoring CT
	53	CT Secondary for Mains L3	2.5mm ² AWG 13	Connect to s1 secondary of L3 monitoring CT

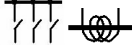
Connection to terminals 54 & 55

The function of terminals 54 and 55 change position depending upon wiring topology as follows :

Type	Topology	Pin No	Description	CABLE SIZE
	No earth fault measuring	54	DO NOT CONNECT	
		55	Common for CTs connected to L1,L2,L3	2.5mm ² AWG 13
	Restricted earth fault measuring	54	Common for CTs connected to L1,L2,L3,N	2.5mm ² AWG 13
		55	Connect to CT on the neutral conductor	2.5mm ² AWG 13
	Un-restricted earth fault measuring (Earth fault CT is fitted in the neutral to earth link)	54	DO NOT CONNECT	
		55	Common for CTs connected to L1,L2,L3	2.5mm ² AWG 13


NOTE!- Take care to ensure correct polarity of the CT primary as shown below. If in doubt, check with the CT supplier.



	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	56	CT Secondary for Bus L1	2.5mm ² AWG 13	Connect to s1 secondary of L1 monitoring CT
	57	CT Secondary for Bus L1	2.5mm ² AWG 13	Connect to s2 secondary of L1 monitoring CT

 **NOTE:-** Terminals 59 and 60 are not fitted to the DSE7560 MK1 controller

4.2.6 CONFIGURABLE DIGITAL INPUTS

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	60	Configurable digital input A	0.5mm ² AWG 20	Switch to negative
	61	Configurable digital input B	0.5mm ² AWG 20	Switch to negative
	62	Configurable digital input C	0.5mm ² AWG 20	Switch to negative
	63	Configurable digital input D	0.5mm ² AWG 20	Switch to negative
	64	Configurable digital input E	0.5mm ² AWG 20	Switch to negative
	65	Configurable digital input F	0.5mm ² AWG 20	Switch to negative
	66	Configurable digital input G	0.5mm ² AWG 20	Switch to negative
	67	Configurable digital input H	0.5mm ² AWG 20	Switch to negative
	68	Configurable digital input I	0.5mm ² AWG 20	Switch to negative

 **NOTE:-** Terminal 69 is not fitted to the DSE7560 MK1 controller.

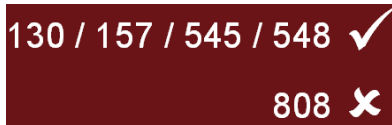
4.2.7 PC CONFIGURATION INTERFACE CONNECTOR



8-way connector allows connection to PC via 810 configuration interface. Module can then be re-configured utilising the 75xx for Windows™ software.

! CAUTION! This socket must not be used for any other purpose.

4.2.8 EXPANSION INTERFACE CONNECTOR



4-way connector allows connection to the P130 input expansion, P157 relay expansion module or 545/548 LED expansion modules.

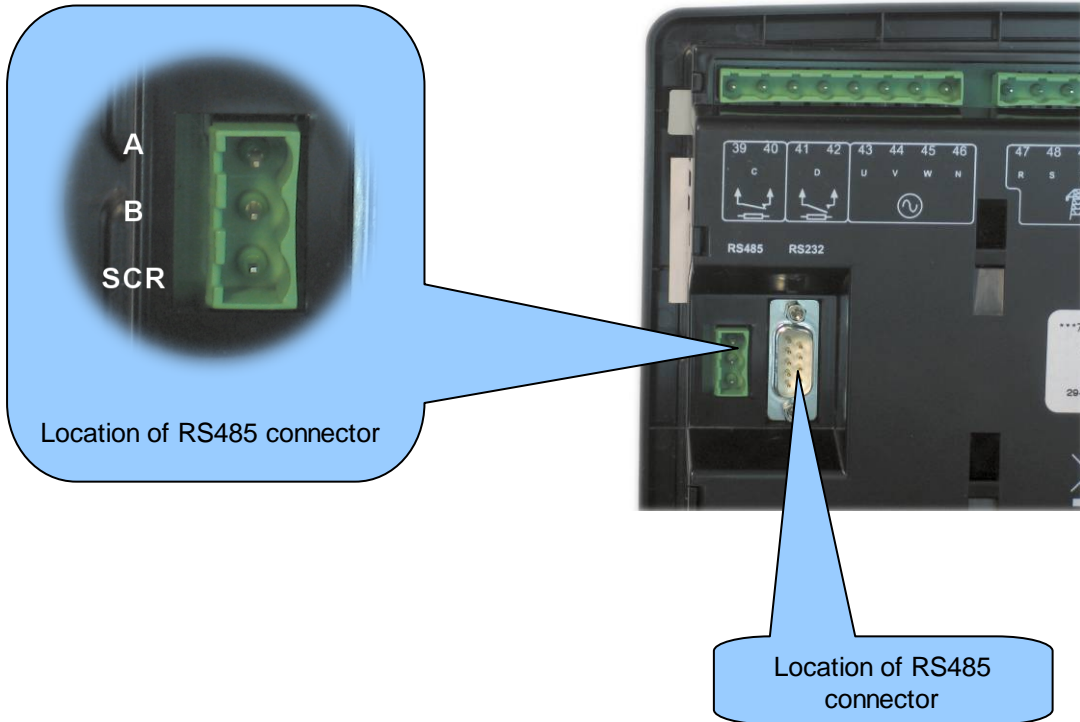
A maximum of 2 relay or LED expansion modules may be connected in series to this port.

! CAUTION! - Do not connect the 808 configuration interface to this port, as it is not possible to use the 808 software to configure the 7560MK1 module.

! CAUTION! This socket must not be used for any other purpose.

4.2.9 RS485 CONNECTOR

PIN No	NOTES
A	Two core screened twisted pair cable. 120Ω impedance suitable for RS485 use.
B	Recommended cable type - Belden 9841
SCR	Max distance 1000m (1km) when using Belden 9841 or direct equivalent.



4.2.10 LED INDICATORS AND LOGO INSERT

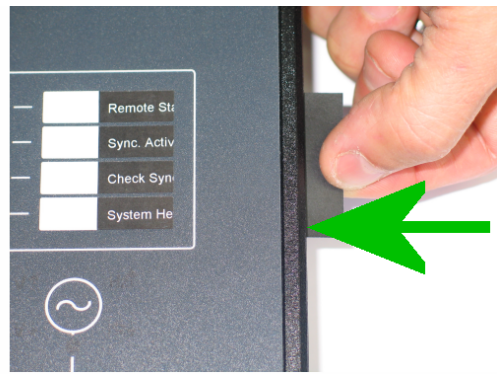
USER CONFIGURABLE LED's

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

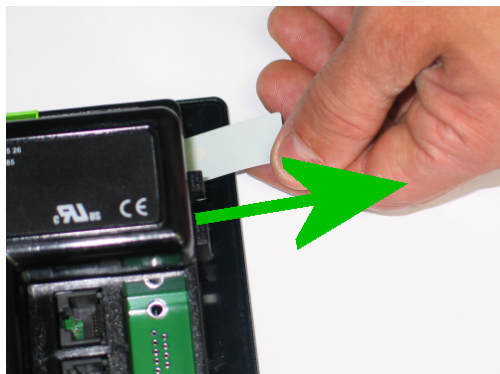
- **INDICATIONS** - Monitoring of a digital input and indicating associated functioning user's equipment - *Such as Battery Charger On or Louvre Open, etc.*
- **WARNINGS and SHUTDOWNS** - Specific indication of a particular warning or shutdown condition, backed up by LCD indication - *Such as Low Oil 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 SoftwareCD to ease the production of text and logo insert cards to suit your application.

