DEEP SEA ELECTRONICS PLC
DSE8860 Controller Operators Manual

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DSE8860 Operators Manual

Amendments List

Issue	Comments	Minimum Module Version Required
1	Initial release	

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
053-137	DSE8810 Installation Instructions
053-139	DSE8860 Installation Instructions
053-032	DSE2548 LED Expansion Annunciator Installation Instructions
053-033	DSE2130 Input Expansion Installation Instructions
053-034	DSE2157 Output Expansion Installation Instructions
053-125	DSE2131 Ratiometric Input Expansion Installation Instructions
053-126	DSE2133 RTD/Thermocouple Input Expansion Installation Instructions
053-134	DSE2152 Ratio-metric 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
056-006	Introduction to Comms
056-010	Overcurrent Protection
056-013	Load Demand Scheme
056-018	Negative Phase Sequence
056-019	Earth Fault Protection
056-020	Loss of Excitation
056-021	Mains Decoupling
056-022	Breaker Control
056-024	GSM Modem
056-026	kW & kVAr
056-030	Module PIN Codes
056-032	xx60 With No Bus Breaker
056-042	Bus or Mains Mode

1.3   MANUALS

Product manuals are can be downloaded from the DSE website: www.deepseaplc.com

DSE PART	DESCRIPTION
057-045	Guide to Synchronising and Load Sharing Part 1
057-046	Guide to Synchronising and Load Sharing Part 2
057-047	Load Share Design and Commissioning Guide
057-164	DSE8810 PC Software Configuration Manual
057-174	DSE8860 PC Software Configuration Manual
057-082	DSE2130 Input Expansion Manual
057-083	DSE2157 Output Expansion Manual
057-084	DSE2548 Annunciator Expansion Manual
057-139	DSE2131 Ratio-metric Input Expansion Manual
057-140	DSE2133 RTD/Thermocouple Expansion Manual
057-141	DSE2152 Ratio-metric Output Expansion Manual

1.4   THIRD PARTY DOCUMENTS

The following third party documents are also referred to:

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 DSE8860 module, 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 **DSE8860** is designed to provide differing levels of functionality across a common platform. This allows the generator OEM greater flexibility in the choice of controller to use for a specific application.

The **DSE8860** module has been designed to monitor the mains (utility) supply and automatically start/stop one or more generator sets equipped with DSE8x10 controllers depending upon the status of the mains (utility) supply.

Synchronising and Load Sharing features are included within the controller, along with the necessary protections for such a system. This provides forward sync, back sync (no break changeover) and start/stop upon changing load levels.

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

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

- *Text and graphical colour LCD display (supporting multiple languages).*
- *True RMS Voltage, Current and Power monitoring with minimum and maximum ranges*
- *Harmonic Display*
- *Communications capability (USB, RS232, RS485 and Ethernet)*
- *Event log and instrumentation data log*
- *Fully configurable inputs for use as alarms or a range of different functions.*
- *Synchronising and load sharing with load demand start/stop*
- *R.O.C.O.F. and Vector shift for detection of mains failure when in parallel with the mains supply.*
- *Integral PLC to help provide customisation where required*

Using a PC and the DSE Configuration Suite software allows alteration of selected operational sequences, timers, alarms and operational sequences. 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.

3 SPECIFICATIONS

3.1 PART NUMBERING

| 8860 | - | 001 | - | 01 |

Product type

| DSE8860 ATS and Mains Controller | 8860 |

Variant

| Standard version | 01 |
| UL approved version | 32 |

Hardware revision

| Initial Release | 001 |
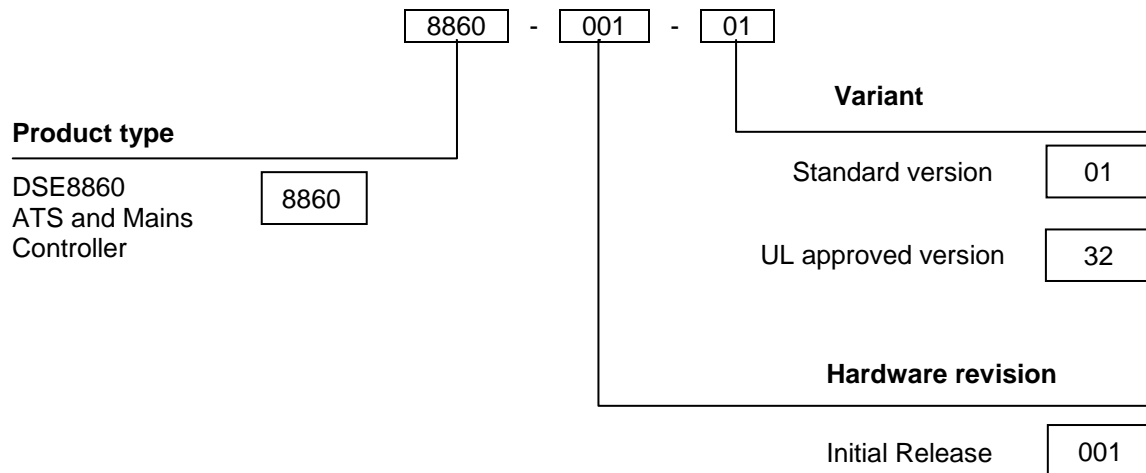
At the time of this document production, there have been no revisions to the module hardware.

3.1.1 SHORT NAMES

Short Name	Description
DSE8000,DSE8xxx	All modules in the DSE8000 range.
DSE8800,DSE88xx	All modules in the DSE8800 range.

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	0.5 mm² (AWG 24)	
Maximum Cable Size	2.5 mm² (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	8 V continuous
Cranking Dropouts	Able to survive 0 V for 50 mS providing the supply was at least 10 V before the dropout and recovers to 5 V afterwards.
Maximum Supply Voltage	35 V continuous (60 V protection)
Reverse Polarity Protection	-35 V continuous
Maximum Operating Current	300 mA at 24 V 600 mA at 12 V
Maximum Standby Current	160 mA at 24 V 330 mA at 12 V

3.3.1   PLANT SUPPLY INSTRUMENTATION DISPLAY

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

3.4   VOLTAGE / FREQUENCY SENSING

Measurement Type	True RMS conversion
Sample Rate	5 KHz or better
Harmonics	Up to 10th or better
Input Impedance	300 K Ω ph-N
Phase To Neutral	15 V (minimum required for sensing frequency) to 333 V AC (absolute maximum) Suitable for 110 V to 277 V nominal (±20 % for under/overvoltage detection)
Phase To Phase	26 V (minimum required for sensing frequency) to 576 V AC (absolute maximum) Suitable for 19 0 V ph-ph to 479 V ph-ph nominal (±20 % for under/overvoltage detection)
Common Mode Offset From Earth	100 V 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	3.5 Hz
Maximum Frequency	75.0 Hz
Frequency Resolution	0.1 Hz
Frequency Accuracy	±0.2 Hz

3.5 CURRENT SENSING

Measurement Type	True RMS conversion
Sample Rate	5 kHz or better
Harmonics	Up to 10th or better
Nominal CT Secondary Rating	1 A or 5 A (5 A recommended)
Maximum Continuous Current	5 A
Overload Measurement	3 x Nominal Range setting
Absolute Maximum Overload	50 A for 1 second
Burden	0.5 VA (0.02 Ω current shunts)
Common Mode Offset	±2 V peak plant ground to CT common terminal
Resolution	0.5 % of 5 A
Accuracy	±1 % of Nominal (1 A or 5 A) (excluding CT error)

3.5.1 VA RATING OF THE CTS

The VA burden of the module on the CTs is 0.5 VA. However depending upon the type and length of cabling between the CTs and the 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.

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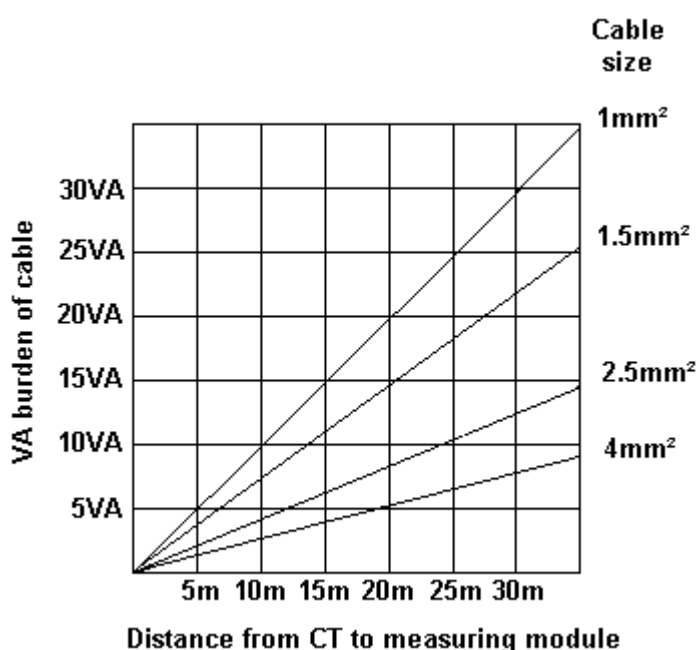
Example
If 1.5 mm² cable is used and the distance from the CT to the measuring module is 20 m, then the burden of the cable alone is approximately 15 VA. As the burden of the DSE controller is 0.5 VA, then a CT with a rating of at least 15+0.5 V = 15.5 VA must be used.
If 2.5 mm² cables are used over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

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

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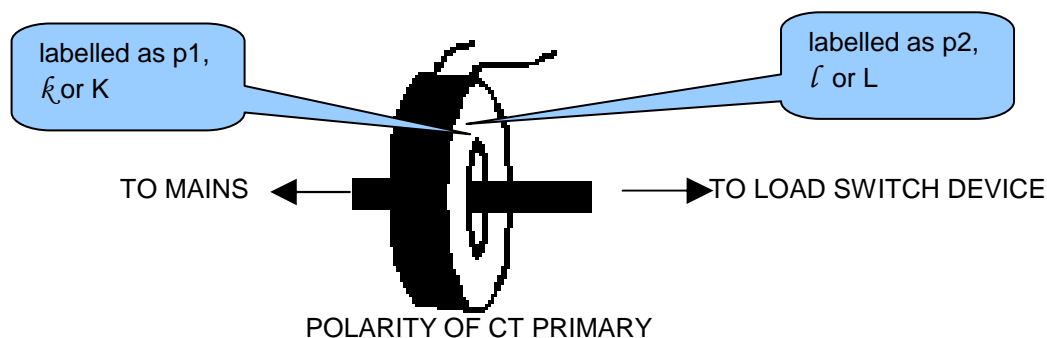

labelled as p1, k or K

labelled as p2, l or L

TO MAINS ◄—————— ——————► TO LOAD SWITCH DEVICE

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   ANALOGUE INPUTS C & D

> ⚠ **NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.**

3.6.1.1   CONFIGURED AS DIGITAL INPUTS

Arrangement	Contact between input terminal and the analogue common.
Low Level Threshold	2.1V minimum
High Level Threshold	6.6V maximum
Max Input Voltage	+60V DC with respect to battery negative
Min Input Voltage	-24V DC with respect to battery negative
Contact Wetting Current	7mA typical
Open Circuit Voltage	Plant supply typical

3.6.1.2   CONFIGURED AS RESISTIVE SENSOR INPUTS

Arrangement	Contact between input terminal and the analogue common.
Measurement Current	9.3mA typical
Full Scale	480Ω
Sensor Fail	Values greater than full scale return an over range sentinel that may be interpreted as sensor fail if appropriate (host controller dependant)
Resolution	1% of full scale
Accuracy	±2% of full scale resistance, excluding transducer (sensor) error
Maximum Common Mode Voltage	3V
Transducer (Sensor Type)	Configurable in host controller

3.6.1.3   CONFIGURED AS 0-10V INPUTS

Arrangement	Contact between input terminal and the analogue common.
Measureable Range	0V DC to 10V DC
Sensor Fail	Values greater than full scale return an over range sentinel that may be interpreted as sensor fail if appropriate.
Internal Impedance	Greater than 10kΩ
External Impedance	0 to 3kΩ
Resolution	1% of full scale
Accuracy	±1% of full scale voltage, excluding transducer (sensor) error
Transducer (Sensor Type)	Configurable in host controller

3.6.1.4   CONFIGURED AS 4-20MA INPUTS

Arrangement	Contact between input terminal and the analogue common.
Measureable Range	0mA DC to 20mA DC
Sensor Fail	Values greater than full scale return an over range sentinel that may be interpreted as sensor fail if appropriate.
Internal Sense Resistor	240Ω
External Impedance	0 to 3kΩ
Resolution	1% of full scale
Accuracy	±1% of full scale current, excluding transducer (sensor) error
Transducer (Sensor Type)	Configurable in host controller

3.6.2 DIGITAL INPUTS A, B, C, D, E, F, G, H, I, J, K & L

⚠️**NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.**

Number	12 configurable digital inputs.
Arrangement	Contact between terminal and ground
Low Level Threshold	2.1 V minimum
High Level Threshold	6.6 V maximum
Maximum Input Voltage	+50 V DC with respect to plant supply negative
Minimum Input Voltage	-24 V DC with respect to plant supply negative
Contact Wetting Current	7 mA typical
Open Circuit Voltage	Plant supply typical

3.7 OUTPUTS

Ten (10) outputs are fitted to the controller.

⚠️**NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.**

3.7.1 VOLT FREE OUTPUTS C & D (LOAD SWITCHING)

Type	Two (2) 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.

3.7.2 DIGITAL OUTPUTS E, F, G, H, I, J, K & L

Number	Eight (8) configurable DC outputs.
Type	Fully configurable, supplied from DC supply terminal 2.
Rating	2A resistive at plant supply voltage.
Open Circuit Voltage	Plant supply typical.

3.8   COMMUNICATION PORTS

> ⚠ **NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.**

USB Port	USB2.0 Device for connection to PC running DSE configuration suite only Max distance 6m (yards)
RS232 Serial port	Non – Isolated port Max Baud rate 115K baud subject to configuration TX, RX, RTS, CTS, DSR, DTR, DCD Male 9 way D type connector Max distance 15m (50 feet)
2 x RS485 Serial ports	Isolated Data connection 2 wire + common Half Duplex Data direction control for Transmit (by s/w protocol) Max Baud rate 115K baud subject to configuration External termination required (120Ω) Max common mode offset 70V (on board protection transorb) Max distance 1.2km (¾ mile)
Ethernet	Auto detecting 10/100 Ethernet port.

3.8.1   USB CONNECTION

The USB port is provided to give a simple means of connection between a PC and the 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 module to a PC by USB, the following items are required:

- DSE8800 series module

- DSE Configuration Suite PC 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 DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.

3.8.2   USB HOST-MASTER (USB DRIVE CONNECTION)

USB Type A connection for USB Host facility which is used to connected an external USB storage device for the Data Logging feature.
Maximum size of externally storage device can be 16 GB (see viewing the instrument pages).

⚠NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.

3.8.3   RS232

The RS232 port on the 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 controller to a telephone or GSM modem for more remote communications.

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

3.8.3.1   RECOMMENDED PC RS232 SERIAL PORT ADD-ONS

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.

3.8.3.2   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)

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

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

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- 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.

3.8.4   RS485

The RS485 ports on the controller support 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 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).**

3.8.4.1   RECOMMENDED PC RS485 SERIAL PORT ADD-ONS

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.
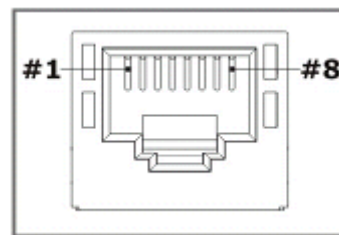
3.8.5 ETHERNET

The Ethernet port on the controller supports the Modbus TCP protocol.
The DSE Gencomm register table for the controller is available upon request from the DSE Technical Support Department.

Ethernet is allows for connection to PCs, PLCs and Building Management Systems and LAN (Local Area Networks) to name just a few devices.

One advantage of the Ethernet connection is the ability to access the module via an internet connection. This allows for a large distance between the module and a PC running the DSE Configuration Suite Software. The operator is then able to control the module, starting or stopping the generator(s), selecting operating modes, etc.

Terminal	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

⚠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 Ethernet (which is more suited to longer distance connections).

3.8.5.1 DIRECT PC CONNECTION
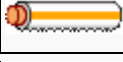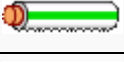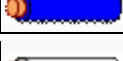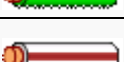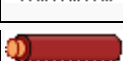
Requirements
- DSE module with the ability to connect to Ethernet
- Crossover Ethernet cable (see Below)
- PC with Ethernet port

Crossover
network cable
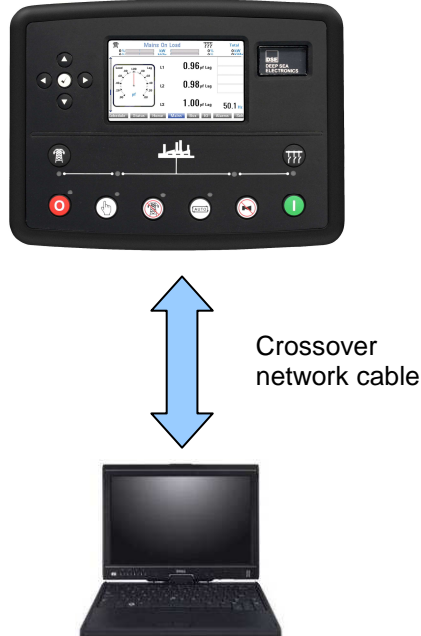
Crossover cable wiring detail

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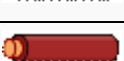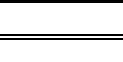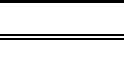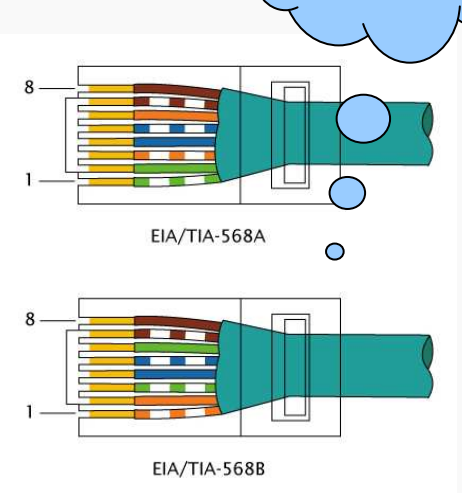10baseT/100baseTX crossover

