DEEP SEA ELECTRONICS

DSEG8660 Operator Manual

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Operator Manual

Amendments Since Last Publication

Amd. No.	Comments
1	Initial Release

Typeface: The typeface used in this document is *Arial*. Care must 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.

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Section **Page**

1 INTRODUCTION

This document details the installation and operation requirements of the DSEG8660 module and is 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.* DSE do not automatically inform on updates. Any future updates of this document are included on the DSE website at www.deepseaelectronics.com

The DSEG8660 module 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.

Synchronising and Load Sharing features are included within the controller, along with the necessary protections for such a system.

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

The DSEG8660 module has been designed to be configured for the following:

- Configured as a Mains Parallel Controller to monitor the mains (utility) supply and automatically start/stop one or more generator sets equipped with DSEG8600 (Multi Set) controllers depending upon the status of the mains (utility) supply.
- Configured as a Group Controller which allows the expansion of a system beyond the 64-module limit that is imposed by the capacity of a AMSC bus.

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

- *Text based LCD display*
- *True RMS Voltage*
- *Current and Power monitoring*
- *USB, RS485 and Ethernet Communications*
- *Fully configurable inputs for use as alarms or a range of different functions.*
- *Synchronising and load sharing with load demand start/stop*
- *Integral PLC to help provide customisation where required*
- *Data Logging*
- *R.O.C.O.F. and vector shift protection for detection of mains failure when in parallel with the mains.*

The DSE Configuration Suite PC Software allows alteration of selected operational sequences, timers, alarms, and operational sequences. Additionally, the module's integral front panel configuration editor allows adjustment of this information.

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

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

1.1 CLARIFICATION OF NOTATION

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.**

1.2 GLOSSARY OF TERMS

Term	Description
ADSL	Asymmetric Digital Subscriber Line. A technology for transmitting digital information over standard telephone lines.
AMSC	Advanced Multi-Set Communication
AVR	Automatic Voltage Regulator
BMS	Building Management System. A digital/computer-based control system for a building's infrastructure.
BUS	BUS is a communication system that transfers data between components inside a computer, or between computers.
CAN	Controller Area Network. Vehicle standard to allow digital devices to communicate to one another.
CDMA	Code Division Multiple Access. Cell phone access used in small number of areas including parts of the USA and Australia.
DEF	Diesel Exhaust Fluid (AdBlue). A liquid used as a consumable in the SCR process to lower nitric oxide and nitrogen dioxide concentration in engine exhaust emissions.
DHCP	DHCP (Dynamic Host Configuration Protocol) is a protocol that provides quick, automatic, and central management for the distribution of IP addresses within a network.
DNS	Domain Name System is a collection of databases that translate hostnames to IP addresses.
DPF	Diesel Particulate Filter. A filter fitted to the exhaust of an engine to remove diesel particulate matter or soot from the exhaust gas.
DTC	Diagnostic Trouble Code. The name for the entire fault code sent by an engine ECU.
EMC	Electromagnetic compatibility is the ability of electrical equipment and systems to function acceptably in their electromagnetic environment
FPE	Front Panel Editor
FRT	Fault Ride Through
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications. Cell phone technology used in most of the World.
HMI	Human Machine Interface. A device that provides a control and visualisation interface between a human and a process or machine.
IDMT	Inverse Definite Minimum Time
IEEE	Institute of Electrical and Electronics Engineers
ISBN	International Standard Book Number
LAN	Local Area Network
LCD	Liquid Crystal Display

Continued over page…

Term	Description
LED	Light Emitting Diode
MAC	Media Access Control Address. A MAC address is a hardware identification number that uniquely identifies each device on a network.
MPU	Magnetic Pickup Unit
MSC	Multi-Set Communication
NAPT	Network Address and Port Translation
NVD	Neutral Voltage Displacement
OEM	Original Equipment Manufacturer
PCI	Peripheral Component Interface
PIN	PIN number
PLC	Programmable Logic Controller. A programmable digital device used to create logic for a specific purpose.
RMS	Root Mean Square
ROCOF	Rate Of Change Of Frequency
RPM	Revolutions Per Minute
RTD	An RTD (Resistance Temperature Detector) is a sensor whose resistance changes as its temperature changes. The resistance increases as the temperature of the sensor increases.
SCADA	Supervisory Control And Data Acquisition. A system that operates with coded signals over communication channels to provide control and monitoring of remote equipment
SCR	Selective Catalytic Reduction. A process that uses DEF with the aid of a catalyst to convert nitric oxide and nitrogen dioxide into nitrogen and water to reduce engine exhaust emission.
SIM	Subscriber Identity Module. The small card supplied by the GSM/CDMA provider that is inserted into the cell phone, GSM modem or DSEGateway device to give GSM/GPRS connection.
SMS	Short Message Service. The text messaging service of mobile/cell phones.
SNMP	Simple Network Management Protocol. An international standard protocol for managing devices on IP networks.
SPN	Suspect Parameter Number. A part of DTC that indicates what the failure is, e.g., oil pressure, coolant temperature, turbo pressure etc.
TCP	TCP (Transmission Control Protocol) is a standard that defines how to establish and maintain a network conversation via which application programs can exchange data.
USB	Universal Serial Bus
WAN	Wide Area Network
WEEE	Waste Electrical and Electronic Equipment

1.3 BIBLIOGRAPHY

This document refers to, and is referred by the following DSE publications which are obtained from the DSE website: www.deepseaelectronics.com or by contacting DSE technical support: support@deepseaelectronics.com.

1.3.1 INSTALLATION INSTRUCTIONS

Installation instructions are obtained from the DSE website: www.deepseaelectronics.com or by contacting DSE technical support: support@deepseaelectronic.com and are intended as a 'quick start' guide only.

DSE Part	Description
052-267	DSE BC1205 & BC2405 Battery Charger Installation Instructions
053-032	DSE2548 LED Expansion Annunciator Installation Instructions
053-033	DSE2130 Input Expansion Installation Instructions
053-034	DSE2157 Output Expansion Installation Instructions
053-049	DSE9xxx Battery Charger Installation Instructions
053-125	DSE2131 Ratio-metric Input Expansion Installation Instructions
053-126	DSE2133 RTD/Thermocouple Input Expansion Installation Instructions
053-134	DSE2152 Ratio-metric Output Expansion Installation Instructions
053-147	DSE9460 & DSE9461 Battery Charger Installation Instructions
053-175	DSE9474 & DSE9484 Battery Charger Installation Instructions
053-185	DSE9473 & DSE9483 Battery Charger Installation Instructions
053-235	DES9476 Battery Charger Installation Instructions
053-248	DSE8920 Installation Instructions
053-251	DSE BC2410Ei Battery Charger Installation Instructions
053-253	DSEG8660 Installation Instructions
053-265	DSE BC2415i Battery Charger Installation Instructions

1.3.2 MANUALS

Product manuals are obtained from the DSE website: www.deepseaelectronics.com or by contacting DSE technical support: support@deepseaelectronics.com.

DSE Part	Description
N/A	DSEGencomm (MODBUS protocol for DSE controllers)
057-045	Guide to Synchronising and Load Sharing Part 1 (Usage of DSE Load Share Controllers in synchronisation / load sharing systems.)
057-046	Guide to Synchronising and Load Sharing Part 2 (Governor & AVR Interfacing)
057-047	Load Share System Design and Commissioning Guide
057-082	DSE2130 Input Expansion Operator Manual
057-083	DSE2157 Output Expansion Operator Manual
057-084	DSE2548 Annunciator Expansion Operator Manual
057-085	DSE9xxx Battery Charger Operator Manual
057-139	DSE2131 Ratio-metric Input Expansion Manual
057-140	DSE2133 RTD/Thermocouple Expansion Manual
057-141	DSE2152 Ratio-metric Output Expansion Manual
057-151	DSE Configuration Suite PC Software Installation & Operation Manual
057-175	PLC Programming Guide For DSE Controllers
057-176	DSE9460 & DSE9461 Battery Charger Operator Manual
057-220	Options for Communications with DSE Controllers
057-312	DSEAssistant PC Software Manual
057-314	Advanced PLC Programming Guide for DSE Controllers
057-324	DSEG8660 Configuration Suite PC Software Manual

1.3.3 TRAINING GUIDES

Training guides are provided as ‘hand-out’ sheets on specific subjects during training sessions and contain specific information regarding to that subject.

DSE Part	Description
056-001	Four Steps To Synchronising
056-005	Using CTs With DSE Products
056-006	Introduction to Comms
056-007	Advantages of Bus/Load CT
056-010	Over Current Protection
056-013	Load Demand Scheme
056-021	Mains Decoupling
056-022	Breaker Control
056-026	kW, kvar, kVA and pf.
056-030	Module PIN Codes
056-033	Synchronising Requirements
056-036	Expansion Modules
056-042	Bus Mode or Mains Mode
056-043	Sync Process
056-045	PLC as Load Demand Controller
056-047	Out of Sync and Failed To Close
056-051	Modbus Control
056-069	Firmware Update
056-072	Dead Bus Synchronising
056-075	Adding Language Files
056-076	Gencomm Alarms
056-079	Gencomm Status
056-080	MODBUS
056-081	Screen Heaters
056-082	Override Gencomm PLC Example
056-083	Synchronising & Loadsharing
056-091	Equipotential Earth Bonding
056-092	Best Practices for Wiring Restive Sensors
056-095	Remote Start Input Functions
056-097	USB Earth Loop and Isolation
056-099	Digital Output to Digital Input Connection

1.3.4 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 MAINS PARALLEL CONTROLLER (MPC) AND GROUP CONTROLLER (GC) APPLICATION SELECTION MENU

NOTE: Care must be taken when updating the module's firmware as this resets the configuration files for the Mains Parallel (MP) and the Group Controller (GC) software applications back to their factory defaults.

NOTE: The module contains one Data Logging file for both the Mains Parallel (MP) and the Group Controller (GC) software applications. The logged data is maintained and is accessible after the software application is changed.

The DSEG8660 module contains two selectable software applications:

- Mains Parallel Controller (MPC)
- Group controller (GC)

CAUTION!: The mains breaker closes when an application is switched without synchronising protections.

NOTE: A *Bus Breaker Failed To Open* alarm will halt application switching.

The two software applications within the DSEG8660 module allows the user to easily convert to Mains Parallel Controller (MPC) if required. This is useful when the system is upgraded to a multiple generator synchronising system as the Mains Parallel Controller (MPC) and Group Controller (GC) application enables the AMSC connection to other DSEG8600 modules.

3 SPECIFICATION

3.1 OPERATING TEMPERATURE

Module	Specification
DSE8660	-30 ºC +70 ºC (-22 ºF +158 ºF)
Display Heater	-40 ºC +70 ºC (-40 ºF +158 ºF)

3.1.1 SCREEN HEATER OPERATION

The heater operates on a sliding power output to maintain good visibility from 0ºC.

3.2 REQUIREMENTS FOR UL

WARNING!: More than one live circuit exists, refer to section 4.2.11 entitled *Typical Wiring Diagrams.*

Specification	Description
Screw Terminal Tightening Torque	4.5 lb-in (0.5 Nm)
Conductors	Terminals suitable for connection of conductor size 13 AWG to 20 AWG (0.5 mm² to 2.5 mm²). Conductor protection must be provided in accordance with NFPA 70, Article 240 Low voltage circuits (35 V or less) must be supplied from the engine starting battery or an isolated secondary circuit. The communication, sensor, and/or battery derived circuit conductors shall be separated and secured to maintain at least ¼" (6 mm) separation from the generator and mains connected circuit conductors unless all conductors are rated 600 V or greater.
Current Inputs	Must be connected through UL Listed or Recognized isolating current transformers with the secondary rating of 5 A max.
Communication Circuits	Must be connected to communication circuits of UL Listed equipment
DC Output Pilot Duty	0.5 A
Mounting	Suitable for flat surface mounting in Type 1 Enclosure Type rating with surrounding air temperature -22 ºF to +122 ºF (-30 ºC to +50 ºC) Suitable for pollution degree 3 environments when voltage sensing inputs do not exceed 300 V. When used to monitor voltages over 300 V device to be installed in an unventilated or filtered ventilation enclosure to maintain a pollution degree 2 environment.
Operating Temperature	-22 ºF to +122 ºF (-30 ºC to +50 ºC)

3.3 TERMINAL SPECIFICATION

Description	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 12)	
Tightening Torque	0.5 Nm (4.5 lb-in)	
Wire Strip Length	7 mm (9/32”)	

3.4 POWER SUPPLY REQUIREMENTS

Description	Specification
Minimum Supply Voltage	5 V continuous
Cranking Dropouts	Able to survive 0 V for 100 ms providing the supply was at least greater than 5 V for 2 seconds 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	700 mA at 12 V 350 mA at 24 V
Maximum Standby Current	350 mA at 12 V 190 mA at 24 V
Maximum Current When In Sleep Mode	110 mA at 12 V 60 mA at 24 V
Typical Power (Controller On, Heater Off)	4.0 W to 4.5 W
Typical Power (Controller On, Heater On)	4.5 W to 11 W

3.4.1 MODULE SUPPLY INSTRUMENTATION DISPLAY

Description	Specification
Range	0 V to 70 V DC (Maximum continuous operating voltage of 35 V DC)
Resolution	0.1 V
Accuracy	1 % full scale (±0.35 V)

3.5 VOLTAGE & FREQUENCY SENSING

Description	Specification
Measurement Type	True RMS conversion
Sample Rate	40 kHz
Harmonics	Up to 21st or better
Input Impedance	450 kΩ phase to neutral
Phase To Neutral	15 V (minimum required for sensing frequency) to 415 V AC (absolute maximum) Suitable for 345 V AC nominal (±20 % for under/overvoltage detection)
Phase To Phase	25 V (minimum required for sensing frequency) to 720 V AC (absolute maximum) Suitable for 600 V AC nominal (±20 % for under/overvoltage detection)
Common Mode Offset From Earth	100 V AC (max)
Resolution	1 V AC phase to neutral 2 V AC phase to phase
Accuracy	±1 % of full-scale phase to neutral ±1 % of full-scale phase to phase
Minimum Frequency	3.5 Hz
Maximum Frequency	75.0 Hz
Frequency Resolution	0.1 Hz
Frequency Accuracy	±0.05 Hz

3.6 CURRENT SENSING

Description	Specification
Measurement Type	True RMS conversion
Sample Rate	40 kHz
Harmonics	Up to 21st or better
Nominal CT Secondary Rating	1 A and 5 A
Maximum Continuous Current	5 A
Overload Measurement	15 A
Absolute Maximum Overload	50 A for 0.2 second 30 A for 5 second
Burden	0.5 VA (0.02 Ω current shunts)
Common Mode Offset	70 V peak plant ground to CT common terminal under fault condition
Resolution	25 mA
Accuracy	±1 % of Nominal (excluding CT error)

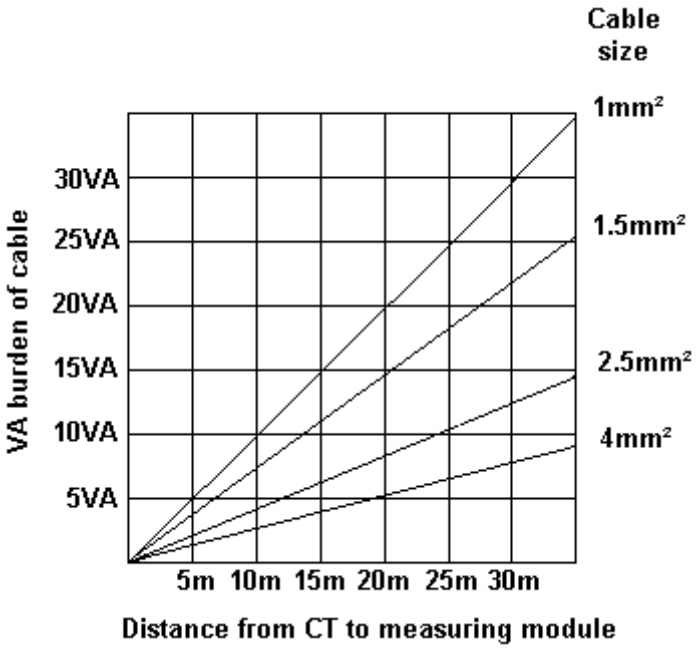
3.6.1 VA RATING OF THE CTS

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.

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.



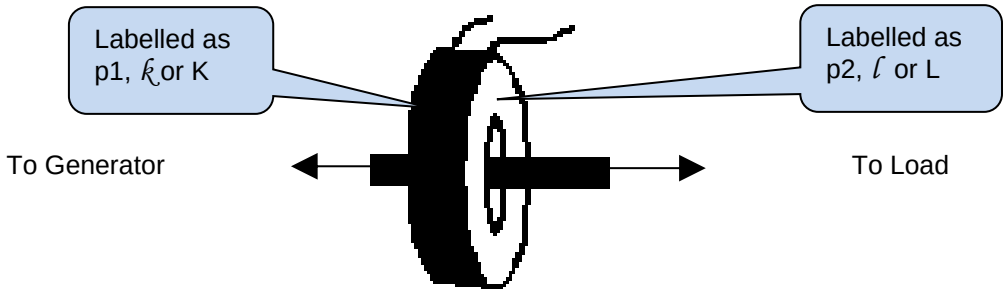
Example:
If 1.5 mm² cable is used and the distance from the CT to the measuring module is 20 m, then the burden of the cable alone is approximately 15 VA. As the burden of the DSE controller is .5 VA, then a CT with a rating of at least 15 VA + 0.5 VA = 15.5 VA must be used. 0.5 VA, then a CT with a rating of at least 15 VA + 0.5 VA = 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).

3.6.2 CT POLARITY

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

Take care to ensure the correct polarity of the CTs. Incorrect CT orientation leads to negative kW readings when the set is supplying power. Take note that paper stick-on labels on CTs that show the orientation are often incorrectly placed on the CT. It is more reliable to use the labelling in the case moulding as an indicator to orientation (if available).

To test orientation, run the generator in island mode (not in parallel with any other supply) and load the generator to around 10 % of the set rating. Ensure the DSE module shows positive kW for all three individual phase readings.



Polarity of CT Primary

3.6.3 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 connected to generator phase 1. Incorrect connection of the phases as described above results in incorrect power factor (pf) measurements, which in turn results in incorrect kW measurements.

Correct CT connection is critical for load share and load control applications particularly when paralleling with the mains.

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.

3.6.4 CT CLASS

Ensure the correct CT type is chosen. For instance, if the DSE module is providing over current protection, ensure the CT can measure the overload level required to protect against, and at the accuracy level required.

For instance, this may mean fitting a protection class CT (P15 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 required. The DSE module is accurate to better than 1% of the full-scale current reading. To maintain this accuracy, fit a Class 0.5 or Class 1 CT.

Check with the CT manufacturer for further advice on selecting CTs.

3.7 INPUTS

3.7.1 DIGITAL INPUTS

Description	Specification
Number	12 configurable digital inputs (16 when *Analogue Inputs* are configured as 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	12 V typical

3.8 OUTPUTS

3.8.1 CONFIGURABLE VOLT-FREE RELAY OUTPUTS C & D

Description	Specification
Type	Normally used for load switching control Fully configurable volt-free relays. Output C normally closed and Output D normal open.
Rating	8 A resistive at 250 V AC

3.8.2 CONFIGURABLE DC OUTPUTS E, F, G, H, I & J

Description	Specification
Type	Fully configurable, supplied from DC supply terminal 2.
Rating	2 A resistive at module supply.

3.9 COMMUNICATION PORTS

NOTE: All communication ports can be used at the same time.

Description	Specification
USB Slave Port	Type B USB 2.0 For connection to PC running DSE Configuration Suite Max distance 5 m (16 feet)
USB Host Port	Type A USB 2.0 Capability to add a maximum of 16 GB USB storage device for data recording only
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 115.2 kbaud subject to configuration External termination required (120 Ω) Max common mode offset 70 V (on board protection transorb) Max distance 1.2 km (¾ mile)
Ethernet	Auto detecting 10/100 Mbit Ethernet port.
AMSC (Multi Set Communication) and CAN Port	**NOTE: For additional length, the DSE124 CAN Extender is available. For more information, refer to DSE Publication: *057-116 DSE124 Operator Manual*** Standard implementation of 'Slow mode', up to 250 kbits/s Data connection 2 wire + common Isolated External termination required (120 Ω) Max common mode offset max 70 V, 1kv surge ECU port Primary AMSC 1 (CAN 2 Isolated), Secondary AMSC (CAN2 Port 2 Isolated) Redundant AMSC 2 (CAN Port 3 Isolated) Max distance 250 m Max distance 250 m using Belden 9841 Cable or equivalent
DSENet® (Expansion Comms) Port	Non-isolated Data connection 2 wire + common Half Duplex Data direction control for Transmit (by s/w protocol) Baud Rate of 115 kbaud Internal termination fitted (120 Ω) Max common mode offset ±5 V Max distance 1.2 km (¾ mile)

3.10 COMMUNICATION PORT USAGE

3.10.1 USB SLAVE PORT (PC CONFIGURATION)

NOTE: DSE stock 2 m (6.5 feet) USB type A to type B cable, DSE Part Number: 016-125. Alternatively, they are purchased from any PC or IT store.

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

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG*8660 Configuration Suite PC Software Manual.*

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 engine, selecting operating modes, etc.

Additionally, the various operating parameters (such as coolant temperature, oil pressure, etc.) of the engine are available to be viewed or changed.

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

DSEG8660 Controller

DSE Configuration Suite PC Software
(Available from www.deepseaelectronics.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

3.10.2 USB HOST PORT (DATA LOGGING)

USB Type A connection for an external USB storage device of maximum 16 GB for instrumentation data logging. A 16 GB external USB storage device allows for 33 weeks, 4 days and 20 minutes worth of data, assuming 20 parameters were configured to be logged, each with a *Log Interval* of 1 second.

3.10.3 RS485 PORTS

NOTE: When the *RS485 Port Usage* is configured to "*PLC Comms*", all other modules' *Port Usage* must be configured to "*Gencomm*". This allows the module configured as "*PLC Comms*" to act as a master and read from the module(s) configured to "*Gencomm*".
For details on how to configure the *PLC Editor* to read via its RS485, refer to DSE Publication: *057-314 Advanced PLC Software Manual* which is found on our website: www.deepseaelectronics.com

NOTE: For a single module to PC connection and distances up to 5 m (16 feet) the USB connection method is more suitable and provides for a lower cost alternative to RS485 (which is more suited to longer distance connections).

The RS485 ports on the controller support the MODBUS RTU protocol and is for connection to a single MODBUS master device only.

The DSE MODBUS register table for the controller is available upon request from the DSE Technical Support Department.

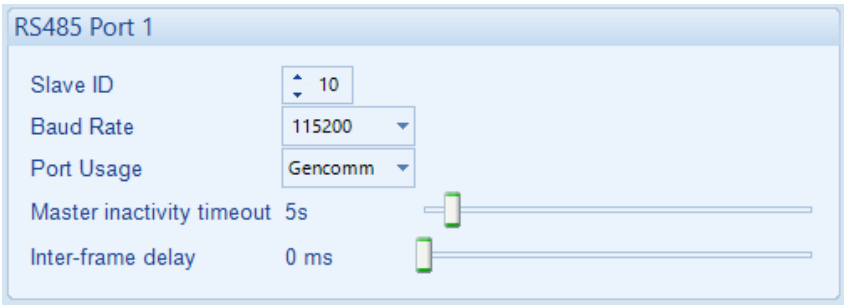
RS485 is used for point-to-point cable connection of more than one device (maximum 64 devices) and allows for connection to PCs, PLCs, and Building Management Systems (to name just a few devices).

One advantage of the RS485 interface is the large distance specification (1.2 km 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 engine, selecting operating modes, etc.

The various operating parameters (such as coolant temperature, oil pressure, etc.) of the remote engine are viewed or changed.

Many PCs are not fitted with an internal RS485 serial port. DSE DOES NOT recommend the use of USB to RS485 convertors but can recommend PC add-ons to provide the computer with an RS485 port.

The DSEG8660 has two RS485 ports which are configurable using the Configuration Suite Software. An example of configuring the RS485 connection using the DSE Configuration Suite Software is shown below:



NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

3.10.3.1 RECOMMENDED PC RS485 SERIAL PORT ADD-ONS

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

NOTE: For further details of setting up the devices below, refer to the manufacture whose details are below.

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

3.10.4 ETHERNET PORT

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

NOTE: For a single module to PC connection and distances up to 5 m (16 feet) the USB connection method is more suitable and provides for a lower cost alternative to Ethernet (which is more suited to longer distance connections).

NOTE: DSE stock 2 m (6.5 feet) Ethernet Cable, DSE Part Number: 016-137. Alternatively, they can be purchased from any PC or IT store.

Ethernet is used for point-to-point cable connection of more than one device and allows for connection to PCs, PLCs, Building Management Systems and SNMP Managers (to name just a few devices) or to other DSE modules using the *PLC Editor*.

One advantage of the Ethernet interface is the ability to interface into an existing LAN (Local Area Network) connection for remote connection via an internet connection. This allows for a large distance between the module and a PC running the DSE Configuration Suite software or any external device. The operator is then able to control the module, starting or stopping the engine, selecting operating modes, etc through various means.

3.10.4.1 MODBUS TCP

The Ethernet port on the controller supports the Modbus TCP protocol and is for connection for up to five Modbus master devices. The various operating parameters (such as bus power, mains status, etc.) of the remote engine are viewed or changed.

The DSE Modbus register table for the controller is available upon request from the DSE Technical Support Department.

3.10.4.2 ETHERNET PORT USED FOR PLC COMMUNICATION

NOTE: For details on how to configure the *PLC Editor* to read through the TCP/IP, refer to DSE Publication: *057-314 Advanced PLC Software Manual* which is found on our website: www.deepseaelectronics.com

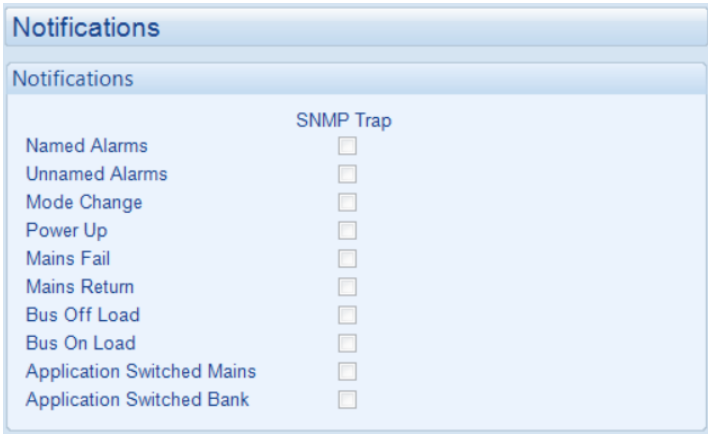
The DSE module can communicate with other DSE modules using the Ethernet Port, this is configured from the *PLC Editor* to allow it read specific GenComm registers from other modules over the TCP/IP to perform certain tasks in the PLC.
When the DSE module is configured to communicate with the other modules via the TCP/IP it becomes a MODBUS TCP Master, hence care must be taken on the slave TCP modules not to exceed their total supported five MODBUS TCP masters.

3.10.4.3 SNMP

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

The Ethernet port on the controller supports V2c of the Simple Network Management Protocol (SNMP) and can connect to two SNMP managers. SNMP is an international standard protocol for managing devices on IP networks. It is used to monitor network-attached devices for conditions that warrant administrative attention.

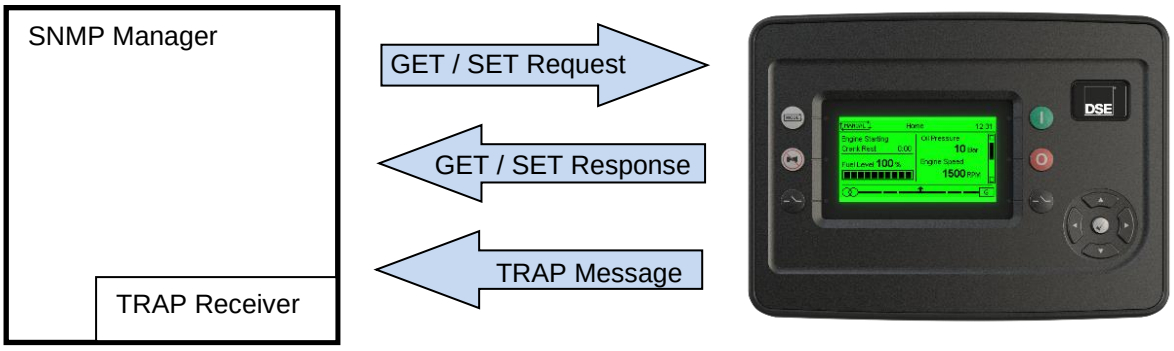
Up to two administrative computers (SNMP managers) monitor the DSE module. If an 'event' occurs, the DSE module reports information via SNMP TRAP messages to the SNMP manager. The SNMP TRAP messages that are sent are configured used the DSE Configuration Suite PC Software by the system integrator. An example of the available SNMP TRAP messages is shown below.



Additionally, the DSE module responds to GET / SET messages from the SNMP manager to allow the operating mode of the DSE module to be changed, or instrumentation values to be retrieved. The SNMP manager knows how to communicate to the DSE module by using the .MIB file provided by DSE.

Many third-party SNMP managers exist. DSE do not produce or supply SNMP managers.

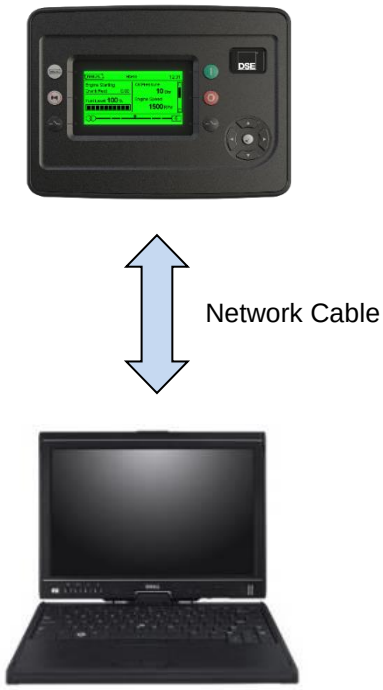
The DSE MIB file for the controller is available upon request from the DSE Technical Support Department or by downloading it from the DSE website, www.deepseaelectronics.com.



3.10.4.4 DIRECT PC CONNECTION

Requirements

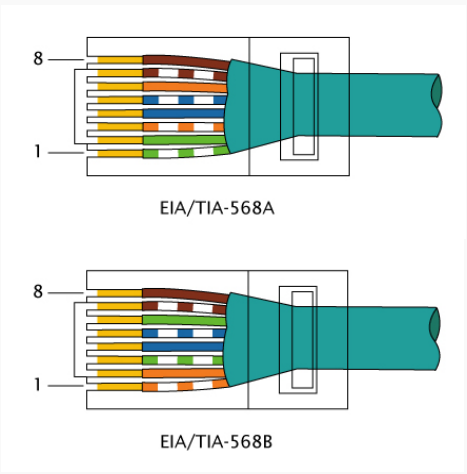
- Ethernet cable (see below)
- PC with Ethernet port



Ethernet Cable Wiring Detail

NOTE: DSE stock 2 m (6.5 feet) Ethernet Cable, DSE Part Number: 016-137. Alternatively, they can be purchased from any PC or IT store.

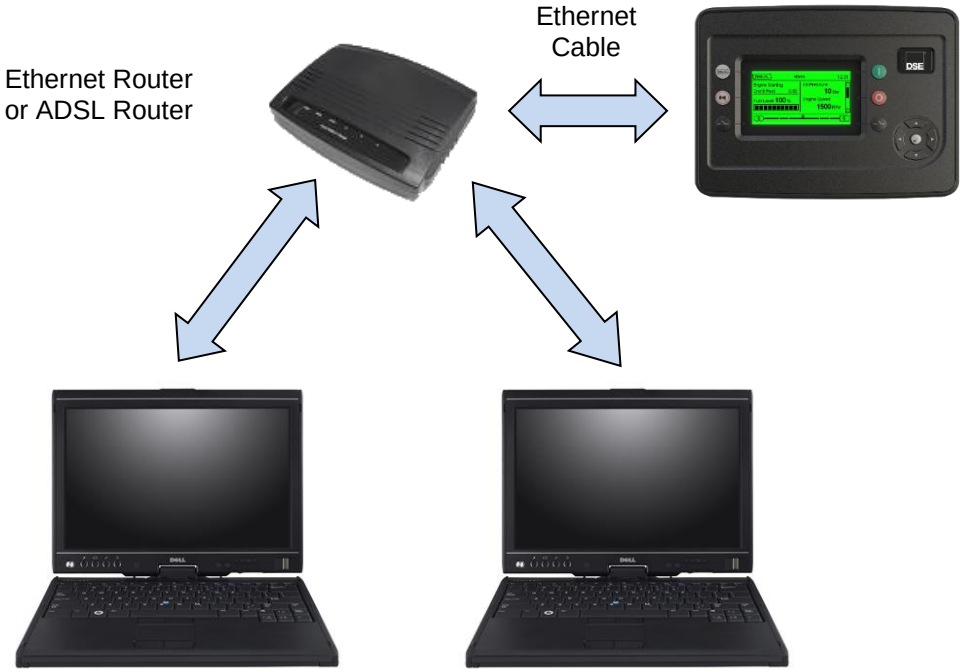
Pin	Connection 1 (T568A)	Connection 2 (T568B)
1	white/green stripe	white/orange stripe
2	green solid	orange solid
3	white/orange stripe	white/green stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	green solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown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



3.10.4.5 CONNECTION TO BASIC ETHERNET

Requirements

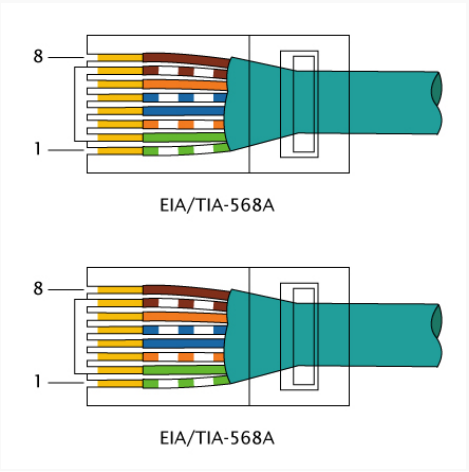
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- PC with Ethernet port



Ethernet Cable Wiring Detail

NOTE: DSE stock 2 m (6.5 feet) Ethernet Cable, DSE Part Number: 016-137. Alternatively, they can be purchased from any PC or IT store.

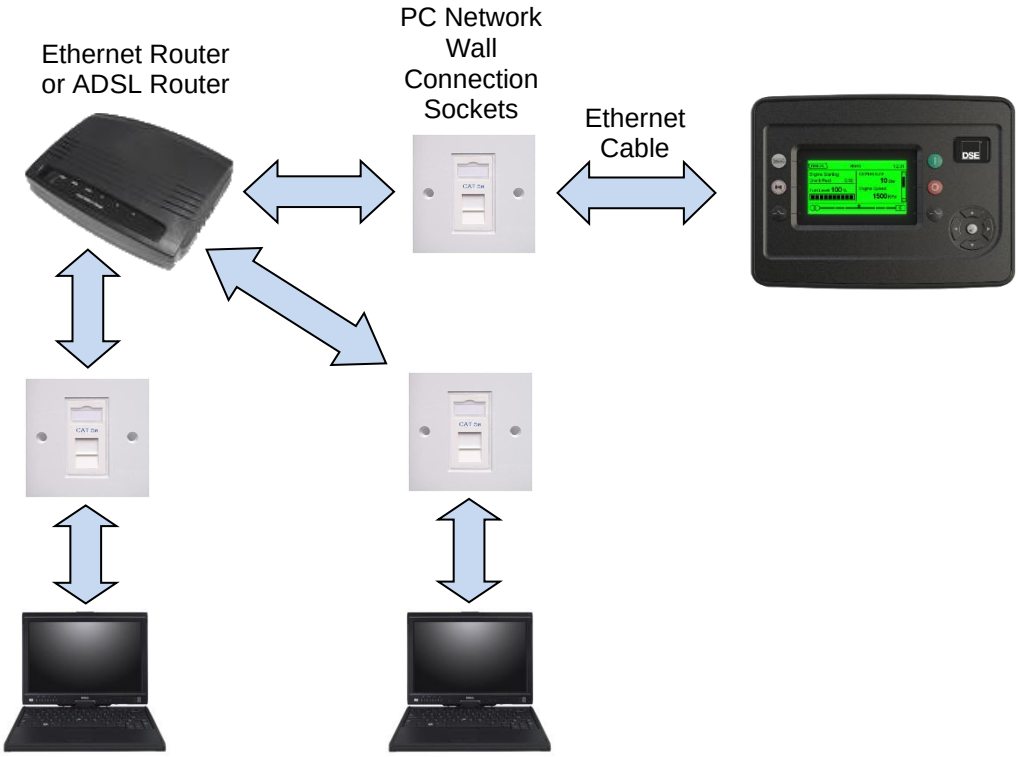
Pin	Connection 1 (T568A)	Connection 2 (T568A)
1	white/green stripe	white/green stripe
2	green solid	green solid
3	white/orange stripe	white/orange stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	orange solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown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



3.10.4.6 CONNECTION TO COMPANY ETHERNET INFRASTRUCTURE

Requirements

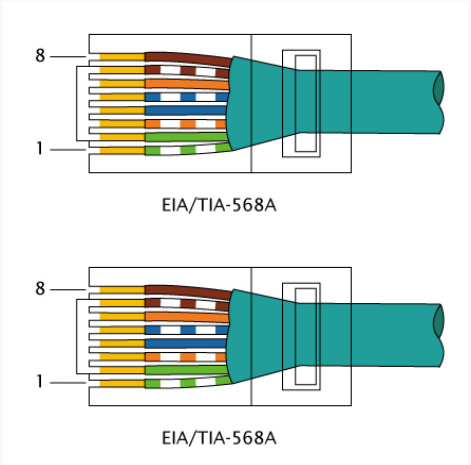
- DSE module with the ability to connect to Ethernet
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- PC with Ethernet port



Ethernet Cable Wiring Detail

NOTE: DSE stock 2 m (6.5 feet) Ethernet Cable, DSE Part Number: 016-137. Alternatively, they can be purchased from any PC or IT store.

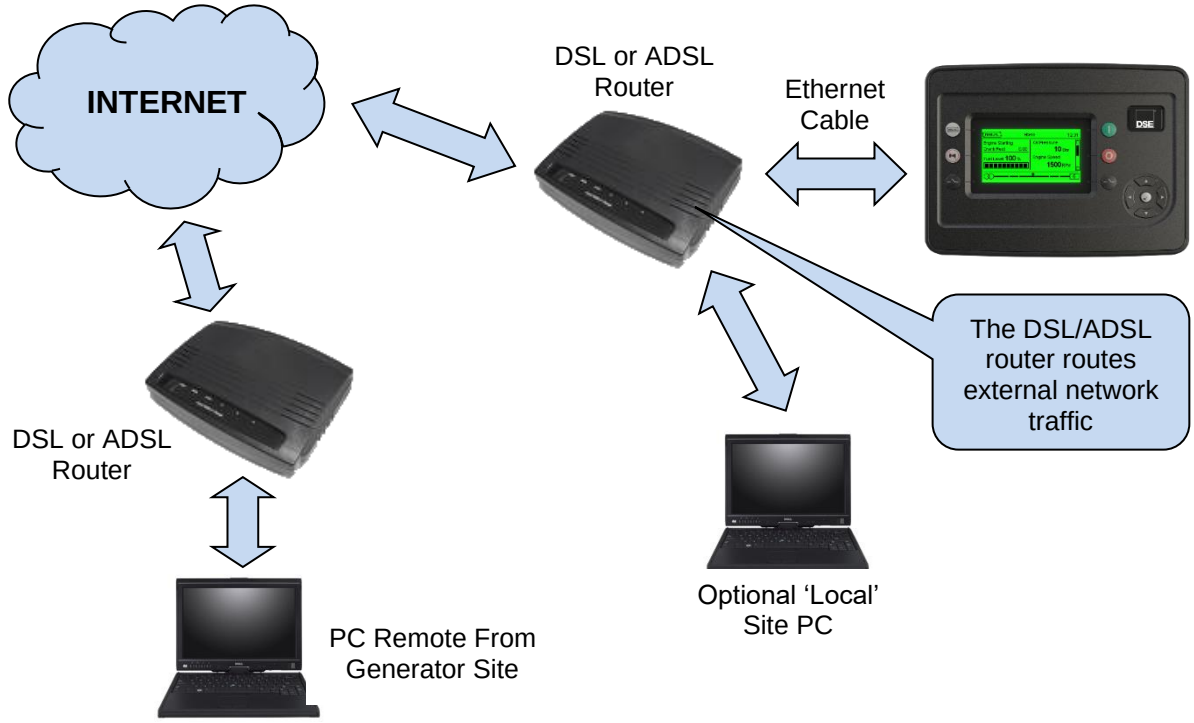
Pin	Connection 1 (T568A)	Connection 2 (T568A)
1	white/green stripe	white/green stripe
2	green solid	green solid
3	white/orange stripe	white/orange stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	orange solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown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



3.10.4.7 CONNECTION TO THE INTERNET

Requirements

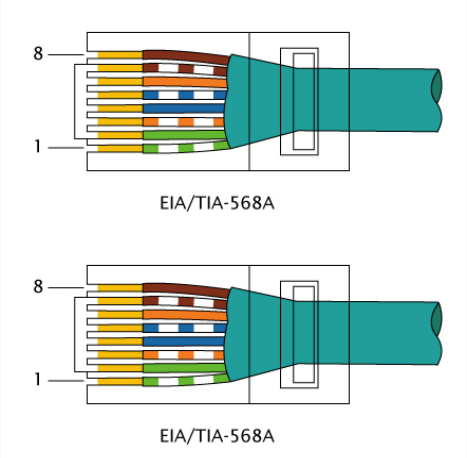
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- Working Internet connection (ADSL or DSL recommended)



Ethernet Cable Wiring Detail

NOTE: An Ethernet Patch Cable can use for this type of connection and can be purchased from any PC or IT store.