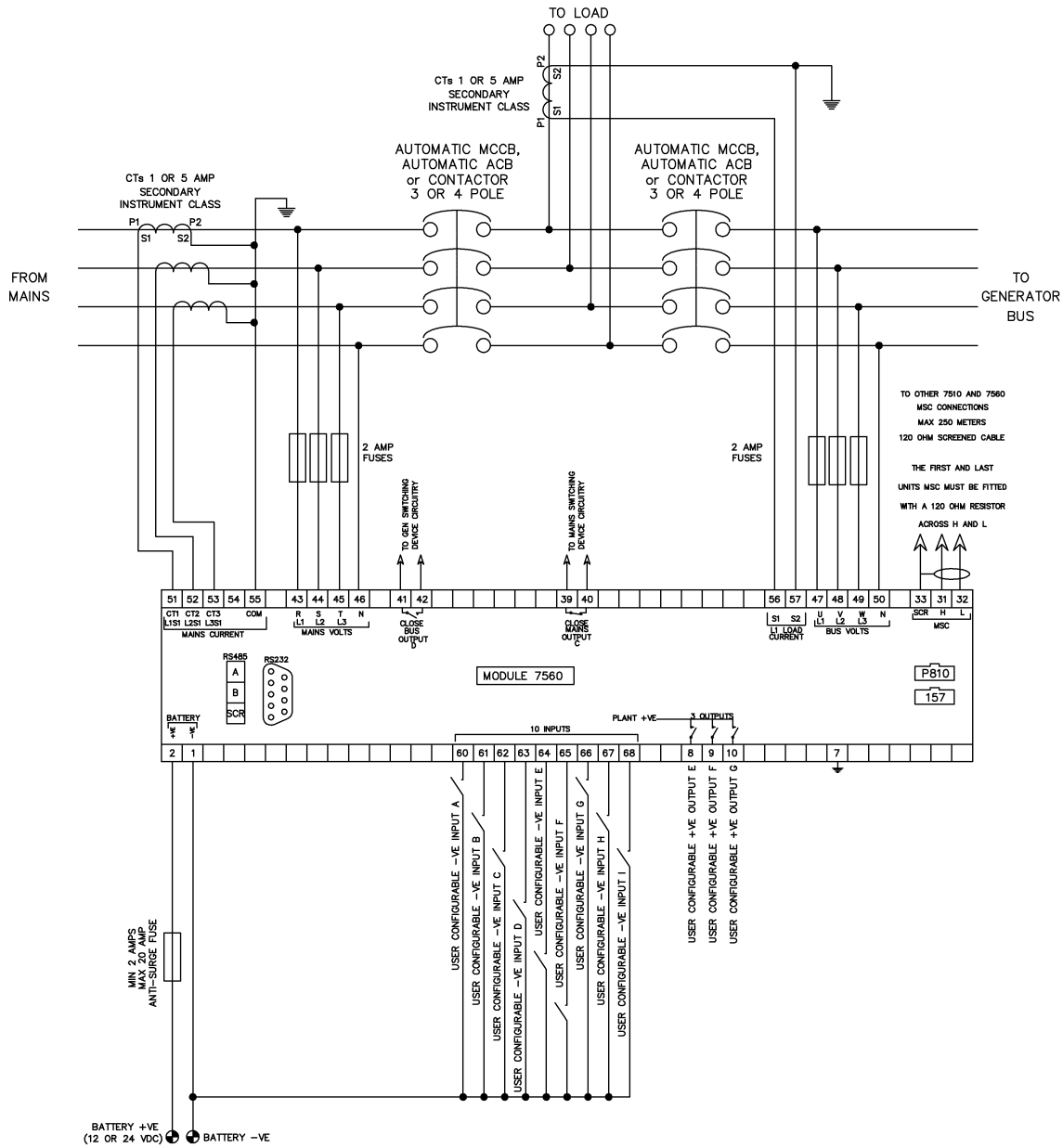


Removal and insertion of the LED text insert card



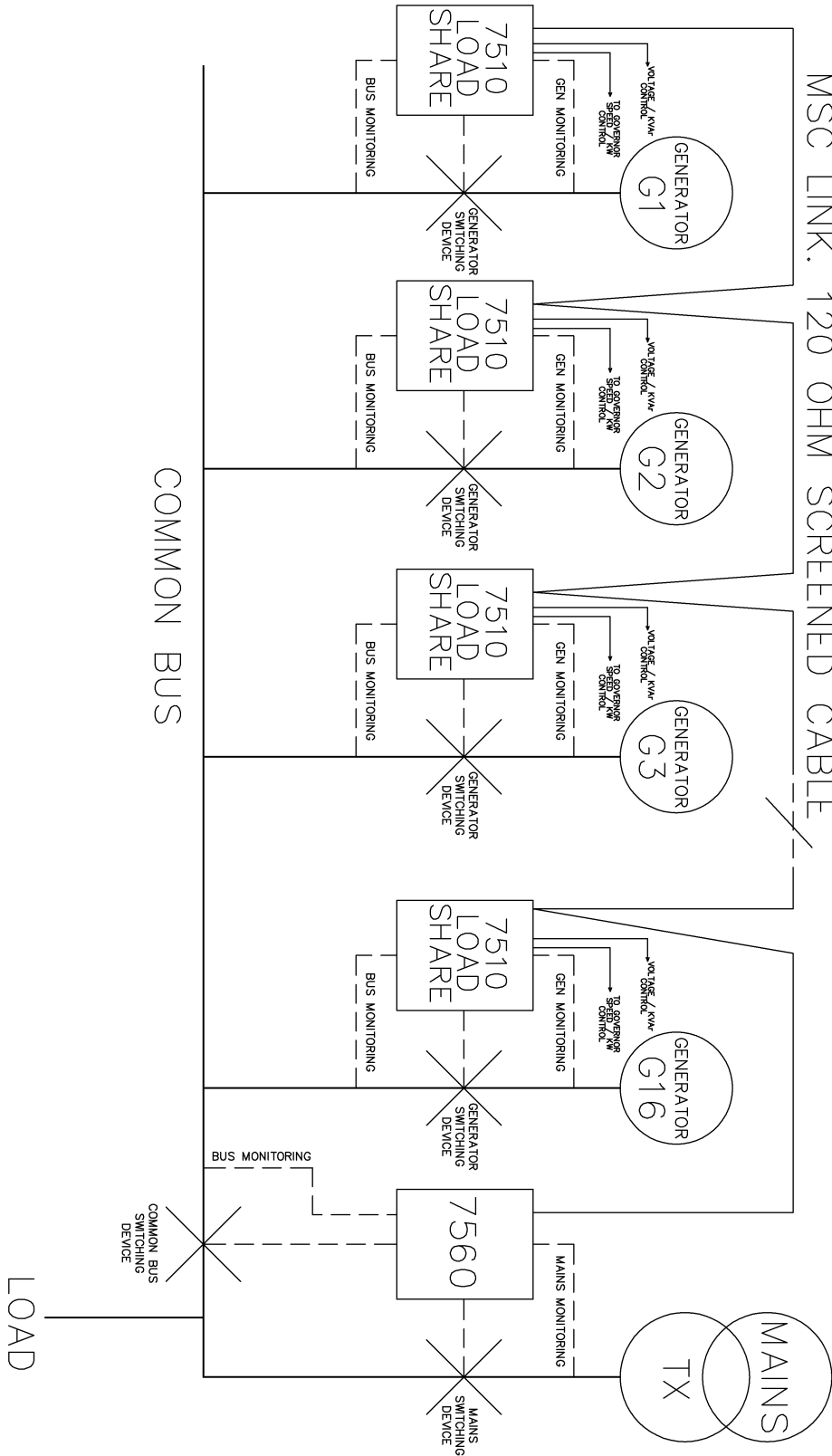
Removal and insertion of the Logo insert card