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

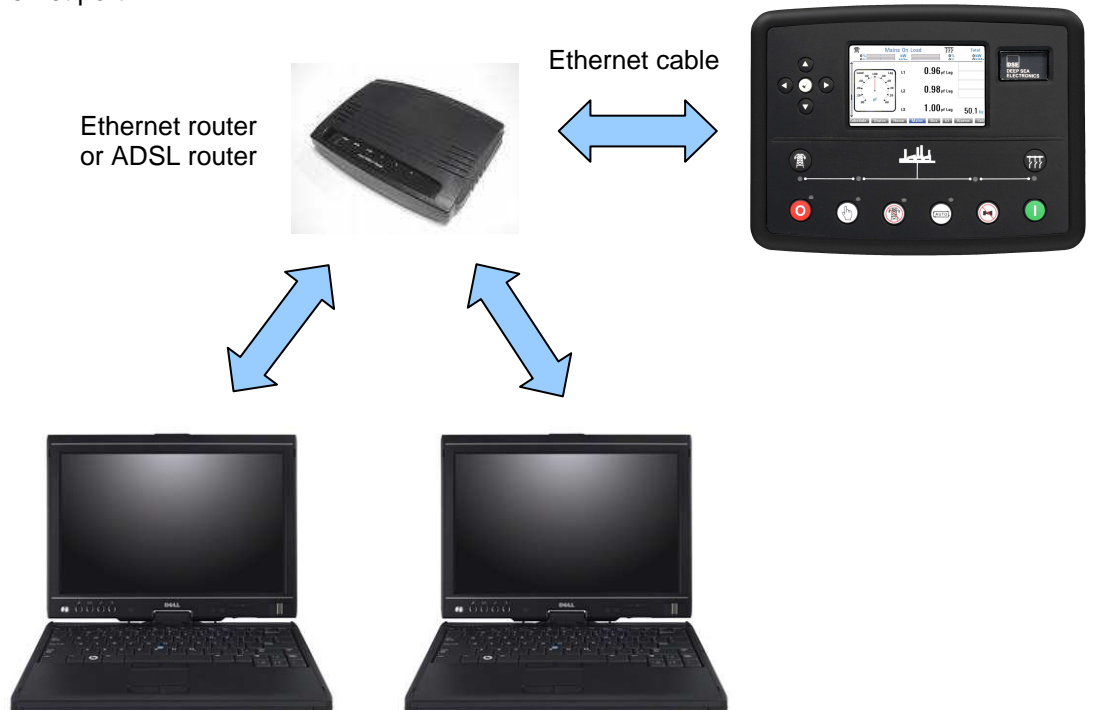| Pin	Connection 1 (T568A)	Connection 2 (T568B)
1	white/green stripe	white/orange stripe
2	green solid	orange solid
3	white/orange stripe	white/green stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	green solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown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

EIA/TIA-568A

EIA/TIA-568B

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

3.8.5.2   CONNECTION TO BASIC ETHERNET

Requirements
- DSE module with the ability to connect to Ethernet
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- PC with Ethernet port

Ethernet cable

Ethernet router
or ADSL router

Ethernet cable wiring detail

.
10baseT/100baseT

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

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

EIA/TIA-568A

EIA/TIA-568B

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

3.8.5.3 CONNECTION TO COMPANY INFRASTRUCTURE ETHERNET

Requirements
- DSE module with the ability to connect to Ethernet
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- PC with Ethernet port

Ethernet router or ADSL router

PC Network wall connection sockets

Ethernet cable

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

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

EIA/TIA-568A

EIA/TIA-568B

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

3.8.5.4 CONNECTION TO THE INTERNET
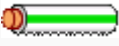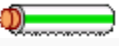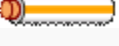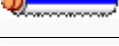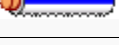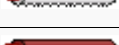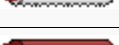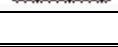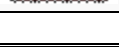
Requirements
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- Working Internet connection (ADSL or DSL recommended)

Ethernet cable wiring detail

10baseT/100baseT

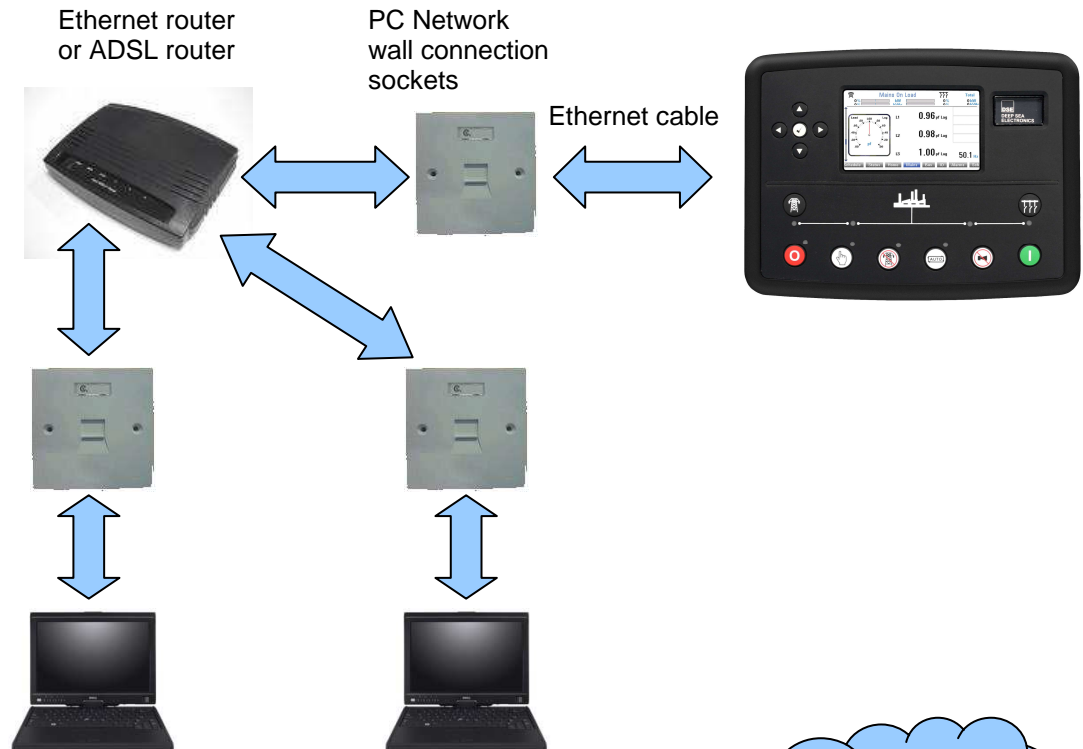| Pin	Connection 1 (T568A)		Connection 2 (T568A)	
1		white/green stripe		white/green stripe
2		green solid		green solid
3		white/orange stripe		white/orange stripe
4		blue solid		blue solid
5		white/blue stripe		white/blue stripe
6		orange solid		orange solid
7		white/brown stripe		white/brown stripe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

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

3.8.5.5 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 module. 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 module makes its data available over Modbus TCP and as such communicates over the Ethernet using a Port configured via the DSE Configuration 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 module cannot be used and another port must be used.

Outgoing Firewall rule

As the module 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 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 the requests reach the modem/router, we want this passed to a 'virtual server' for handling, in our case this is the module.

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

> ⚠**NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.**

3.9   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), DSE2131 (up to 4), DSE2133 (up to 4), DSE2152 (up to 4), DSE2157 (up to 10), DSE2548 (up to 10) This gives the possibility of : Maximum 24 additional 0-10V or 4-20mA outputs (DSE2152) Maximum 80 additional Volt-free relay outputs (DSE2157) Maximum 80 additional LED indicators (DSE2548) Maximum 32 additional Inputs (DSE2130 can be configured as either 32 digital or 16 digital/16 resistive) Maximum 32 additional RTD or Thermocouple inputs (DSE2133). Maximum 40 additional Inputs (DSE2131 can be configured as either digital, resistive, 0-10V or 4-20mA)

⚠**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: DSE8800 series module does not support the DSE2510/2520 display modules.**

3.10 SOUNDER

The module features an internal sounder to draw attention to warning, shutdown and electrical trip alarms.
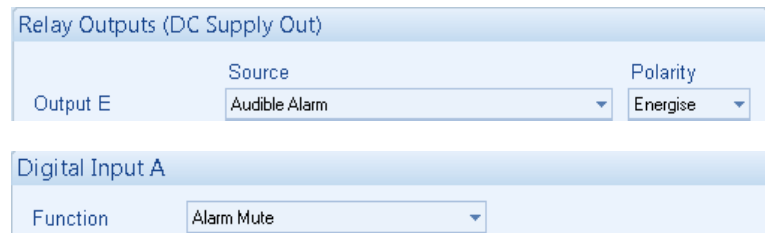
Sounder level	64db @ 1m

3.10.1 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:

3.11 ACCUMULATED INSTRUMENTATION

Accumulated instrumentation along with 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.

3.12 DIMENSIONS AND MOUNTING

3.12.1 DIMENSIONS
245 mm x 184 mm x 50 mm (9.6" x 7.2" x 2.0")

3.12.2 PANEL CUTOUT
220mm x 160mm (8.7" x 6.3")

3.12.3 WEIGHT
0.7kg (1.4lb)

3.12.4 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 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.

Fixing clip

Fixing clip fitted to module
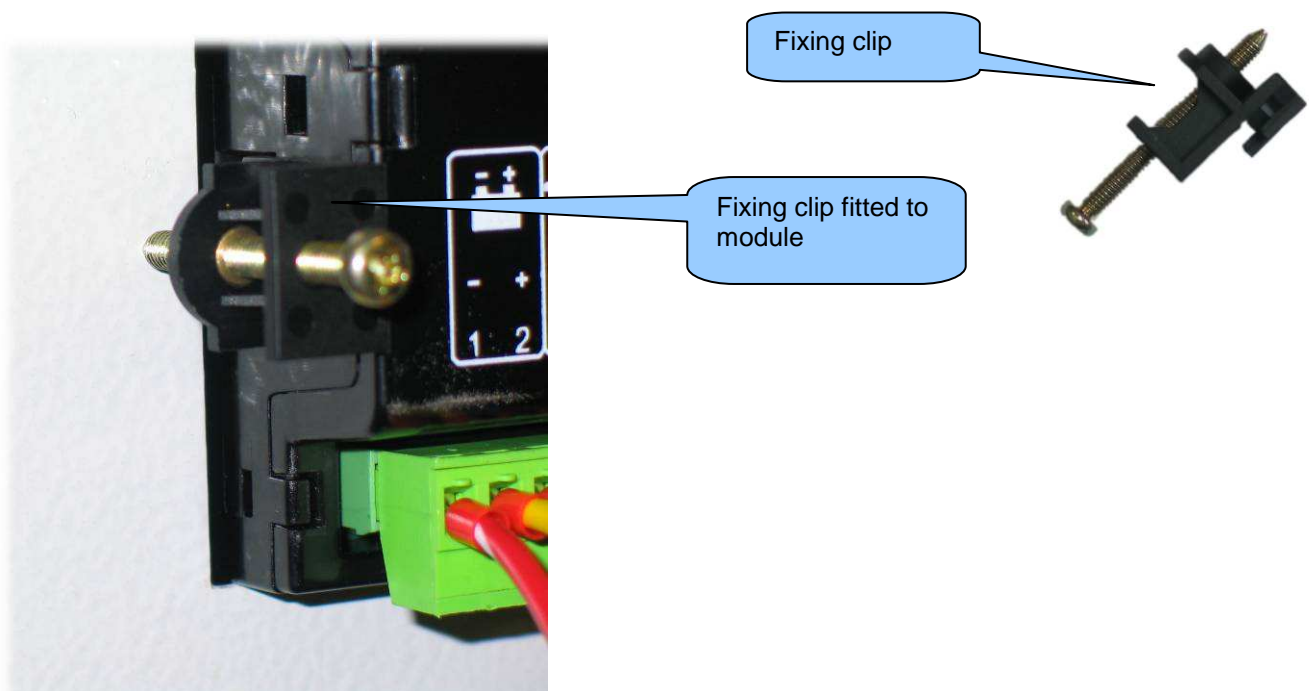
⚠️**NOTE: In conditions of excessive vibration, mount the module on suitable anti-vibration mountings.**

3.12.5 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
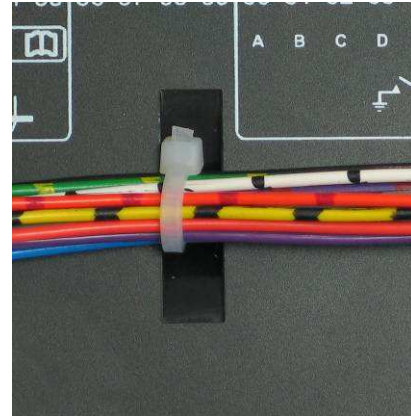
With cable and tie in place

3.12.6 SILICON SEALING GASKET

The supplied silicon gasket provides improved sealing between 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.

Sealing gasket

Gasket fitted to module
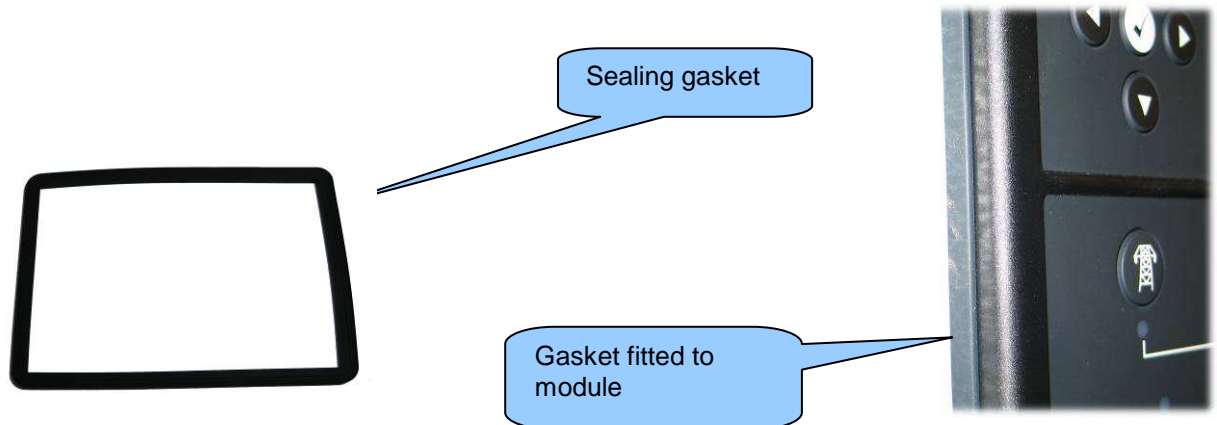
3.13 APPLICABLE STANDARDS

3.13.1 BS, UL AND IEEE CLASSIFICATIONS

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 controller is device number 11L-8000 (Multifunction device protecting Line (generator) –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 3 – Checking Or Interlocking Relay 5 – Stopping Device 6 – Starting Circuit Breaker 8 – Control Power Disconnecting Device 10 – Unit Sequence Switch 11 – Multifunction Device 12 – Overspeed Device 14 – Underspeed Device 15 – Speed Or Frequency Matching Device. 23 – Temperature Control Device 25 – Synchronising Or Synchronism Check Relay 26 – Apparatus Thermal Device 27AC – AC Undervoltage Relay 27DC – DC Undervoltage Relay 29 – Isolating Contactor Or Switch 30 – Annunciator Relay 31 – Separate Excitation Device 37 – Undercurrent Or Underpower Relay (**USING INTERNAL PLC EDITOR**) 41 – Field Circuit Breaker 42 – Running Circuit Breaker 44 – Unit Sequence Relay

Continued overleaf.

IEEE C37.2 (Standard Electrical Power System Device Function Numbers and Contact Designations)	Continued… 46 – Reverse-Phase Or Phase-Balance Current Relay 48 – Incomplete Sequence Relay 49 – Machine Or Transformer Thermal Relay 50 – Instantaneous overcurrent relay 51 – AC time overcurrent relay 52 – AC circuit breaker 53 – Exciter or DC generator relay 54 – Turning gear engaging device 55 – Power factor relay (**USING INTERNAL PLC EDITOR**) 59AC – AC overvoltage relay 59DC – DC overvoltage relay 62 – Time delay stopping or opening relay 63 – Pressure switch 71 – Level switch 74 – Alarm relay 77 – Telemetering Device 78 – Phase-angle measuring relay 79 – Reclosing relay (**USING INTERNAL PLC EDITOR**) 81 – Frequency relay 83 – Automatic selective control or transfer relay 86 – Lockout relay

3.13.2 ENCLOSURE CLASSIFICATIONS

IP CLASSIFICATIONS

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

3.13.3 NEMA CLASSIFICATIONS

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

4.1   USER CONNECTIONS

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

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

Terminals 39-46

Serial ports

Terminals 47-50

Terminals 51-57

Terminals 59-70

Ethernet

Terminals 1-15

Terminals 16-20

Terminals 22-38

USB Host
Data Logging

USB
PC Configuration
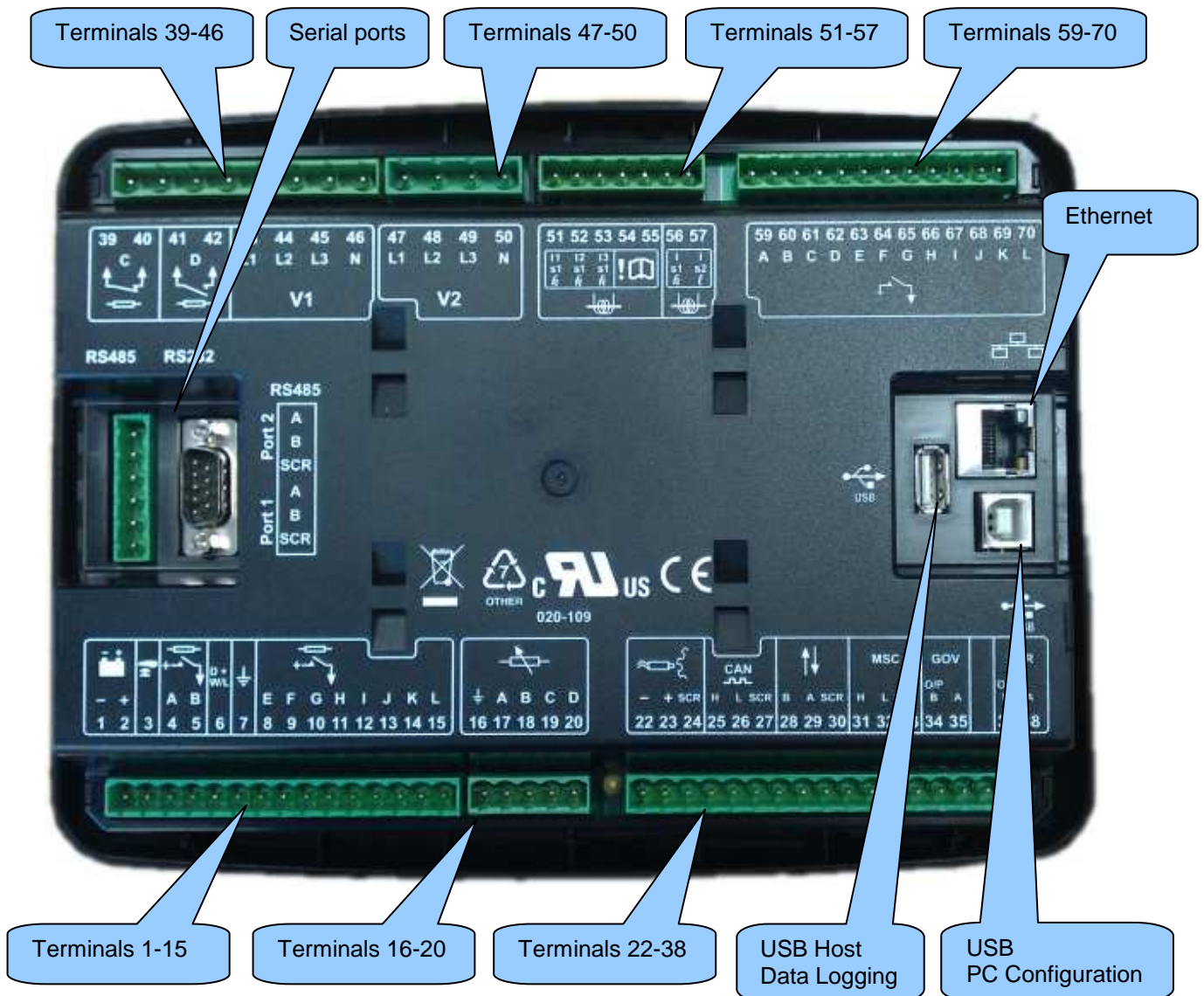
4.2   TERMINAL DESCRIPTION

4.2.1   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	Not Connected		
	4	Not Connected		
	5	Not Connected		
D + W/L	6	Not Connected		
	7	Not Connected		
	8	Output relay E	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 2 Amp rated.
	9	Output relay F	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 2 Amp rated.
	10	Output relay G	1.0mm² AWG 18	Plant Supply Positive.from terminal 2. 2 Amp rated.
	11	Output relay H	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 2 Amp rated.
	12	Output relay I	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 2 Amp rated.
	13	Output relay J	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 2 Amp rated.
	14	Output relay K	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 2 Amp rated.
	15	Output relay L	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 2 Amp rated.

