DEEP SEA ELECTRONICS PLC
DSE8620 Control Module Operating Manual

Document number 057-142

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DSE8620 Automatic Mains Failure (AMF) control Module.

Amendments List

Issue	Comments	Minimum Module version required	Minimum Configuration Suite Version required
1	Initial release	V4.3.35	2011.10v1.0.7

Typeface: The typeface used in this document is *Arial*. Care should be taken not to mistake the upper case letter I with the numeral 1. The numeral 1 has a top serif to avoid this confusion.

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.

TABLE OF CONTENTS

Section Page

1 BIBLIOGRAPHY

This document refers to and is referred to by the following DSE publications which can be obtained from the DSE website www.deepseaplc.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
053-129	DSE8620 Installation Instructions
053-032	DSE2548 LED Expansion Annunciator Installation Instructions
053-033	DSE2130 Input Expansion Installation Instructions
053-034	DSE2157 Output Expansion Installation Instructions

1.2 TRAINING GUIDES

Training Guides are produced to give 'handout' sheets on specific subjects during training sessions

DSE PART	DESCRIPTION
056-005	Using CTs With DSE Products
056-010	Overcurrent Protection
056-018	Negative Phase Sequence
056-019	Earth Fault Protection
056-020	Loss of Excitation
056-021	Mains Decoupling (G59)
056-022	Breaker Control
056-024	GSM Modem
056-026	kW & kVAr
056-029	Smoke Limiting
056-030	Module PIN Codes
056-057	SW1 & SW2

1.3 MANUALS

DSE PART	DESCRIPTION
057-004	Electronic Engines and DSE wiring
057-045	DSE Guide to Synchronising and Load Sharing Part1
057-046	DSE Guide to Synchronising and Load Sharing Part2
057-047	DSE Load Share Design and Commissioning Guide
057-119	DSE8600 Series Configuration Software Manual
057-082	DSE2130 Input Expansion Manual
057-083	DSE2157 Output Expansion Manual
057-084	DSE2548 Annunciator Expansion Manual

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 DSE8600 Series modules, part of the DSEGenset® 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.deepseaplc.com

The **DSE8620** module has been designed to allow the operator to start and stop the generator, and if required, transfer the load to the generator either manually (via fascia mounted push-buttons) or automatically. Utilising the inbuilt synchronising, volts matching and paralleling functions, the controller is able to parallel with the mains supply for soft transfer of peak lopping. Synchronsing and Load Sharing features are included within the controller, along with the necessary protections for such a system.

The **DSE8620** has mains failure detection to enable the transfer of load to a generator and return back upon restoration of the mains with added features to avoid transients of the supply.

The user also has the facility to view the system operating parameters via the LCD display.

The **DSE8620** module monitors the engine, indicating the operational status and fault conditions, automatically shutting down the engine and giving a true first up fault condition of an engine failure by a COMMON AUDIBLE ALARM. The LCD display indicates the fault.

The powerful ARM microprocessor contained within the module allows for incorporation of a range of complex features:

- *Text based LCD display (supporting multiple languages).*
- ***True RMS** Voltage, Current and Power monitoring.*
- *Communications capability (RS485, RS232 or Ethernet)*
- *Engine parameter monitoring.*
- *Automatic sync capability*
- *Load control capability*
- *Fully configurable inputs for use as alarms or a range of different functions.*
- *Engine ECU interface to **electronic engines**.*
- *Direct connection to governor / AVR for synchronising and load sharing*
- *R.O.C.O.F. and Vector shift for detection of mains failure when in parallel with the mains supply.*

Using a PC and the **DSE Configuration Suite** software allows alteration of selected operational sequences, timers and alarms. Additionally, the module's integral fascia configuration editor allows adjustment of a subset of this information.
A robust plastic case designed for front panel mounting houses the module. Connections are via locking plug and sockets.

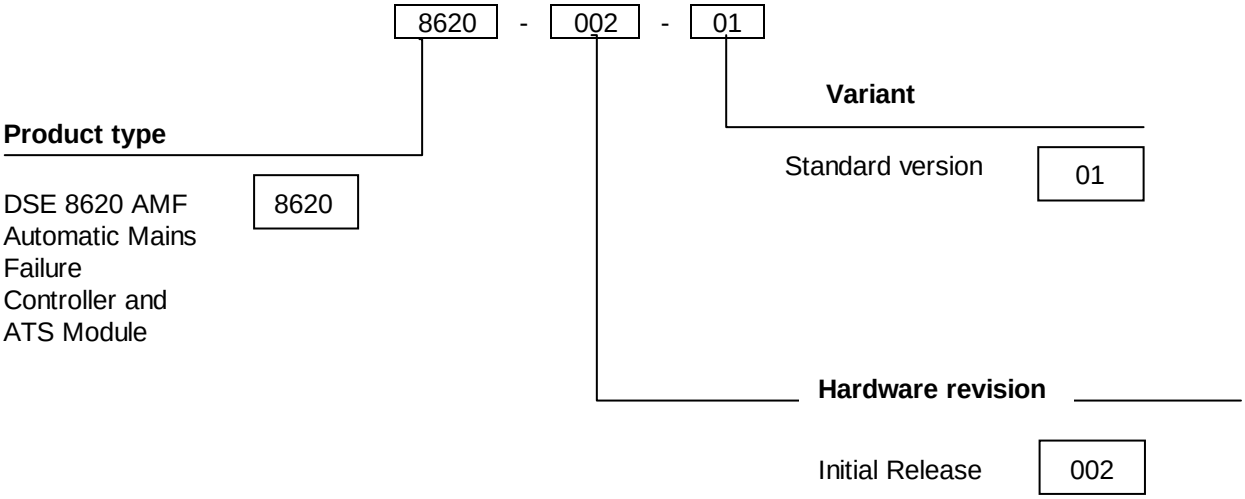
Selective operational sequences, timers and alarm trips can be altered by the customer via a PC using the DSE Configuration suite or via the integral front panel configuration editor.

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
DSE8000,	All modules in the DSE8000 Series
DSE8600,DSE86xx	All modules in the DSE8600 sync/load share range
DSE8620	DSE8620 module

3.2 TERMINAL SPECIFICATION

Connection type	Two part connector. • Male part fitted to module • Female part supplied in module packing case - Screw terminal, rising clamp, no internal spring.	 Example showing cable entry and screw terminals of a 10 way connector
Minimum cable size	0.5mm² (AWG 24)	
Maximum cable size	2.5mm² (AWG 10)	

NOTE: For purchasing additional connector plugs from DSE, please see the section entitled *Maintenance, Spares, Repair and Servicing* elsewhere in this document.

3.3 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	300mA at 24V 600mA at 12V
Maximum standby current	190mA at 24V 390mA at 12V

Plant supply instrumentation display

Range	0V-70V DC (note Maximum continuous operating voltage of 35V DC)
Resolution	0.1V
Accuracy	1% full scale (±0.7V)

3.4 GENERATOR VOLTAGE / FREQUENCY SENSING

Measurement type	True RMS conversion
Sample Rate	5KHz or better
Harmonics	Up to 10th or better
Input Impedance	300K Ω ph-N
Phase to Neutral	15V (minimum required for sensing frequency) to 333V AC (absolute maximum) Suitable for 110V to 277V nominal (±20% for under/overvoltage detection)
Phase to Phase	26V (minimum required for sensing frequency) to 576V AC (absolute maximum) Suitable for 190V ph-ph to 479V ph-ph nominal (±20% for under/overvoltage detection)
Common mode offset from Earth	100V AC (max)
Resolution	1V AC phase to neutral 2V AC phase to phase
Accuracy	±1% of full scale phase to neutral ±2% of full scale phase to phase
Minimum frequency	3.5Hz
Maximum frequency	75.0Hz
Frequency resolution	0.1Hz
Frequency accuracy	±0.2Hz

3.5 GENERATOR CURRENT SENSING

Measurement type	True RMS conversion
Sample Rate	5KHz or better
Harmonics	Up to 10th or better
Nominal CT secondary rating	1A or 5A (5A recommended)
Maximum continuous current	5A
Overload Measurement	3 x Nominal Range setting
Absolute maximum overload	50A for 1 second
Burden	0.5VA (0.02Ω current shunts)
common mode offset	±2V peak plant ground to CT common terminal
Resolution	0.5% of 5A
Accuracy	±1% of Nominal (1A or 5A) (excluding CT error)

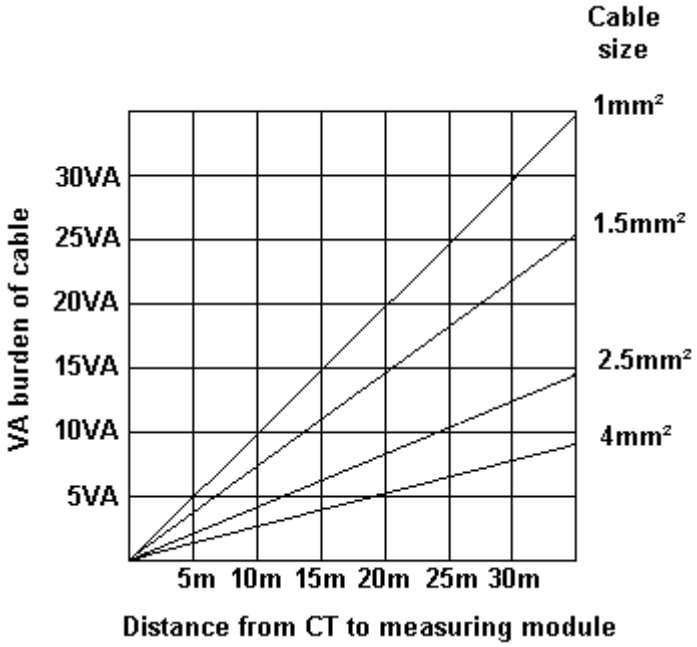
3.5.1 VA RATING OF THE CTS

The VA burden of the DSE8620 module on the CTs is 0.5VA. However depending upon the type and length of cabling between the CTs and the DSE8620 module, CTs with a greater VA rating than the module are required.

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

If the CTs are fitted within the alternator top box, the star point (common) of the CTs should be connected to system ground (earth) as close as possible to the CTs. This minimises the length of cable used to connect the CTs to the DSE module.

Example.
If 1.5mm² cable is used and the distance from the CT to the measuring module is 20m, then the burden of the cable alone is approximately 15VA. As the burden of the DSE controller is 0.5VA, then a CT with a rating of at least 15+0.5V = 15.5VA must be used.
If 2.5mm² cables are used over the same distance of 20m, then the burden of the cable on the CT is approximately 7VA. CT's required in this instance is at least 7.5VA (7+0.5).

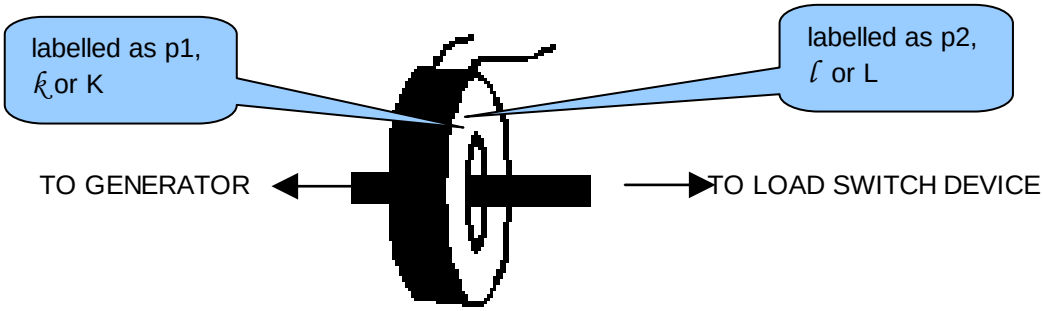


NOTE: - Details for 4mm² cables are shown for reference only. The connectors on the DSE modules are only suitable for cables up to 2.5mm².

NOTE: - CTs with 5A secondary windings are recommended with DSE modules. 1A CTs can be used if necessary however, the resolution of the readings is 5 times better when using 5A CTs.

3.5.2 CT POLARITY

Take care to ensure the correct polarity of the CTs. Incorrect CT orientation will lead to negative kW readings when the set is supplying power. Take note that paper stick-on labels on CTs that show the orientation are often incorrectly placed on the CT (!). It is more reliable to use the labelling in the case moulding as an indicator to orientation (if available).
To test orientation, run the generator in island mode (not in parallel with any other supply) and load the generator to around 10% of the set rating. Ensure the DSE module shows positive kW for all three individual phase readings.



POLARITY OF CT PRIMARY

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

3.5.3 CT PHASING

Take particular care that the CTs are connected to the correct phases. For instance, ensure that the CT on phase 1 is connected to the terminal on the DSE module intended for connection to the CT for phase 1.
Additionally ensure that the voltage sensing for phase 1 is actually connected to generator phase 1. Incorrect connection of the phases as described above will result in incorrect power factor (pf) measurements, which in turn results in incorrect kW measurements.
One way to check for this is to make use of a single-phase load. Place the load on each phase in turn, run the generator and ensure the kW value appears in the correct phase. For instance if the load is connected to phase 3, ensure the kW figure appears in phase 3 display and not in the display for phase 1 or 2.

3.5.4 CT CLASS

Ensure the correct CT type is chosen. For instance if the DSE module is providing overcurrent protection, ensure the CT is capable of measuring the overload level you wish to protect against, and at the accuracy level you require.
For instance, this may mean fitting a protection class CT (P10 type) to maintain high accuracy while the CT is measuring overload currents.
Conversely, if the DSE module is using the CT for instrumentation only (current protection is disabled or not fitted to the controller), then measurement class CTs can be used. Again, bear in mind the accuracy you require. The DSE module is accurate to better than 1% of the full-scale current reading. To maintain this accuracy you should fit Class 0.5 or Class 1 CTs.

You should check with your CT manufacturer for further advice on selecting your CTs

3.6 INPUTS

3.6.1 DIGITAL INPUTS

Number	11 configurable inputs
Arrangement	Contact between terminal and ground
Low level threshold	2.1V minimum
High level threshold	6.6V maximum
Maximum input voltage	+50V DC with respect to plant supply negative
Minimum input voltage	-24V DC with respect to plant supply negative
Contact wetting current	7mA typical
Open circuit voltage	12V typical

3.6.1 ANALOGUE INPUTS

Oil Pressure (Configurable if engine ECU link provides oil pressure measurement)

Measurement type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Differential resistance measurement input
Measurement current	15mA
Full scale	240Ω
Over range / fail	270Ω
Resolution	0.1 Bar (1-2 PSI)
Accuracy	±2% of full scale resistance (±4.8Ω) excluding transducer error
Max common mode voltage	±2V
Display range	13.7 bar (0-200 PSI) subject to limits of the sensor

Coolant Temperature (Configurable if engine ECU link provides coolant temp measurement)

Measurement type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Differential resistance measurement input
Measurement current	10mA
Full scale	480Ω
Over range / fail	540Ω
Resolution	1°C (2℉)
Accuracy	+/-2% of full scale resistance (±9.6Ω) excluding transducer error
Max common mode voltage	±2V
Display range	0°C -140°C (32℉ - 284℉) subject to limits of the sensor

Fuel Level

Measurement type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Differential resistance measurement input
Measurement current	10mA
Full scale	480Ω
Over range / fail	540Ω
Resolution	1°C (2℉)
Accuracy	+/-2% of full scale resistance (±9.6Ω) excluding transducer error
Max common mode voltage	±2V
Display range	0-250%

Flexible sensor

Number	2
Measurement type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Differential resistance measurement input
Measurement current	10mA
Full scale	480Ω
Over range / fail	540Ω
Resolution	1%
Accuracy	±2% of full scale resistance (±9.6Ω) excluding transducer error
Max common mode voltage	±2V
Display range	0-250%

3.6.2 CHARGE FAIL INPUT

Minimum voltage	0V
Maximum voltage	35V (plant supply)
Resolution	0.2V
Accuracy	± 1% of max measured voltage
Excitation	Active circuit constant power output
Output Power	2.5W Nominal @12V and 24V
Current at 12V	210mA
Current at 24V	105mA

The charge fail input is actually a combined input and output. Whenever the generator is required to run, the terminal provides excitation current to the charge alternator field winding.
When the charge alternator is correctly charging the battery, the voltage of the terminal is close to the plant battery supply voltage. In a failed charge situation, the voltage of this terminal is pulled down to a low voltage. It is this drop in voltage that triggers the *charge failure* alarm. The level at which this operates and whether this triggers a warning or shutdown alarm is configurable using the DSE Config Suite Software.

3.6.3 MAGNETIC PICKUP

Type	Single ended input, capacitive coupled
Minimum voltage	0.5V RMS
Max common mode voltage	±2V
Maximum voltage	Clamped to ±70V by transient suppressers, dissipation not to exceed 1W.
Maximum frequency	10,000Hz
Resolution	6.25 RPM
Accuracy	±25 RPM
Flywheel teeth	10 to 500

NOTE : DSE can supply a suitable magnetic pickup device, available in two body thread lengths :
DSE Part number 020-012 - Magnetic Pickup probe 5/8 UNF 2½" thread length
DSE Part number 020-013 - Magnetic Pickup probe 5/8 UNF 4" thread length

Magnetic Pickup devices can often be 'shared' between two or more devices. For example, one device can often supply the signal to both the DSE8600 series module and the engine governor. The possibility of this depends upon the amount of current that the magnetic pickup can supply.

3.7 OUTPUTS

Ten (10) digital outputs are fitted to the DSE8620 controller. Additional outputs are provided for by adding up to ten (10) external relay boards (DSE2157). This allows for up to 80 additional digital outputs.

3.7.1 OUTPUTS A & B

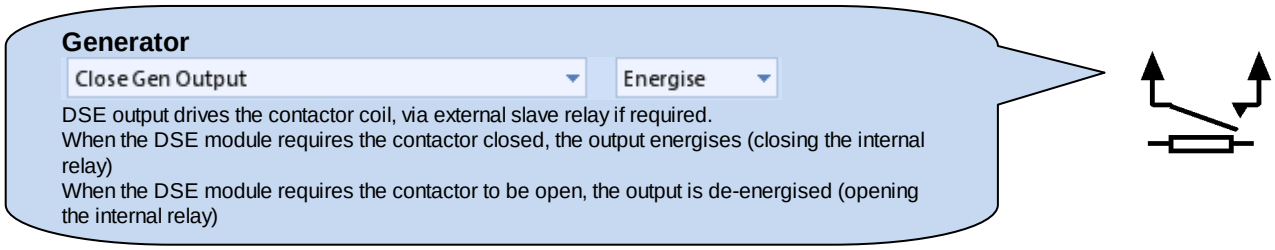
Type	Normally used for Fuel / Start outputs. Fully configurable for other purposes if the module is configured to control an electronic engine. Supplied from Emergency Stop terminal 3.
Rating	15A resistive @ 35V

3.7.2 CONFIGURABLE OUTPUTS C & D (LOAD SWITCHING)

Type	Fully configurable volts free relays. Output C – Normally Closed, Output D – Normally Open
Rating	8A resistive@ 250V AC
Protection	Protected against over current & over temperature. Built in load dump feature.

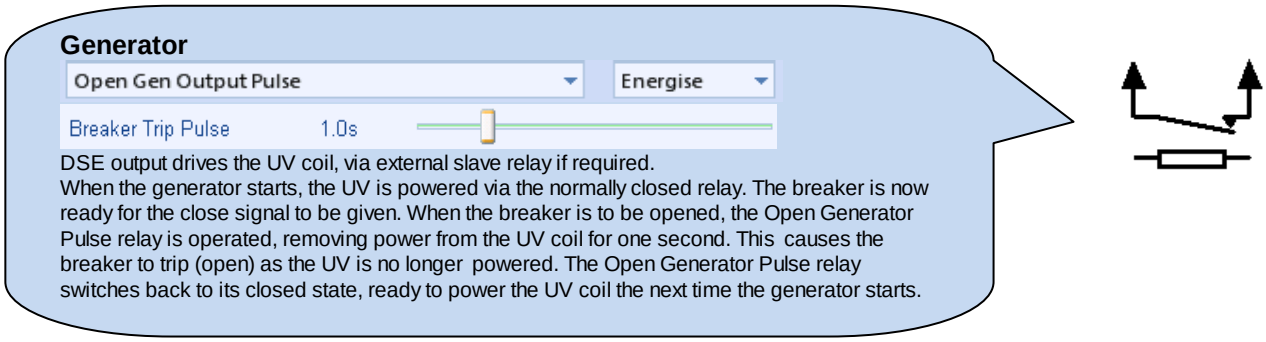
Contactor coils

Use output D, the normally open relay:



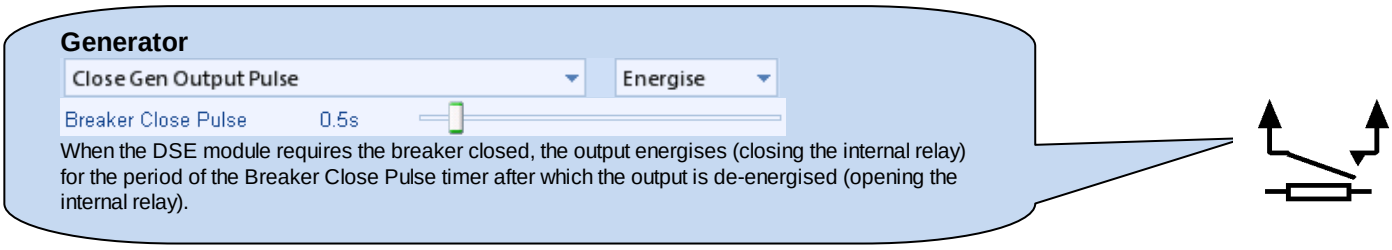
Undervoltage (UV coils)

Use output C, the normally closed relay :



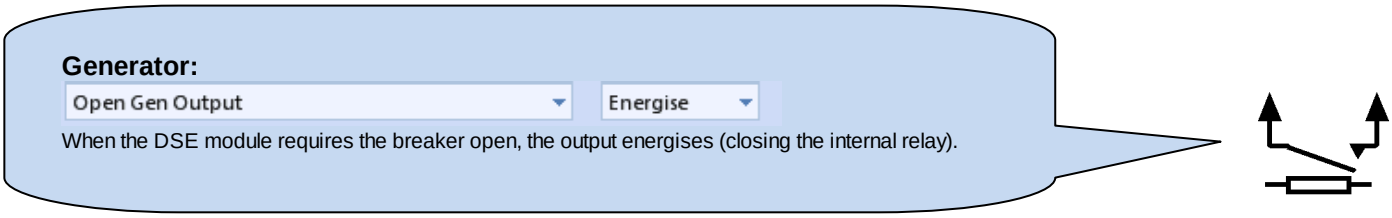
Closing coils

For continuous closing signals (close signal is present continuously when the breaker is closed), follow the instructions above as for *Contactor Coils*.
For momentary (pulsed) closing signals, use OUTPUT D, the normally open relay:

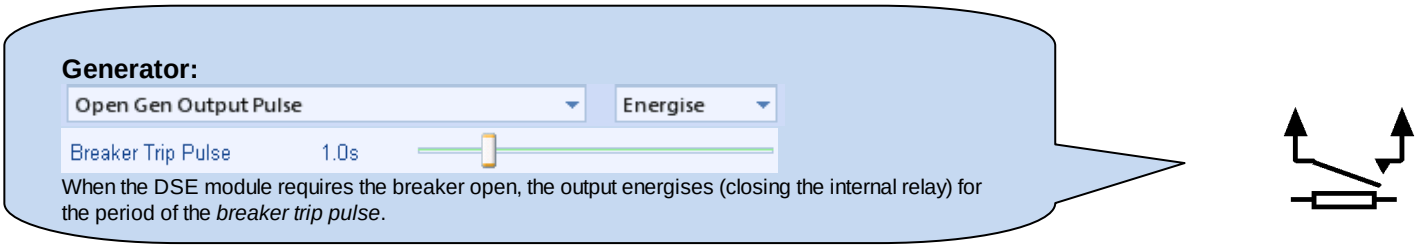


Opening coils / Shunt Trip coils

For Continuous opening signal, use output D, the normally open relay:



For momentary (pulsed) closing signals, use a normally open relay:



3.7.1 OUTPUTS E,F,G,H, I ,J & K

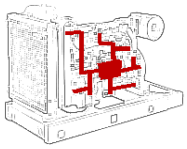
Number	7
Type	Fully configurable, supplied from DC supply terminal 2.
Rating	3A resistive @ 35V

3.8 COMMUNICATION PORTS

USB Port	USB2.0 Device for connection to PC running DSE configuration suite only Max distance 6m (yards)
Serial Communication	RS232 and RS485 are both fitted but and provide independent operation
RS232 Serial port	Non – Isolated port Max Baud rate 115K baud subject to S/W TX, RX, RTS, CTS, DSR, DTR, DCD Male 9 way D type connector Max distance 15m (50 feet)
RS485 Serial port	Isolated Data connection 2 wire + common Half Duplex Data direction control for Transmit (by s/w protocol) Max Baud Rate 19200 External termination required (120Ω) Max common mode offset 70V (on board protection transorb) Max distance 1.2km (¾ mile)
CAN Port	Engine CAN Port Standard implementation of 'Slow mode', up to 250K bits/s Non-Isolated. Internal Termination provided (120Ω) Max distance 40m (133 feet)
Ethernet	Auto detecting 10/100 Ethernet port.

3.9 COMMUNICATION PORT USAGE

3.9.1 CAN INTERFACE



Modules are fitted with the CAN interface as standard and are capable of receiving engine data from engine CAN controllers compliant with the CAN standard.

CAN enabled engine controllers monitor the engine's operating parameters such as engine speed, oil pressure, engine temperature (among others) in order to closely monitor and control the engine. The industry standard communications interface (CAN) transports data gathered by the engine controller interface. This allows generator controllers such as the DSE8600 series to access these engine parameters with no physical connection to the sensor device.

NOTE:- For further details for connections to CAN enabled engines and the functions available with each engine type, refer to the manual *Electronic Engines and DSE Wiring.* Part No. 057-004

3.9.2 USB CONNECTION

The USB port is provided to give a simple means of connection between a PC and the DSE8600 series controller.
Using the DSE Configuration Suite Software, the operator is then able to control the module, starting or stopping the generator, selecting operating modes, etc.
Additionally, the various operating parameters (such as output volts, oil pressure, etc.) of the remote generator are available to be viewed or changed.

To connect a DSE8600 series module to a PC by USB, the following items are required:

- DSE8600 series module

- DSE 8600 series configuration software
  (Supplied on configuration suite software CD or available from www.deepseaplc.com).

- USB cable Type A to Type B.
  (This is the same cable as often used between a PC and a USB printer)

  DSE can supply this cable if required :
  PC Configuration interface lead (USB type A – type B) DSE Part No 016-125

NOTE:- The DC supply must be connected to the module for configuration by PC.

NOTE:- Refer to DSE8600 series Configuration Suite Manual (DSE part 057-119) for further details on configuring, monitoring and control.

3.9.3 USB HOST-MASTER (USB DRIVE CONNECTION)

Capability to add USB Host facility for USB ‘Pen drive’ type interface for data recording
Connector Type A.
For data logging max maximum size 16Gb.(see viewing the instrument pages)

NOTE:- Refer to DSE8600 series Configuration Suite Manual (DSE part 057-119) for further details on configuring, monitoring and control.

3.9.4 RS232

The RS232 port on the DSE8600 series controller supports the Modbus RTU protocol.
The Gencomm register table for the controller is available upon request from the DSE Technical Support Department.

RS232 is for short distance communication (max 15m) and is typically used to connect the DSE86xx series controller to a telephone or GSM modem for more remote communications.

Many PCs are not fitted with an internal RS232 serial port. DSE DOES NOT recommend the use of USB to RS232 convertors but can recommend PC add-ons to provide the computer with an RS232 port.

Recommended PC Serial Port add-ons (for computers without internal RS232 port):
Remember to check these parts are suitable for your PC. Consult your PC supplier for further advice.

- Brainboxes PM143 PCMCIA RS232 card (for laptop PCs)

- Brainboxes VX-001 Express Card RS232 (for laptops and nettops PCs)

- Brainboxes UC246 PCI RS232 card (for desktop PCs)

- Brainboxes PX-246 PCI Express 1 Port RS232 1 x 9 Pin (for desktop PCs)

Supplier:
Brainboxes
Tel: +44 (0)151 220 2500
Web: http://www.brainboxes.com
Email: Sales:sales@brainboxes.com

NB DSE Have no business tie to Brainboxes. Over many years, our own engineers have used these products and are happy to recommend them.