4.3 TYPICAL WIRING DIAGRAMS

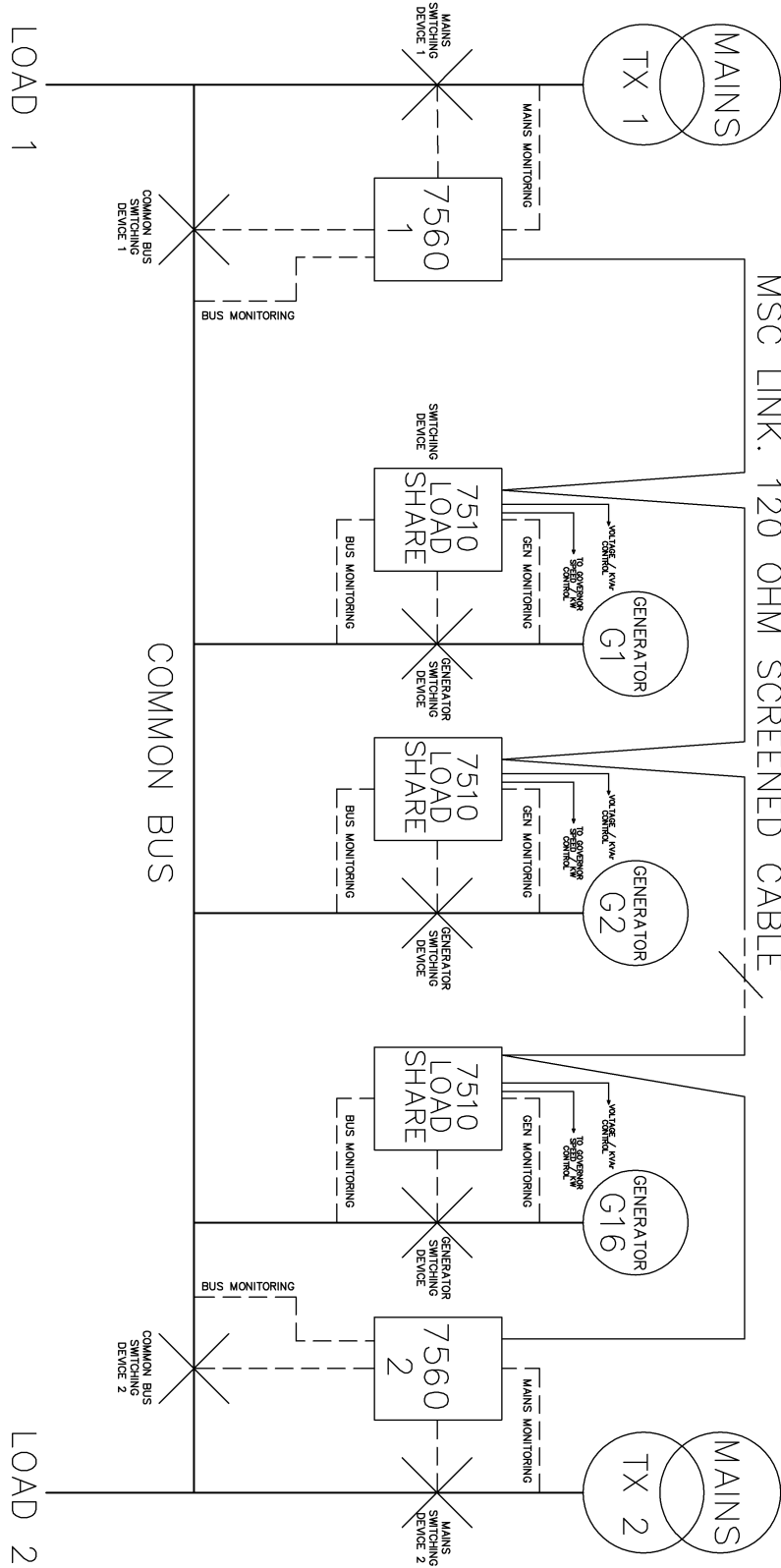


NOTE:- The LOAD CT is only required on 'multiple mains' systems (multiple 7560s installed in the system).