4.2.2   ANALOGUE SENSOR

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	16	Sensor Common Return	0.5mm² AWG 20	Return feed for sensors
	17	Not Connected		
	18	Not Connected		
	19	Flexible sensor C	0.5mm² AWG 20	Connect to additional sensor (user configurable)
	20	Flexible sensor D	0.5mm² AWG 20	Connect to additional sensor (user configurable)

⚠ **NOTE: Terminal 21 is not fitted to the controller.**

4.2.3 MAGNETIC PICKUP, CAN AND EXPANSION

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	22	Not Connected		
	23	Not Connected		
	24	Not Connected		
CAN	25	Not Connected		
	26	Not Connected		
	27	Not Connected		
	28	DSENet expansion A	0.5mm² AWG 20	Use only 120Ω RS485 approved cable
	29	DSENet expansion B	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	Not Connected		
	35	Not Connected		
	36	Not Connected		
AVR	37	Not Connected		
	38	Not Connected		

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

4.2.4 LOAD SWITCHING AND V1 MAINS VOLTAGE SENSING

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	39	Output relay C	1.0mm AWG 18	Normally configured to control mains contactor coil (Recommend 10A fuse)
	40	Output relay C	1.0mm AWG 18	Normally configured to control mains contactor coil
	41	Output relay D	1.0mm AWG 18	Normally configured to control generator contactor coil (Recommend 10A fuse)
	42	Output relay D	1.0mm AWG 18	Normally configured to control generator contactor coil
V1	43	Mains L1 (R) voltage monitoring	1.0mm AWG 18	Connect to Mains L1 (R) incoming supply (AC) (Recommend 2A fuse)
	44	Mains L2 (S) voltage monitoring	1.0mm AWG 18	Connect to Mains L1 (S) incoming supply (AC) (Recommend 2A fuse)
	45	Mains L3 (T) voltage monitoring	1.0mm AWG 18	Connect to Mains L1 (T) incoming supply (AC) (Recommend 2A fuse)
	46	Mains Neutral (N) input	1.0mm AWG 18	Connect to Mains N incoming supply (AC)

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

4.2.5 V2 BUS VOLTAGE SENSING

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
V2	47	Bus L1 (R) voltage monitoring	1.0mm AWG 18	Connect to Bus L1 (U) output (AC) (Recommend 2A fuse)
	48	Bus L2 (S) voltage monitoring	1.0mm AWG 18	Connect to Bus L2 (V) output (AC) (Recommend 2A fuse)
	49	Bus L3 (T) voltage monitoring	1.0mm AWG 18	Connect to Bus L3 (W) output (AC) (Recommend 2A fuse)
	50	Bus Neutral (N) input	1.0mm AWG 18	Connect to Bus Neutral terminal (AC)

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

4.2.6 MAINS 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 module has a burden of 0.5VA on the CT. Ensure the CT is rated for the burden of the controller, the cable length being used and any other equipment sharing the CT. If in doubt, consult your CT supplier.**

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

CT LABELLING

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

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 module.

labelled as p1, k or K

labelled as p2, l or L

TO MAINS ◄───   ───►TO LOAD SWITCH DEVICE

POLARITY OF CT PRIMARY

	PIN No	DESCRIPTION	CABLE SIZE	NOTES
	51	CT Secondary for Mains L1	2.5mm² AWG 13	Connect to s1 secondary of L1 monitoring CT
	52	CT Secondary for Mains L2	2.5mm² AWG 13	Connect to s1 secondary of L2 monitoring CT
	53	CT Secondary for Mains L3	2.5mm² AWG 13	Connect to s1 secondary of L3 monitoring CT
	54	DO NOT CONNECT		
	55	Common for CTs connected to L1,L2,L3 (s2)	2.5mm² AWG 13	Connect to s2 secondary of L1,L2,L3 monitoring CTs

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

4.2.7 BUS/LOAD CURRENT TRANSFORMER

☠**WARNING!: Do not disconnect this plug when the CT is carrying current. Disconnection will open circuit the secondary of the C.T. and dangerous voltages may then develop. Always ensure the CT is not carrying current and the CT is short circuit connected before making or breaking connections to the module.**

⚠**NOTE: Bus/Load CT is NOT REQUIRED in a system including only one mains supply (with one DSE8x60 controller). See section below detailing advantages of the Bus/Load CT in a multiple mains (multiple DSE8x60) system.**

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

⚠**NOTE: Take care to ensure correct polarity of the CT primary as shown below. If in doubt, check with the CT supplier.**
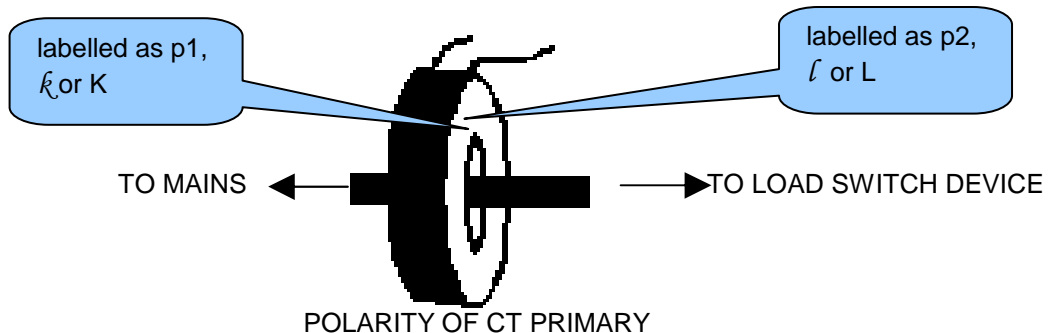
	Pin No	Description	CABLE SIZE	NOTES
⟶⊗⟵	56	CT Secondary for Bus/Load CT	2.5mm² AWG 13	Connect to s1 secondary of Bus/Load CT
	57	CT Secondary for Bus/Load CT	2.5mm² AWG 13	Connect to s2 secondary of Bus/Load CT

⚠**NOTE: Take care to ensure correct polarity of the CT primary as shown in the previous section. If in doubt, check with the CT supplier.**

4.2.7.1 ADVANTAGES OF BUS/LOAD CT

The Bus/Load CT is only required when there is **more than one** DSE8x60 on the same system.

When the Bus/Load CT is fitted, the DSE8x60 transfers the right amount of load to the mains before disconnecting the bus, preventing the generator(s) from being shock loaded/unloaded.

Without the Bus/Load CT, the DSE8x60 does not know how much load to transfer to the mains when other DSE8x60's are still in island mode. The DSE8x60 would transfer a pre-determined amount of load before disconnecting the bus from the mains. This would lead to there being too much load or not enough load transferred, and the generator(s) would be shock loaded/unloaded as the bus disconnect from the mains.

4.2.8 CONFIGURABLE DIGITAL INPUTS

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

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

4.2.9 PC CONFIGURATION INTERFACE CONNECTOR

	DESCRIPTION	CABLE SIZE	NOTES	
USB	Socket for connection to PC with DSE Configuration Suite 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 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.

4.2.10 RS232 CONNECTOR

One configurable RS232 port is provided. Typical examples of devices that can be connected to this ports are PCs, PLCs, HMIs and Modems

Terminal	Description
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
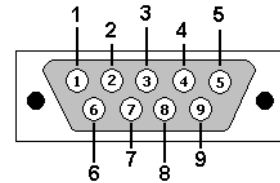
View looking into the male connector on the module

4.2.11 RS485 CONNECTOR

Two, independently configurable RS485 ports are provided. Typical examples of devices that can be connected to these ports are PCs, PLCs & HMIs.

Terminal	Description
Port1 A (-)	Two core screened twisted pair cable.
Port1 B (+)	120Ω impedance suitable for RS485 use.
Port1 SCR	Recommended cable type - Belden 9841
	Max distance 1200m (1.2km) when using Belden 9841 or direct equivalent.
Port2 A (-)	Two core screened twisted pair cable.
Port2 B (+)	120Ω impedance suitable for RS485 use.
Port2 SCR	Recommended cable type - Belden 9841
	Max distance 1200m (1.2km) when using Belden 9841 or direct equivalent.

4.2.12 ETHERNET

One configurable Ethernet port is provided for connection to LAN (local area networks). Typical examples of devices that can be connected to this port are PCs, PLCs and HMIs.

Terminal	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
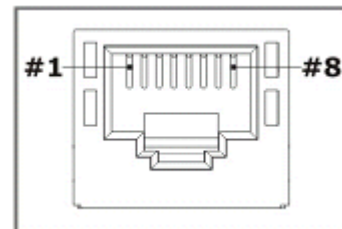
View looking into the male connector on the module

4.3 TYPICAL WIRING DIAGRAM (3 PHASE, 4 WIRE STAR)

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
056-011	MSC Link
056-022	Breaker Control (Training guide)
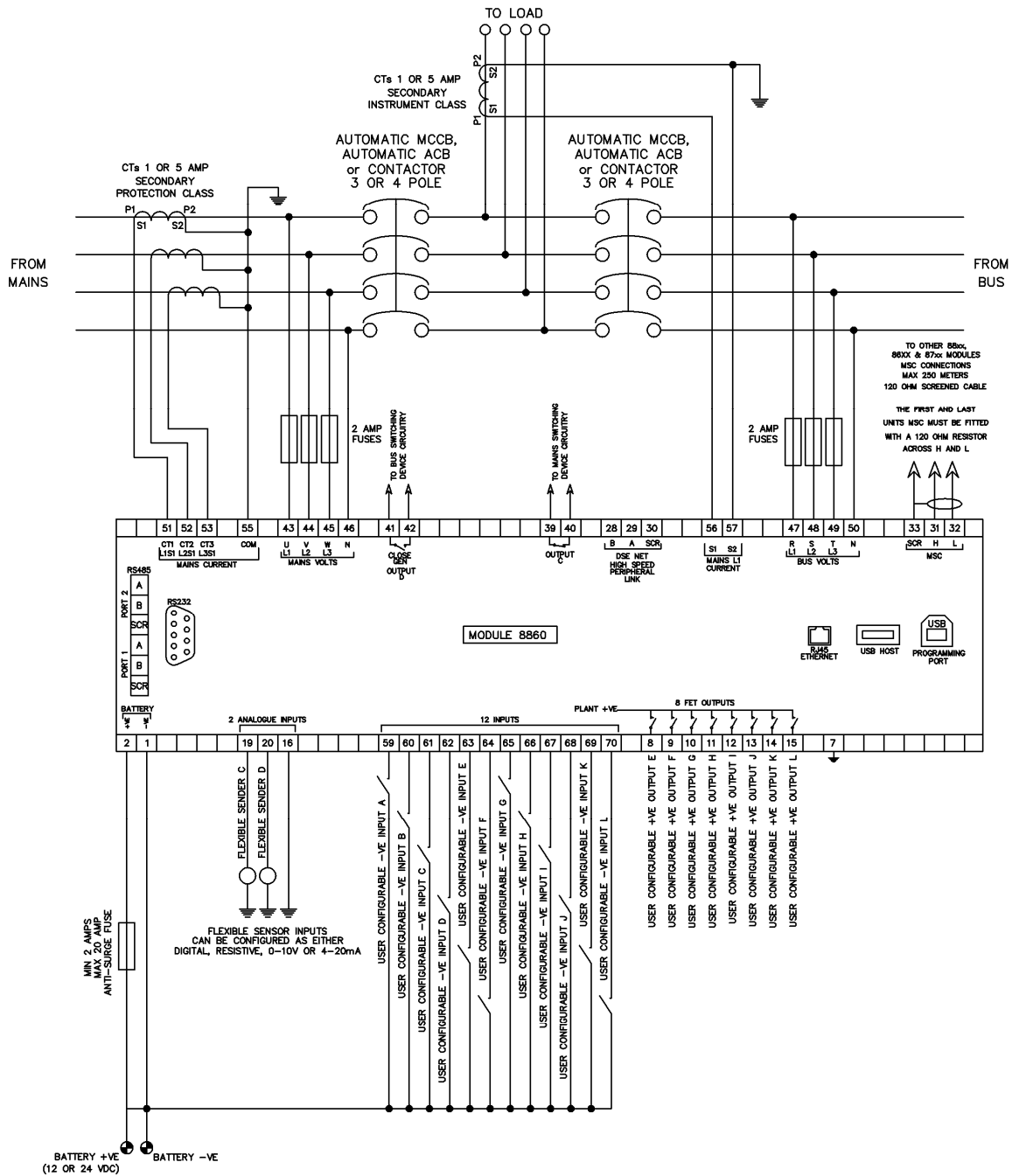
4.3.1 ALTERNATE TOPOLOGIES