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



3.10.4.8 FIREWALL CONFIGURATION FOR INTERNET ACCESS

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

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 or SNMP V2c 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 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.

3.10.5 AMSC (MULTI-SET COMMUNICATIONS) LINK

NOTE: A termination resistor MUST be fitted to the first and last unit on the AMSC link. For connection details, refer to section 4.2.12 entitled *Typical Arrangement of AMSC Link*.

NOTE: DSE recommend Belden 9841 (or equivalent) cable for AMSC communication. This is rated to a maximum cable length of 250 m. DSE Stock Belden 9841 cable, DSE Part Number: 016-030.

The AMSC link is the interconnection cable between all DSE synchronising controllers and must not be connected to any device other than DSE equipment designed for connection to the AMSC link.

Description	Specification
Cable Type	Two core screened and shielded twisted pair
Cable Characteristics	120 Ω, Low capacitance
Recommended Cable	Belden 9841, Belden 9271
Maximum Cable Length	**NOTE: For additional length, the DSE124 CAN Extender is available. For more information, refer to DSE Publication: *057-116 DSE124 Operator Manual*** 250 m (273 yards) when using Belden 9841 or direct equivalent. 125 m (136 yards) when using Belden 9271 or direct equivalent.
AMSC Topology	“Daisy Chain” Bus with no stubs (spurs)
AMSC Termination	120 Ω. Must be fitted externally to the first and last module.
Maximum DSEG8660 Modules	The maximum number of DSEG8660 modules on an AMSC link is 64.

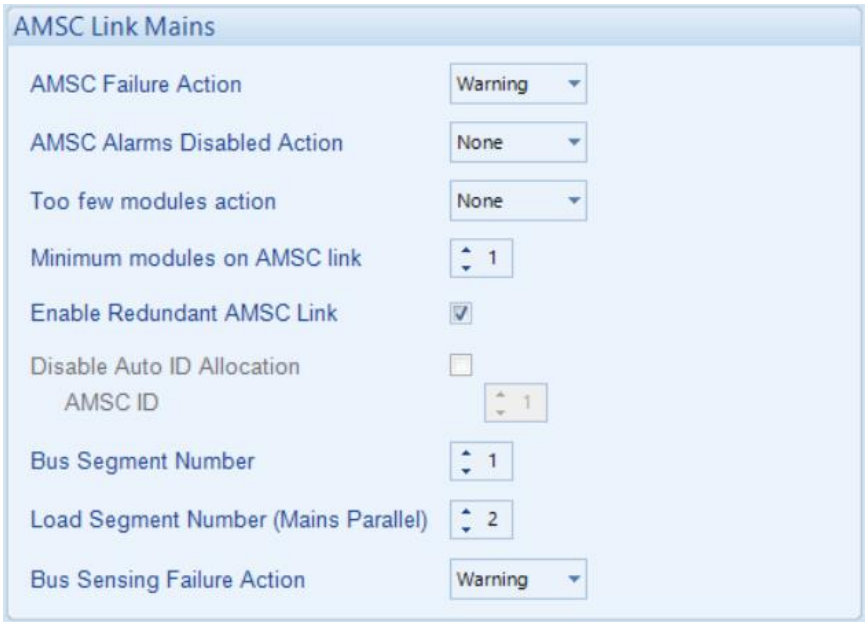
3.10.6 REDUNDANT AMSC LINK

NOTE: The redundant AMSC link connectivity is only available in DSEG8xxx modules. Contact DSE technical support: support@deepseaelectronics.com for more information.

NOTE: A termination resistor MUST be fitted to the first and last unit on the AMSC link. For connection details, refer to section 4.2.12 entitled *Typical Arrangement of AMSC Link*.

NOTE: DSE recommend Belden 9841 (or equivalent) cable for AMSC communication. This is rated to a maximum cable length of 250 m. DSE Stock Belden 9841 cable, DSE Part Number: 016-030.

The AMSC link is the interconnection cable between all DSE synchronising controllers and must not be connected to any device other than DSE equipment designed for connection to the AMSC link. Upon the main AMSC link failing for any reason, the system automatically selects the Redundant AMSC Link connection using the CAN Port connection. See section 4.2.3 for further information.
An example of configuring the Redundant AMSC Link connection the DSE Configuration Suite Software is shown below:



The G8660 can support a redundant link on either the generator bus or the group bus, not both and can automatically switched between the two. If the redundant link is on the group, a redundant link is not available on the generator bus.
The redundant link must be configured and connected for all modules on an AMSC bus.
Continued Overleaf

NOTE: Load and Bus Segment Numbers must be unique in the system, the same segment number can't be used for both a Load and a Bus AC segment.
The Load segment Number needs to be set differently to the Bus Segment Number even when the bus breaker is omitted.

…

3.10.7 DSENET® (EXPANSION MODULES)

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG*8660 Configuration Suite PC Software Manual.*

NOTE: As a termination resistor is internally fitted to the controller, the controller must be the 'first' unit on the DSENet® link. A termination resistor MUST be fitted to the 'last' unit on the DSENet® link. For connection details, refer to section 4.2.11 entitled *Typical Arrangement of DSENet®*.

NOTE: DSE recommend Belden 9841 (or equivalent) cable for DSENet® communication. This is rated to a maximum cable length of 1.2 km. DSE Stock Belden 9841 cable, DSE Part Number: 016-030.

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

Description	Specification
Cable Type	Two core screened and shielded twisted pair
Cable Characteristics	120 Ω Low capacitance
Recommended Cable	Belden 9841 Belden 9271
Maximum Cable Length	1200 m (¾ mile) when using Belden 9841 or direct equivalent. 600 m (656 yards) when using Belden 9271 or direct equivalent.
DSENet® Topology	"Daisy Chain" Bus with no stubs (spurs)
DSENet® Termination	120 Ω. Fitted internally to host controller. Must be fitted externally to the 'last' expansion module.
Maximum Expansion Modules	**NOTE: Only supported DSE Intelligent Battery Chargers may be connected to the DSENet®. Contact DSE Technical Support for further information.** 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) and DSE Intelligent Battery Chargers (up to 4) This gives the possibility of: • Maximum 32 additional 0-10 V or 4-20 mA outputs (DSE2152) • Maximum 80 additional relay outputs (DSE2157) • Maximum 80 additional LED indicators (DSE2548) • Maximum 24 additional RTD or thermocouple inputs (DSE2133). • Maximum 32 additional inputs (Can be configured as either digital, or resistive when using DSE2130) • Maximum 40 additional flexible inputs (All can be configured as either digital, resistive, 0-10 V or 4-20 mA when using DSE2131) • Maximum 4 DSE Intelligent Battery Chargers.

3.11 SOUNDER

The module features an internal sounder to draw attention to warning and electrical trip alarms.

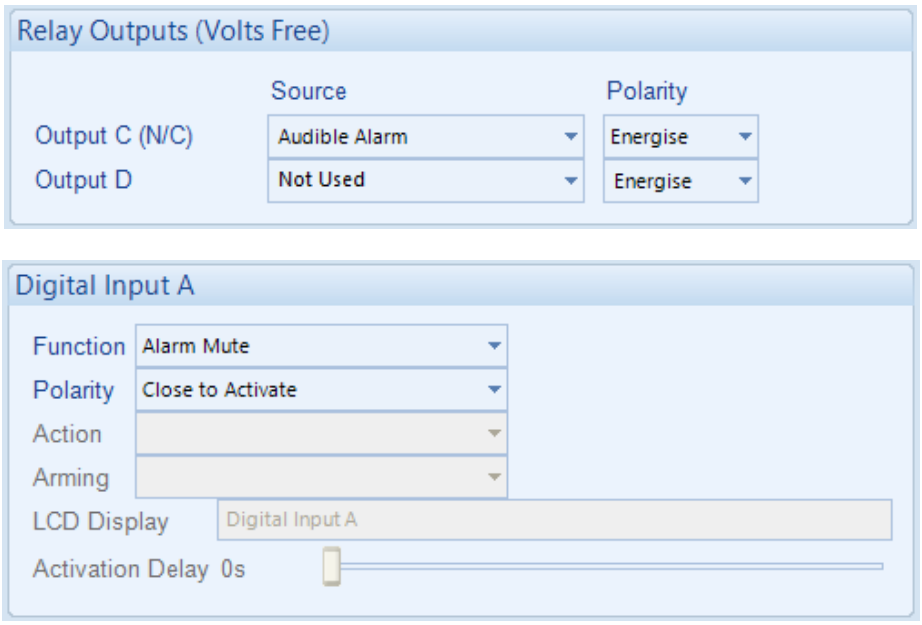
Description	Specification
Sounder Level	64 db at 1 m

3.11.1 ADDING AN EXTERNAL SOUNDER

If an external alarm or indicator is 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 ***Lamp Test / Alarm Mute*** button activate 'in parallel' with each other. Either signal mutes both the internal sounder and audible alarm output.

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



3.12 ACCUMULATED INSTRUMENTATION

The accumulated power instrumentation can be set/reset using the DSE Configuration Suite PC software. Depending upon module configuration, this may have been PIN number locked by the supplier.

Description	Specification
Accumulated Power	999999 kWh / kvarh / kVAh
Engine Hours Run	Maximum 99999 hrs 59 minutes (Approximately 11yrs 4 months)

3.13 DIMENSIONS AND MOUNTING

3.13.1 DIMENSIONS

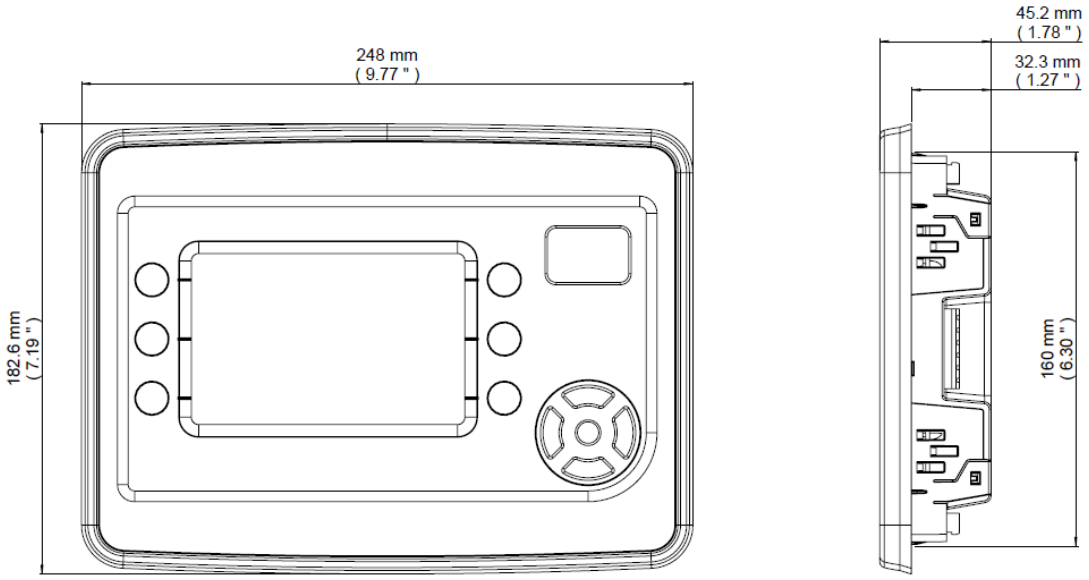
248 mm x 182.6 mm x 45.2 mm
(9.76” x 7.18 ” x 1.77 ”)

3.13.2 PANEL CUTOUT

220 mm x 160 mm
(8.66” x 6.29”)

3.13.3 WEIGHT

0.76 kg
(1.67 lb)

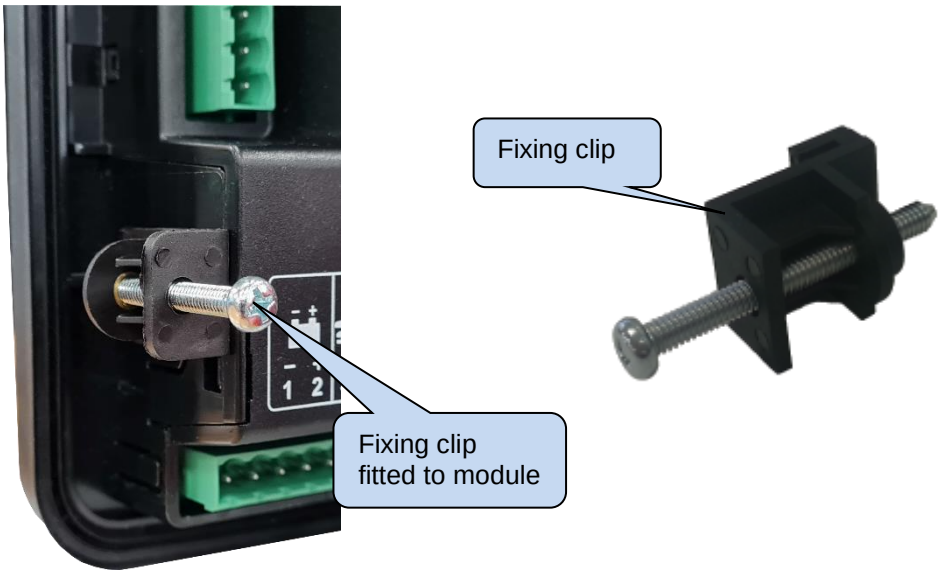


3.13.4 FIXING CLIPS

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

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

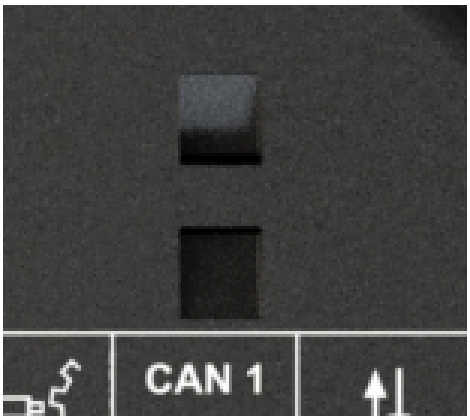
- Withdraw the fixing clip screw (turn anticlockwise) until only the pointed end is protruding from the clip.
- Insert the three ‘prongs’ of the fixing clip into the slots in the side of the module case.
- Pull the fixing clip backwards (towards the back of the module) ensuring all three prongs of the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



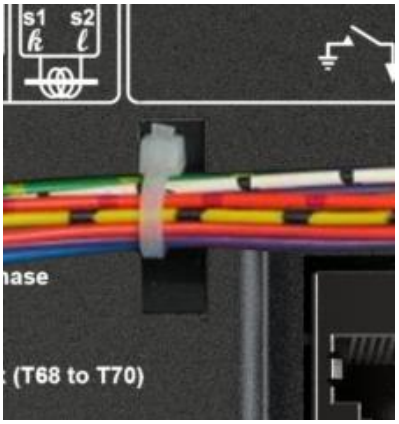
3.13.4.1 CABLE TIE FIXING POINTS

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, reducing the chance of future connection failures.

Care must be taken not to over tighten the cable tie (for instance with cable tie tools) to prevent the risk of damage to the module case.



Cable Tie Fixing Point



With Cable And Tie In Place

3.13.5 SEALING GASKET

The gasket provides improved sealing between module and the panel fascia. The gasket is incorporated into the module as shown below. Ensure correct fitment to the panel facia to maintain the integrity of the seal.

3.14 APPLICABLE STANDARDS

Standard	Description
BS EN 60068-2-1 (Minimum temperature)	-30 °C (-22 °F)
BS EN 60068-2-2 (Maximum temperature)	+70 °C (158 °F)
BS EN 60068-2-6 (Vibration)	Ten sweeps in each of three major axes 5 Hz to 8 Hz at ± 7.5 mm 8 Hz to 500 Hz at 2 gn
BS EN 60068-2-27 (Shock)	Three shocks in each of three major axes 15 gn in 11 ms
BS EN 60068-2-30 (Damp heat cyclic)	20°C to 55 °C at 95% relative humidity for 48 hours
BS EN 60068-2-78 (Damp heat static)	40 °C at 95% relative humidity for 48 hours
BS EN 60950 (Electrical safety)	Safety of information technology equipment, including electrical business equipment
BS EN 61000-6-2 (Electro-magnetic Compatibility)	EMC Generic Immunity Standard (Industrial)
BS EN 61000-6-4 (Electro-magnetic Compatibility)	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 optional 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 optional 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 vary. Depending on module configuration, the device numbers included within the module could be: 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 15 – Speed or frequency matching device. 25 – Synchronising or synchronism check relay

Continued over the page...

Standard	Description
IEEE C37.2 (Standard Electrical Power System Device Function Numbers and Contact Designations)	Continued… 26 – Apparatus thermal device 27AC – AC undervoltage relay 27DC – DC undervoltage relay 29 – Isolating contactor or switch 30 – Annunciator relay 37 – Undercurrent or underpower relay (**USING INTERNAL PLC EDITOR**) 42 – Running circuit breaker 44 – Unit sequence relay 46 – Reverse-phase or phase-balance current relay 48 – Incomplete sequence relay 50 – Instantaneous overcurrent relay 51 – AC time overcurrent relay 52 – AC circuit breaker 55 – Power factor relay (**USING INTERNAL PLC EDITOR**) 59AC – AC overvoltage relay 59DC – DC overvoltage relay 62 – Time delay stopping or opening relay 71 – Level switch 74 – Alarm relay 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

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

3.14.1 ENCLOSURE CLASSIFICATIONS

3.14.1.1 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).

First Digit Protection against contact and ingress of solid objects	Second Digit Protection against ingress of water
0 No protection	0 No protection
1 Protected against ingress solid objects with a diameter of more than 50 mm. No protection against deliberate access, e.g., with a hand, but large surfaces of the body are prevented from approach.	1 Protection against dripping water falling vertically. No harmful effect must be produced (vertically falling drops).
2 Protected against penetration by solid objects with a diameter of more than 12 mm. Fingers or similar objects prevented from approach.	2 Protection against dripping water falling vertically. There must be no harmful effect when the equipment (enclosure) is tilted at an angle up to 15° from its normal 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).

3.14.1.2 NEMA CLASSIFICATIONS

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

12 (Front of module when module is installed into the control panel).

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 noncorrosive liquids.
13 **IP65**	Provides a degree of protection against dust and spraying of water, oil, and non-corrosive coolants.

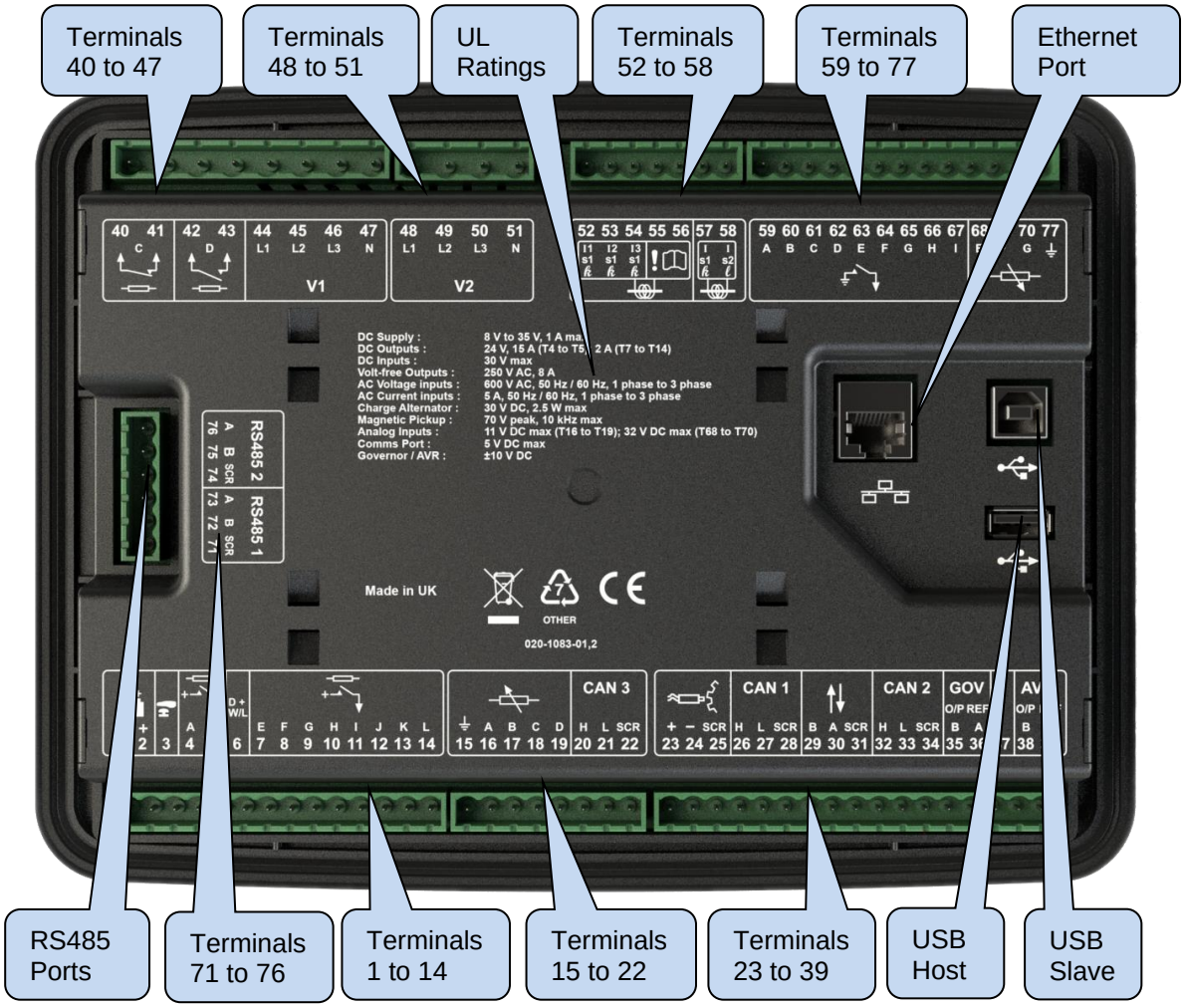
4 INSTALLATION

The module is designed to be mounted on the panel fascia. For dimension and mounting details, see the section 3.13 entitled *Dimension and Mounting*.

4.1 USER CONNECTIONS

NOTE: Availability of some terminals depends upon module version. Full details are given in the section 4.2 entitled *Connection Descriptions*.

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.



4.2 CONNECTION DESCRIPTIONS

4.2.1 DC SUPPLY & DC OUTPUTS

NOTE: When the module is configured for operation with an electronic engine, *Fuel* and *Start* output requirements may be different. For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines And DSE Wiring*

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG*8660 Configuration Suite PC Software Manual.*

	Pin No	Description	Cable Size	Notes
	1	DC Plant Supply Input (Negative)	2.5 mm² AWG 13	Connect to ground where applicable.
	2	DC Plant Supply Input (Positive)	2.5 mm² AWG 13	Supplies the module and DC Outputs E, F, G, H, I & J
	3	Not Connected		
	4	Not Connected		
	5	Not Connected		
D+ W/L	6	Not Connected		
	7	DC Output E	1.0 mm² AWG 18	Plant Supply Positive from terminal 2. 2 A DC rated.
	8	DC Output F	1.0 mm² AWG 18	Plant Supply Positive from terminal 2. 2 A DC rated.
	9	DC Output G	1.0 mm² AWG 18	Plant Supply Positive from terminal 2. 2 A DC rated.
	10	DC Output H	1.0 mm² AWG 18	Plant Supply Positive from terminal 2. 2 A DC rated.
	11	DC Output I	1.0 mm² AWG 18	Plant Supply Positive from terminal 2. 2 A DC rated.
	12	DC Output J	1.0 mm² AWG 18	Plant Supply Positive from terminal 2. 2 A DC rated.
	13	Not Connected		
	14	Not Connected		

4.2.2 CAN

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

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

	Pin No	Description	Cable Size	Notes
	15	Not Connected		
	16	Not Connected		
	17	Not Connected		
	18	Not Connected		
	19	Not Connected		
CAN 3 REDUNDANT AMSC 2	20	CAN Port H	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	21	CAN Port L	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	22	CAN Port Screen	Shield	Use only 120 Ω CAN or RS485 approved cable

4.2.3 AMSC & DSENET®

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 *DSEG8660 Configuration Suite PC Software Manual.*

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

NOTE: As a termination resistor is internally fitted to the controller, the controller must be the 'first' unit on the DSENet® link. A termination resistor MUST be fitted to the 'last' unit on the DSENet® link. For connection details, refer to section 4.2.11 entitled *Typical Arrangement of DSENet®*.

	Pin No	Description	Cable Size	Notes
	23	Not Connected		
	24	Not Connected		
	25	Not Connected		
PRIMARY AMSC GROUP CONTROLLER ONLY	26	CAN Port H	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	27	CAN Port L	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	28	CAN Port Screen	Shield	Use only 120 Ω CAN or RS485 approved cable
	29	DSENet® Expansion B	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	30	DSENet® Expansion A	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	31	DSENet® Expansion Screen	Shield	Use only 120 Ω CAN or RS485 approved cable
SECONDARY AMSC (GROUP CONTROLLER) **AMSC 1 (MAINS PARALLEL)**	32	CAN Port H	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	33	CAN Port L	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	34	CAN Port Screen	Shield	Use only 120 Ω CAN or RS485 approved cable
GOV	35	Not Connected		
	36	Not Connected		
	37	Not Connected		
AVR	38	Not Connected		
	39	Not Connected		

4.2.4 OUTPUT C & D & V1 (MAINS) VOLTAGE & FREQUENCY SENSING

NOTE: The below table describes connections to a three phase, four wire supply. For alternative wiring topologies, see section 4.3 entitled *Typical Wiring Diagrams*.

	Pin No	Description	Cable Size	Notes
	40	Normally Closed Volt-Free Relay Output C	1.0mm² AWG 18	Normally configured to control the mains contactor coil
	41		1.0mm² AWG 18	
	42	Normally Open Volt-Free Relay Output D	1.0mm² AWG 18	Normally configured to control the bus contactor coil
	43		1.0mm² AWG 18	
V1	44	Mains L1 (R) Voltage Sensing	1.0 mm² AWG 18	Connect to mains L1 (R) output (AC) (Recommend 2 A fuse)
	45	Mains L2 (S) Voltage Sensing	1.0 mm² AWG 18	Connect to mains L2 (S) output (AC) (Recommend 2 A fuse)
	46	Mains L3 (T) Voltage Sensing	1.0 mm² AWG 18	Connect to mains L3 (T) output (AC) (Recommend 2 A fuse)
	47	Mains Neutral (N) Input	1.0 mm² AWG 18	Connect to mains Neutral terminal (AC)

4.2.5 V2 (BUS) VOLTAGE & FREQUENCY SENSING

NOTE: The below table describes connections to a three phase, four wire Bus supply. For alternative wiring topologies, see section 4.3 entitled *Typical Wiring Diagrams*.

	Pin No	Description	Cable Size	Notes
V2	48	Bus L1 (U) Voltage Sensing	1.0 mm² AWG 18	Connect to Bus L1 (U) output (AC) (Recommend 2 A fuse)
	49	Bus L2 (V) Voltage Sensing	1.0 mm² AWG 18	Connect to Bus L2 (V) output (AC) (Recommend 2 A fuse)
	50	Bus L3 (W) Voltage Sensing	1.0 mm² AWG 18	Connect to Bus L3 (W) output (AC) (Recommend 2 A fuse)
	51	Bus Neutral (N) Input	1.0 mm² AWG 18	Connect to Bus Neutral terminal (AC)

4.2.6 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 0.5 VA 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.

4.2.6.1 MAINS CURRENT TRANSFORMERS

	Pin No	Description	Cable Size	Notes
	52	CT Secondary for Mains L1	2.5 mm² AWG 13	Connect to s1 secondary of L1 monitoring CT
	53	CT Secondary for Mains L2	2.5 mm² AWG 13	Connect to s1 secondary of L2 monitoring CT
	54	CT Secondary for Mains L3	2.5 mm² AWG 13	Connect to s1 secondary of L3 monitoring CT
	55	DO NOT CONNECT		
	56	Common for CTs connected to L1,L2,L3 (s2)	2.5 mm² AWG 13	Connect to s2 secondary of L1,L2,L3 monitoring CTs

4.2.6.2 BUS/LOAD CURRENT TRANSFORMER

NOTE: The Bus/Load CT is NOT REQUIRED in a system including only one DSEG8660 controller.

	Pin No	Description	CABLE SIZE	NOTES
	57	CT Secondary for Bus/Load CT	2.5 mm² AWG 13	Connect to s1 secondary of Bus/Load CT
	58	CT Secondary for Bus/Load CT	2.5 mm² AWG 13	Connect to s2 secondary of Bus/Load CT

Advantages of Bus/Load CT

The Bus/Load CT is only required when there is **more than one** DSEG8660 (selected for mains application) in the same system.

When the Bus/Load CT is fitted, the DSEG8660 transfers the correct amount of load to the mains before disconnecting the generator bus, preventing the generator(s) from being shock loaded/unloaded. No power is flowing through the breaker when it is opened.

Without the Bus/Load CT, the DSEG8660 does not know how much load to transfer to the mains when other DSEG8660's are still operating in island mode. Instead, the DSEG8660 would open the bus breaker at a pre-determined load level on the mains. This may lead to there being too much load

or not enough load transferred, and the generator(s) may be shock loaded/unloaded as the bus disconnect from the mains.

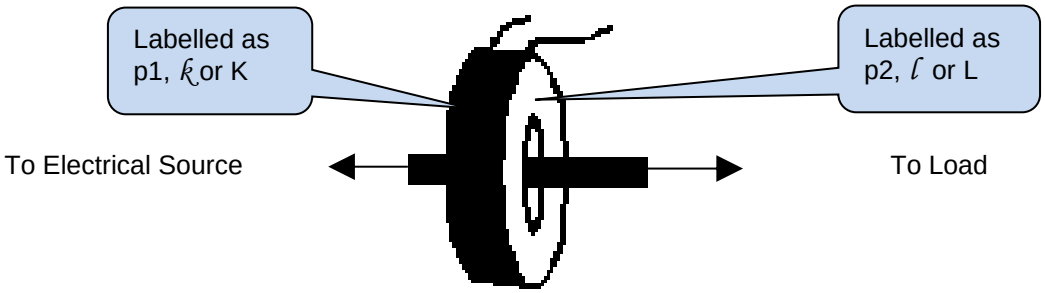
4.2.6.3 CT CONNECTIONS

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

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

s1 is the secondary of the CT that connects to the DSE Module's input for the CT measuring

s2 is the secondary of the CT that is connected with other common s2 connections of all the other CTs and connected to the CT common terminal of the module.



Polarity of CT Primary

4.2.7 DIGITAL INPUTS

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 *DSEG8660 Configuration Suite PC Software Manual.*

	Pin No	Description	Cable Size	Notes
	59	Configurable Digital Input A	0.5 mm² AWG 20	Switch To Negative
	60	Configurable Digital Input B	0.5 mm² AWG 20	Switch To Negative
	61	Configurable Digital Input C	0.5 mm² AWG 20	Switch To Negative
	62	Configurable Digital Input D	0.5 mm² AWG 20	Switch To Negative
	63	Configurable Digital Input E	0.5 mm² AWG 20	Switch To Negative
	64	Configurable Digital Input F	0.5 mm² AWG 20	Switch To Negative
	65	Configurable Digital Input G	0.5 mm² AWG 20	Switch To Negative
	66	Configurable Digital Input H	0.5 mm² AWG 20	Switch To Negative
	67	Configurable Digital Input I	0.5 mm² AWG 20	Switch To Negative
	68	Not Connected		
	69	Not Connected		
	70	Not Connected		
	77	Not Connected		

4.2.8 RS485

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 *DSEG8660 Configuration Suite PC Software Manual.*

NOTE: A 120 Ω termination resistor must be fitted across terminals A and B if the DSE module is the first or last device on the R485 link.

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

	Pin No	Description	Cable Size	Notes
RS485 1	71	RS485 Port Screen	Shield	Use only 120 Ω CAN or RS485 approved cable
	72	RS485 Port B (+)	0.5 mm² AWG 20	Connect to RXD+ and TXD+ Use only 120 Ω CAN or RS485 approved cable
	73	RS485 Port A (-)	0.5 mm² AWG 20	Connect to RXD- and TXD- Use only 120 Ω CAN or RS485 approved cable
RS485 2	74	RS485 Port Screen	Shield	Use only 120 Ω CAN or RS485 approved cable
	75	RS485 Port B (+)	0.5 mm² AWG 20	Connect to RXD+ and TXD+ Use only 120 Ω CAN or RS485 approved cable
	76	RS485 Port A (-)	0.5 mm² AWG 20	Connect to RXD- and TXD- Use only 120 Ω CAN or RS485 approved cable

4.2.9 USB SLAVE (PC CONFIGURATION) CONNECTOR

NOTE: The USB connection cable between the PC and the module must not be extended beyond 5 m (16 feet). For distances over 5 m, it is possible to use a third-party USB extender. Typically, they extend USB up to 50 m. The supply and support of this type of equipment is outside the scope of Deep Sea Electronics.

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 *DSEG8660 Configuration Suite PC Software Manual.*

	Description	Cable Size	Notes
	Socket for connection to PC with DSE Configuration Suite Software	0.5 mm² AWG 20	This is a standard USB type A to type B connector. 

4.2.10 USB HOST (DATA LOGGING) CONNECTOR

NOTE: For further details on how to add and remove a USB storage device, refer to section 5.3.7entitled *Data Logging*.

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Software Manual.*

	Description	Storage Size	Notes
	Socket for connection to USB storage device for data logging	Maximum 16 GB	USB storage device must be formatted as FAT32.

4.2.11 TYPICAL ARRANGEMENT OF DSENET®

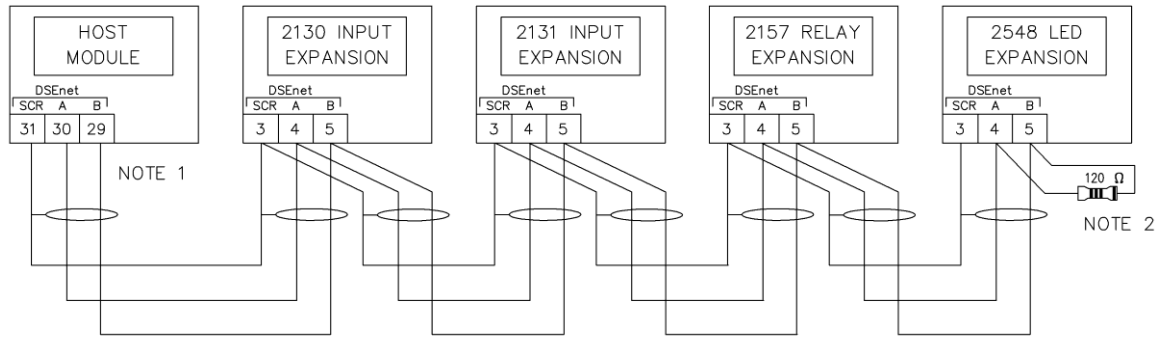
NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

NOTE: Screened 120 Ω 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)

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

Device	Maximum Number Supported
DSE2130 Input Expansion	4
DSE2131 Input Expansion	4
DSE2133 Input Expansion	4
DSE2152 Relay Output Expansion	4
DSE2157 Relay Output Expansion	10
DSE2548 LED Expansion	10
DSE Intelligent Battery Chargers	4



NOTE 1

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

NOTE 2

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

4.2.12 TYPICAL ARRANGEMENT OF AMSC LINK

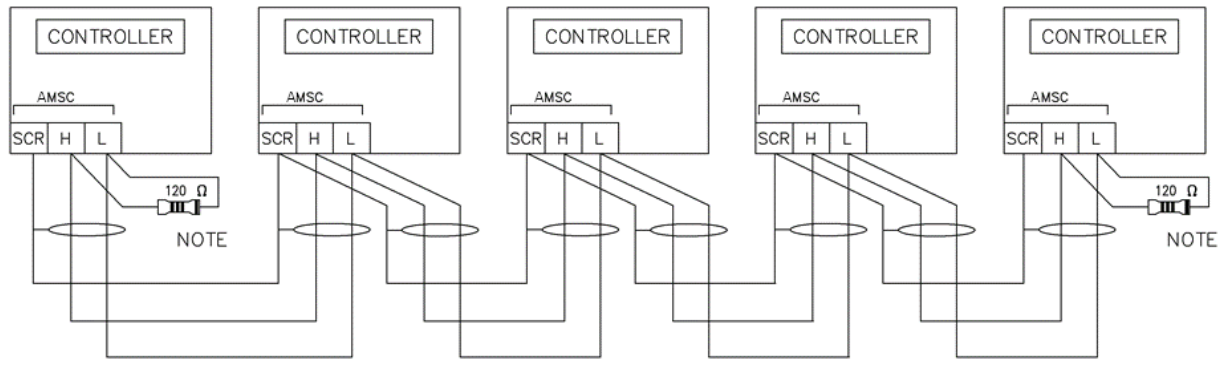
NOTE: For further information on the maximum number of modules that can be connected to the AMSC link and Redundant AMSC link, refer to sections 3.10.5 & 3.10.6 entitled *AMSC (Multi-Set Communications) Link* and *CAN Port (Redundant AMSC)*.

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

NOTE: Screened 120 Ω impedance cable specified for use with CAN must be used for the AMSC link connection.

DSE stock and supply Belden cable 9841 which is a high quality 120 Ω impedance cable suitable for AMSC link (DSE part number 016-030)

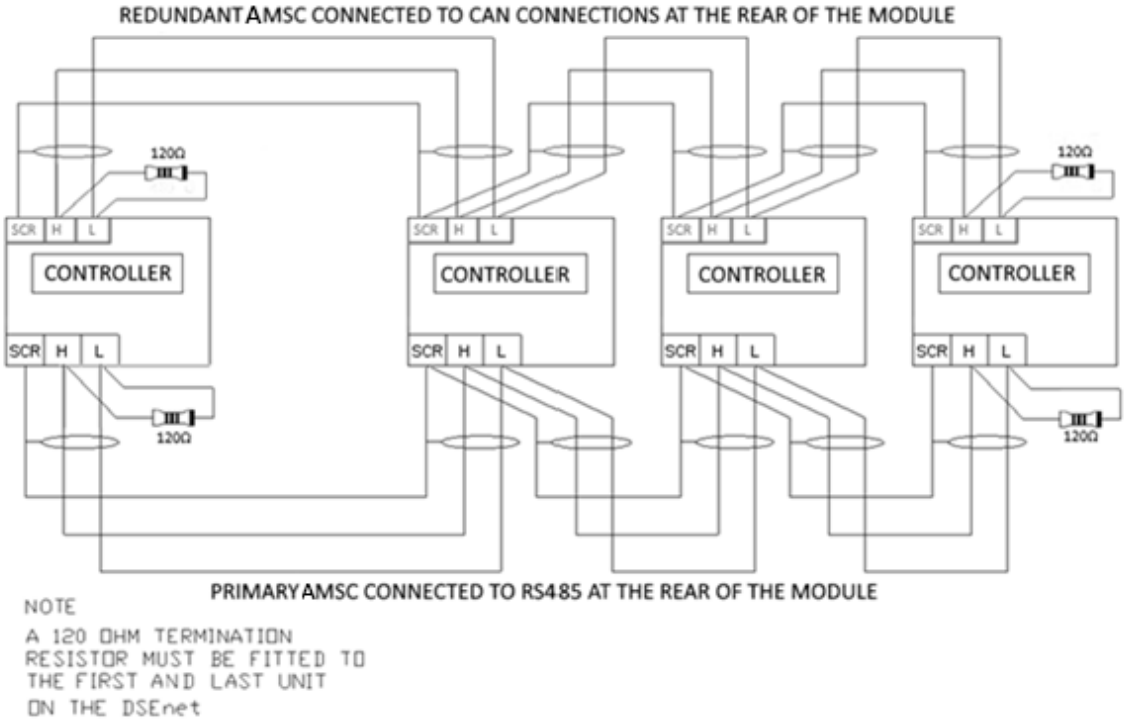
NOTE: A termination resistor MUST be fitted to the first and last unit on the AMSC link.



NOTE
A 120 OHM TERMINATION RESISTOR MUST BE FITTED
TO THE FIRST AND LAST UNIT ON THE AMSC LINK

4.2.13 TYPICAL ARRANGEMENT OF REDUNDANT AMSC LINK

The additional CAN port (CAN Port 3) can be used as a redundant AMSC link between the DSEG86xx modules. The AMSC link is the interconnection cable between all DSE synchronising controllers and must not be connected to any device other than DSE equipment designed for connection to the AMSC link. Upon the main AMSC link failing for any reason, the user can configure the DSEG86xx modules to revert to the Redundant AMSC Link connection using the CAN Port connection.



NOTE: For further details about the *Redundant AMSC* activation on the *Multi Set (MS)* application, refer to DSE Publication: 057-324 *DSEG8660 Configuration Suite PC Software Manual.*

4.3 TYPICAL WIRING DIAGRAMS

NOTE: It is recommended that the mains load switch uses DC coils/shunts for opening control and that no UV (under voltage) coils are fitted.

CAUTION!: Switching the application to Group Controller forces the mains breaker to be closed without synchronising checks.

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 always refer to the completed system diagram provided by the system manufacturer for complete wiring detail.

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

DSE Part	Description
056-022	Breaker Control (Training guide)
056-005	Using CTs With DSE Products
056-022	Breaker Control
056-091	Equipotential Earth Bonding
056-092	Best Practices for Wiring Resistive Sensors

4.3.1 EARTH SYSTEMS

4.3.1.1 NEGATIVE EARTH

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

4.3.1.2 POSITIVE EARTH

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

Follow the typical wiring diagram as normal for all sections ***except*** the earth points.
All points shown as Earth on the typical wiring diagram are connected to ***battery negative*** (not earth).