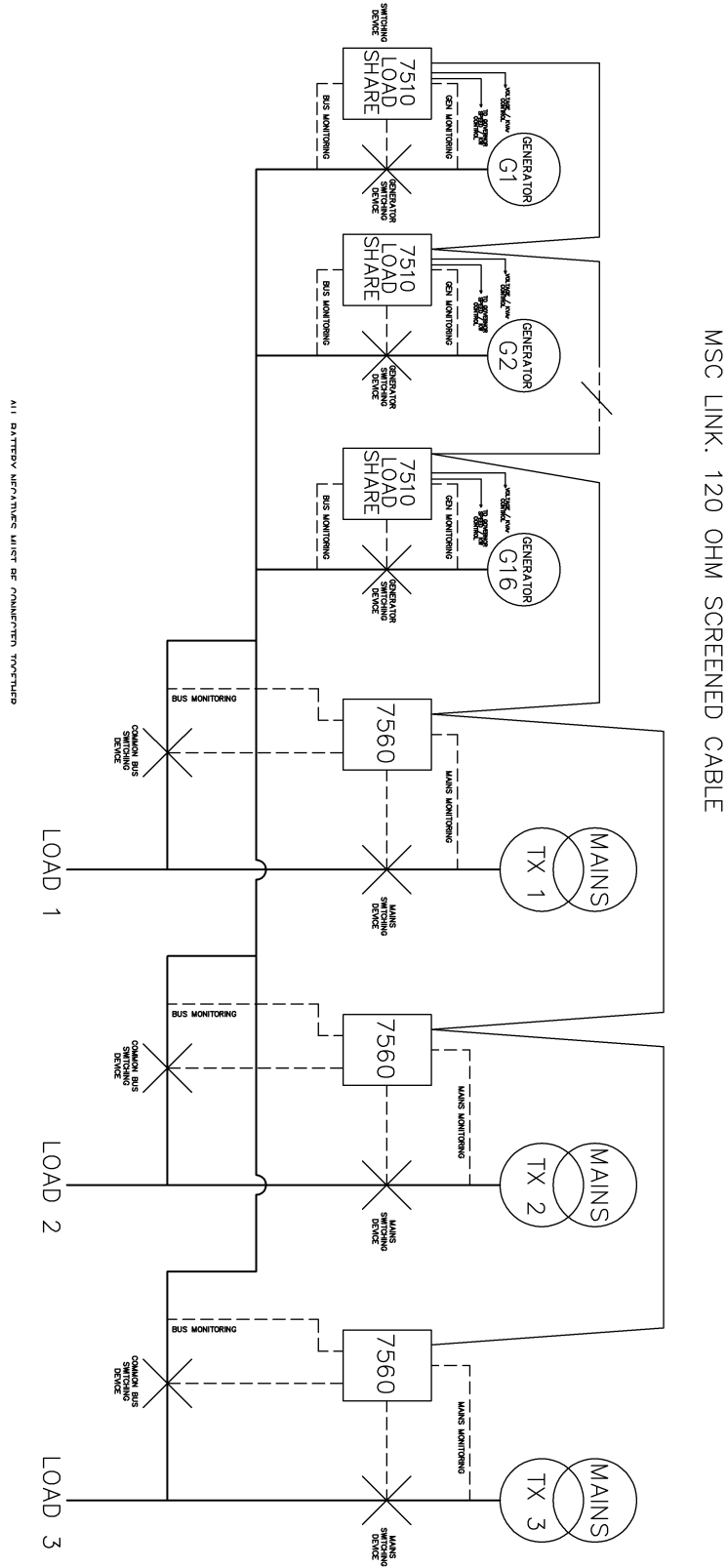
4.3.1 SINGLE MAINS, MULTIPLE GENERATORS



4.3.2 DUAL MAINS, MULTIPLE GENERATORS



4.3.3 MULTIPLE MAINS, MULTIPLE GENERATORS

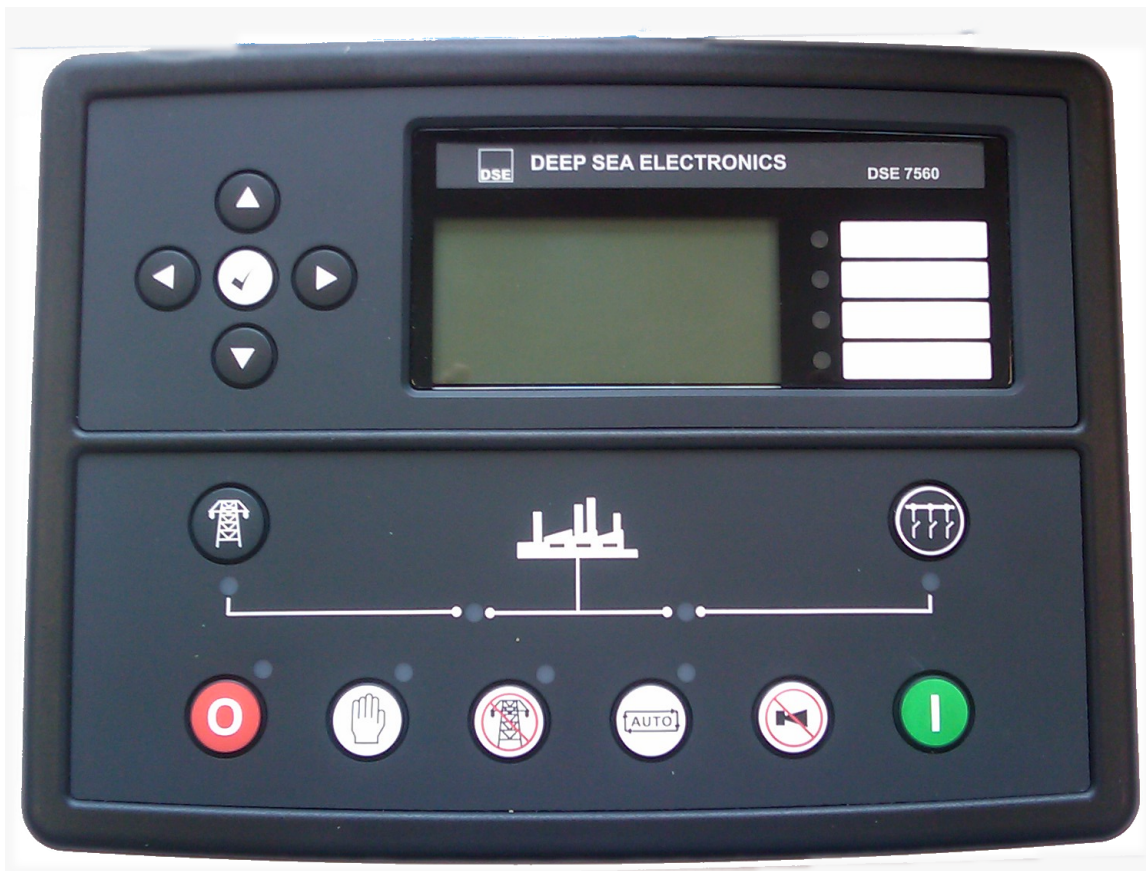



5 OPERATION

5.1 CONTROL

Control of the **DSE7560 MK1** 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.

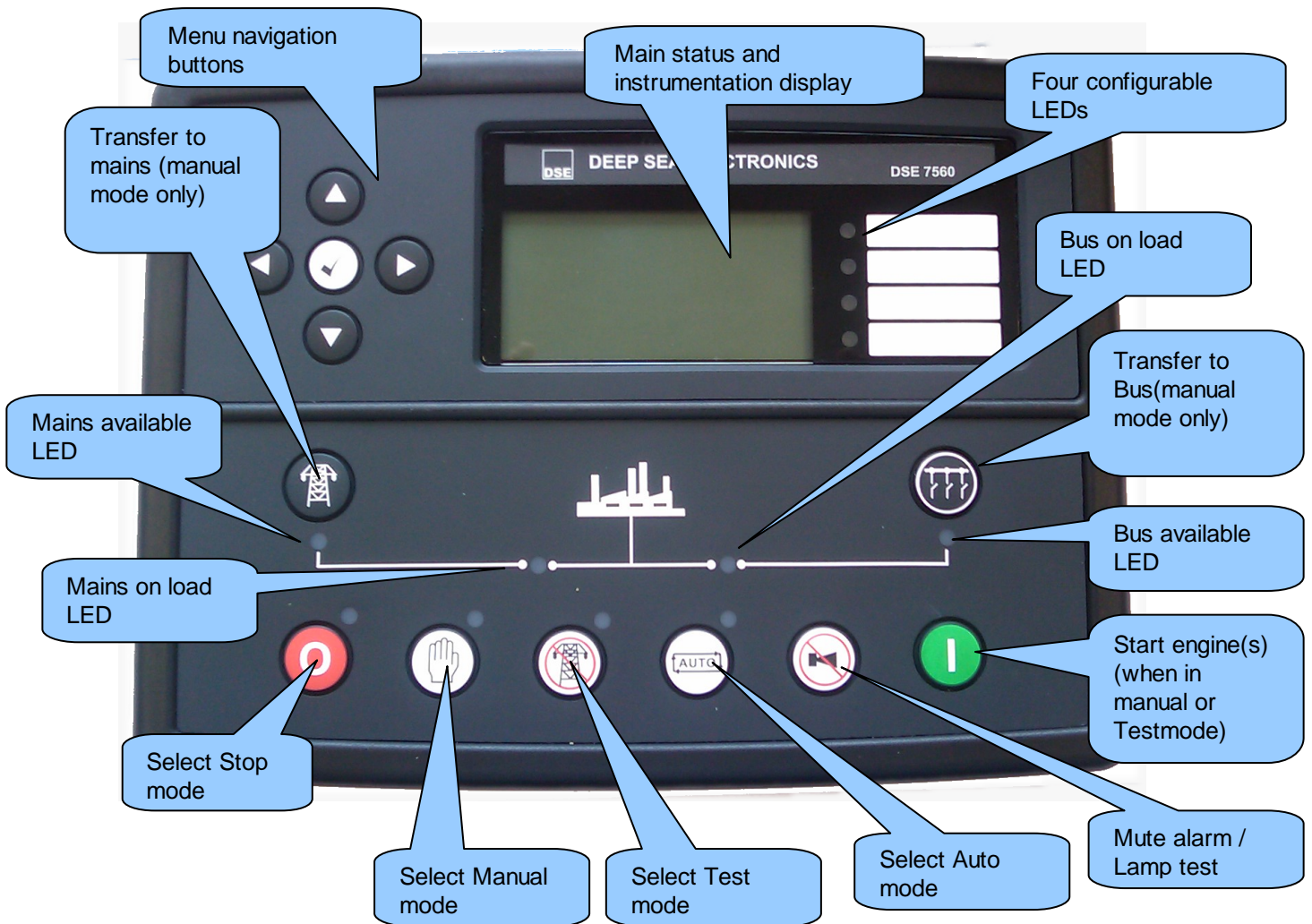
The following descriptions detail the sequences followed by a module containing the standard 'factory configuration'. Always refer to your configuration source for the exact sequences and timers observed by any particular module in the field.