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

> ⚠ **NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.**

4.3.1.1 SINGLE PHASE, 2 WIRE
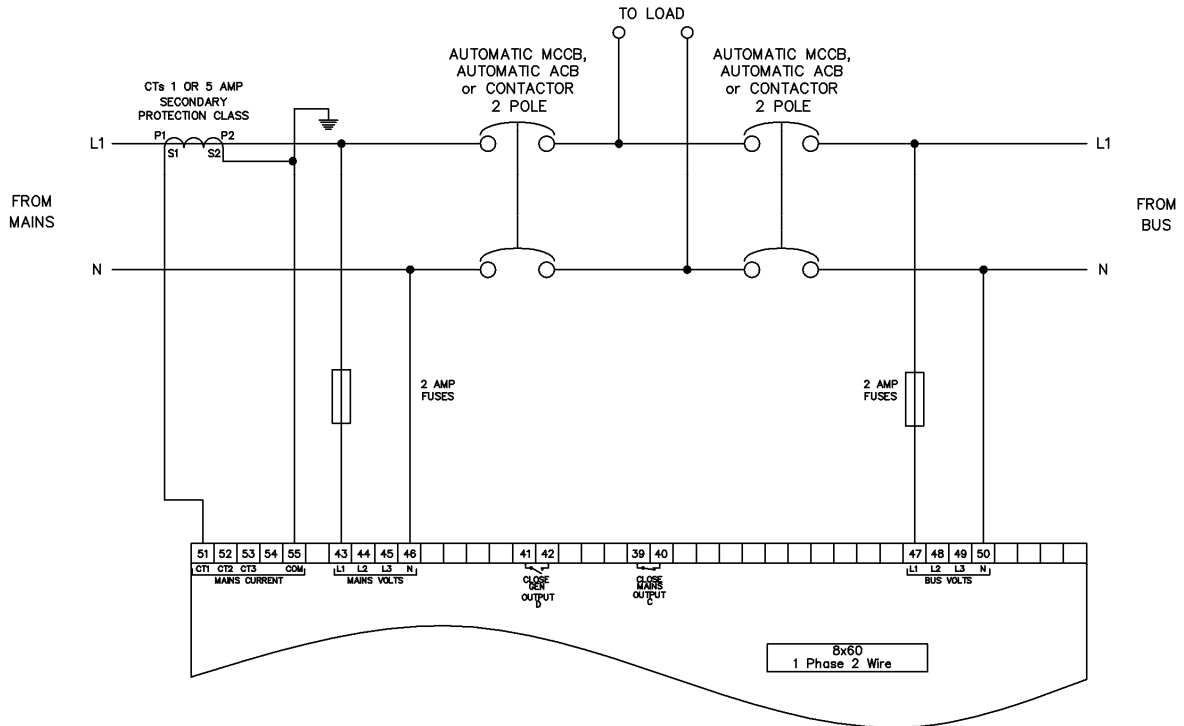
4.3.1.2   2 PHASE (L1 & L2), 3 WIRE DELTA
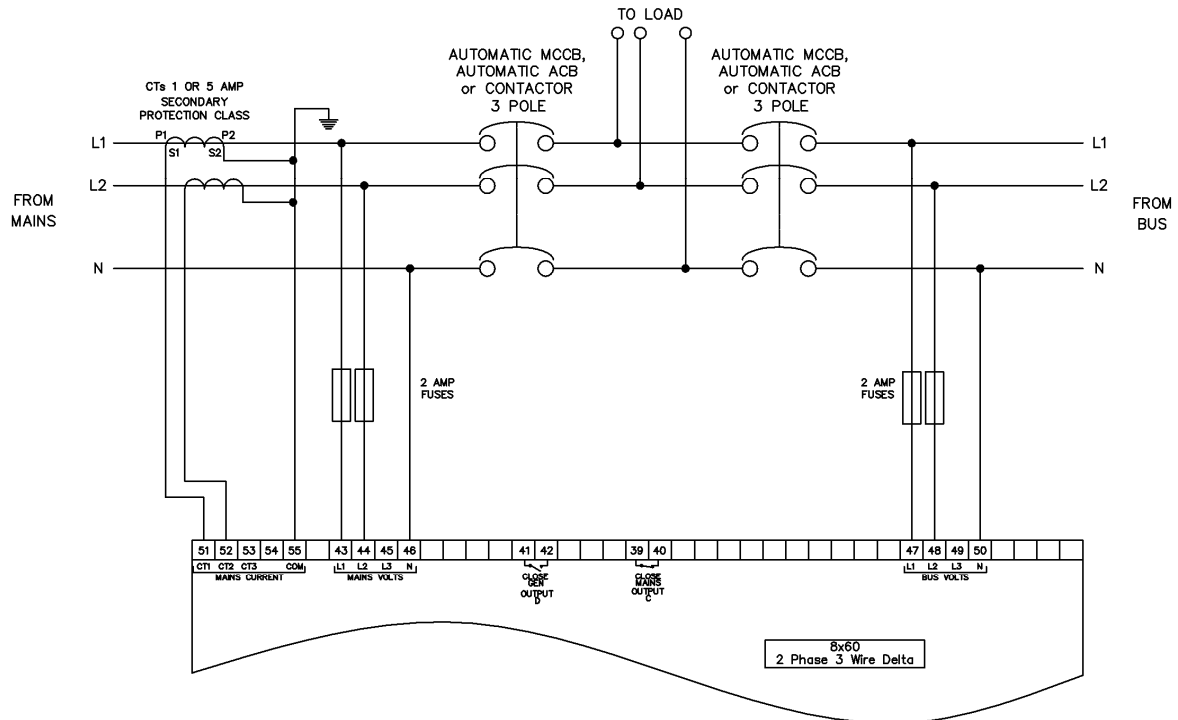
4.3.1.3   2 PHASE (L1 & L3), 3 WIRE DELTA
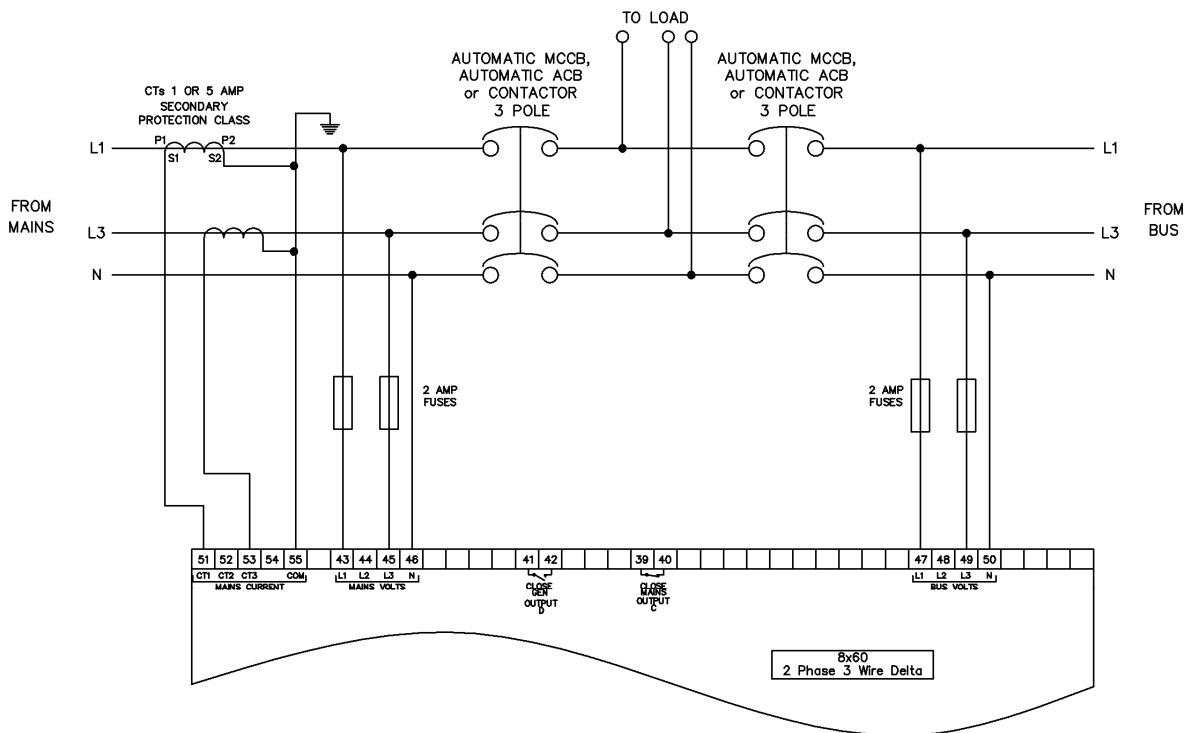
4.3.1.4   3 PHASE, 3 WIRE DELTA
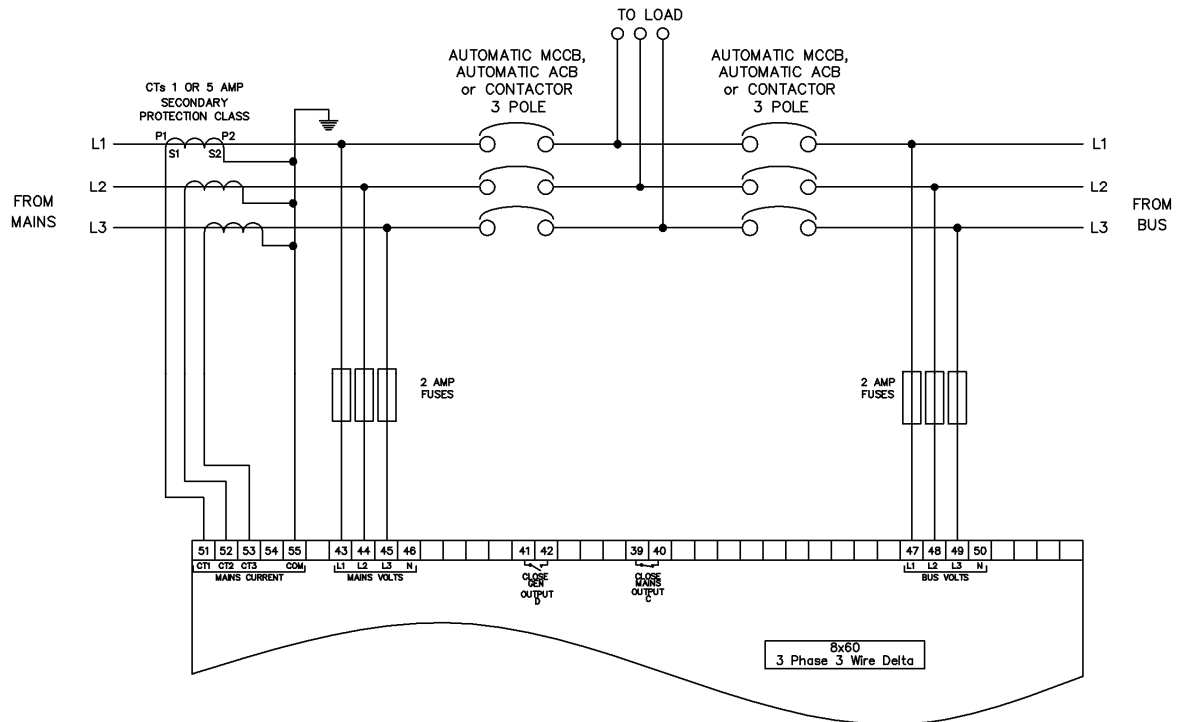
4.3.1.5   3 PHASE, 4 WIRE DELTA
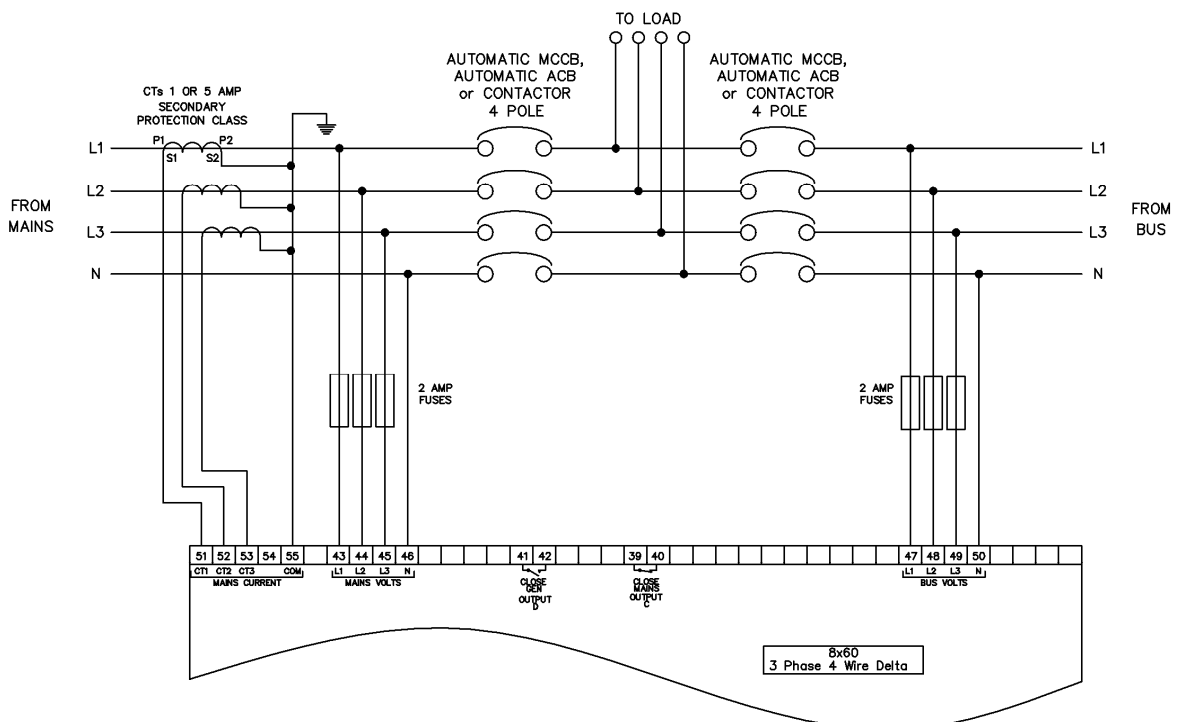
4.3.2   BUS AND LOAD CURRENT TRANSFORMER POSITION

> ⚠**NOTE: Bus/Load CT is NOT REQUIRED in a system including only one mains supply (with one DSE8x60 controller). See section below detailing advantages of the Bus/Load CT in a multiple mains (multiple DSE8x60) system.**

> ⚠**NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on how to configuring which transform position is to be used in the system.**

4.3.2.1   3 PHASE, 4 WIRE WITH A BUS CURRENT TRANSFORMER
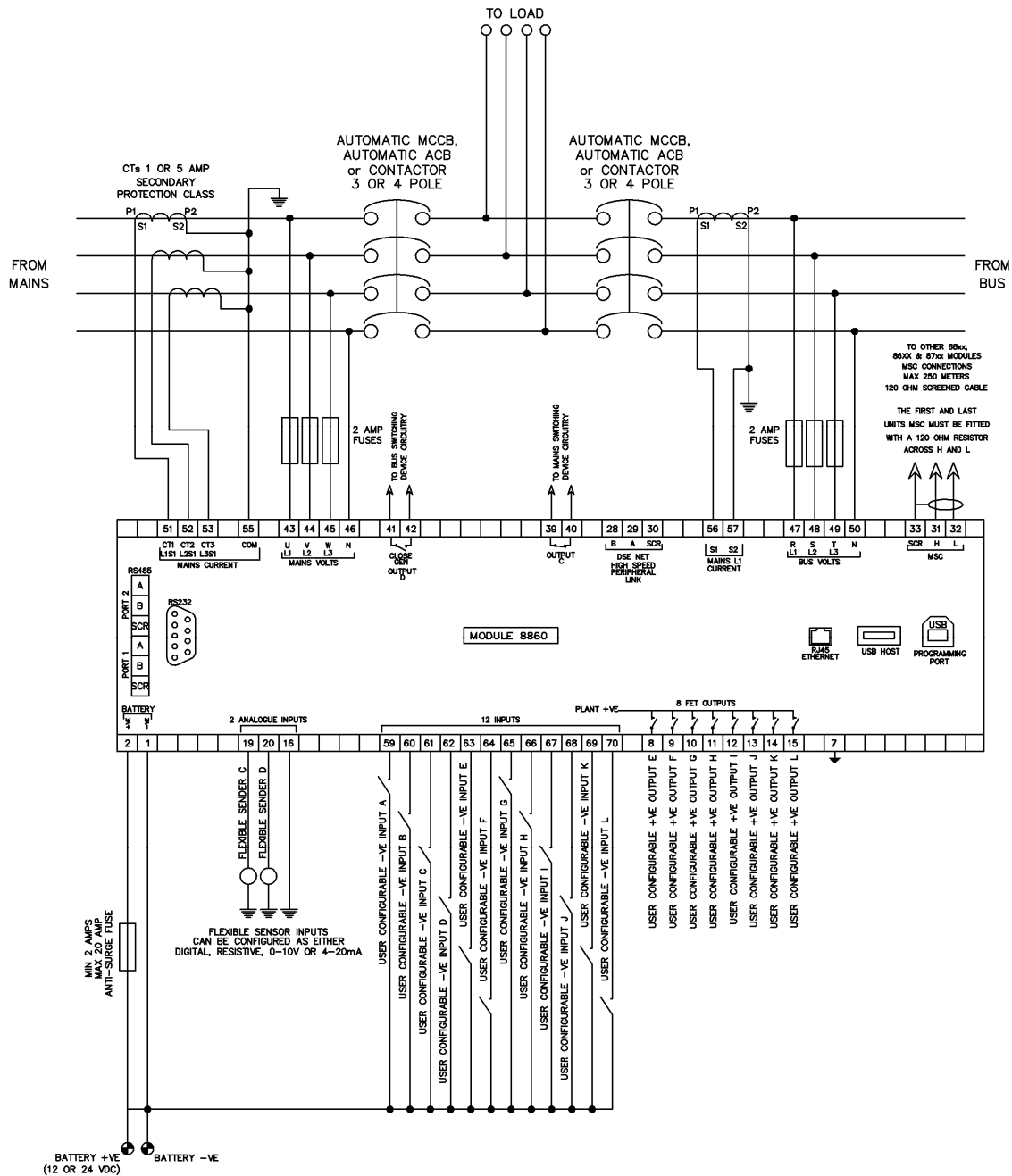
4.3.2.2   3 PHASE, 4 WIRE WITH A LOAD CURRENT TRANSFORMER
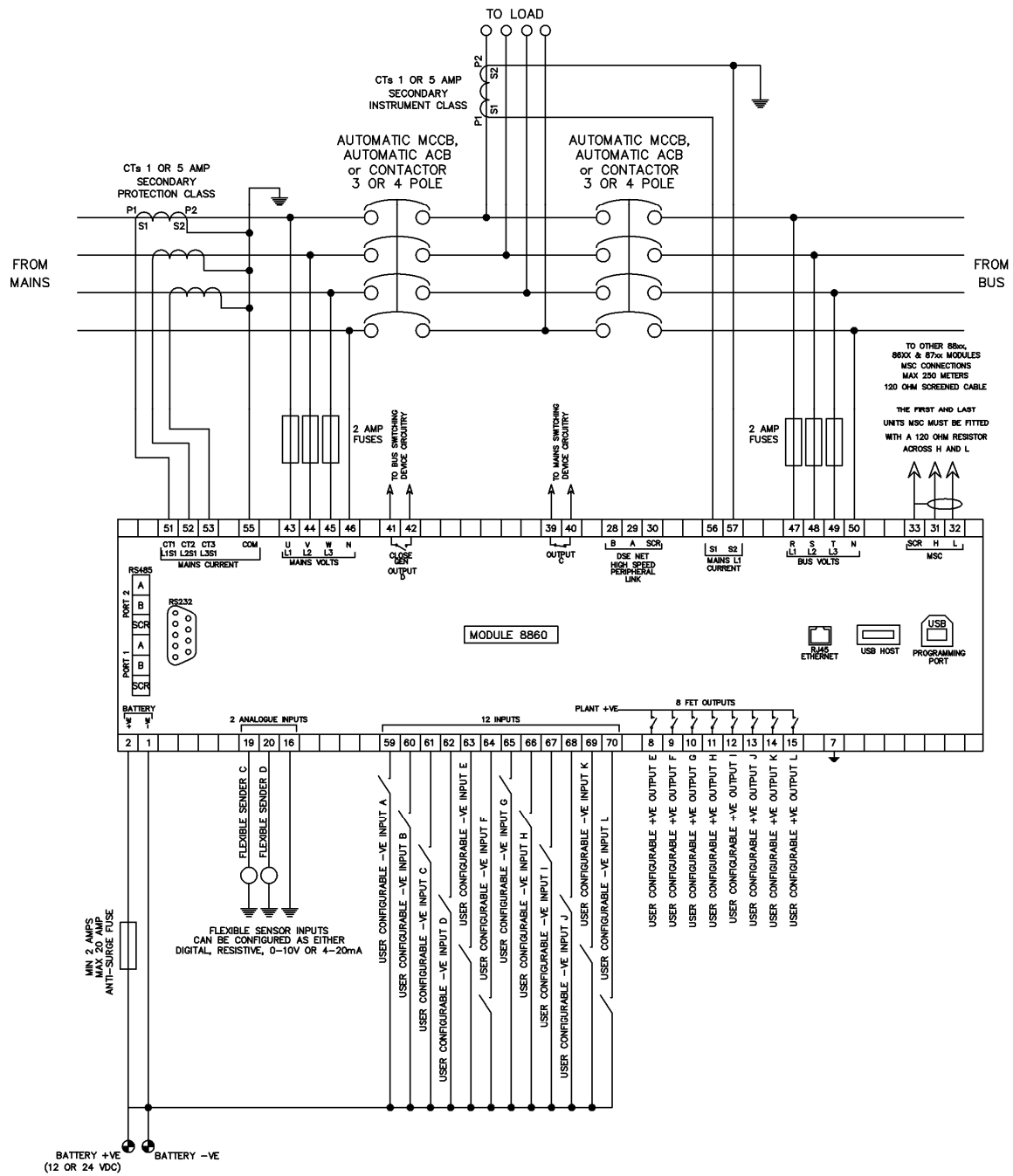
4.3.3   TYPICAL SYSTEM SCHEMATICS