4.3.1.3 FLOATING EARTH

Where neither the battery positive nor battery negative terminals are connected 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 are connected to ***battery negative*** (not earth).

4.4 MAINS PARALLEL ALTERNATE TOPOLOGY WIRING DIAGRAMS

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Software Manual.*

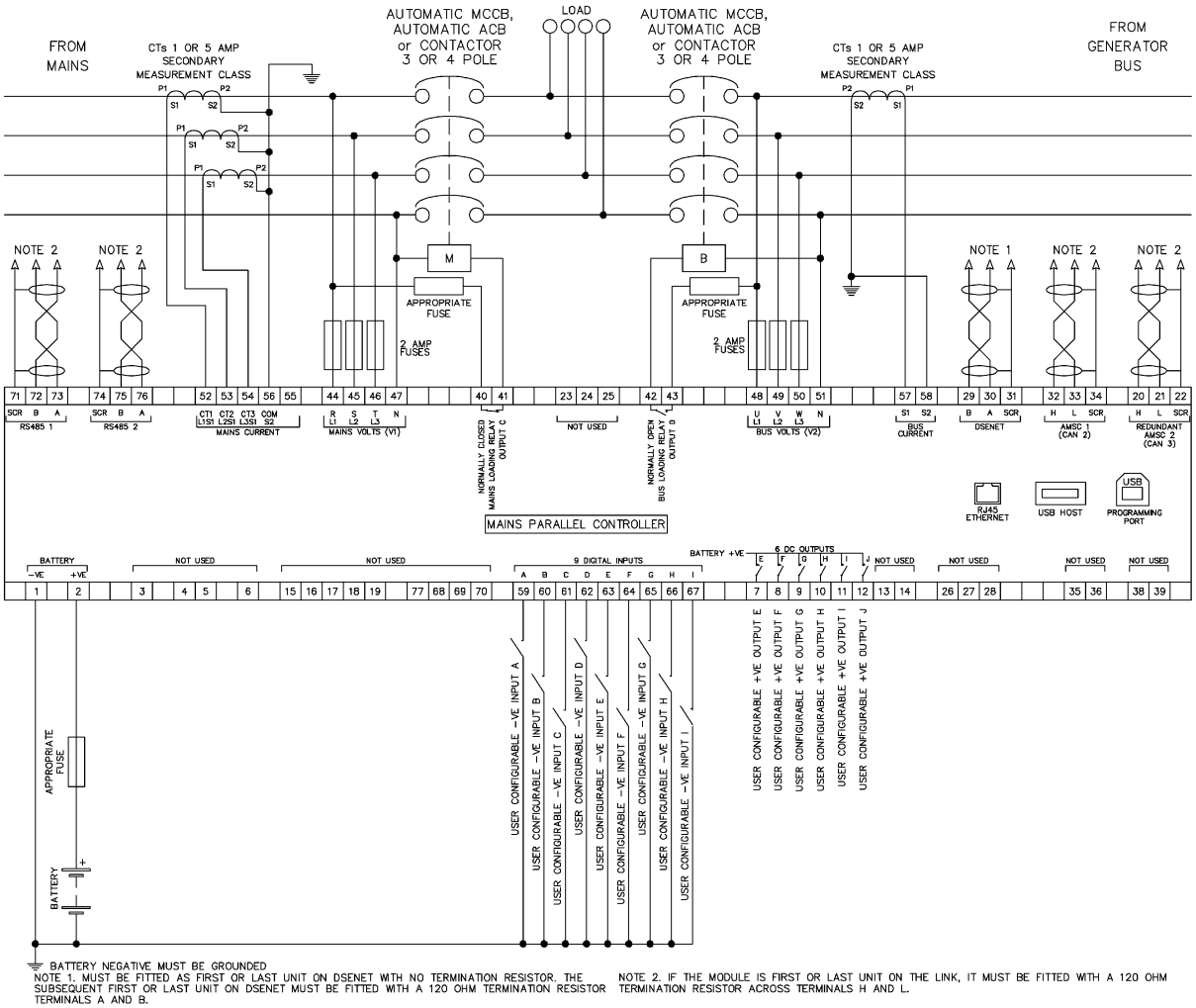
NOTE: The Bus/Load CT is NOT REQUIRED in a system including only one DSEG8660 controller. For further information regarding the advantages of a Bus/Load CT, refer to section 6.8.2 entitled *Bus/Load Current Transformer*, or refer to DSE Publication: *056-007 Advantages of Bus/Load CT.*

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.

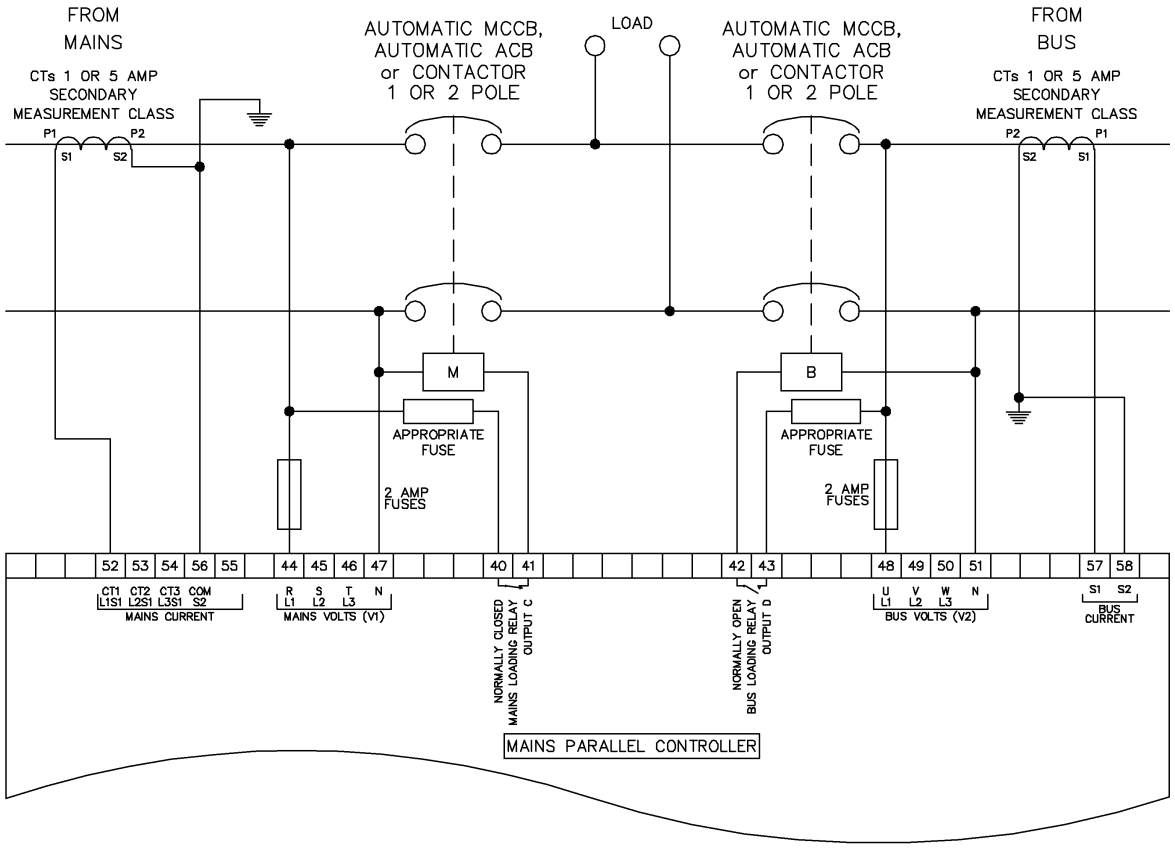
4.4.1 3 PHASE, 4 WIRE WITH A BUS CT

NOTE: The below diagram is applicable for the following AC topologies: 3 Phase 4 Wire Star, 3 Phase 4 Wire Delta L1-N-L2, 3 Phase 4 Wire Delta L1-N-L3 and 3 Phase 4 Wire Delta *L2-N-L3*. For further details of module configuration to suit these different topologies, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

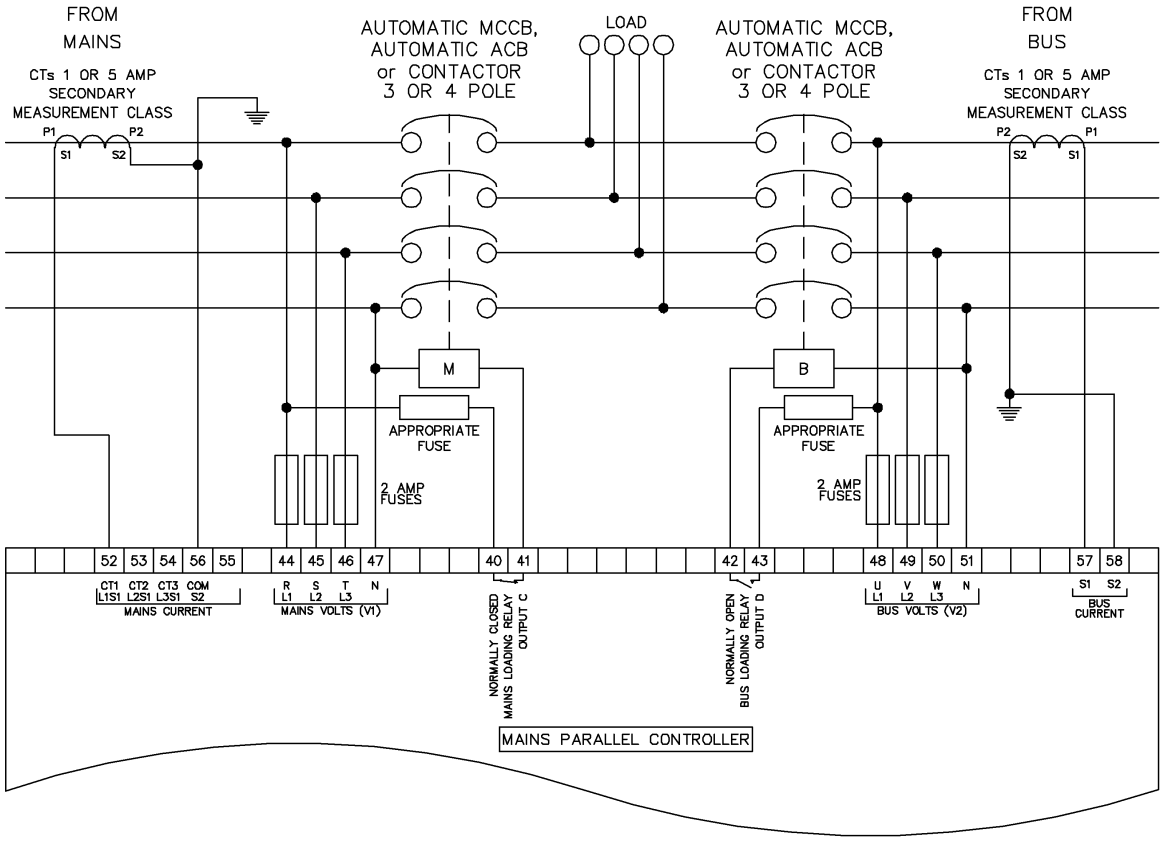
NOTE: The Bus/Load CT is NOT REQUIRED in a system including only one DSEG8660 controller. For further information regarding the advantages of a Bus/Load CT, refer to section 6.8.2 entitled *Bus/Load Current Transformer*, or refer to DSE Publication: *056-007 Advantages of Bus/Load CT.*



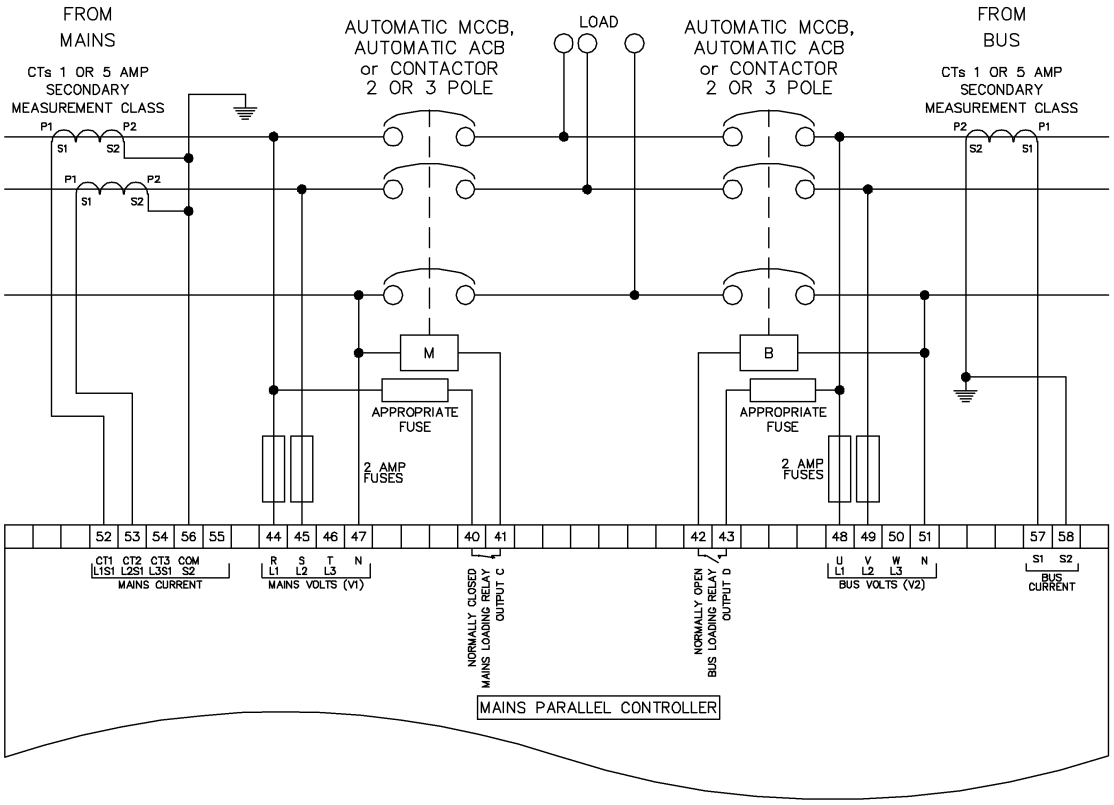
4.4.2 SINGLE PHASE (L1 & N) 2 WIRE WITH A BUS CT



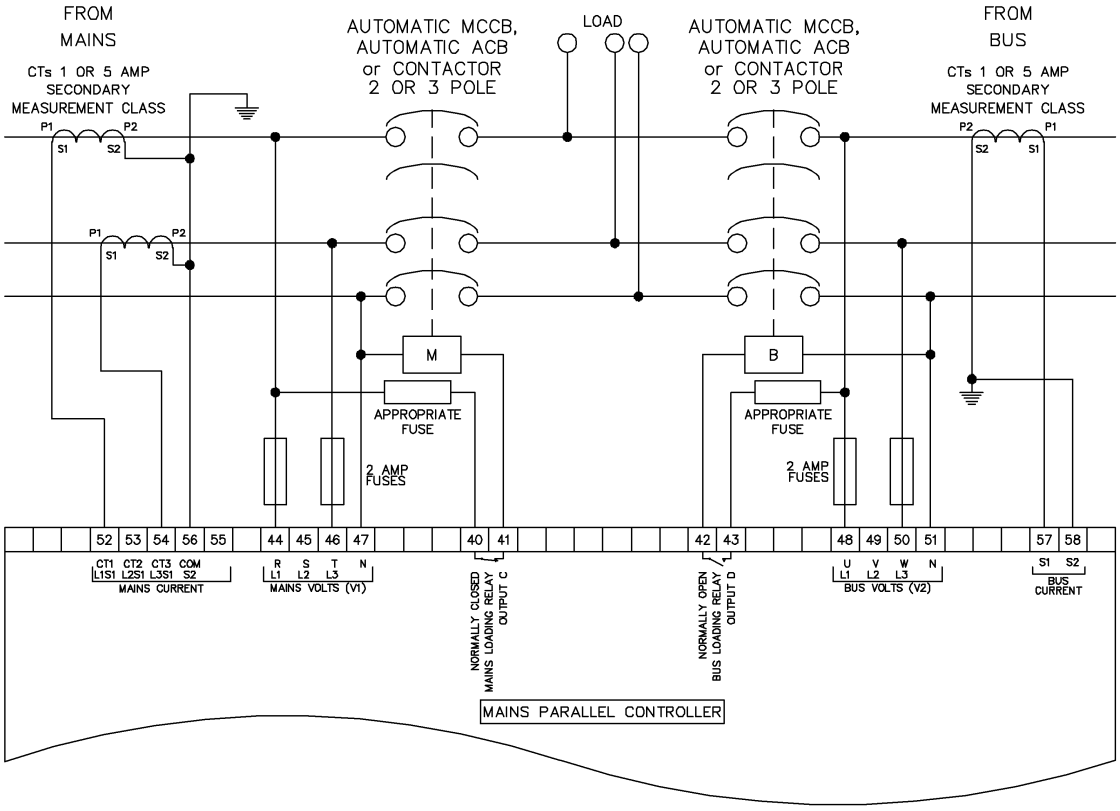
4.4.3 SINGLE PHASE 4 WIRE DELTA WITH A BUS CT



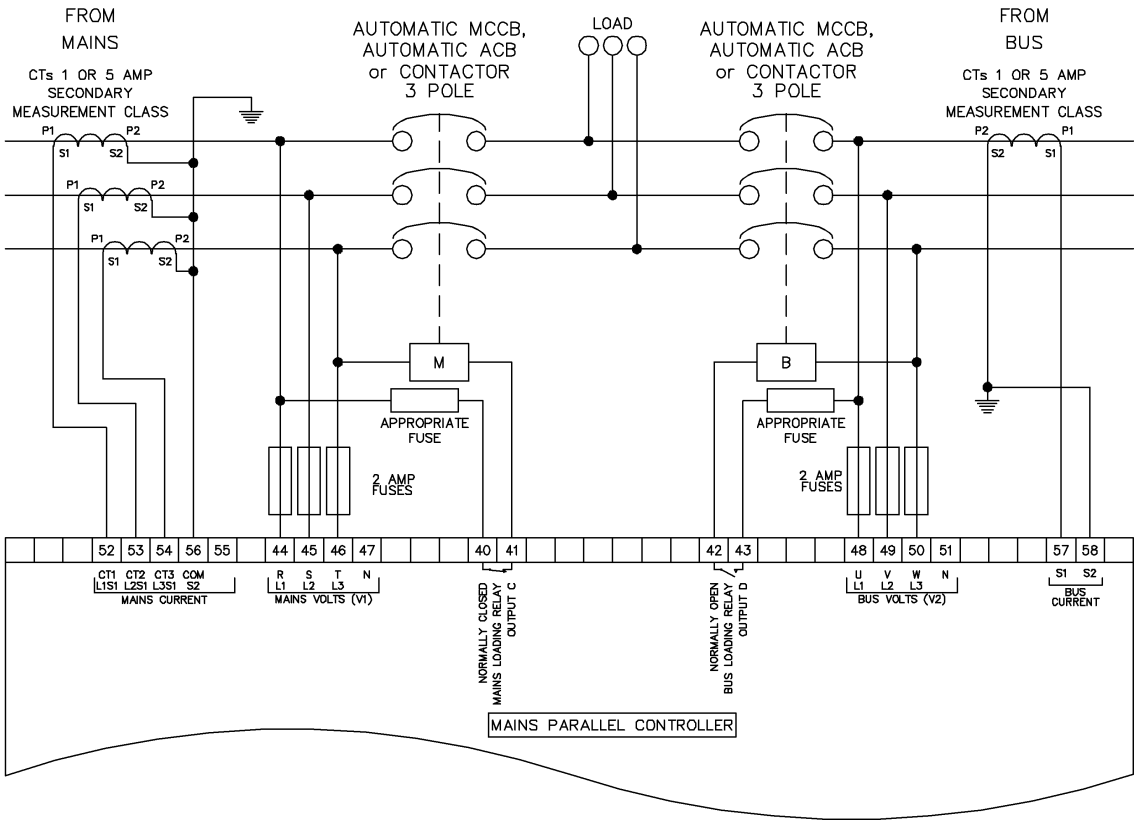
4.4.4 2 PHASE (L1 & L2) 3 WIRE WITH A BUS CT



4.4.5 2 PHASE (L1 & L3) 3 WIRE WITH A BUS CT

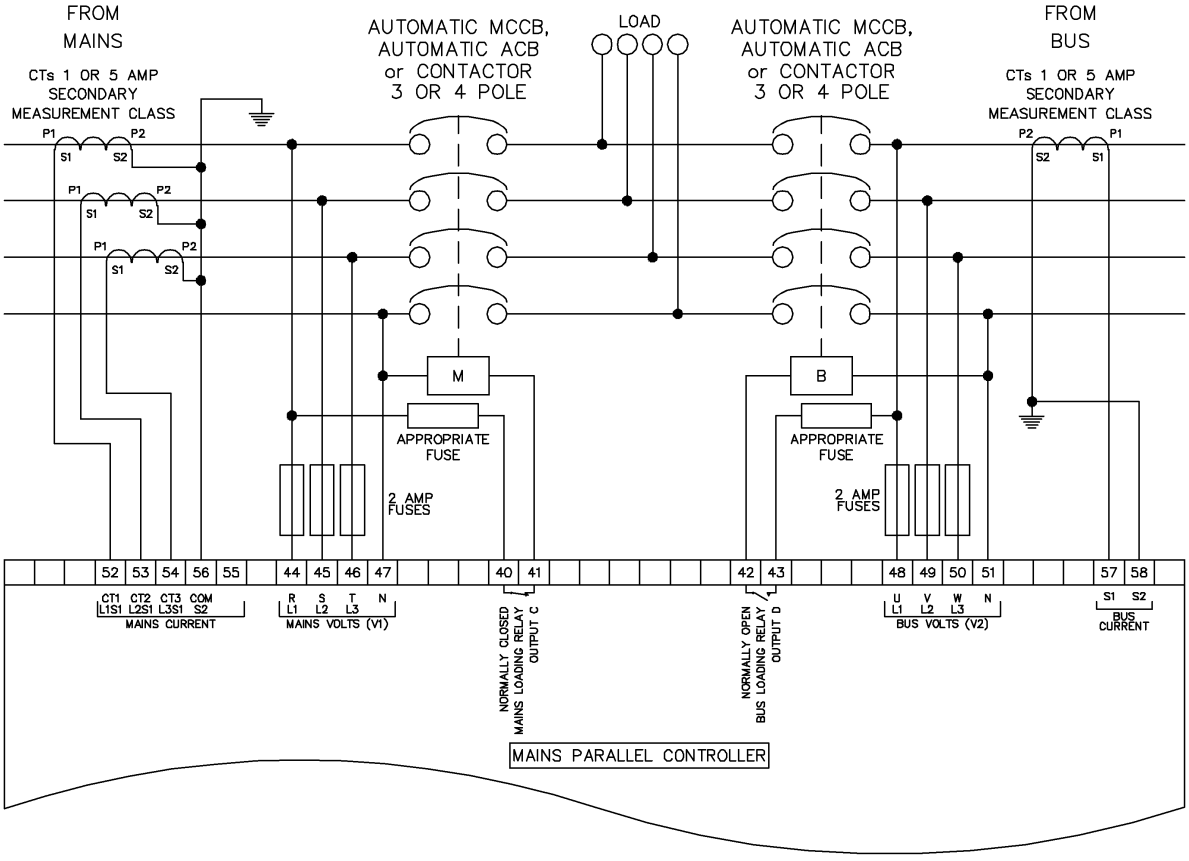


4.4.6 3 PHASE 3 WIRE DELTA WITH A BUS CT



4.4.7 3 PHASE, 4 WIRE WITH A BUS CT

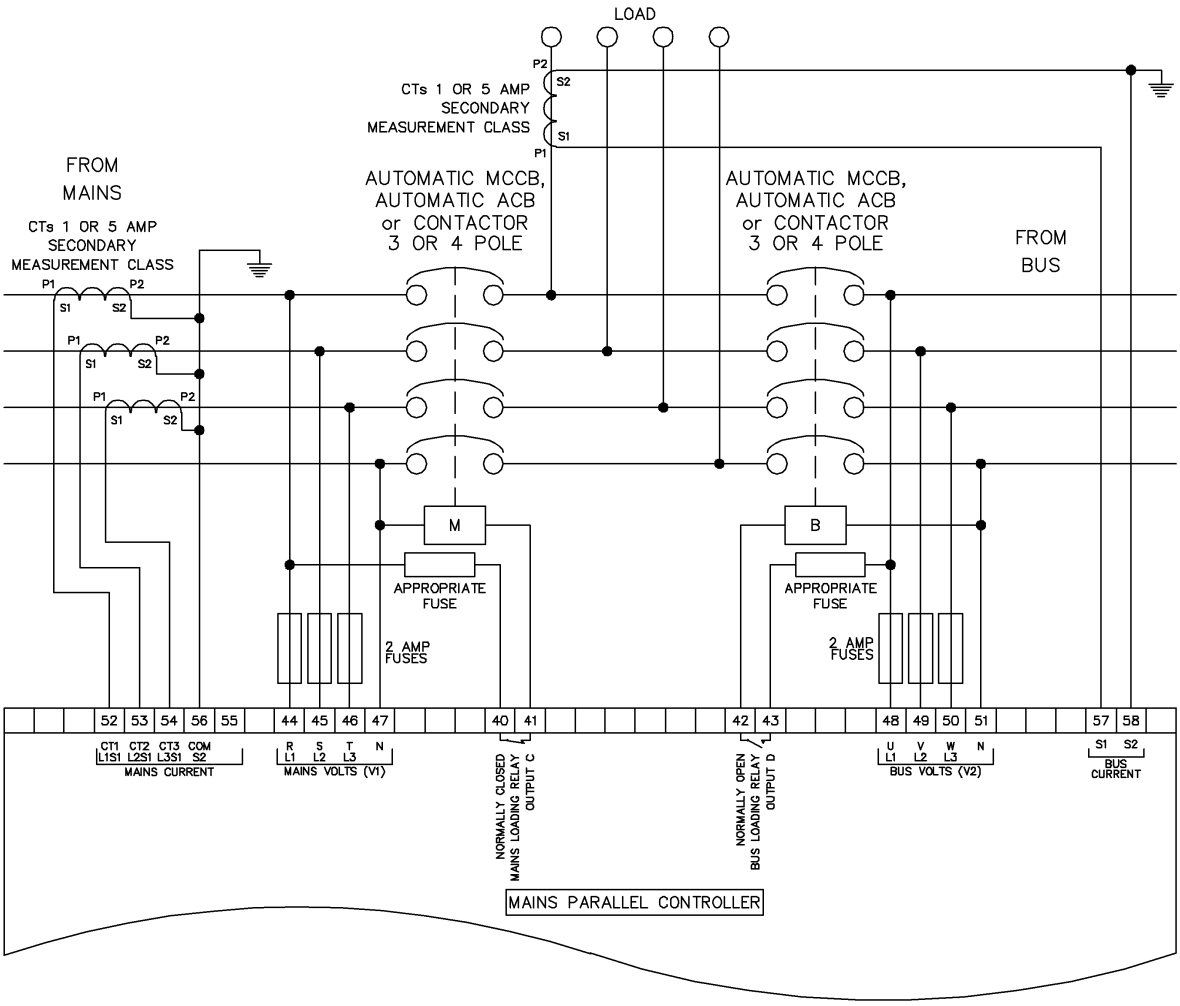
NOTE: The below diagram is applicable for the following AC topologies: 3 Phase 4 Wire Star, 3 Phase 4 Wire Delta L1-N-L2, 3 Phase 4 Wire Delta L1-N-L3 and 3 Phase 4 Wire Delta *L2-N-L3*. For further details of module configuration to suit these different topologies, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*



4.4.8 3 PHASE, 4 WIRE WITH A LOAD CT

NOTE: The below diagram is applicable for the following AC topologies: 3 Phase 4 Wire Star, 3 Phase 4 Wire Delta L1-N-L2, 3 Phase 4 Wire Delta L1-N-L3 and 3 Phase 4 Wire Delta *L2-N-L3*. For further details of module configuration to suit these different topologies, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

This example shows the Bus/Load CT in the common load feed for a three phase four wire system, but the same philosophy is applicable to the other topologies

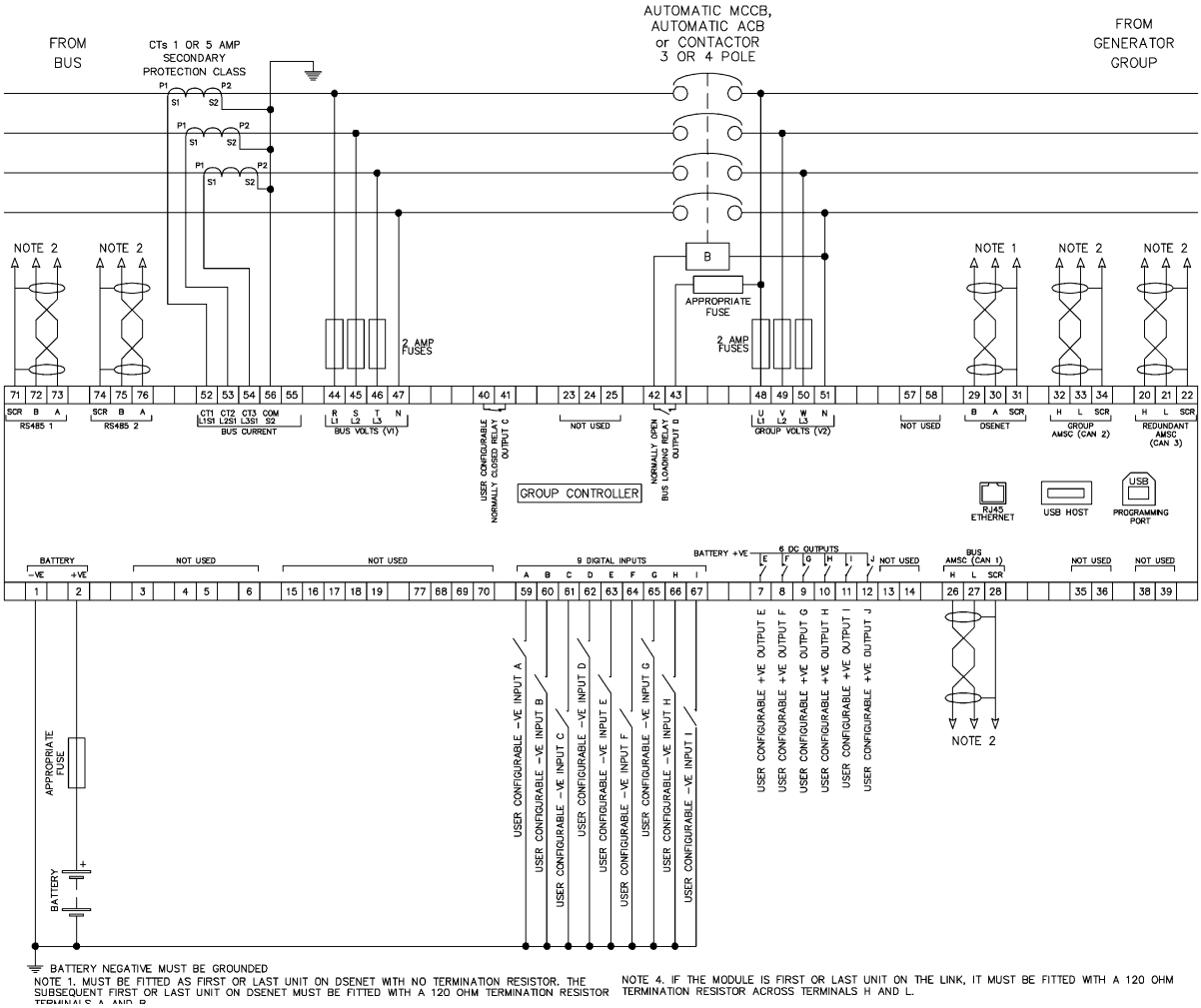


4.5 GROUP CONTROLLER ALTERNATIVE TOPOLOGY DIAGRAMS

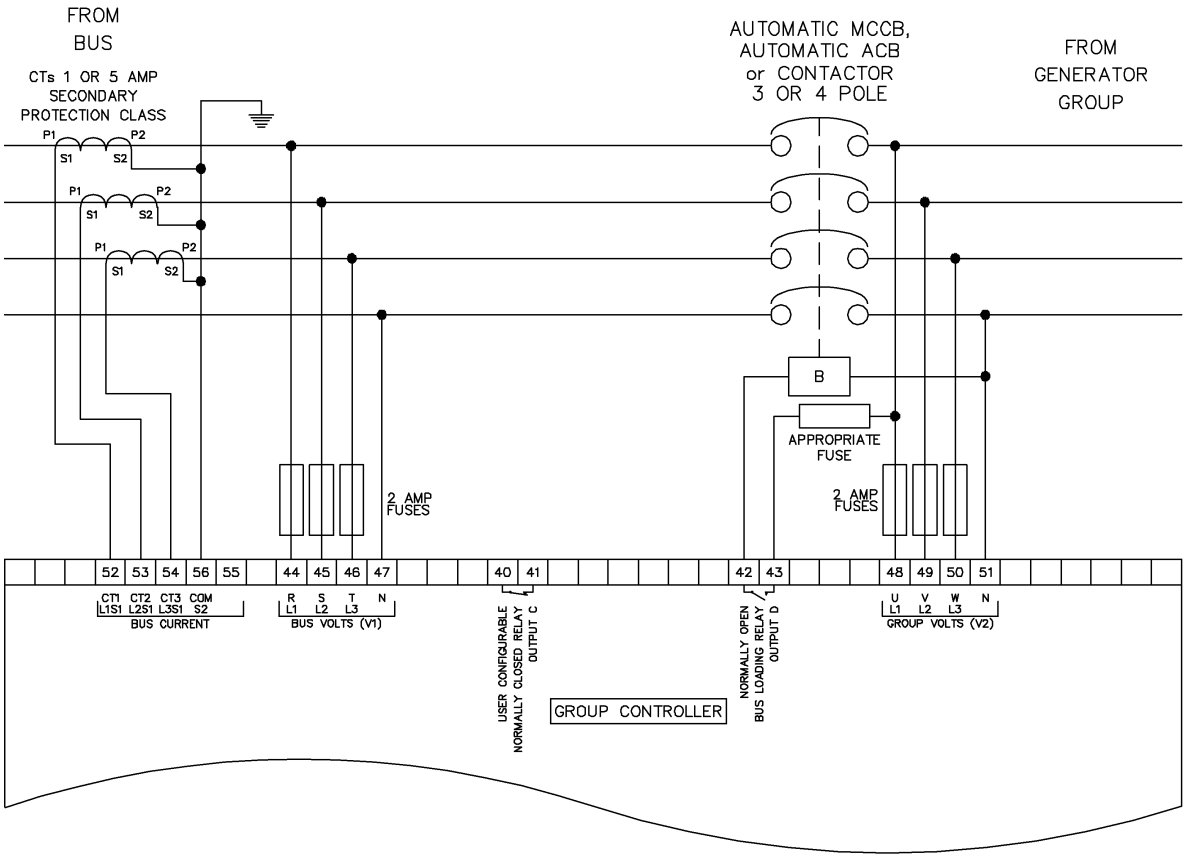
NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Software Manual.

CAUTION!: Switching the application to Group Controller forces the mains breaker to be closed without synchronising checks.