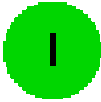


 **CAUTION:** - The module may instruct an engine start event due to external influences. Therefore, it is possible for the engine to start at any time without warning. Prior to performing any maintenance on the system, it is recommended that steps are taken to remove the battery and isolate supplies.







5.1.1 DESCRIPTION OF CONTROLS

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







6 CONTROL PUSH-BUTTONS


<p>STOP/RESET</p> <p>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 engine is running and this push-button is operated, the module will automatically instruct the generator contactor/breaker to unload the generator. The fuel supply will be removed and engine will be brought to a standstill. Should a remote start signal be present while operating in the mode, a remote start will <u>not</u> occur.</p>	
<p>MANUAL</p> <p>This push-button is used to allow manual control of the generator 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 generator operation. For example, once in Manual mode it is possible to start the engine by using the 'START' push-button. If the engine is running, off-load in the Manual mode and a remote start signal becomes present, the module will automatically instruct the generator contactor/breaker device to place the generator on load. Should the remote start signal then be removed the generator will remain on load until either the 'STOP/RESET' or 'AUTO' push-buttons are operated.</p>	
<p>START</p> <p>This push-button is used to start the engine. The module must first be placed in the 'MANUAL' mode of operation. The 'START' button should then be operated. The engine will then automatically attempt to start. Should it fail on the first attempt it will re-try until either the engine fires or the pre-set number of attempts have been made. To stop the engine the 'STOP/RESET' button should be operated. It is also possible to configure the module such that the start push-button must be held to maintain engine cranking.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NOTE:- Different modes of operation are possible - Please refer to your configuration source for details.</p> </div>	
<p>AUTO</p> <p>This push-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 once a start condition is signalled the set will be automatically started and placed on load. If the starting signal is removed, 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. <i>For further details, please see the more detailed description of 'Auto Operation' earlier in this manual.</i></p>	
<p>ALARM MUTE</p> <p>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></p> <p>When the Alarm Mute is operated a Lamp test function will also be implemented and all LED indicators will be illuminated.</p>	

<p>CLOSE MAINS</p> <p>This push button is used to control the closure of the mains load switching device and has two modes of operation :</p> <ol style="list-style-type: none"> 1. Synchronising is NOT enabled. Pressing this button when the mains is available off load and in MANUAL mode, the bus load switch is opened and the mains load switch is closed. Further presses of this button will have no effect. 2. Synchronising is enabled. Pressing this button when the mains is available and in MANUAL mode, the 7510MK1 controller, will volts match and synchronise with the Bus. The mains load switch is then closed in parallel with the Bus. <p> NOTE:- This button is only active in MANUAL mode.</p> <p> NOTE:- If the bus is live when the manual button is pressed, synchronising will take place before the load switch is closed.</p> <p>mode.</p>	
<p>CLOSE GENERATOR</p> <p>This push button is used to control the closure of the generator load switching device and has two modes of operation :</p> <ol style="list-style-type: none"> 3. Synchronising is NOT enabled. Pressing this button when the generator is running off load and in MANUAL mode, the generator load switch is closed. Further presses of this button will have no effect. 4. Synchronising is enabled. Pressing this button when the generator is running and in MANUAL mode, the 7510MK1 controller, will volts match and synchronise with the Bus. The generator load switch is then closed in parallel with the Bus. <p> NOTE:- This button is only active in MANUAL mode.</p> <p> NOTE:- If the bus is live when the manual button is pressed, synchronising will take place before the load switch is closed.</p>	



6.1 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 7560 will issue a start command to all connected 7510 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 7560 will display: Any available 7510 in auto mode will be issued with a start signal. Please refer to the 7510 operating manual for further details of the start sequence	Status Start request Manual mode
Once the Minimum number of sets (set using 75xx software) have synchronised onto the bus, the 7560 will display:	Status Mains on load Manual mode
Pressing the transfer to bus/open mains button  will synchronise the bus to the mains. The 7560 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 7560 will display:	Status Ramp onto bus 10% kW 12% kVAr Manual mode
Once the bus power / mains power level has been reached (configured using 75xx software) the 7560 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 7560 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 7560 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 7560 will display:	Status Synchronise bus Manual mode
Once the bus has synchronised to the mains, the mains will close and power will be ramped off the bus (generators). The 7560 will display:	Status Ramp off bus 10% kW 12% kVAr Manual mode
Once the bus power / mains power level has been reached (configured using 75xx software) the 7560 will display:	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 7560 will display:	Status Ramp off bus 10% kW 12% kVAr Manual mode
Once the bus loading has reached 0kW the bus will open and the 7560 will display:	Status Mains on load Manual mode
Pressing the red stop button will issue a stop to all 7510s on the system	
The LED above the button will illuminate and the LCD display will briefly indicate:	Status Mains on load Stop mode
Any 7510 running in auto mode will then display: Please refer to the 7510 operating manual for further details of the 7510 stop sequence	RETURN DELAY 00:50

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

6.2 AUTOMATIC OPERATION


6.2.1 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 :	<table border="1"> <tr> <td>Status</td> <td></td> </tr> <tr> <td>Mains on load</td> <td></td> </tr> <tr> <td>Auto mode</td> <td></td> </tr> </table>	Status		Mains on load		Auto mode	
Status							
Mains on load							
Auto mode							
The call to start can come from a number of sources (if configured) : <ul style="list-style-type: none"> • 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 7560 will display:	<table border="1"> <tr> <td>Status</td> <td></td> </tr> <tr> <td>Start delay</td> <td style="text-align: right;">00:05</td> </tr> <tr> <td>Auto mode</td> <td></td> </tr> </table>	Status		Start delay	00:05	Auto mode	
Status							
Start delay	00:05						
Auto mode							
Once this timer has expired, any available 7510 in auto mode will be issued with a start signal, and will display: Please refer to the 7510 operating manual for further details of the 7510 start sequence.	<table border="1"> <tr> <td>START DELAY</td> <td style="text-align: right;">00:05</td> </tr> </table>	START DELAY	00:05				
START DELAY	00:05						
The 7560 will display:	<table border="1"> <tr> <td>Status</td> <td></td> </tr> <tr> <td>Start request</td> <td></td> </tr> <tr> <td>Auto mode</td> <td></td> </tr> </table>	Status		Start request		Auto mode	
Status							
Start request							
Auto mode							

6.2.2 CLOSING THE BUS BREAKER

MAINS FAILED

<p>As the mains supply has failed, there is no requirement for synchronising. However, the 7560 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).</p>	<p>Status Continuous paralleling Auto mode</p>
<p>Should the mains supply return, the module will first initiate a return timer to ensure that it is safe to stop the generators. The 7560 will display:</p>	<p>Status Return delay Auto mode</p> <p style="text-align: right;">00:05</p>

 **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

<p>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:</p> <ul style="list-style-type: none"> • 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) <p>Once the Minimum number of sets (set using 75xx software) have synchronised onto the bus, the 7560 will display:</p>	<p>Status Synchronise to bus Auto mode</p>
<p>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 7560 will display:</p>	<p>Status Ramp onto bus 10% kW 12% kVAr Auto mode</p>
<p>Once the bus power / mains power level has been reached (configured using 75xx software) the 7560 will display:</p>	<p>Status Continuous paralleling Auto mode</p>

6.2.3 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 7560 will display: Once the mains loading has reached 0kW, the bus load switch will be opened and the 7560 will display:	Status
	Ramp onto bus 76% kW 80% kVAr 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 7560 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 7560 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.