4.3.3.1   SINGLE MAINS, MULTIPLE GENERATORS
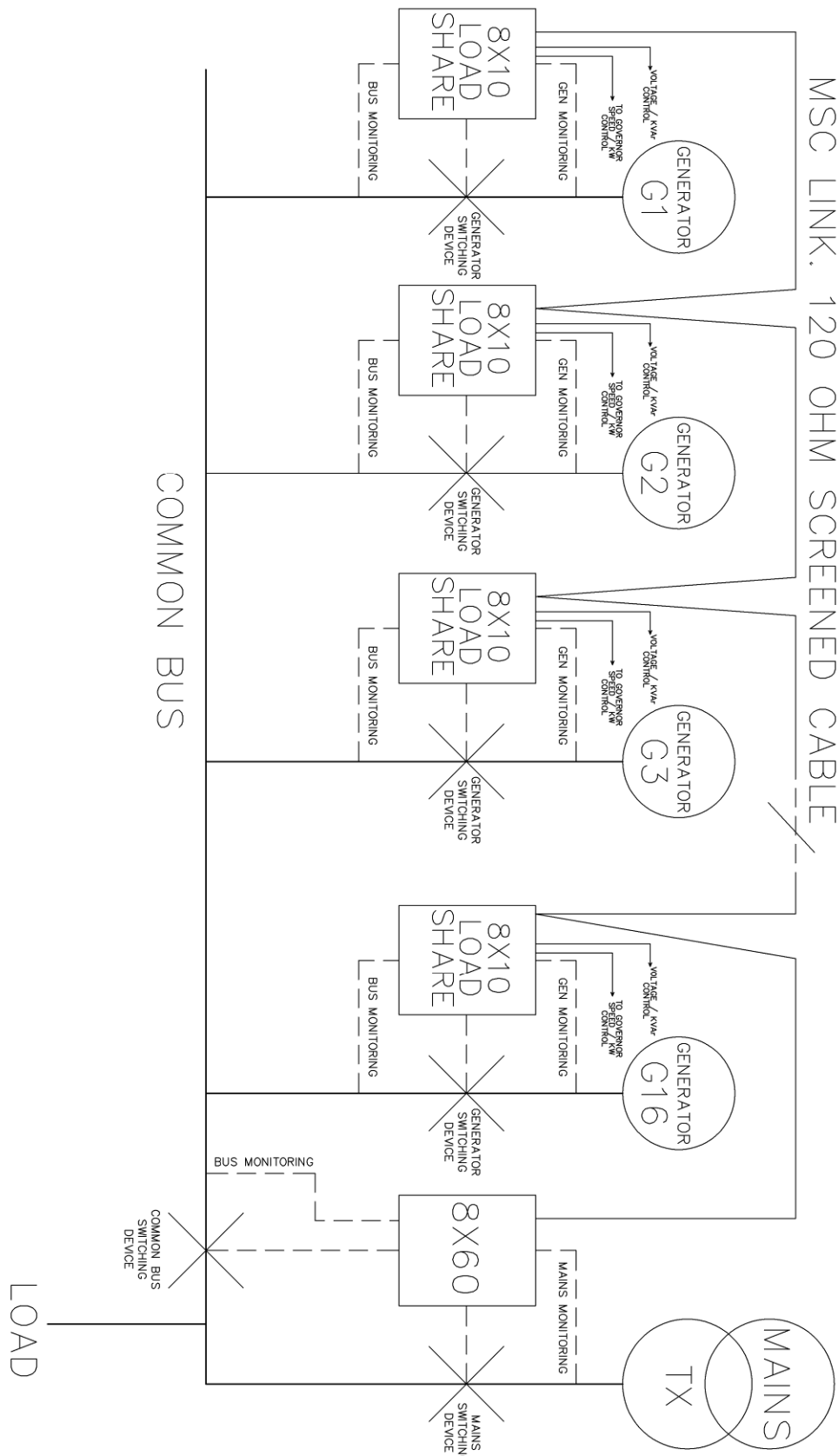
4.3.3.2 DUAL MAINS, MULTIPLE GENERATORS
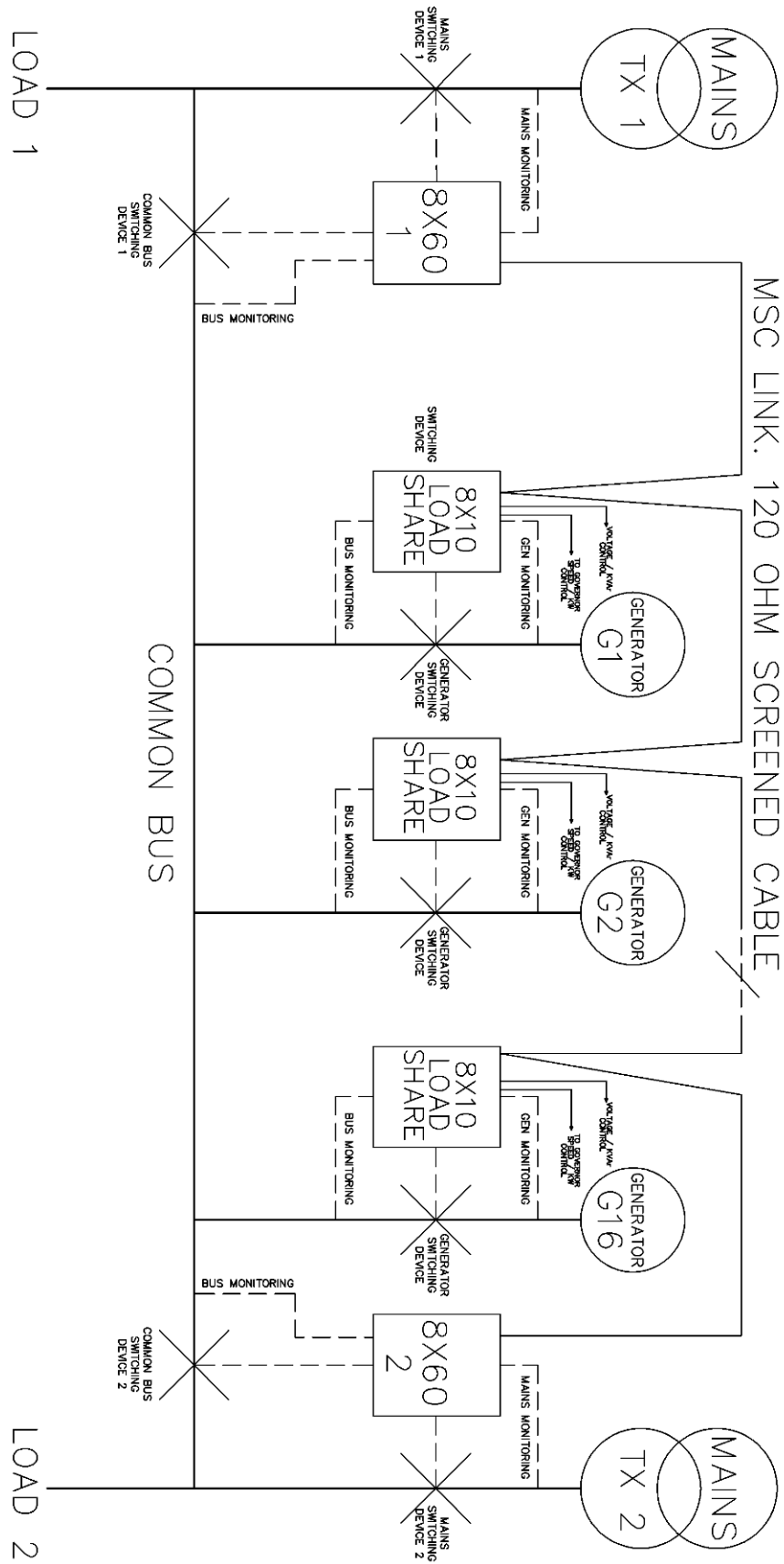
4.3.3.3   MULTIPLE MAINS, MULTIPLE GENERATORS
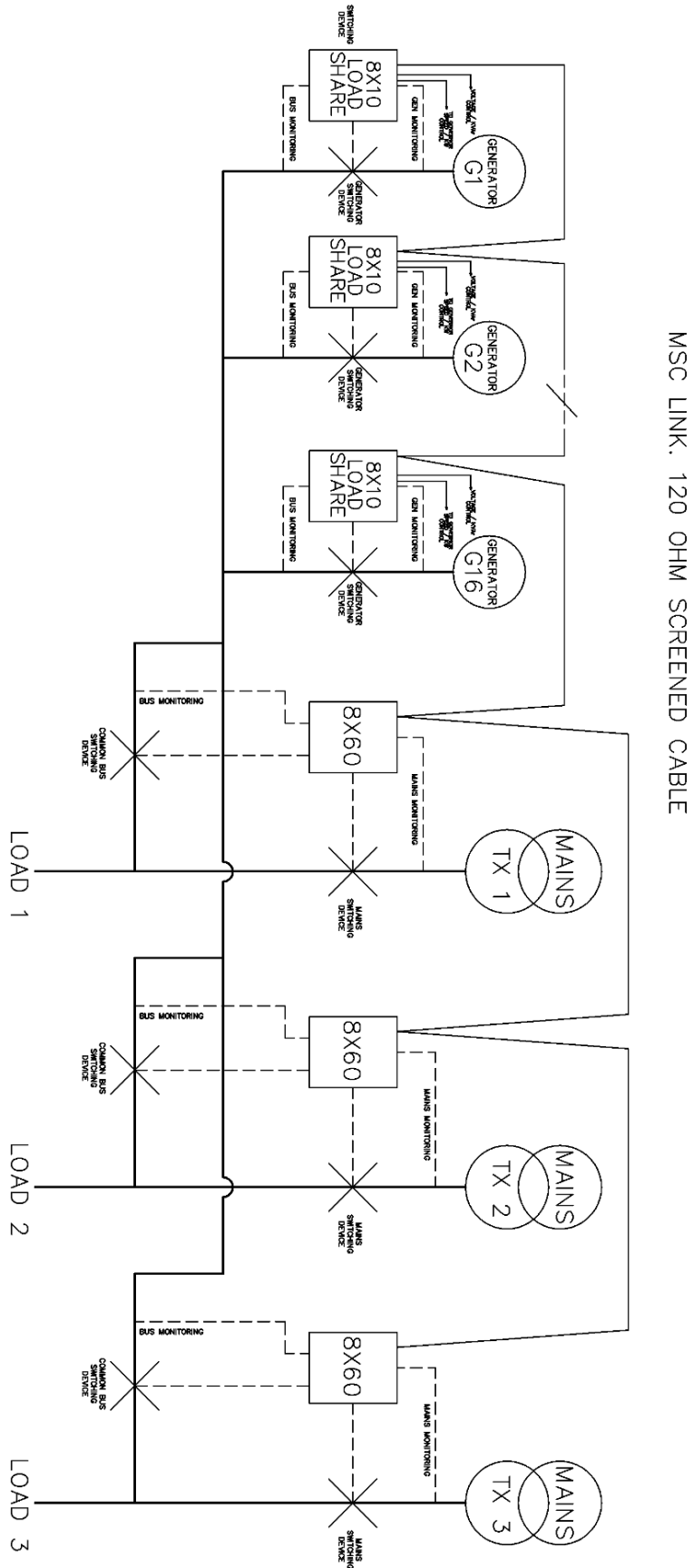
4.4 EARTH SYSTEMS

4.4.1 NEGATIVE EARTH

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

4.4.2 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).

4.4.3 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).

4.5 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
DSE2131 Ratio-metric Input Expansion	4
DSE2133 RTD/Thermocouple Intput Expansion	4
DSE2152 Ratio-metric Output Expansion	4
DSE2157 Relay Output Expansion	10
DSE2548 LED Expansion	10

⚠️**NOTE: DSE8800 series does not support the 2510/2520 display modules.**

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

⚠️**NOTE: Screened 120Ω impedance cable specified for use with CAN must be used for the DSENet® (RS485) connection.**
DSE stock and supply Belden cable 9841 which is a high quality 120Ω impedance cable suitable for DSENet® use (DSE part number 016-030).
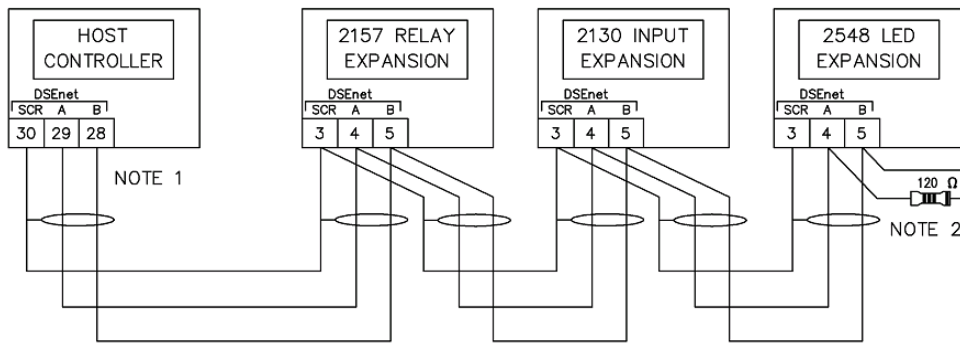
NOTE 1
AS A TERMINATING RESISTOR IS INTERNALLY FITTED
TO THE HOST CONTROLLER, THE HOST CONTROLLER
MUST BE THE FIRST UNIT ON THE DSEnet

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

5 DESCRIPTION OF CONTROLS

5.1 DSE8860 AUTO START CONTROL MODULE
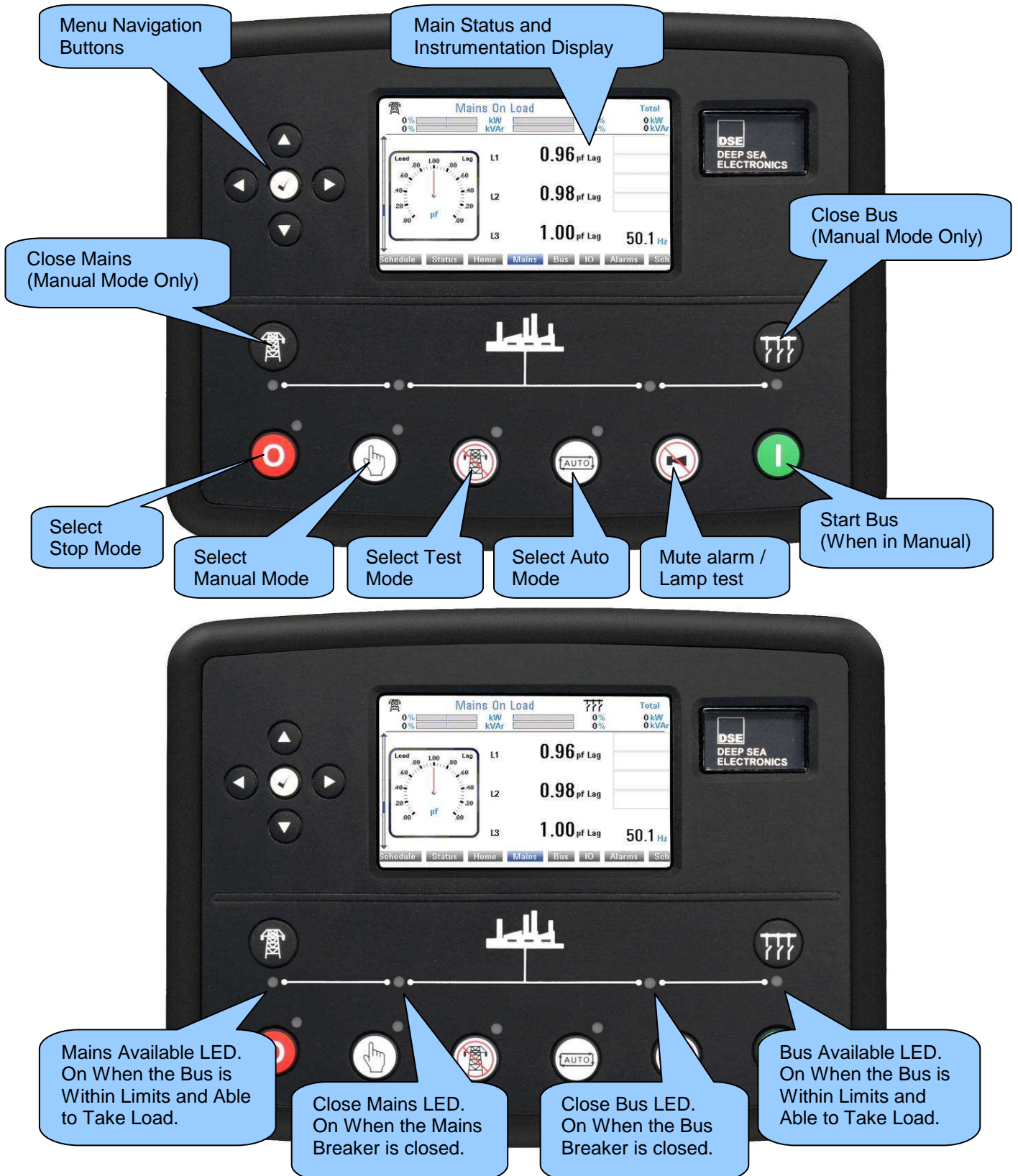
5.2 QUICKSTART GUIDE

This section provides a quick start guide to the module's operation.

5.2.1 STARTING THE GENERATOR(S)

First, Select Manual Mode…

…Then Press the Start Button to start the Generator(s).

⚠NOTE: For further details, see the section entitled 'OPERATION' elsewhere in this manual.

5.2.2 STOPPING THE ENGINE

Select Stop/Reset Mode. The Generator(s) is stopped.

⚠NOTE: For further details, see the section entitled 'OPERATION' elsewhere in this manual.

5.3   VIEWING THE INSTRUMENT PAGES

5.3.1   DISPLAY OVERVIEW

5.3.2   PAGE INDICATORS

Alarms	Schedule	Status	Home	Mains	Bus	I/O
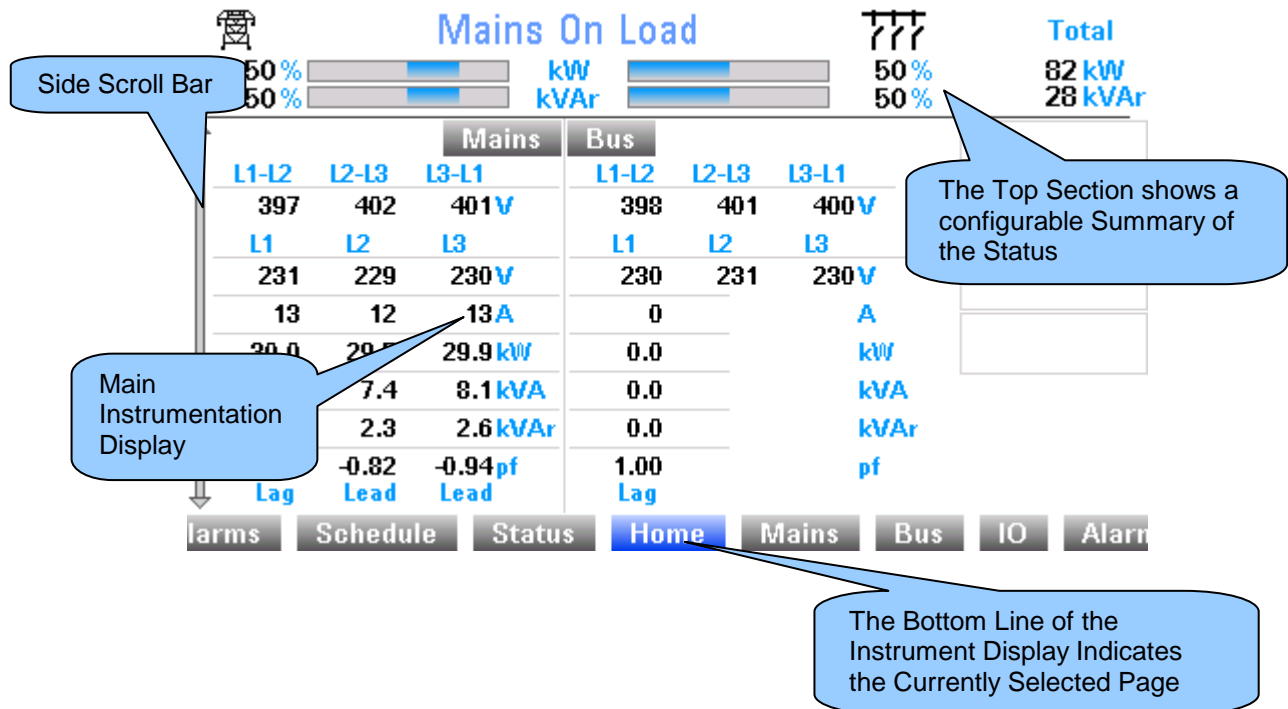
Pressing the next / previous page buttons   scrolls between the available pages.

Example

Alarms	Schedule	Status	Home	Mains	Bus	I/O

Press Page Right   to move to the next page.

It May be Quicker to Scroll Left Through the Pages Rather Than Right!

Schedule	Status	Home	Mains	Bus	I/O	Alarms

Press Page Right   to move to the next page.

Status	Home	Mains	Bus	I/O	Alarms	Schedule

5.3.3 SIDE SCROLL BAR

While a page is being viewed, the scroll bar at the side of the display represents how 'far down' the page you are currently viewing. Pressing the scroll buttons moves up and down the currently selected page.

Examples

An all grey vertical bar shows there is no further information to display, the whole page is currently being displayed.

The blue section indicates that you are currently viewing the 'bottom' half of a page. Press *scroll up/down* to move through the page

The blue section indicates that you are currently viewing a small part of a page. Press *scroll up/down* to move through the 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 (configurable *page timer*), the module will revert to the status display.

5.3.4 SUMMARY AREA

5.3.4.1 WHEN CONFIGURED TO SHOW LOAD SWITCH

Mains On Load
50.1 Hz   50.1 Hz   Total
82 kW
28 kVAr

Mains Available LED

Load Switch Position

Bus Available LED

Actual Mains Loading
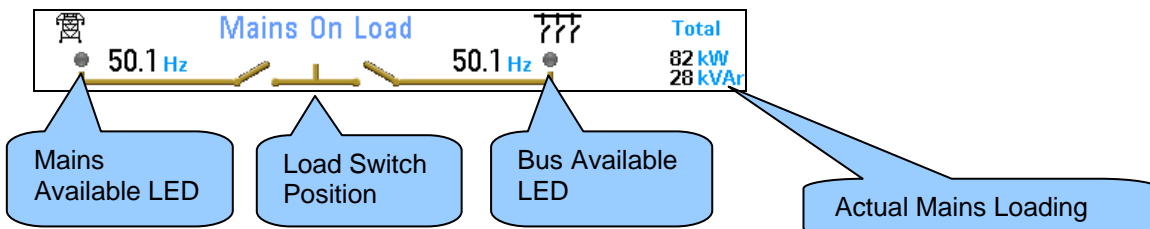
5.3.4.2 WHEN CONFIGURED TO SHOW BAR GRAPHS

Mains On Load
50 %   kW   50 %   Total
50 %   kVAr   50 %   82 kW
28 kVAr

Mains and Bus Loading as a Percentage of Full Load

Actual Mains Loading

5.3.4.3 DURING SYNCHRONISING

Mains On Load
0 V ✓   Total
0.00 Hz ✓   82 kW
28 kVAr

Actual Mains Loading

Voltage and Frequency difference between the supplies. The 'Tick' displays if the parameter is within the check sync window.