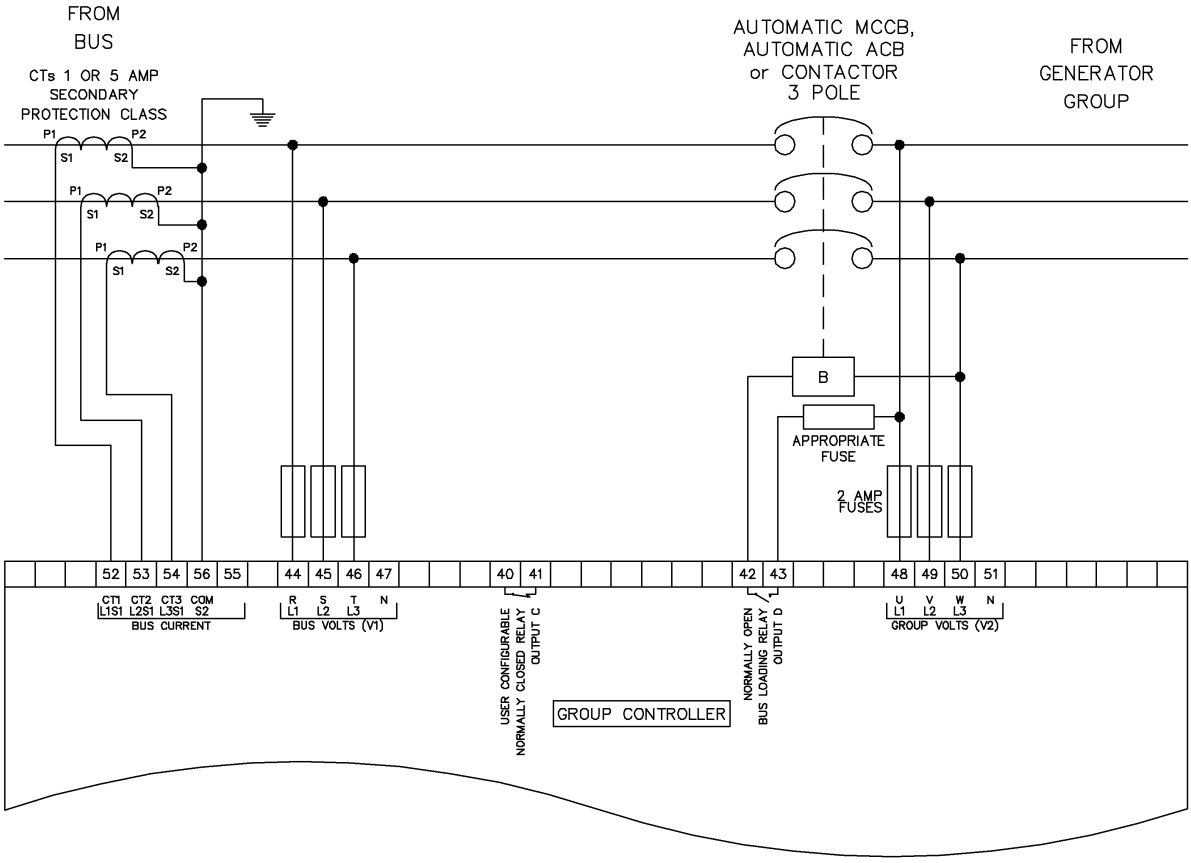
4.5.1 3 PHASE (L1,L2,L3 &N) 4 WIRE



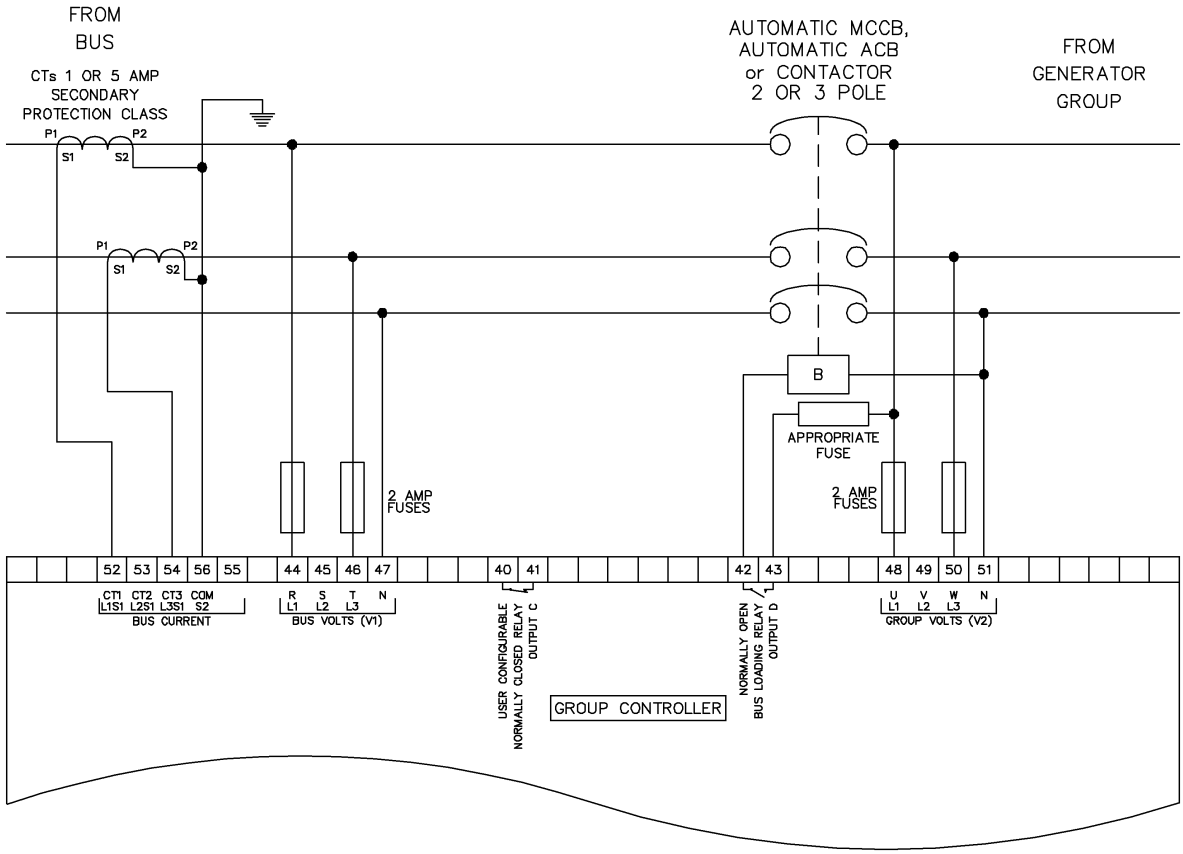
4.5.2 3 PHASE (L1,L2,L3 & N) 4 WIRE



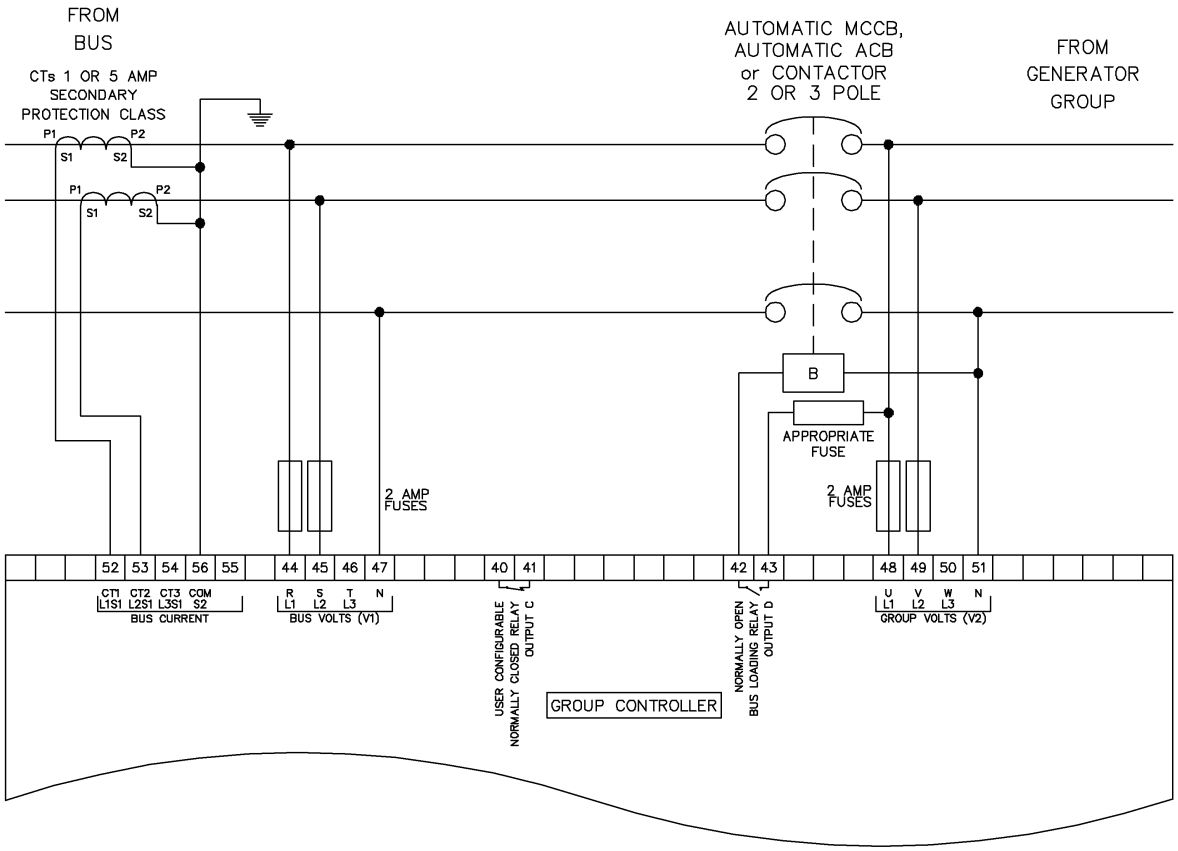
4.5.3 3 PHASE (L1,L2,L3) 3 WIRE



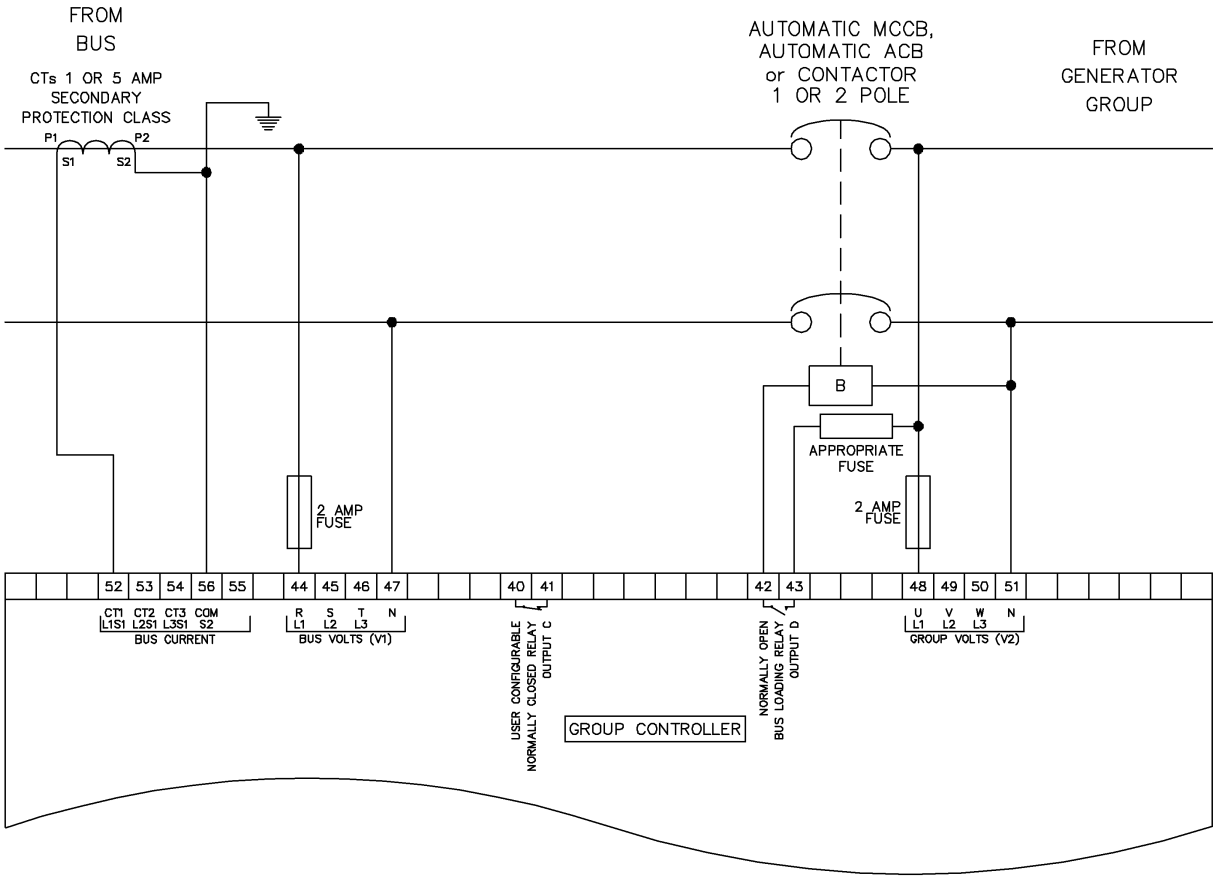
4.5.4 2 PHASE (L1,L3 & N) 3 WIRE



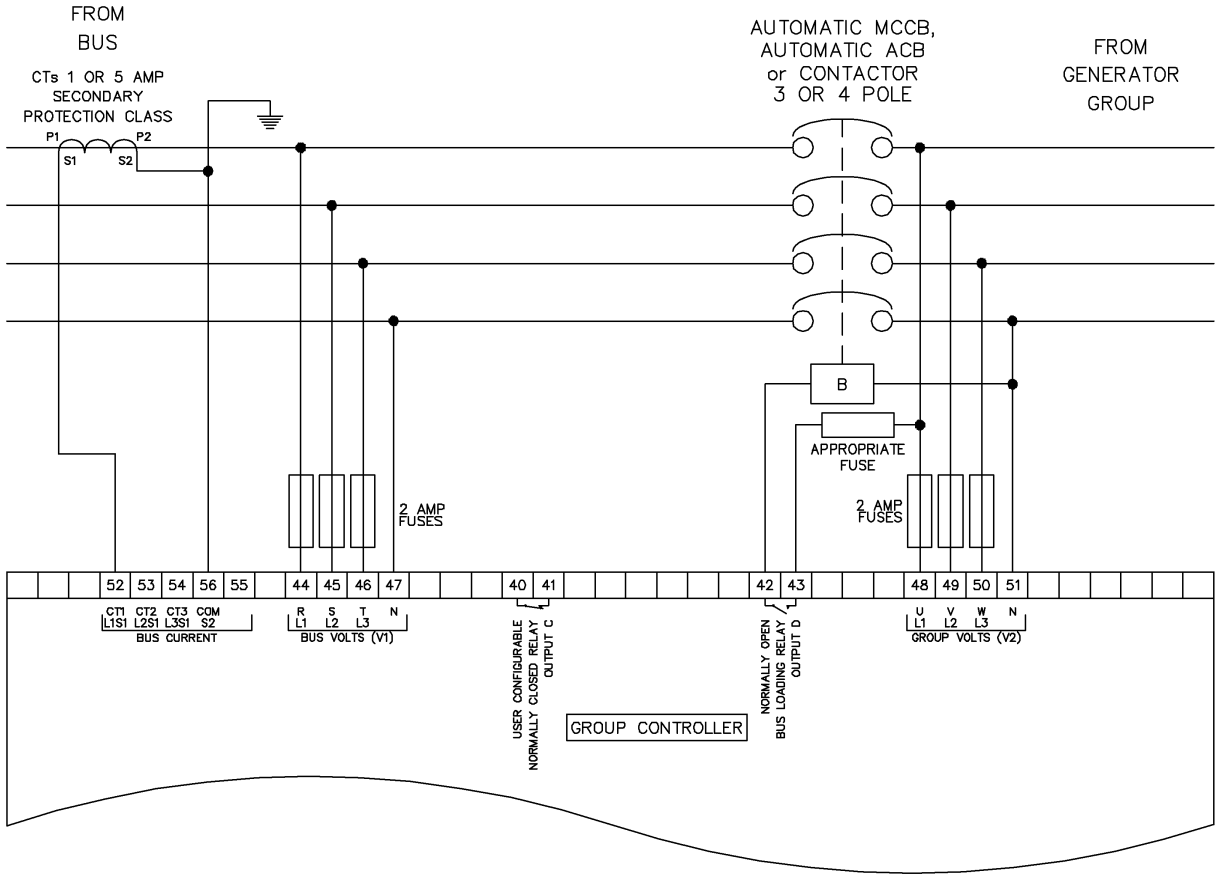
4.5.5 2 PHASE (L1,L2 & N) 3 WIRE



4.5.6 SINGLE PHASE (L1 & N) 2 WIRE



4.5.7 3 PHASE (L1,L2 ,L3 & N) 4 WIRE

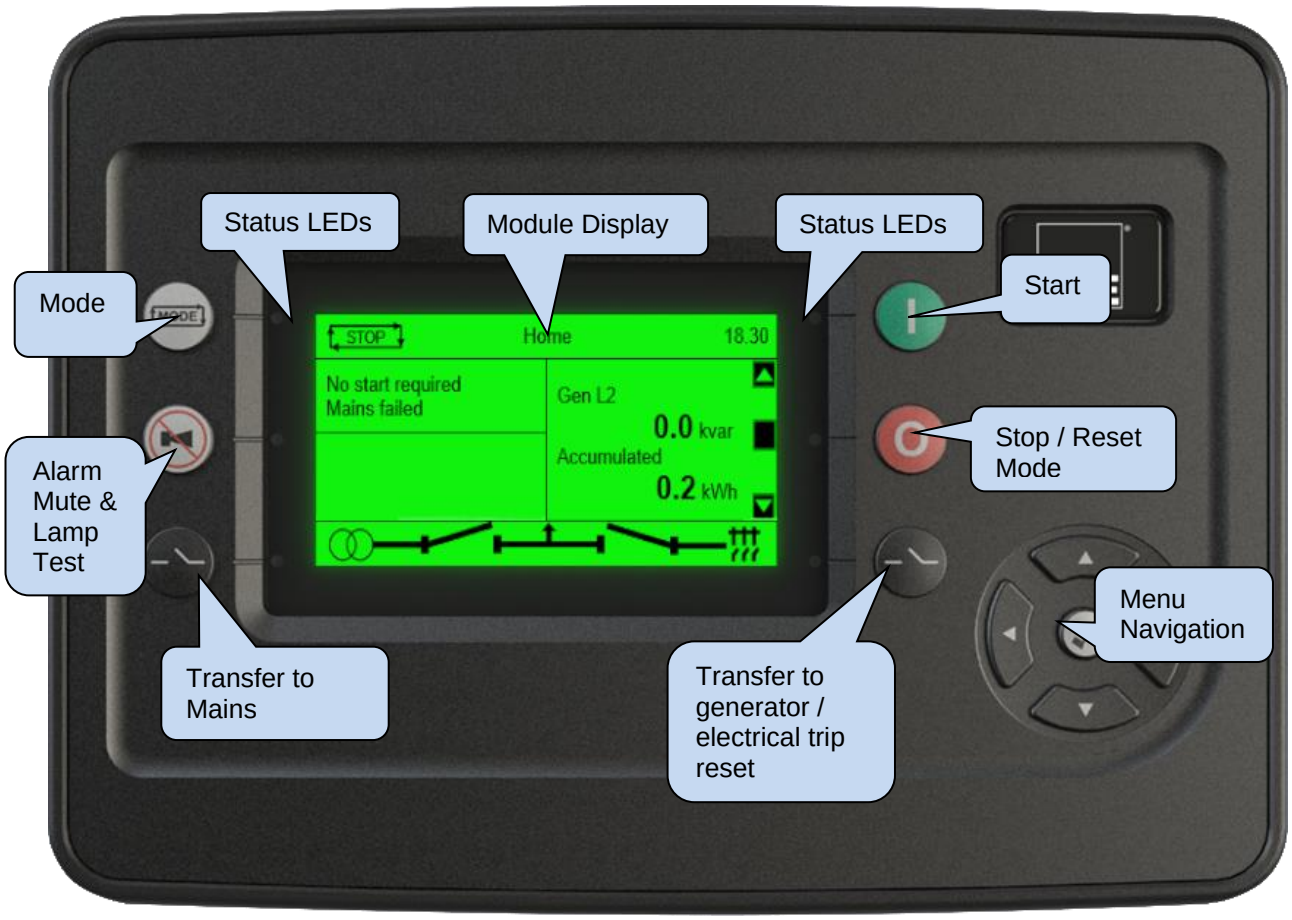


5 DESCRIPTION OF CONTROLS

CAUTION: The module may instruct breaker transitions events due to external influences. Therefore, it is possible for breaker transitions to happen 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.

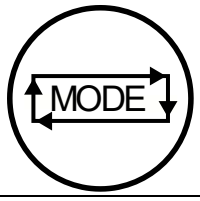
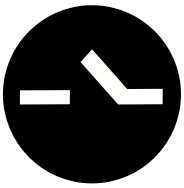
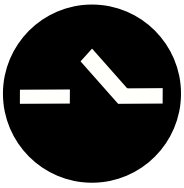
NOTE: The following descriptions detail the sequences followed by a module containing the standard 'factory configuration'. Always refer to your configuration source for the exact sequences and timers observed by any module in the field.

Control of the module is via push buttons mounted on the front of the module with ***Stop/Reset Mode*** , **Start/*Manual Mode*** , ***Test Mode/Auto Mode*** , ***Alarm Mute/Lamp Test*** , ***Transfer to Mains*** and ***Transfer to Generator/Bus*** functions. For normal operation, these are the only controls which need to be operated. Details of their operation are provided later in this document.



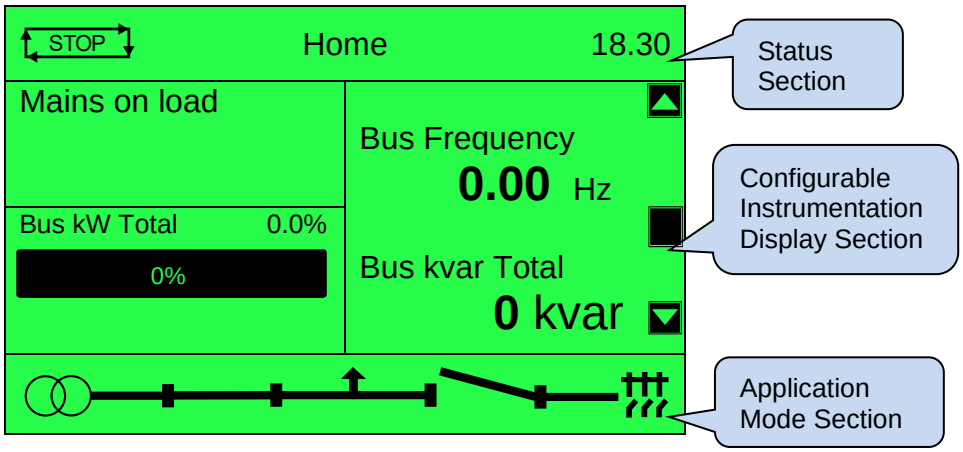
5.1 CONTROL PUSH BUTTONS

NOTE: For further details, see section 5.3.17.7 entitled *Operation*.

Icon	Description
	**Mode Button** In the G8660 the mode button is used to select ***Auto Mode, Test Mode,*** or ***Manual Mode***. Pressing the button cycles through ***Auto mode*** > (***Test mode***) > ***Manual mode*** > ***Auto mode*** >.
	**Alarm Mute / Lamp Test** This button silences the audible alarm in the controller, de-activates the *Audible Alarm* output (if configured) and illuminates all the LEDs on the module's facia as a lamp test function.
	**RHS Breaker Button** The breaker button provides the following function: Transfer to generator / bus
	**LHS Breaker Button** The breaker button provides the following function: Transfer to Mains
	**Start** This button is only active in the ***Stop/Reset Mode*** O, ***Manual Mode*** MANUAL And ***Test Mode***. Pressing the ***Start*** I button in ***Stop/Reset Mode*** O places the controller in manual mode Pressing the ***Start*** I button in ***Manual Mode*** MANUAL starts the generator and runs it off load in ***Manual Mode*** MANUAL
	**Stop / Reset Mode** This button places the module into its ***Stop/Reset Mode*** O. This clears any alarm conditions for which the triggering criteria has been removed.
	**Menu Navigation** Used for navigating the instrumentation, event log and configuration screens.

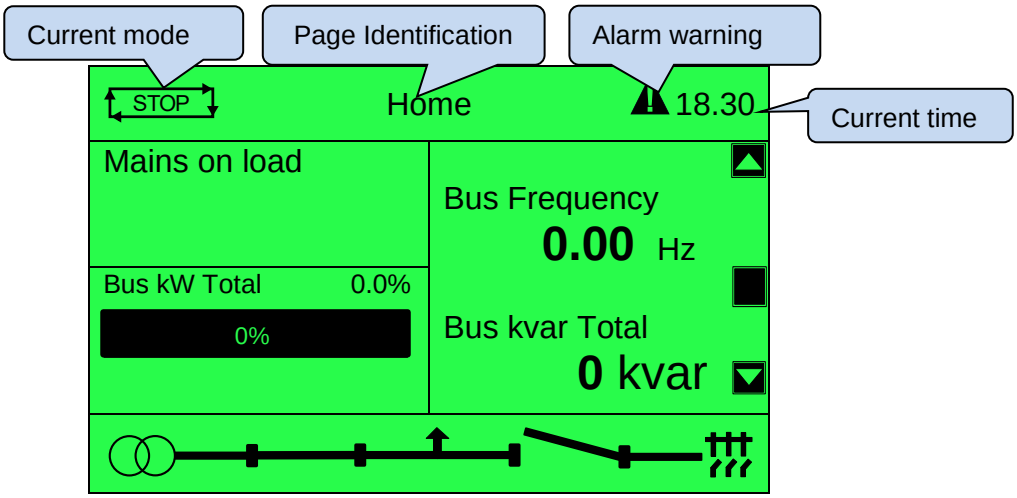
5.2 DISPLAY SCREEN

When an event or user interaction happens, this may be represented on the display graphically. There are three sections on the display namely the *Status*, *Configurable Instrumentation Display* and *Application Mode* section which help the user identify what operating state the module is in.



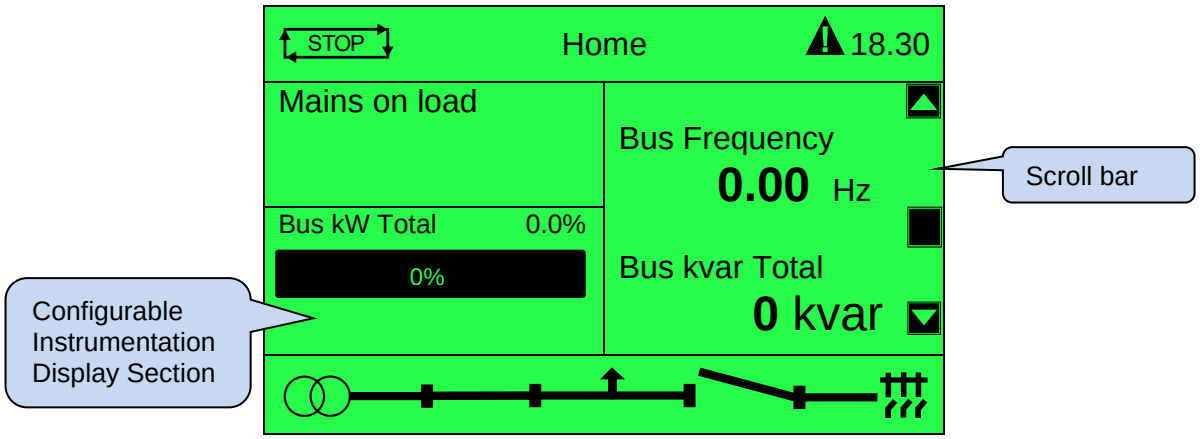
Status Section

The top of the display screen displays the status of the module.



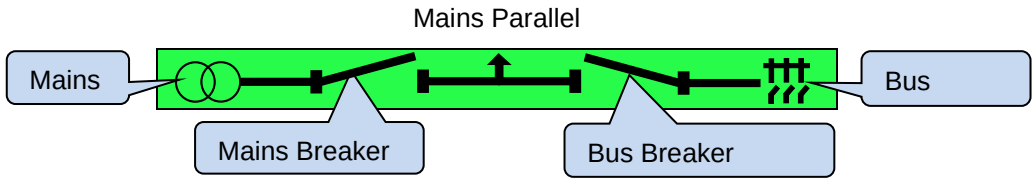
Configurable Instrumentation Display Section

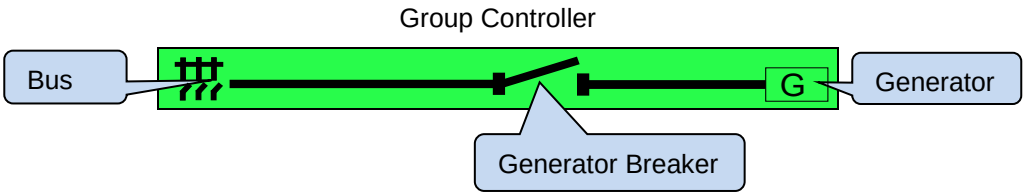
The middle section of the display shows any configured instrumentation.



Application Mode Section

The bottom of the display screen will show two different types of graphics depending on which application mode has been selected. These will represent either Mains Parallel or Group Controller as shown.





5.3 VIEWING THE INSTRUMENT PAGES

NOTE: Depending upon the module's configuration, some display screens may be disabled. For further details of module configuration, refer to DSE Publication: 057- 324 *DSEG8660 Configuration Suite PC Software Manual.*

Selecting Pages

To navigate to different pages or sub-pages the following sequence must be observed.

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

Home Page

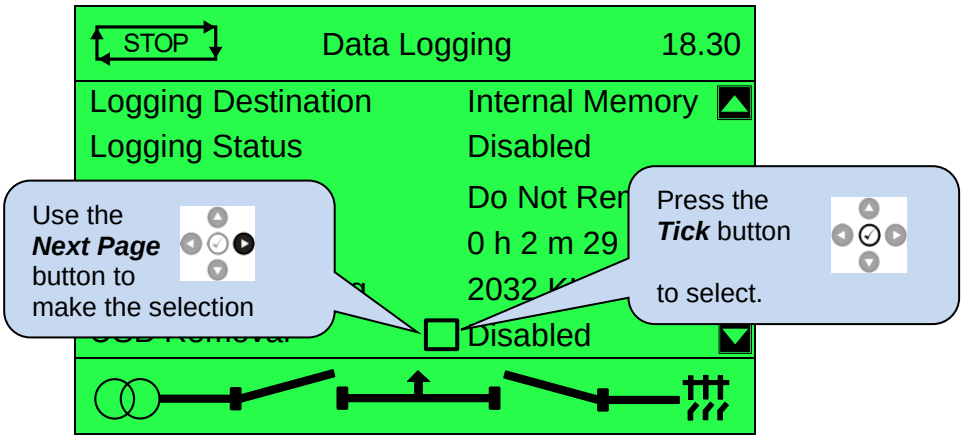
To navigate back to the home page the following sequence must be observed.

Repeated presses of the *Left Next Page* button will eventually reveal the *Back Button* and pressing the *Tick* button which will return to the Home page.

Enabling/Disabling Items

Selecting an item on a page can be achieved by repeatably pressing the ***Tick*** button to cycle through each item and then using the ***Next Page*** button to make the selection.

Example

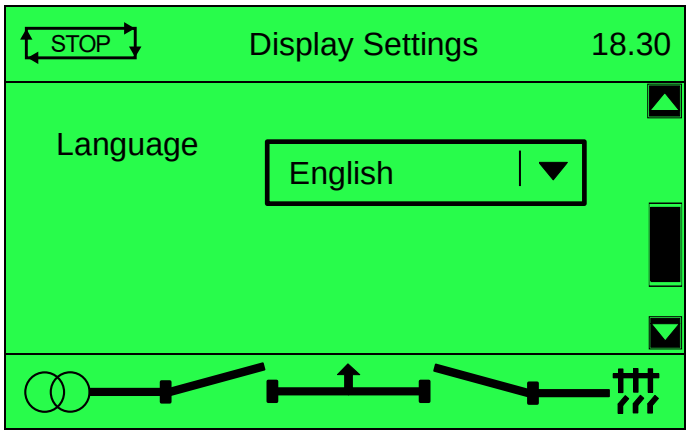


Using Drop-Down Menus

Press the ***Tick*** button and press the ***Next Page*** to open the drop-down menu.

Use the ***Scroll*** buttons to navigate.

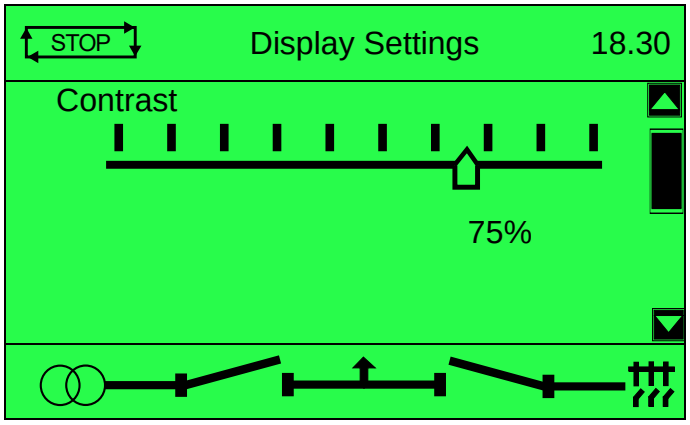
Press the ***Tick*** button to select and save the setting.



Using Slider Controls

Press the ***Tick*** button and using the Next or Previous Page buttons adjust the slider.

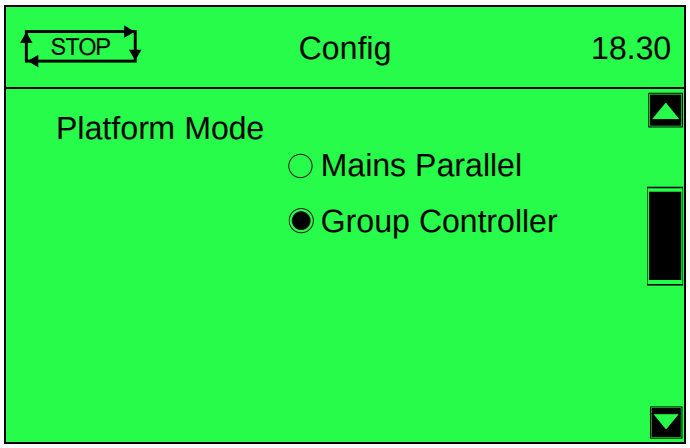
Once the selection has been made press the ***Tick*** button again to save the setting.



Making Selections

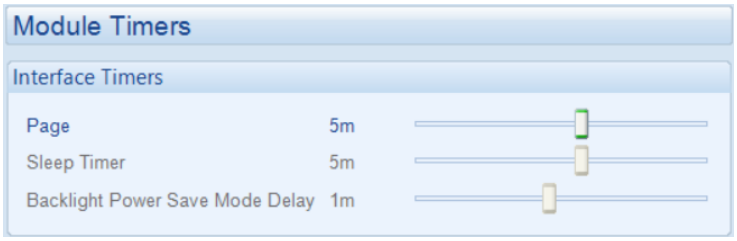
Press the ***Tick*** button to highlight and use the **Scroll** buttons to change the selection.

Once a selection has been made press the ***Tick*** button to confirm.



Configuring Timers

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



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

Alternatively, to scroll manually through all instruments on the currently selected page, press the **Scroll** buttons.

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

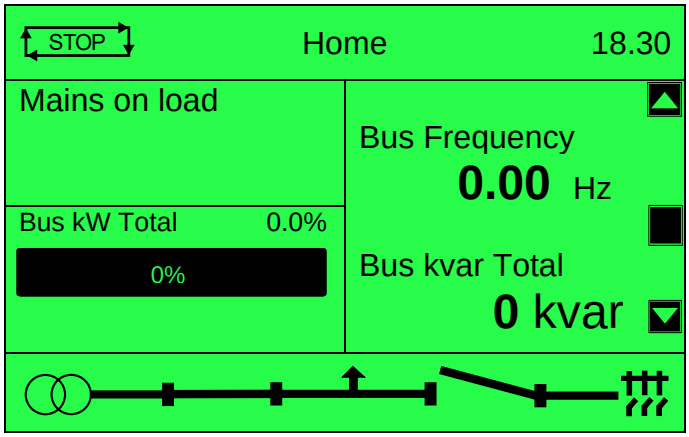
If an alarm becomes active while viewing the status page, the display shows the Alarms page to draw the operator's attention to the alarm condition. The complete order and contents of each information page are given in the following sections.

5.3.1 HOME

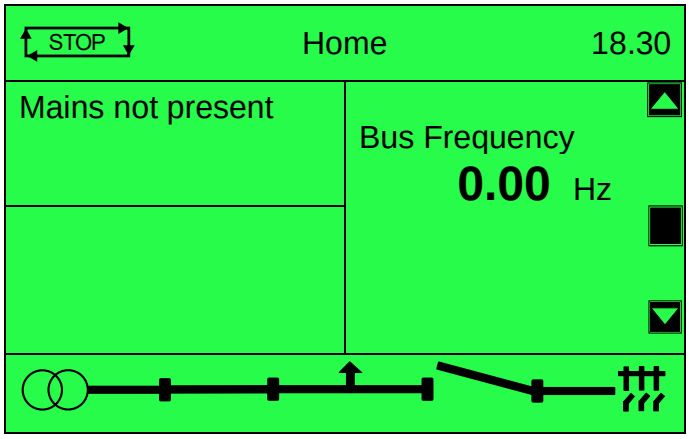
NOTE: Press the *Scroll* buttons on the *Home Page* to view other Configurable Status Screens if configured. For further details of module configuration, refer to DSE Publication: 057- 324 *DSEG8660 Configuration Suite PC Software Manual.*

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

This page changes with the action of the controller for example when the generator is running and available:



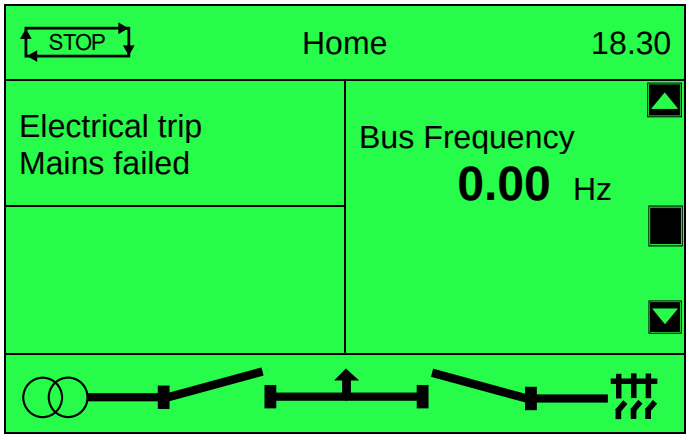
Factory setting of *Home* screen showing mains on load



and mains failure...

5.3.1.1 ELECTRICAL TRIP

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

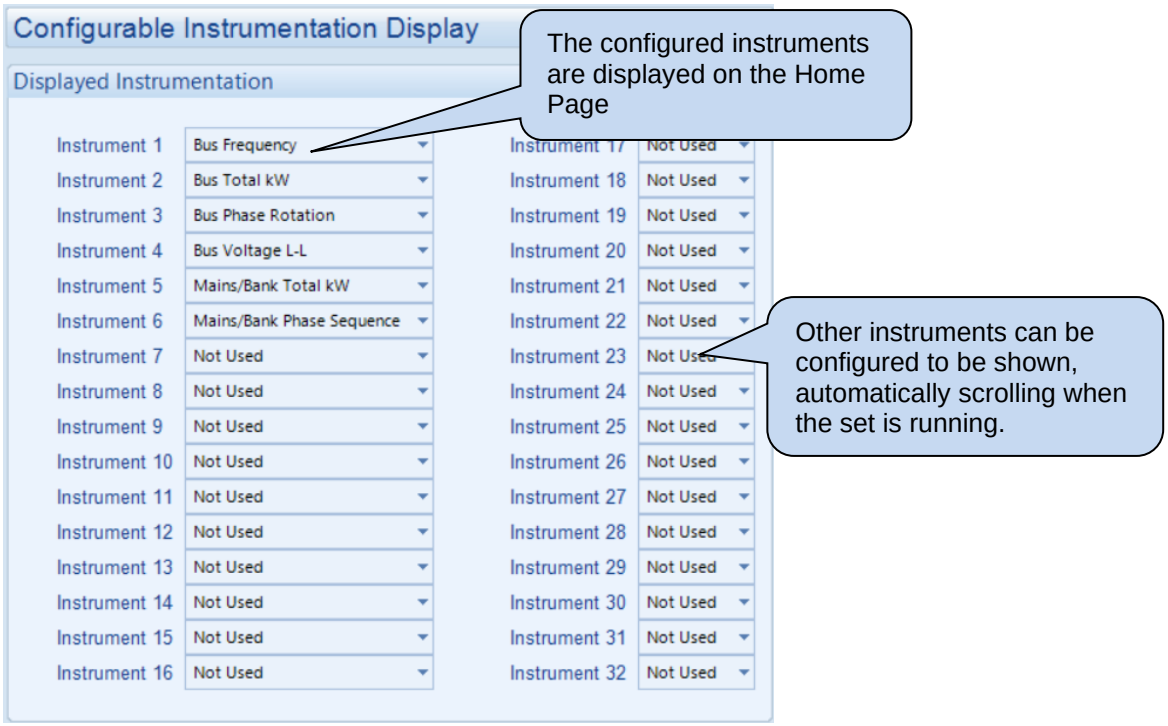


Electrical Trip Alarm on the module. Press the ***Next or Previous Page*** button to scroll to the alarms page to investigate. Press the ***Stop/Reset Mode*** button to clear the alarm, if the alarm does not clear the fault is still active.

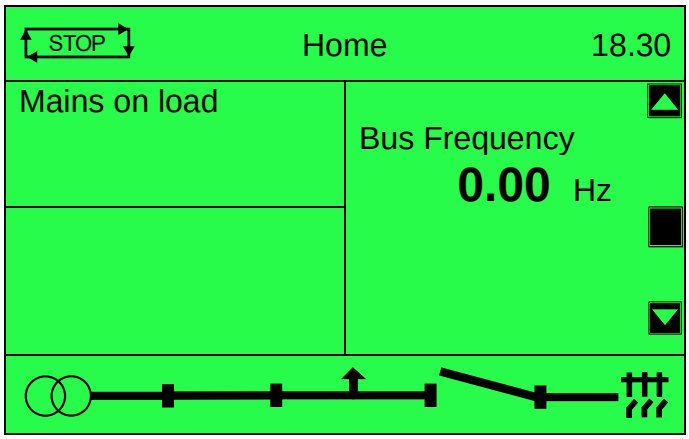
NOTE: For further details of alarms, see section 8 entitled *Protections* .

5.3.1.2 CONFIGURABLE INSTRUMENT DISPLAY

The contents of the Home Page may vary depending upon configuration by the generator manufacturer or supplier. Below is an example of the Home Page being changed to show bus instrumentation.



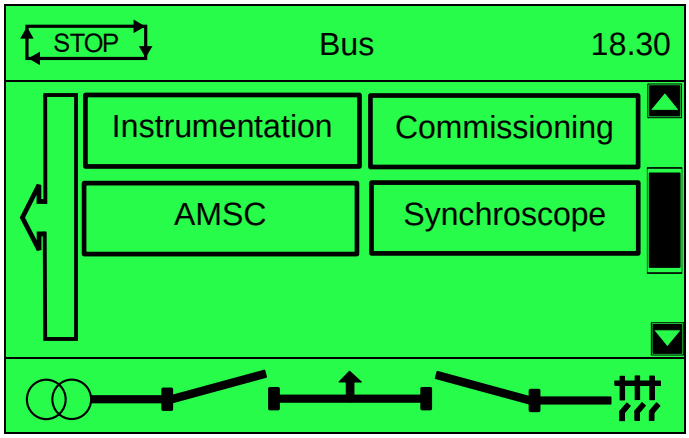
Home Screen Example:



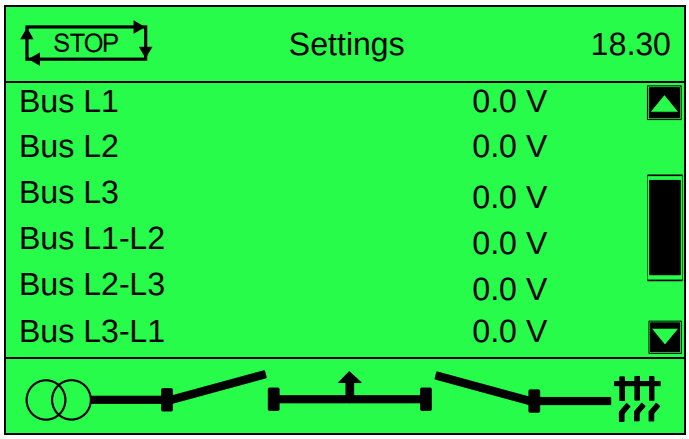
5.3.2 BUS

Contains electrical values of the Bus, measured, or derived from the module's voltage and current inputs.

Press the *Scroll*  buttons scroll through the ***Bus*** parameters.



5.3.2.1 INSTRUMENTATION



The parameters are:

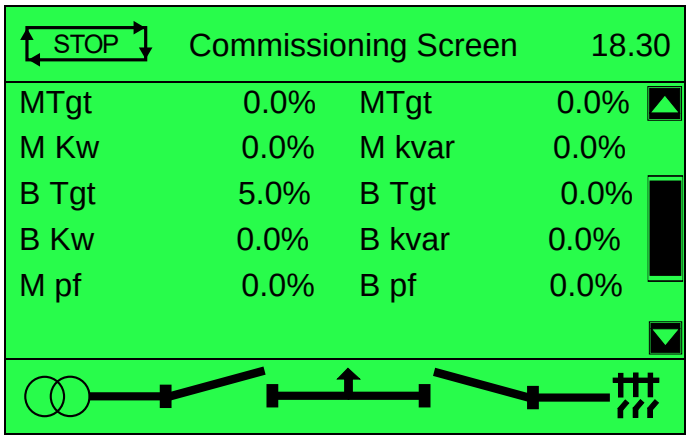
- Bus L1-N (V)
- Bus L3-N (V)
- Bus L2-L3 (V)
- Bus Frequency (Hz)
- Bus kW Total (%)
- Bus kvar Total (%)
- Zero Sequence (V)
- Negative Sequence (V)
- Bus L2-N (V)
- Bus L1-L2 (V)
- Bus L3-L1 (V)
- Bus kW Total (kW)
- Bus kvar Total (kvar)
- Bus Phase Rotation
- Positive Sequence (V)
- Asymmetry (V)

5.3.2.2 COMMISSIONING

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

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

Commissioning Screen



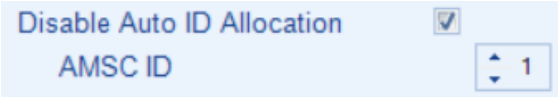
5.3.2.3 AMSC

NOTE: The A*MSC ID* is configured only using the DSE Configuration Suite Software. For further details, refer to DSE Publication: 057-324 *G8660 Configuration Suite PC Software Manual.*

NOTE: Depending on the module's configuration, the A*MSC ID* is set automatically or manually. For further details, refer to DSE Publication: 057-324 *G8660 Configuration Suite PC Software Manual.*

Every module connected on the AMSC link has a unique A*MSC ID up to a maximum of 64.*

The AMSC ID is set automatically or manually depending on the *Disable Auto ID Allocation* option in the DSE module's configuration.