6.2.4 RE-TRANSFER TO MAINS

<p>Once the return delay has expired, the bus is synchronised to the mains.</p>	<p>Status Synchronise to Mains Auto mode</p>
<p>The load is then ramped back onto the mains. The 7560 will display:</p>	<p>Status Ramp off bus 10% kW 12% kVAr Auto mode</p>
<p>Once the bus loading has reached 0kW, the bus load switch will be opened and the 7560 will display :</p>	<p>Status Mains on load Auto mode</p>
<p>Any 7510 running in Auto mode will be issued a stop command and will display : Please refer to the 7510 operator manual for details on the stopping sequence.</p>	<p>Return delay 00:05</p>

6.3 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 7560 will display:	Status Start delay 00:05 Test mode
Once this timer has expired, any available 7510 in auto mode will be issued with a start signal, and will display: Please refer to the 7510 operating manual for further details of the 7510 start sequence.	START DELAY 00:05
The 7560 will display:	Status Start request Test mode
Once the Minimum number of sets (set using 75xx software) have synchronised onto the bus, the 7560 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 7560 will display:	Status Ramp onto bus 10% kW 12% kVAr Test mode
Once the bus power / mains power level has been reached (configured using 75xx software) the 7560 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.	

6.4 7560 MULTIPLE MAINS OPERATION

In a multiple mains system, the generator sets are controlled by more than one 7560 mains controller and used to provide power to multiple loads.


Should one or more of the mains supplies fail, the generators (controlled by DSE 7510 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 7510 controllers share power equally on a percentage basis with the other generators in the system.

- If one mains supply returns, the 7560 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 7560 with the highest priority will take control of the generators and affect a no-break changeover back to the mains supply. The remaining 7560s will operate in priority order providing no-break returns back to their respective mains supplies.

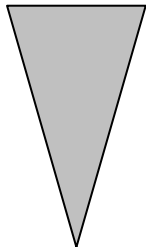
If the generators are 'peak-logging' with one mains supply, and another mains supply fails, dependent upon module configuration, the generators will either:

- Continue to peak-lop 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.**

6.4.1 7560 PRIORITY

Where more than one 7560 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
	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

Where two or more 7560 controllers have the same conditions in the table above, the 'Set Priority' configuration setting comes into effect. If two or more 7560 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 7560 requests to control the generators (either automatically or manually) it will not be allowed to do so until higher priority 7560 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.

6.4.2 7560 LOAD CT

The 7560 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 7560 to determine what portion of the load is being supplied by the generators. This allows the 7560 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.

7 PROTECTIONS

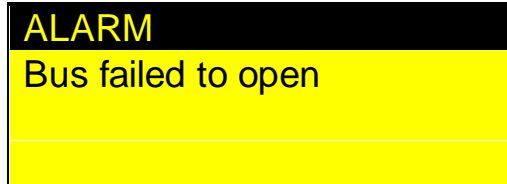
The module will indicate that an alarm has occurred in several ways;

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

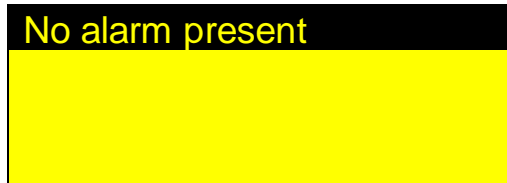


The LCD display will jump from the 'Status page' to display the Alarm.


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 

7.1 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 7560 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 7560 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.

7.2 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 7560 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 7560 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 7560 detects that two or more 7560 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.

7.3 ROCOF / VECTOR SHIFT

When configured to run in parallel with the mains (utility) supply, the module monitors for ROCOF / Vector shift trips according to the module's configuration settings. This is included within the module and will detect failure of the mains supply during parallel operation with the generator.

 **NOTE:- This protection operates only when in parallel with the mains supply and is disabled at all other times.**

Should either of these alarms operate, the module will perform either a controlled shutdown (electrical trip) of the generator or will instigate the mains failure function. This operation must be manually reset :

- 1) Press  button. The engine will stop if it is still running and the alarm is cleared.
- 2) Activate digital input configured to "Clear ROCOF/Vector shift" if this has been provided.
- 3) Press  and  button together and hold for 5 seconds. The ROCOF/Vector shift instrument is displayed and all 'peak hold' values are reset, clearing the ROCOF/Vector shift alarm.

For details on activating and configuring the ROCOF/Vector shift protection you are referred to the 75xx for Windows configuration software manual.

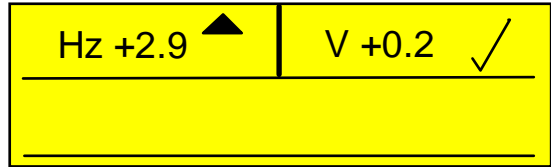
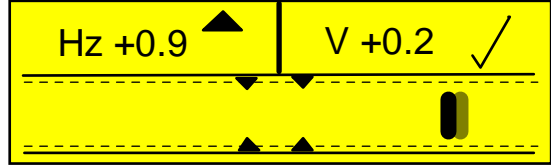
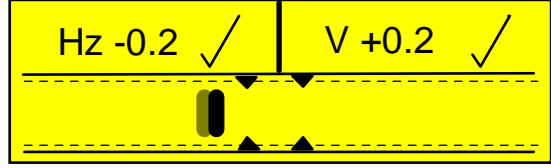
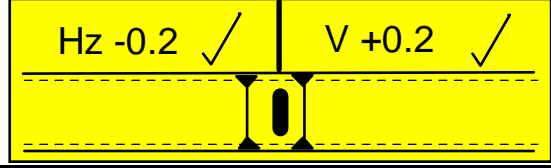
7.3.1 MAINS DECOUPLING TEST MODE

To aid the testing of the mains decoupling features in the controller, a special test mode is included. This is activated by placing the module into STOP mode and enabling the 'test mode' in the module's front panel 'running editor', described elsewhere in this document.

This allows a 'one shot' test of the mains decoupling protection, enabling the Test Engineer to inject the necessary test signals into the DSE control and timing the reaction from application of the signal to activation of a DSE output configured to 'combined mains decoupling'.

The actual testing of mains decoupling must be left to experienced engineers and is outside the scope of DSE support.

7.3.2 SYNCHROSCOPE OPERATION

	<p>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.</p>
	<p>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.</p>
	<p>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.</p>
	<p>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.</p>

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.

7.4 COMPLETE INSTRUMENTATION LIST

7.4.1 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



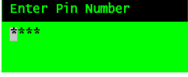






ROCOF / Vector shift

Synchroscope




7.5 THE FRONT PANEL CONFIGURATION EDITOR

This configuration mode allows the operator limited customising of the way the module operates.

7.5.1 ACCESSING THE FRONT PANEL CONFIGURATION EDITOR.

- Press the Stop/Reset  and Info  buttons simultaneously.
- If a module security PIN has been set, the PIN number request is then shown : 
- Press  (up) or  (down) to adjust it to the correct value.
- Press  (right) when the first digit is correctly entered. The digit you have just entered will now show '#' for security.
- Repeat this process for the other digits of the PIN number. You can press  (left) if you need to move back to adjust one of the previous digits.
- When  is pressed after editing the final PIN digit, the PIN is checked for validity. If the number is not correct, you must re-enter the PIN.
- If the PIN has been successfully entered (or the module PIN has not been enabled), the editor is displayed : 

EDITING A PARAMETER

- Enter the editor as described above.
- Press the left or right buttons to cycle to the section you wish to view/change.
- To edit the parameter, press  to enter edit mode. The parameter begins to flash to indicate that you are editing the value.
- Press the up or down buttons to change the parameter to the required value.
- Press  to save the value. The parameter ceases flashing to indicate that it has been saved.
- To exit the editor at any time, press the  button.