RECOMMENDED EXTERNAL MODEMS:

- Multitech Global Modem – MultiModem ZBA (PSTN)
  DSE Part Number 020-252
  (Contact DSE Sales for details of localisation kits for these modems)

- Wavecom Fastrak Supreme GSM modem kit (PSU, Antenna and modem)*
  DSE Part number 0830-001-01

- Brodersen GSM Industrial Modem*
  DSE Part number 020-245

NOTE: *For GSM modems a SIM card is required, supplied by your GSM network provider :

- For SMS only, a 'normal' voice SIM card is required. This enables the controller to send SMS messages to designated mobile phones upon status and alarm conditions.
- For a data connection to a PC running DSE Configuration Suite Software, a 'special' CSD (Circuit Switched Data) SIM card is required that will enable the modem to answer an incoming data call. Many 'pay as you go' services will not provide a CSD (Circuit Switched Data) SIM card.

3.9.5 RS485

The RS485 port on the DSE8600 series controller supports the Modbus RTU protocol.
The DSE Gencomm register table for the controller is available upon request from the DSE Technical Support Department.

RS485 is used for point-to-point cable connection of more than one device (maximum 32 devices) and allows for connection to PCs, PLCs and Building Management Systems (to name just a few devices).

One advantage of the RS485 interface is the large distance specification (1.2km when using Belden 9841 (or equivalent) cable. This allows for a large distance between the DSE8600 series module and a PC running the DSE Configuration Suite software. The operator is then able to control the module, starting or stopping the generator, selecting operating modes, etc.
The various operating parameters (such as output volts, oil pressure, etc.) of the remote generator can be viewed or changed.

NOTE:- For a single module to PC connection and distances up to 6m (8yds) the USB connection method is more suitable and provides for a lower cost alternative to RS485 (which is more suited to longer distance connections).

Recommended PC Serial Port add-ons (for computers without internal RS485 port).
Remember to check these parts are suitable for your PC. Consult your PC supplier for further advice.

- Brainboxes PM154 PCMCIA RS485 card (for laptops PCs)
  Set to ‘Half Duplex, Autogating” with ‘CTS True’ set to ‘enabled’

- Brainboxes VX-023 ExpressCard 1 Port RS422/485 (for laptops and nettop PCs)

- Brainboxes UC320 PCI Velocity RS485 card (for desktop PCs)
  Set to ‘Half Duplex, Autogating” with ‘CTS True’ set to ‘enabled’

- Brainboxes PX-324 PCI Express 1 Port RS422/485 (for desktop PCs)

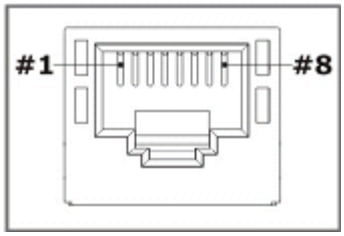
Supplier:
Brainboxes
Tel: +44 (0)151 220 2500
Web: http://www.brainboxes.com
Email: Sales:sales@brainboxes.com

NB DSE have no business tie to Brainboxes. Over many years,our own engineers have used these products and are happy to recommend them.

3.9.6 ETHERNET

The DSE8620 is fitted with ETHERNET socket for connection to LAN (local area networks)

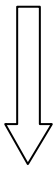
	Description
1	TX+
2	TX-
3	RX+
4	Do not connect
5	Do not connect
6	RX-
7	Do not connect
8	Do not connect



3.9.6.1 DIRECT PC CONNECTION

Requirements

- DSE8620
- Crossover Ethernet cable (see Below)
- PC with Ethernet port and Windows Internet Explorer 6 or above, Firefox



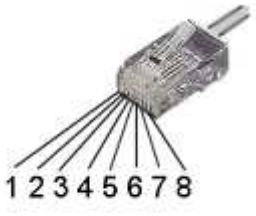
Crossover
network cable

Crossover cable wiring detail

Two pairs crossed, two pairs uncrossed
10baseT/100baseTX crossover

Pin	Connection 1 (T568A)	Connection 2 (T568B)
1	white/green stripe	white/orange stripe
2	green solid	orange solid
3	white/orange stripe	white/green stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	green solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown solid

For the advanced Engineer, a crossover cable is a CAT5 cable with one end terminated as T568A and the other end terminated as T568B

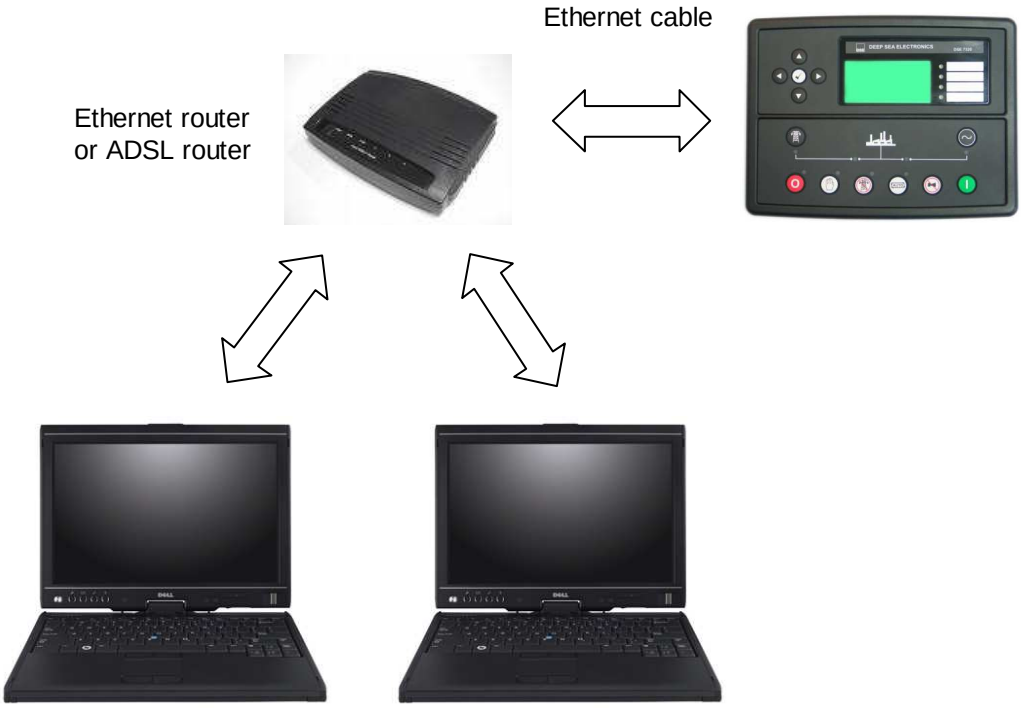


NOTE:- This cable can be purchased from any good PC or IT store.

3.9.6.2 CONNECTION TO BASIC ETHERNET

Requirements

- DSE8620
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- PC with Ethernet port and Windows Internet Explorer 6 or above, Firefox

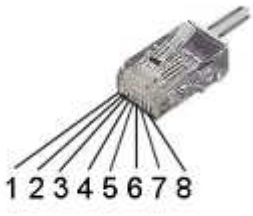


Ethernet cable wiring detail

10baseT/100baseT

Pin	Connection 1 (T568A)	Connection 2 (T568A)
1	white/green stripe	white/green stripe
2	green solid	green solid
3	white/orange stripe	white/orange stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	orange solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown solid

For the advanced Engineer, this cable has both ends terminated as T568A (as shown below) or T568B.

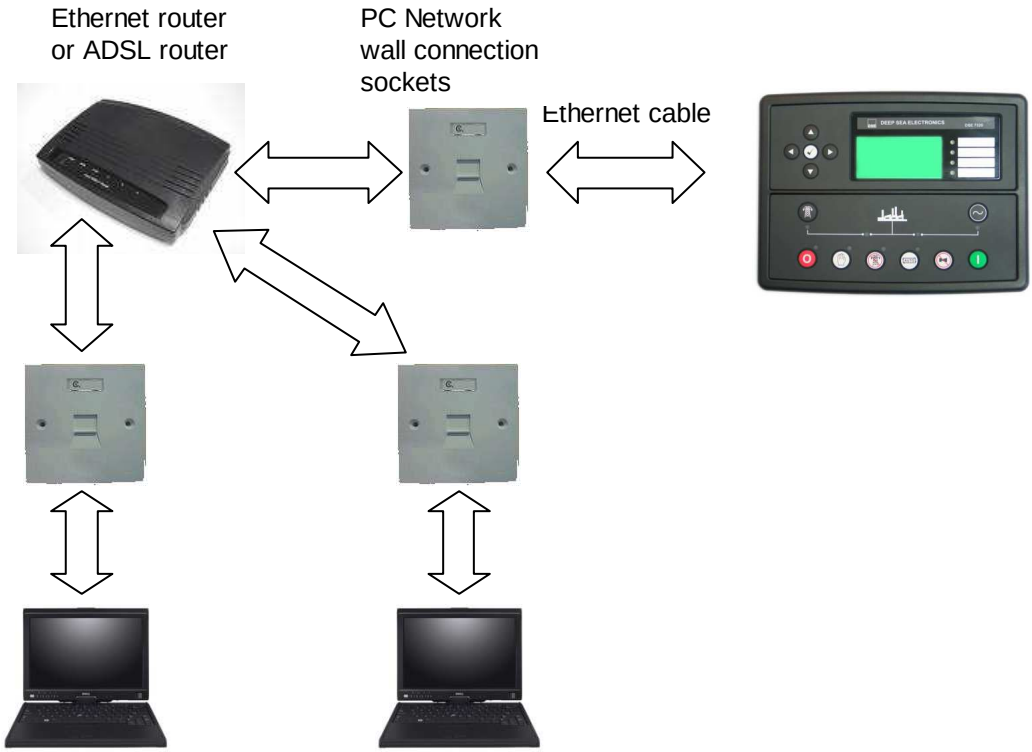


NOTE:- DSE Stock a 2m (2yds) Ethernet Cable – Part number 016-137. Alternatively they can be purchased from any good PC or IT store.

3.9.6.3 CONNECTION TO COMPANY INFRASTRUCTURE ETHERNET

Requirements

- DSE8620
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- PC with Ethernet port and Windows Internet Explorer 6 or above, Firefox

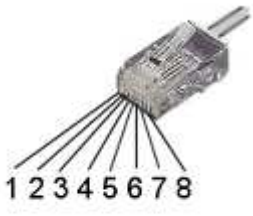


Ethernet cable wiring detail

10baseT/100baseT

Pin	Connection 1 (T568A)	Connection 2 (T568A)
1	white/green stripe	white/green stripe
2	green solid	green solid
3	white/orange stripe	white/orange stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	orange solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown solid

For the advanced Engineer, this cable has both ends terminated as T568A (as shown below) or T568B.

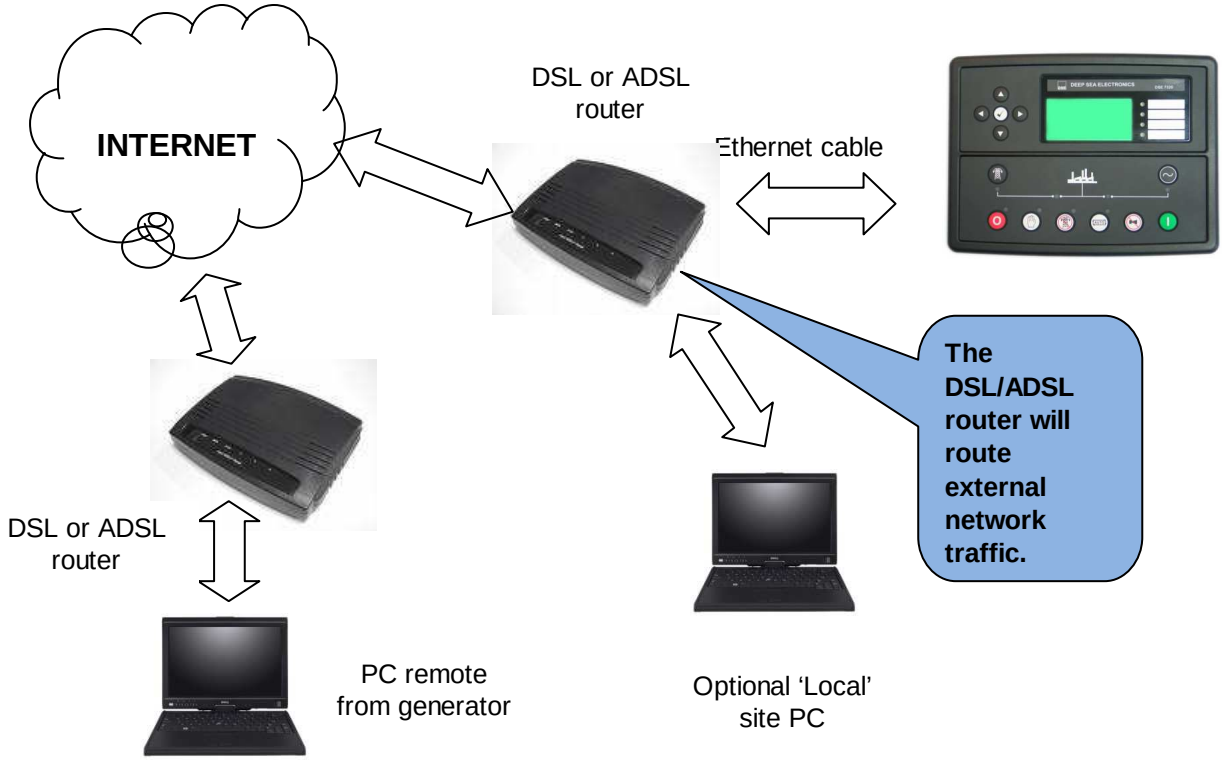


NOTE:- DSE Stock a 2m (2yds) Ethernet Cable – Part number 016-137. Alternatively they can be purchased from any good PC or IT store.

3.9.6.4 CONNECTION TO THE INTERNET

Requirements

- Ethernet cable (see below)
- Working Ethernet (company or home network)
- Working Internet connection (ADSL or DSL recommended)

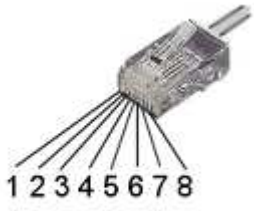


Ethernet cable wiring detail

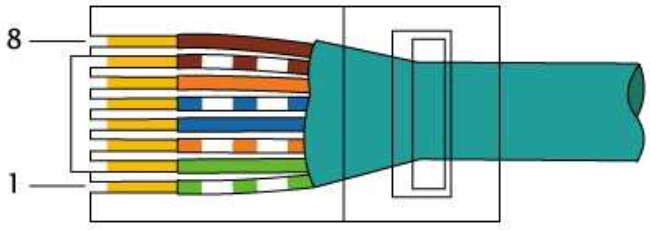
10baseT/100baseT

Pin	Connection 1 (T568A)	Connection 2 (T568A)
1	white/green stripe	white/green stripe
2	green solid	green solid
3	white/orange stripe	white/orange stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	orange solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown solid

For the advanced Engineer, this cable has both ends terminated as T568A (as shown below) or T568B.



NOTE:- DSE Stock a 2m (2yds) Ethernet Cable – Part number 016-137. Alternatively they can be purchased from any good PC or IT store.



EIA/TIA-568A

Firewall configuration for internet access

As modem/routers differ enormously in their configuration, it is not possible for DSE to give a complete guide to their use with the DSE8620. However it is possible to give a description of the requirements in generic terms. For details of how to achieve the connection to your modem/router you are referred to the supplier of your modem/router equipment.

The DSE8620 makes its data available over Modbus TCP and as such communicates over the Ethernet using a Port configured via the DSE config suite software..

You must configure your modem/router to allow inbound traffic on this port. For more information you are referred to your WAN interface device (modem/router) manufacturer.

It is also important to note that if the port assigned (setting from software “Modbus Port Number”) is already in use on the LAN, the DSE8620 cannot be used and another port must be used .

Outgoing Firewall rule

As the DSE8620 makes its user interface available to standard web browsers, all communication uses the chosen port. It is usual for a firewall to make the same port outgoing open for communication.

Incoming traffic (virtual server)

Network Address and Port Translation (NAPT) allows a single device, such as the modem/router gateway, to act as an agent between the Internet (or "public external network") and a local (or "internal private") network. This means that only a single, unique IP address is required to represent an entire group of computers.

For our DSE8620 application, this means that the WAN IP address of the modem/router is the IP address we need to access the site from an external (internet) location.

When requests reaches the modem/router, we want this passed to a ‘virtual server’ for handling, in our case this is the DSE8620 module.

R**esult :** Traffic arriving from the WAN (internet) on port xxx is automatically sent to IP address set within the configuration software on the LAN (DSE8620) for handling.

NOTE:- Refer to DSE8600 series Configuration Suite Manual (DSE part 057-119) for further details on configuring, monitoring and control.

3.10 DSENET® FOR EXPANSION MODULES

DSENet® is the interconnection cable between the host controller and the expansion module(s) and must not be connect to any device other than DSE equipment designed for connection to the DSENet®

Cable type	Two core screened twisted pair
Cable characteristic impedance	120Ω
Recommended cable	Belden 9841 Belden 9271
Maximum cable length	1200m (¾ mile) when using Belden 9841 or direct equivalent. 600m (666 yds) when using Belden 9271 or direct equivalent.
DSENet® topology	"Daisy Chain" Bus with no stubs (spurs)
DSENet® termination	120Ω. Fitted internally to host controller. Must be fitted externally to the 'last' expansion module by the customer.
Maximum expansion modules	Total 20 devices made up of DSE2130 (up to 4), DSE2157 (up to 10), DSE2548 (up to 10) This gives the possibility of : Maximum 80 additional relay outputs Maximum 80 additional LED indicators Maximum 32 additional inputs (16 of which can be analogue inputs if required)

NOTE: As a termination resistor is internally fitted to the host controller, the host controller must be the 'first' unit on the DSENet®. A termination resistor MUST be fitted to the 'last' unit on the DSENet®. For connection details, you are referred to the section entitled 'typical wiring diagram' elsewhere in this document.

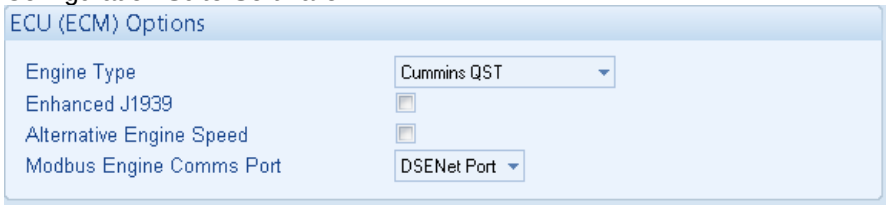
NOTE : DSE8600 series does not support the 2510/2520 display modules.

3.10.1 DSENET® USED FOR MODBUS ENGINE CONNECTION

As DSENet® utilises an RS485 hardware interface, this port can be configured for connection to Cummins Modbus engines (Engines fitted with Cummins GCS).
This leaves the RS485 interface free for connection to remote monitoring equipment (i.e. Building Management System, PLC or PC RS485 port).

While this is a very useful feature in some applications, the obvious drawback is that the DSENet® interface is no longer available for connection to expansion devices.

Example of configuring the DSENet® for connection to Cummins QST GCS using the DSE Configuration Suite Software:



3.11 SOUNDER

DSE8600 Series features an internal sounder to draw attention to warning, shutdown and electrical trip alarms.

Sounder level	64db @ 1m

3.11.1 ADDING AN EXTERNAL SOUNDER TO THE APPLICATION

Should an external alarm or indicator be required, this can be achieved by using the DSE Configuration Suite PC software to configure an auxiliary output for “Audible Alarm”, and by configuring an auxiliary input for “Alarm Mute” (if required).
The audible alarm output activates and de-activates at the same time as the module’s internal sounder. The Alarm mute input and internal alarm mute button activate ‘in parallel’ with each other. Either signal will mute both the internal sounder and audible alarm output.

Example of configuration to achieve external sounder with external alarm mute button:

3.12 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)

The number of logged Engine Hours and Number of Starts can be set/reset using the DSE Configuration Suite PC software. Depending upon module configuration, this may have been PIN number locked by your generator supplier

3.13 DIMENSIONS AND MOUNTING

3.13.1 DIMENSIONS

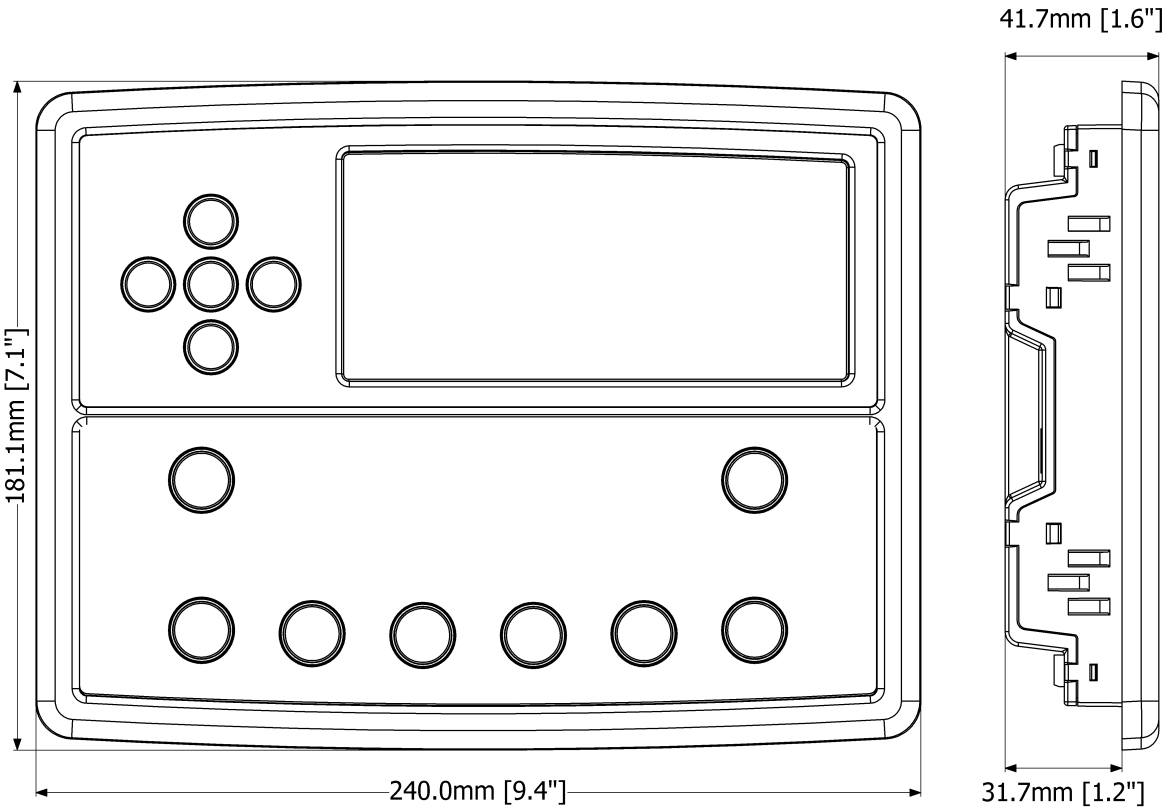
240.0mm x 181.1mm x 41.7mm (9.4” x 7.1” x 1.6”)

PANEL CUTOUT

220mm x 160mm (8.7” x 6.3”)

WEIGHT

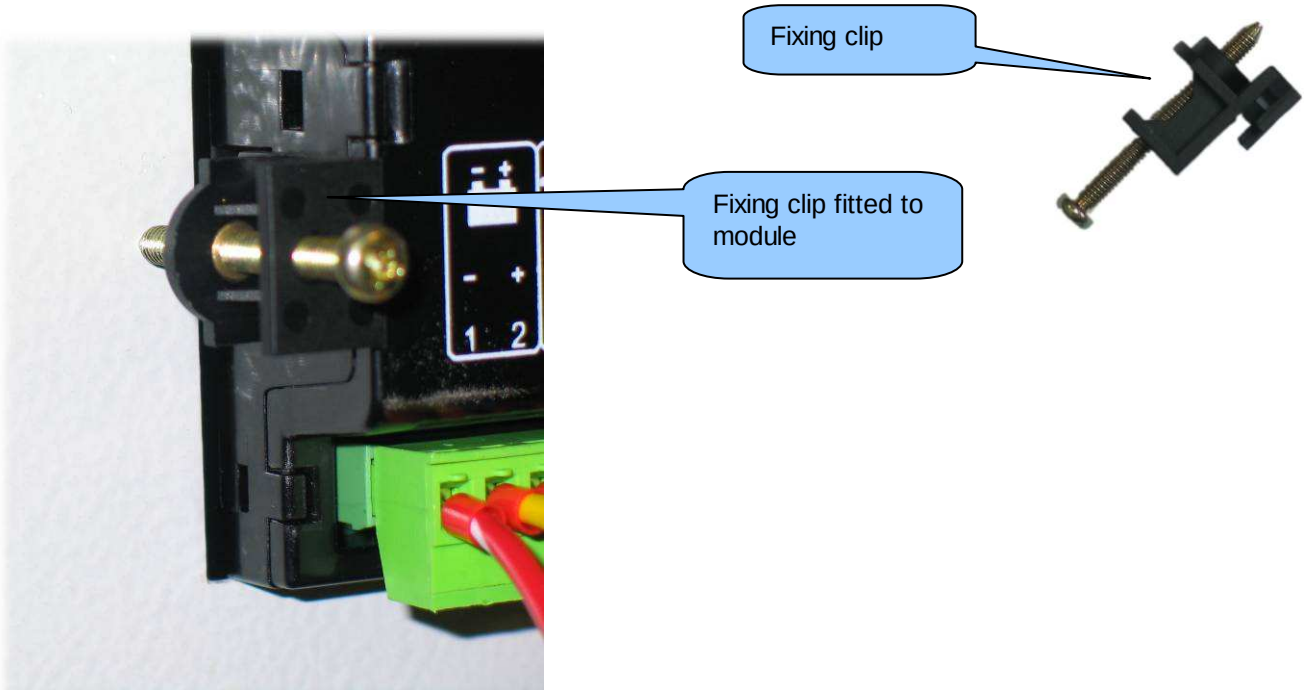
0.7kg (1.4lb)



3.13.2 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 8000 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.

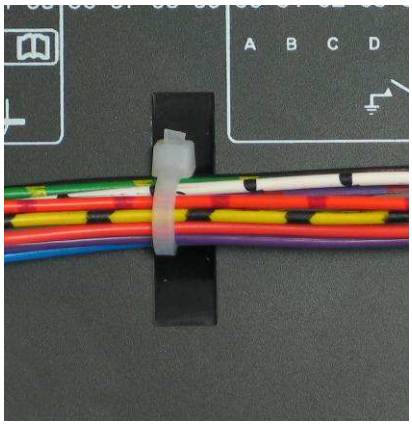


NOTE:- In conditions of excessive vibration, mount the module on suitable anti-vibration mountings.

3.13.3 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.

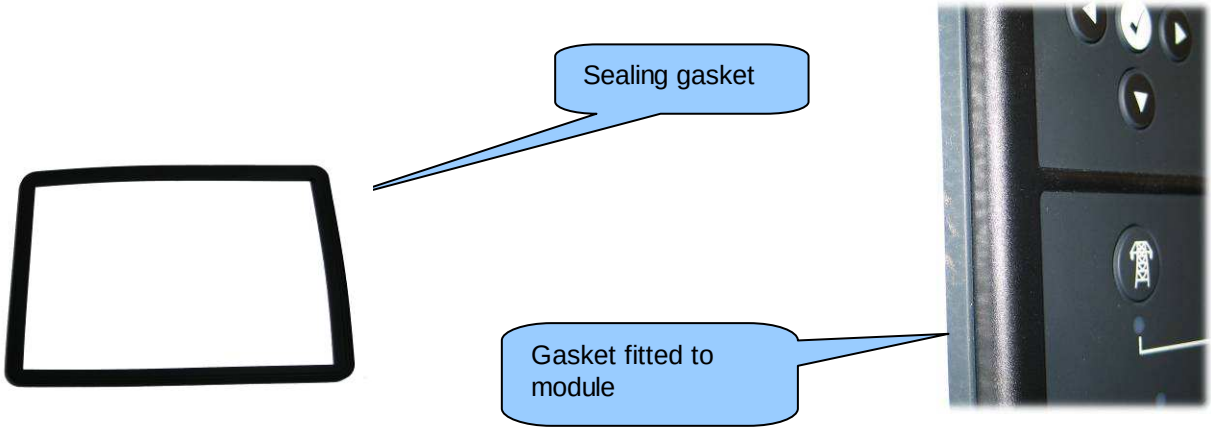
Cable tie fixing point



With cable and tie in place

3.13.4 SILICON SEALING GASKET

The supplied silicon gasket provides improved sealing between the 8000 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.