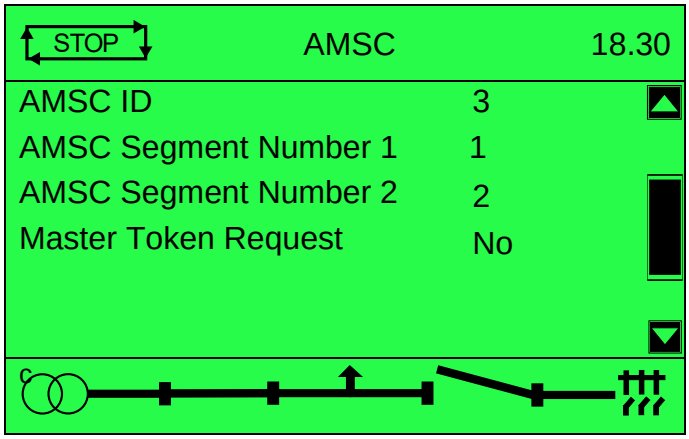


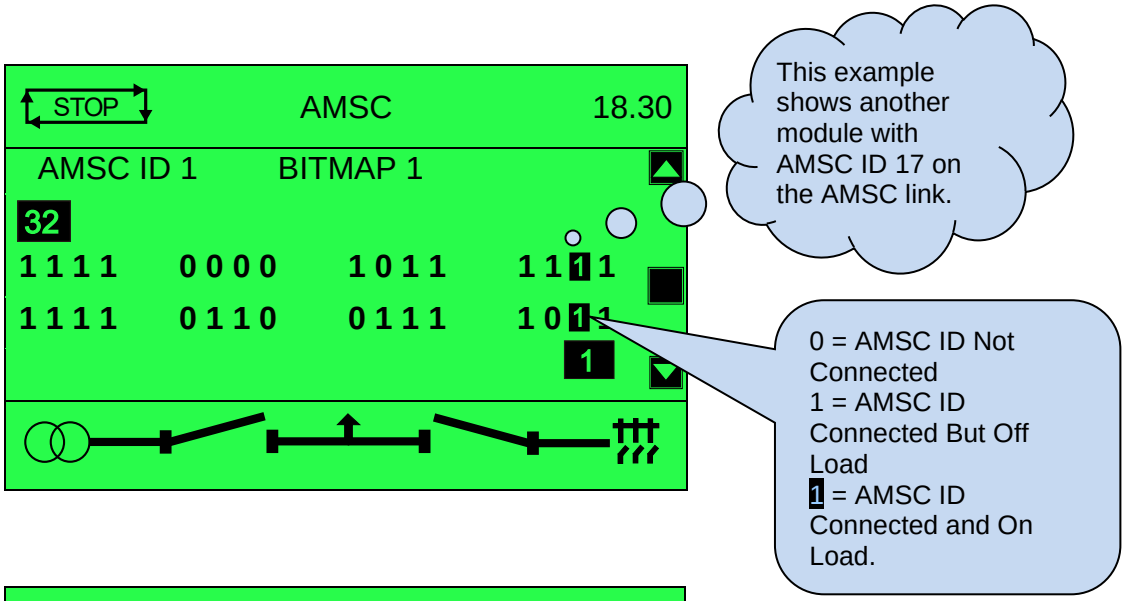
When the *Disable Auto ID Allocation* option is not enabled in the DSE module's configuration, the A*MSC ID* is automatically set when all the modules are powered up one at a time. If all the modules are powered up together, this may result in the A*MSC ID Error* alarm activating.

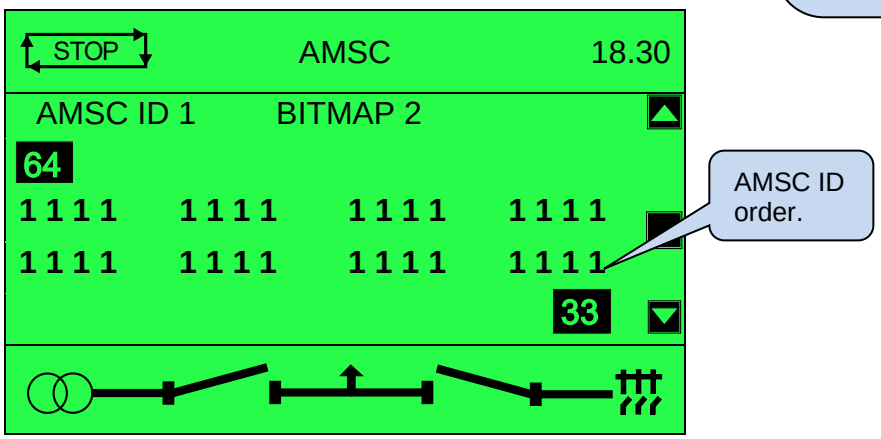
Manually setting the A*MSC ID* using the DSE Configuration Suite PC Software's SCADA allows this alarm to be reset and prevents this from occurring. It also has the benefit of being able to determine which module on the AMSC link has a communication issue.

When the *Disable Auto ID Allocation* option is enabled in the DSE module's configuration, the A*MSC ID* is assigned to the configured A*MSC ID* value when the module is powered up. Take note to enable this option in all the DSE modules if to be used, ensuring that each DSE module has a unique A*MSC ID*.

This display screen shows this module's A*MSC ID* and shows which A*MSC IDs* are currently communicating on the AMSC link by the number 1 indication. A*MSC IDs* that are currently not communicating or not connected are indicated by the number 0. If the A*MSC ID* for each module is known, this display screen can be used to determine which module is not communicating on the AMSC link. The shaded numbers indicate the generators on load.
The small numbers (32 & 1) on the top-left and bottom-right of the screen represent the A*MSC ID* orders.
Each section of the ac bus requires a unique identifier, a segment number. All modules connected to the same section or segment must have the same number.

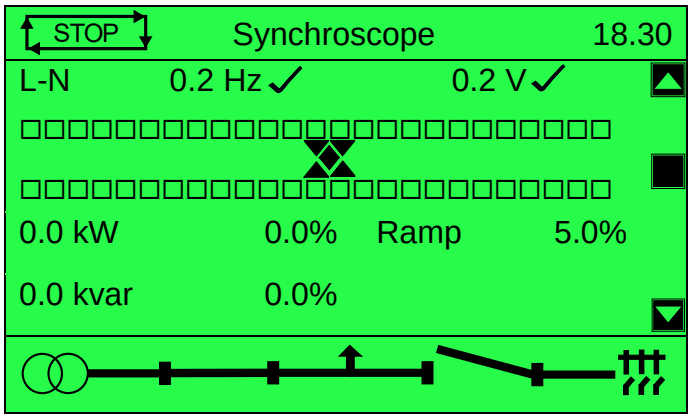






5.3.2.4 SYNCHROSCOPE

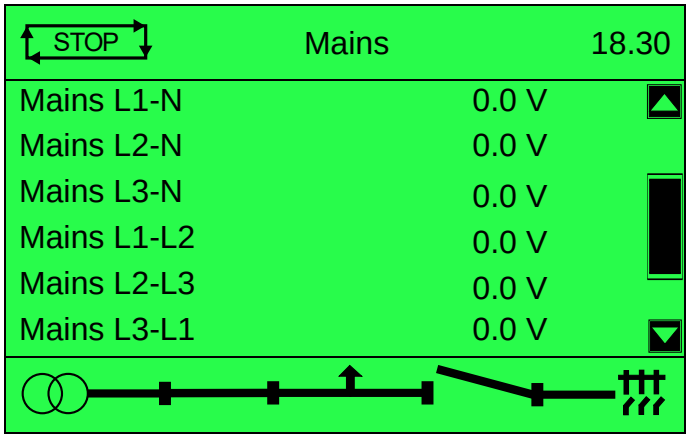
Once the mains and bus supplies are in sync, the module initiates a breaker close signal to the generator load switch closing the generator onto the mains.



5.3.3 MAINS (MAINS PARALLEL)

Contains electrical values of the Mains (utility), measured, or derived from the module's (that controls the mains (utility) switch) voltage and current inputs.

Press the ***Scroll***  buttons to scroll through the ***Mains*** parameters.



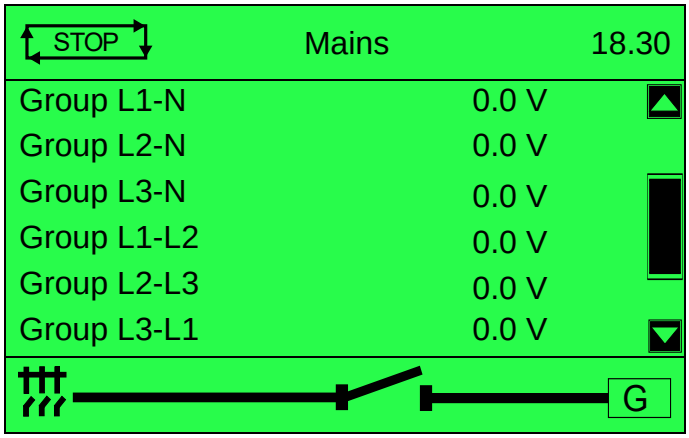
The following parameters are available:

- Mains L1-N (V)
- Mains L2-N (V)
- Mains L3-N (V)
- Mains L1-L2 (V)
- Mains L2-L3 (V)
- Mains L3-L1 (V)
- Mains Frequency (Hz)
- Mains L1 (A)
- Mains L2 (A)
- Mains L3 (A)
- Nominal Voltage
- AC System
- Active Config
- Zero Sequence
- Positive Sequence
- Negative Sequence
- Asymmetry
- Accumulated (kWh)
- Accumulated (kVAh)
- Accumulated (kVArh)
- Battery (V)
- Mains L1 (kvar)
- Mains L2 (kvar)
- Mains L3 (kvar)
- Mains kvar Total (kvar)
- Mains kvar Total (%)
- Mains PF L1
- Mains PF L2
- Mains PF L3
- Mains PF Avg
- Mains Phase Rotation
- Mains L1 (kW)
- Mains L2 (kW)
- Mains L3 (kW)
- Mains kW Total (kW)
- Mains kW Total (%)
- Mains L1 (kVA)
- Mains L2 (kVA)
- Mains L3 (kVA)
- Mains kVA Total (kW)
- Mains kVA Total (%)

5.3.4 GROUP

Contains electrical values of the Group (utility), measured, or derived from the module's (that controls the Group (utility) switch) voltage and current inputs.

Press the ***Scroll***  buttons to scroll through the ***Group*** parameters.



The following parameters are available:

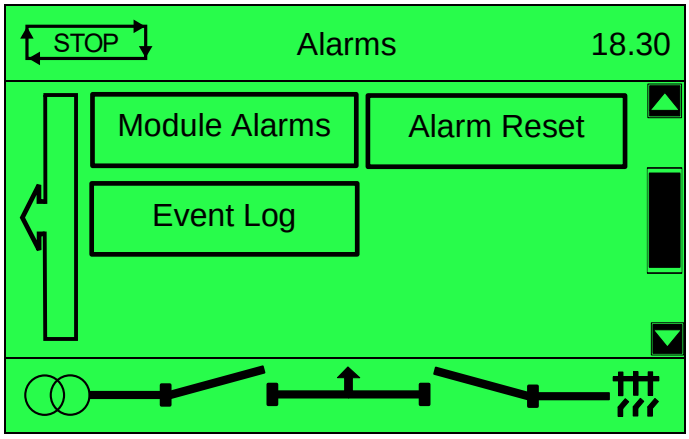
- Group L1-N (V)
- Group L2-N (V)
- Group L3-N (V)
- Group L1-L2 (V)
- Group L2-L3 (V)
- Group L3-L1 (V)
- Group Frequency (Hz)
- Group L1-N (A)
- Group L2-N (A)
- Group L3-N (A)
- Nominal Voltage
- AC System
- Active Config
- Accumulated (kWh)
- Accumulated (kVAh)
- Accumulated (kVArh)
- Battery (V)
- Group L1-N (kW)
- Group L2-N (kW)
- Group L3-N (kW)
- Group kW Total (kW)
- Group kW Total (%)
- Group L1-N (kVA)
- Group L2-N (kVA)
- Group L3-N (kVA)
- Group kVA Total (kW)
- Group kVA Total (%)
- Group L1-N (kvar)
- Group L2-N (kvar)
- Group L3-N (kvar)
- Group kvar Total (kvar)
- Group kvar Total (%)
- Group PF L1
- Group PF L2
- Group PF L3
- Group PF Avg
- Phase Rotation
- Nominal Frequency (Hz)

5.3.5 ALARMS

When an alarm is active, the *Internal Audible Alarm* sounds and the alarm LED next to the Stop button, flashes for a warning and is steady on for a trip. Common Alarm LED, if configured, illuminates.

The audible alarm is silenced by pressing the ***Alarm Mute / Lamp Test*** button.

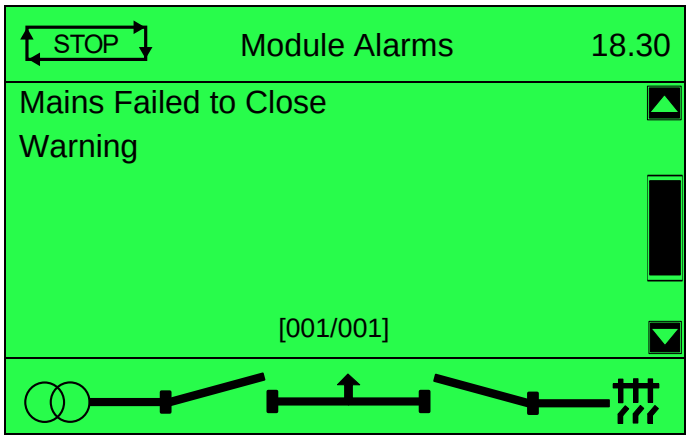
The LCD display jumps from the 'Information page' to display the Alarms Page



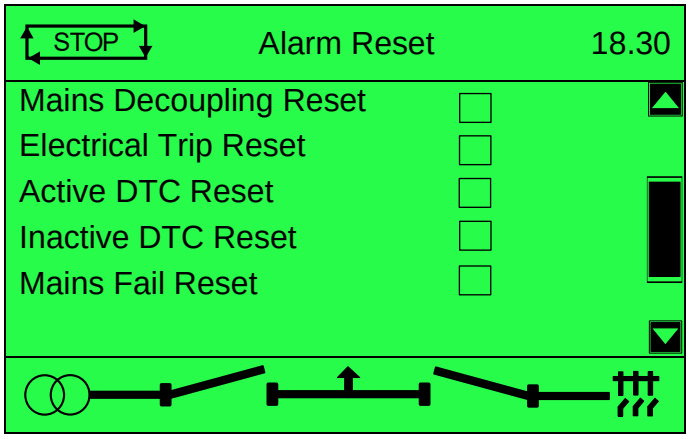
5.3.5.1 MODULE ALARMS

Any alarms associated with the module will be displayed in the *Module Alarms* page.

Press the ***Scroll*** buttons to scroll to other available alarms.



5.3.5.2 ALARM RESET



The parameters are:

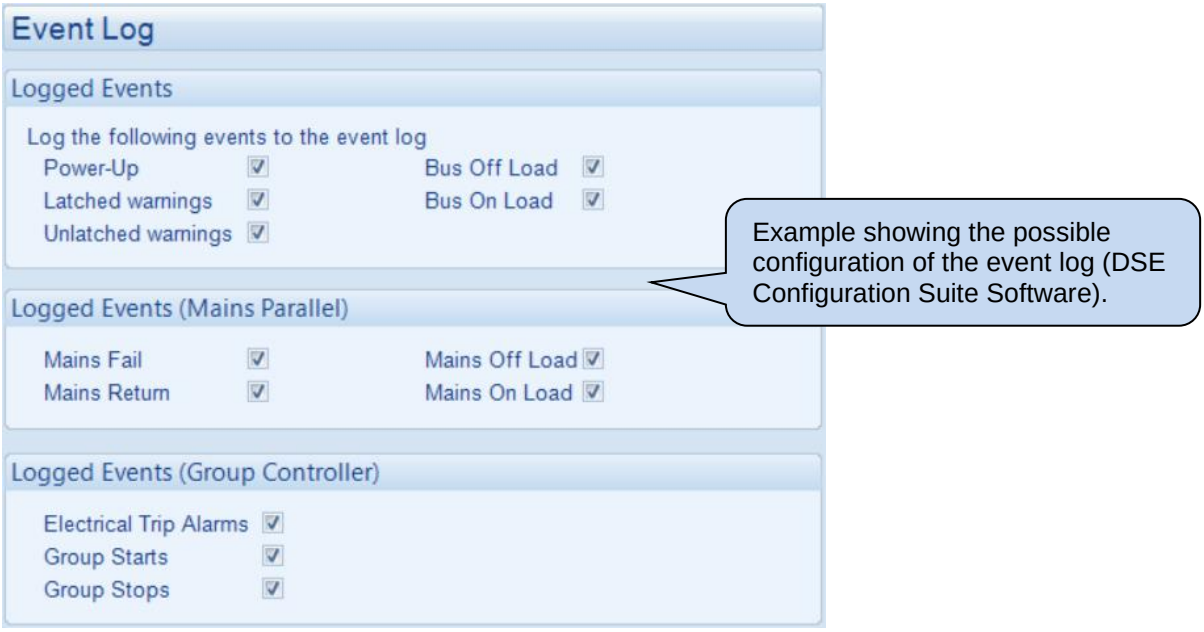
- Mains Decoupling Reset
- Electrical Trip Reset
- Active DTC Reset
- Inactive DTC Reset
- Mains Fail Reset

5.3.5.3 EVENT LOG

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

The module maintains a log of past alarms and/or selected status changes.

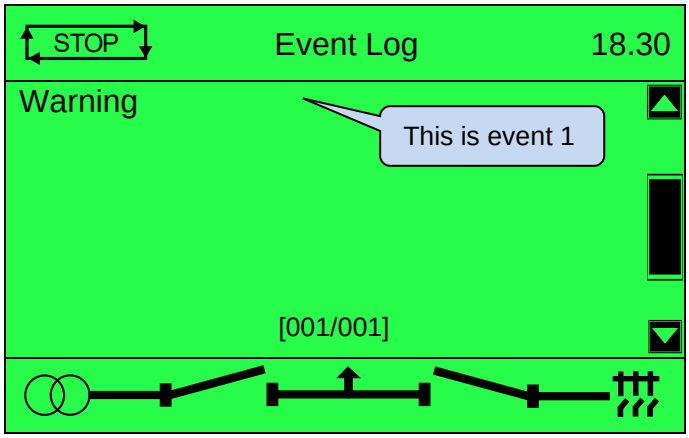
Under default factory settings, the event log is configured to include all possible options; however, this is configurable by the system designer using the DSE Configuration Suite software.



When the event log is full, any subsequent event overwrites the oldest entry. Hence, the event log always contains the most recent events. The module logs the event type, along with the date and time (or engine running hours if configured to do so).

The *Event Log* page is situated in the *Alarms* section.

To view the event log, repeatedly press the ***Next or Previous Page*** buttons until the LCD screen displays the *Event Log* page.



Press the ***Scroll Down***  button to view the next most recent event.

Continuing to press the ***Scroll Down***  button cycles through the past events after which, the display shows the most recent alarm, and the cycle begins again.

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

5.3.6 COMMUNICATIONS

5.3.6.1 RS485 SERIAL PORTS 1&2

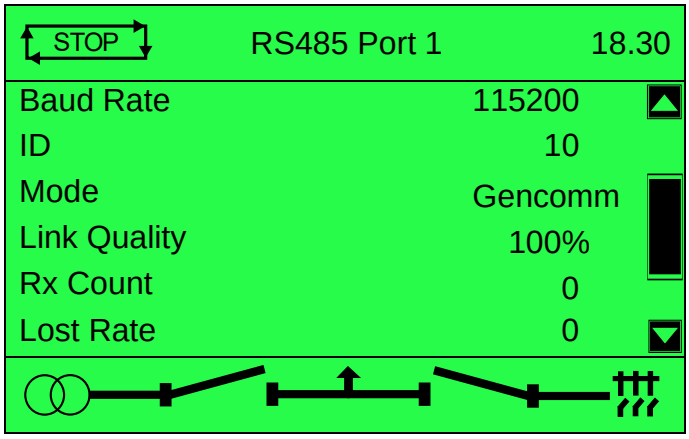
This section is included to give information about the currently selected serial port

The items displayed on this page change depending upon configuration of the module. Refer to the system supplier for further details.

NOTE: Factory Default settings are for the RS485 port to operate at 115200 baud, MODBUS slave address 10.

Connected to an R485 MODBUS Master

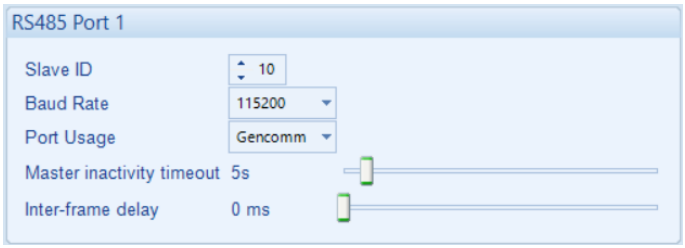
The modules operate as a MODBUS RTU slave device.
In a MODBUS system, there is only one Master, typically a PLC, HMI system or PC SCADA system.



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 115200 baud, MODBUS slave address 10.

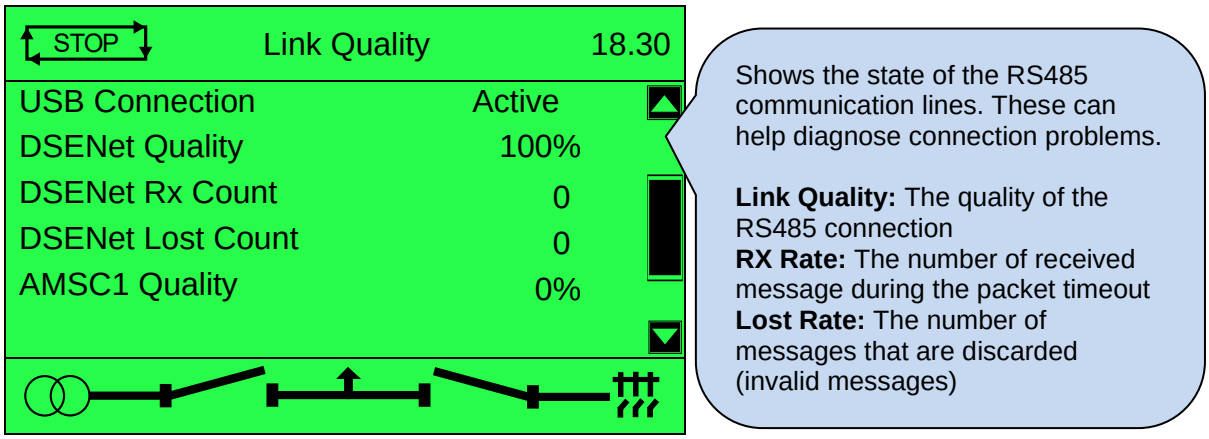
'Master inactivity timeout' should be set to at least twice the value of the system scan time. For example, if a MODBUS master PLC requests data from the module once per second, the timeout should be set to at least 2 seconds.



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

5.3.6.2 LINK QUALITY RS485 MODBUS RTU DIAGNOSTICS

RS485 MODBUS RTU diagnostic screens are included; press the ***Scroll Down*** button when viewing the *RS485 Serial Port* instruments to cycle to the available screens. If experiencing RS485 MODBUS RTU communication problems, this information aids troubleshooting.



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)

`Warning=(ReadRegister(10,0306,1) >> 11) & 1)`: reads (hex) 0306 and looks at bit 12 (Warning alarm present)

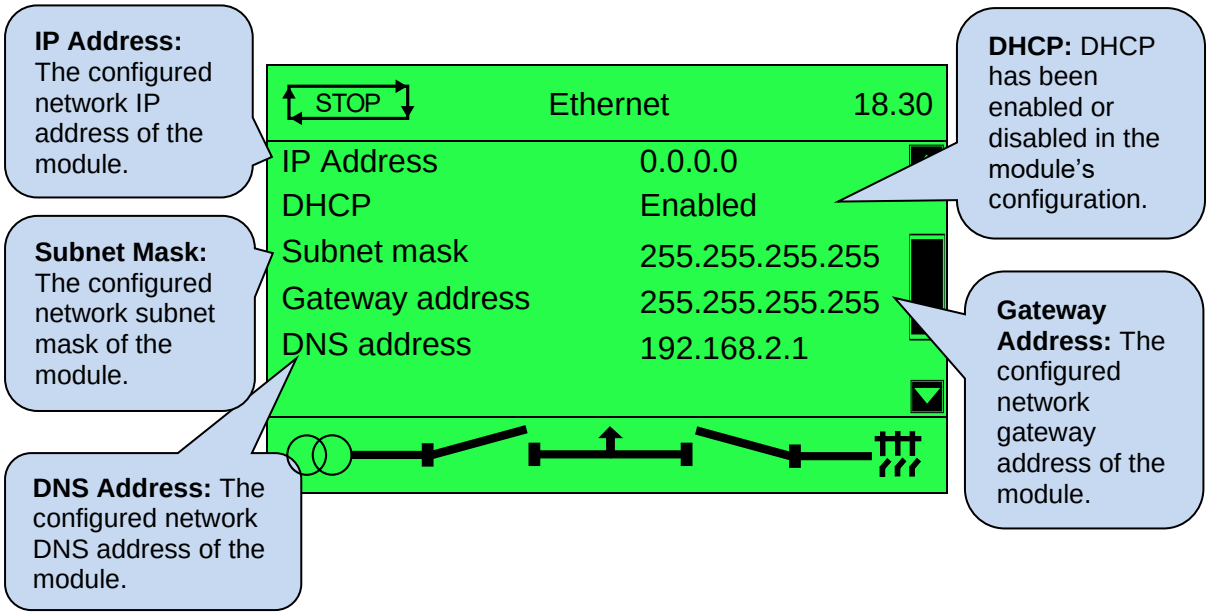
`ElectricalTrip=(ReadRegister(10,0306,1) >> 10) & 1)`: reads (hex) 0306 and looks at bit 11 (Electrical Trip alarm present)

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

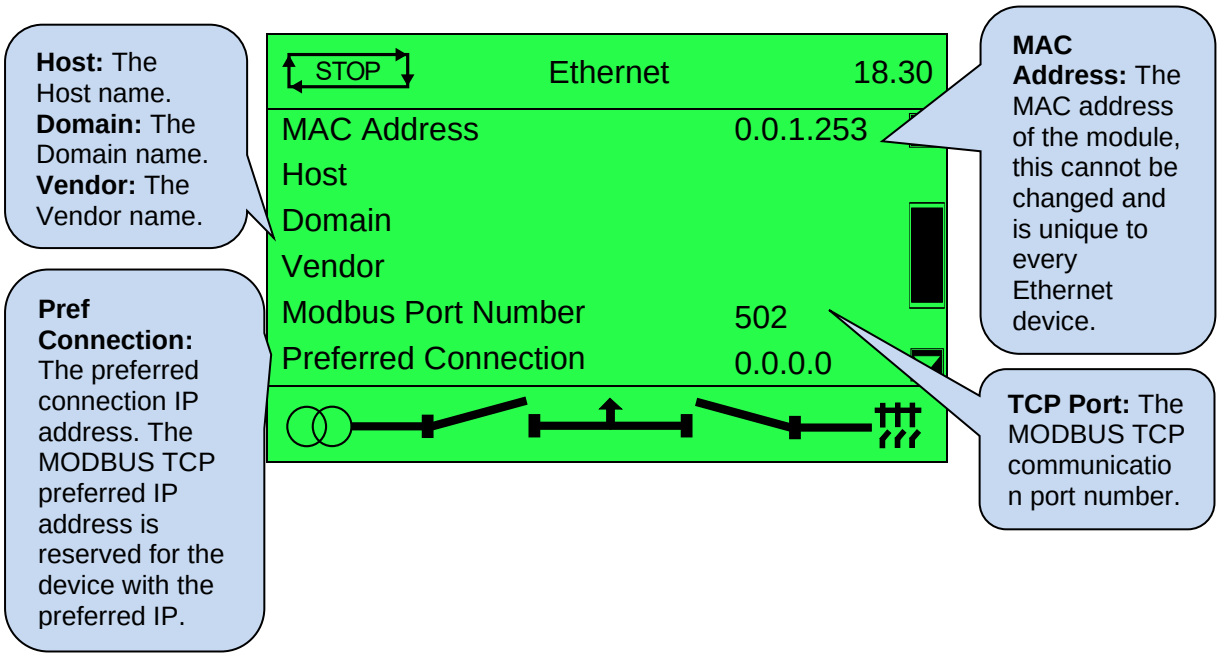
5.3.6.3 ETHERNET

Whilst in the *Communication* section, press the ***Scroll Down*** button  to access more information about the network settings.

Network settings are configured using DSE Configuration Suite PC Software. The module must be rebooted for the changes to take effect.



Press the ***Scroll Down***  button to access more information about the network settings.



5.3.7 SCHEDULER

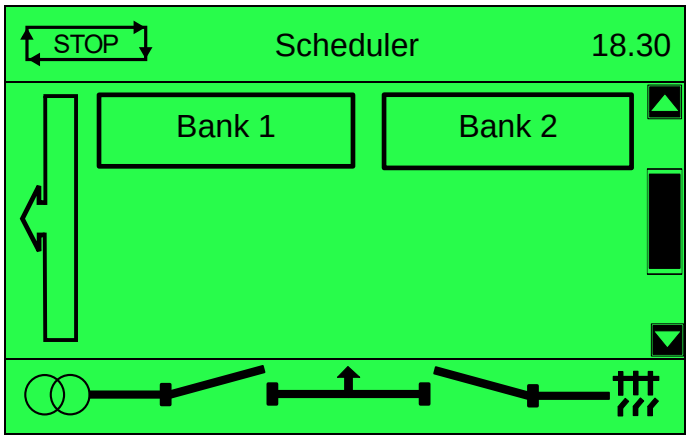
NOTE: For further details on the operation of the inbuilt scheduler feature, refer to section entitled *Scheduler* in the *Operation* section of this document.

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

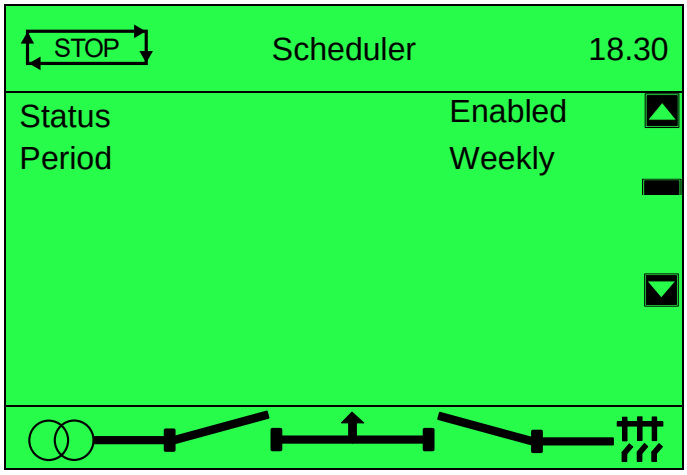
The controller contains an inbuilt exercise run scheduler, capable of automatically starting and stopping the set or inhibiting the set from starting. Up to 16 scheduled (in two banks of 8) start/stop/inhibiting start sequences can be configured to repeat on a 7-day or 28-day cycle.

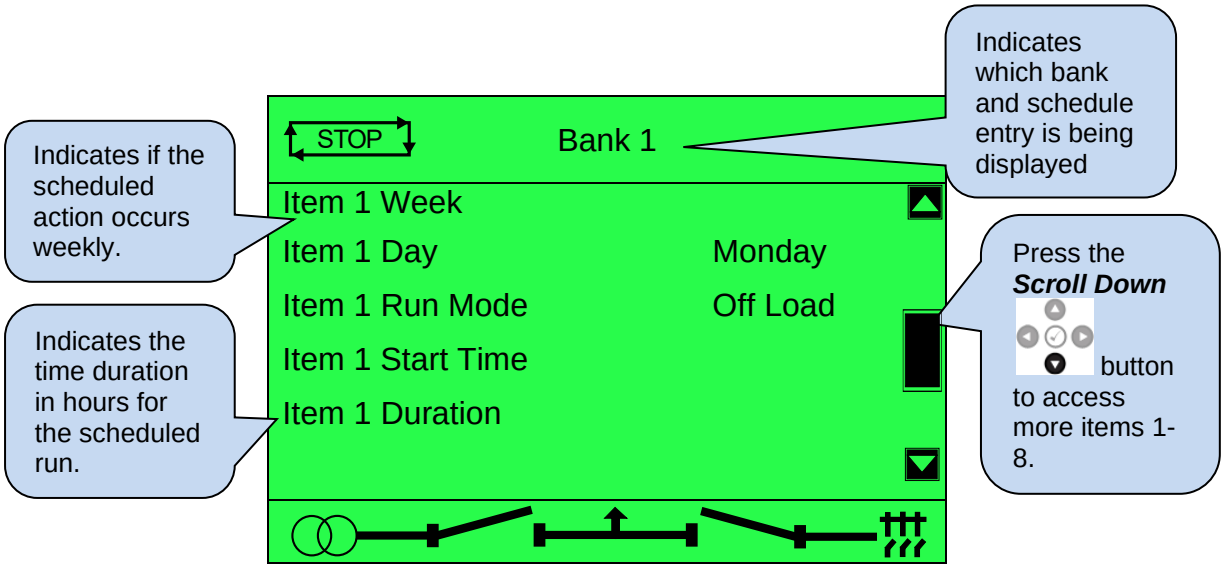
Scheduled runs may be on load or off load depending upon module configuration.

This section of the module's display shows how exactly the scheduler (if enabled) is configured. Under default factory settings the Schedule is not viewable. It is enabled by the system designer using the DSE Configuration Suite software.



Press the ***Tick***  button and then using the ***Next Page***  button to enable or disable the Schedule..

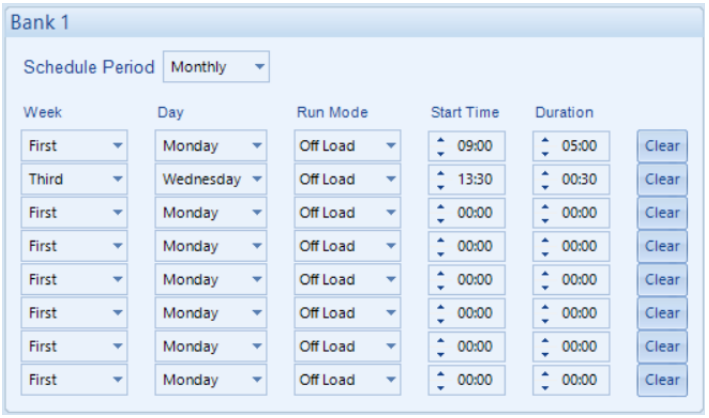




Example

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

In this example the start request is made on Monday in the First Week of each month at 09:00 am and lasts for 5 hours, then Wednesday in the Third Week of each month at 13:30 pm and lasts for 30 minutes.



5.3.8 STOP/RESET MODE

- Scheduled runs do not occur when the module is in ***Stop/Reset Mode*** .

5.3.9 MANUAL MODE

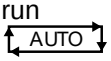
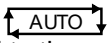
- Scheduled runs do not occur when the module is in ***Manual Mode*** MANUAL waiting for a start request.

5.3.10 TEST MODE

- Scheduled runs do not occur when the module is in ***Test Mode*** TEST waiting for a start request.

5.3.11 AUTO MODE

- Scheduled runs operate only if the module is in ***Auto Mode*** AUTO with no *Electrical Trip* alarm active.

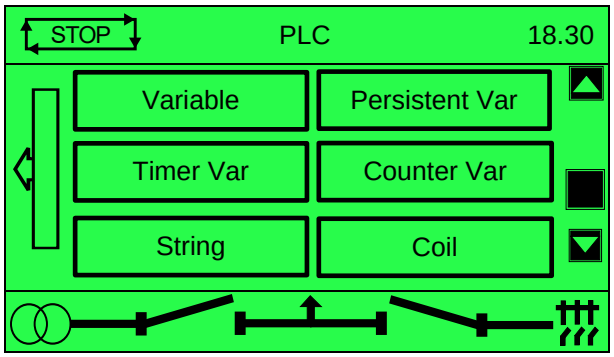
- If the module is in ***Stop/Reset Mode***  or ***Manual Mode***  when a scheduled run begins, the start request is not given. However, if the module is moved into ***Auto Mode***  during a scheduled run, the start request is given.
- If the generator bus is running *Off Load* in ***Auto Mode***  and a scheduled run configured to *Parallel* or *Island* begins, the generator bus is forced to the appropriate state for the duration of the Schedule.
- Depending upon configuration by the system designer, an external input can be used to inhibit a scheduled run.

5.3.12 PLC INSTRUMENTS

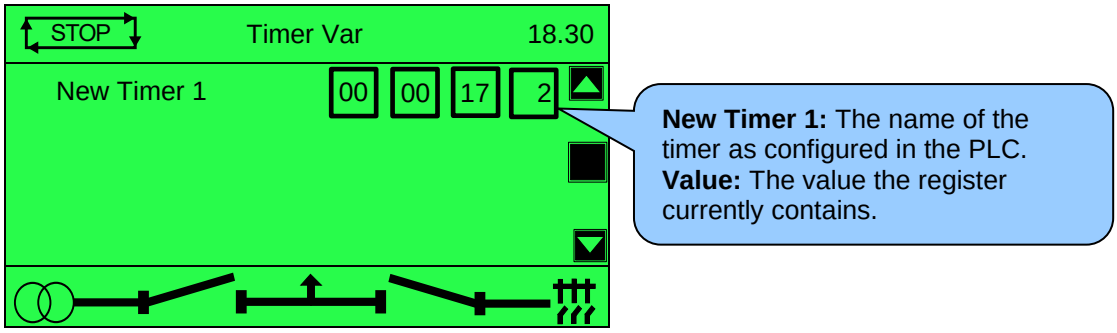
NOTE: Depending upon the module's configuration, some display screens may be disabled. The PLC Instrument screen is visible once watched variables have been written to the module using the PLC Editor. For further details of module configuration, refer to DSE Publication: *057-314 Advanced PLC Programming Guide for DSE Modules*.

Contains values from various elements from the module's internal PLC editor to enable the user to view them from the module's facia.

Press the ***Instrumentation Scroll*** buttons scroll through the ***PLC Instruments*** parameters if configured.



Timer Var Example:

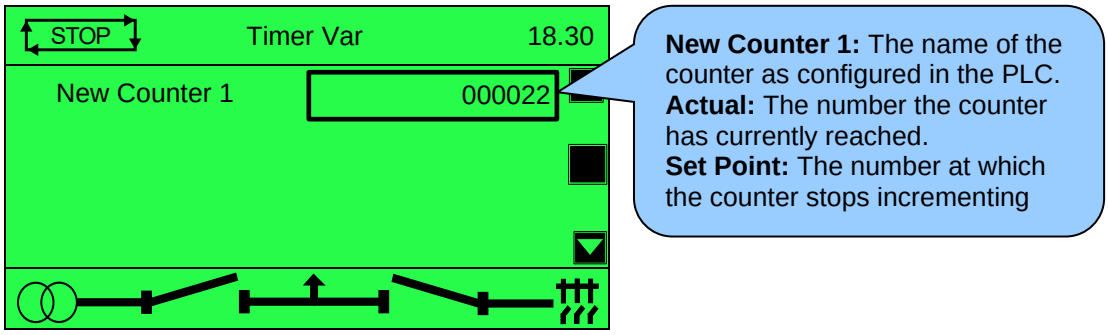


Press and hold the ***Tick*** button to cycle through to the setting to be adjusted.

Use the ***Instrumentation Scroll*** buttons to adjust the value.

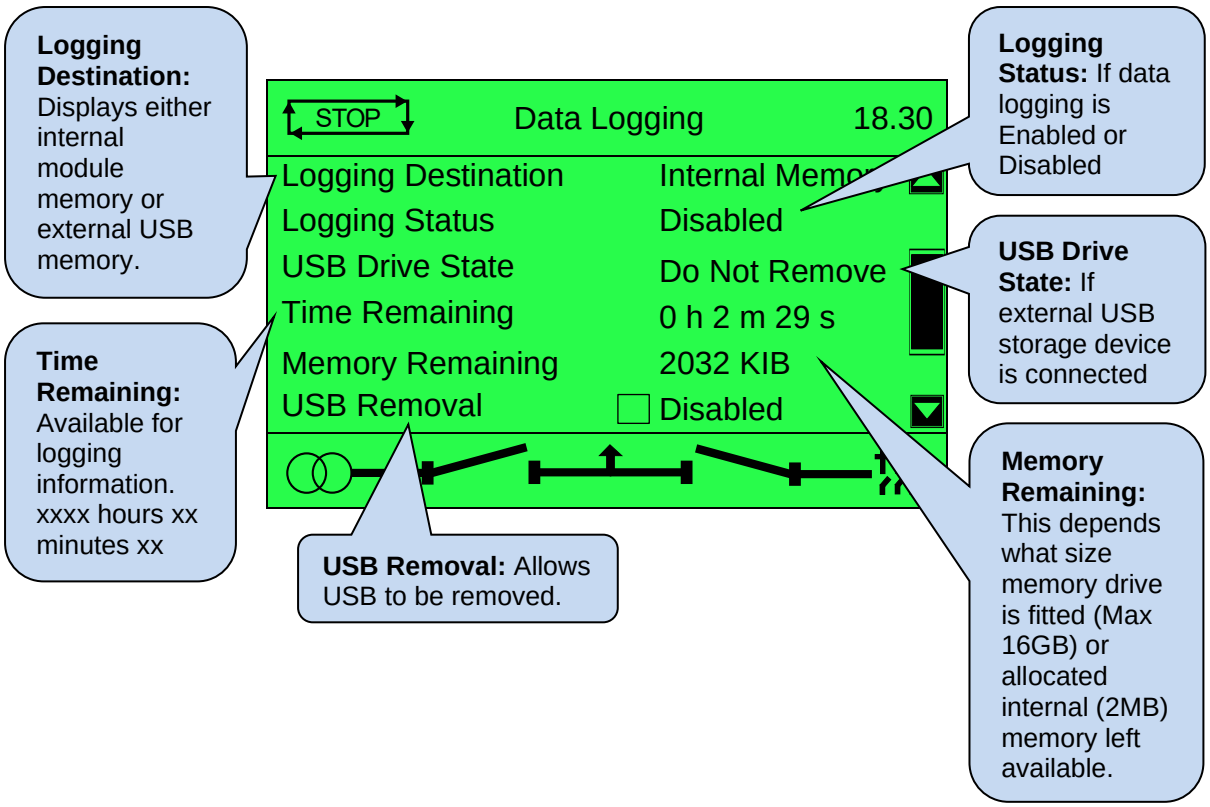
To exit the screen press the ***Tick*** button repeatedly until no settings are selected and then press the ***Previous Page*** button to exit.