- ▲ **NOTE: When the editor is visible, it is automatically exited after 5 minutes of inactivity to ensure security.**
- ▲ **NOTE: The PIN number is automatically reset when the editor is exited (manually or automatically) to ensure security.**
- ▲ **NOTE: More comprehensive module configuration is possible using the 75xx series PC configuration software. Please contact us for further details**
- ▲ **NOTE: The contents of the tables overleaf may differ depending on the actual module configuration.**

7.5.2 LIST OF ADJUSTABLE PARAMETERS IN ‘MAIN CONFIGURATION EDITOR’

Front Panel Configuration Editor (Factory default settings are shown in bold italicised text)


Section	Parameter as shown on	Values
Timers	Mains Transient Delay	0-10s (2s)
	Start Delay	0- 60m (5s)
	Transfer Delay	0- 10s (0.7s)
	Return Delay	0- 60m (30sa0)
	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	0Hz-75Hz (45Hz)
	Mains Over Frequency	0Hz-75Hz (55Hz)
System	Plant Battery Under Volt Alarm	0-40v (10v)
	Plant Battery Over Alarm	0-40v (30v)
Misc	Language	English, Other
	Alternative Frequency	Enable Disable
	Alternative Voltage	Enable Disable
	AC System	3 phase 4 wire Single phase 2 Wire 3 phase 3 wire 2 phase 3 wire L1 & L2 3 phase 4 wire ED 2 phase 3 wire L1 & L3
	Contrast	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
	Date and Time	dd mmm yyyy hh:mm
	Auto scroll Time	0-10s (2s)
	Mains CT Primary Rating	5A- 6000A (600A)
	Mains CT Secondary Rating	1A, 5A (5A)
	Load Ramp Rate	0.1%-100% (2.0%) (% per sec)

NOTE:- More comprehensive module configuration is possible using the 75xx 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 us for the list of latest supported languages.



7.6 RUNNING EDITOR



7.6.1 ACCESSING THE 'RUNNING' CONFIGURATION EDITOR


- The 'running' editor can be entered while the engine is running. All protections remain active if the engine is running while the running editor is entered.
- Press and hold the  button to enter the running editor.


EDITING A PARAMETER

- Enter the editor as described above.

- Press the left  or right  buttons to cycle to the section you wish to view/change.

- Press the up  or down  buttons to change the parameter to the required value.

- To save parameters scroll to 'save changes and exit' followed by the down  button

- To cancel changes scroll to 'Abandon changes and exit' followed by the down  button

ADJUSTABLE PARAMETERS (Running editor)

Running Editor


Section	Parameter as shown on display	Factory Settings
DISPLAY	Contrast	<input type="checkbox"/> <input type="checkbox"/>
	Language	English
	Load power factor	%
	Load parallel power	%
	Enable commissioning screens	No
	Voltage adjust (manual mode only engine running bus breaker open)	Raise Steady Lower
	Frequency adjust (manual mode only engine running bus breaker open)	Raise Steady Lower
	Enable mains decoupling	No
	Abandon changes and exit	
	Save changes and exit	

8 COMMISSIONING

8.1.1 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 7510s 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 7510s 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 7510s 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 7560 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 7560 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 **7560** 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

8.2 COMMISSIONING SCREENS

Commissioning screens are available to both aid the commissioning process and also to give additional information about the synchronising and load sharing process. These screens can be enabled and disabled in the module's display editor.

8.2.1 SCREEN 1


L-N	0V	kW	0	Average L-N Voltage and total kW
Sets load	0A	KVAr	0	Load on the set(s) and total kVAr
Ramp	0.0%	kW	0.0%	Ramp level and % of full load kW
		kVAr	0.0%	% of full load kVAr

8.2.2 SCREEN 2

B kW	0.0%	kVAr	0.0%	Bus load levels (kW / kVAr)
B Tgt	0.0%	kW	0.0%	Target and actual % of full load buskW
B Tgt	0.0%	kVAr	5.0%	Target and actual % of full load bus kVAr
Sets load	0			Load on the set(s)


8.2.3 SCREEN 3

M Tgt	0%	kW	0%	Target and actual % of full load mains kW
M Tgt	0%	kVAr	0%	Target and actual % of full load mains kVAr
Pf	0.00	Sets load	0	Mains power factor Load on the set(s)
L-N	0V	Amps	0A	Mains average voltage and maximum amps

 **NOTE:-** Some of the items may be removed from the commissioning screens if they are not applicable to the module configuration.

9 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.

9.1 ACCESSORIES

9.1.1 OUTPUT EXPANSION

There are several methods of output expansion available for the 75xxMK1 range of modules: -

RELAY OUTPUT EXPANSION (157)

An expansion module is available, which connects to the configuration socket, and enables the 75xxMK1 to use eight additional relays, providing Volt-free contacts for customer connection. A maximum of two of these units can be used give 16 independent volt-free contacts.

The 157's need to be identified as module 'A' and module 'B'

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

LED OUTPUT EXPANSION (548)

An expansion module is available, which connects to the configuration socket, and enables the 75xxMK1 to use the eight additional LED's on the 548 module, providing remote LED's indication. A maximum of two of these units can be used give 16 independent remote LED's.

The 548's need to be identified as module 'A' and module 'B'

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

It is possible to use a mix of 157 and 548 modules to give both relay and LED expansion if required.

9.1.2 INPUT EXPANSION (P130/P540/P541)

It is possible to increase the number of monitored inputs available by utilising either:

- DSE P130 input expansion.
- 540 / 541 Protection Expansion/Annunciator.

Please refer to the relevant product documentation for further details.

9.2 COMMUNICATIONS OPTION

9.2.1 DESCRIPTION

The 75xx series configuration software allows the 7560MK1 controller to communicate with a PC. The computer can be connected to the module either directly, or via an RS485 link**.

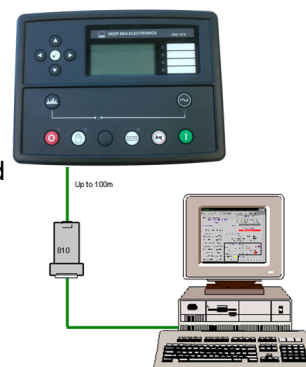
The operator is then able to remotely control the module, starting or stopping the generator, selecting operating modes, etc. The various operating parameters (such as output volts, oil pressure, etc.) on the remote generator can also be viewed.

The information contained in this manual should be read in conjunction with the appropriate module documentation. This manual only details the operation of the communications software and how it should be used. The operation of the module is detailed in its own relevant manual.