3.14 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)	Under the scope of IEEE 37.2, *function numbers can also be used to represent functions in microprocessor devices and software programs*. The 8000 series controller is device number 11L-8000 (Multifunction device protecting Line (generator) – 8620 series module). 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 : 2 – Time delay starting or closing relay 6 –Starting circuit breaker 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 63 – pressure switch 74– alarm relay 81 – frequency relay 86 – lockout relay

3.14.1 ENCLOSURE CLASSIFICATIONS

IP CLASSIFICATIONS

8600 series specification under BS EN 60529 Degrees of protection provided by enclosures

IP65 (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)

First Digit Protection against contact and ingress of solid objects	Second Digit 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 pos ition (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 interface 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).

3.14.2 NEMA CLASSIFICATIONS

8600 series 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)

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.

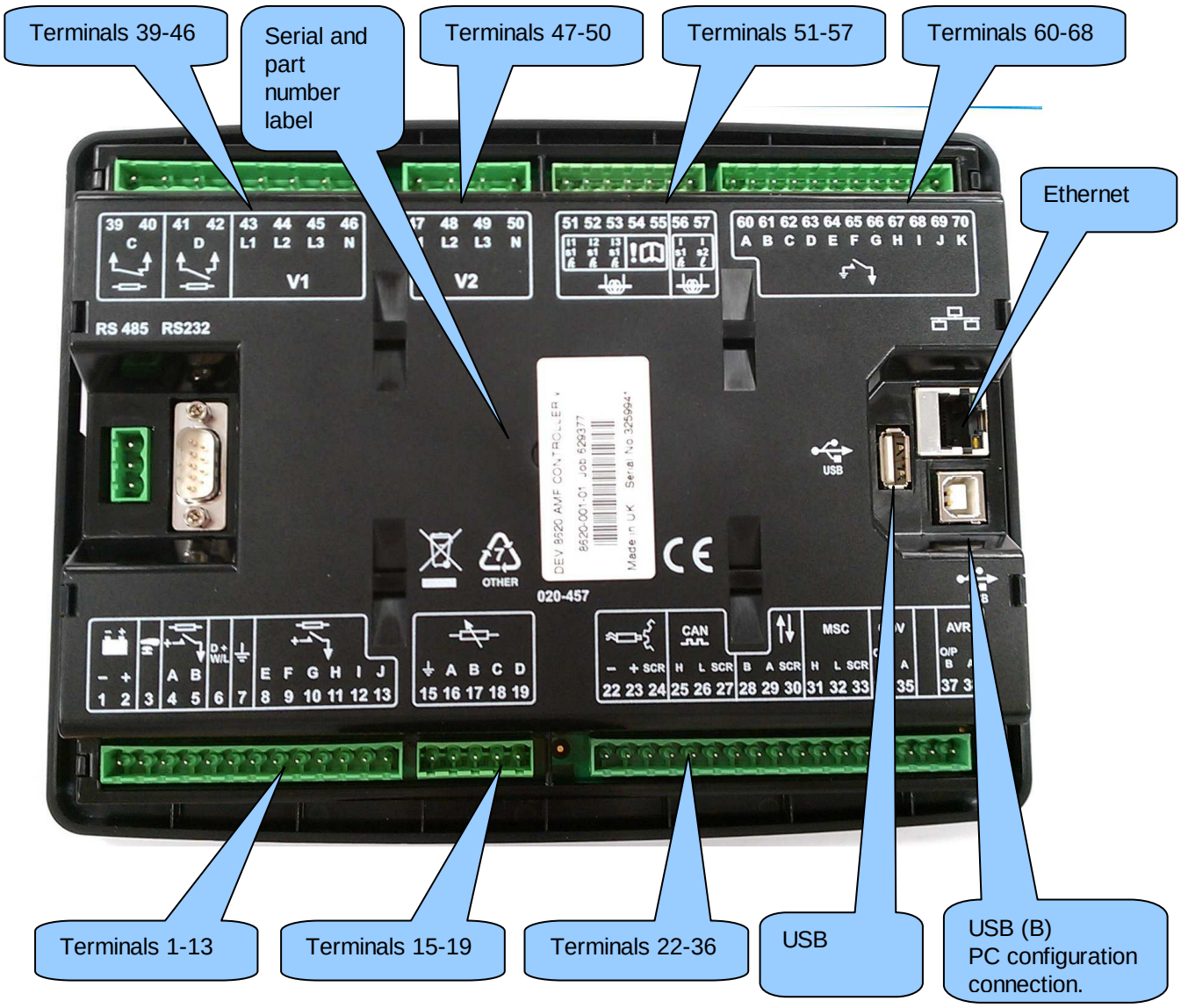
4 INSTALLATION

The DSE8xxx 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 TERMINAL DESCRIPTION

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.



4.1.1 DC SUPPLY, FUEL AND START OUTPUTS, OUTPUTS E-J

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	1	DC Plant Supply Input (Negative)	2.5mm² AWG 13	
	2	DC Plant Supply Input (Positive)	2.5 mm² AWG 13	(Recommended Maximum Fuse 15A anti-surge) Supplies the module (2A anti-surge requirement) and Output relays E,F,G & H
	3	Emergency Stop Input	2.5mm² AWG 13	Plant Supply Positive. Also supplies outputs 1 & 2. (Recommended Maximum Fuse 20A)
	4	Output relay A (FUEL)	2.5mm² AWG 13	Plant Supply Positive from terminal 3. 15 Amp rated. Fixed as FUEL relay if electronic engine is not configured.
	5	Output relay B (START)	2.5mm² AWG 13	Plant Supply Positive from terminal 3. 15 Amp rated. Fixed as START relay if electronic engine is not configured.
D + W/L	6	Charge fail / excite	2.5mm² AWG 13	Do not connect to ground (battery negative). If charge alternator is not fitted, leave this terminal disconnected.
	7	Functional Earth	2.5mm² AWG 13	Connect to a good clean earth point.
	8	Output relay E	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.
	9	Output relay F	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.
	10	Output relay G	1.0mm² AWG 18	Plant Supply Positive. from terminal 2. 3 Amp rated.
	11	Output relay H	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.
	12	Output relay I	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.
	13	Output relay J	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.

NOTE:- Terminal 14 is not fitted to the DSE 8620 controller.

NOTE:- When the module is configured for operation with an electronic engine, FUEL and START output requirements may be different. Refer to *Electronic Engines and DSE Wiring* for further information. Part No. 057-004.

4.1.2 ANALOGUE SENSOR

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	15	Sensor Common Return	0.5mm² AWG 20	Return feed for sensors*
	16	Oil Pressure Input	0.5mm² AWG 20	Connect to Oil pressure sensor
	17	Coolant Temperature Input	0.5mm² AWG 20	Connect to Coolant Temperature sensor
	18	Fuel Level input	0.5mm² AWG 20	Connect to Fuel Level sensor
	19	Flexible sensor	0.5mm² AWG 20	Connect to additional sensor (user configurable)

NOTE:- Terminals 20 and 21 are not fitted to the 8600 series controller.

NOTE: - It is VERY important that terminal 15 (sensor common) is soundly connected to an earth point on the ENGINE BLOCK, not within the control panel, and must be a sound electrical connection to the sensor bodies. This connection MUST NOT be used to provide an earth connection for other terminals or devices. The simplest way to achieve this is to run a SEPARATE earth connection from the system earth star point, to terminal 15 directly, and not use this earth for other connections.

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

4.1.3 MAGNETIC PICKUP, CAN AND EXPANSION

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	22	Magnetic pickup Positive	0.5mm² AWG 20	Connect to Magnetic Pickup device
	23	Magnetic pickup Negative	0.5mm² AWG 20	Connect to Magnetic Pickup device
	24	Magnetic pickup screen	Shield	Connect to ground at one end only
CAN	25	CAN port H	0.5mm² AWG 20	Use only 120Ω CAN approved cable
	26	CAN port L	0.5mm² AWG 20	Use only 120Ω CAN approved cable
	27	CAN port Common	0.5mm² AWG 20	Use only 120Ω CAN approved cable
	28	DSENet expansion +	0.5mm² AWG 20	Use only 120Ω RS485 approved cable
	29	DSENet expansion -	0.5mm² AWG 20	Use only 120Ω RS485 approved cable
	30	DSENet expansion SCR	0.5mm² AWG 20	Use only 120Ω RS485 approved cable
MSC	31	Multiset Comms (MSC) Link H	0.5mm² AWG 20	Use only 120Ω RS485 approved cable
	32	Multiset Comms (MSC) Link L	0.5mm² AWG 20	Use only 120Ω RS485 approved cable
	33	Multiset Comms (MSC) Link SCR	0.5mm² AWG 20	Use only 120Ω RS485 approved cable
GOV	34	Analogue Governor Output B	0.5mm² AWG 20	
	35	Analogue Governor Output A	0.5mm² AWG 20	
AVR	37	Analogue AVR Output B	0.5mm² AWG 20	
	38	Analogue AVR Output A	0.5mm² AWG 20	

NOTE:- Terminal 36 is not fitted to the 8620 controller

NOTE:- Screened cable must be used for connecting the Magnetic Pickup, ensuring that the screen is earthed at one end ONLY.

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

NOTE:- When the module is configured for CAN operation, terminals 22, 23 & 24 should be left unconnected. Engine speed is transmitted to the 8620 series controller on the CAN link. Refer to *Electronic Engines and DSE Wiring* for further information. Part No. 057-004.

4.1.4 V1 LOAD SWITCHING AND GENERATOR 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
V1	43	Generator L1 (U) voltage monitoring	1.0mm² AWG 18	Connect to generator L1 (U) output (AC) (Recommend 2A fuse)
	44	Generator L2 (V) voltage monitoring input	1.0mm² AWG 18	Connect to generator L2 (V) output (AC) (Recommend 2A fuse)
	45	Generator L3 (W) voltage monitoring input	1.0mm² AWG 18	Connect to generator L3 (W) output (AC) (Recommend 2A fuse)
	46	Generator Neutral (N) input	1.0mm² AWG 18	Connect to generator Neutral terminal (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.

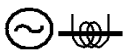
4.1.5 V2 MAINS VOLTAGE SENSING

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
V2	47	Mains L1 (R) voltage monitoring	1.0mm AWG 18	Connect to Mains L1 (R) incoming supply (AC) (Recommend 2A fuse)
	48	Mains L2 (S) voltage monitoring	1.0mm AWG 18	Connect to Mains L1 (S) incoming supply (AC) (Recommend 2A fuse)
	49	Mains L3 (T) voltage monitoring	1.0mm AWG 18	Connect to Mains L1 (T) incoming supply (AC) (Recommend 2A fuse)
	50	Mains Neutral (N) input	1.0mm AWG 18	Connect to Mains N incoming supply (AC)

4.1.6 GENERATOR 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 DSE8620 module has a burden of 0.5VA on the CT. Ensure the CT is rated for the burden of the DSE 8620 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 Gen L1	2.5mm² AWG 13	Connect to s1 secondary of L1 monitoring CT
	52	CT Secondary for Gen L2	2.5mm² AWG 13	Connect to s1 secondary of L2 monitoring CT
	53	CT Secondary for Gen L3	2.5mm² 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 :

	Topology	Pin No	Description	CABLE SIZE
	**No earth fault measuring**	54	DO NOT CONNECT	
		55	Connect to s2 of the CTs connected to L1,L2,L3,N	2.5mm² AWG 13
	Restricted earth fault measuring	54	Connect to s2 of the CTs connected to L1,L2,L3,N	2.5mm² AWG 13
		55	Connect to s1 of the CT on the neutral conductor	2.5mm² AWG 13
	Un-restricted earth fault measuring (Earth fault CT is fitted in the neutral to earth link)	54	Connect to s1 of the CT on the neutral to earth conductor.	2.5mm² AWG 13
		55	Connect to s2 of the CT on the neutral to earth link. Also connect to the s2 of CTs connected to L1, L2, L3.	2.5mm² AWG 13

4.1.7 MAINS CURRENT TRANSFORMERS

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	56	CT Secondary for Mains L1	2.5mm² AWG 13	Connect to s1 secondary of L1 monitoring CT
	57	CT Secondary for Mains L2	2.5mm² AWG 13	Connect to s2 secondary of L2 monitoring CT

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

NOTE: - Terminals 56 to 59 are not fitted to the 8610 series controller.

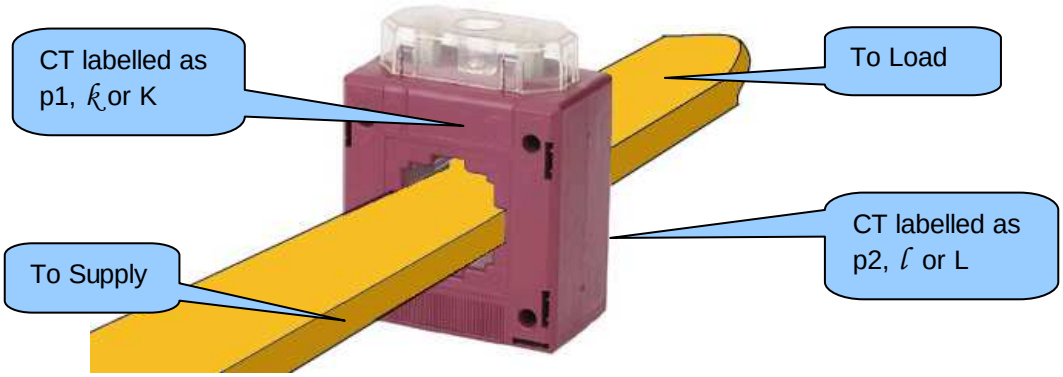
CT CONNECTIONS

p1, k or K is the primary of the CT that 'points' towards the GENERATOR

p2, l or L is the primary of the CT that 'points' towards the LOAD

s1 is the secondary of the CT that connects to the DSE Module's input for the CT measuring (I1,I2,I3)

s2 is the secondary of the CT that should be commoned with the s2 connections of all the other CTs and connected to the CT common terminal of the DSE8600 series modules.



4.1.8 CONFIGURABLE DIGITAL INPUTS

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	60	Configurable digital input A	0.5mm² AWG 20	Switch to negative
	61	Configurable digital input B	0.5mm² AWG 20	Switch to negative
	62	Configurable digital input C	0.5mm² AWG 20	Switch to negative
	63	Configurable digital input D	0.5mm² AWG 20	Switch to negative
	64	Configurable digital input E	0.5mm² AWG 20	Switch to negative
	65	Configurable digital input F	0.5mm² AWG 20	Switch to negative
	66	Configurable digital input G	0.5mm² AWG 20	Switch to negative
	67	Configurable digital input H	0.5mm² AWG 20	Switch to negative
	68	Configurable digital input I	0.5mm² AWG 20	Switch to negative
	69	Configurable digital input J	0.5mm² AWG 20	Switch to negative
	70	Configurable digital input K	0.5mm² AWG 20	Switch to negative

NOTE:- See the software manual for full range of configurable outputs available.

4.1.9 PC CONFIGURATION INTERFACE CONNECTOR

	DESCRIPTION	CABLE SIZE	NOTES
USB	Socket for connection to PC with 86xx series PC software.	0.5mm² AWG 20	This is a standard USB type A to type B connector. 

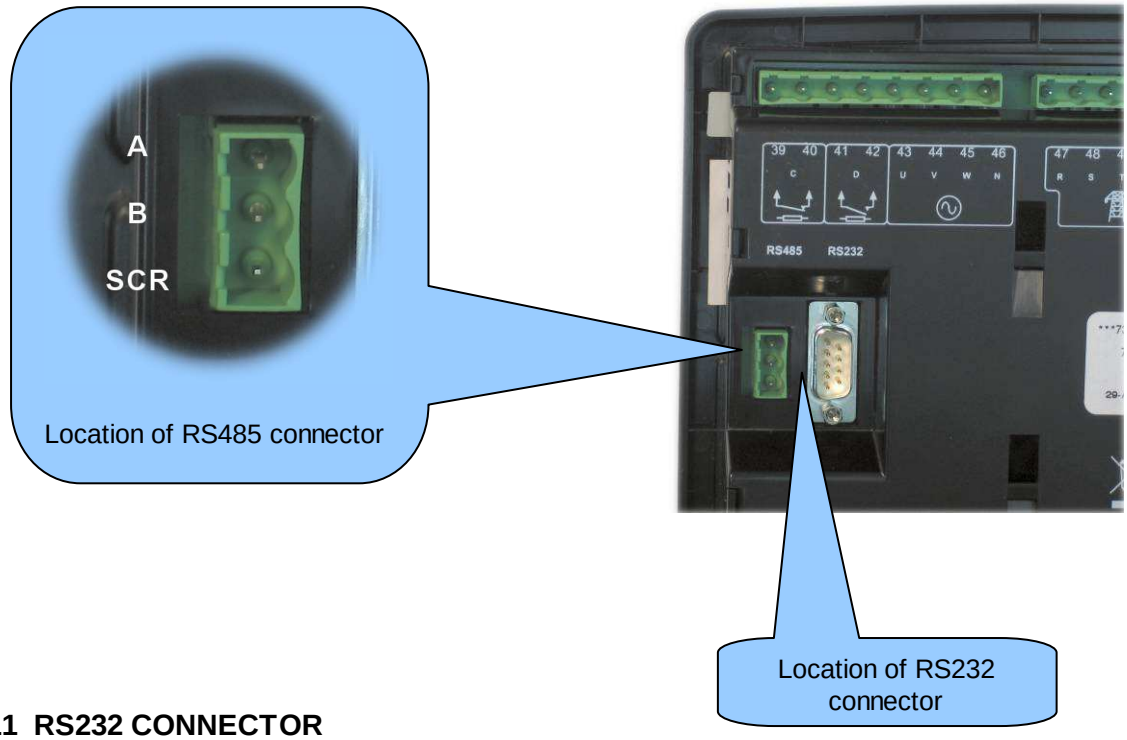
NOTE:- The USB connection cable between the PC and the 8600 series module must not be extended beyond 5m (yards). For distances over 5m, it is possible to use a third party USB extender. Typically, they extend USB up to 50m (yards). The supply and support of this type of equipment is outside the scope of Deep Sea Electronics PLC.

CAUTION!: Care must be taken not to overload the PCs USB system by connecting more than the recommended number of USB devices to the PC. For further information, consult your PC supplier.

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

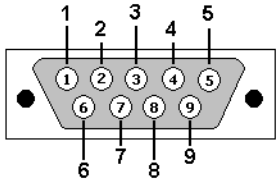
4.1.10 RS485 CONNECTOR

PIN No	NOTES
A	Two core screened twisted pair cable. 120Ω impedance suitable for RS485 use. Recommended cable type - Belden 9841 Max distance 1200m (1.2km) when using Belden 9841 or direct equivalent.
B	
SCR	



4.1.11 RS232 CONNECTOR

PIN No	NOTES
1	Received Line Signal Detector (Data Carrier Detect)
2	Received Data
3	Transmit Data
4	Data Terminal Ready
5	Signal Ground
6	Data Set Ready
7	Request To Send
8	Clear To Send
9	Ring Indicator



View looking into the male connector on the 8000 series module

4.2 TYPICAL WIRING DIAGRAMS

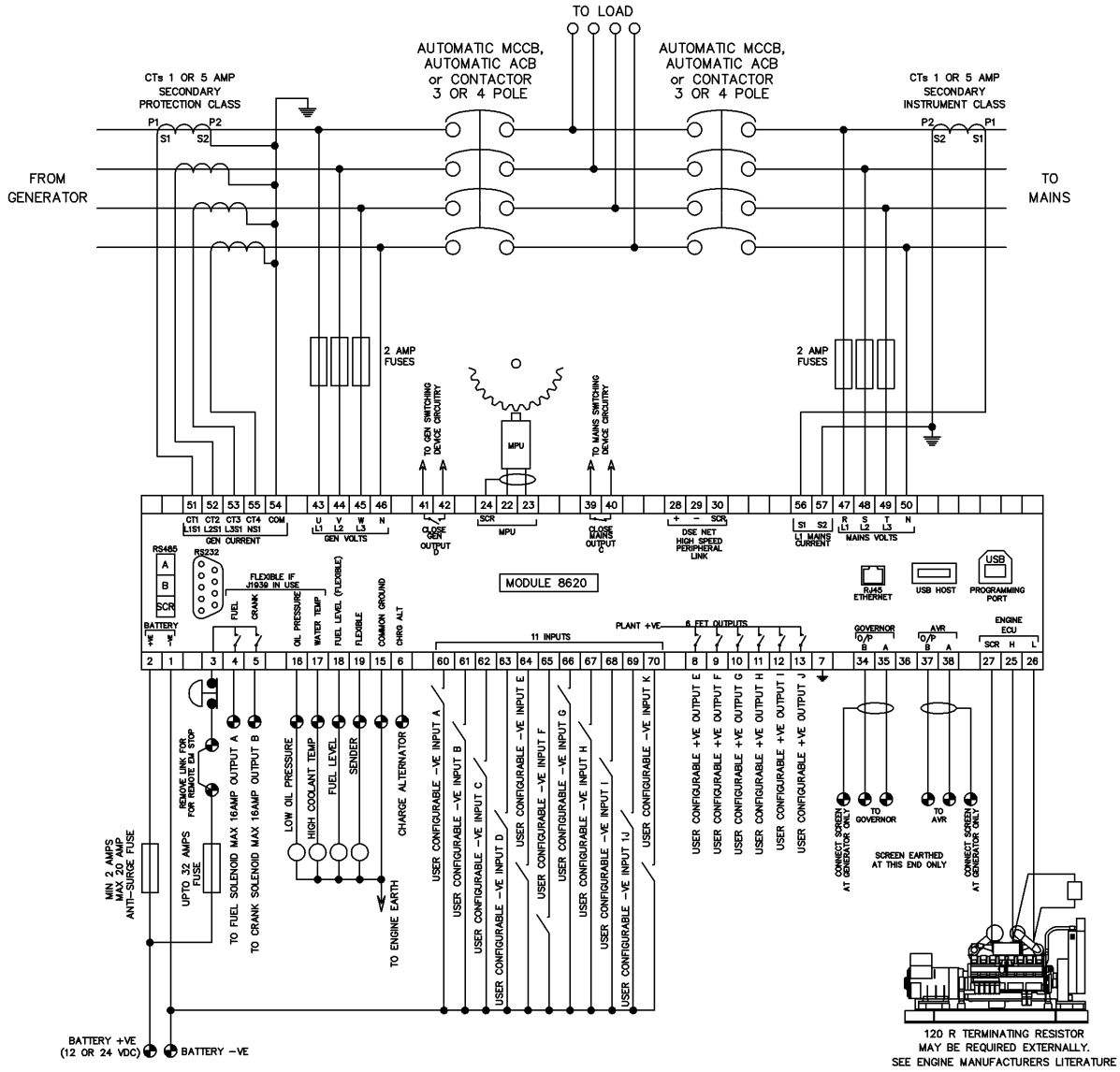
As every system has different requirements, these diagrams show only a TYPICAL system and do not intend to show a complete system.

Genset manufacturers and panel builders may use these diagrams as a starting point; however, you are referred to the completed system diagram provided by your system manufacturer for complete wiring detail.

Further wiring suggestions are available in the following DSE publications, available at www.deepseaplc.com to website members.

DSE PART	DESCRIPTION
056-022	Breaker Control (Training guide)
057-004	Electronic Engines and DSE Wiring

4.2.1 3 PHASE, 4 WIRE WITH RESTRICTED EARTH FAULT PROTECTION



NOTE:- Earthing the neutral conductor 'before' the neutral CT allows the module to read earth faults 'after' the CT only (Restricted to load / downstream of the CT)
Earthing the neutral conductor 'after' the neutral CT allows the module to read earth faults 'before' the CT only (Restricted to generator / upstream of the CT)

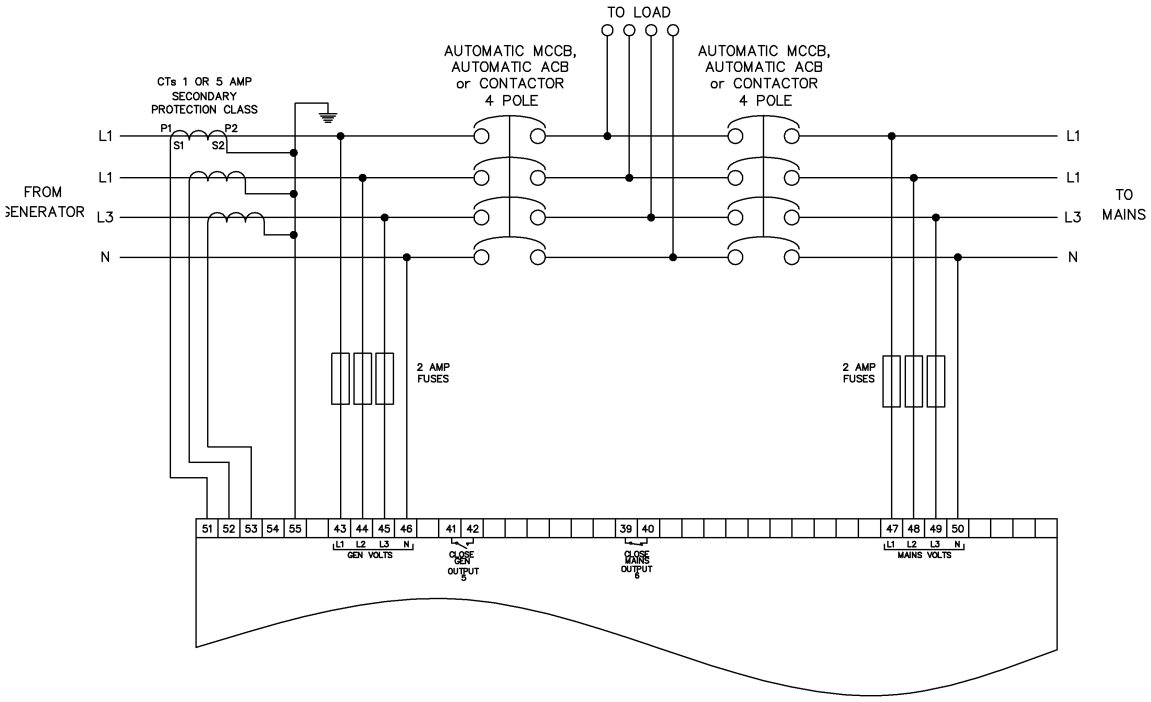
NOTE:- The MAINS CT is only required on for 'true' peak lop systems where the mains is held at a constant level and the generator provides variable power to the load.

4.3 ALTERNATIVE TOPOLOGIES

The 8000 controller is factory configured to connect to a 3 phase, 4 wire Star connected alternator. This section details connections for alternative AC topologies. Ensure to configure the 8000 series controller to suit the required topology.