Phase difference of the two Supplies. The 'Barred' Section is the Configurable Phase Window.

5.3.5 HOME

In addition to the common display area, the following instruments are displayed on the home page.

Pressing the scroll ⬇ buttons moves up and down the pages mentioned below.

Example image :
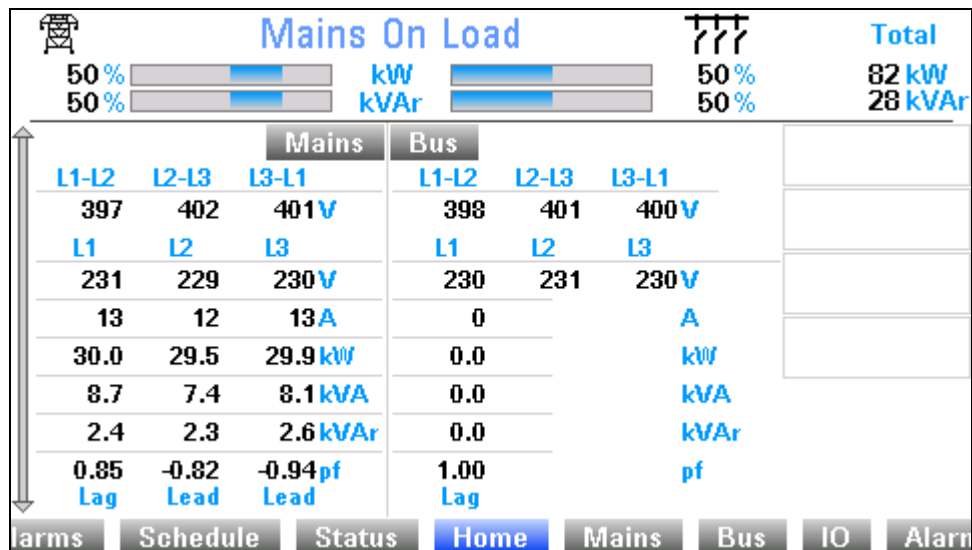
Mains

- Mains Voltage (ph-N)
- Mains Voltage (ph-ph)
- Mains Current
- Mains Load (kW)
- Mains Load (kV A)
- Mains Power Factor
- Mains Load (kV Ar)

Bus

- Bus Voltage (ph-N)
- Bus Voltage (ph-ph)
- Bus/Load CT Current (L1)
- Bus/Load CT Load (kW L1)
- Bus/Load CT Load (kVA L1)
- Bus/Load CT Load (kVAr L1)
- Bus/Load CT Power Factor (L1)

<u>Bus/Mains Mode</u>

- kW Bus/Mains Actual (% of Total)
- kW Bus/Mains Target (% of Total)
- kVAr Bus/Mains Actual (% of Total)
- kVAr Bus/Mains Target (% of Total)
- Ramp %

<u>Mains Supply Information</u>

- Mains Average Voltage (ph-N)
- Mains Phase Rotation
- Mains AC System
- Mains Nominal Settings (Hz & Voltage)

<u>Bus Supply Information</u>

- Bus Average Voltage (ph-N)
- Bus Phase Rotation
- Bus AC System
- Bus Nominal Settings (Hz & Voltage)

<u>Sets on Bus/Load</u>

- Sets on Bus/Load (Number of Sets on Bus/Load / Number of Sets on the MSC Link)
- ID (MSC ID number and LCD Indicator to show if set is closed onto the Bus/Load)

5.3.6 MAINS

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

Pressing the scroll   buttons moves up and down the pages mentioned below.

Example image:
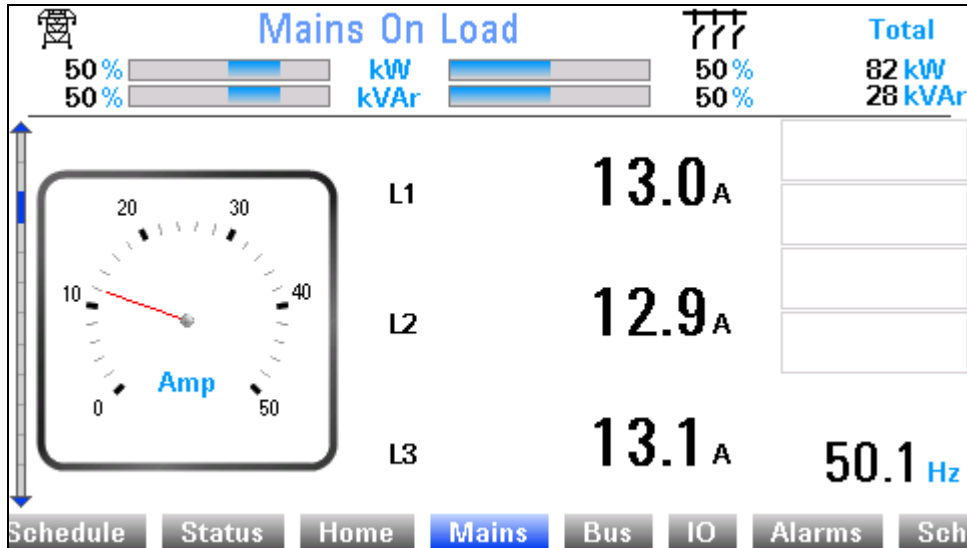
Mains

- Mains Voltage (ph-ph)
- Mains Voltage (ph-N)
- Mains Current
- Mains Load (kW)
- Mains Load (kV A)
- Mains Load (kV Ar)
- Mains Power Factor

Averages

⚠NOTE: Press the ⊘ (tick) button and the ⬆ (up) and ⬇ (down) buttons to cycle through the average parameters

- Average Voltage (ph-N),
- Average Voltage (ph-ph)
- Average Current
- Average Load (kW)
- Average Load (kV A)
- Average Load (kV Ar)
- Average Power Factor

AC System

- Mains Configuration (AC System diagram)
- Mains Configuration (Nominals)

Accumulated

- Mains kW h +
- Mains kW h -
- Mains kV A h
- Mains kV Ar h

Total

- Mains Total Load (kW, kV A, kV Ar, Power Factor)

Mains Decoupling

- R.O.C.O.F (Instantaneous reading and peak hold)
- Vector Shift (Instantaneous reading and peak hold)

AC System

5.3.7 BUS

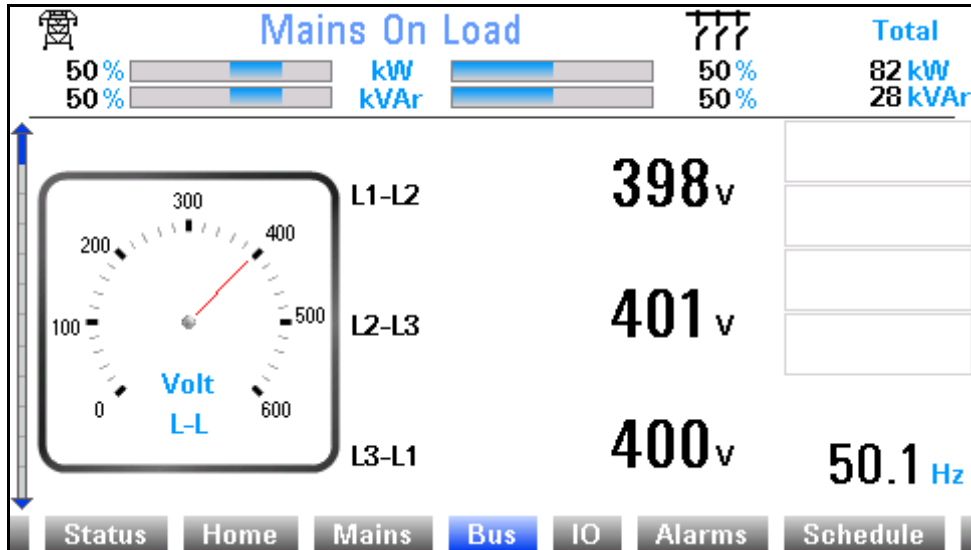Contains electrical values of the common generator bus, this is derived from the MSC link which connects all the modules together.

Pressing the scroll   buttons moves up and down the pages mentioned below.

Example image:

Bus

- Bus Voltage (ph-N)
- Bus Voltage (ph-ph)
- Bus/Load CT Current (L1)
- Bus/Load CT Load (kW L1)
- Bus/Load CT Load (kVA L1)
- Bus/Load CT Load (kVAr L1)
- Bus/Load CT Power Factor (L1)

Averages

⚠️**NOTE: Press the** ⊘ **(tick) button and the** 🔺 **(up) and** 🔻 **(down) buttons to cycle through the average parameters**

- Average Voltage (ph-N),
- Average Voltage (ph-ph)
- Average Current (L1)
- Average Load (kW L1)
- Average Load (kVA L1)
- Average Load (kVAr L1)
- Average Power Factor (L1)

AC System

- Bus Configuration (AC System diagram)
- Bus Configuration (Nominals)

Bus Load

- Bus Load (kW and Total %)
- Bus Load (kV Ar and Total %)

5.3.8 I/O

Displays the measured values of the analogue inputs C and D.

Pressing the scroll 🔼⚪🔽 buttons moves up and down the pages mentioned below.
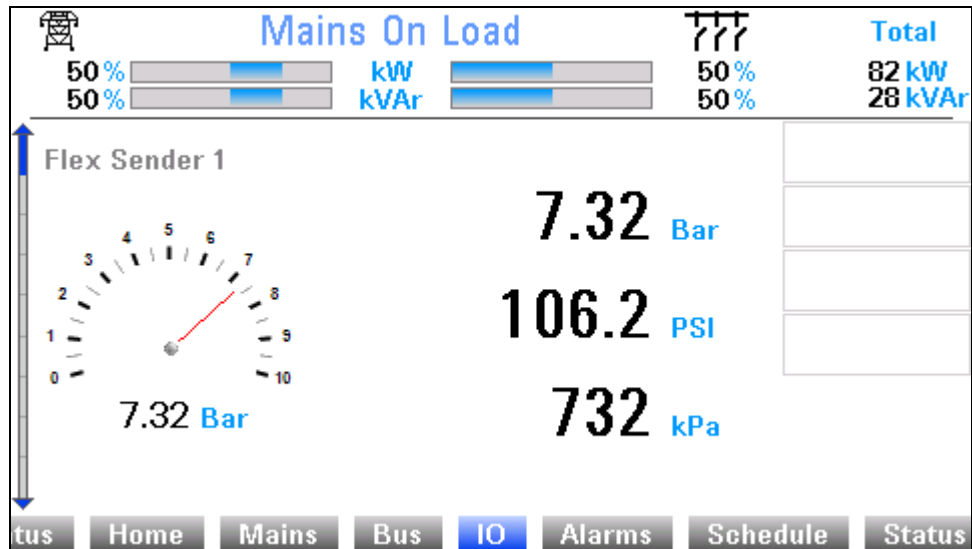
Example image:

5.3.9   ALARMS

Contains all the alarms currently present on the module.

Pressing the scroll ⬤ buttons moves up and down the pages mentioned below.

Example image:
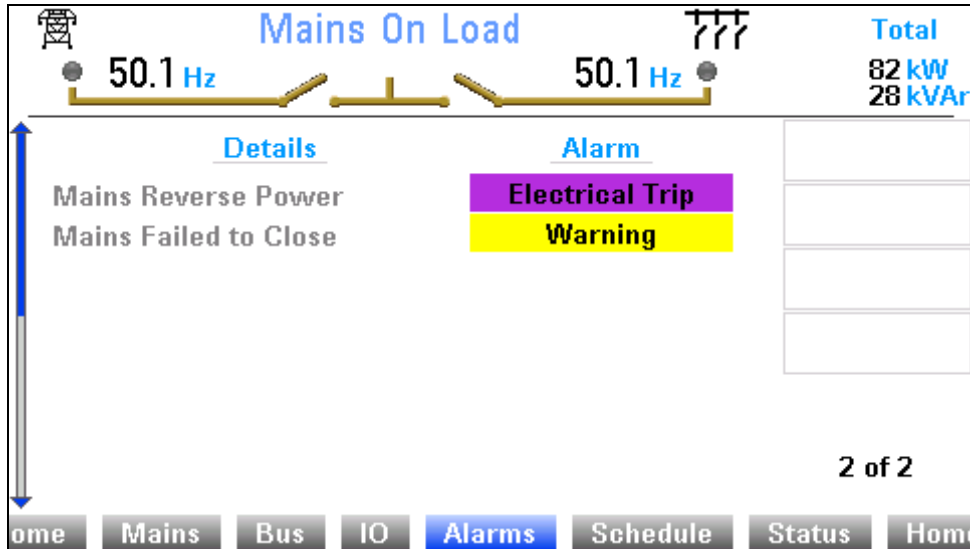
Event Log

- Alarm History containing up to 250 past events logged. Where more than 250 events are logged, the last 250 are displayed.
- Press ✓ Tick to enter the event log, then press ▲ (up) and ▼ (down) buttons to navigate through the past events.
- Press ✓ Tick again to return to the main instrument navigation.

Example image:

5.3.10 SCHEDULE

Contains the scheduler settings for the controller.

Pressing the scroll ⬆⬇ buttons moves up and down the pages mentioned below.

Example images:

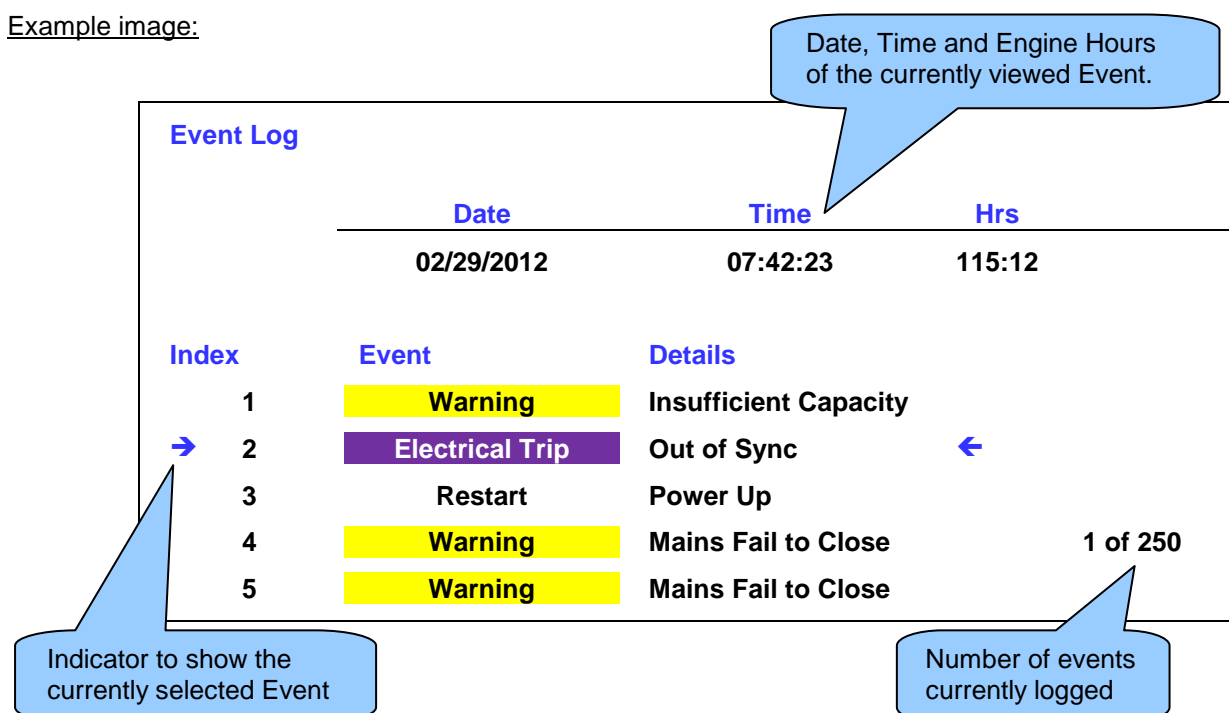## 5.3.11 STATUS

Contains status information for the controller.

Pressing the scroll ⬆⬇ buttons moves up and down the pages mentioned below.

Depending upon configuration of the controller, the information displayed will change.

Information	
Model	**8860**
USB ID	**0x0000BC12563**
Control	**V1.00.02**
Graphics	**V1.00.03**
Analogue	**V3.00.02**
Engine	**V1.18**
Bootloader Control	**V1.00**
Bootloader Graphics	**V1.02.03**

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

RS232 No Modem	
Slave ID	**10**
Baud Rate	**115200**
Tx Packets	**1562**
Rx Packets	**1562**
Exception Packets	**3**

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 module is powered 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 module. At regular intervals after power up, the modem is reset, and reinitialised, to ensure the modem does not 'hang up'.

If the 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 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.

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.

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.

RS485 Port 1 / Port 2

Slave ID	10
Baud Rate	115200
Tx Packets	1562
Rx Packets	1562
Exception Packets	3

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.

The 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 (The 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.

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).

Pressing the scroll buttons moves up and down the pages mentioned below.

Ethernet Port Up

DHCP enable	**Disabled**
Host Name	
IP address	**192.168.10.23**
Modbus Port Number	**502**
Subnet Mask	**255.255.255.0**
Gateway IP	**0.0.0.0**
DNS IP	**0.0.0.0**
MAC Address	**008080EF1F2F3**

Ethernet Traffic

DHCP enable	**Disabled**
Tx Packets	**1562**
Rx Packets	**1562**
Exception Packets	**3**

USB Traffic

Tx Packets	**1562**
Rx Packets	**1562**
Exception Packets	**3**

Pressing the scroll buttons moves up and down the pages mentioned below.