Counter Var Example



5.3.13 DATA LOGGING

Whilst on the *Data Logging* page use the ***Scroll*** buttons to access more information about the Data logging settings.



USB Eject Procedure

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

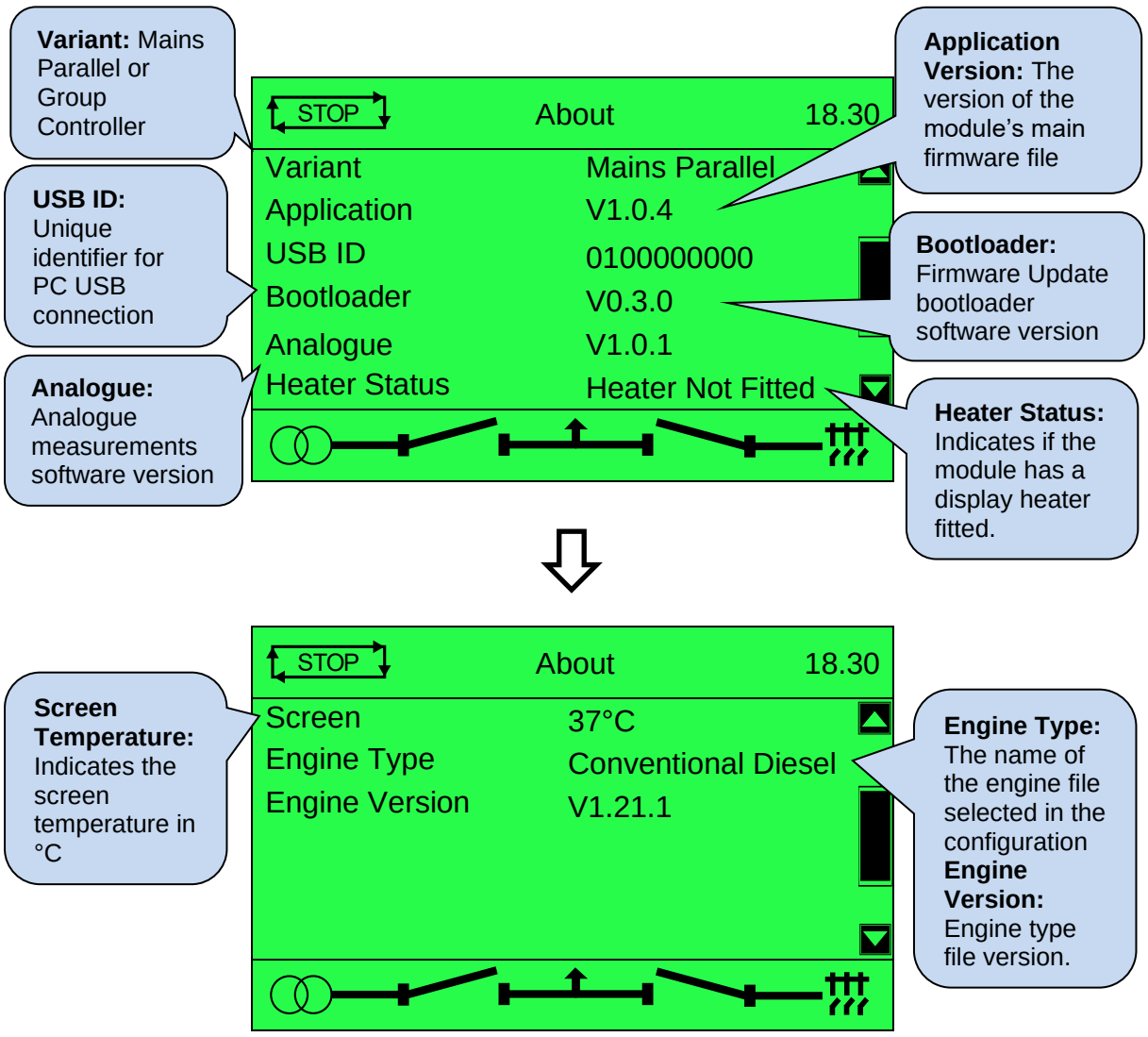
Press and hold the *Tick* button until "*Safe to remove*" is displayed.

If the display shows "*Safe to remove*" then it is now safe to remove the USB drive.
This ensures the logging data file saves to memory complete and does not become corrupt.

5.3.14 ABOUT

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

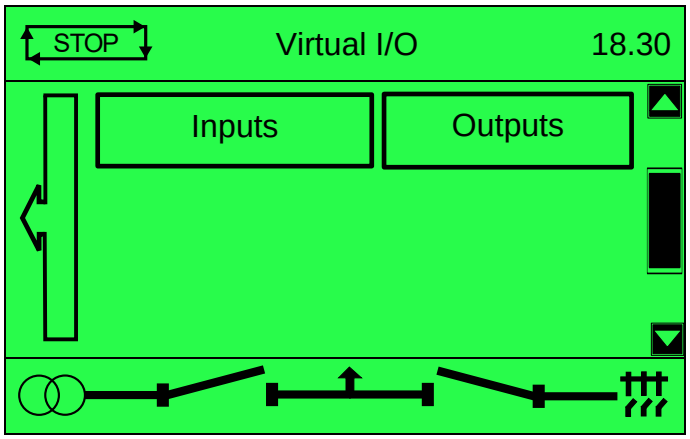
Use the **Scroll**  buttons to access more information about the module.



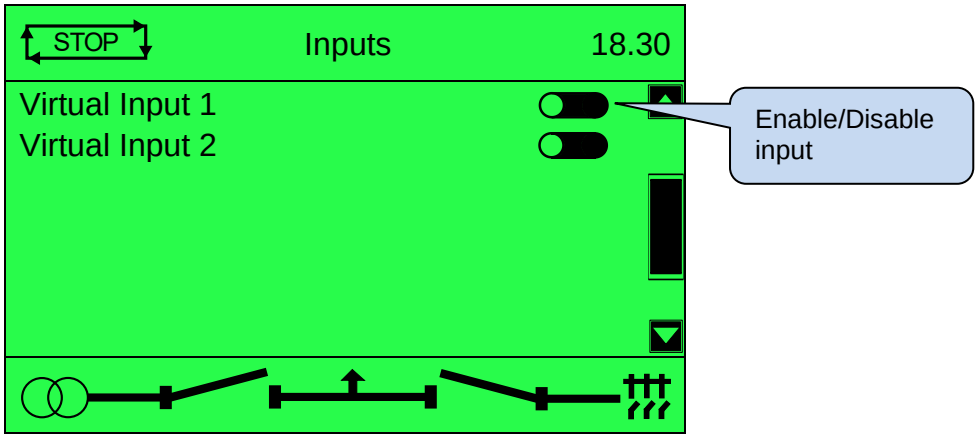
5.3.15 VIRTUAL I/O

NOTE: Virtual I/O is configured using the DSE Configuration Suite Software. For further details, refer to DSE Publication: 057-324 *G8660 Configuration Suite PC Software Manual.*

This page displays the inputs and outputs configured using the Configuration Suite PC Software using the *Virtual Input* and *Virtual LEDs* pages. The virtual LEDs provide a configuration of 'status' items. These items are available for viewing on the module and seen in the SCADA section of the PC software, or read by third party systems (i.e. BMS or PLCs) using the Modbus protocol.



Inputs

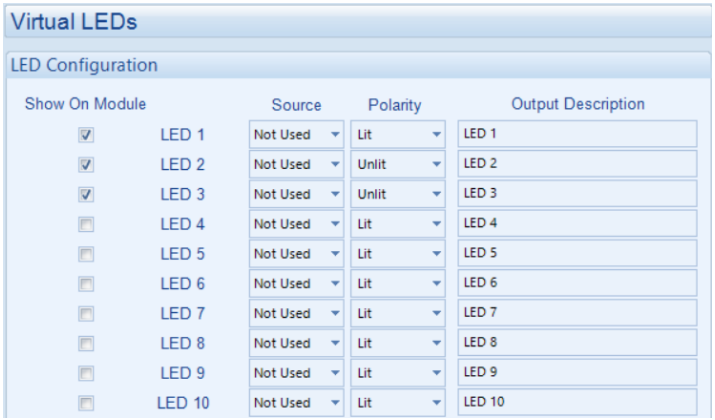


Press and hold the ***Tick*** button to cycle through the inputs.

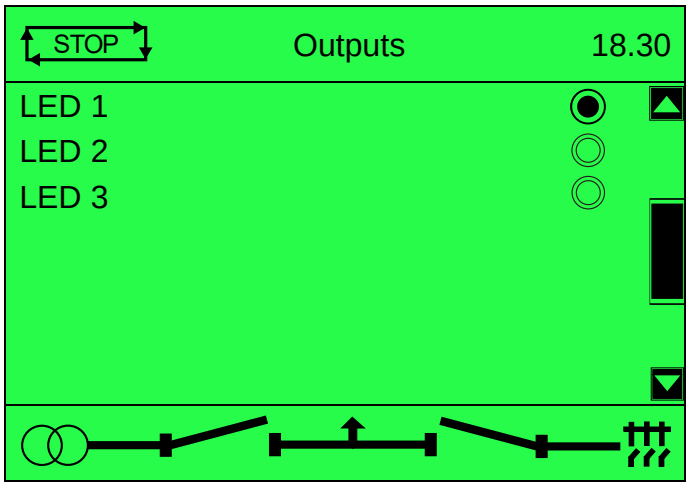
Press the ***Next Page*** button to switch the input On or Off

Outputs

The LED outputs are configured in the Virtual LED section of Config Suite.



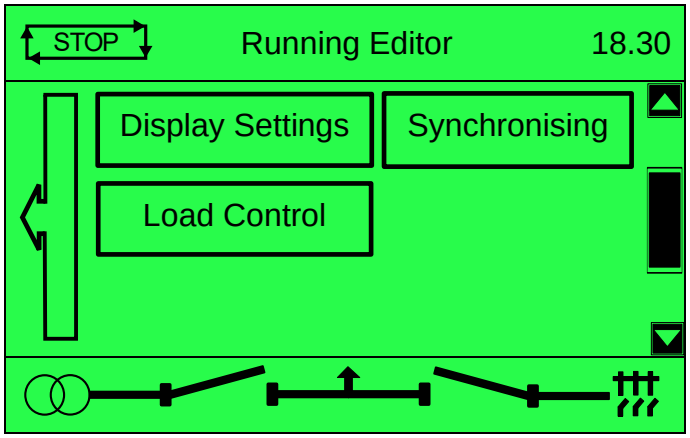
Once the LED is configured in the *LED Configuration*, it will show on the *Outputs* page below.



5.3.16 RUNNING EDITOR

Use the  **Next or Previous Page** buttons to select.

Press the ***Tick***  button to confirm selection.



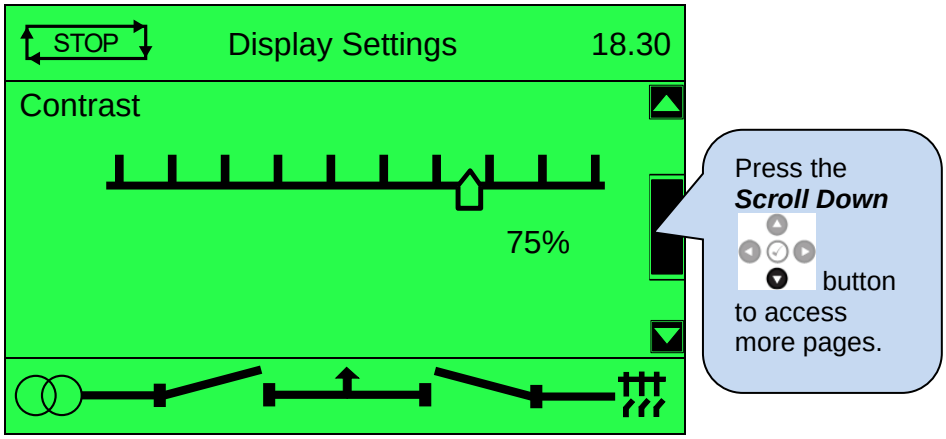
5.3.16.1 DISPLAY SETTINGS

The list of parameters are:

Contrast

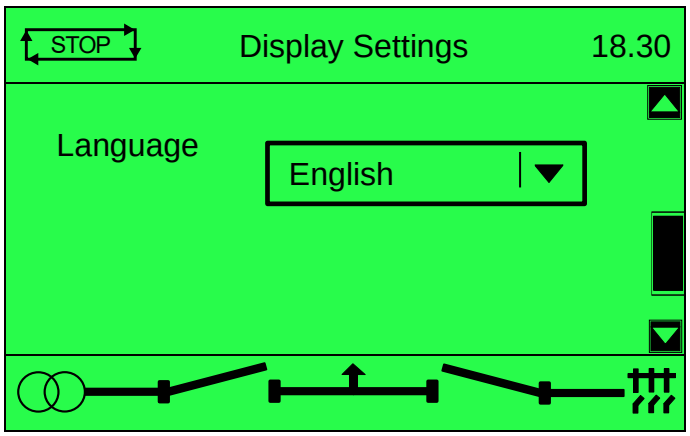
Press the ***Tick***  button and using the  Next or Previous Page buttons adjust the slider.

Once the selection has been made press the ***Tick***  button again to save the setting.



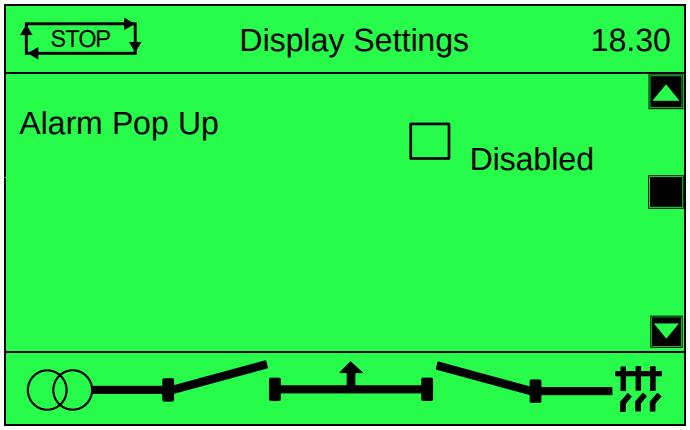
Language

Press the ***Tick*** button and press the ***Next Page*** followed by the ***Scroll*** buttons to change the selection.



Alarm Pop Up

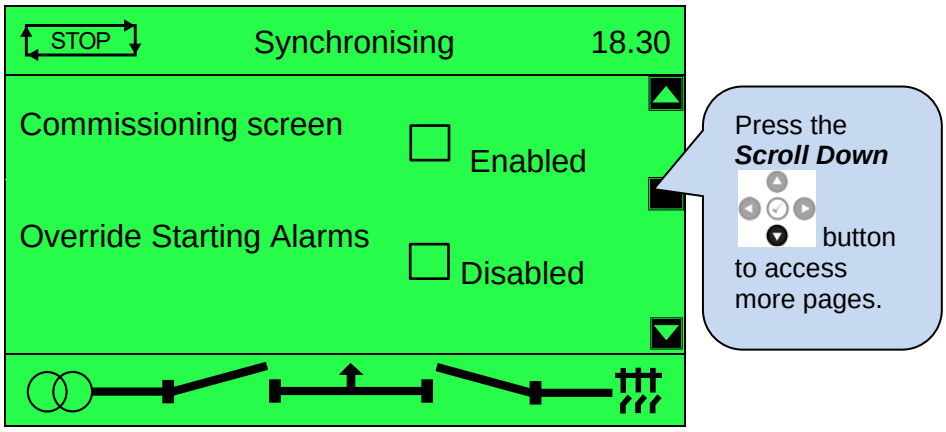
Press the ***Tick***  button and then using the ***Next Page***  button to enable/disable the selection.



5.3.16.2 SYNCHRONISING

Commissioning & Override Starting Alarms

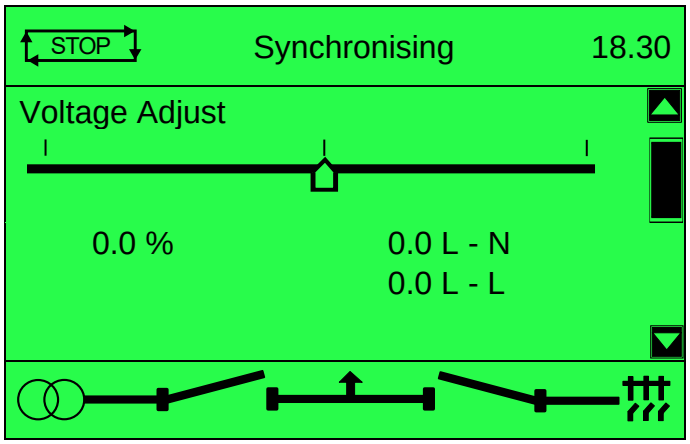
Press the ***Tick*** button and press the ***Next Page button*** to change the selection to change selection from *Enabled* to *Disabled* or vice-versa.



Voltage Adjust

Press the ***Tick*** button and using the ***Next or Previous Page*** buttons adjust the slider.

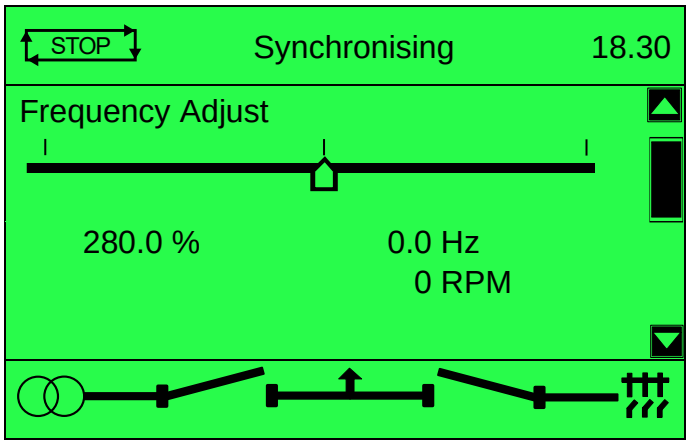
Once the selection has been made press the ***Tick*** button again to save the setting.



Frequency Adjust

Press the ***Tick*** button and using the ***Next or Previous Page*** buttons adjust the slider.

Once the selection has been made press the ***Tick*** button again to save the setting.

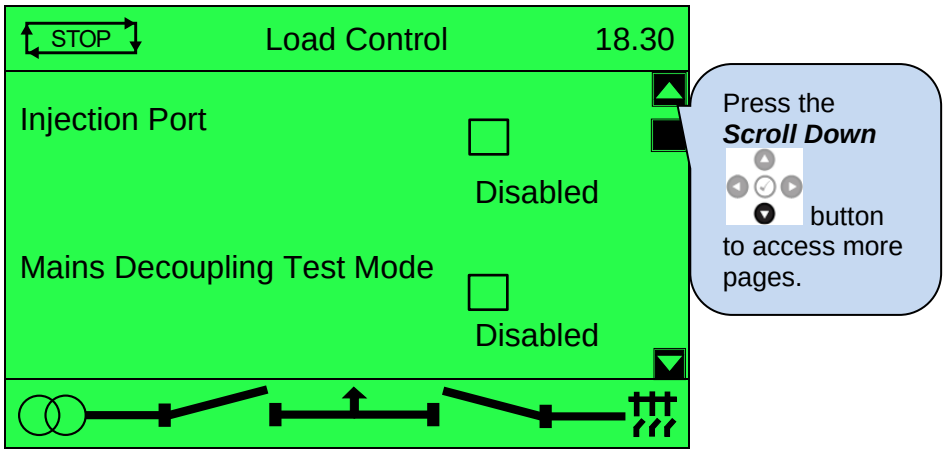


5.3.16.3 LOAD CONTROL (MAINS PARALLEL)

Mains Decoupling Test Mode

The Test Mode is used to avoid tripping the breaker when simulated injection testing is carried out.

Press the ***Tick*** button and press the ***Next Page*** button to change the selection to change selection from *Enabled* to *Disabled* or vice-versa.



Press the ***Tick*** button and then using the ***Next Page*** button to enable the selection.

Injection Port

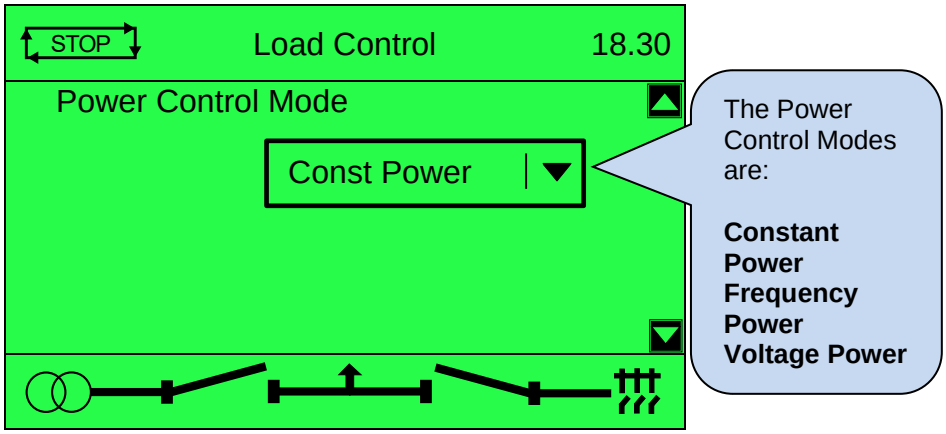
The Simulation Injection Testing tool of the DSE Configuration Suite PC Software allows testing the generator's frequency response and check its performance for the Power Control curves. For details on how to test the Simulation Injection on the DSE module refer to DSE Publication: 056-123 Simulation Injection Testing document.
The Injection Port must be enabled in the DSE module from the Running Editor to be able to accept the injecting control.

Mains Decoupling Test Mode

The Test Mode is used to allow testing of the mains decoupling functions without going into parallel.

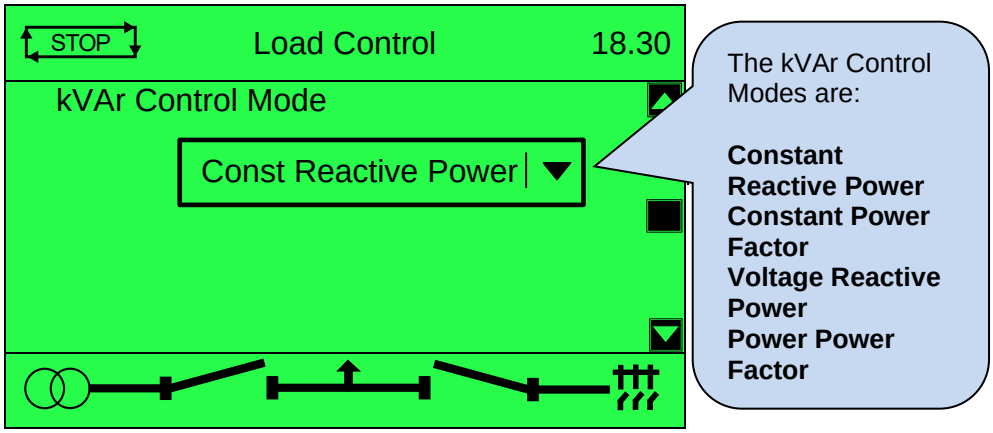
Power Control Mode

Press the ***Tick***  button and press the  ***Next Page*** button followed by the ***Scroll***  button to change the selection.



kVar Control Mode

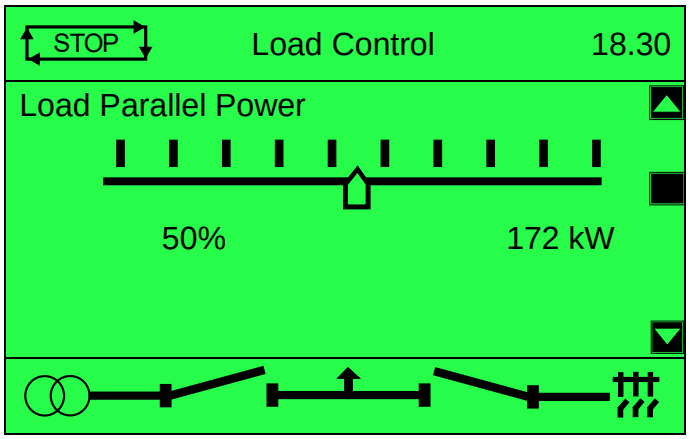
Press the ***Tick***  button and press the  **Next Page** button followed by the **Scroll**  button to change the selection.



Load Parallel Power

Press the ***Tick*** button and using the ***Next or Previous Page*** buttons adjust the slider.

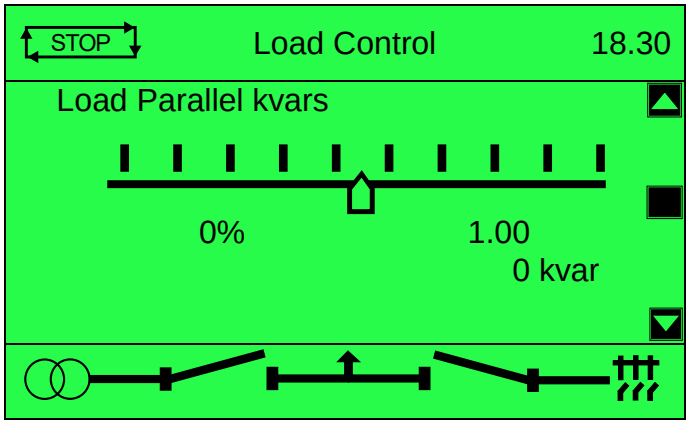
Once the selection has been made press the ***Tick*** button again to save the setting.



Load Parallel kvars

Press the ***Tick*** button and using the ***Next or Previous Page*** buttons adjust the slider.

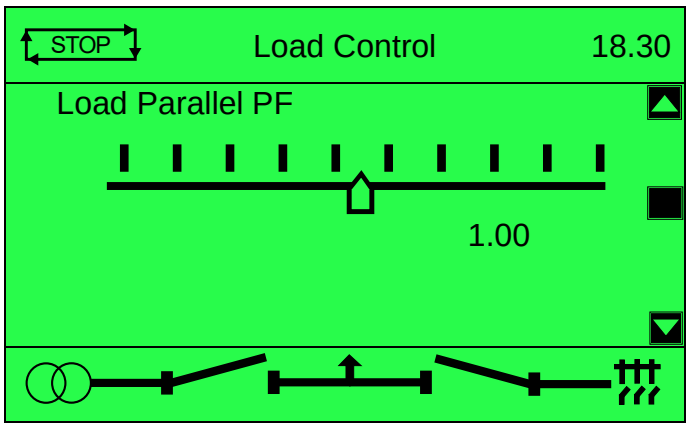
Once the selection has been made press the ***Tick*** button again to save the setting.



Load Parallel PF

Press the ***Tick*** button and using the ***Next or Previous Page*** buttons adjust the slider.

Once the selection has been made press the ***Tick*** button again to save the setting.

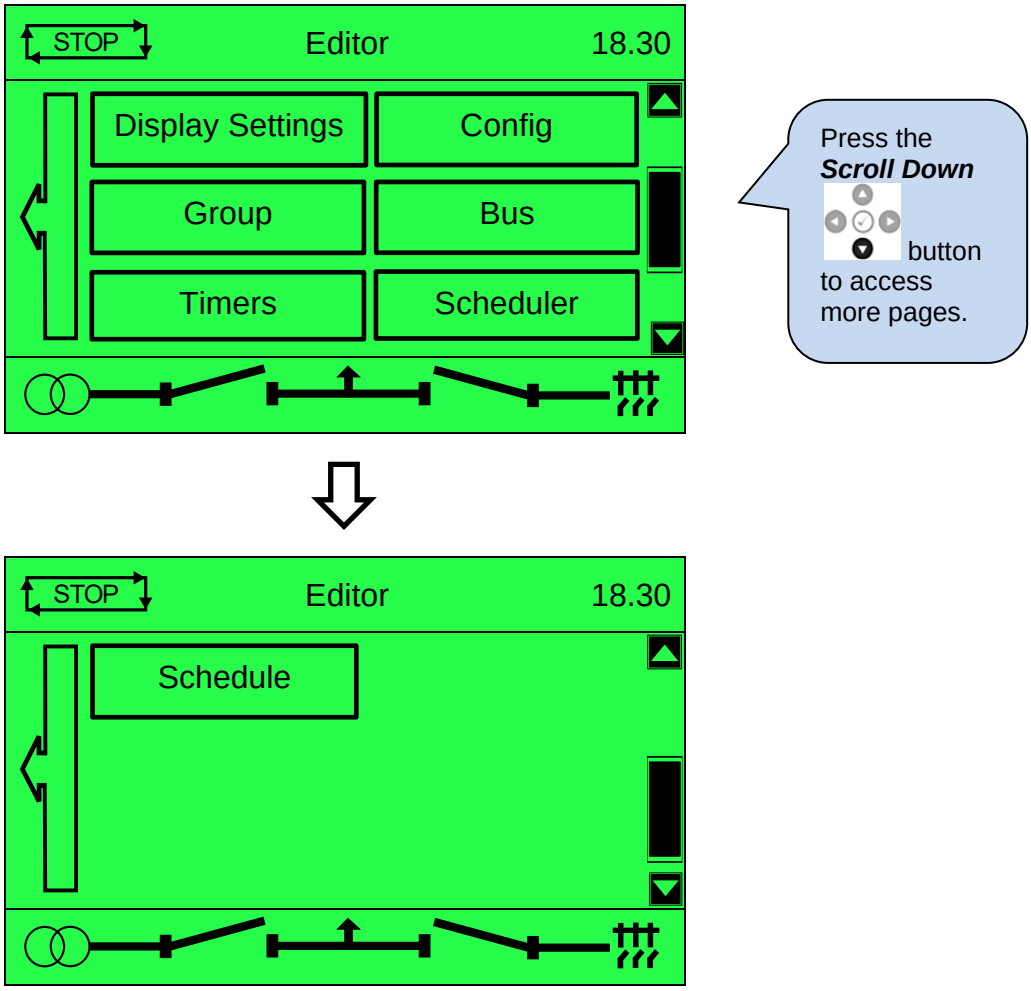


5.3.17 EDITOR

NOTE: Depending upon the module's configuration, some display screens may be disabled. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*

Contains a selection of parameters selected by the operator that may be edited from the facia without having to enter the module's *Front Panel Editor.* For further details refer to section 9.1.

Press the ***Scroll*** buttons scroll through the ***Editor*** parameters if configured.

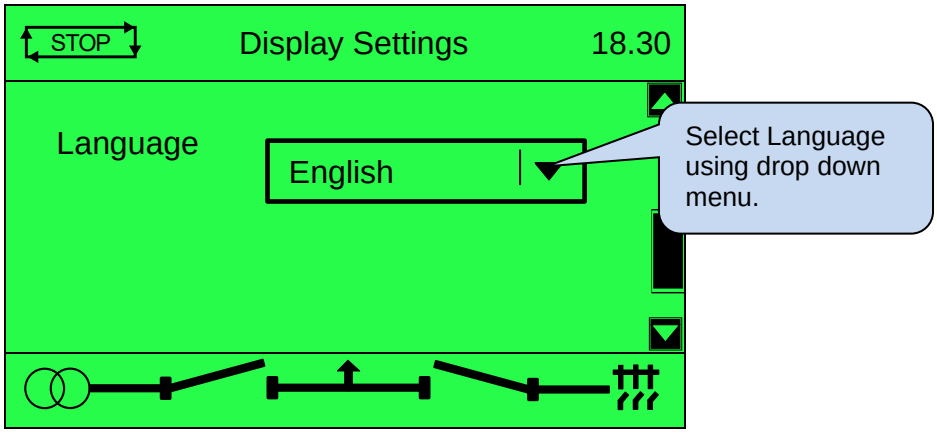


5.3.17.1 DISPLAY SETTINGS

Language

Press the ***Tick*** button and using the ***Next or Previous Page*** buttons adjust the contrast

Press the ***Tick*** button again to save the setting

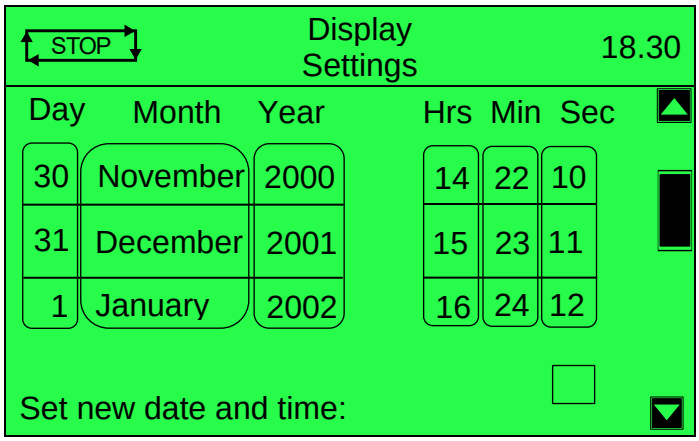


Current Date & Time

The current date and time are adjusted starting with the 'Day' using the scroll buttons.

Press the ***Scroll*** **Next or Previous Page** buttons to scroll through 'Day', 'Month', 'Year' etc.

Use the selection button to adjust and use the scroll button to change the value.

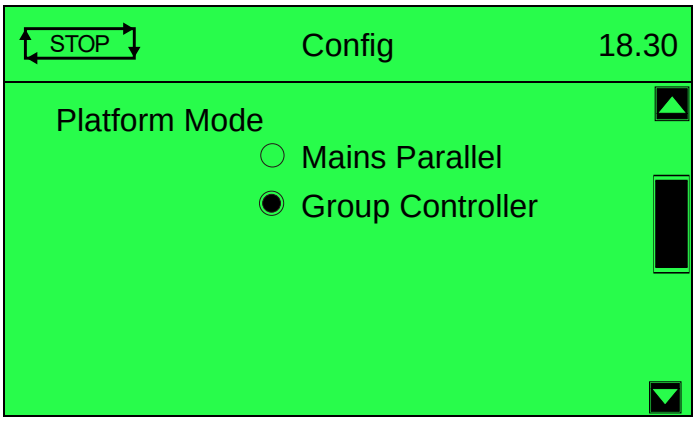


Platform Mode

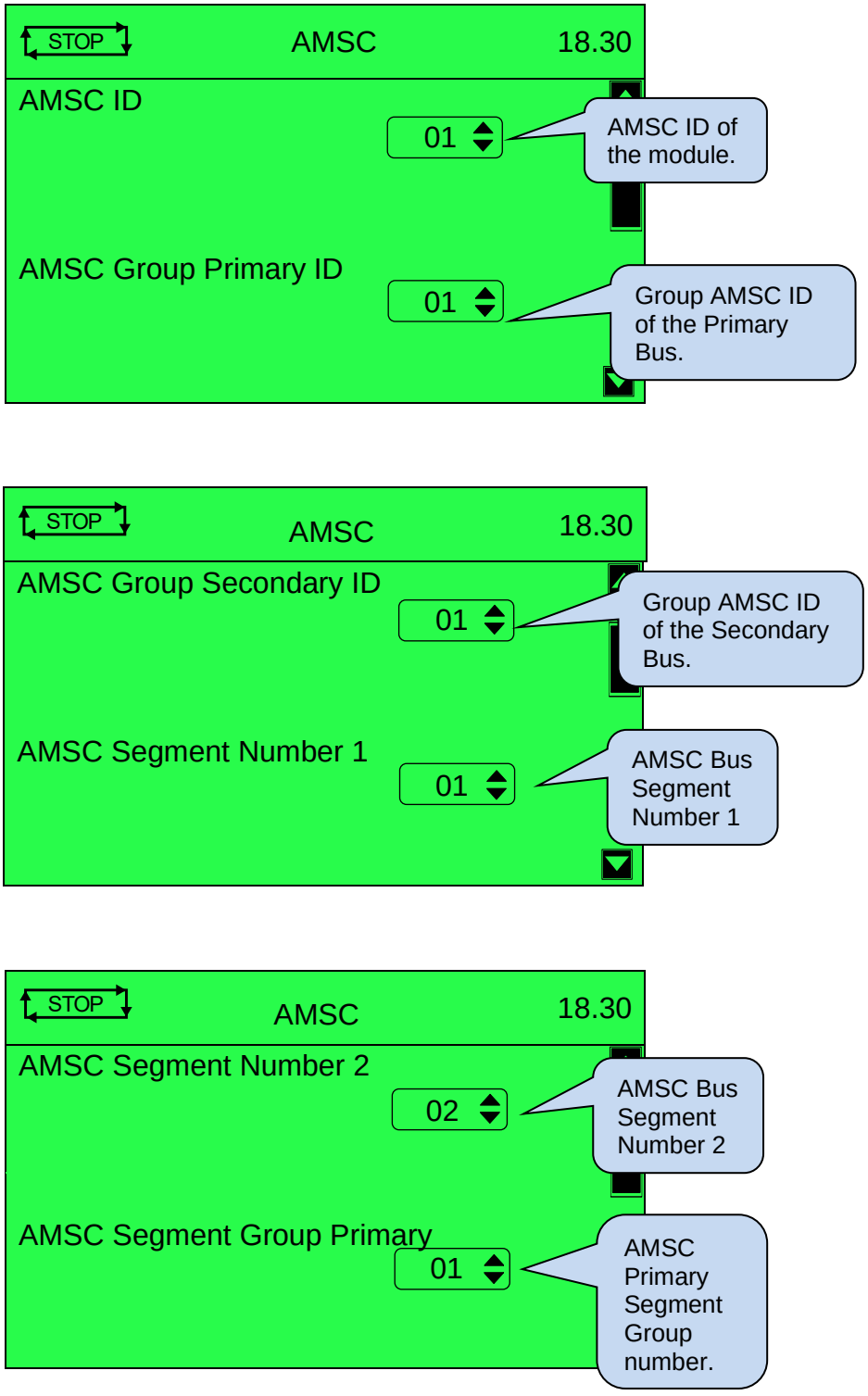
The current platform is displayed.

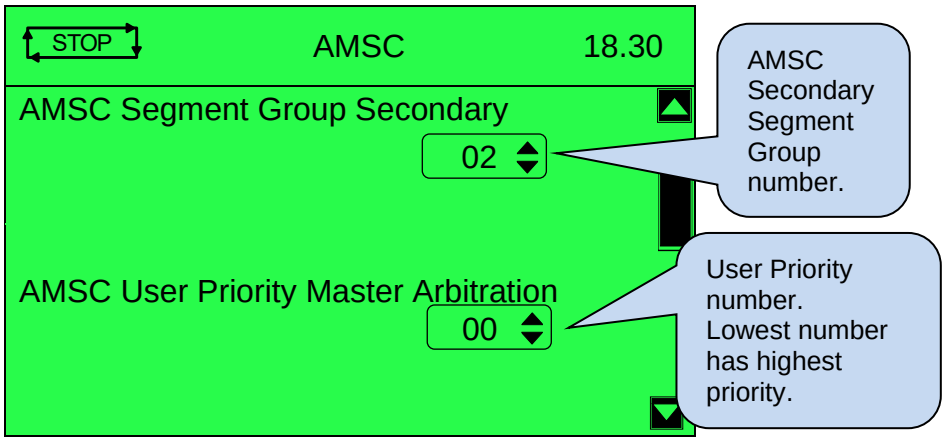
Press the ***Tick*** button to highlight and use the ***Scroll*** button to change the selection.

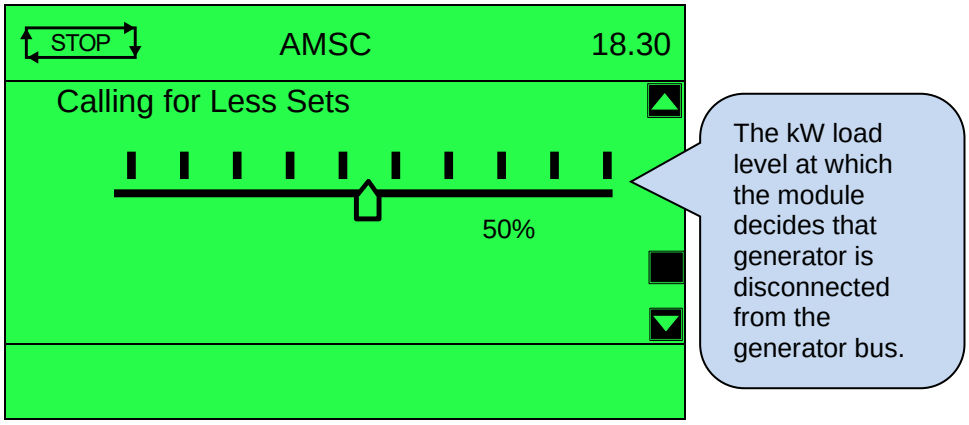
Once a selection has been made press the ***Tick*** button to confirm.