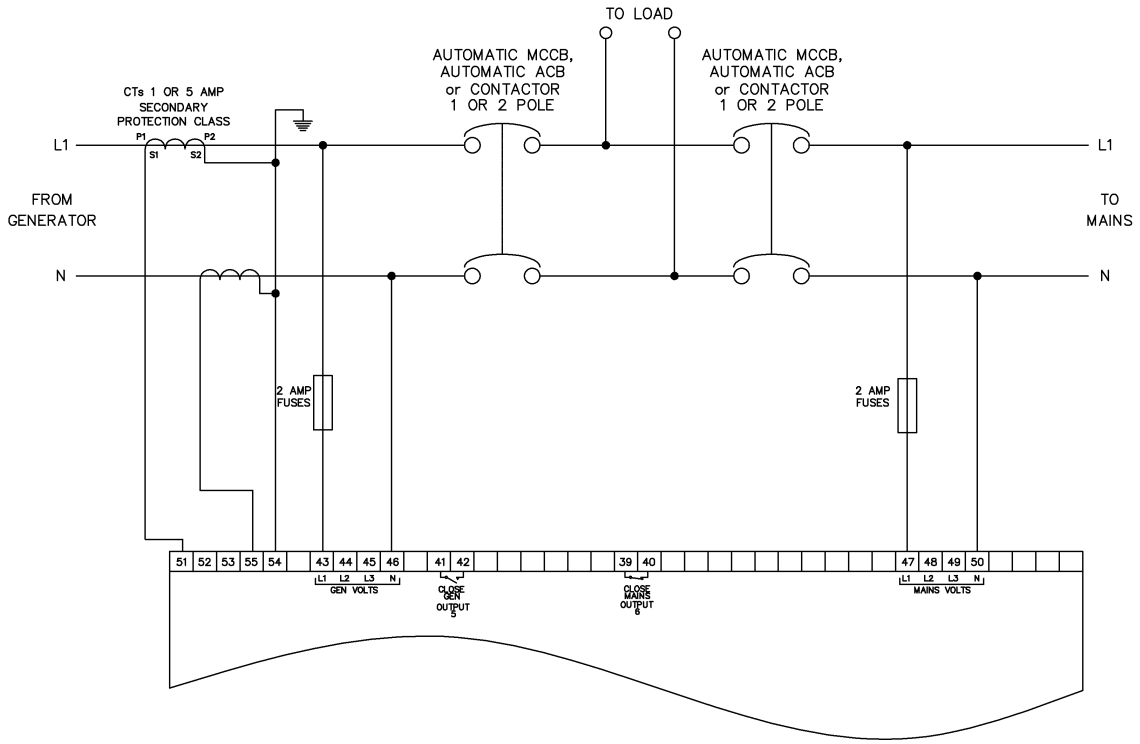
NOTE:- Further details of module configuration are contained within the DSE8000 Series configuration software manual (DSE part number 057-078)

4.3.1 3 PHASE, 4 WIRE WITHOUT EARTH FAULT PROTECTION

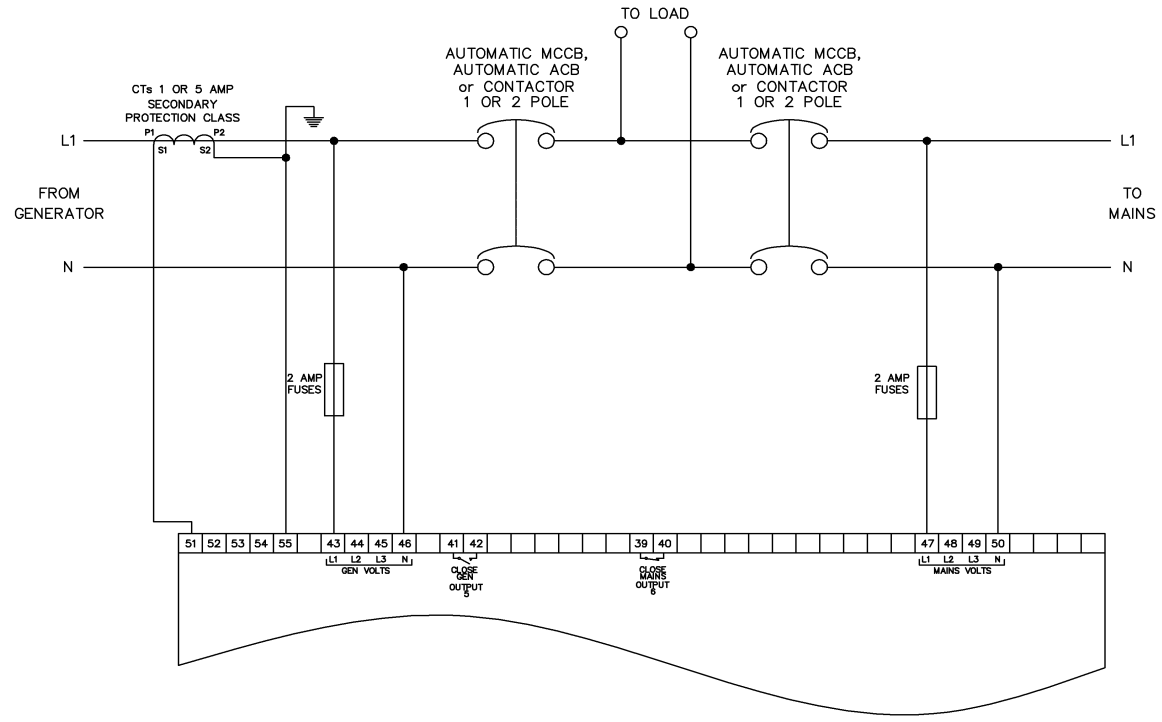


4.3.2 SINGLE PHASE WITH RESTRICTED EARTH FAULT

NOTE:- Earthing the neutral conductor 'before' the neutral CT allows the module to read earth faults 'after' the CT only (Restricted to load / downstream of the CT)
Earthing the neutral conductor 'after' the neutral CT allows the module to read earth faults 'before' the CT only (Restricted to generator / upstream of the CT)

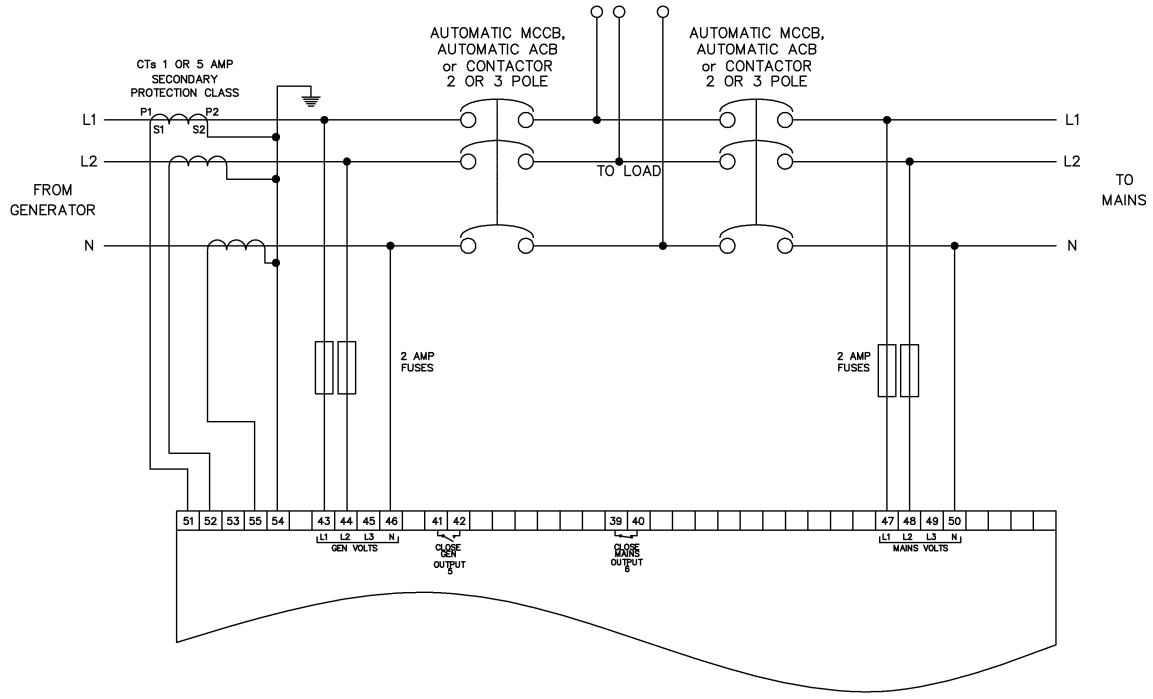


4.3.3 SINGLE PHASE WITHOUT EARTH FAULT

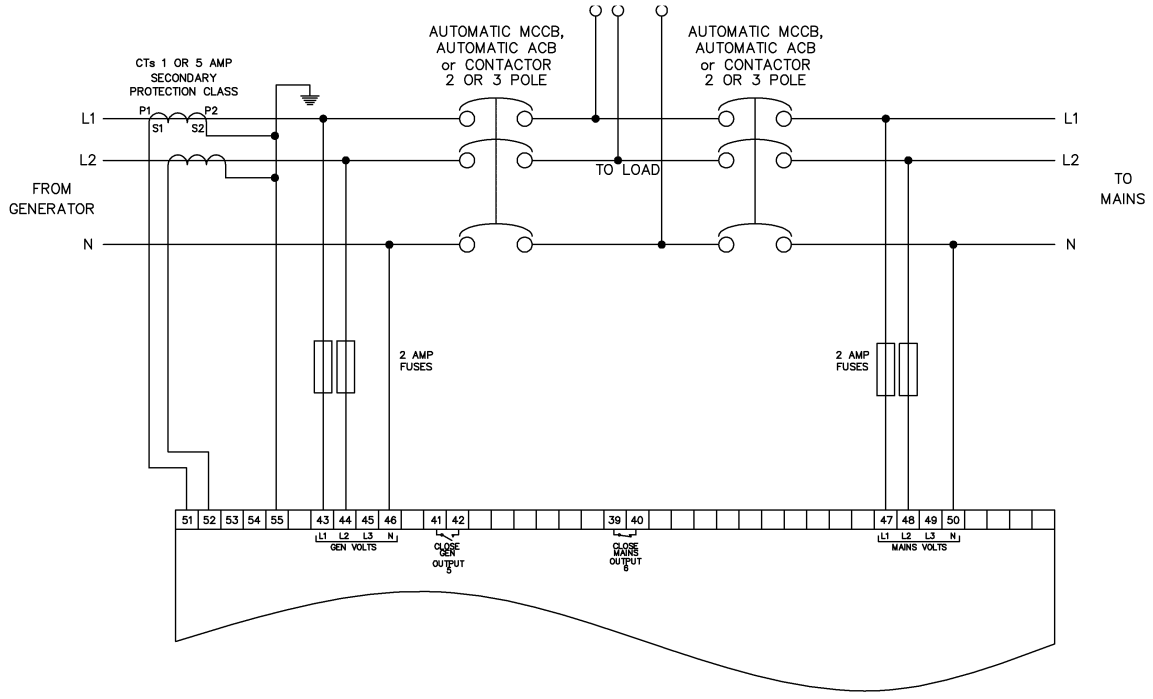


4.3.4 2 PHASE (L1 & L2) 3 WIRE WITH RESTRICTED EARTH FAULT

NOTE:- Earthing the neutral conductor 'before' the neutral CT allows the module to read earth faults 'after' the CT only (Restricted to load / downstream of the CT)
Earthing the neutral conductor 'after' the neutral CT allows the module to read earth faults 'before' the CT only (Restricted to generator / upstream of the CT)

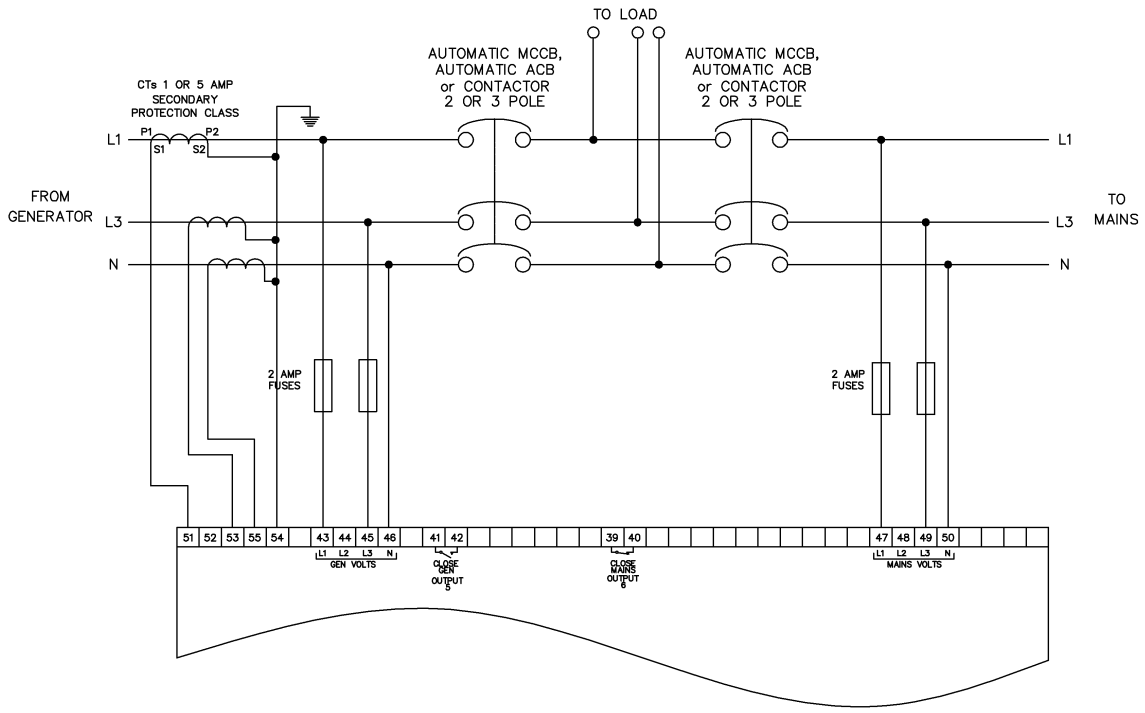


4.3.5 2 PHASE (L1 & L2) 3 WIRE WITHOUT EARTH FAULT

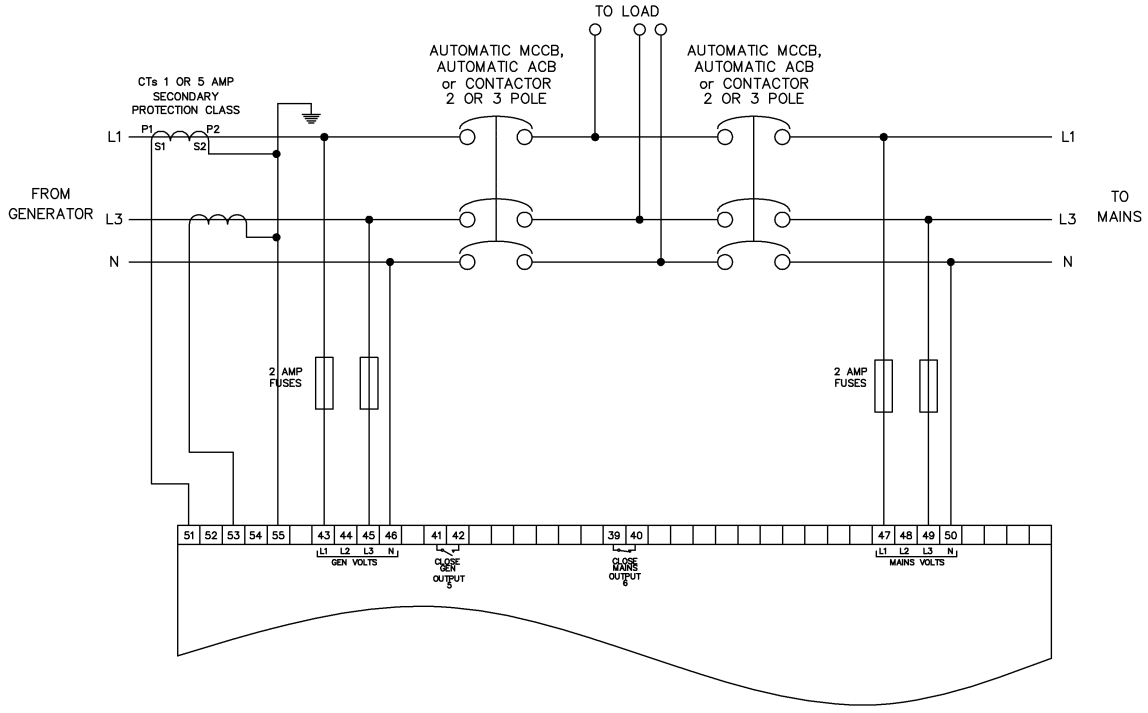


4.3.6 2 PHASE (L1 & L3) 3 WIRE WITH RESTRICTED EARTH FAULT

NOTE:- Earthing the neutral conductor 'before' the neutral CT allows the module to read earth faults 'after' the CT only (Restricted to load / downstream of the CT)
Earthing the neutral conductor 'after' the neutral CT allows the module to read earth faults 'before' the CT only (Restricted to generator / upstream of the CT)

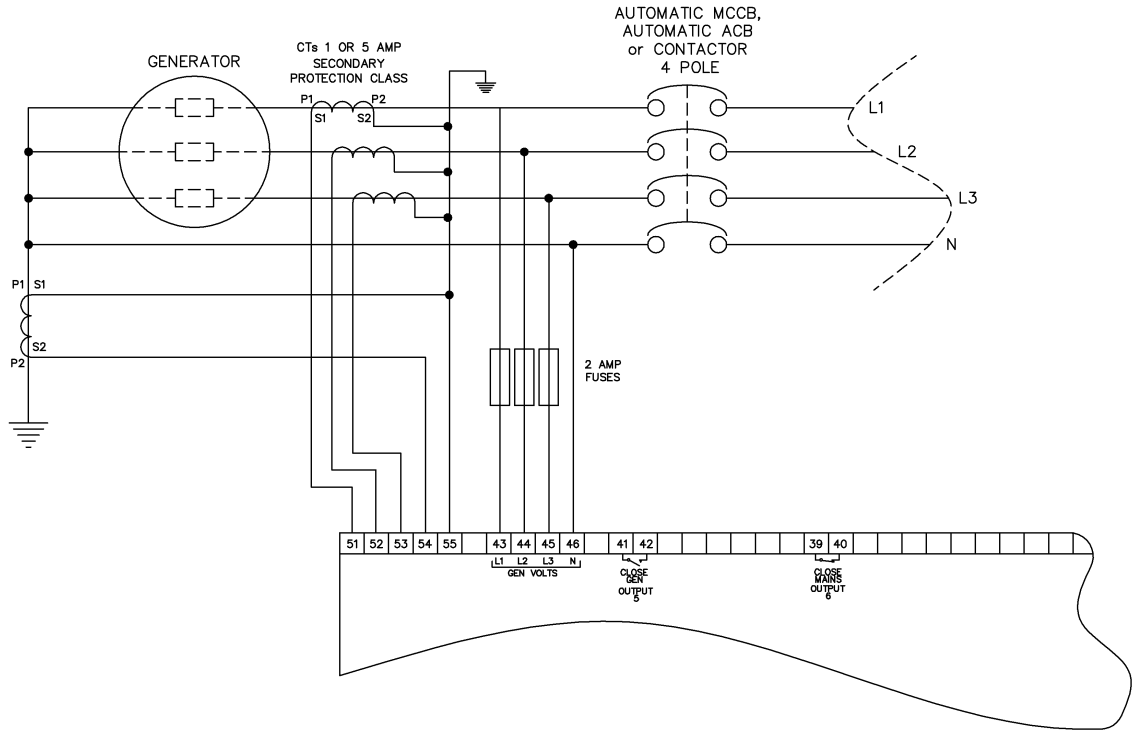


4.3.7 2 PHASE (L1 & L3) 3 WIRE WITHOUT EARTH FAULT MEASURING



4.3.8 3 PHASE 4 WIRE WITH UNRESTRICTED EARTH FAULT MEASURING

NOTE:- Unrestricted Earth Fault Protection detects earth faults in the load and in the generator. Be sure to measure the natural earth fault of the site before deciding upon an earth fault alarm trip level.



4.3.9 EARTH SYSTEMS

4.3.9.1 Negative Earth

The typical wiring diagrams located within this document show connections for a negative earth system (the battery negative connects to Earth)

4.3.9.2 Positive Earth

When using a DSE module with a Positive Earth System (the battery positive connects to Earth), the following points must be followed:

- Follow the typical wiring diagram as normal for all sections EXCEPT the earth points
- All points shown as Earth on the typical wiring diagram should connect to BATTERY NEGATIVE (not earth).

4.3.9.3 Floating earth

Where neither the battery positive nor battery negative terminals are connected to earth the following points must to be followed

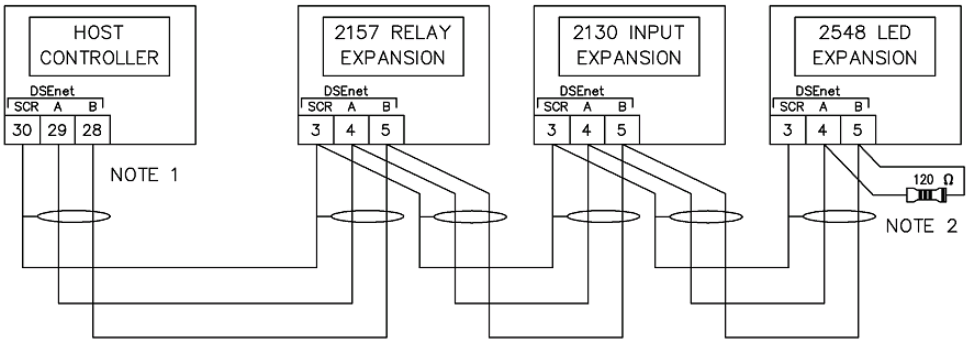
- Follow the typical wiring diagram as normal for all sections EXCEPT the earth points
- All points shown as Earth on the typical wiring diagram should connect to BATTERY NEGATIVE (not earth).

4.4 TYPICAL ARRANGEMENT OF DSENET®

Twenty (20) devices can be connected to the DSENet®, made up of the following devices :

Device	Max number supported
DSE2130 Input Expansion	4
DSE2157 Output Expansion	10
DSE2548 LED Expansion	10

For part numbers of the expansion modules and their documentation, see section entitled *DSENet Expansion Modules* elsewhere in this manual.



NOTE 1

AS A TERMINATING RESISTOR IS INTERNALLY FITTED TO THE HOST CONTROLLER, THE HOST CONTROLLER MUST BE THE FIRST UNIT ON THE DSEnet

NOTE 2

A 120 OHM TERMINATION RESISTOR MUST BE FITTED TO THE LAST UNIT ON THE DSEnet

4.4.1 EARTH SYSTEMS

4.4.1.1 Negative Earth

The typical wiring diagrams located within this document show connections for a negative earth system (the battery negative connects to Earth)

4.4.1.2 Positive Earth

When using a DSE module with a Positive Earth System (the battery positive connects to Earth), the following points must be followed:

- Follow the typical wiring diagram as normal for all sections EXCEPT the earth points
- All points shown as Earth on the typical wiring diagram should connect to BATTERY NEGATIVE (not earth).

4.4.1.3 Floating Earth

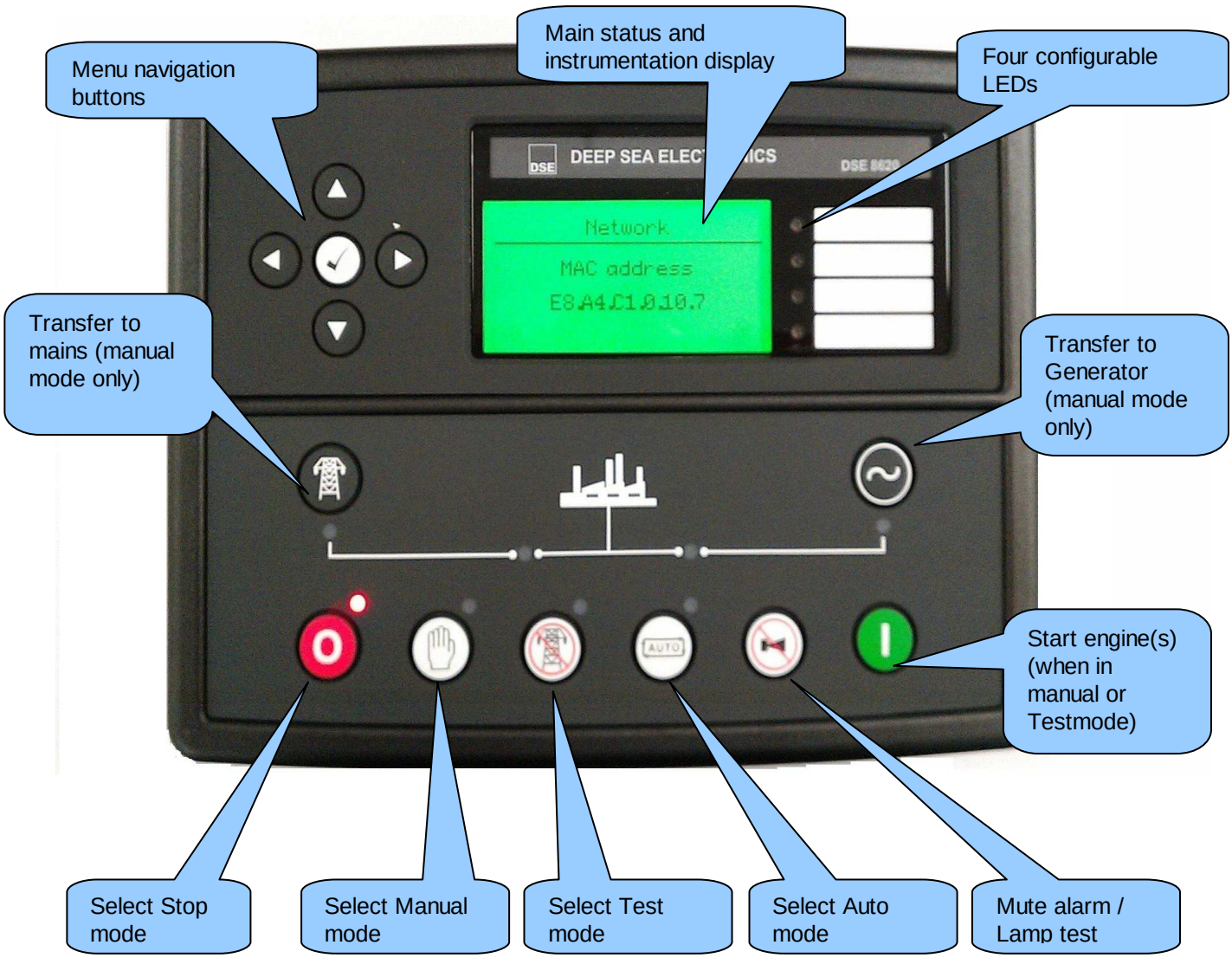
Where neither the battery positive nor battery negative terminals are connected to earth, the following points must to be followed

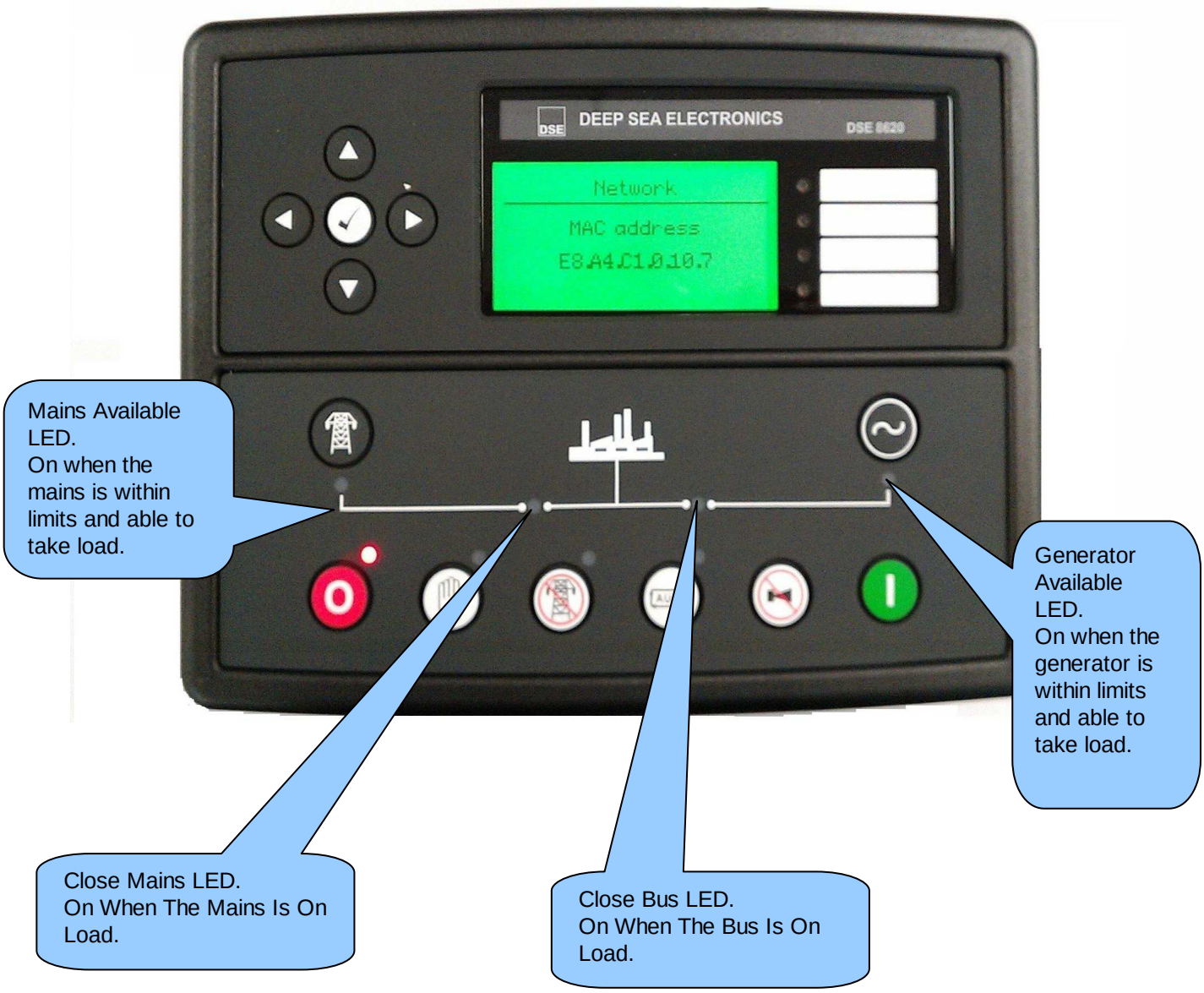
- Follow the typical wiring diagram as normal for all sections EXCEPT the earth points
- All points shown as Earth on the typical wiring diagram should connect to BATTERY NEGATIVE (not earth).