Logging

Log State	**Enabled**
Log Destination	**Internal**
Log Mode	**Newest**
Total Log Memory	**2048k**
Log Memory Free	**1463k**
USB Drive State	**Not Detected**
Logging Time Remaining	**26hr 52m**

Status

Supervisor State	**At Rest**
Mains State	**Mains Available**
Load State	**Mains on Load**

Identity

MSC ID	**2**
Priority	**1**
Site Identity	**Deep Sea Electronics**
Mains Identity	**Mains #5**

6   FACIA OPERATION

6.1   CONTROL

Control of the 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 generator 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 the generator(s) to 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: This control module has PLC functionality built in. This can have change the standard operation when used. (Default configuration the no PLC is set. Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring,

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6.2   CONTROL PUSH-BUTTONS

STOP / RESET This button places the module into its ⭘ **Stop/Reset** mode. This will clear any alarm conditions for which the triggering criteria have been removed. If the generator(s) is running and the module is put into ⭘ Stop mode, the module will automatically instruct the changeover device to unload the generator bus *('Close Bus becomes inactive (if used))* and the start request to the DSE8x10 controller(s) is taken away. Should a **remote start signal** be present while operating in this mode, a remote start will <u>not</u> occur.	⭘
MANUAL This mode allows manual control of the functions. Once in 🖑 **Manual mode** the module will respond to the ❘ START button, sending a start request to the generator(s) over the MSC link. If the generator(s) is running off-load in the **Manual mode** and a **remote start signal** becomes present, the module will automatically instruct the changeover device to place the generator bus on load *('Close Bus becomes active (if used))*. Upon removal of the **remote start signal**, the generator bus remains on load until either selection of the '⭘ **STOP/RESET'** or '🔲 **AUTO'** modes. *For further details, please see the more detailed description of 'Manual operation' elsewhere in this manual.*	🖑
TEST This button places the module into its **'Test'** mode. This allows an on load test of the generator(s). Once in '⊗ **TEST'** mode the module it will send a start request to the generator(s) over the MSC link, and run on load in parallel with the mains supply or off load depending on configuration. *For further details, please see the more detailed description of 'Test operation' elsewhere in this manual.*	⊗
AUTO This button places the module into its '🔲 **AUTO'** mode. This mode allows the module to control the function of the system automatically. The module will monitor the *remote start* input and mains supply status and once a start request is made, the generator(s) will be automatically started and placed on load. Upon removal of the starting signal, the module will automatically transfer the load from the generator bus and shut the generator(s) 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' elsewhere in this manual.*	AUTO
START This button is only active in MANUAL 🖑 mode. Pressing this button in manual will request the generator(s) to start and run off load	❘
MUTE / LAMP TEST This button silences the audible alarm if it is sounding and illuminates all of the LEDs as a lamp test feature.	⊗
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.	▲ ◀✓▶ ▼

CLOSE MAINS

This push button is used to control the closure of the mains load switching device in ⊙ **Manual mode** and has two modes of operation :

'Normal' breaker button control
- **Synchronising is NOT enabled:** Pressing this button when the mains is available and off load in ⊙ MANUAL mode, the bus load switch is opened and the mains load switch is closed. Further presses of this button will have no effect.
- **Synchronising is enabled:** Pressing this button when the mains is available, in ⊙ MANUAL mode and the mains load switch open, the controller will synchronise with the Bus. The mains load switch is then closed in parallel with the Bus. Further presses of this button will ramp all the load from the generator bus and once done, open the bus load switch leaving just the mains supplying the load.

'Alternative' breaker button control
- **Synchronising is NOT enabled:** Pressing this button when the mains is available and off load in ⊙ MANUAL mode, the bus load switch is opened and the mains load switch is closed. Further presses of this button will open and close the mains load switch and leave the bus load switch in the open position.
- **Synchronising is enabled:** Pressing this button when the mains is available, in MANUAL mode and the mains load switch open, the controller will synchronise with the Bus. The mains load switch is then closed in parallel with the Bus. Further presses of this button will ramp all the load onto the generator bus and once done, open the mains load switch leaving just the generator bus supplying the load.

CLOSE BUS

This push button is used to control the closure of the generator load switching device in ⊙ **Manual mode** and has two modes of operation :

'Normal' breaker button control
- **Synchronising is NOT enabled:** Pressing this button when the generator bus is available and off load in ⊙ MANUAL mode, the mains load switch is opened and the generator bus load switch is closed. Further presses of this button will have no effect.
- **Synchronising is enabled:** Pressing this button when the generator bus is available, in ⊙ MANUAL mode and the generator bus load switch is open, the controller will synchronise the generator(s) to the Mains. The generator load switch is then closed in parallel with the Mains. Further presses of this button will ramp the entire load from mains and once done, open the mains load switch leaving just the generator(s) supplying the load.

'Alternative' breaker button control
- **Synchronising is NOT enabled:** Pressing this button when the generator bus is available and off load in ⊙ MANUAL mode, the bus load switch is closed and the mains load switch is opened. Further presses of this button will open and close the generator bus load switch and leave the mains load switch in the open position.
- **Synchronising is enabled:** Pressing this button when the generator bus available, in ⊙ MANUAL mode and the generator bus load switch open, the controller will synchronise the generator(s) to the mains, the mains load switch is then closed in parallel with the Bus. Further presses of this button will ramp the entire load onto the mains and once done, open the generator bus load switch leaving just the mains supplying the load.

7   OPERATING PROCEDURE

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's configuration 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.

7.1   STOP MODE

> ⚠**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.**

Activate auto mode by pressing the ⊙ pushbutton. An LED indicator beside the button confirms this action.

In STOP mode, the module will remove the generator bus from load (if necessary) before removing the start request from the engines.

Any latched alarms (electrical trip) that have been cleared are reset when STOP mode is entered.

The generator(s) will not be started by the DSE8860 when in STOP mode. If remote start signals are given or the mains supply fails, the start request is not sent to the generator(s) until AUTO mode is entered.

If *Immediate mains dropout* is enabled, the mains load switch is opened and closed as appropriate, when the mains fails or becomes available to take load.

7.2   AUTOMATIC MODE

⚠️**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.**

Activate auto mode by pressing the 🔘 pushbutton. An LED indicator beside the button confirms this action.

Auto mode will allow the generator(s) to operate fully automatically, starting and stopping as required with no user intervention.

7.2.1   WAITING IN AUTO MODE

If a starting request is made, the starting sequence will begin.
Starting requests can be from the following sources:

- Mains supply out of limits
- High mains load (when the DSE8860 is configured for an automatic peak lopping system)
- Activation of an auxiliary input that has been configured to *remote start on load, remote start in island mode* or *remote start off load.*
- Activation of an auxiliary input that has been configured to *Aux Mains Failure.*
- Activation of the inbuilt exercise scheduler.
- Instruction from external remote telemetry devices using the RS232, RS485 or Ethernet interface.

7.2.2   STARTING SEQUENCE

To allow for 'false' start requests such as mains brownouts, the *start delay* timer begins. There are individual start delay timers for each of the different start request types.

Should all start requests be removed during the *start delay* timer, the unit will return to a stand-by state.

If a start request is still present at the end of the *start delay* timer, the starting request is sent to the generator(s) over the MSC data link.

7.2.3   BUS AVAILABLE (GENERATOR(S) RUNNING)

Once the generator bus becomes available, the load is transferred. If required, the generator bus is first synchronised with the mains supply. This operation is automatic, using the MSC data link.
Load ramping takes place when appropriate, the DSE8860 controls the generator bus to provide the configured power to the load and/or mains supply.

7.2.3.1   BUS MODE

In this mode, the generator(s) are used to provide a **fixed** amount of active power (kW), this is configured into the *Load parallel power* parameter.

How much reactive power is provided depends upon the kVAr/pf selection:
- kVAr – The generator(s) will provide the number of kVAr configured into the *Load Parallel VAr* parameter. The power factor is variable in order to achieve this.

- Pf – The generator(s) will produce power at the power factor configured into the *Load power factor* parameter. The kVAr is variable in order to achieve this.

7.2.3.2   MAINS MODE

In this mode, the generator(s) are used to provide a **variable** amount of active power (kW), to maintain the mains import/export levels at the configured values. This is configured into the *Load parallel power* parameter.

How much reactive power is taken from or exported to the mains depends upon the kVAr/pf selection:

- KVAr – The generator(s) will be used to provide enough kVAr to keep the mains import/export VAr at the level configured into the *Load Parallel VAr* parameter. The mains power factor is variable in order to achieve this.

- Pf – The generator(s) will be used to provide enough kVAr to keep the mains import/export at the power factor configured into the *Load power factor* parameter. The mains kVAr is variable in order to achieve this.

As the load increases and decreases, sets may automatically start and stop, depending upon their configuration.
If all start requests are removed, the *stopping sequence* will begin.

7.2.4   STOPPING SEQUENCE

The *return delay* timer operates to ensure that the starting request has been permanently removed and is not just a short-term removal.

If there are no starting requests at the end of the *return delay* timer, the load is transferred back from the generator bus to the mains supply and the start request is removed from the generator(s).

7.3   MANUAL MODE

⚠️**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.**

Activate Manual mode be pressing the 👆 pushbutton. An LED indicator beside the button confirms this action.

Manual mode allows the operator to start and stop the generator(s) manually, and if required change the state of the load switching devices.

7.3.1   WAITING IN MANUAL MODE

When in manual mode, the generator(s) will not start automatically.

To begin the starting sequence, press the Ⓘ button.

7.3.2   BUS AVAILABLE (GENERATOR(S) RUNNING)

In manual mode, the load is not transferred to the generator bus unless a 'loading request' is made.
A loading request can come from a number of sources.

- Pressing the *transfer to bus* button
- Mains supply out of limits.
- Activation of an auxiliary input that has been configured to *remote start on load, remote start in island mode* or *remote start off load.*
- Activation of an auxiliary input that has been configured to *Aux Mains Failure.*
- Activation of the inbuilt exercise scheduler if configured for 'on load' runs.

Parallel operation is governed by configuration. See the previous section ***Auto Mode: Bus Available (Generator(s) Running)*** for further details.

Once bus and mains are in parallel, you can either

- Press the *transfer to bus* button. The load is ramped to the bus, the mains breaker is opened.
- Press the *transfer to mains* button. The load is transferred to the mains. The generator bus breaker is opened.
- Press the *auto mode* button to return to automatic mode.

7.3.3   STOPPING SEQUENCE

In manual mode, the set will continue to run until either:

- The *stop button* 🅞 is pressed – The generator(s) are requested to stop
- The *auto button* is pressed. The generator(s) will observe all auto mode start requests and stopping timers before beginning the ***Auto Mode: Stopping Sequence.***

7.4   TEST MODE

⚠**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.**

Activate test mode be pressing the 🔘 pushbutton. An LED indicator beside the button confirms this action.

Test mode will start the generator(s) and parallel the mains to the generator bus to provide a *Test on load* function. Depending upon configuration this can be continuous parallel or island mode operation.

7.4.1   WAITING IN TEST MODE

As soon as test mode is entered, the generator(s) will start automatically.

7.4.2   BUS AVAILABLE (GENERATOR(S) RUNNING)

Parallel operation is governed by configuration. See the previous section entitled *Auto Mode: Bus Available (Generator(s) Running)* for further details.

In test mode, the set will continue to run *on load* until either:

- The *stop button* 🔴 is pressed – The generator bus breaker is opened and the generator(s) is called to stop.
- The *auto button* 🔘 is pressed. The generator(s) will observe all auto mode start requests and stopping timers before beginning the *Auto Mode: Stopping Sequence*.

7.5   MULTIPLE MAINS OPERATION

In a multiple mains system, the generator(s) are controlled by more than one DSE8860 mains controller and used to provide power to multiple loads.
Should one or more of the mains supplies fail, the generator(s) (controlled by DSE8x10 modules) are started and supply power to the load. If more than one mains supply has failed, the loads are transferred to the generator(s) one by one.

The DSE8x10 controllers share power equally on a percentage basis with the other generators in the system.

- If one mains supply returns, the DSE8860 connected to that mains supply will synchronise the generator(s) with the mains and affect a no-break changeover. The generator(s) continue to supply power to the remaining loads.
- If more than one mains supply returns at the same time, then the DSE8860 with the highest priority will take control of the generator(s) and affect a no-break changeover back to the mains supply. The remaining DSE8860s will operate in priority order providing no-break returns back to their respective mains supplies.
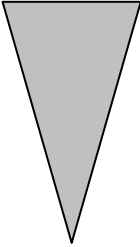
If the generator(s) are 'peak-lopping' with one mains supply, and another mains supply fails, dependent upon module configuration, the generator(s) will either:

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

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

7.5.1   DSE8X60 PRIORITY

Where more than one DSE8x60 controller is present, they must determine which one is to take control over the generator(s). The following table shows how this priority decision is made.

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

Where two or more DSE8x60 controllers have the same conditions in the table above, the 'Set Priority' configuration setting comes into effect. If two or more DSE8x60 controllers have the same priority number, an electrical trip alarm is generated - Priority Selection Error - and the priority numbers must be changed before the system will operate.

⚠️**NOTE: - If a DSE8x60 requests to control the generators (either automatically or manually) it will not be allowed to do so until higher priority DSE8X60 controllers have relinquished control over them.**

For typical one line diagram of a multi-mains system, see the section entitled "**TYPICAL SYSTEM SCHEMATICS**" elsewhere in this manual.

7.5.2   DSE8860 BUS/LOAD CT

The DSE8860 controller incorporates an optional (but recommended) extra CT for measuring the amount of power the generator bus is producing or the size of the load. Used in conjunction with the CTs measuring the amount of load on the mains supply, this CT allows the DSE8860 to determine what portion of the load is being supplied by the generator(s).
This allows the DSE8860 to remove the generator(s) from this load when there is little or no current passing through the bus breaker. For example: When the generator(s) are ramping off load.

8   PROTECTIONS

When an alarm is present, the Audible Alarm will sound and the LCD display indicates the alarm(s) that are present:
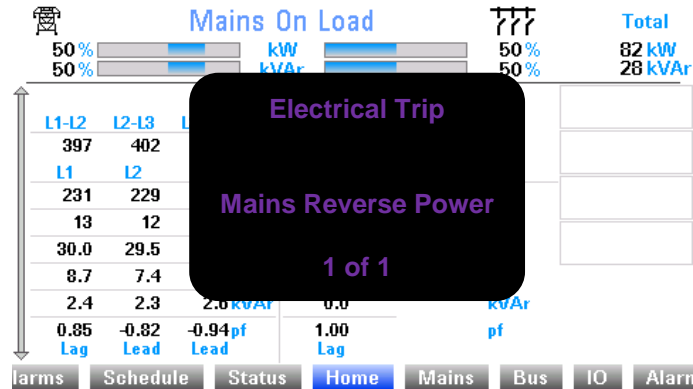
The audible alarm can be silenced by pressing the *Mute button*

To reset the alarm, address the cause of the alarm, then press the *Stop/Reset* button.

8.1   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 LCD 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.

- LCD Indicator to make LCD1 illuminate when the module is in Stop Mode.
- The Insert Card Text allows the system designer to print an insert card detailing the LCD function.

- Sample showing operation of the LCD indicators.

Text scrolls if it's too long to fit onto the display

8.2 WARNINGS

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

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 DSE 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.
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 Sync	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.
Insufficient Capacity	If the generator(s) 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 Decoupling High Frequency	If the module detects the mains frequency increase when in parallel with the generator(s) more then the configure value. The LCD will indicate **'MAINS DECOUPLING HIGH FREQUENCY'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling High Voltage	If the module detects the mains voltage increase when in parallel with the generator(s) more then the configure value. The LCD will indicate **'MAINS DECOUPLING HIGH VOLTAGE'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling Low Frequency	If the module detects the mains frequency decreases when in parallel with the generator(s) below the configure value. The LCD will indicate **'MAINS DECOUPLING LOW FREQUENCY'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling Low Voltage	If the module detects the mains voltage decreases when in parallel with the generator(s) below the configure value. The LCD will indicate **'MAINS DECOUPLING LOW VOLTAGE'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling ROCOF	If the module detects the mains frequency changing when in parallel with the generator(s) more then the configure value in a time frame. The LCD will indicate **'MAINS DECOUPLING ROCOF'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling Vector Shift	If the module detects the mains phase angle changing when in parallel with the generator(s) more then the configure value in a time frame. The LCD will indicate **'MAINS DECOUPLING VECTOR SHIFT'** and the **COMMON ALARM LED** will illuminate.

Display	Reason
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.
Mains Reverse Power	If the DSExx60 detects that the bus is exporting more than the configured limit, the LCD will indicate **'MAINS REVERSE POWER'** and the **COMMON ALARM LED** will flash.
MSC Alarms Inhibited	if an input has been configured as 'MSC ALARMS INHIBIT' and is active, the LCD will indicate **'MSC ALARMS INHIBIT'** and the **COMMON ALARM LED** will illuminate.
MSC Data Error	If the data on the MSC link is corrupt, then the LCD will indicate **'MSC DATA ERROR'** and the **COMMON ALARM LED** will illuminate.
MSC Failure	If the link breaks, the LCD will indicate **'MSC FAILURE'** and the **COMMON ALARM LED** will illuminate.
MSC ID Error	If more than one DSExx60 module is connected to the same MSC link, the LCD will indicate **'MSC ID ERROR'** and the **COMMON ALARM LED** will illuminate.
MSC Too Few Sets	If the number of modules on the MSC link falls below the **Minimum modules on Multiset comms link**, the LCD will indicate **'MSC TOO FEW SETS'** and the **COMMON ALARM LED** will illuminate.

8.3 ELECTRICAL TRIPS

Electrical trips are latching and stop the Generator(s) but in a controlled manner. On initiation of the electrical trip condition the module will de-energise the **'Close Bus'** Output to remove the load from the generator(s). Once this has occurred the generator controllers will start the 'Return Delay' timer and once the generator(s) breaker has opened, the 'Cooldown Timer' will begin to allow the generator to cool off-load before shutting down

To reset the alarm first remove the fault and then press Stop/Reset Ⓞ to reset the alarm on the module.

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.
Bus Failed To Close	If the bus breaker fails to close, the LCD will indicate **'BUS FAILED TO CLOSE'** and the **COMMON ALARM LED** will flash.
Bus Failed To Open	**If** the bus breaker fails to open, the LCD will indicate **'BUS FAILED TO OPEN'** and the **COMMON ALARM LED** will flash.
Bus Phase Rotation	If the module detects a bus phase rotation error, an electrical trip is initiated. The LCD will indicate **'BUS PHASE SEQ WRONG'** and the **COMMON ALARM LED** will illuminate.
Fail To Sync	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.
Insufficient Capacity	If the generator(s) 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 Decoupling High Frequency	If the module detects the mains frequency increase when in parallel with the generator(s) more then the configure value. The LCD will indicate **'MAINS DECOUPLING HIGH FREQUENCY'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling High Voltage	If the module detects the mains voltage increase when in parallel with the generator(s) more then the configure value. The LCD will indicate **'MAINS DECOUPLING HIGH VOLTAGE'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling Low Frequency	If the module detects the mains frequency decreases when in parallel with the generator(s) below the configure value. The LCD will indicate **'MAINS DECOUPLING LOW FREQUENCY'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling Low Voltage	If the module detects the mains voltage decreases when in parallel with the generator(s) below the configure value. The LCD will indicate **'MAINS DECOUPLING LOW VOLTAGE'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling ROCOF	If the module detects the mains frequency changing when in parallel with the generator(s) more then the configure value in a time frame. The LCD will indicate **'MAINS DECOUPLING ROCOF'** and the **COMMON ALARM LED** will illuminate.
Mains Decoupling Vector Shift	If the module detects the mains phase angle changing when in parallel with the generator(s) more then the configure value in a time frame. The LCD will indicate **'MAINS DECOUPLING VECTOR SHIFT'** and the **COMMON ALARM LED** will illuminate.

Display	Reason
Mains Reverse Power	If the DSExx60 detects that the bus is exporting more than the configured limit, the LCD will indicate **'MAINS REVERSE POWER'** and the **COMMON ALARM LED** will flash.
Minimum Sets Not Reached	If the minimum number of sets on the bus has not been reached prior to closing the generator bus load switching device, the LCD will indicate '**MINIMUM SETS NOT REACHED**' and the **COMMON ALARM LED** will illuminate.
MSC Failure	If the link breaks, the LCD will indicate **'MSC FAILURE'** and the **COMMON ALARM LED** will illuminate.
MSC Old Version Unit On The Bus	If the module detects that there is one or more DSE controller connected to the MSC link that are not compatible with the module (for example earlier versions), '**MSC OLD VERSION UNIT ON THE BUS**' is displayed and the **COMMON ALARM LED** will flash.
MSC Too Few Sets	If the number of modules on the MSC link falls below the **Minimum modules on Multiset comms link**, the LCD will indicate **'MSC TOO FEW SETS'** and the **COMMON ALARM LED** will illuminate.
Out Of Sync	If the module detects that the supplies either side of either the mains or generator bus breaker are not in sync when the breaker is closed. The LCD will indicate **'OUT OF SYNC'** and the **COMMON ALARM LED** will illuminate.
Out Of Sync Bus	If the module detects that the supplies either side of either the generator bus breaker are not in sync when the breaker is closed. The LCD will indicate **'OUT OF SYNC BUS'** and the **COMMON ALARM LED** will illuminate.
Mains Phase Rotation	If the module detects a mains phase rotation error, an electrical trip is initiated is initiated. The LCD will indicate **'MAINS PHASE SEQ WRONG'** and the **COMMON ALARM LED** will illuminate.
Priority Selection Error (Mains Priority Must Be Unique For A Multi-Mains System)	If the DSExx60 detects that two or more DSExx60 controllers share the same priority number, an electrical trip is initiated. The LCD will indicate **'PRIORITY SELECTION ERROR'** and the **COMMON ALARM LED** will illuminate.