5.3.17.2 AMSC

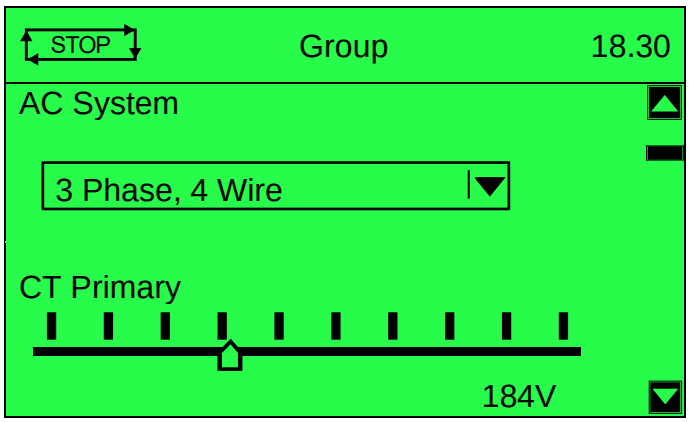

STOP
AMSC
18.30
AMSC ID
01
AMSC ID of the module.
AMSC Group Primary ID
01
Group AMSC ID of the Primary Bus.
STOP
AMSC
18.30
AMSC Group Secondary ID
01
Group AMSC ID of the Secondary Bus.
AMSC Segment Number 1
01
AMSC Bus Segment Number 1
STOP
AMSC
18.30
AMSC Segment Number 2
02
AMSC Bus Segment Number 2
AMSC Segment Group Primary
01
AMSC Primary Segment Group number.


STOP
AMSC
18.30
AMSC Segment Group Secondary
02
AMSC User Priority Master Arbitration
00
AMSC Secondary Segment Group number.
User Priority number. Lowest number has highest priority.


STOP
AMSC
18.30
Calling for Less Sets
50%
The kW load level at which the module decides that generator is disconnected from the generator bus.

5.3.17.3 GROUP (GROUP CONTROLLER)

The Group page gives an overview of the instrumentation group parameters.



Press the ***Tick*** button and then using the ***Next Page*** button to reveal the other AC topologies.

Press the ***Tick*** button again to save the setting.

Use the ***Scroll*** buttons to select the option and press the ***Tick*** button again to save the setting.

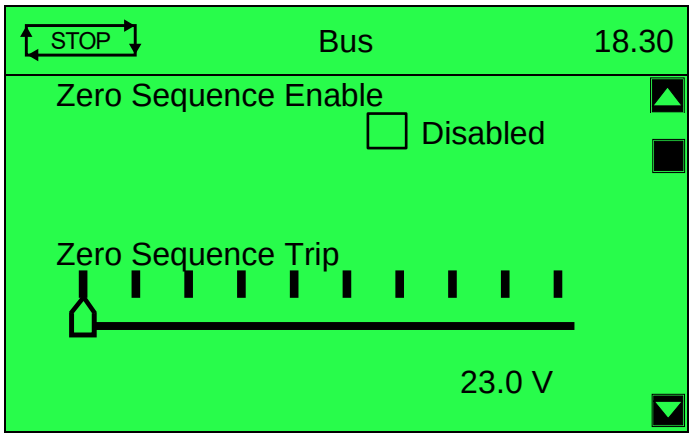
Select the AC topology of the generator from the following list:

- 2 Phase, 3 Wire L1 – L2
- 3 Phase, 3 Wire
- 3 Phase, 4 Wire
- 3 Phase, 4 Wire Delta L1 – N – L3
- Single Phase, 2 Wire
- Single Phase, 3 Wire L1 – L3
- 2 Phase, 3 Wire L1 – L3
- 3 Phase, 3 Wire NVD
- 3 Phase, 4 Wire Delta L1 – N – L2
- 3 Phase, 4 Wire Delta L2 – N – L3
- Single Phase, 3 Wire L1 – L2

Select the Group parameters from the following list:

- Positive Sequence Alarm Delay
- Negative Sequence Alarm
- Negative Sequence Alarm Trip
- Negative Sequence Alarm Delay
- Asymmetry Alarm
- Asymmetry Alarm Trip
- Asymmetry Alarm Delay
- CT Primary
- CT Secondary 5 Amp, 1 Amp
- Nominal Frequency
- IDMT Alarm
- Overcurrent Alarm
- Overcurrent Time Multiplier
- Short Circuit Alarm
- Short Circuit Alarm Trip
- Earth Fault Alarm Trip
- AMSC ID
- AMSC Bank Primary ID
- AMSC Bank Secondary ID
- Zero Sequence Alarm
- Zero Sequence Alarm Trip
- Zero Sequence Alarm Delay
- Positive Sequence Alarm
- Positive Sequence Trip
- AMSC Segment Number 1
- AMSC Segment Number 2
- AMSC Segment Bank Primary
- AMSC Segment Bank Secondary
- AMSC User Priority Master Arbitration
- Load demand hours
- Spinning Reserve
- Spinning Capacity
- Reverse Power Alarm Trip
- Reverse Power Alarm Delay
- Ramp Up Rate
- Ramp Down Rate
- Insufficient Capacity Action
- Insufficient Capacity Delay

5.3.17.4 BUS

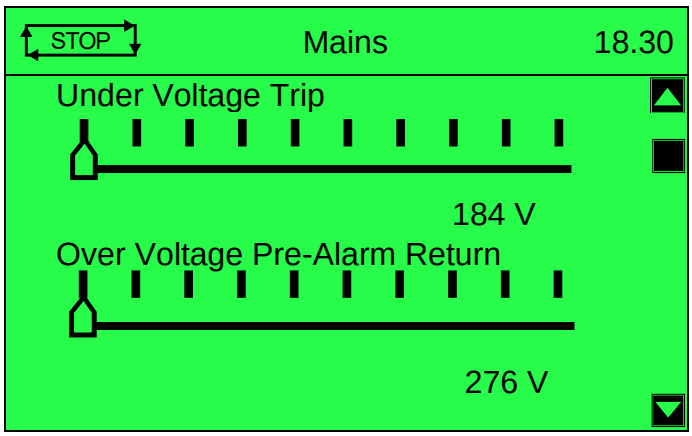


The list of available parameters are:

- Zero Sequence Enable
- Positive Sequence Enable
- Negative Sequence Enable
- Asymmetry Enable

5.3.17.5 MAINS (MAINS PARALLEL)

Contains electrical values of the Mains (utility), measured, or derived from the module's (that controls the mains (utility) switch) voltage and current inputs.



Press the ***Tick*** button and then using the ***Next or Previous*** buttons adjust the Setting.

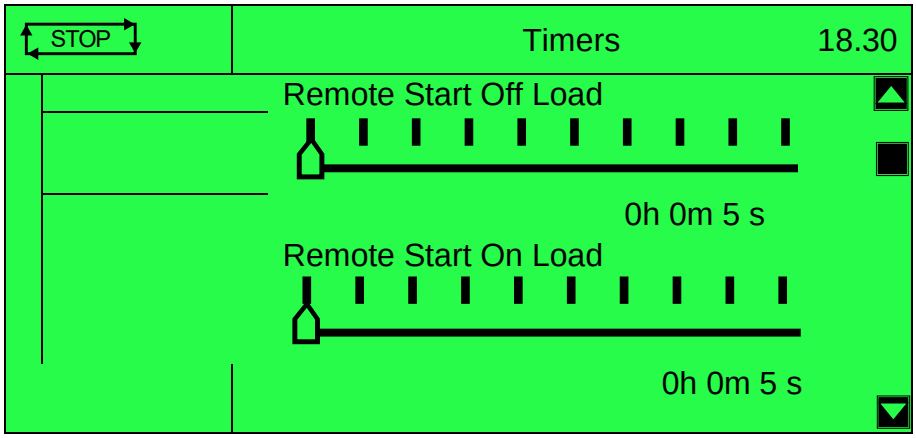
Press the ***Tick*** button again to save the setting

The list of available parameters are:

- Under Voltage Trip
- Under Voltage Pre-Alarm Return
- Over Voltage Pre-Alarm Return
- Over Voltage Trip
- Zero Sequence Enable
- Zero Sequence Trip
- Zero Sequence Alarm Delay
- Positive Sequence Enable
- Negative Sequence Enable
- Asymmetry Enable
- Under Frequency Alarm Trip
- Under Frequency Pre-Alarm Return
- Over Frequency Pre-Alarm Return
- Over Frequency Alarm Trip
- CT Primary
- Full Load Rating
- Full kvar Rating

5.3.17.6 TIMERS

The timers page allows adjustment of various Start Delay and Start Timers.



- Remote Start Off Load
- Remote Start On Load
- Telemetry Start
- Mains Fail
- Mains Transient Delay
- Breaker Close Pulse
- Breaker Trip Pulse
- Start From AMSC Master
- Page Timer

5.3.17.7 SCHEDULER

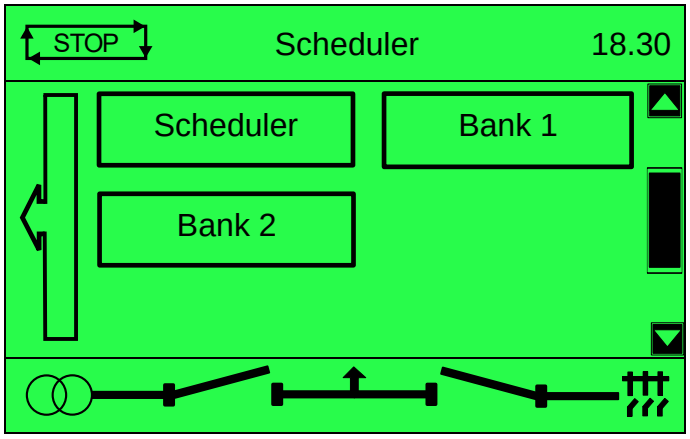
NOTE: For further details on the operation of the inbuilt scheduler feature, refer to section entitled *Scheduler* in the *Operation* section of this document.

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

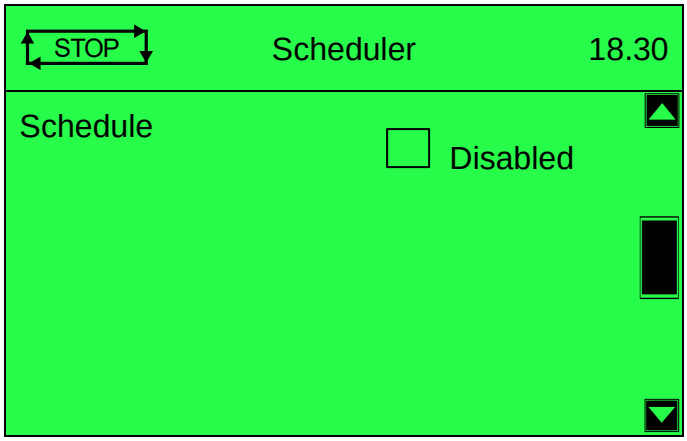
The controller contains an inbuilt exercise run scheduler, capable of automatically starting and stopping the set or inhibiting the set from starting. Up to 16 scheduled (in two banks of 8) start/stop/inhibiting start sequences can be configured to repeat on a 7-day or 28-day cycle.

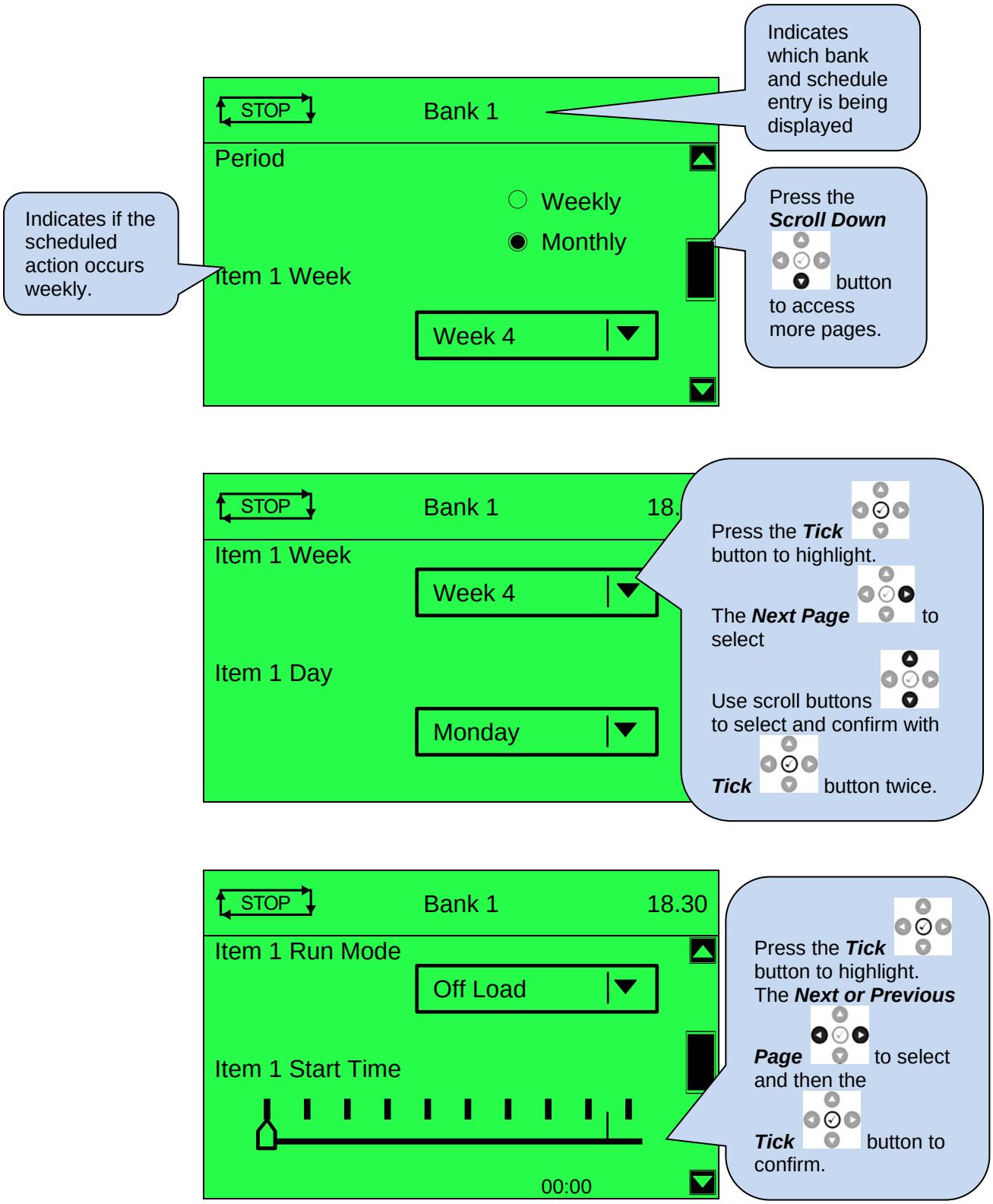
Scheduled runs may be on load or off load depending upon module configuration.

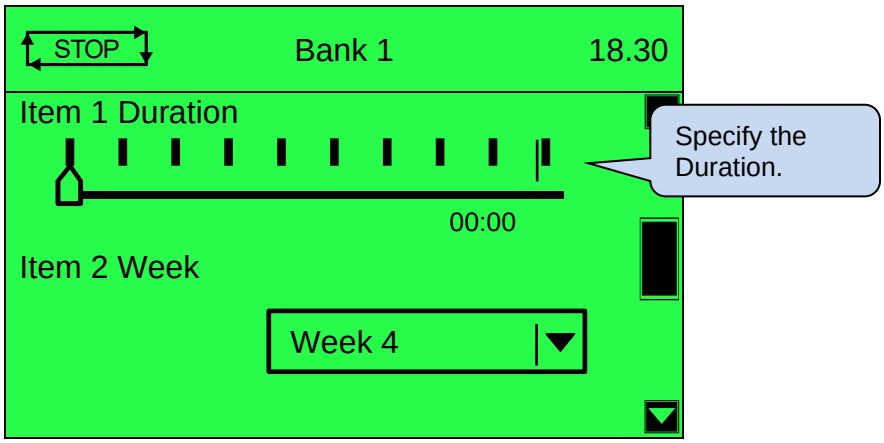
This section of the module's display shows how exactly the scheduler (if enabled) is configured. Under default factory settings the Schedule is not viewable. It is enabled by the system designer using the DSE Configuration Suite software.



Press the ***Tick***  button and then using the ***Next Page***  button to enable or disable the Schedule..




Indicates which bank and schedule entry is being displayed
STOP
Bank 1
Period
Weekly
Monthly
Item 1 Week
Week 4
Indicates if the scheduled action occurs weekly.
Press the ***Scroll Down*** button to access more pages.
STOP
Bank 1
18.
Item 1 Week
Week 4
Item 1 Day
Monday
Press the ***Tick*** button to highlight.
The ***Next Page*** to select
Use scroll buttons to select and confirm with ***Tick*** button twice.
STOP
Bank 1
18.30
Item 1 Run Mode
Off Load
Item 1 Start Time
00:00
Press the ***Tick*** button to highlight.
The ***Next or Previous Page*** to select and then the ***Tick*** button to confirm.


STOP
Bank 1
18.30
Item 1 Duration
00:00
Specify the Duration.
Item 2 Week
Week 4

6 OPERATION

NOTE: 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 module in the field.

6.1 QUICKSTART GUIDE

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

6.1.1 STARTING THE GENERATOR(S)

To manually start the generator, press the start button once to put the module into manual mode, and then a second time to start the generator.

6.1.2 STOPPING THE GENERATOR(S)

Select the Stop/Reset mode button to stop the generator.

6.2 STOP/RESET MODE

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

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

Stop/Reset Mode is activated by pressing the ***Stop/Reset Mode*** button.

The LED adjacent to the ***Stop/Reset Mode*** button illuminates to indicate ***Stop/Reset Mode*** operation.

In ***Stop/Reset Mode***, the module removes the generator from load (if necessary) before stopping the generator.

To detect the engine at rest the following must occur:

- Engine speed is zero as detected by the CAN ECU
- Generator AC Voltage and Frequency must be zero.
- Engine Charge Alternator Voltage must be zero.
- Oil pressure sensor must indicate low oil pressure

When the engine has stopped and the module is in the ***Stop/Reset Mode***, it is possible to send configuration files to the module (if the bus breaker is open and not be synchronising or ramping) from DSE Configuration Suite PC software and to enter the Front Panel Editor to change parameters.

Any latched alarms that have been cleared are reset when ***Stop/Reset Mode*** is entered.

The generators on the bus are not started when in ***Stop/Reset Mode***. If start signals are given, the input is ignored until ***Auto Mode*** AUTO is entered.

When left in ***Stop/Reset Mode*** with no presses of the fascia buttons, no form of communication active and configured for *Power Save Mode,* the module enters *Power Save Mode*. To 'wake' the module, press any fascia control buttons.

Power Save Mode in the DSE Configuration Suite Software

6.3 MANUAL MODE

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

Manual Mode is activated by pressing the ***Start*** button.
The display will show MANUAL to indicate operations.

In ***Manual Mode*** MANUAL the generator does not start automatically

To begin the starting sequence, press the ***Start*** button.

6.3.1 STARTING SEQUENCE

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

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

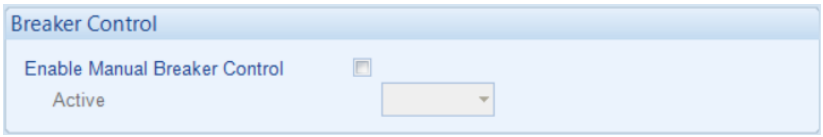
A start request is sent to all the DSEG8600 (Multi Set) modules and Group controllers on the AMSC link. The type of start request sent from the DSEG8660 is dependent upon module configuration. The type of start signal is either *Remote Start on Load* or *Remote Start on Load Demand.* The starting sequence of the generator(s) is then controlled by the DSEG8600 (Multi Set) controllers.

6.3.2 LOADING GENERATOR BUS

Once the generator(s) closes its load switch, the generator bus is seen as available and the generator bus LED illuminates.

In ***Manual Mode*** ,MANUAL the generator bus load switch is not closed until a 'loading request' is made.
A loading request can come from several sources:

- Press the ***Transfer to Generator Bus*** button. The operation of this button is dependent on module configuration, for further details see section 5.1entitled *Control Push Buttons*.
- With *Manual Breaker Control* disabled, the following loading requests take effect.
-



  - Failure of mains supply
  - High mains load (when the module is set for *Auto Mode*)
  - Activation of an auxiliary input that has been configured to *Remote Start on Load* function.
  - Activation of an auxiliary input that has been configured to *Auxiliary Mains Failure.*
  - Activation of the inbuilt exercise scheduler if configured for *Parallel* or *Island* operation.
  - Instruction from external remote telemetry devices using the RS485 or Ethernet interface.

The generator bus is then instructed to go into continuous parallel with the mains or into island operation, for further details see sections 6.6 & 6.7 entitled *Continuous Parallel Operation* and/or *Island Operation*.

Before closing the generator bus breaker, the generator bus is synchronised to the mains (if required) and is placed on load by ramping load (if required) onto the generator bus from the mains.

NOTE: The bus must have sufficient capacity to be loaded, or the capacity alarm will become active.

6.3.3 UNLOADING GENERATOR BUS

Once the generator bus has been placed on load, it is not automatically removed. To instruct the generator bus to ramp its load off and open its load switch, ensure none of the loading requests are active or have *Manual Breaker Control* enabled and either:

- Press the ***Start*** (I) button to go into ***Manual Mode*** MANUAL.
- Press the ***Mode*** (MODE) button to return to automatic mode. The module observes all ***Auto Mode*** AUTO start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.
- Press the ***Stop/Reset Mode*** (O) button to open the generator bus load switch and remove start request on AMSC link.
- Activation of an auxiliary input that has been configured to *Bus Load Inhibit* (no ramping occurs)

6.3.4 STOPPING SEQUENCE

In ***Manual Mode*** MANUAL the set continues to run until either:

- The ***Stop/Reset Mode*** (O) button is pressed – The generator bus load switch opens immediately and start request on AMSC link is removed.
- The ***Mode*** (MODE) button is pressed. The module observes all ***Auto Mode*** AUTO start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.

6.4 TEST MODE

NOTE: If a digital input configured to *Panel Lock* is active on either module, changing modes on both modules is not possible. Viewing the instruments and event logs is NOT affected by panel lock.

Test Mode is activated by pressing ***Mode*** button.
The display will show TEST to indicate operations.

In ***Test Mode*** TEST***,*** a start request does not occur automatically.

To create a start request, press the ***Start*** button.

6.4.1 STARTING SEQUENCE

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

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

A start request is sent to all the DSEG8660 modules on the AMSC link. The type of start request sent from the DSEG8660 is dependent upon module configuration. The type of start signal is either:

Remote Start on Load
When in auto mode, the module performs the start sequence and places the Generator Bus in parallel with the mains.
In Manual mode, the Generator Bus is placed in parallel with the Mains if it was already running; however, in manual mode, this input does not generate start/stop requests.

Remote Start on Load Demand
Where module's input is active for Group Controller on load demand. Also indicates that the controller has received a Remote Start on load signal via the AMSC link.

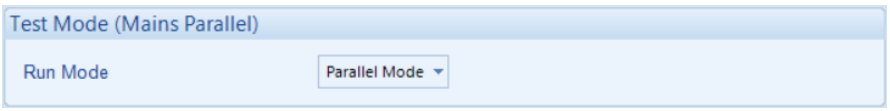
The starting sequence of the generator(s) is then controlled by the DSEG8660s.

6.4.2 LOADING GENERATOR BUS

Once the generator(s) closes its load switch, the generator bus is seen as available and the generator bus LED illuminates.

In ***Test Mode*** TEST, the generator bus load switch is closed automatically when the generator bus is seen as available.
Before closing the generator bus breaker, the generator bus is synchronised to the mains (if required) and is placed on load by ramping load (if required) onto the generator bus from the mains.

Depending upon module configuration, the generator bus is then instructed to go into continuous parallel with the mains or into island operation, for further details see section 6.6 & 6.7 entitled *Continuous Parallel Operation* and/or *Island Operation*.



6.4.3 UNLOADING GENERATOR BUS

Once the generator bus has been placed on load, it is not automatically removed. To instruct the generator bus to ramp its load off and open its load switch, ensure none of the loading requests are active or have *Manual Breaker Control* enabled and either:

- Press the ***Mode*** MODE button and then press the ***Transfer to Mains*** button. The operation of ***Transfer to Mains*** button is dependent on module configuration, for further details see section 5.1 entitled *Control Push Buttons*.
- Press the ***Mode*** MODE button to return to automatic mode. The module observes all ***Auto Mode*** AUTO start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.
- Press the ***Stop/Reset Mode*** O button to open the generator bus load switch and remove start request on AMSC link.
- Activation of an auxiliary input that has been configured to *Bus Load Inhibit* (no ramping occurs)

6.4.4 STOPPING SEQUENCE

In ***Test Mode*** TEST the generator bus continues to run until either:

- The ***Stop/Reset Mode*** O button is pressed – The generator bus load switch opens immediately and start request on AMSC link is removed.
- The ***Mode*** MODE button is pressed. The module observes all ***Auto Mode*** AUTO start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.

6.5 AUTOMATIC MODE

NOTE: If a digital input configured to *Panel Lock* is active on either module, changing modes on both modules is not possible. Viewing the instruments and event logs is NOT affected by panel lock.

Auto Mode is activated by pressing the ***Mode*** button.
The display will show AUTO to indicate operations.

Auto Mode AUTO allows the system to operate fully automatically, sending start request on the AMSC link as required with no user intervention.

6.5.1 WAITING IN AUTO MODE

If a starting request is made, the starting sequence begins.
Starting requests are from the following sources:

- Failure of mains supply
- High mains load (when the module is set for *Mains Mode*)
- Activation of an auxiliary input that has been configured to *Remote Start* function.
- Activation of an auxiliary input that has been configured to *Auxiliary Mains Failure.*
- Activation of the inbuilt exercise scheduler if configured for *Parallel*, *Island* or *Off Load* operation.
- Instruction from external remote telemetry devices using the RS485 or Ethernet interface.

6.5.2 STARTING SEQUENCE

To allow for 'false' start requests, the *Start Delay* timer begins.

If all start requests are removed during the *Start Delay* timer, the unit returns to a stand-by state.

If a start request is still present at the end of the *Start Delay* timer, the start request is activated on the AMSC link.

The starting sequence is then controlled in the DSEG8600 (Multi Set) module.

6.5.3 LOADING GENERATOR BUS

Once the generator closes its load switch, the generator bus is seen as available and the generator bus LED illuminates.

In ***Auto Mode*** AUTO the generator bus load switch is closed automatically (if instructed too) when the generator bus is seen as available. A loading request can come from several sources:

- Failure of mains supply
- High mains load (when the module is configured for *Mains Mode*)
- Activation of an auxiliary input that has been configured to *Remote Start On Load* or *Remote Start In Island Mode* function.
- Activation of an auxiliary input that has been configured to *Auxiliary Mains Failure.*
- Activation of the inbuilt exercise scheduler if configured for *Parallel* or *Island* operation.
- Instruction from external remote telemetry devices using the RS485 or Ethernet interface.

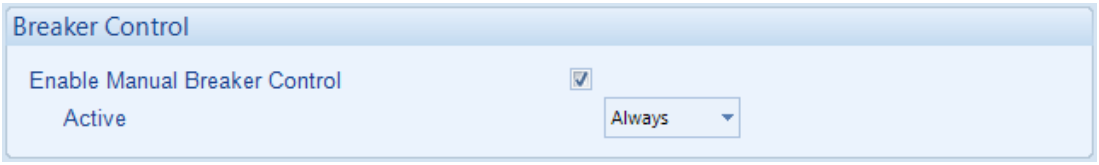
The generator bus is then instructed to go into continuous parallel with the mains or into island operation, for further details see section 6.6 & 6.7 entitled *Continuous Parallel Operation* and/or *Island Operation*.

Before closing the generator bus breaker, the generator bus is synchronised to the mains (if required) and is placed on load by ramping load (if required) onto the generator bus from the mains.

6.5.4 UNLOADING GENERATOR BUS

To instruct the generator bus to ramp its load off and open its load switch:

- Press the ***Mode*** AUTO button. The module observes all ***Auto Mode*** AUTO start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.
- Press the ***Stop/Reset Mode*** O button to open the generator bus load switch and remove start request on AMSC link.
- Activation of an auxiliary input that has been configured to *Bus Load Inhibit* (no ramping occurs)
- With *Manual Breaker Control* enabled, the following unloading requests take effect.



  - Press the ***Start*** I button (***Manual Mode***) followed by the ***Transfer to Mains*** button. The operation ***Transfer to Mains*** button is dependent on module configuration, for further details see section entitled 5.1 *Control Push Buttons*.

6.5.5 STOPPING SEQUENCE

If all start requests are removed, the *Stopping Sequence* begins.

In ***Auto Mode*** AUTO the *Return Delay* timer operates to ensure that the starting request has been permanently removed and isn't just a short-term removal. If another start request is made during the *Return Delay* period, the timer stops.

If there are no starting requests at the end of the *Return Delay* timer, the generator bus load switch opens, and the start request on the AMSC link is removed.

6.6 ISLAND OPERATION (LOAD SHARE)

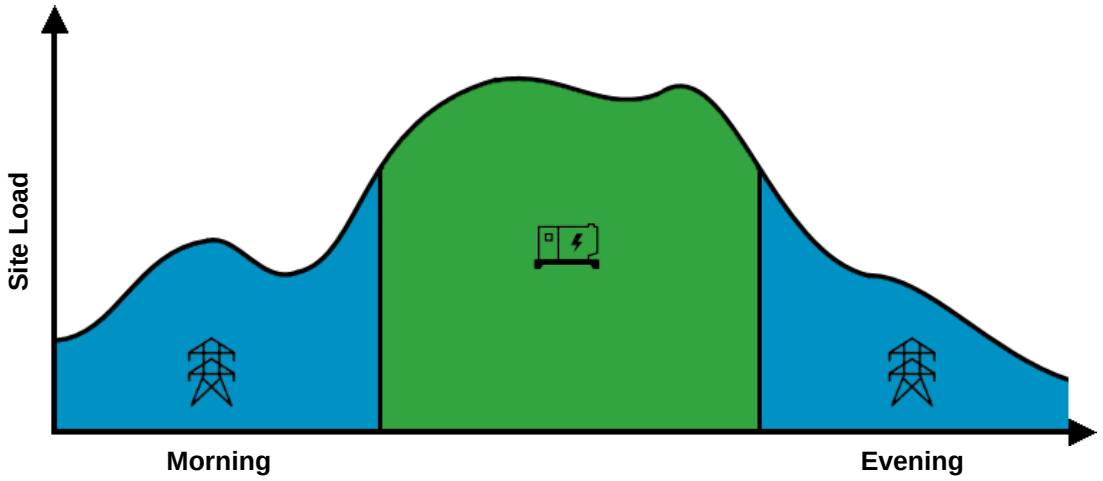
NOTE: For further details on the DSE Load Demand Scheme (the automatic starting/stopping of generators based on load demand), refer to DSE Publication: 056-013 *Load Demand Scheme.*

NOTE: If there is more than one Mains Parallel Controller in island operation in a steady state then all controllers will have the same priority. The priority is based on the user set priority that can be adjusted by the PLC or Scada etc.

The generator bus can be started during a mains failure or when the load level starts to exceed the rating of the mains. The generator bus in this case must be capable of supplying the entire load during this time. The generator bus can then be used to power the load by:

- *Synchronising No- break (Close Transition) Transfer* if the mains is available
- By closing the generator bus breaker onto the load without synchronising if the mains supply had failed.

This leaves the generator bus running in *Island Operation*, suppling the load entirely on its own. This is the case until the load is transferred back to the mains using a synchronising no break (close transition) transfer if the mains is available.



When generators are running in parallel isochronously (zero droop) with one another in *Island Operation*, the amount of power they produce to the load has to be controlled to ensure it is shared amongst them.

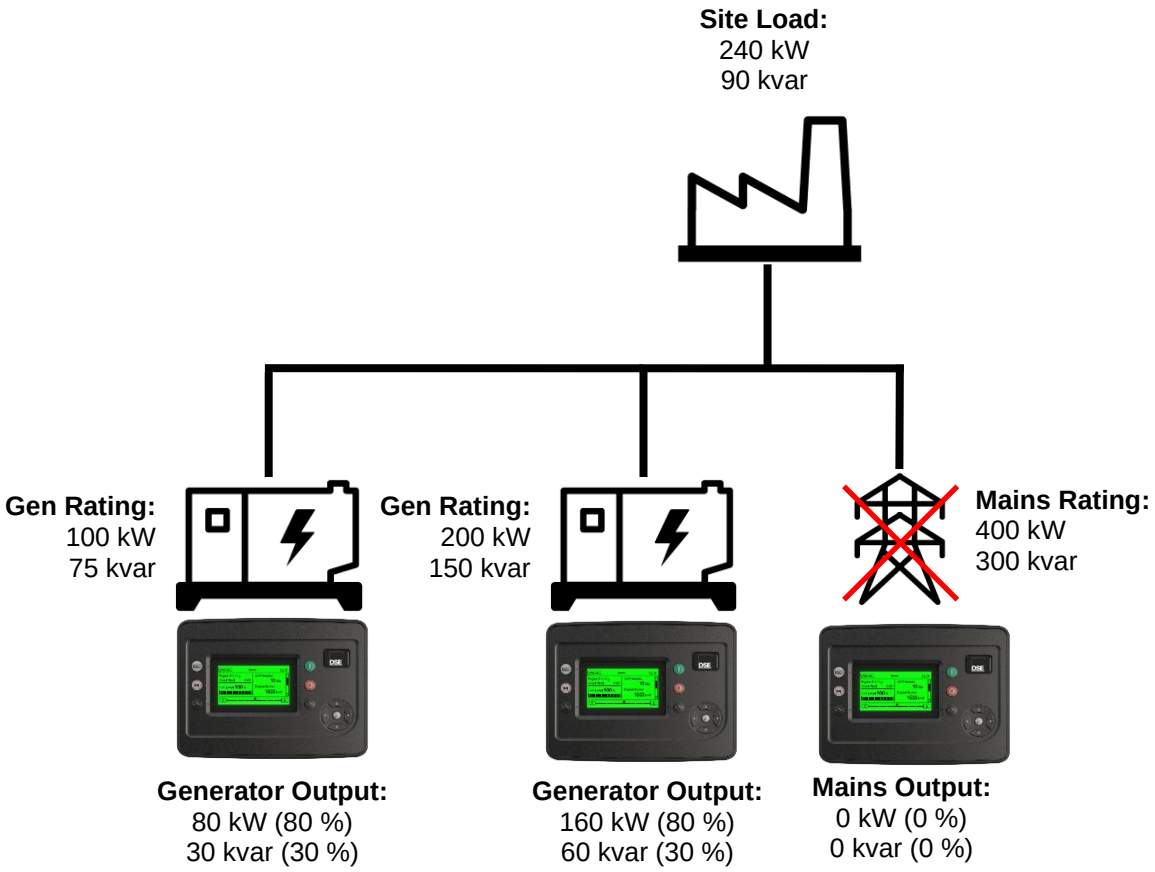
The *Reactive Power* (kvar) sharing is achieved by controlling the alternator's AVR. This is done to alter the amount of field excitation supplied to the alternator and then monitor the amount of *Reactive Power* (kvar) supplied by the generator.

The DSEG8600 knows it is in island operation due to commands sent down the AMSC link from the DSEG8660, as it knows the status of the mains and generator bus breaker.

The DSEG8660 controllers communicate with one another using the AMSC link, passing information and instructions between themselves regarding the amount of power to produce. This information is also used to automatically bring in or drop off other generating sets as load changes if the option for *Enable Running on Load Demand* is enabled in the DSEG8660.

Whilst generators are in parallel, the DSEG8660 controllers instruct the generators to supply an equal percentage of the generators rating.

In the example below, the mains has failed so is not supplying any power to the load. One generator is twice the size of the other though both generators are instructed to produce 80 % of their kW rating and 40 % of their kvar rating. This ensures that one generator is not being overworked, preventing excessive wear.

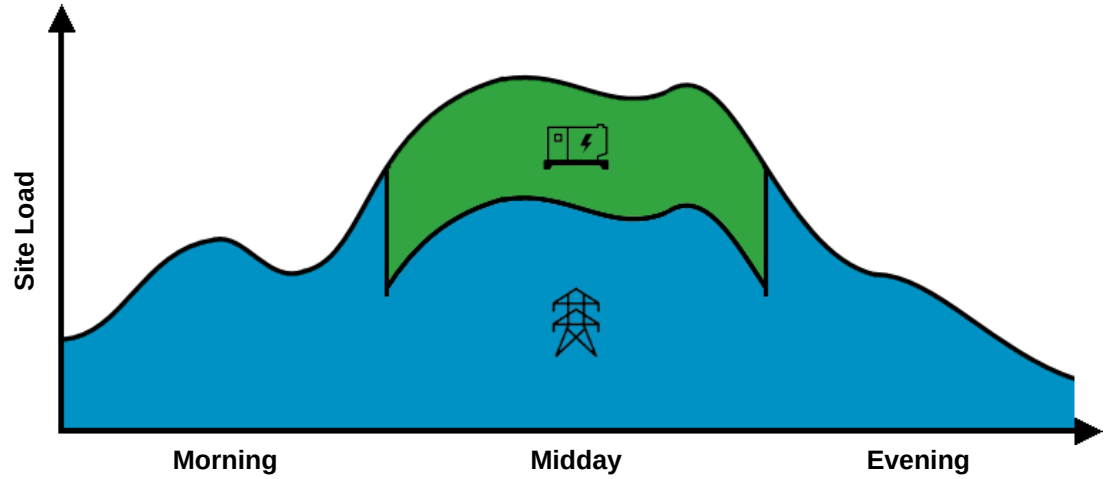


6.7 CONTINOUS PARRALLEL OPERATION

6.7.1 BUS MODE (FIXED EXPORT / BASE LOAD)

During specified times of the day, the generator bus can be started and parallel to the mains using the *Remote Start on Load* input to the DSEG8660 or the Scheduler. When the DSEG8660 is set to *Bus Mode,* this causes the generator bus to produce a fixed (base) level of power against the mains, synchronising to the mains before closing the generator bus breaker.

This leaves the generator bus running in *Continuous Fixed Export (Base Load) Parallel Operation*. The fixed (base) level of power produced by the generator bus supplies the local load and any excess is exported to the mains. This is the case until the *Remote Start on Load* signal is removed from the DSEG8660 module.

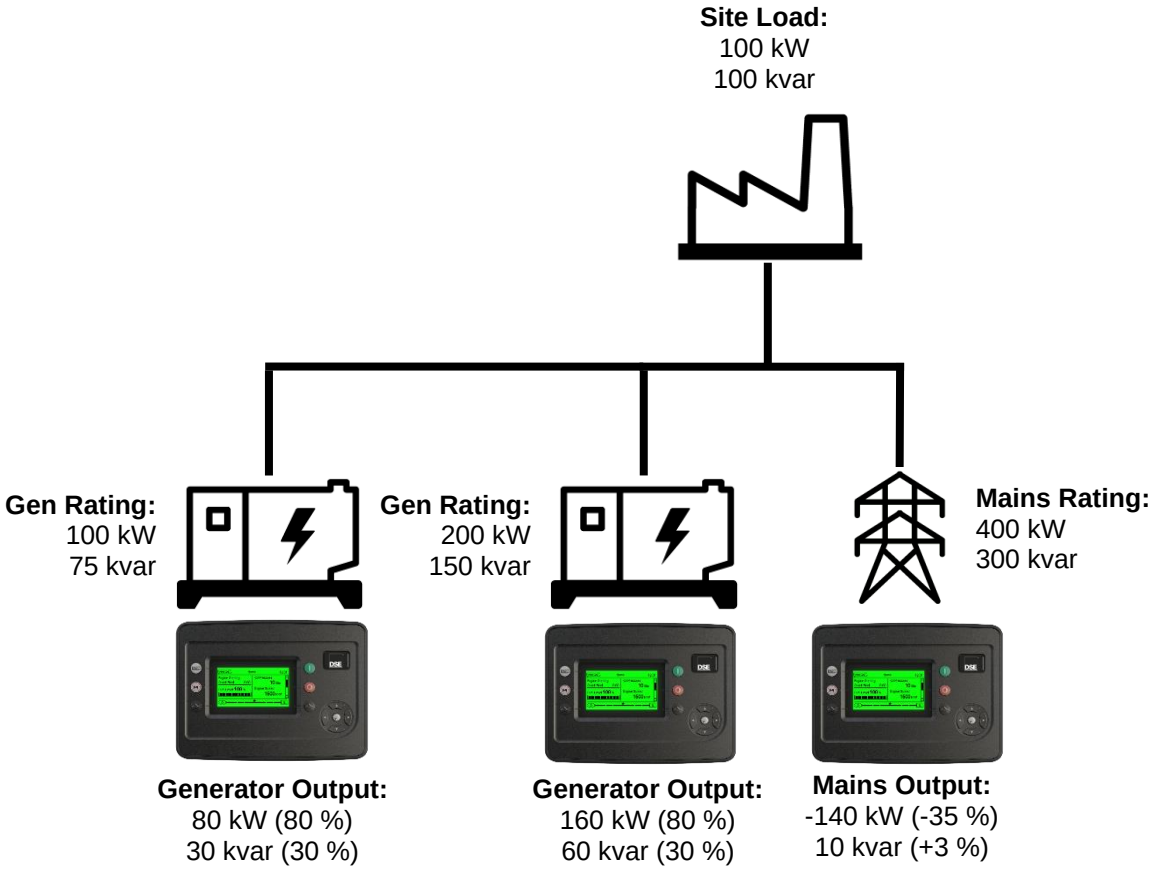


When a generator is running in parallel with the mains isochronously (zero droop) in *Continuous Parallel Operation*, the amount of power they produce must be controlled.

It is the job of the DSEG8660s to make precise changes to the amount *Active Power* (kW) and *Reactive Power* (kvar) produced by their respective generator. The *Active Power* (kW) regulation is achieved by controlling the engine's governing system. This is done to alter the amount of fuel supplied to the engine and then monitor the amount of *Active Power* (kW) produced by the generator. The *Reactive Power* (kvar) regulation is achieved by controlling the alternator's AVR. This is done to alter the amount of field excitation supplied to the alternator and then monitor the amount of *Reactive Power* (kvar) supplied by the generator.

The DSEG8660 knows it is going to parallel the generator with a mains supply due to commands sent down the AMSC link from the DSEG8660, as it knows the status of the mains and generator bus breaker.