5 DESCRIPTION OF CONTROLS

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

5.1 DSE8620 AUTOMATIC MAINS FAILURE (AMF) CONTROL MODULE




DEEP SEA ELECTRONICS
DSE 8620
Network
MAC address
E8A4C10107
Mains Available LED.
On when the mains is within limits and able to take load.
Generator Available LED.
On when the generator is within limits and able to take load.
Close Mains LED.
On When The Mains Is On Load.
Close Bus LED.
On When The Bus Is On Load.

5.2 VIEWING THE INSTRUMENT PAGES

It is possible to scroll to display the different pages of information by repeatedly operating the next / previous page buttons  .

Example

Status  Engine  Generator 

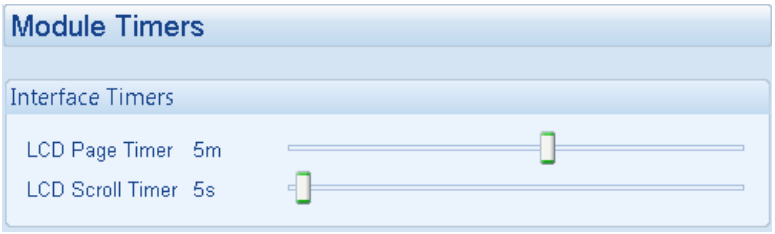
And so on until the last page is reached. A Further press of the scroll right button returns the display to the Status page.

The complete order and contents of each information page are given in the following sections

Once selected the page will remain on the LCD display until the user selects a different page, or after an extended period of inactivity (*LCD Page Timer*), the module will revert to the status display.

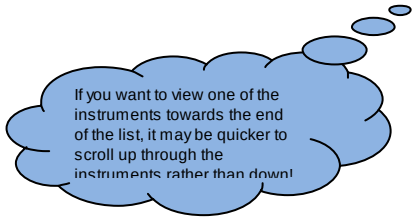
If no buttons are pressed upon entering an instrumentation page, the instruments will be displayed automatically subject to the setting of the *LCD Scroll Timer*.

The *LCD Page* and *LCD Scroll* timers are configurable using the DSE Configuration Suite Software or by using the Front Panel Editor.



The screenshot shows the factory settings for the timers, taken from the DSE Configuration Suite Software.

Alternatively, to scroll manually through all instruments on the currently selected page, press the scroll  buttons. The 'autoscroll' is disabled.



To re-enable 'autoscroll' press the scroll  buttons to scroll to the 'title' of the instrumentation page (ie Engine). A short time later (the duration of the *LCD Scroll Timer*), the instrumentation display will begin to autoscroll.

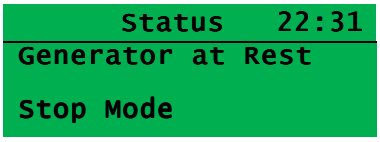
When scrolling manually, the display will automatically return to the Status page if no buttons are pressed for the duration of the configurable *LCD Page Timer*.

If an alarm becomes active while viewing the status page, the display shows the Alarms page to draw the operator's attention to the alarm condition.

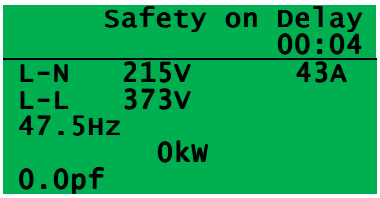
5.2.1 STATUS

This is the 'home' page, the page that is displayed when no other page has been selected, and the page that is automatically displayed after a period of inactivity (*LCD Page Timer)* of the module control buttons.

This page will change with the action of the controller , when on gen generator parameters will be seen and when changing to mains the mains parameters will be shown.



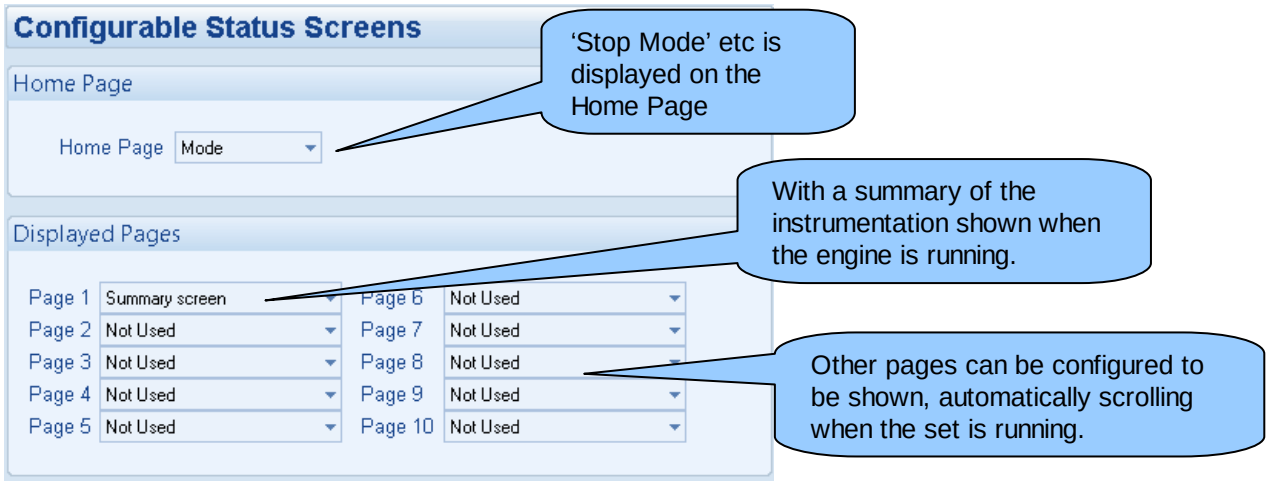
Factory setting of Status screen showing engine stopped...



...and engine running

The contents of this display may vary depending upon configuration by the generator manufacturer / supplier.

The display above is achieved with the factory settings, shown below in the DSE Configuration suite software:



NOTE:- The following sections detail instrumentation pages, accessible using the scroll left and right buttons, regardless of what pages are configured to be displayed on the 'status' screen.

5.2.2 ENGINE

Contains instrumentation gathered about the engine itself, some of which may be obtained using the CAN or other electronic engine link.

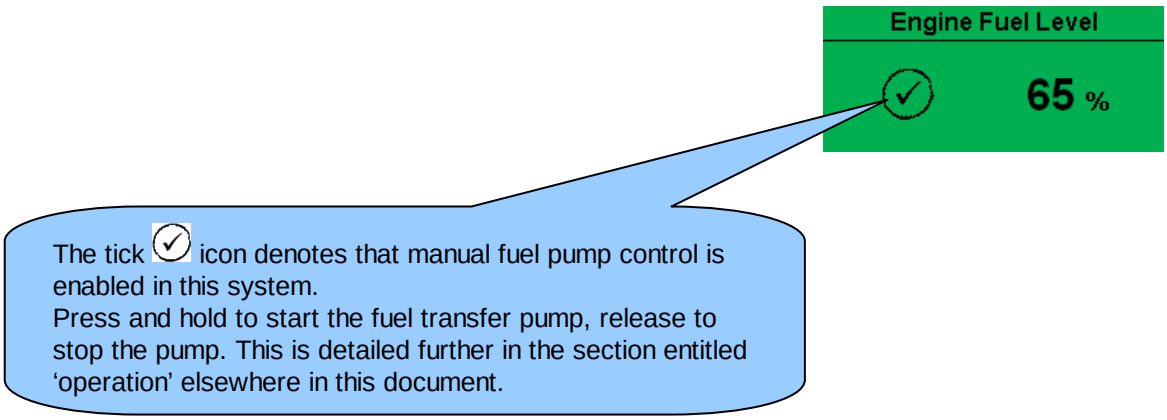
- Engine Speed
- Oil Pressure
- Coolant Temperature
- Engine Battery Volts
- Engine Run Time
- Engine Fuel Level
- Oil Temperature*
- Coolant Pressure*
- Inlet Temperature*
- Exhaust Temperature*
- Fuel Temperature*
- Turbo Pressure*
- Fuel Pressure*
- Fuel Consumption*
- Fuel Used*
- Fuel Level*
- Auxiliary Sensors (If fitted and configured)
- Engine Maintenance Due (If configured)
- Engine ECU Link*

*When connected to suitably configured and compatible engine ECU. For details of supported engines see 'Electronic Engines and DSE wiring' (DSE Part number 057-004).

- Tier 4 engine information will also be available if used with a Tier 4 suitable engine / ECU.

Depending upon configuration and instrument function, some of the instrumentation items may include a tick ✓ icon beside them. This denotes a further function is available, detailed in the 'operation' section of this document.

Example:



5.2.3 GENERATOR

Contains electrical values of the generator (alternator), measured or derived from the module's voltage and current inputs.

- Generator Voltage (ph-N)
- Generator Voltage (ph-ph)
- Generator Frequency
- Generator Current
- Generator Earth Current
- Generator Load %
- Generator Load (kW)
- Generator Load (kVA)
- Generator Power Factor
- Generator Power Factor Average
- Generator Load (kVAr)
- Generator Load (kWh, kVAh, kVArh)
- Generator Phase Sequence
- Generator config (Nominals)
- Generator Active Config
- Synchroscope display

5.2.4 MAINS

- Mains Voltage (ph-N)
- Mains Voltage (ph-ph)
- Mains Frequency
- Mains Current
- Mains Load (kW)
- Mains Load Total (kW)
- Mains Load (kVA)
- Mains Load Total (kVA)
- Mains Power Factor
- Mains Power Factor Average
- Mains Load (kVAr)
- Mains Load (kWh, kVAh, kVArh)
- Mains Phase Sequence
- Mains config (Nominals)
- Mains Active Config

5.2.1 RS232 SERIAL PORT

This section is included to give information about the RS232 serial port and external modem (if connected).
The items displayed on this page will change depending upon configuration of the module. You are referred to your system supplier for further details.

NOTE:- Factory Default settings are for the RS232 port to be enabled with no modem connected, operating at 19200 baud, modbus slave address 10.

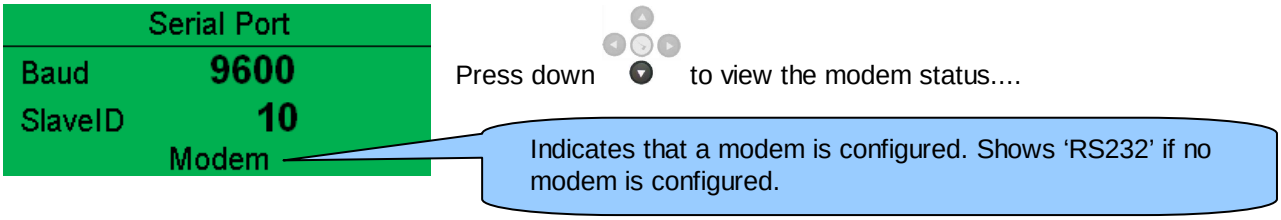
Example 1 – Module connected to an RS232 telephone modem.

When the DSE8610 series module is power up, it will send 'initialisation strings' to the connected modem. It is important therefore that the modem is already powered, or is powered up at the same time as the DSE86xx series module. At regular intervals after power up, the modem is reset, and reinitialised, to ensure the modem does not 'hang up'.

If the DSE8610 series module does not correctly communicate with the modem, "Modem initialising' appears on the Serial Port instrument screen as shown overleaf.

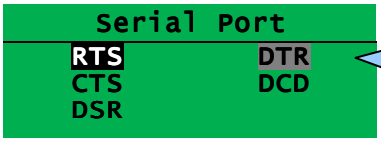
If the module is set for "incoming calls" or for "incoming and outgoing calls", then if the modem is dialled, it will answer after two rings (using the factory setting 'initialisation strings)'. Once the call is established, all data is passed from the dialling PC and the DSE8610 series module.

If the module is set for "outgoing calls" or for "incoming and outgoing calls", then the module will dial out whenever an alarm is generated. Note that not all alarms will generate a dial out; this is dependant upon module configuration of the event log. Any item configured to appear in the event log will cause a dial out.



Example 1 continued – Modem diagnostics

Modem diagnostic screens are included; press  when viewing the *RS232 Serial Port* instrument to cycle the available screens. If you are experiencing modem communication problems, this information will aid troubleshooting.

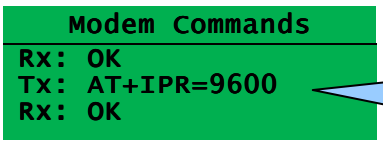


Shows the state of the modem communication lines. These can help diagnose connection problems.

Example:

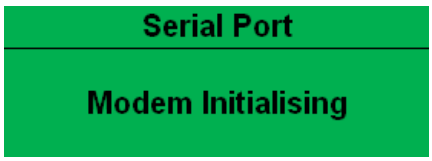
RTS A dark background shows the line is active.
RTS a grey background shows that the line is toggling high and low.

Line	Description	
RTS	Request To Send	Flow control
CTS	Clear To Send	Flow control
DSR	Data Set Ready	Ready to communicate
DTR	Data Terminal Ready	Ready to communicate
DCD	Data Carrier Detect	Modem is connected

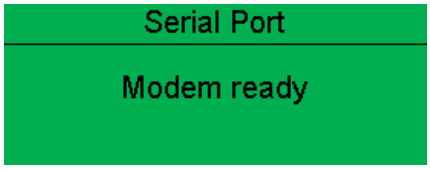


Shows the last command sent to the modem and the result of the command.

Modem Setup Sequence

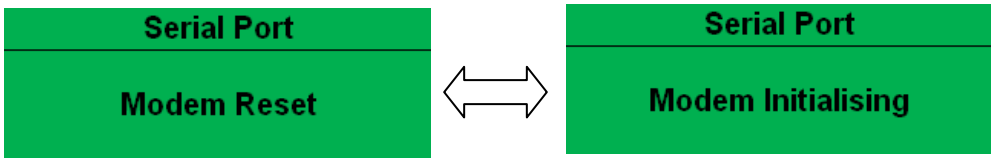
1) 

If the Modem and DSE8600 series communicate successfully:

2) 

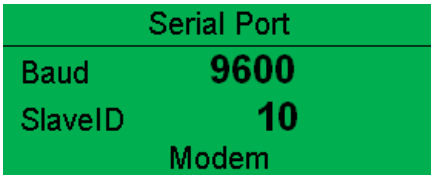
In case of communication failure between the modem and DSE8600 series module, the modem is automatically reset and initialisation is attempted once more:

3)

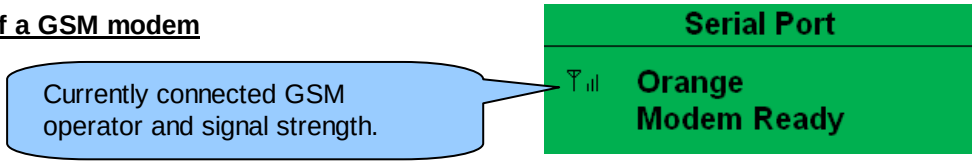


In the case of a module that is unable to communicate with the modem, the display will continuously cycle between 'Modem Reset' and 'Modem Initialising' as the module resets the modem and attempts to communicate with it again, this will continue until correct communication is established with the modem.
In this instance, you should check connections and verify the modem operation.

Example 2 – Module connected to a modem.



Example 3 – Modem status of a GSM modem



Many GSM modems are fitted with a status LED to show operator cell status and ringing indicator. These can be a useful troubleshooting tool.

In the case of GSM connection problems, try calling the DATA number of the SIMCARD with an ordinary telephone. There should be two rings, followed by the modem answering the call and then 'squealing'. If this does not happen, you should check all modem connections and double check with the SIM provider that it is a DATA SIM and can operate as a data modem. DATA is NOT the same as FAX or GPRS and is often called Circuit Switched Data (CSD) by the SIM provider.

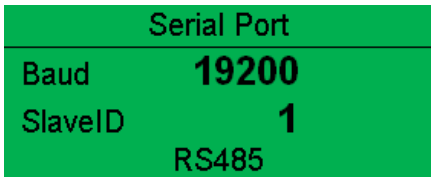
NOTE: In the case of GSM modems, it is important that a DATA ENABLED SIM is used. This is often a different number than the 'voice number' and is often called Circuit Switched Data (CSD) by the SIM provider.

If the GSM modem is not purchased from DSE, ensure that it has been correctly set to operate at 9600 baud. You may need to install a terminal program on your PC and consult your modem supplier to do this. GSM modems purchased from DSE are already configured to work with the DSE86xx series module.

5.2.1 RS485 SERIAL PORT

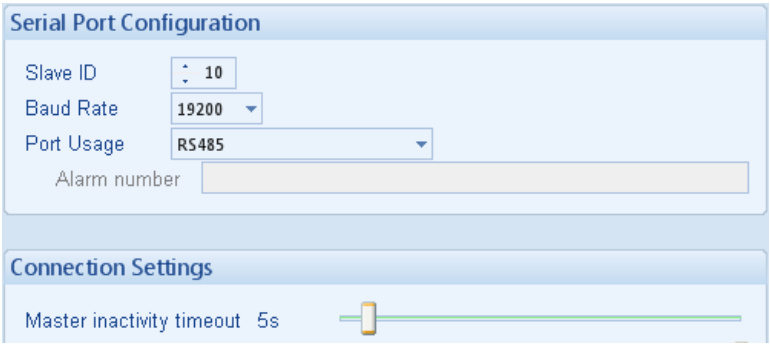
This section is included to give information about the currently selected serial port and external modem (if connected).
The items displayed on this page will change depending upon configuration of the module. You are referred to your system supplier for further details.

NOTE:- Factory Default settings are for the RS485 port to operating at 19200 baud, modbus slave address 10.



Module RS485 port configured for connection to a modbus master.

DSE86xx series modules operate as a modbus RTU slave device.
In a modbus system, there can be only one Master, typically a PLC, HMI system or PC SCADA system.
This master requests for information from the modbus slave (DSE86xx series module) and may (in control systems) also send request to change operating modes etc. Unless the Master makes a request, the slave is 'quiet' on the data link.
The factory settings are for the module to communicate at 19200 baud, modbus slave address 10.
To use the RS485 port, ensure that 'port usage' is correctly set using the DSE Configuration Suite Software.
Required settings are shown below.



'Master inactivity timeout' should be set to at least twice the value of the system scan time. For example if a modbus master PLC requests data from the DSE86xx modbus slave once per second, the timeout should be set to at least 2 seconds.

The DSE Modbus Gencomm document containing register mappings inside the DSE module is available upon request from support@deepseaplc.com. Email your request along with the serial number of your DSE module to ensure the correct information is sent to you.

Typical requests (using Pseudo code)

`BatteryVoltage=ReadRegister(10,0405,1)` : reads register (hex) 0405 as a single register (battery volts) from slave address 10.

`WriteRegister(10,1008,2,35701, 65535-35701)` : Puts the module into AUTO mode by writing to (hex) register 1008, the values 35701 (auto mode) and register 1009 the value 65535-35701 (the bitwise opposite of auto mode)

`Shutdown=(ReadRegister(10,0306,1) >> 12) & 1)` : reads (hex) 0306 and looks at bit 13 (shutdown alarm present)
`Warning=(ReadRegister(10,0306,1) >> 11) & 1)` : reads (hex) 0306 and looks at bit 12 (Warning alarm present)
`ElectricalTrip=(ReadRegister(10,0306,1) >> 10) & 1)` : reads (hex) 0306 and looks at bit 11 (Electrical Trip alarm present)

`ControlMode=ReadRegister(10,0304,2);` reads (hex) register 0304 (control mode).

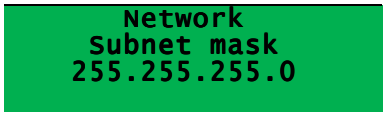
5.2.2 ABOUT

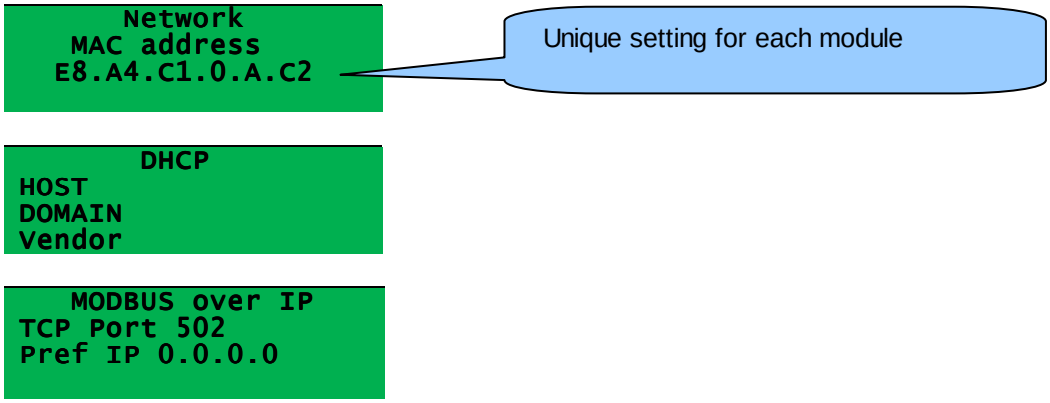
Contains important information about the module and the firmware versions. This information may be asked for when contacting DSE Technical Support Department for advice.

- Module Type (i.e. 8620)
- Application Version – The version of the module's main firmware file – Updatable using the Firmware Update Wizard in the DSE Configuration Suite Software.
- USB ID – unique identifier for PC USB connection
- Analogue Measurements software version
- Firmware Update Boot loader software version.

5.2.2.1 Ethernet Pages

- Update Network settings using DSE Configuration Suite Software+ 1 Power cycle off/on before the editor pages are updated..

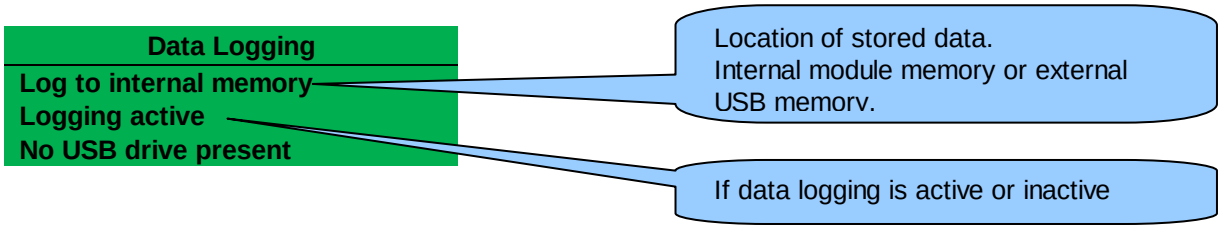




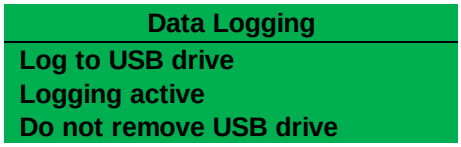
Pages available in the "ABOUT" screen to confirm Network settings.

Data Logging Pages

The DSE data logging pages show information depending on the configuration in the module.

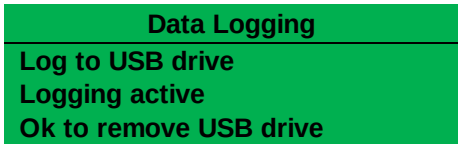


Inserting a USB drive to the host USB will display the following change to the page.



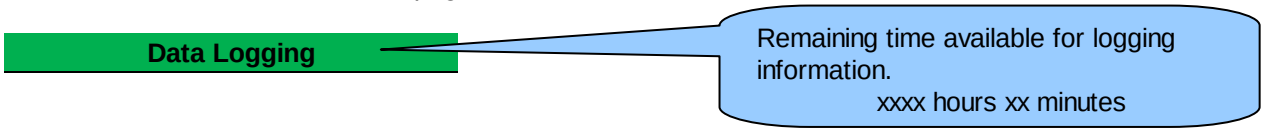
NOTE:- Removal of the USB drive should only be carried out using the following method.

Press and hold the tick button until "Ok to remove USB drive" is displayed.



It is now safe to remove the USB drive.
This ensures the logging data file will save to memory complete and will not become corrupt.

Press down to view the next page.



Time remaining
xxxx h xx m

Press down  to view the next page.

Data Logging
Memory remaining
xxxx

Memory space remaining, this depends what size memory drive is fitted (Max 16Gb) or allocated internal (2Mb) memory left available.

.

5.2.1 CAN ERROR MESSAGES

When connected to a suitable CAN engine the 8620 series controller displays alarm status messages from the ECU.

Alarm
ECU Warning

Warning

Type of alarm that is triggered in the DSE module (i.e. Warning or Shutdown)

Press  to access the list of current active Engine DTCs (Diagnostic Trouble Codes).

Engine DTCs
Water Level
Low
Xxx,xxx,xxx

The code interpreted by the module shows on the display as a text message. Additionally, the manufacturer's code is shown.

NOTE: - For details on these code meanings, refer to the ECU instructions provided by the engine manufacturer, or contact the engine manufacturer for further assistance.

NOTE: - For further details on connection to electronic engines please refer to *Electronic engines and DSE wiring.* Part No. 057-004

5.3 VIEWING THE EVENT LOG

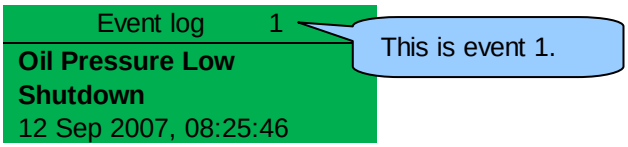
The DSE8600 series modules maintain a log of past alarms and/or selected status changes.
The log size has been increased in the module over past module updates and is always subject to change. At the time of writing, the 86xx series log is capable of storing the last 250 log entries.

Under default factory settings, the event log only includes shutdown and electrical trip alarms logged (The event log does not contain Warning alarms**);** however, this is configurable by the system designer using the DSE Configuration Suite software.

Example showing the possible configuration of the DSE8600 series event log (DSE Configuration Suite Software)
This also shows the factory settings of the module (Only shutdown alarms and the mains status are logged).

Once the log is full, any subsequent shutdown alarms will overwrite the oldest entry in the log. Hence, the log will always contain the most recent shutdown alarms.
The module logs the alarm, along with the date and time of the event (or engine running hours if configured to do so).
If the module is configured and connected to send SMS text

To view the event log, repeatedly press the next page button  until the LCD screen displays the Event log :



Press down  to view the next most recent shutdown alarm:

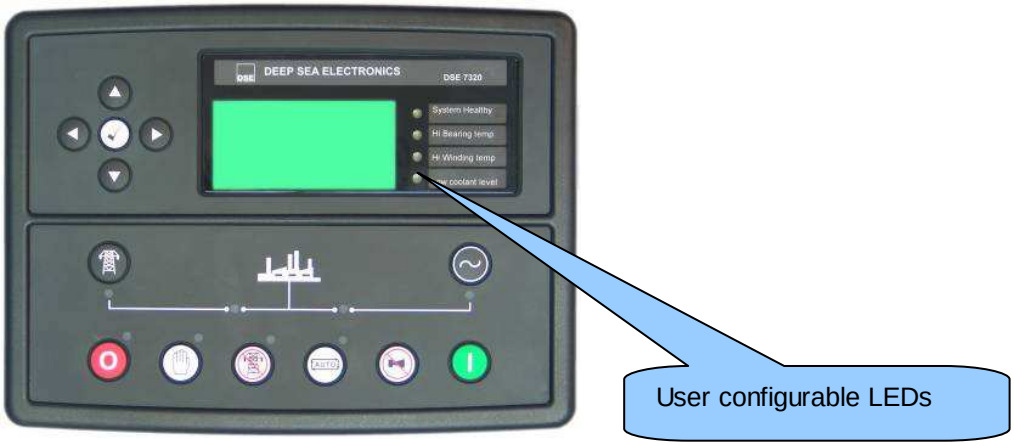
Continuing to press down  cycles through the past alarms after which the display shows the most recent alarm and the cycle begins again.

To exit the event log and return to viewing the instruments, press the next page  button to select the next instrumentation page.

5.4 USER CONFIGURABLE INDICATORS

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 Louvres Open, etc*.
- **WARNINGS a**nd **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.*



6 OPERATION

6.1 CONTROL

Control of the **DSE8620** 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.

NOTE: -PLC Functionality. This control module has PLC functionality built in. This can have change the standard operation when used.(Default configuration the no PLC is set. See software manual for more information)

6.2 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 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 not occur.	
MANUAL 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.	
START 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. **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 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. *For further details, please see the more detailed description of 'Auto Operation' earlier in this manual.*	
Mute / Lamp Test This button silences the audible alarm if it is sounding and illuminates all of the LEDs as a lamp test feature.	