8.4 ROCOF / VECTOR SHIFT

When the mains (utility) and the generator(s) supplies are in parallel, the module monitors for a ROCOF and Vector shift trip which are set in the module's configuration settings.

> ⚠ **NOTE: This protection operates only when the mains and the common generator bus are in parallel, it is disabled at all other times.**

Should either of these alarms operate, the module will perform a controlled electrical trip of the common generator bus or a mains failure. This operation must be manually reset:

1) Press the 🅞 stop button. The generator bus load switch will open, the generator(s) will be called to stop if it is still running and the alarm is also cleared.
2) Activate digital input configured to "Clear ROCOF/Vector shift" if this has been provided.
3) To clear the ROCOC / Vector Shift alarm without pressing the 🅞 stop button

   1) Press the 🔼 (up) and 🔽 (down) buttons together and hold to enter the 'Maintenance Configuration Editor' Editor.

   2) Press the 🔼 (up) or🔽 (down) buttons to cycle to the '*Clear Mains Decouple Alarm'* option.

   3) To change the action press ▶(right) button to enter edit mode. The action is highlighted in blue to indicate selection.

   4) Press the 🔼 (up) button to activate the action. The action will then change to show it has been activated.

   5) Press the ✓ tick button to exit the "Maintenance Configuration Editor".

9 SCHEDULER

The controller contains an inbuilt exercise run scheduler, capable of automatically starting and stopping the generator(s). 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.

9.1.1 STOP MODE

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

9.1.2 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 cause the generator bus to be placed on load.

9.1.3 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.

10 FRONT PANEL CONFIGURATION

⚠️**NOTE: Refer to DSE8860 PC Software Configuration Manual (DSE part 057-174) for further details on configuring, monitoring and control.**

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:
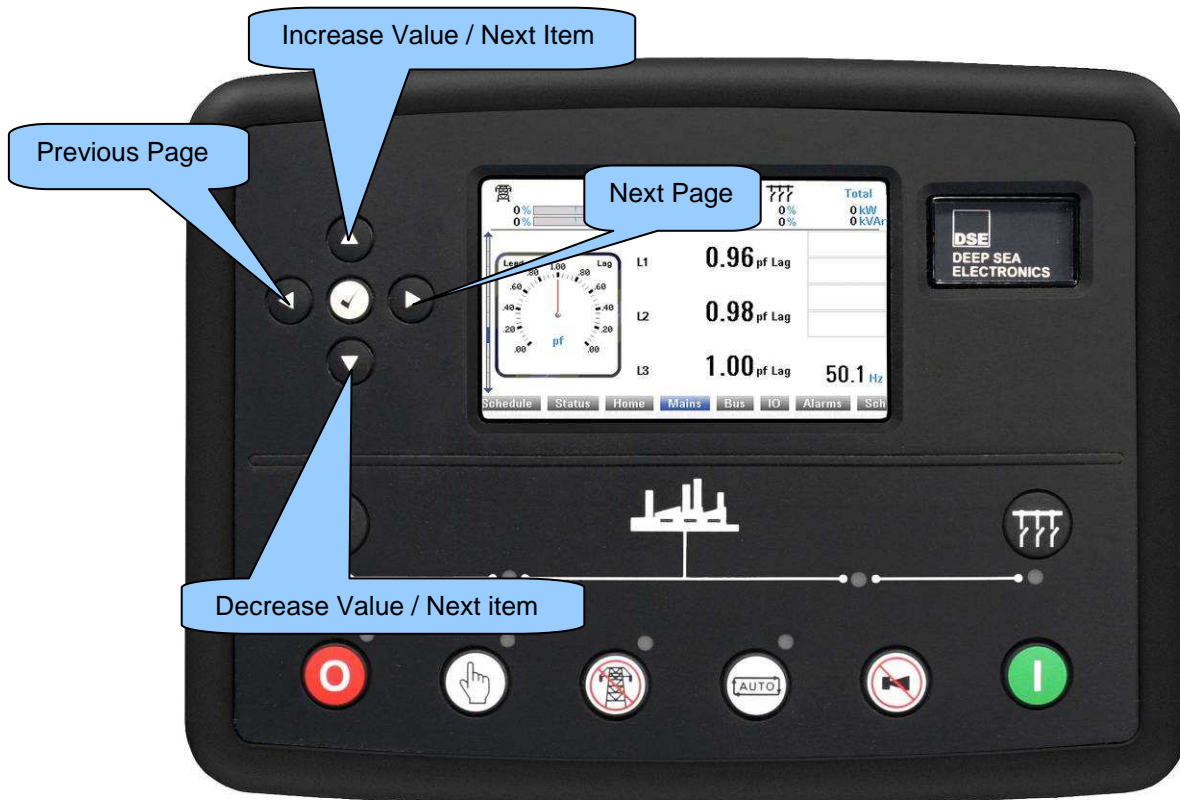
10.1 ACCESSING THE MAIN FRONT PANEL CONFIGURATION EDITOR

- Ensure the generator(s) is at rest and the module is in STOP mode by pressing the Stop/Reset ⬤ button.

- Press and hold the ⬤ Stop button and ✓ tick button together.

- 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) button to adjust it to the correct value.

- Press ▶ (right) button when the first digit is correctly entered. The digit you have just entered will now show '#' for security.

- The other digits of the PIN number. You can press ◀ (left) button 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.

10.1.1 EDITING A PARAMETER

- Enter the editor as described above.

- Press the ⬆(up), ⬇(down), ◀(left) and ▶(right) to cycle to the section you wish to view/change.

- Then press ⬆(up) or ⬇(down) to cycle to the parameter within the section you have chosen.

- To edit the parameter, press ✓ to enter edit mode. The parameter is highlighted blue 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 PIN number is not set by DSE when the module leaves the factory. If the module has a PIN code set, this has been implemented 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. The PIN number is automatically reset when the editor is exited (manually or automatically) to ensure security.**

⚠ **NOTE: The editor automatically exits after 5 minutes of inactivity to ensure security.**

10.1.2 ADJUSTABLE PARAMETERS

Section	Parameter	Detail of Parameter	Parameter Action	Values
Timers	Start Timers	Start Delay	Remote Start Off Load	s
			Remote Start On Load	s
			Telemetry Start	s
			Mains Transient Delay	s
	Load/Stopping Timers	Load Timers	Tran Time/Load Delay	s
		Stopping Timers	Return Delay	s
	Display	Display	Page Timer	mm:ss
Mains	Mains Options	AC System		3 Phase, 4 wire Delta
				2 Phase, 3 Wire L1-L3
				2 Phase, 3 Wire L1-L2
				3 Phase, 3 Wire
				Single Phase, 2 Wire
				3 Phase, 4 Wire
	Mains Current	Current Options	CT Primary (L1,L2,L3,N)	0A
			CT Secondary 5Amp / 1 Amp	5 / 1 Amp
	Mains Voltage	Under Voltage Trip	Trip	0V
		Nominal Voltage	Nominal Voltage	0V
		Over Voltage Trip	Trip	0V
	Mains Frequency	Under Frequency Trip	Trip	0.0Hz
		Nominal Frequency	Nominal Frequency	0.0Hz
		Over Frequency Trip	Trip	0.0Hz
Bus	Ramp	Ramp Speed	Ramp Speed	0.0 %/s
	Load Demand	Load Demand	Calling For More Sets	0 %
			Calling For Less Sets	0 %
	Running	Running	Load Parallel Power	0%
				0kW
			Load Power Factor	0%
				0.00pf
				0kVAr
System	System options	Insufficient Capacity	Action	Warning / None / Indication / Electrical Trip
			Delay	s
	Plant Battery	Under Voltage Alarms	Under Volts Enable	Enabled / Disabled
			Under Volts Delay	mm:ss
			Under Volts Pre-Alarm	0.0v
		Over Voltage Alarms	Over Volts Enable	Enabled / Disabled
			Over volts Delay	mm:ss
			Over Volts Pre-Alarm	0.0v

10.2 ACCESSING THE 'MAINTENANCE' CONFIGURATION EDITOR

- The 'Maintenance' Editor can be entered while the generator(s) is running. All protections remain active if the generator(s) is running while the Maintenance Editor is entered.

- Press the ● (up) and ● (down) buttons together and hold to enter the 'Running' Editor.

10.2.1 EDITING A PARAMETER

- Enter the editor as described above.

- Press the ● (up) or ● (down) buttons to cycle to the section you wish to view / change.

- To change the action press ●(right) button to enter edit mode. The action is highlighted in blue to indicate selection.

- Press the ● (up) button to activate the action. The action will then change to show it has been activated.

- To change another action press ●(left) button to exit edit mode. The action is no longer highlighted in blue to indicate selection.

- Press the ⊘ tick button to exit the "Maintenance Configuration Editor".

10.2.2 ADJUSTABLE PARAMETERS

Description	Action	Activation
USB Stick Removal	Request	Press ● Button
Clear AMF Alarm	Clear	
Min / Max Session Reset	Request	
Cancel Telemetry	Request	
Decoupling Test Mode	Request	
Clear Mains Decouple Alarm	Request	

10.3 ACCESSING THE 'RUNNING' CONFIGURATION EDITOR

- The 'Running' Editor can be entered while the generator(s) is running. All protections remain active if the generator(s) is running while the 'Running' Editor is entered.

- Press and hold the ⊘ button to enter the 'Running' Editor.

10.3.1 EDITING A PARAMETER

- Enter the editor as described above.

- Press the ▲(up), ▼(down), ◀(left) and ▶(right) to cycle to the section you wish to view/change.

- Then press ▲(up) or ▼(down) to cycle to the parameter within the section you have chosen.

- To edit the parameter, press ⊘ to enter edit mode. The parameter is highlighted blue 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.

- Press and hold ⊘ tick button to exit the "Running Configuration Editor".

10.3.2 ADJUSTABLE PARAMETERS

Section	Parameter	Detail Of Parameter	Values
Language	Language		Other
			English (United Kingdon)
Bus	Running	Load Power Factor	0%
			0.00pf
			0kVAr
		Load Parallel Power	0%
			0kW
	Options	Decoupling Test Mode	Disabled / Enabled
	Voltage	Voltage Adjust	0%
	Frequency	Frequency Adjust	0%
Display	Press/ Temp Units	Pressure	kPA / PSI / Bar
		Temperature	Deg F / Deg C
	Volume Units	Volume	Litre / Gallons US / Gallons (UK)
	Display	LCD Backlight	0
	AC Graphics	AC Min / Max Enable	Enabled / Disabled
		AC Meter Enable	Enabled / Disabled
		THD Screen Enable	Enabled / Disabled
	I/O	Multi Meter Mode	Enabled / Disabled
	Alarm	Alarm Alert Box	Enabled / Disabled
	Summary	Summary Area Graphic	Bars / Connectors
	Home	Commissioning Screens	Enabled / Disabled
Time	Module Time		hh:mm:ss
	Module Date		DD/ MM/ YYYY
	Date Format		MM/ DD/ YYYY OR DD/ MM/ YYYY

11 COMMISSIONING

11.1 PRE-COMMISSIONING

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

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

- Check the operation of the MSC datalink. Use the DSE Config Suite to check this on the SCADA | BUS | MSC LINK page. Verify the number of sets on the bus.

- Ensure all DSE8x10 controllers in the system have been fully commissioned using the DSE "Four Steps to Successful Synchronising".

- Place the DSE8860 module into ⭕ STOP mode. Place the DSE8x10(s) into AUTO mode. Initiate a start by pressing the 👆 MANUAL Mode and 🟢 START button of the DSE8860. All DSE8x10's start upon receipt of the MSC start command.

- The bus will remain off load so long as the mains supply is healthy and on load.

- Press the DSE8860's ⭕ STOP button to remove the start request and stop the set(s).

- 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.*

- If, despite repeated checking of the connections between the DSE8000 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:-

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

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12 FAULT FINDING

12.1 STARTING

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.
Fail to Start is activated on DSE8x10 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 module's inputs. Refer to engine manual.
Continuous starting of generator(s) when in (AUTO) Auto mode.	• Check that there is no signal present on the "Remote Start" input. Check configured polarity is correct. • Check the mains supply is available and within configured limits
Generators fail 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 is configured to be used as "Remote Start". • Check MSC link operation • Check the DSE8860 and DSE8x10 controllers are in (AUTO) AUTO mode.

12.2 LOADING

SYMPTOM	POSSIBLE REMEDY
Bus 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 generaor(s) will not take load in (hand) MANUAL mode unless the mains supply fails, a remote start on load input is present or the close generator button is pressed.
Inaccurate 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: (kW = kVA x powerfactor) • The 8000 series controllers are 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. Voltage full scale is 333V ph-n so accuracy is ±3.33V (1% of 333V).

12.3 COMMUNICATIONS

SYMPTOM	POSSIBLE REMEDY
RS485 inoperative	Check : • Connection cable – Belden 9841 or equivalent • 120Ω termination resistors are correctly fitted • Baud rate of controller and of master device are the same • Slave ID of the controller is the same as configured in the master device
RS232 connection to PC inoperative	Check : • RS232 maximum of 15m is not exceeded • Direct to PC connection requires a Crossover (NULL modem) RS232 cable • Baud rate of controller and of master device are the same • Slave ID of the controller is the same as configured in the master device
RS232 connection to GSM modem inoperative	Check : • RS232 maximum of 15m is not exceeded • Modem Initialisation strings in the DSE configuration is correct for the connected modem type • Modem is configured to 9600 baud • SIM card is CSD (circuit switched data) compatible • SIM card is not PIN locked • SIM card is correctly inserted • Antenna is correctly installed and is not inside an earthed metal cabinet / control panel • A good signal is available in the locality
RS232 connection to landline modem inoperative	Check : • RS232 maximum of 15m is not exceeded • Modem Initialisation strings in the DSE configuration is correct for the connected modem type • Modem is configured to 9600 baud
Ethernet comms direct to PC inoperative	Check : • Ethernet rated cable is used • Direct to PC connection requires a CROSSOVER cable. • Check the IP address of the DSE controller is correct • Check the PC is not set to obtain IP address automatically • Check PC firewall will allow traffic on the configured port.
Ethernet connected to a router.	Check : • Ethernet rated cable is used • Router connection requires a *straight through'* cable. • Check the IP address of the DSE controller is correct • Check all firewalls and routers will allow traffic on the configured port. • Test the controller connected directly to a PC for test purposes to elimate router problems.

12.4 INSTRUMENTS

SYMPTOM	POSSIBLE REMEDY
Inaccurate 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: (kW = kVA x powerfactor) • The 8000 series controllers are 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. Voltage full scale is 333V ph-n so accuracy is ±3.33V (1% of 333V).

12.5 MISCELLANEOUS

SYMPTOM	POSSIBLE REMEDY
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

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

13 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.

13.1 CONTROL

Check the control from DSE8x10 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.

13.2 METERING

Check the metering on the DSE8860 and DSE8x10(s) is working:
- 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.

13.3 COMMUNICATIONS

Check the MSC link connected to the DSE8860 and DSE8x10(s) is working:
- 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.

13.4 SYNC CHECKS

Check each phase across the breakers controlled by the DSE8860 and DSE8x10(s) are wired correctly:
- 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)

14 MAINTENANCE, SPARES, REPAIR AND SERVICING

The 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).
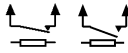
14.1 PURCHASING ADDITIONAL CONNECTOR PLUGS FROM DSE

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

14.1.1 PACK OF PLUGS

Module type	Plug Pack Part Number
DSE8800	100-400-88

14.1.2 INDIVIDUAL PLUGS

Module Terminal Designation		Plug Description	Part No.
1-15		13 way 5.08mm	007-102
16-19		5 way 5.08mm	007-445
22-38	CAN MSC	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
59-70		12 way 5.08mm	007-109
RS485	Port1 Port2	6 way 5.08mm	007-446
	USB	PC Configuration interface lead (USB type A – USB type B)	016-125

⚠NOTE: Terminals 20, 21 and 58 are not fitted to the controller.

14.2 PURCHASING ADDITIONAL FIXING CLIPS FROM DSE

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

14.3 PURCHASING ADDITIONAL SEALING GASKET FROM DSE
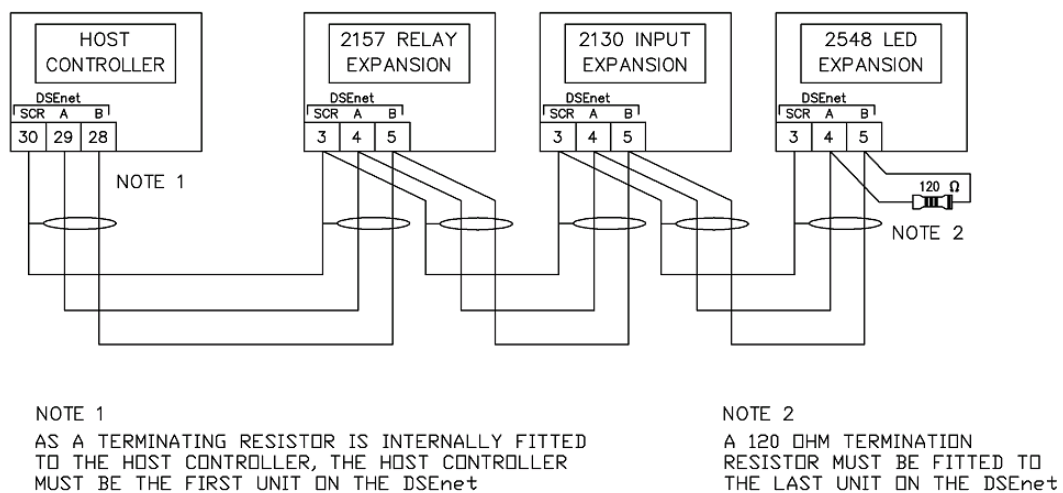
Item	Description	Part No.
	DSE88xx Moulded silicon sealing gasket	020-508

14.4 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 the Belden 9841 cable. DSE Part Number 016-030.

Item	Max No. supported	Description	Model order number	DSE Part Numbers Sales literature	Operator manual	Installation Instructions
	4	Model DSE2130 input module provides additional analogue and digital inputs for use with the controller.	2130-001-00	055-060	057-082	053-033
	4	Model DSE2131 Ratio-metric input expansion module provides additional restive, digital, 0-10V and 4-20ma inputs for use with the controller.	2131-001-00	055-115	057-139	053-125
	4	Model DSE2133 RTD/Thermocouple input expansion module provides additional RTD and thermocouple inputs for use with the controller.	2133-001-00	055-114	057-140	053-126
	4	Model DSE2152 Ratio-metric output expansion module provides additional 0-10V and 4-20ma outputs for use with the controller.	2152-001-00	055-112	057-141	053-134
	10	Model DSE2157 expansion relay module provides eight additional voltage free relays for use with the 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 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

15 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).

16 DISPOSAL

16.1 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.

16.2 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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