9.2.2 CONTROLLER TO PC (DIRECT) CONNECTION

To connect a 7560MK1 to a modem the following items are required: -

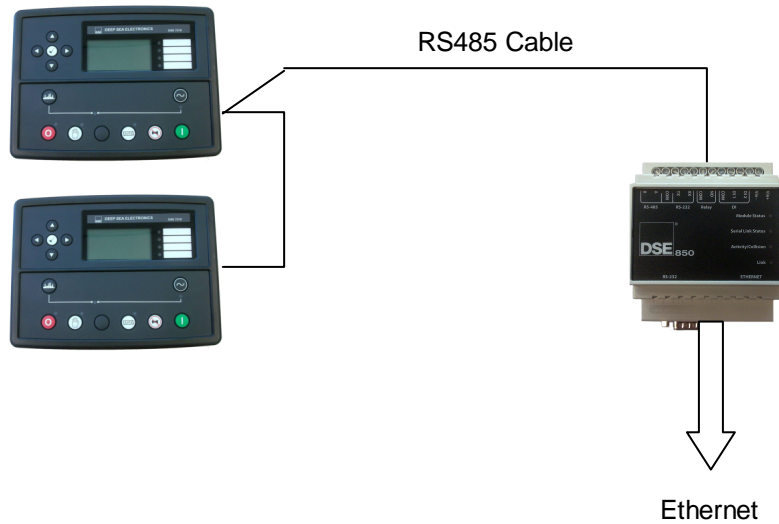
- 7560MK1 Module 75xx series configuration software (Supplied on DSE software CD).
- P810 interface (USB or RS485 as required)



9.2.3 CONTROLLER TO ETHERNET CONNECTION

To connect a 7560MK1 to the Ethernet the following items are required: -

- 7510MK1 Module (1 to 6 DSE7510 controllers are supported and up to 2 DSE7560 controllers)
- 75xx series configuration software
- DSE850 multiset Ethernet module



Sample screenshot of 4 x DSE7510 and 1 x DSE7560 controllers

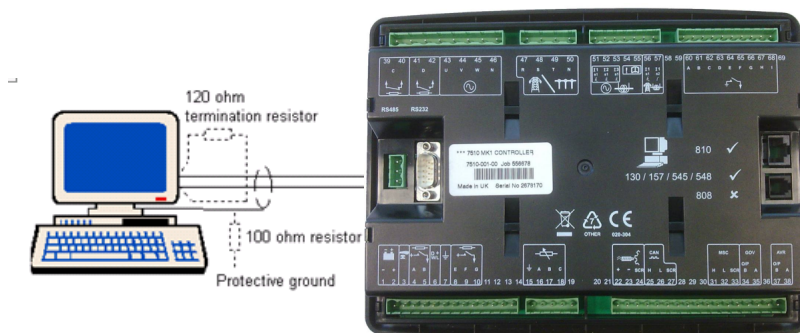


9.2.4 RS485 LINK TO CONTROLLER

The RS485 enabled 7560MK1 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).

Typical connections of RS485 PC system (master) to RS485 DSE controller (slave)

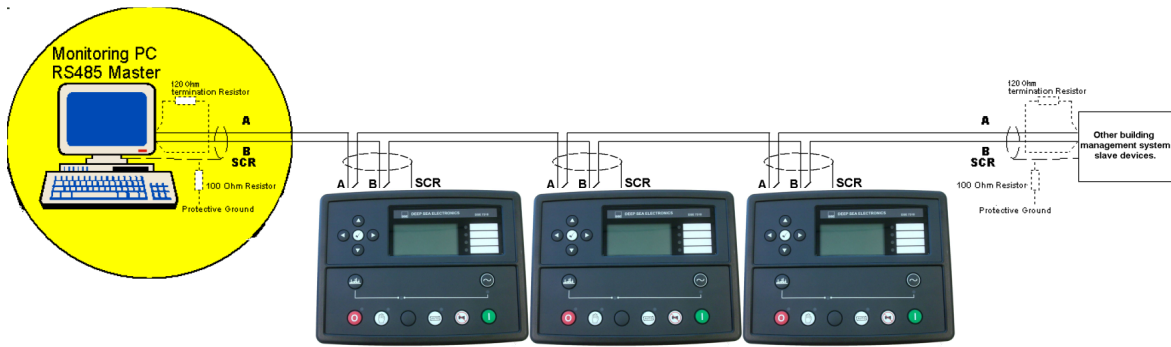


NOTE: - The RS485 system will comprise of one MODBUS master (typically a PC) and up to 31 MODBUS slaves. The 7560MK1 modules are always MODBUS slave devices. To ensure correct operation a suitable 120Ω terminal resistor must be fitted to each end of the RS485 connection bus.

Caution! - The A and B lines of the RS485 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 7510MK1 controller is the 'last' device on the bus, then it's 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 7560MK1 module via this protocol. Please refer to Deep Sea Electronics Plc for details.

9.2.5 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 (7560MK1 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 7560MK1 Module receives a query it will respond by either supplying the requested register data or performing the requested action. A slave device (the 7560MK1 module) will never initiate communications on the Modbus™ link. The 7560MK1 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 Link7000plus Manual for further details on communications expansion.

NOTE:- 7560MK1 controller only available with RS485 communications.

9.3 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 0 No protection	Protection against ingress of water 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.

9.4 IEEE C37.2 STANDARD ELECTRICAL POWER SYSTEM DEVICE FUNCTION NUMBERS

The DSE 7560MK1 contains many protection devices and functions, which are listed in detail in the following sections.

Functions and protections provided corresponding to IEEE C37.2 (1996) system device numbers are listed below.

Overall the 7560MK1 is designated as 11 - *Multifunction device* and includes the following protections and functions:

Device	Description
2	time delay starting or closing relay
3	checking or interlocking relay
5	stopping device
12	overspeed device
14	underspeed device
15	speed or frequency matching device
18	accelerating or decelerating device
25	synchronizing or synchronism-check relay
27	undervoltage relay
30	annunciator relay
31	separate excitation device
32	directional power relay
46	reverse-phase or phase-balance current relay
48	incomplete sequence relay
50	instantaneous overcurrent relay

51 ac time overcurrent relay	A device that functions when the ac input current exceeds a predetermined value, and in which the input current and operating time are inversely related through a substantial portion of the performance range.
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Device	Description
52 ac circuit breaker	A device that is used to close and interrupt an ac power circuit under normal conditions or to interrupt this circuit under fault or emergency conditions.
54 turning gear engaging device	A device electrically operated, controlled, or monitored that functions to cause the turning gear to engage (or disengage) the machine shaft.
55 power factor relay	A device that operates when the power factor in an ac circuit rises above or falls below a predetermined value.
59 overvoltage relay	A device that operates when its input voltage exceeds a predetermined value.
62 time-delay stopping or opening relay	A device that imposes a time delay in conjunction with the device that initiates the shutdown, stopping, or opening operation in an automatic sequence or protective relay system.
63 pressure switch	A device that operates at a given pressure value or at a given rate of change of pressure.
69 permissive control device	A device with two-positions that in one position permits the closing of a circuit breaker, or the placing of a piece of equipment into operation, and in the other position, prevents the circuit breaker or the equipment from being operated.
71 level switch	A device that operates at a given level value, or on a given rate of change of level.
74 alarm relay	A device other than an annunciator, as covered under device function 30, that is used to operate, or that operates in connection with, a visual or audible alarm.
78 phase-angle measuring relay	A device that functions at a predetermined phase angle between two voltages, between two currents, or between voltage and current.
81 frequency relay	A device that responds to the frequency of an electrical quantity, operating when the frequency or rate of change of frequency exceeds or is less than a predetermined value.
83 automatic selective control or transfer relay	A device that operates to select automatically between certain sources or conditions in equipment or that performs a transfer operation automatically.
86 lockout relay	A device that trips and maintains the associated equipment or devices inoperative until it is reset by an operator, either locally or remotely.
90 regulating device	A device that functions to regulate a quantity or quantities, such as voltage, current, power, speed, frequency, temperature, and load, at a certain value or between certain (generally close) limits for machines, tie lines, or other apparatus.