Test This button places the module into its **'Test'** mode. This allows an on load test of the generator. Once in **Test mode** the module will respond to the start button, start the engine, and run on load. *For further details, please see the more detailed description of 'Test operation' elsewhere in this document.*	
Transfer to mains Operative in Manual Mode only 'Normal' breaker button control • Allows the operator to transfer the load to the mains • If the Generator is on load and mains is available the generator will synchronise and parallel with the mains. • If the Generator & mains are in parallel, the generator power will ramp off and open the generator breaker. 'Alternative' breaker button control (Synchronises when necessary) • If generator is on load, transfers the load to the mains. • If mains is on load, opens the mains breaker • If generator and mains are off load, closes the mains breaker.	
Transfer to generator Operative in Manual Mode only 'Normal' breaker button control • Allows the operator to transfer the load to the generator • If the mains is on load and the generator is available the generator will synchronise and parallel with the mains. • If the mains & generator are in parallel the generator power will ramp up and open the mains breaker. 'Alternative' breaker button control (Synchronises when necessary) • If mains is on load, transfers the load to the generator. • If generator is on load, opens the generator breaker . If generator and mains are off load, closes the generator breaker	
Menu navigation Used for navigating the instrumentation, event log and configuration screens. For further details, please see the more detailed description of these items elsewhere in this manual	

The following description details the sequences followed by a module containing the standard '*factory configuration*'.

Remember that if you have purchased a completed generator set or control panel from your supplier, the module'sconfiguration will probably have been changed by them to suit their particular requirements.

Always refer to your configuration source for the exact sequences and timers observed by any particular module in the field.

6.3 DUMMY LOAD / LOAD SHEDDING CONTROL

This feature may be enabled by the system designer to ensure the loading on the generator is kept to a nominal amount. If the load is low, 'dummy loads' (typically static load banks) can be introduced to ensure the engine is not too lightly loaded. Conversely as the load increases towards the maximum rating of the set, non-essential loads can be shed to prevent overload of the generator.

6.2.1 DUMMY LOAD CONTROL

The *dummy load control* feature (if enabled) allows for a maximum of five dummy load steps.
When the set is first started, all configured *Dummy Load Control* outputs are de-energised.
Once the generator is placed onto load, the generator loading is monitored by the *Dummy Load Control* scheme.

If the generator loading falls below the *Dummy Load Control Trip* setting (kW), the *Dummy Load Control Trip Delay* is displayed on the module display. If the generator loading remains at this low level for the duration of the timer, the first *Dummy Load Control* output is energised. This is used to energise external circuits to switch in (for instance) a static load bank.

The generator loading has now been increased by the first dummy load. Again the generator loading is monitored. This continues until all configured *Dummy Load Control* outputs are energised.
Should the generator loading rise above the *Dummy Load Return* level, the *Dummy Load Return Delay* begins. If the loading remains at these levels after the completion of the timer, the 'highest' active *Dummy*

Load Control
output is de-energised. This continues until all *Dummy Load Control* outputs have been de-energised.
Example screen shot of *Dummy Load Control* setup in the DSE Configuration Suite

6.2.2 LOAD SHEDDING CONTROL

The *Load Shedding Control* feature (if enabled) allows for a maximum of five load shedding steps.
When the generator is about to take load, the configured number of *Load Shedding Control Outputs at Startup* will energise. This configurable setting allows (for instance) certain loads to be removed from the generator prior to the set's load switch being closed. This can be used to ensure the initial loading of the set is kept to a minimum, below the *Load Acceptance* specification of the generating set.

The generator is then placed on load. The *Load Shedding Control* scheme begins.
When the load reaches the *Load Shedding Trip* level the *Trip Delay* timer will start. If the generator loading is still high when the timer expires, the first *Load shedding Control* output will energise. When the load has been above the trip level for the duration of the timer the 'next' *Load shedding Control* output will energise and so on until all *Load Shedding Control outputs are energised.*

If at any time the load falls back below the *Load Shedding Return* level, the *Return Time* will start. If the load remains below the return level when the timer has expired the 'highest' *Load Shedding Control* output that has been energised will be de-energised. This process will continue until all outputs have been de-energised.
When the set enters a stopping sequence for any reason the *Load Shedding control*' outputs will de-energise at the same time as the generator load switch is signalled to open.

Details can be found in the 057-119 8600 Configuration suite software Manual.

6.4 STOP MODE

STOP mode is activated by pressing the button.

In STOP mode, the module will remove the generator from load (if necessary) before stopping the engine if it is already running.

If the engine does not stop when requested, the FAIL TO STOP alarm is activated (subject to the setting of the *Fail to Stop* timer). To detect the engine at rest the following must occur :

- Engine speed is zero as detected by the Magnetic Pickup or CANbus ECU (depending upon module variant).
- Generator frequency must be zero.
- Oil pressure switch must be closed to indicate low oil pressure (MPU version only)

When the engine has stopped, it is possible to send configuration files to the module from DSE Configuration Suite PC software and to enter the Front Panel Editor to change parameters.

Any latched alarms that have been cleared will be reset when STOP mode is entered.

The engine will not be started when in STOP mode. If remote start signals are given, the input is ignored until AUTO mode is entered.

When configured to do so, When left in STOP mode for five minutes with no presses of the fascia buttons, the module enters low power mode. To 'wake' the module, press the button or any other fascia control button.

6.4.1 ECU OVERRIDE

NOTE:- ECU Override function is only applicable when the controller is configured for a CAN engine.

NOTE:- Depending upon system design, the ECU may be powered or unpowered when the module is in STOP mode. ECU override is only applicable if the ECU is unpowered when in STOP mode.

When the ECU powered down (as is normal when in STOP mode), it is not possible to read the diagnostic trouble codes or instrumentation. Additionally, it is not possible to use the engine manufacturers' configuration tools.

As the ECU is usually unpowered when the engine is not running, it must be turned on manually as follows :

- Select STOP mode on the DSE controller.
- Press and hold the START button to power the ECU. As the controller is in STOP mode, the engine will not be started.

.

- The ECU will remain powered 2 minutes after the START button is released.

This is also useful if the engine manufacturer's tools need to be connected to the engine, for instance to configure the engine as the ECU needs to be powered up to perform this operation.

6.5 AUTOMATIC OPERATION

6.5.1 MAINS FAILURE

This mode of operation is used to ensure continuity of supply to critical loads during a mains failure condition. This is the normal mode of operation when installed on a standby generator.

NOTE: If a digital input configured to *panel lock* is active, changing module modes will not be possible. Viewing the instruments and event logs is NOT affected by panel lock.

This mode is activated by pressing the 

pushbutton. An LED indicator beside the button will illuminate to confirm this operation.
Auto mode will allow the generator to operate fully automatically, starting and stopping as required with no user intervention.

Should the mains (utility) supply fall outside the configurable limits for longer than the period of the mains transient delay timer, the mains (utility) available GREEN indicator LED extinguishes.

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

NOTE: - If the mains supply returns within limits during the Start Delay timer, the unit will return to a stand-by state.

After the above delays have expired the **Fuel Solenoid (or enable ECU** output if configured) is energised, then one second later, the **Starter Motor** is engaged.

NOTE:- If the unit has been configured for CAN Bus, compatible ECU's will receive the start command via CAN Bus. Refer to the Manual CAN and DSE Wiring. Part No. 057-004 for more information on utilising DSE modules with electronically controlled engines.

The engine is cranked for a pre-set time. If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Should this sequence continue beyond the set number of attempts, the start sequence will be terminated and **Fail to Start** fault will be displayed.

Alarm
Shutdown
Fail to start

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency measured from the alternator output. Alternatively, a Magnetic Pickup mounted on the flywheel housing can be used for speed detection (This is selected by PC using the 86xx series configuration software). Rising oil pressure can also be used to disconnect the starter motor; however it cannot be used for underspeed or overspeed detection.

NOTE:- If the unit has been configured for CAN Bus, speed sensing is via CAN Bus.

After the starter motor has disengaged, the **Safety On** timer is activated, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.

6.5.1 ENGINE RUNNING

Once the engine is running, the *Warm Up* timer, if selected, begins, allowing the engine to stabilise before accepting the load.

After the **Warm-up** timer has expired then the module will transfer the load from the failed mains supply to the generator output. It will observe the following sequence. The **Mains Contactor/Breaker** will be instructed to open and after a short delay (**transfer delay**), the **Generator Contactor/Breaker** will be instructed to close.

The generator will then supply the requirements of the load.

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

When the mains supply returns, the **Stop** delay timer is initiated. Once it has expired, the set is synchronised and paralleled with the mains supply. The system remains in this condition until expiry of the **Parallel run** timer. Once this has expired, the module will ramp the remaining load from the generator to mains supply. The Generator Contact/Breaker will open and the **Cooling** timer is then initiated, allowing the engine a cooling down period off load before shutting down. Once the **Cooling** timer expires, the **Fuel Solenoid** is de-energised, bringing the generator to a stop.

During the parallel run, the module can be configured to either run at a fixed level output, or to maintain an output in relation to the load level on the mains. For full details of these mode please refer to the manual ‘The Guide to sync and load share Pt1’

Should the mains supply fall outside limits once again the set will return on load.

NOTE: - When synchronising is enabled, the mains supply is checked before closing any load switching device. If the supply is live, synchronising will take place before any closure takes place.

NOTE: - Synchronising can be disabled if the application does not require this function. Contact your genset supplier in the first instance for further details.

6.5.2 REMOTE START IN ISLAND MODE

This mode of operation is used to start the set in response to an external start requirement from another device. It may also be used to provide continuity of supply during expected black out events.

NOTE:- If a digital input configured to panel lock is active, changing module modes will not be possible. Viewing the instruments and event log are NOT affected by panel lock. If panel lock is active the Panel lock indicator (if configured) illuminates.

This mode is activated by pressing the AUTO pushbutton. An LED indicator beside the button will illuminate to confirm this operation.

If the *remote start in island mode* input activates, the **Remote Start Active** indicator (if configured) illuminates.

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

NOTE:- If the Remote Start signal is removed during the Start Delay timer, the unit will return to a stand-by state.

After the above delays, the **Fuel Solenoid (or enable ECU** output if configured) is energised, and then one second later, the **Starter Motor** is engaged.

NOTE: - If the unit has been configured for CAN Bus, compatible ECU's will receive the start command via CAN Bus. Refer to the Manual CAN and DSE Wiring. Part No. 057-004 for more information on utilising DSE modules with electronically controlled engines.

The engine is cranked for a pre-set time. If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Should this sequence continue beyond the set number of attempts, the start sequence will be terminated and **Fail to Start** fault will be displayed.

Alarm
Shutdown
Fail to start

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency measured from the alternator output. Alternatively, a Magnetic Pickup mounted on the flywheel housing can be used for speed detection (). Rising oil pressure can also be used to disconnect the starter motor; however, it cannot be used for underspeed or overspeed detection.

NOTE: - If the unit is configured for CAN Bus, speed sensing is via CAN Bus.

After the starter motor has disengaged, the **Safety On** timer is activated, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.

Once the engine is running, the **Warm Up** timer, if selected is initiated, allowing the engine to stabilise before accepting the load.

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

The Generator will first be instructed to **synchronise** with the mains supply before closing the **Generator Contact/Breaker** and transferring load from mains to generator until the generator is supplying the required amount of power (adjustable using DSE Configuration Suite software).

When the supplies have been in parallel for the duration of the **parallel run time,** the load will ramp off the mains supply and onto the generator. The **Mains Contactor/Breaker** will be instructed to open.

The generator will then supply the requirements of the load.

When the remote start signal is removed, the **Stop** delay timer is initiated. Once it has expired, the set is synchronised and paralleled with the mains supply.

The system remains in this condition until expiry of the **Parallel run** timer. Once this has expired, the module will ramp the remaining load from the generator to mains supply.

Alternative Ramping Scheme- The controller holds the power until the end of the Parallel run timer before initiating any ramping off.

The **Generator Contact/Breaker** will open and the **Cooling** timer is then initiated, allowing the engine a cooling down period off load before shutting down.

Once the **Cooling** timer expires, the **Fuel Solenoid** is de-energised, bringing the generator to a stop.

NOTE: - Synchronising can be disabled if the application does not require this function. Contact your generating set supplier in the first instance for further details.

NOTE: - The internal 'Scheduler' can be configured to operate the system in the same manner as described for the Remote start input. Please refer to the 86xx Configuration Software manuals for full details on the feature.

6.5.3 REMOTE START ON LOAD

This mode of operation is used to start the set in response to rising load levels on the mains supply (if configured).

NOTE: - If a digital input configured to panel lock is active, changing module modes will not be possible. Viewing the instruments and event log are NOT affected by panel lock. If panel lock is active the Panel lock indicator (if configured) illuminates.

This mode is activated by pressing the AUTO pushbutton. An LED indicator beside the button will illuminate to confirm this operation.

Should the load level on the mains supply exceed a pre-set level the module will initiate a start sequence.

To allow for short duration load surges, the Start Delay timer is initiated. After this delay, if the pre-heat output option is selected then the pre-heat timer is initiated and the corresponding auxiliary output (if configured) will energise.

NOTE: - If the load level returns below the pre-set level during the Start Delay timer, the unit will return to a stand-by state.

After the above delays, the **Fuel Solenoid (or enable ECU** output if configured) is energised, and then one second later, the **Starter Motor** is engaged.

NOTE: - If the unit has been configured for CAN Bus, compatible ECU's will receive the start command via CAN Bus. Refer to the Manual CAN and DSE Wiring. Part No. 057-004 for more information on utilising DSE modules with electronically controlled engines.

The engine is cranked for a pre-set time. If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Should this sequence continue beyond the set number of attempts, the start sequence will be terminated and **Fail to Start** fault will be displayed.

Alarm
Shutdown
Fail to start

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency measured from the alternator output. Alternatively, a Magnetic Pickup mounted on the flywheel housing can be used for speed detection (This is selected by PC using the DSE configuration Suite software). Rising oil pressure can also be used to disconnect the starter motor; however, it cannot be used for underspeed or overspeed detection.

NOTE: - If the unit is configured for CAN Bus, speed sensing is via CAN Bus.

After the starter motor has disengaged, the **Safety On** timer is activated, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.

Once the engine is running, the **Warm Up** timer, if selected is initiated, allowing the engine to stabilise before accepting the load.

After the **Warm-up** timer has expired then the module will transfer the load from the mains supply to the generator output. It will observe the following sequence.

The Generator will first be instructed to **synchronise** with the mains supply. Once these are matched, the **Generator Contact/Breaker** will be instructed to close.

The load will then be **ramped** from the Mains to the appropriate level on the generator.
The generator will then supply the requirements of the load.

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

Advanced Ramping Scheme - When configured the breaker closes and the Generator power is held until the end of the timer before ramping off

When the *remote start on load* input is removed, the **Stop** delay timer is initiated. Once this timer has expired, the module will ramp the load from the generator to mains supply. The **Generator Contact/Breaker** will open and the **Cooling** timer is then initiated, allowing the engine a cooling down period off load before shutting down. Once the **Cooling** timer expires, the **Fuel Solenoid** is de-energised, bringing the generator to a stop.

During the parallel run, the module can be configured to either run at a fixed level output, or to maintain an output in relation to the load level on the mains.

NOTE: - When synchronising is enabled, the mains supply is checked before closing any load switching device. If the supply is live, synchronising will take place before any closure takes place.

NOTE: - Synchronising can be disabled if the application does not require this function. Contact your genset supplier in the first instance for further details.

NOTE: - The load level mode of operation relies on a Current Transformer (CT) fitted to the mains feed of the system. This is then used for measurement of the mains current used in the load level calculations.

6.6 MANUAL OPERATION

Manual mode is used to allow the operator to control the operation of the generator, and to provide fault finding and diagnostic testing of the various operations normally performed during Automatic mode operation.

NOTE: - If a digital input configured to panel lock is active, changing module modes will not be possible. Viewing the instruments and event logs and event log is NOT affected by panel lock. If panel lock is active the Panel lock indicator (if configured) illuminates.

MANUAL, mode is selected by pressing the pushbutton. An LED besides the button will illuminate to confirm this operation. When the button is operated, the module will initiate the start sequence.

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

If the **pre-heat** output option has been selected, this timer will be initiated and the auxiliary output selected energised.

After the above delay, the **Fuel Solenoid** (**or ECU** output if configured) is energised, and then one second later, the **Starter Motor** is engaged.

NOTE:- If the unit is configured for CAN Bus, compatible ECU's will receive the start command via CAN Bus. Refer to the Manual CAN and DSE Wiring. Part No. 057-004 for more information on utilising DSE modules with electronically controlled engines.

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

Alarm
Shutdown
Fail to start

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency measured from the Alternator output. Alternatively, a Magnetic Pickup mounted on the flywheel housing can be used for speed detection (This is selected by PC using the 5xxx series configuration software). Rising oil pressure can also be used to disconnect the starter motor; however, it cannot be used for underspeed or overspeed detection.

NOTE: - If the unit is configured for CAN Bus, speed sensing is via CAN Bus.

After the starter motor has disengaged, the **Safety On** timer is activated, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.

Once the engine is running, the **Warm Up** timer (if selected) is initiated, allowing the engine to stabilise before it can be loaded. Once the warm up timer has expired, the generator is then available to go on load and the **Generator Available LED** will illuminate on the front panel.

The generator will run off load unless:

1. The mains supply fails,
2. A **Remote Start on load** signal is applied, or an on-load run is configured in the scheduler.
3. The **Close Generator** button is pressed.

If any of the above signals are received, the generator is synchronised and paralleled with the mains supply (if available).

During the parallel run, the module can be configured to either run at a fixed level output, or to maintain an output in relation to the load level on the mains. For full details of these mode please refer to the manual 'The Guide to sync and load share Pt1'

Parallel operation:

- If the **Close Generator** button is pressed again while in parallel, then the module will transfer the load fully to the generators, removing the load from the mains supply. This will be achieved by ramping the load from the parallel operating level to the generator. The Mains Contactor/Breaker will then be opened. Pressing the **Close Mains** button will cause the module to re-synchronise the generator with the mains supply and then return to parallel operation.
- If the **Close Mains** button is pressed while in parallel, the module will open the generator load switching device, transferring the load fully to the mains supply.

If **Auto** mode is selected and the mains supply is healthy, and the remote start on load signal not active, and the scheduler is not calling for a run, then the **Return Delay Timer** will start.

Once this has expired then the module will exit **parallel** operation and will ramp the load back to the mains supply. It will then open the **Generator Contactor/Breaker.** The generator will then run **off** load allowing the engine a **cooling** period.

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

WARNING: - Operation of the STOP button in any mode will stop the generator operation and return the load switching system to a safe state. This operation may lead to loss of supply to the load. It is recommended that the STOP button is only operated once the generator is OFF LOAD and the mains is supplying the load.

NOTE: - Synchronising can be disabled if the application does not require this function. Contact your genset supplier in the first instance for further details. If synchronising is disabled the system will always perform an open transition when switching the load from the mains to the generator or when returning to the mains. The parallel run stages of the sequence are not used when operating in this way.

NOTE: - When synchronising is enabled, the mains supply is checked before closing any load switching device. If the supply is live, synchronising will take place before any closure takes place.

6.7 TEST OPERATION

Test operation is used to perform a full on load test sequence to allow for diagnosis of faults. Alternatively, it may also be used to provide continuity of supply during expected black out events, peak lopping or peak shaving during high tariff periods.

NOTE: - If a digital input configured to panel lock is active, changing module modes will not be possible. Viewing the instruments and event log is NOT affected by panel lock. If panel lock is active the Panel lock indicator (if configured) illuminates.

TEST mode is initiated by pressing the pushbutton. An LED besides the button will illuminate to confirm this operation. When the **START** button is operated, the module will initiate the start sequence.

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

If the **pre-heat** output option has been selected, this timer will initiate and the auxiliary output selected will be energised.

After the above delay, the **Fuel Solenoid (or ECU** output if configured) is energised, and then one second later, the **Starter Motor** is engaged.

NOTE: - If the unit has been configured for CAN Bus, compatible ECU's will receive the start command via CAN Bus. Refer to the Manual CAN and DSE Wiring. Part No. 057-004 for more information on utilising DSE modules with electronically controlled engines.

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

Alarm
Shutdown
Fail to start

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency from the Alternator output. Alternatively, a Magnetic Pickup mounted on the flywheel housing can be used for speed detection (This is selected by PC using the DSE Configuration Suite software). Rising oil pressure can also be used to disconnect the starter motor; however, it cannot be used for underspeed or overspeed detection.

NOTE: - If the unit has been configured for CAN Bus speed sensing is via CAN Bus.

After the starter motor has disengaged, the **Safety On** timer is activated, allowing Oil Pressure, High Engine Temperature, Under-speed, Charge Fail and any delayed Auxiliary fault inputs to stabilise without triggering the fault.

Once the engine is running, the **Warm Up** timer, if selected is initiated, allowing the engine to stabilise before accepting the load.

After the **Warm-up** timer has expired then the module will transfer the load from the mains supply to the generator output. It will observe the following sequence.

The Generator will first be instructed to **synchronise** with the mains supply. Once these are matched the **Generator Contact/Breaker** will be instructed to close.

The load will then be **ramped** from the Mains to the appropriate level on the generator.

It will remain in this state whilst in the TEST mode unless the configuration (Advanced Options-Test mode) is configured for Run Mode=Island mode.

If the module has an active *remote start in island mode input* or the internal scheduler has been configured for *island mode* then the **parallel run time** will activate. When this expires, the load will ramp off the mains supply and onto the generator. The **Mains Contactor/Breaker** will be instructed to open

The generator will then supply the requirements of the load.

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

The system will then remain in this mode of operation until a different mode is selected. It is recommended that  mode is used to cancel the TEST mode.

When  mode is selected the **Stop** delay timer is initiated. Once it has expired, the set is synchronised and paralleled with the mains supply. The system remains in this condition until expiry of the **Parallel run** timer. Once this has expired the module will ramp the remaining load from the generator to mains supply. The **Generator Contact/Breaker** will open and the **Cooling** timer is then initiated, allowing the engine a cooling down period off load before shutting down. Once the **Cooling** timer expires the **Fuel Solenoid** is de-energised, bringing the generator to a stop.

During the parallel run the module can be configured to either run at a fixed level output, or to maintain an output in relation to the load level on the mains. For full details of these mode please refer to the manual ‘The Guide to sync and load share Pt1’

NOTE:- When synchronising is enabled, the mains supply is checked before closing any load switching device. If the supply is live, synchronising will take place before any closure takes place.

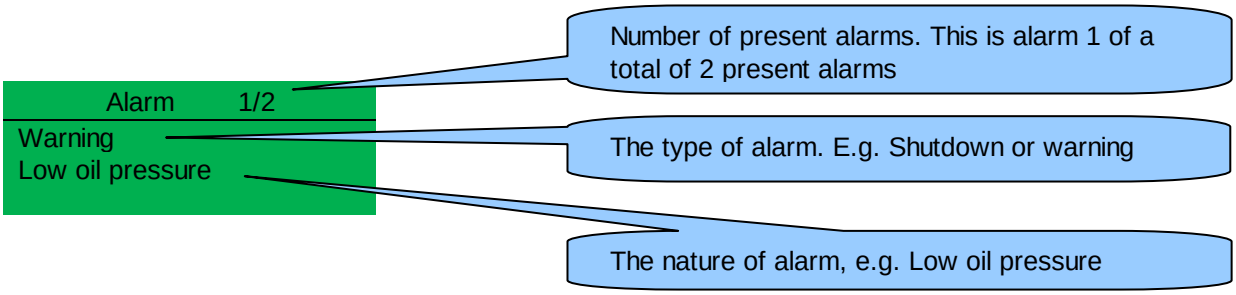
NOTE:- Synchronising can be disabled if the application does not require this function. Contact your genset supplier in the first instance for further details.

7 PROTECTIONS

When an alarm is present, the Audible Alarm will sound and the Common alarm LED if configured will illuminate.

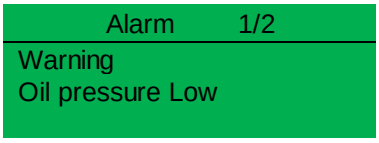
The audible alarm can be silenced by pressing the *Mute button*

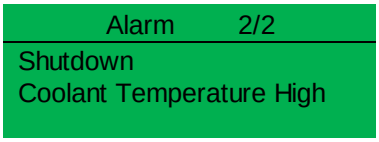
The LCD display will jump from the 'Information page' to display the Alarm Page



The LCD will display multiple alarms E.g. "High Engine Temperature shutdown", "Emergency Stop" and "Low Coolant Warning". These will automatically scroll in the order that they occurred.

In the event of a warning alarm, the LCD will display the appropriate text. If a shutdown then occurs, the module will again display the appropriate text.
Example:-





7.1 PROTECTIONS DISABLED

User configuration is possible to prevent Shutdown / Electrical Trip alarms from stopping the engine. Under such conditions, *Protections Disabled* will appear on the module display to inform the operator of this status.

This feature is provided to assist the system designer in meeting specifications for “Warning only”, “Protections Disabled”, “Run to Destruction”, “War mode” or other similar wording.

When configuring this feature in the PC software, the system designer chooses to make the feature either permanently active, or only active upon operation of an external switch. The system designer provides this switch (not DSE) so its location will vary depending upon manufacturer, however it normally takes the form of a key operated switch to prevent inadvertent activation. Depending upon configuration, a warning alarm may be generated when the switch is operated.

The feature is configurable in the PC configuration software for the module. Writing a configuration to the controller that has “Protections Disabled” configured, results in a warning message appearing on the PC screen for the user to acknowledge before the controller’s configuration is changed. This prevents inadvertent activation of the feature.

7.1.1 INDICATION / WARNING ALARMS

Under Indication or Warning alarms:

- The module operation is unaffected by the *Protections Disabled* feature. See sections entitled *Indications* and *Warnings* elsewhere in this document.

7.1.2 SHUTDOWN / ELECTRICAL TRIP ALARMS

NOTE:- The EMERGENCY STOP input and shutdown alarm continues to operate even when *Protections Disabled* has been activated.

Under Shutdown or Electrical Trip alarm conditions (excluding Emergency Stop):

- The alarm is displayed on the screen as detailed in the section entitled *Shutdown alarm*s elsewhere in this document.
- The set continues to run.
- The load switch maintains its current position (it is not opened if already closed)
- ***Shutdown Blocked*** also appears on the LCD screen to inform the operator that the Protections Disabled feature has blocked the shutdown of the engine under the normally critical fault.
- The ‘shutdown’ alarm is logged by the controllers *Event Log (*if configured to log shutdown alarms) and logs that the Shutdown was prevented.

7.1.3 CAN ALARMS

NOTE:- Please refer to the engine manufacturer's documentation for Can error message information.

CAN alarms are messages sent from the CAN ECU to the DSE controller and displayed as follows in the below tables.

Display	Reason
CAN ECU WARNING	The engine ECU has detected a warning alarm and has informed the DSE module of this situation. The exact error is also indicated on the module's display and action taken depending upon the setting for the DM1 signals
ECU SHUTDOWN	The engine ECU has detected a shutdown alarm and has informed the DSE module of this situation. The exact error is also indicated on the module's display.
ECU DATA FAIL	The module is configured for CAN operation and does not detect data on the engine CAN datalink, the engine shuts down.

DM1 Signals. Messages from the CAN ECU that are configurable within the DSE module for:-
Warning, Electrical Trip, shutdown or None

Display	Reason
Amber Warning	The CAN ECU has detected a Amber warning.
Red Shutdown	The CAN ECU has detected a Red Shutdown.
Malfunction	The CAN ECU has detected a Malfunction message.
Protect	The CAN ECU has detected a Protect message

Advanced CAN alarms Allows configuration of additional can messages from the engine ECU.

Display	Reason
Water in Fuel	The ECU has detected water in the fuel action taken is set by settings in advanced.
After Treatment	The ECU has detected "After Treatment alarm" consult engine manufacturer for details" action taken by DSE controller is set by settings in advanced

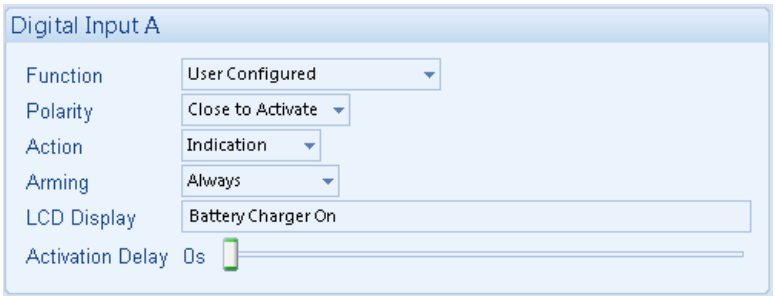
NOTE:- For CAN ECU error code meanings, refer to the ECU documentation provided by the engine manufacturer, or contact the engine manufacturer for further assistance.

7.2 INDICATIONS

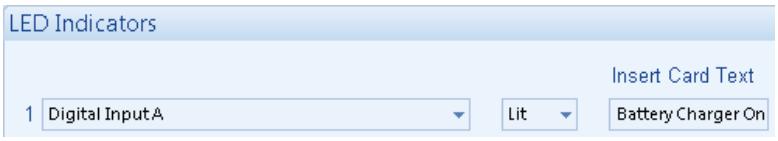
Indications are non-critical and often status conditions. They do not appear on the LCD of the module as a text message. However, an output or LED indicator can be configured to draw the operator's attention to the event.

Example

- Input configured for indication.
- The LCD text will not appear on the module display but can be added in the configuration to remind the system designer what the input is used for.
- As the input is configured to *Indication* there is no alarm generated.



- LED Indicator to make LED1 illuminate when Digital Input A is active.
- The Insert Card Text allows the system designer to print an insert card detailing the LED function.

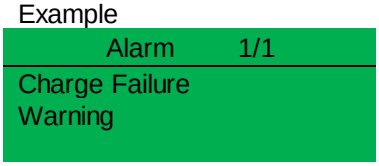


- Sample showing operation of the LED.

7.3 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.

Example



In the event of an alarm the LCD will jump to the alarms page, and scroll through all active warnings and shutdowns.

By default, warning alarms are self-resetting when the fault condition is removed. However enabling 'all warnings are latched' will cause warning alarms to latch until reset manually. This is enabled using the 8600 series configuration suite in conjunction with a compatible PC.

Display	Reason
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.
CHARGE FAILURE	The auxiliary charge alternator voltage is low as measured from the W/L terminal.
BATTERY UNDER VOLTAGE	The DC supply has fallen below the low volts setting level for the duration of the low battery volts timer
BATTERY OVER VOLTAGE	The DC supply has risen above the high volts setting level for the duration of the high battery volts timer
FAIL TO STOP	The module has detected a condition that indicates that the engine is running when it has been instructed to stop. **NOTE:- 'Fail to Stop' could indicate a faulty oil pressure sensor or switch - If the engine is at rest check oil sensor wiring and configuration.**
FUEL USAGE	Indicates the amount of fuel measured by the fuel level sensor is in excess of the *Fuel Usage* alarm settings. This often indicates a fuel leak or potential fuel theft.
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	Auxiliary inputs can be user configured and will display the message as written by the user.
LOW FUEL LEVEL	The level detected by the fuel level sensor is below the low fuel level setting.
CAN ECU ERROR	The engine ECU has detected a warning alarm and has informed the DSE module of this situation. The exact error is also indicated on the module's display.
kW OVERLOAD	The measured Total kW is above the setting of the kW overload warning alarm
EARTH FAULT	The measured Earth Fault Current has been in excess of the earth fault trip and has surpassed the IDMT curve of the Earth Fault alarm.
NEGATIVE PHASE SEQUENCE	Indicates 'out of balance' current loading of the generator. Sometimes also called Negative Sequence Current or Symmetry Fault
MAINTENANCE DUE	Indicates that the maintenance alarm has triggered. A visit is required by the Generator service company.
MAINS REVERSE POWER	if the 8620 detects that the generator is exporting more than the configured limit, the LCD will indicate **'MAINS REVERSE POWER'** and the **COMMON ALARM LED** will flash
LOADING VOLTAGE NOT REACHED	Indicates that the generator voltage is not above the configured *loading voltage.* The generator will not take load when the alarm is present after the safety timer.
LOADING FREQUENCY	Indicates that the generator frequency is not above the configured *loading*

NOT REACHED	*frequency.* The generator will not take load when the alarm is present after the safety timer.
PROTECTIONS DISABLED	Shutdown and electrical trip alarms can be disabled by user configuration. In this case, Protections Disabled will appear on the module display; The alarm text is displayed but the engine will continue to run. This is 'logged' by the module to allow DSE Technical Staff to check if the protections have been disabled on the module at any time. This feature is available from V4 onwards.
LOW OIL PRESSURE	The module detects that the engine oil pressure has fallen below the low oil pressure pre-alarm setting level after the *Safety On* timer has expired.
ENGINE HIGH TEMPERATURE	The module detects that the engine coolant temperature has exceeded the high engine temperature pre-alarm setting level after the *Safety On* timer has expired.
ENGINE LOW TEMPERATURE	The module detects that the engine coolant temperature has fallen below the high engine temperature pre-alarm setting level.
OVERSPEED	The engine speed has risen above the overspeed pre alarm setting
UNDERSPEED	The engine speed has fallen below the underspeed pre alarm setting
GENERATOR OVER FREQUENCY	The generator output frequency has risen above the pre-set pre-alarm setting.
GENERATOR UNDER FREQUENCY	The generator output frequency has fallen below the pre-set pre-alarm setting after the *Safety On* timer has expired.
GENERATOR OVER VOLTAGE	The generator output voltage has risen above the pre-set pre-alarm setting.
GENERATOR UNDER VOLTAGE	The generator output voltage has fallen below the pre-set pre-alarm setting after the *Safety On* timer has expired.
INSUFFICIENT CAPACITY	f the generator 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.
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.
ECU WARNING	The engine ECU has detected a warning alarm and has informed the DSE module of this situation. The exact error is also indicated on the module's display.

If the module is configured for, **CAN** and receives an "error" message from the engine control unit, 'Can ECU Warning" is shown on the module's display and a warning alarm is generated.

7.4 HIGH CURRENT WARNING ALARM

GENERATOR HIGH CURRENT, if the module detects a generator output current in excess of the pre-set trip a warning alarm initiates. The module shows Alarm Warning High Current. If this high current condition continues for an excess period, then the alarm escalates to a shutdown condition. For further details of the high current alarm, please see High Current Shutdown Alarm.

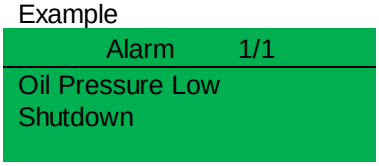
By default, High Current Warning Alarm is self-resetting when the overcurrent condition is removed. However enabling 'all warnings are latched' will cause the alarm to latch until reset manually. This is enabled using the 8600 series configuration suite in conjunction with a compatible PC.

7.5 SHUTDOWNS

NOTE:- Shutdown and Electrical Trip alarms can be disabled by user configuration. See the section entitled *Protections Disabled* elsewhere in this document.

Shutdowns are latching alarms and stop the Generator. Clear the alarm and remove the fault then press Stop/Reset to reset the module.

Example



NOTE:- The alarm condition must be rectified before a reset will take place. If the alarm condition remains, it will not be possible to reset the unit (The exception to this is the Low Oil Pressure alarm and similar 'active from safety on' alarms, as the oil pressure will be low with the engine at rest).

Display	Reason
EARTH FAULT	The measured Earth Fault Current has been in excess of the earth fault trip and has surpassed the IDMT curve of the Earth Fault alarm.
FAIL TO START	The engine has not fired after the preset number of start attempts
EMERGENCY STOP	The emergency stop button has been depressed. This a failsafe (normally closed to battery positive) input and will immediately stop the set should the signal be removed. Removal of the battery positive supply from the emergency stop input will also remove DC supply from the Fuel and Start outputs of the controller. **NOTE:- The Emergency Stop Positive signal must be present otherwise the unit will shutdown.**
LOW OIL PRESSURE	The engine oil pressure has fallen below the low oil pressure trip setting level after the *Safety On* timer has expired.
ENGINE HIGH TEMPERATURE	The engine coolant temperature has exceeded the high engine temperature trip setting level after the *Safety On* timer has expired.
FUEL USAGE	Indicates the amount of fuel measured by the fuel level sensor is in excess of the *Fuel Usage* alarm settings. This often indicates a fuel leak or potential fuel theft.
PHASE ROTATION	The phase rotation is measured as being different to the configured direction.
OVERSPEED	The engine speed has exceeded the pre-set trip **NOTE:-During the start-up sequence, the overspeed trip logic can be configured to allow an extra trip level margin. This is used to prevent nuisance tripping on start-up - Refer to the 8000 series configuration software manual under heading 'Overspeed Overshoot' for details.**

UNDERSPEED	The engine speed has fallen below the pre-set trip after the ***Safety On*** timer has expired.

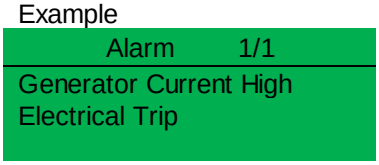
Display	Reason
GENERATOR OVER FREQUENCY	The generator output frequency has risen above the preset level
GENERATOR UNDER FREQUENCY	The generator output frequency has fallen below the preset level
GENERATOR OVER VOLTAGE	The generator output voltage has risen above the preset level
GENERATOR UNDER VOLTAGE	The generator output voltage has fallen below the preset level
OIL PRESSURE SENSOR OPEN CIRCUIT	The oil pressure sensor is detected as not being present (open circuit)
AUXILIARY INPUTS	An active auxiliary input configured as a shutdown will cause the engine to shut down. The display shows the text as configured by the user.
LOSS OF SPEED SIGNAL	The speed signal from the magnetic pickup is not being received by the DSE controller.
ECU DATA FAIL	The module is configured for CAN operation and does not detect data on the engine Can datalink, the engine shuts down.
ECU SHUTDOWN	The engine ECU has detected a shutdown alarm and has informed the DSE module of this situation. The exact error is also indicated on the module's display.
kW OVERLOAD	The measured Total kW is above the setting of the kW overload shutdown alarm
NEGATIVE PHASE SEQUENCE (DSE7000 series V2.0 or above only)	Indicates 'out of balance' current loading of the generator. Sometimes also called Negative Sequence Current or Symmetry Fault
MAINTENANCE DUE (DSE7000 series V2.1 or above only)	Indicates that the maintenance alarm has triggered. A visit is required by the Generator service company.
GENERATOR HIGH CURRENT	A High Current condition has continued for an excess period, then the alarm escalates to either a shutdown or electrical trip condition (depending upon module configuration). For further details of the high current alarm, please see High Current Shutdown / Electrical Trip Alarm.
LOADING VOLTAGE NOT REACHED	Indicates that the generator voltage is not above the configured loading voltage after the safety timer. The generator will shutdown.
LOADING FREQUENCY NOT REACHED	Indicates that the generator frequency is not above the configured loading frequency after the safety timer. The generator will shutdown.
PROTECTIONS DISABLED	Shutdown and electrical trip alarms can be disabled by user configuration. In this case, Protections Disabled will appear on the module display; The alarm text will be displayed but the engine will continue to run. This is 'logged' by the module to allow DSE Technical Staff to check if the protections have been disabled on the module at any time. This feature is available from V4 onwards.

7.6 ELECTRICAL TRIPS

NOTE:- Shutdown and Electrical Trip alarms can be disabled by user configuration. See the section entitled *Protections Disabled* elsewhere in this document.

Electrical trips are latching and stop the Generator but in a controlled manner. On initiation of the electrical trip condition the module will de-energise the **'Close Generator'** Output to remove the load from the generator. Once this has occurred the module will start the Cooling timer and allow the engine to cool off-load before shutting down the engine. The alarm must be accepted and cleared, and the fault removed to reset the module.

Example



Electrical trips are latching alarms and stop the Generator. Remove the fault then press Stop/Reset to reset the module.

Display	Reason
GENERATOR HIGH CURRENT	If a generator output in excess of the high current alarm point, a warning alarm occurs. If this high current condition continues for an excess period, then the alarm escalates to either a shutdown or electrical trip condition (depending upon module configuration). For further details of the high current alarm, please see High Current Shutdown / Electrical Trip Alarm.
AUXILIARY INPUTS	If an auxiliary input configured as an electrical trip is active, the user configured message shows on the display.
kW OVERLOAD	The measured Total kW is above the setting of the kW overload Electrical Trip alarm
EARTH FAULT	The measured Earth Current is above the setting of the Earth fault alarm.
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
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.
NEGATIVE PHASE SEQUENCE	Indicates 'out of balance' current loading of the generator. Sometimes also called Negative Sequence Current or Symmetry Fault
FUEL USAGE	Indicates the amount of fuel used is in excess of the *Fuel Usage* alarm settings. This often indicates a fuel leak or potential fuel theft.
LOADING VOLTAGE NOT REACHED	Indicates that the generator voltage is not above the configured loading voltage after the safety timer. The generator will shutdown.
LOADING FREQUENCY NOT REACHED	Indicates that the generator frequency is not above the configured loading frequency after the safety timer. The generator will shutdown.
PROTECTIONS DISABLED	Shutdown and electrical trip alarms is disabled by user configuration. In this case, Protections Disabled will appear on the module display; The alarm text is displayed but the engine will continue to run. This is 'logged' by the module to allow DSE Technical Staff to check if the protections have been disabled on the module at any time. This feature is available from V4 onwards.
GENERATOR UNDER FREQUENCY	The generator output frequency has fallen below the preset level

GENERATOR UNDER VOLTAGE	The generator output voltage has fallen below the preset level
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.
UNDERSPEED	The engine speed has fallen below the underspeed setting

7.7 HIGH CURRENT SHUTDOWN / ELECTRICAL TRIP ALARM

The overcurrent alarm combines a simple warning trip level with a fully functioning IDMT curve for thermal protection.

7.7.1 IMMEDIATE WARNING

If the *Immediate Warning* is enabled, the DSE8600 Series controller generates a *warning alarm* as soon as the *Trip* level is reached. The alarm automatically resets once the generator loading current falls below the *Trip* level (unless *All Warnings are latched* is enabled). For further advice, consult your generator supplier.

7.7.2 IDMT ALARM

If the *IDMT Alarm* is enabled, the DSE8600 Series controller begins following the IDMT 'curve' when the *trip* level is passed.

If the *Trip* is surpassed for an excess amount of time the *IDMT Alarm* triggers (*Shutdown* or *Electric trip* as selected in *Action*).

High current shutdown is a latching alarm and stops the Generator.
Remove the fault then press Stop/Reset to reset the module.

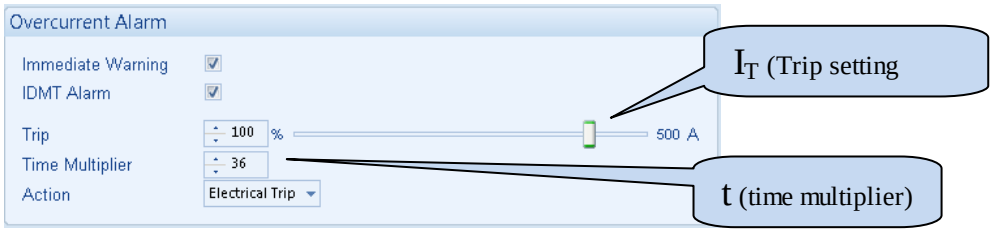
High current electrical trip is a latching alarm and removes the generator from the load, before stopping the Generator after the off load *cooling* timer.
Remove the fault then press Stop/Reset to reset the module.

The higher the overload, the faster the trip. The speed of the trip is dependent upon the fixed formula:

$$T = t / ((I_A / I_T) - 1)^2$$

Where: T is the tripping time in seconds
I_A is the actual current of the most highly loaded line (L1 or L2 or L3)
I_T is the delayed over-current trip point
t is the time multiplier setting and also represents the tripping time in seconds at twice full load (when $I_A / I_T = 2$).

Factory settings for the *IDMT Alarm* when used on a brushless alternator are as follows (screen capture from the DSE Configuration Suite PC software :

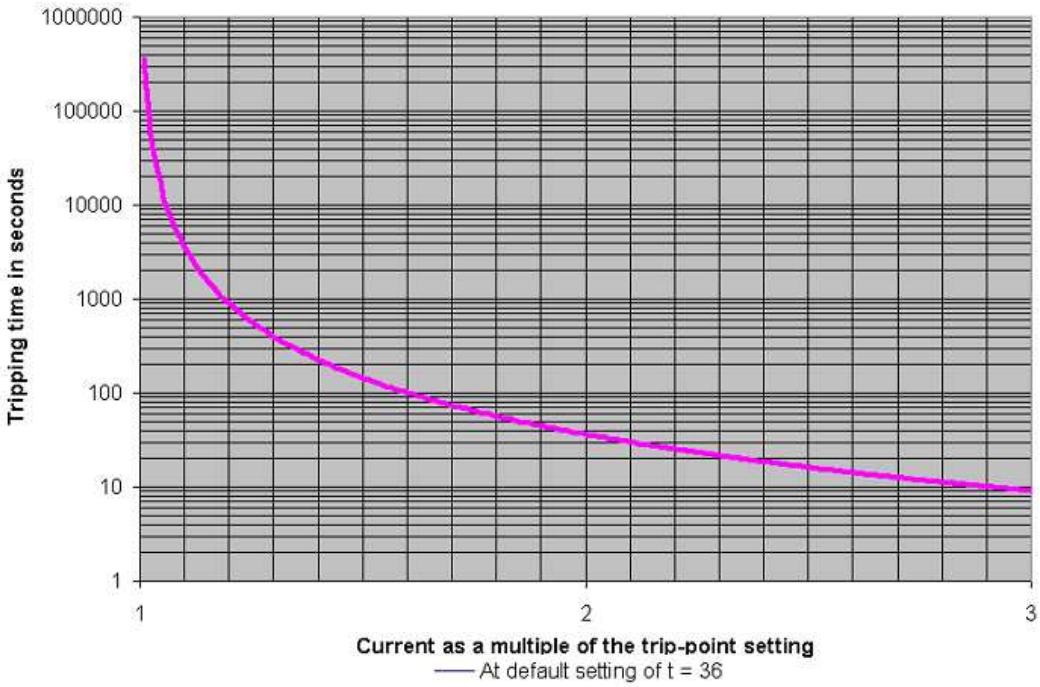


These settings provide for normal running of the generator up to 100% full load. If full load is surpassed, the *Immediate Warning* alarm is triggered, the set continues to run.
The effect of an overload on the generator is that the alternator windings begin to overheat; the aim of the *IDMT alarm* is to prevent the windings being overload (heated) too much. The amount of time that the set can be safely overloaded is governed by how high the overload condition is.

With typical settings as above, the tripping curve is followed as shown below.

This allows for overload of the set to the limits of the *Typical Brushless Alternator* whereby 110% overload is permitted for 1 hour.

If the set load reduces, the controller then *follows* a cooling curve. This means that a second overload condition may trip much sooner than the first as the controller *knows* if the windings have not cooled sufficiently.



For further details on the *Thermal damage curve* of your alternator, you are referred to your alternator manufacturer and generator supplier.

7.8 EARTH FAULT SHUTDOWN / ELECTRICAL TRIP ALARM

When the module is suitably connected using the 'Earth Fault CT'. The module measures Earth Fault and can optionally be configured to generate an alarm condition (shutdown or electrical trip) when a specified level is surpassed.

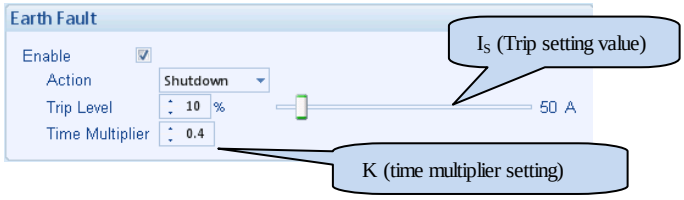
If the *Earth Fault alarm* is enabled, the controller begins following the IDMT 'curve'. If the *Trip* is surpassed for an excess amount of time the Alarm triggers (*Shutdown* or *Electric trip* as selected in *Action*).

The higher the Earth Fault, the faster the trip. The speed of the trip is dependent upon the fixed formula :

$$\mathbf{T = K \times 0.14 / ((I / I_s)^{0.02} - 1)}$$

Where: T is the tripping time in seconds (accurate to +/- 5% or +/- 50ms (whichever is the greater)
K is the time multiplier setting
I is the actual earth current measured

I_S is the trip setting value



The settings shown in the example above are a screen capture of the DSE factory settings, taken from the DSE Configuration Suite software.

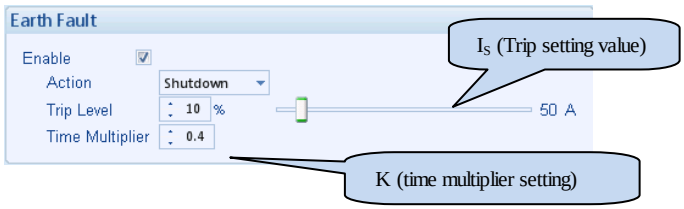
7.9 SHORT CIRCUIT ALARM

If the *Short Circuit alarm* is enabled, the DSE8620 controller begins following the IDMT 'curve'. If the *Trip* is surpassed for an excess amount of time the Alarm triggers (*Shutdown* or *Electrical trip* as selected in *Action*).

The higher the Short Circuit, the faster the trip. The speed of the trip is dependent upon the fixed formula :

$$\mathbf{T = K \times 0.14 / ((I / I_s)^{0.02} - 1)}$$

Where: T is the tripping time in seconds (accurate to +/- 5% or +/- 50ms (whichever is the greater)
K is the time multiplier setting
I is the actual current measured
Is is the trip setting value



The settings shown in the example above are a screen capture of the DSE factory settings, taken from the DSE Configuration Suite software.

7.10 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 DSE8620 software manual.

7.10.1 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.

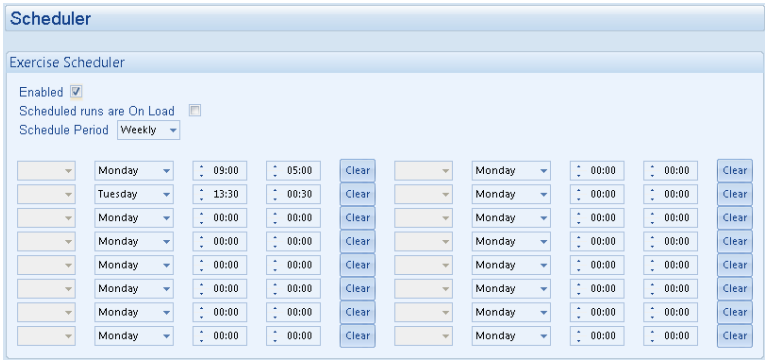
8 SCHEDULER

DSE8600 Series contains an inbuilt exercise run scheduler, capable of automatically starting and stopping the set. Up to 16 scheduled start/stop sequences can be configured to repeat on a 7-day or 28-day cycle.
Scheduled runs may be on load or off load depending upon module configuration.

Example

Screen capture from DSE Configuration Suite Software showing the configuration of the Exercise Scheduler.

In this example the set will start at 09:00 on Monday and run for 5 hours, then start at 13:30 on Tuesday and run for 30 minutes.



8.1.1 STOP MODE

- Scheduled runs will not occur when the module is in STOP/RESET mode.

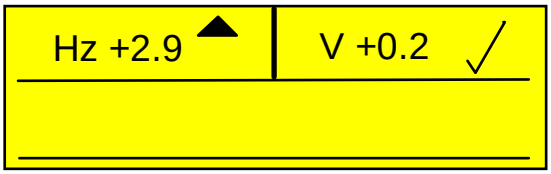
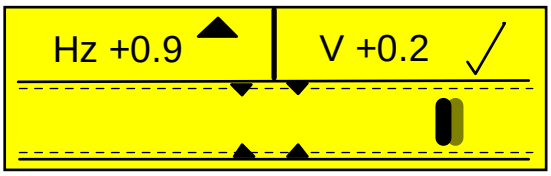
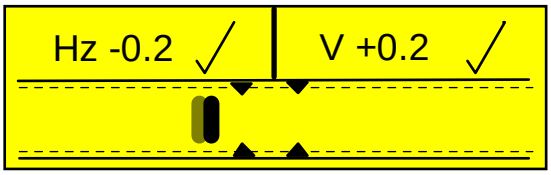
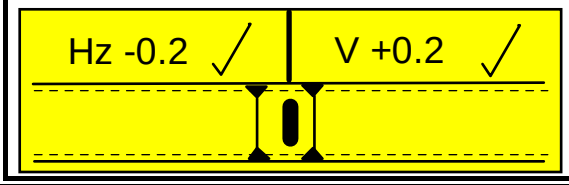
8.1.2 MANUAL MODE

- Scheduled runs will not occur when the module is in MANUAL mode.
- Activation of a Scheduled Run ‘On Load’ when the module is operating OFF LOAD in Manual mode will have no effect, the set continues to run OFF LOAD

8.1.3 AUTO MODE

- Scheduled runs will operate ONLY if the module is in AUTO mode with no Shutdown or Electrical Trip alarm present.
- If the module is in STOP or MANUAL mode when a scheduled run begins, the engine will not be started. However, if the module is moved into AUTO mode during a scheduled run, the engine will be called to start.
- Depending upon configuration by the system designer, an external input can be used to inhibit a scheduled run.
- If the engine is running OFF LOAD in AUTO mode and a scheduled run configured to ‘On Load’ begins, the set is placed ON LOAD for the duration of the Schedule.

9 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.

10 COMMISSIONING

10.1 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.

10.1.1 SCREEN 1

L – L	0V	kW	0.0	Average L-L Voltage and total kW
Amps	0A	kVAr	0.0	Load on the set(s) and total kVAr
Pf	-----	kW	0.0%	Ramp level and % of full load kW
Gov	0.0%	Avr	0.0%	Gov and Avr % of Drive

10.1.2 SCREEN 2

Tgt	0.0%	kW	0.0%	Target % and total kW
Tgt	0.0%	kVAr	0.0%	Target % and total kVAr
Pf	-----	Ramp	5.0%	Ramp level and % of full load kW
Gov	0.0%	Avr	0.0%	Gov and Avr % of Drive

10.1.3 SCREEN 3

GL1	0A	M L1	0A	Generator L1 and Mains L1
Pf	-----	Pf	----	Generator Power factor and Mains Power factor
kW	0.0	kW	0.0	Generator kW and Mains kW
kVAr	0.0	kVAr	0.0	Generator kVAr and Mains kW

10.1.4 SCREEN 4

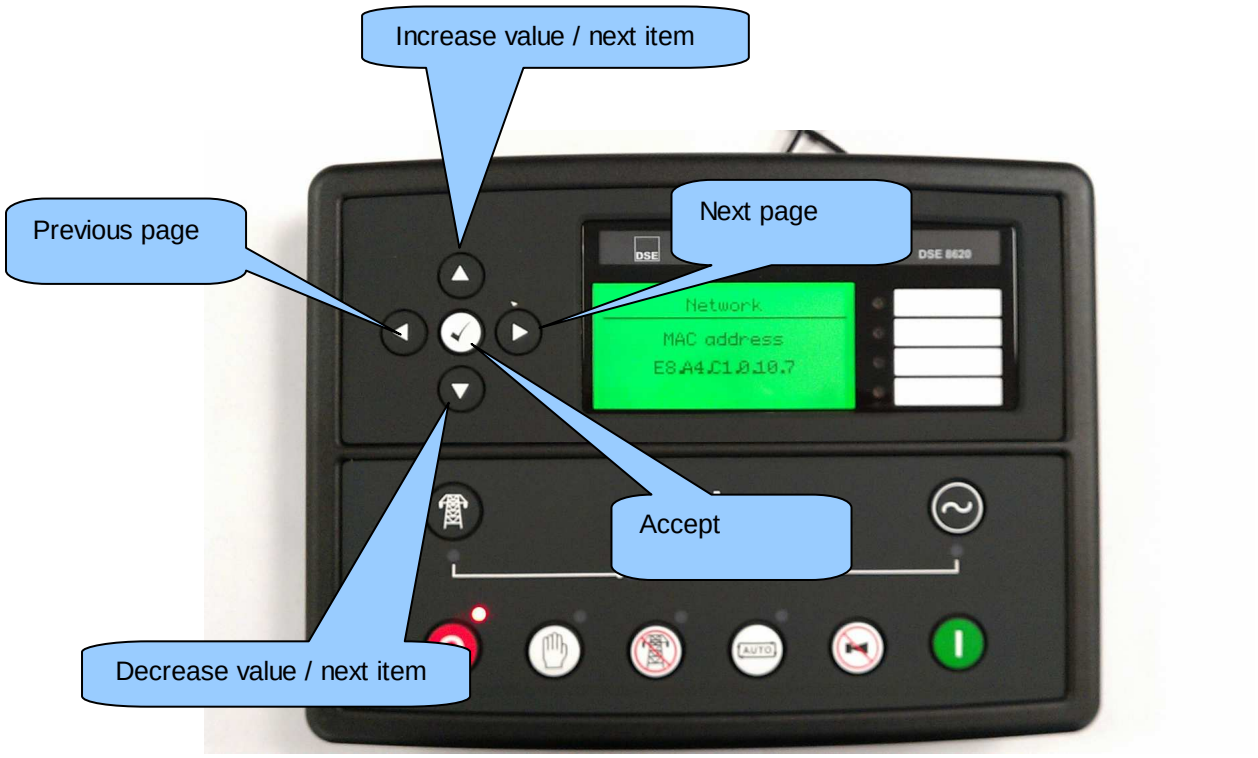
MTgt	0.0%	kW	0.0%	Mains Target and mains actual kW
MTgt	00.0%	kVAr	0.0%	Mains Target and mains actual kW
Pf	-----	Ramp	5.0%	Power factor Ramp rate
Gov	0.0%	Avr	0.0%	Governor Avr

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

11 FRONT PANEL CONFIGURATION

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

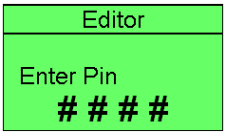
Use the module's navigation buttons to traverse the menu and make value changes to the parameters:



11.1 ACCESSING THE MAIN FRONT PANEL CONFIGURATION EDITOR

Ensure the engine is at rest and the module is in STOP mode by pressing the Stop/Reset button.

Press the Stop/Reset and Info buttons simultaneously.
If a module security PIN has been set, the PIN number request is then shown :



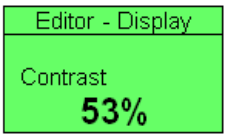
Press , the first '#' changes to '0'. Press (up or down) to adjust it to the correct value.

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 :



NOTE: The PIN number is not set by DSE when the module leaves the factory. If the module has a PIN code set, this has been affected by your generator supplier who should be contacted if you require the code. If the code has been 'lost' or 'forgotten', the module must be returned to the DSE factory to have the module's code removed. A charge will be made for this procedure.
NB - This procedure cannot be performed away from the DSE factory.

11.1.1 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 select the parameter you wish to view/change within the currently selected section.

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 and hold the  or ✓ button.

⚠NOTE: - The editor automatically exits 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 86xx series PC configuration software. Please contact us for further details.

11.2 ADJUSTABLE PARAMETERS

Front Panel Configuration Editor. For descriptions of the parameters, you are referred to The DSE8600 series Configuration Suite Manual, DSE Part 057-119.

Section	Parameter as shown on display	Values
Display	Contrast	53%
	Language	English, others.
	Current Date and Time	*hh:mm*
Timers	LCD Page Timer	5m
	Scroll Delay	*2s*
	Engine Pre Heat Timer	0s
	Engine Crank Duration	10s
	Engine Crank Rest Time	10s
	Engine Safety On Delay	10s
	Engine Smoke Limiting	0s
	Engine Smoke Limiting Off	0s
	Engine Warm Up Time	0s
	Engine Cool Down Time	1m
	Engine Speed Overshoot Delay	0s
	Engine Failed To Stop	30s
	Battery Under Voltage Warning Delay	1m
	Battery Over Voltage Warning Delay	1m
	Return Delay	30s
	Generator Transient Delay	0s
Mains	Mains Transient Delay	2s
	Mains transfer time	0.7s
	Mains Under Voltage Alarm	184V
	Mains Over Voltage Alarm	277V
	Mains Under Frequency Alarm	45Hz
	Mains over Frequency Alarm	55Hz
	Mains Transient Delay	2s
	CT Primary	600A
	CT Secondary	5A
	Mains KW Rating	345kW
	Mains KVar Rating	258kW
Generator	Under Voltage Shutdown	184v
	Under Voltage Pre-Alarm	196v
	Nominal Voltage	230v
	Over Voltage Pre-Alarm	265v
	Over Voltage Shutdown	277v
	Under Frequency Shutdown	40Hz
	Under Frequency Pre-Alarm	42Hz
	Nominal frequency	50Hz
	Over Frequency Pre-Alarm	54Hz
	Over Frequency Shutdown	57Hz
	Full Load Rating	500A
	kW Overload Trip	100%
	Delayed Over current	Active
	Delayed Over Current	100%
	AC System	3 Phase 4 Wire
	CT Primary	600A Power Cycle After Exit
	CT Secondary	5A Power Cycle After Exit
	Short Circuit Trip	200%
	Earth CT Primary	500A
	Earth Fault Trip	Active
	Earth Fault Trip	10%
	Transient Delay	0s
	Gen Reverse Power Delay	2s
	Full kW rating	345kW
	Full kVAr rating	258kVAr
	Load Ramp Rate	3%
	Gen Reverse Power	35kW
	Insufficient Capacity Delay	1s
	Insufficient Capacity action	None
	Reactive Load CTL mode	VAr fixed export
	Load Parallel Power	50%
	Load Power Factor	1.00pf 0 KVAr 0%
Engine	Oil Pressure Low shutdown	1.03bar
	Oil Pressure Low Pre-Alarm	1.24bar
	Coolant Temp High Pre-Alarm	90°C
	Coolant Temp High Electrical Trip	92°C (When Enabled)
	Coolant Temp High Shutdown	95°C
	Start Delay Off load	5s
	Start Delay on load	5s
	Start Delay Telemetry	5s
	Pre Heat Timer	0s
	Crank Duration	10s
	Crank rest Time	10s
	Safety On Delay	10s
	Smoke Limiting	0s
	Smoke limiting off	0s
	Warm Up Time	0s
	Cool Down Time	1m
	Speed Overshoot Delay	0s
	Speed Overshoot	0%
	Fail To Stop Delay	30s
	Battery Under Volts Warning	Active
	Battery Under Volts Warning Delay	1m
	Charge Alternator Failure Shutdown	5s (When Enabled)
	Charge Alternator Failure Shutdown	Active, Inactive. Electronic engines only when droop is enabled.
	Charge Alternator Shutdown Delay	Active, Inactive
	Droop %	Active , Inactive (Only Available When Scheduler Is Active)
Scheduler	Scheduler	Weekly, Monthly (Only Available When Scheduler Is Active)
	Schedule On Load	Active , Inactive (Only Available When Scheduler Is Active)
	Schedule Period	Weekly, Monthly (Only Available When Scheduler Is Active)

	Schedule Time & Date Selection (1-16)	Press ✓ to begin editing then ◄► or ▲▼ when selecting the different parameters in the scheduler.

11.3 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.

11.3.1 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 select the parameter you wish to view/change within the currently selected section.

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 and hold the ✓ button.

11.3.2 ADJUSTABLE PARAMETERS (RUNNING EDITOR)

Running Editor (Factory default settings are shown in bold italicised text)

Section	Parameter as shown on display	Factory Setting
DISPLAY	Contrast	53%
	Language	English
	Load Demand priority	**(1)**
	Load Power factor	0-100% **(0)**
	Load parallel power	0-100% **(50)**
	Enable commissioning screens	Inactive, Active
	Override starting alarms	Inactive, Active
	Voltage adjust (manual mode only engine running breaker open)	0-100 % **(0)**
	Frequency adjust (manual mode only engine running breaker open)	0-100 % **(0)**
	Enable mains decoupling test mode (Stop mode only)	Inactive Active

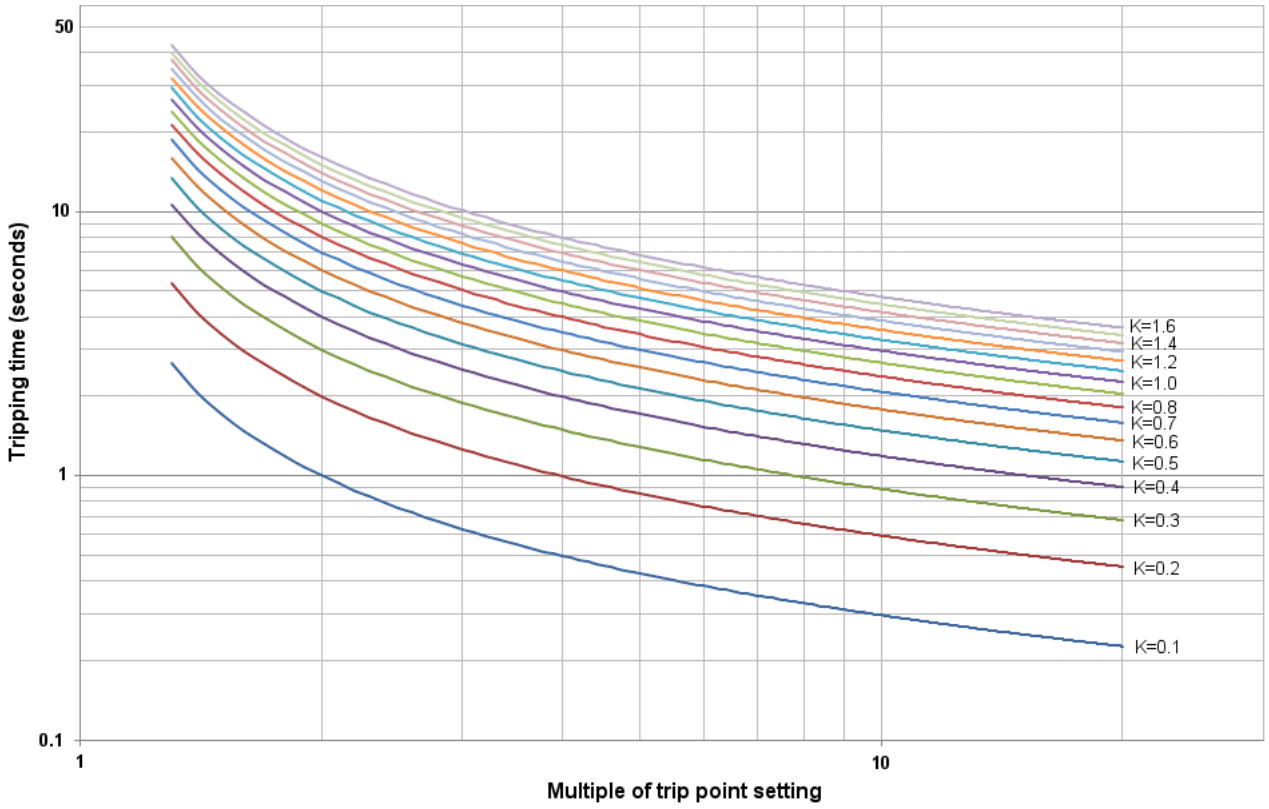
12 FAULT FINDING

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.

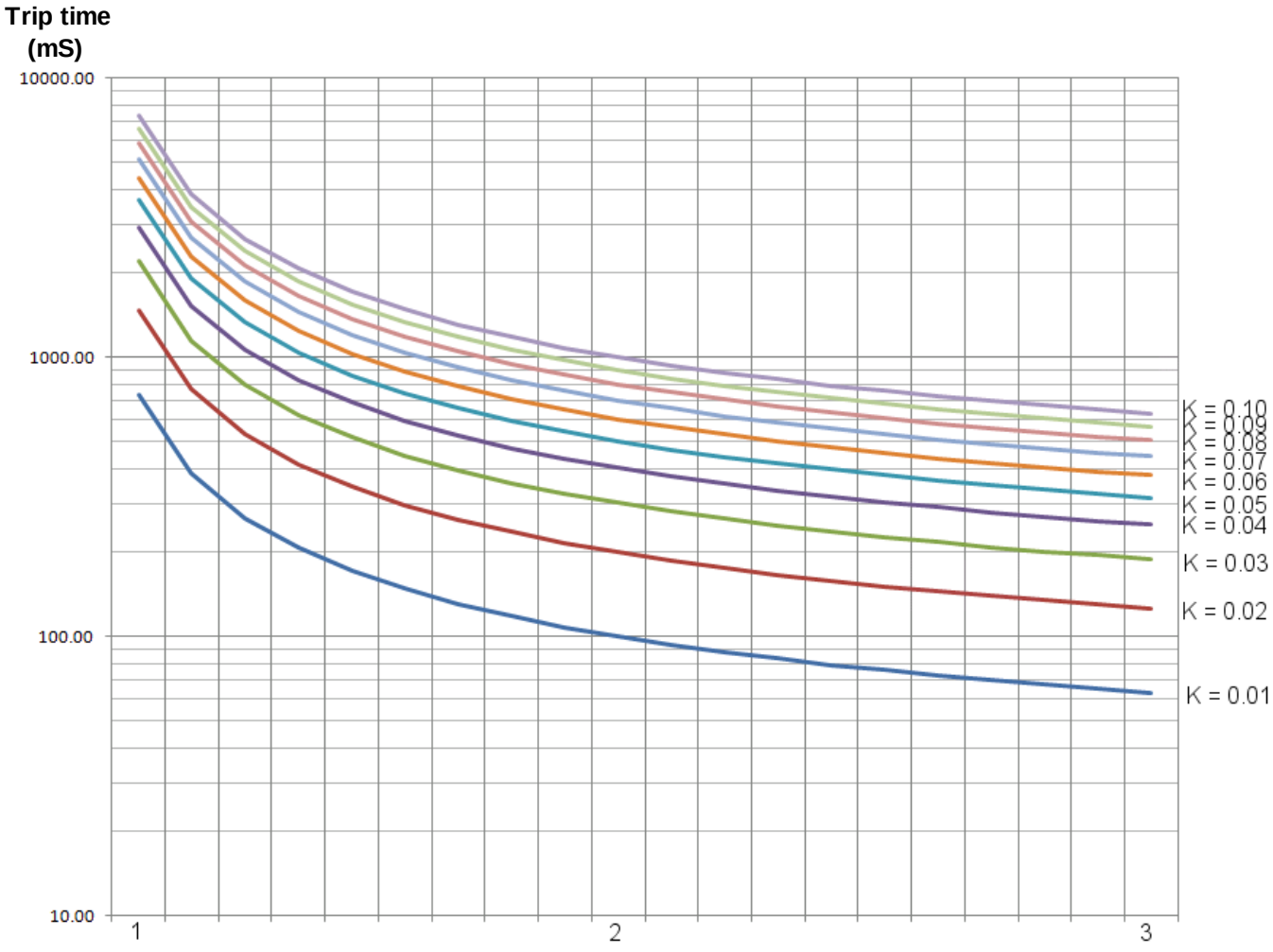
12.1.1 EARTH FAULT TRIPPING CURVES

NOTE: DSE Factory setting is time multiplier (K) = 0.4



12.1.2 SHORT CIRCUIT TRIPPING CURVES

NOTE: DSE Factory setting is time multiplier (K) = 0.01



12.2 COMMUNICATIONS OPTION

12.2.1 DESCRIPTION

The 86xx series configuration software allows the 8620 controller to communicate with a PC. The computer can be connected to the module either directly, via a modem (RS232) 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.

12.2.2 CONTROLLER TO PC (DIRECT) CONNECTION

To connect a 8620 to a modem the following items are required: -

- Any 8620 Module
- DSE Configuration Suite software (Available from the www.deepseaplc.com Website).

12.2.3 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 (8620 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 8620 Module receives a query it will respond by either supplying the requested register data or performing the requested action. A slave device (the 8620 module) will never initiate communications on the Modbus™ link. The 8620 can only be configured as a slave device. The Master can only query individual slaves. Refer to the Modbus™ protocol document for more details.

12.3 IEEE C37.2 STANDARD ELECTRICAL POWER SYSTEM FUNCTION NUMBERS

The DSE 8620 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 8620 is designated as *11 - Multifunction device* and includes the following protections and functions:

Device		Description
2	time delay starting or closing relay	A device that functions to give a desired amount of time delay before or after any point of operation in a switching sequence or protective relay system, except as specifically provided by device functions 48, 62, 79, and 82.
3	checking or interlocking relay	A device that operates in response to the position of one or more other devices or predetermined conditions in a piece of equipment or circuit, to allow an operating sequence to proceed, or to stop, or to provide a check of the position of these devices or conditions for any purpose.
5	stopping device	A control device used primarily to shut down equipment and hold it out of operation. (This device may be manually or electrically actuated, but it excludes the function of electrical lockout [see device function 86] on abnormal conditions.)
12	overspeed device	A device, usually direct connected, that operates on machine overspeed.
14	underspeed device	A device that functions when the speed of a machine falls below a predetermined value.
15	speed or frequency matching device	A device that functions to match and hold the speed or frequency of a machine or a system equal to, or approximately equal to, that of another machine, source, or system.
18	accelerating or decelerating device	A device that is used to close or cause the closing of circuits that are used to increase or decrease the speed of a machine.
25	synchronizing or synchronism-check relay	A synchronizing device produces an output that causes closure at zero-phase angle difference between two circuits. It may or may not include voltage and speed control. A synchronism-check relay permits the paralleling of two circuits that are within prescribed limits of voltage magnitude, phase angle, and frequency.
27	undervoltage relay	A device that operates when its input voltage is less than a predetermined value.
30	annunciator relay	A non-automatically reset device that gives a number of separate visual indications upon the functioning of protective devices and that may also be arranged to perform a lockout function.

31	separate excitation device	A device that connects a circuit, such as the shunt field of a synchronous converter, to a source of separate excitation during the starting sequence.
32	directional power relay	A device that operates on a predetermined value of power flow in a given direction such as reverse power flow resulting from the motoring of a generator upon loss of its prime mover.
46	reverse-phase or phase-balance current relay	A device in a polyphase circuit that operates when the polyphase currents are of reverse-phase sequence or when the polyphase currents are unbalanced or when the negative phase-sequence current exceeds a preset value.
48	incomplete sequence relay	A device that generally returns the equipment to the normal or off position and locks it out if the normal starting, operating, or stopping sequence is not properly completed within a predetermined time.
50	instantaneous overcurrent relay	A device that operates with no intentional time delay when the current exceeds a preset value.
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.

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.

13 COMMISSIONING

13.1.1 PRE-COMMISSIONING

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

10.1. The unit is adequately cooled and all the wiring to the module is of a standard and rating compatible with the system. Check all mechanical parts are fitted correctly and that all electrical connections (including earths) are sound.

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

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

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

10.4. Make all checks on the engine and alternator as detailed by their respective manufacturer documentation.

10.5. Check all other parts in the system according to the manufacturer documentation.

10.6. Thoroughly review the configuration of the DSE controller and check that all parameters meet the requirements of your system.

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

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

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

10.10. Fully commission the engine/alternator and any other parts in the system as detailed in the respective manufacturer documentation. This includes load bank testing, load acceptance, breaker control and more.

10.11. When building a synchronising system, follow the DSE "4 Steps To Synchronising" as detailed elsewhere in this document before attempting to parallel the set with another supply.

10.12. Set the modules internal clock/calendar to ensure correct operation of the scheduler and event logging functions. For details of this procedure see section entitled *Front Panel Configuration – Editing the date and time.*

10.13. If despite repeated checking of the connections between the **8600** series controller and the customer's system, satisfactory operation cannot be achieved, then the customer is requested to contact the factory for further advice on:-

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

Website : www.deepseaplc.com

14 FAULT FINDING

SYMPTOM	POSSIBLE REMEDY
Unit is inoperative Read/Write configuration does not operate	Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse.
Unit shuts down	Check DC supply voltage is not above 35 Volts or below 9 Volts Check the operating temperature is not above 70°C. Check the DC fuse.
Unit locks out on Emergency Stop	If no Emergency Stop Switch is fitted, ensure that a DC positive signal is connected to the Emergency Stop input. Check emergency stop switch is functioning correctly. Check Wiring is not open circuit.
Intermittent Magnetic Pick-up sensor fault	Ensure that Magnetic pick-up screen only connects to earth at one end, if connected at both ends, this enables the screen to act as an aerial and will pick up random voltages. Check pickup is correct distance from the flywheel teeth.
Low oil Pressure fault operates after engine has fired	Check engine oil pressure. Check oil pressure switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sensor is compatible with the 73x0 Module and is correctly configured.
High engine temperature fault operates after engine has fired.	Check engine temperature. Check switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sensor is compatible with the 8600 series module.
Shutdown fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Warning fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Fail to Start is activated after pre-set number of attempts to start	Check wiring of fuel solenoid. Check fuel. Check battery supply. Check battery supply is present on the Fuel output of the module. Check the speed-sensing signal is present on the 8600 series module's inputs. Refer to engine manual.
Continuous starting of generator when in **AUTO**	Check that there is no signal present on the "Remote Start" input. Check configured polarity is correct.
Generator fails to start on receipt of Remote Start signal.	Check Start Delay timer has timed out. Check signal is on "Remote Start" input. Confirm correct configuration of input Check that the oil pressure switch or sensor is indicating low oil pressure to the controller. Depending upon configuration, then set will not start if oil pressure is not low.
Pre-heat inoperative	Check wiring to engine heater plugs. Check battery supply. Check battery supply is present on the Pre-heat output of module. Check pre-heat configuration is correct.
Starter motor inoperative	Check wiring to starter solenoid. Check battery supply. Check battery supply is present on the Starter output of module. Ensure that the Emergency Stop input is at Positive. Ensure oil pressure switch or sensor is indicating the "low oil pressure" state to the 8610 series controller.
Engine runs but generator will not take load	Check Warm up timer has timed out. Ensure generator load inhibit signal is not present on the module inputs. Check connections to the switching device. Note that the set will not take load in manual mode unless there is an active remote start on load signal.
Synchronising or load sharing is not operating satisfactorily	Follow the DSE "4 Steps To Synchronising" as detailed in the following section.

SYMPTOM	POSSIBLE REMEDY
Incorrect reading on Engine gauges Fail to stop alarm when engine is at rest	Check engine is operating correctly. Check sensor and wiring paying particular attention to the wiring to terminal 47 (refer to appendix). Check that sensor is compatible with the 8600 series module and that the module configuration is suited to the sensor.
Module appears to 'revert' to an earlier configuration	When editing a configuration using the PC software it is vital that the configuration is first 'read' from the controller before editing it. This edited configuration must then be "written" back to the controller for the changes to take effect. When editing a configuration using the fascia editor, be sure to press the Accept button to save the change before moving to another item or exiting the fascia editor
Set will not take load	Ensure the generator available LED is lit Check that the output configuration is correct to drive the load switch device and that all connections are correct. Remember that the set will not take load in manual mode unless a remote start on load input is present or the close generator button is pressed.
Inaccurate generator measurements on controller display	Check that the CT primary, CT secondary and VT ratio settings are correct for the application. Check that the CTs are wired correctly with regards to the direction of current flow (p1,p2 and s1,s2) and additionally ensure that CTs are connected to the correct phase (errors will occur if CT1 is connected to phase 2). Remember to consider the power factor. Ie (kW = kVA x power factor) The 8600 series controller is true RMS measuring so gives more accurate display when compared with an 'averaging' meter such as an analogue panel meter or some lower specified digital multimeters. Accuracy of the controller is better than 1% of full scale. I.e. Gen volts full scale is 333V ph-n so accuracy is ±3.33V (1% of 333V).

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

15 DSE 4 STEPS TO SUCCESSFUL SYNCHRONISING

Synchronising and load sharing is often considered to be a complex subject. In fact, it is very simple when broken down into smaller steps.

After following the *Commissioning* section of this manual, the *4 Steps* **must** be followed before any parallel operation is attempted.

The following information is a *short form* guide only, intended as a memory jogger once the steps are fully understood.
The full video presentation of the *4 Steps* is available on the DSE website. www.deepseaplc.com. Registration on the website is required. This is free of charge, along with all other downloads.

This page is also available as a training document (handout style) from DSE. Part Number 056-001 Four Steps to Synchronising – included on the DSE website.

15.1 CONTROL

Check the control of the engine is working:

- Control of AVR
- Control of Governor
- Direction of Control

Failure of the above steps will result in poor control of the governor/AVR leading to problems during synchronising and/or load sharing if not corrected.

15.2 METERING

- CTs on the Right Phase
- CTs in the Right Direction

Failure of the above steps will result in incorrect power factor and kW calculations leading to problems load sharing if not corrected.

15.3 COMMUNICATIONS

- All Modules Connected on the MSC Link
- Re-Calibrate, Sync + Load Control, Multi-Set
- Remove One MSC Plug

Failure of the above steps will result in the controllers being unable to communicate leading to problems during synchronising and/or load sharing if not corrected.

15.4 SYNC CHECKS

- Use the Built in Sync Scope to Determine Correct Phase Wiring
- Phase Checks across the Breaker.

Failure of the above steps will result in serious damage to the system (breakers, bus bars, alternators, engines etc)

16 MAINTENANCE, SPARES, REPAIR AND SERVICING

The DSE8600 Series controller is *Fit and Forget*. As such, there are no user serviceable parts within the controller.
In the case of malfunction, you should contact your original equipment manufacturer (OEM).

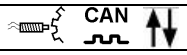
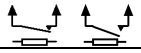
16.1 PURCHASING ADDITIONAL CONNECTOR PLUGS FROM DSE

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

16.1.1.1 Pack of plugs

Module type	Plug Pack Part Number
DSE8620	100-400-86

16.1.1.2 Individual plugs

8600 series terminal designation	Plug description	Part No.
1-13 	13 way 5.08mm	007-166
15-19 	5 way 5.08mm	007-445
22-38  **MSC GOV AVR**	17 way 5.08mm	007-452
39-46  **V1**	8 way 7.62mm	007-454
47-50 **V2**	4 way 7.62mm	007-171
51-57 	7 way 5.08mm	007-447
60-70 	11 way 5.08mm	007-451
	PC Configuration interface lead (USB type A – USB type B)	016-125

NOTE:- Terminals 20, 21, 58 and 59 are not fitted to DSE8600 series controllers.

16.2 PURCHASING ADDITIONAL FIXING CLIPS FROM DSE

Item	Description	Part No.
	8600 series fixing clips (packet of 4)	020-294

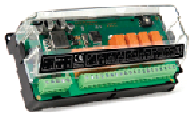
16.3 PURCHASING ADDITIONAL SEALING GASKET FROM DSE

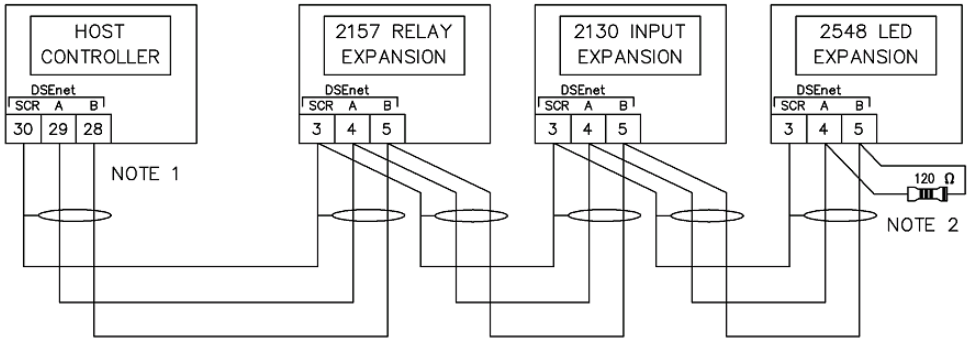
Item	Description	Part No.
	8600 series silicon sealing gasket	020-507

16.4 DSENET EXPANSION MODULES

NOTE:- A maximum of twenty (20) expansion modules can be connected to the DSENet®.

NOTE:- DSENet® utilises an RS485 connection. Using Belden 9841 (or equivalent) cable allows for the expansion cable to be extended to a maximum of 1.2km.
DSE Stock and supply Belden 9841 cable. DSE Part Number 016-030.

Item	Max No. supported	Description	DSE Part numbers			
			Model order number	Sales literature	Operator manual	Installation Instructions
	4	Model DSE2130 expansion input module provides additional analogue and digital inputs for use with the DSE8600 series controller.	2130-001-00	055-060	057-082	053-033
	10	Model DSE2157 expansion relay module provides eight additional voltage free relays for use with the DSE8600 series controller	2157-001-00	055-061	057-083	053-034
	10	Model DSE2548 expansion LED module provides additional LED indications, internal sounder and remote lamp test/alarm mute for use with the DSE8600 series controller.	2548-001-00	055-062	057-084	053-032



NOTE 1
AS A TERMINATING RESISTOR IS INTERNALLY FITTED TO THE HOST CONTROLLER, THE HOST CONTROLLER MUST BE THE FIRST UNIT ON THE DSEnet

NOTE 2
A 120 OHM TERMINATION RESISTOR MUST BE FITTED TO THE LAST UNIT ON THE DSEnet

16.5 ETHERNET (LAN) CONNECTION

NOTE: - DSE860 and DSE865 cannot be used with the DSE8620 although this module does have its own dedicated Ethernet port. (See beginning of manual for details)

17 WARRANTY

DSE provides limited warranty to the equipment purchaser at the point of sale. For full details of any applicable warranty, you are referred to your original equipment supplier (OEM).

18 DISPOSAL

18.1 WEEE (WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT)

Directive 2002/96/EC
If you use electrical and electronic equipment you must store, collect, treat, recycle and dispose of WEEE separately from your other waste.

18.2 ROHS (RESTRICTION OF HAZARDOUS SUBSTANCES)

Directive 2002/95/EC: 2006
To remove specified hazardous substances (Lead, Mercury, Hexavalent Chromium, Cadmium, PBB & PBDE´s)

Exemption Note: Category 9. (Monitoring & Control Instruments) as defined in Annex 1B of the WEEE directive will be exempt from the RoHS legislation. This was confirmed in the August 2005 UK´s Department of Trade and Industry RoHS REGULATIONS Guide (Para 11).

Despite this exemption, DSE has been carefully removing all non RoHS compliant components from our supply chain and products.
When this is completed, a Lead Free & RoHS compatible manufacturing process will be phased into DSE production.

This process that is almost complete and is being phased through different product groups.

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