When the generator bus is paralleled to the mains, the DSEG8660 instructs all the DSEG8600 controllers to instruct their generator to produce the same pre-set percentage of the generators rating. This pre-set percentage is changeable whilst the generator is running via a multitude of different interfaces. In the example below, the generator bus is instructed to produce 80 % of its kW rating and 30 % of its kvar rating. This results in 140 kW being exported to the Mains and the Mains only producing 10 kvar as the local site load consumes most of the power produced by the generator.



6.7.2 POWER MODES

NOTE: The *Frequency and Active Power Control* modes and *Voltage and Reactive Power Control* modes are to be used in conjunction with the following documents:
- COMMISSION REGULATION (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators
- P1547 - IEEE Draft Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

NOTE: For further details of the configuration for the different power modes, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

It is sometimes required that when a generator is placed in parallel with the mains, that it does not simply produced a fixed amount of *Active Power (kW)* or *Reactive Power (kvar)*. It may be required that the generator automatically varies the amount of *Active Power (kW)* or *Reactive Power (kvar)* to stabilise the localised Mains voltage and frequency. For these requirements, the DSE modules have the option to change the mode of operation whilst in parallel with the Mains.

6.7.2.1 FREQUENCY AND ACTIVE (KW) POWER MODES

Constant Active Power Mode (Default)

This is the default mode of exporting power to the mains (utility); where the DSE load share controller holds the amount of active power produced at a constant level. The amount of active power produced by the generator is irrespective of the load level or any other parameter.
The amount of power produced is defined as *Maximum kW Level* and is set using either the *DSE Configuration Suite PC Software*, *Front Panel Running Editor*, in PLC Functions, or via Modbus messages.

Frequency - Active Power Mode

In this mode of exporting power to the mains (utility); the DSE load share controller varies the amount of active power produced with regards to the *Control Curve* depending on the measured mains (utility) frequency.
This mode allows the generator to support the mains (utility) frequency stability by monitoring the frequency and changing the amount of active power produced.

Voltage – Active Power Mode

In this mode of exporting power to the mains (utility); the DSE load share controller varies the amount of active power produced with regards to the *Control Curve* depending on the measured mains (utility) voltage.
This mode allows the generator to support the mains (utility) voltage stability by monitoring the voltage and changing the amount of active power produced.

6.7.2.2 VOLTAGE AND REACTIVE (KVAR) POWER CONTROL

Constant Reactive Power Mode (Default)

This is the default mode of exporting power to the mains (utility); where the DSE load share controller holds the amount of reactive power produced at a constant level. The amount of reactive power produced by the generator is irrespective of the load level or any other parameter.
The amount of reactive power produced is defined as *Maximum kVAr Level* and is set using either the *DSE Configuration Suite PC Software*, *Front Panel Running Editor*, in PLC Functions, or via Modbus messages.

The user has the option to limit the amount of reactive power the generator produces to within their power factor depending on the amount of active power produced. Regardless of this option, the generator does not produce more than its rated reactive power.

Constant Power Factor Mode

In this mode of exporting power to the mains (utility); the DSE load share controller varies the amount of reactive power produced with regards to maintaining the required power factor.
This mode allows the generator to maintain a constant export power factor if so required.
The required power factor is set using either the *DSE Configuration Suite PC Software*, *Front Panel Running Editor*, in PLC Functions, or via Modbus messages.

Voltage - Reactive Power Mode

In this mode of exporting power to the mains (utility); the DSE load share controller varies the amount of reactive power produced with regards to the *Control Curve* depending on the measured voltage.
This mode allows the generator to support the mains (utility) voltage stability by monitoring the voltage and changing the amount of reactive power produced.

Power - Power Factor Mode

In this mode of exporting power to the mains (utility); the DSE load share controller varies the amount of reactive power produced with regards to maintaining the required power factor. This power factor is derived from the averaged power using the *Control Curve.*
This mode allows the generator to support the mains (utility) stability by varying the power factor depending on the produced active power.

6.7.2.3 SIMULATION INJECTION TESTING

NOTE: For further details about the Simulation Injection Testing, refer to DSE Publication: *056-123 Simulation Injection Testing.*

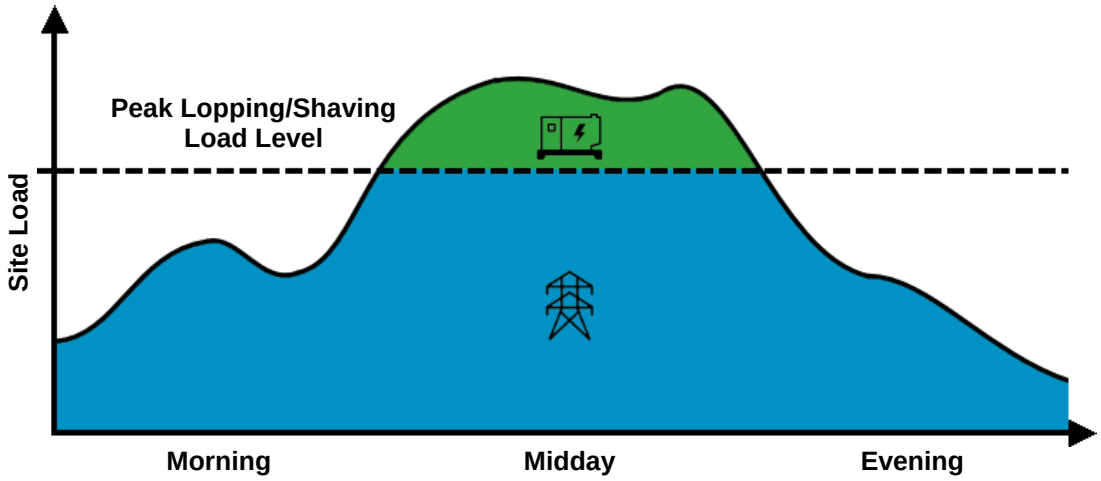
The *Simulation Injection Testing* enables the user to override the DSE module's measurements of the bus generator(s) voltage and frequency. This is provided so the various *Power Modes* for mains parallel can be tested without having to alter the main's actual voltage and frequency.
The simulation injection is controlled via the DSE Configuration Suite PC Software or through the MODBUS communication.

To use the *Simulation Injection Testing* on the DSE module, the *Voltage and Frequency Injection Testing* parameter must be set to Active from the *Running Editor*. Refer to section 9.2 entitled *'Running' Configuration Editor*. Once the *Voltage and Frequency Injection Testing* parameter is set to active, it remains active for only 1 hour. The *Voltage and Frequency Injection Testing* timer is seen from the *Running Editor*.

6.7.3 MAINS MODE (PEAK LOPPING/SHAVING)

During specified times of the day, the generator bus can be started and paralleled to the mains using the *Remote Start on Load* input to the DSEG8660 or the Scheduler. When the DSEG8660 is set to *Mains Mode,* this causes the generator bus to only start and synchronise to the mains when the load level rises above a pre-defined mains load level.

This leaves the generator bus running in *Continuous Peaking Lopping/Shaving Parallel Operation*. The amount of power produced by the generator bus whilst in parallel with the mains is constantly varied to maintain the mains at the pre-defined load level. This is the case until the *Remote Start on Load* signal is removed from the DSEG8660 module or the total site load falls below the *Peak Lopping/Shaving* level settings.

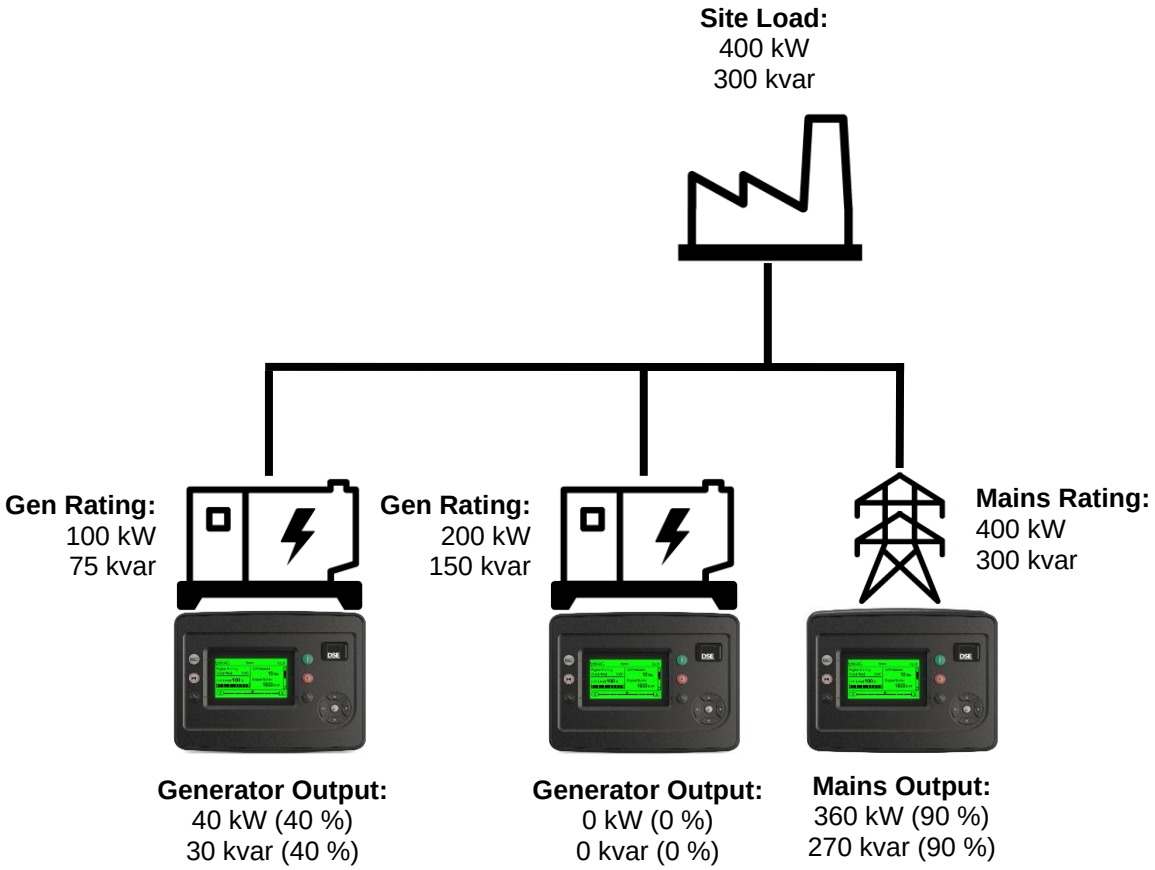


When a generator is running in parallel with the mains isochronously (zero droop) in *Continuous Parallel Operation*, the amount of power they produce must be controlled.

It is the job of the DSEG8660s to make precise changes to the amount *Active Power* (kW) and *Reactive Power* (kvar) produced by their respective generator.

The DSEG8660 knows it is going to parallel the generator with a mains supply due to commands sent down the AMSC link from the DSEG8660, as it knows the status of the mains and generator bus breaker. This information is also used to automatically bring in or drop off other generating sets as load changes if the option for *Enable Running on Load Demand* is enabled in the DSEG8660.

When the generator bus is paralleled to the mains, the DSEG8660 instructs all the DSEG8600 controllers to instruct their generator to produce an equal percentage of the generators rating to maintain the mains at the pre-set percentage. This pre-set percentage is changeable whilst the generator is running via a multitude of different interfaces. In the example below, the main's pre-set percentages are set to 80%. The generator bus is then instructed to produce the excess requirement from the load. As the excess is small, only one generator is required and produced 40 % of its kW rating and 40 % of its kvar rating. This results in the mains power being maintained at 360 kW and 270 kvar whilst only one generator produces the additional 40 kW and 30 kvar to the load.



6.8 MULTIPLE MAINS OPERATION

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

In a multiple mains system, the generator bus is controlled by more than one DSEG8660 mains controller and used to provide power to multiple loads.

If one or more of the mains supplies fail, the generator bus (controlled by DSEG8660 modules) is started and used to supply power to the multiple load change overs. If more than one mains supply has failed, the loads are transferred to the generator bus one by one in order of the *Priority* of the DSEG8660 modules.

The DSEG8600 (Multi Set) controllers share power equally on a percentage basis with the other generators in the system.

- If one mains supply returns, the DSEG8660 connected to that mains supply synchronises the generator bus with the mains and performs a no-break changeover. The generator bus continues to supply power to the remaining loads from the other change overs.
- If more than one mains supply returns at the same time, then the DSEG8660 with the highest priority takes control of the generator bus and performs a no-break changeover back to the mains supply. The remaining DSEG8660s operate in priority order, one at a time, providing no-break returns to their respective mains supplies.

If the generator bus is ‘peak-lopping’ with one mains supply, and another mains supply fails, dependent upon module configuration, the generators either:

- Continue to peak-lop as before. The load with the mains supply that has failed remains without power.
- Cease peak-lopping and backup the failed mains supply, then continue with peak lopping.

6.8.1 DSEG8660 PRIORITY

NOTE: If a DSEG8660 requests to control the generator bus (either automatically or manually) it will not be allowed to do so until the higher priority DSEG8660 and DSE8680 controllers have relinquished control over the generator bus.

Where more than one DSEG8660 controller is present, they determine which one is to take control over the generator bus. The following table shows how this priority decision is made.

Priority	Condition
HIGHEST	
	Request to run in island, not in island
	Request to run in parallel, running off load
	Request to return to mains
	Running in parallel
	Request on the mains, running on load
	Running off load
	Stop mode

Where two or more DSEG8660 controllers have the same conditions in the table above, the *Priority Numbers* of the DSEG8660 comes into effect.

6.8.2 DSEG8660 BUS/LOAD CT

NOTE: The Bus/Load CT is NOT REQUIRED in a system including only one DSEG8660 controller.

The DSEG8660 controller incorporates an optional (but recommended) extra CT measuring the size of the load or the power produced by the generator bus. Used in conjunction with the CTs measuring the amount of load on the mains supply, this CT allows the DSEG8660 to determine what portion of the load is being supplied by the generator bus.

This allows the DSEG8660 to open the bus breaker at the end of ramping when there is little or no current passing through the generator bus breaker. For example: When the generators are ramping off load.

6.9 MANUAL BUS VOLTAGE & FREQUENCY CONTROL IN ISLAND MODE

NOTE: This feature is only available on the current MKII and G Series.

NOTE: The *Manual Island Mode Bus Limits* are configurable in the DSEG8660 module. For further details of module configuration refer to DSE Publication: 057-324 *DSEG8660 Configuration Suite PC Software Manual.*

NOTE: The *Manual Bus Adjust* function must be set to active from the PLC Editor to be able to control the bus voltage and frequency from the PLC. For more information refer to DSE Publication: *057-314 Advanced PLC Software Manual* which is found on our website: www.deepseaelectronics.com

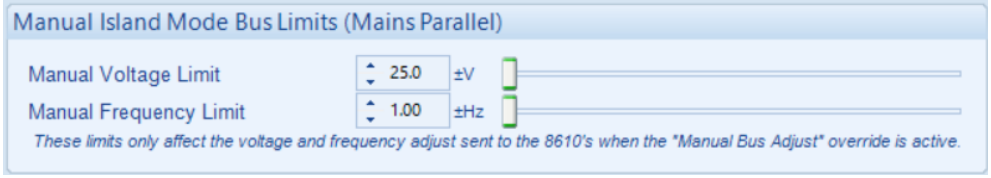
In certain applications where it is required to 'manually' synchronise the generators bus to an external source 'mains' then to manually close the mains switchgear to parallel the generators bus to the mains, the DSEG8660 provides the ability to control the bus voltage and bus frequency through the PLC Editor by using the *Bus Voltage Adjust* and the *Bus Frequency Adjust* functions. The *Manual Bus Adjust* function must be set to active from the PLC Editor for the *Bus Voltage Adjust* and the *Bus Frequency Adjust* actions take place. This feature is only applicable when the generators are running in either *Island* mode or *Manual* mode when the mains switchgear is open.

In this instance the user must configure the *Bus Voltage Adjust* and the *Bus Frequency Adjust* functions to the desired levels in the DSE module's PLC, which then act on certain conditions such as digital inputs activation.
It is also possible to control the *Bus Voltage Adjust* and the *Bus Frequency Adjust* levels through the MODBUS communication.

This operation only takes place when all the following conditions are satisfied:

- The DSEG8660 is running the generators in *Island Mode* or in *Manual Mode* with the mains switchgear open.
- In multi-mains system the DSEG8660 has the Control over the DSEG8600 (Multi Set) modules.
- The *Manual Bus Adjust* is set to active in the module.

The DSEG8660 *Manual Island Mode Bus Limits* must be configured using the DSE Configuration Suite to set the bus voltage bias control limit and the bus frequency bias control limit for the DSEG8660 so that it controls the DSEG8600 (Multi Set) generators carefully to avoid requesting a control range that the generators do not support. For instance, if one or more of the generators on the bus supports a maximum of +/-25 V change, then the *Manual Voltage Limit* in the DSEG8660's configuration must be configured to 25.0 V, similarly if one or more of the generators on the bus supports a maximum of +/-3 Hz change, then the *Manual Frequency Limit* in the DSEG8660's configuration must be configured to 3.00 Hz. In this way the DSEG8660 does not request more than what the generators are able to accept, and these limits apply on all the DSEG8600 (Multi Set) generators on the bus when the DSEG8660 is controlling them through the AMSC Link. The *Manual Voltage Limit* and *Manual Frequency Limit* parameters are shown below.



6.10 DEAD BUS SYNCHRONISING (AUTO MODE)

NOTE: For further details on Dead Bus Synchronising, refer to DSE Publication: 056-072 *Dead Bus Synchronising Training Document.*

6.10.1 BENEFIT OF SYSTEM

Generator set specifications often contain the requirement for the set to be on load within 15 seconds of a mains supply failure. This is easily achievable in single set applications. However in the current era of fuel conservation, multiple sets are often used to provide the backup power solution for many applications. This gives challenges in starting and synchronising the required sets before they can be used to power the load.

The solution to this is a longstanding one, having being used for many decades. However modern digital communications such as the DSE AMSC link has vastly improved the control and hence safety of the system operation. The solution is called *Dead Bus Synchronising*. Using *Dead Bus Synchronising*, any number of generators can be online and in parallel potentially within 15 seconds, depending upon applications and hardware used.

6.10.2 HARDWARE REQUIREMENTS

- DSEG8660 controller
- DSEG8600 (Multi Set Mode).
- DC controlled generator load switch
- Auxiliary contact to feedback generator breaker status to the DSE controller.
- External relay driven by the DSE module to isolate the supply to the AVR inside the generator's alternator.
- Speed detection using an MPU or CAN signal.

6.10.3 OPERATION

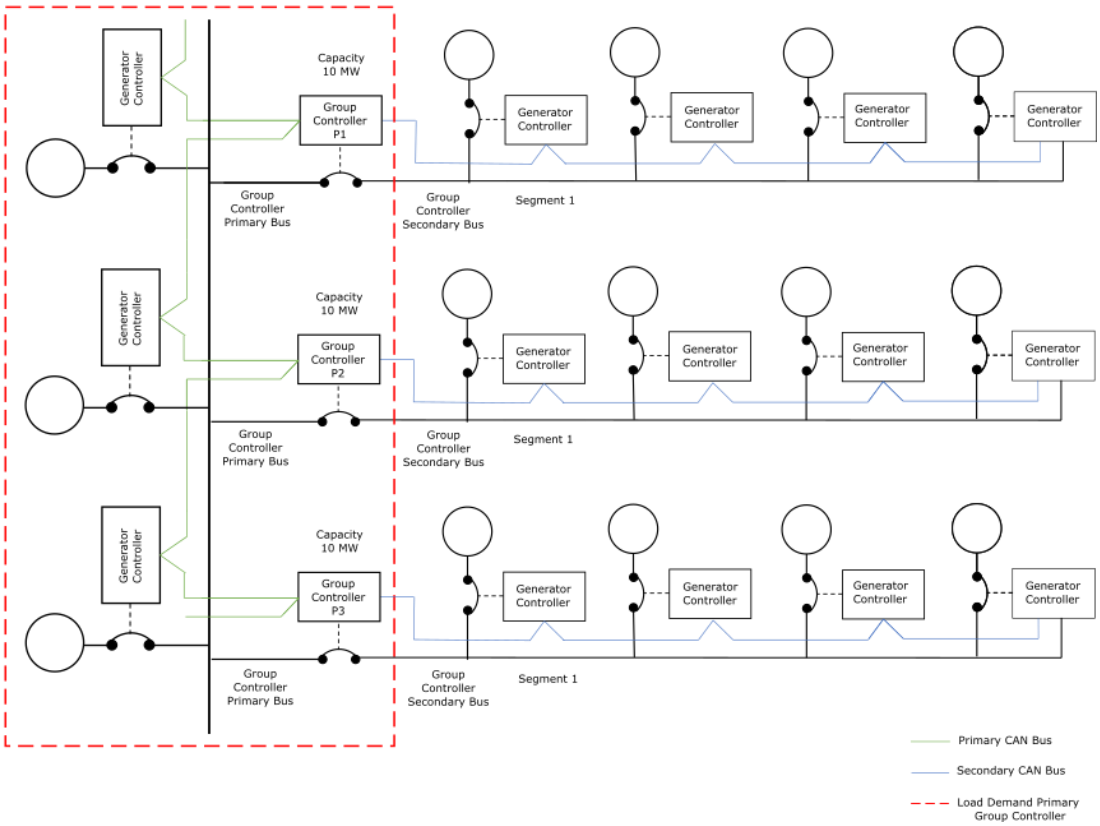
Before the generator sets are started, their load switches are closed. As there is no AC supply the load switches must be DC controlled. Next, the alternator excitation field is disabled by isolating the supply to the AVRs. The engines are all started at the same time and allowed for the *Excitation Delay* timer to reach the desired operating speed. As there is no AC supply generated, frequency cannot be used to determine engine speed, hence the requirement for an MPU of CAN speed signal.

If the engines have attained the desired engine speed within the *Excitation Delay* timer, the AVR's power supply is reconnected, enabling the excitation field and load sharing begins. The AMSC link is used to ensure all sets excite their alternators at the same time. Any generators not up to speed before the end of the *Excitation Delay* timer are instructed to open their load switches. A short time later, these sets synchronize to the bus in the traditional manner.

7 LOAD DEMAND SCHEME TOPOLOGIES

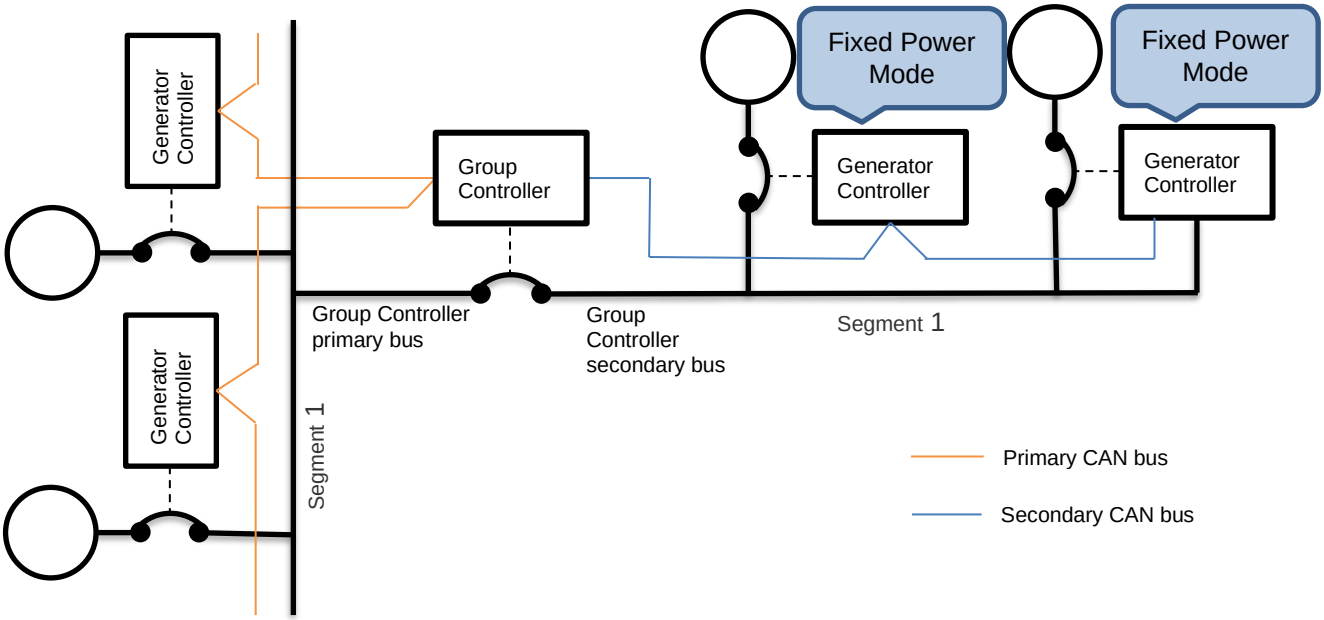
7.1 LOAD DEMAND/PRIMARY (G8660 AS A GROUP CONTROLLER)

From a load share perspective, a G8660 in Group Controller mode appears as a single Generator, transmitting a Fast Share and Arbitration Broadcast message, Slow Share and Bus Arbitration Broadcast message and Config Broadcast message like any other single Generator.
The contents of these messages are largely created from those being broadcast by the Generators on its secondary bus though there are some configuration items from the Group Controller such a its priority.



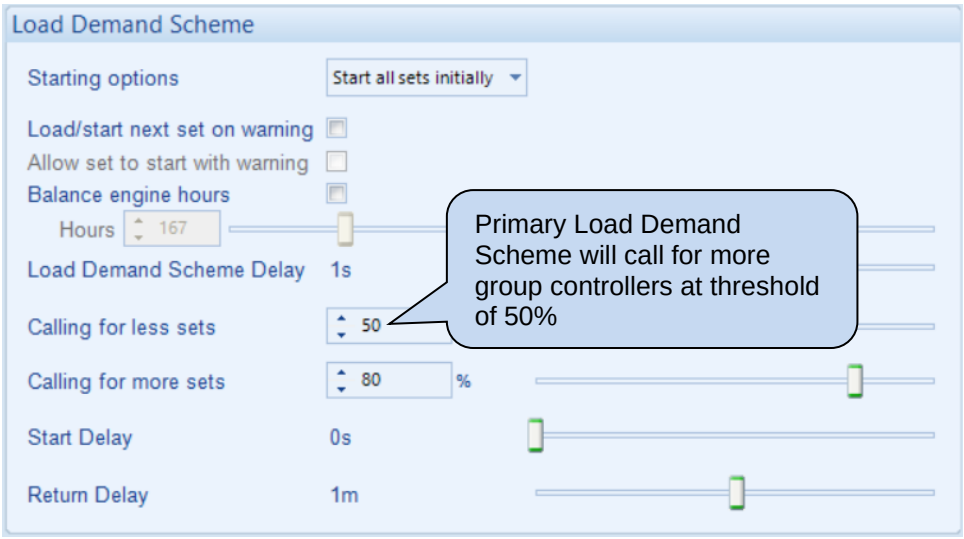
7.2 GROUP CONTROLLERS SECONDARY LOAD DEMAND SCHEME

1. A Group Controller can operate a load demand scheme on its secondary bus, allowing it to reduce the number of Generators being run though at the expense of these being more heavily loaded than they would be if all Generators on the Group were run.
2. This scheme will be invisible to the modules on the primary bus to avoid unmanageable complexity if the two interacted. To achieve this, a Group Controller must deliver the power that a single Generator would deliver in all situations, e.g., if it was delivering 500kW from 10 Generators and decides to stop 4 of them then the remaining 6 must deliver 500kW, not 300kW.
3. Whenever the Group controller has insufficient capacity running on its secondary bus to meet the sharing requirements on its primary bus it shifts all secondary generators into fixed power mode until it can resolve the problem by starting more generators. If it did not do this, then sharing would fail on the primary bus. Refer to 'Group Controllers Sharing on Primary Bus' below for details.



4. A Group Controller provides the Load Demand Scheme for its secondary bus, Generator Controllers can not be allowed to run their own scheme as this would be unaware of the complexities of being in a Group such as having to go into constant power mode to avoid being overloaded while starting additional Generators to meet an increasing load.
5. The Group Controller starts and stops Generators in a similar way to a Mains Controller that is running a Load Demand Scheme, additionally controlling whether a Generator is sharing or in fixed power mode using the Mode in the Master Control message.
6. The decision-making logic is identical to the Primary Load Demand Scheme apart from deciding to put Generators into constant power mode if necessary, to avoid overloading them while awaiting further Generators starting.

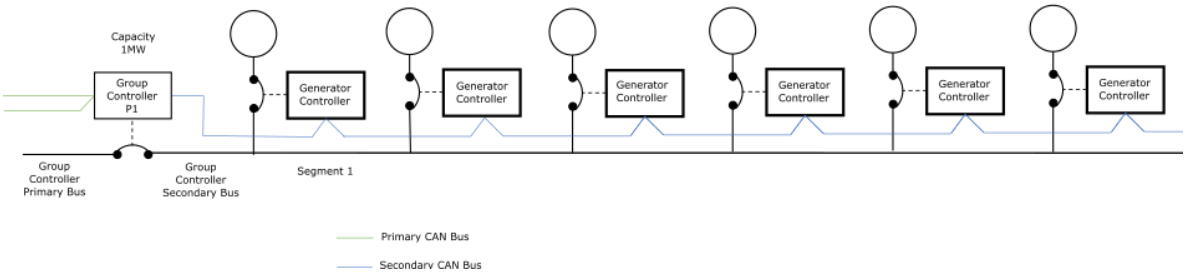
Interaction between Primary AMSC and Secondary AMSC Group Controller



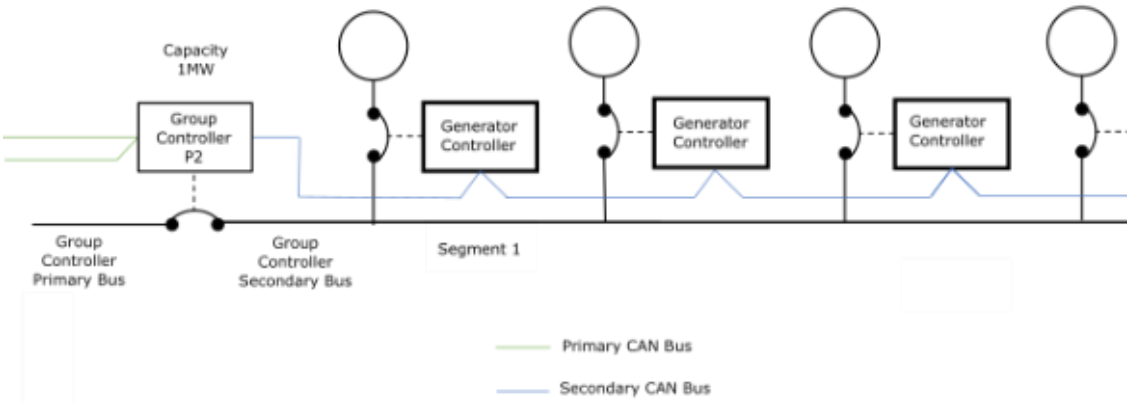
Example

Calling for more sets at 60%

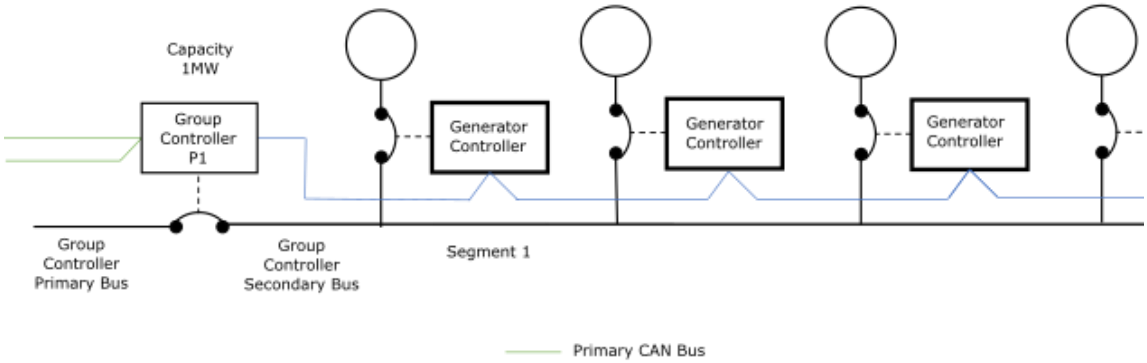
1. Each generator will join the bus once the load is above the "*calling for less sets*" threshold of 70% in the Secondary Load Demand Scheme. The highest priority generator that is not running in the sequence (determined using the *Genset Priority*) begins its *Start Delay* timer. Once this has expired, the generator joins the bus and ramps up.
   The Generator Controllers will continue to start up on P1 until 60% (600KW) is reached.



2. Group controller P2 will start its first controller and the lowest priority generator in the sequence connected to Group Controller P1 (determined using the Genset Priority) will begin its Return Delay timer. Once this has expired, the generator will ramp off and stop.
   Each generator will join Group Controllers P2 Secondary bus and each generator on P1 will begin its return delay timer and ramp off and stop.

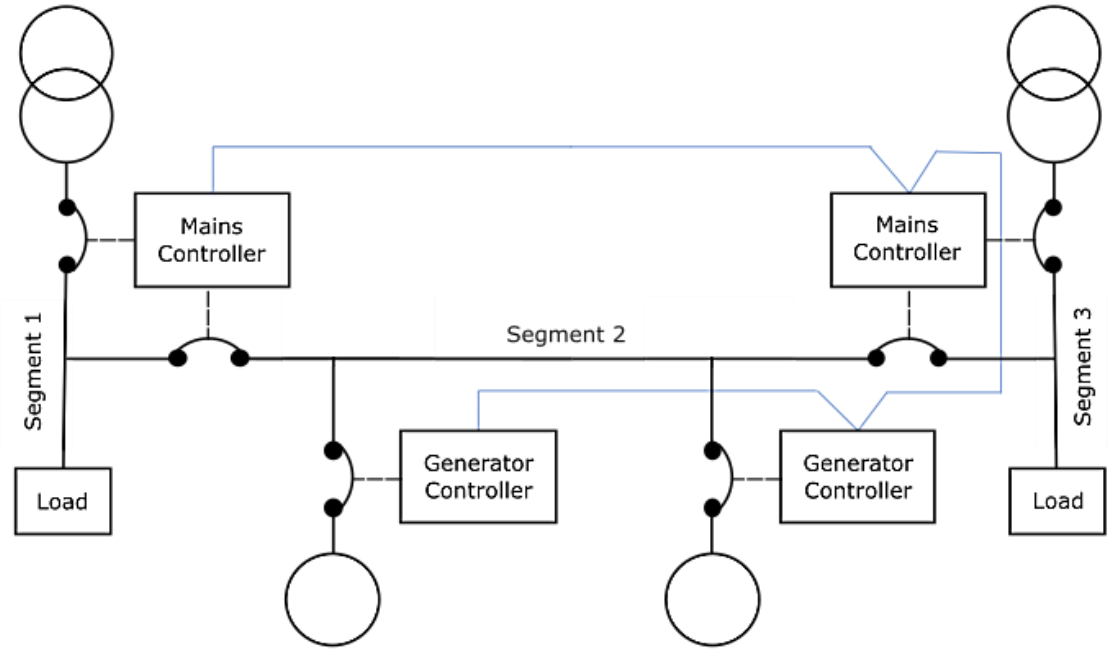


3. Group Controller P1 will then gradually drop down (3 sets) to balance with Group Controller P2.



4. It the load increases this will continue with the next Group Controller and the load will continue to balance out with all previous Group controllers.

7.3 DUAL MAINS, DUAL LOAD, GROUP OF GENERATORS SHARED BETWEEN THE MAINS CONTROLLERS

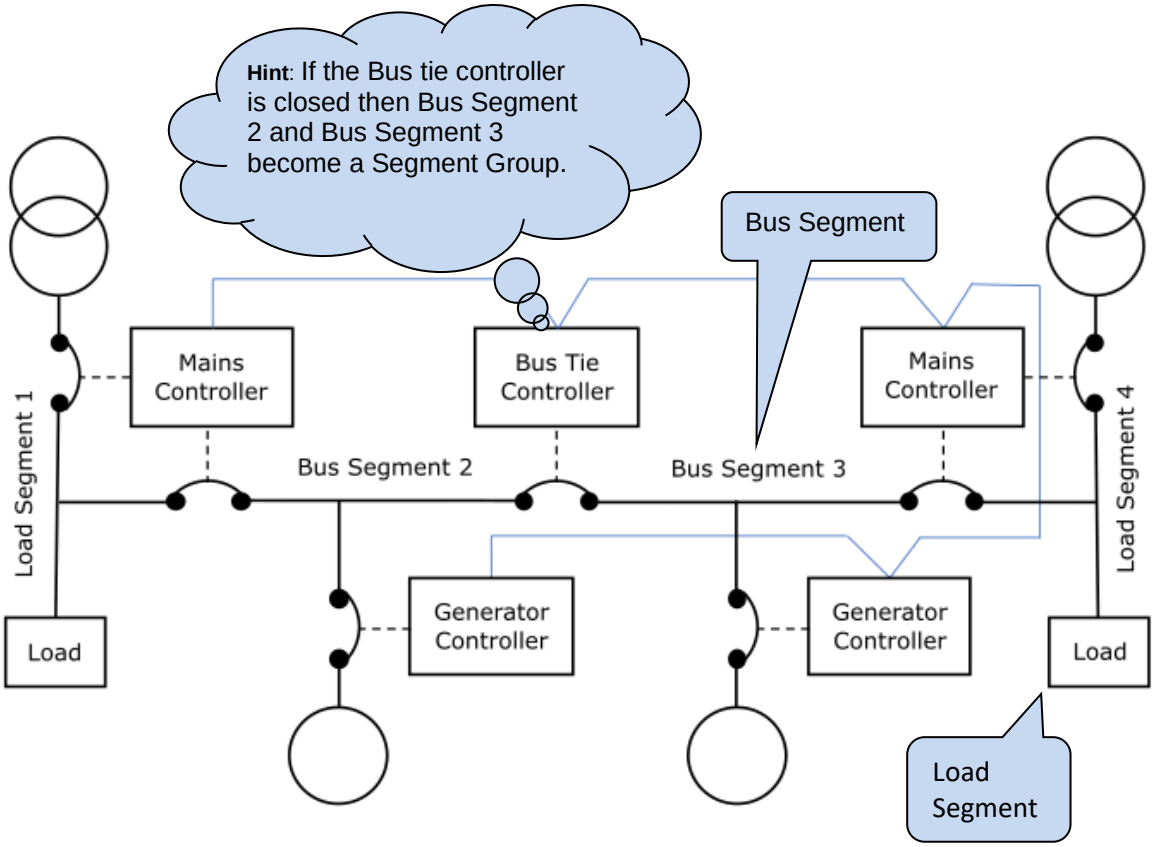


1. Only Generator, Mains and Group Controllers can be configured to this topology.
2. In this topology there are two mains supplies and two loads. One or more Generators are on a bus.
3. Bus breakers are fitted to allow the Generators to be started, synchronised, and paralleled together before connecting to the load, ensuring there is sufficient capacity to energise the load.
4. Generator Controllers in this topology provide the same control logic as in the Island Only Operation topology and this will not be repeated here, only additional logic will be described.
5. This topology is based on the control logic for the Single Mains, Single load, Group of Generators topology.
6. The following description is from the perspective of Mains Controller 1 and refers to load 1 unless otherwise stated.
7. Each Mains Controller has the same perspective as this and competes for the shared resource of the bus of generators.
8. See the Master Token Scheme below for details of the competition between Mains Controllers for the bus.
9. Only the Mains Controller that has the Master Token can control the Generators.

7.4 BUS SEGMENT AND LOAD SEGMENT NUMBERS

The Bus Segment and Load Segment numbers are used to identify Bus and Load segments.

WARNING! : The Bus Segment number and Load Segment numbers cannot be the same! This is critical for safe control!



7.5 SEGMENT GROUPS

1. When two or more segments are connected together by the closure or one or more breakers, they form a Segment Group.
2. Segment Groups are dynamic, being created, destroyed, and altered as the system operates.
3. A Load Share Scheme operates within a single Segment Group.
4. A Load Demand Scheme operates within a single Segment Group.
5. A Segment Group can have one and only one Master Token, though it may have none if no module requires one.
6. A Master Token controls one and only one Segment Group.
7. A module is considered to be in a Segment Group that contains a segment that the module is directly connected to, i.e., it is broadcasting that segment number in its Configuration Broadcast message.
8. All modules must continually perform the task of building a map of the segment groups. This is done using the segment numbers in the Configuration Broadcast message from each module and also the state of the bus breakers in the Bus Tie and Mains Controllers. A closed breaker in these modules joins two segment groups to form one larger one.

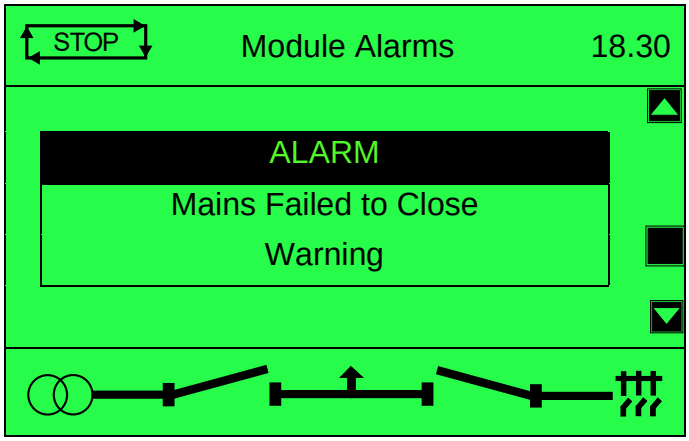
8 PROTECTIONS

8.1 ALARMS

When an alarm is active, the *Internal Audible Alarm* sounds and the *Common Alarm* output if configured, activates.

A pop-up screen will also be displayed in-front of the *Home* menu.

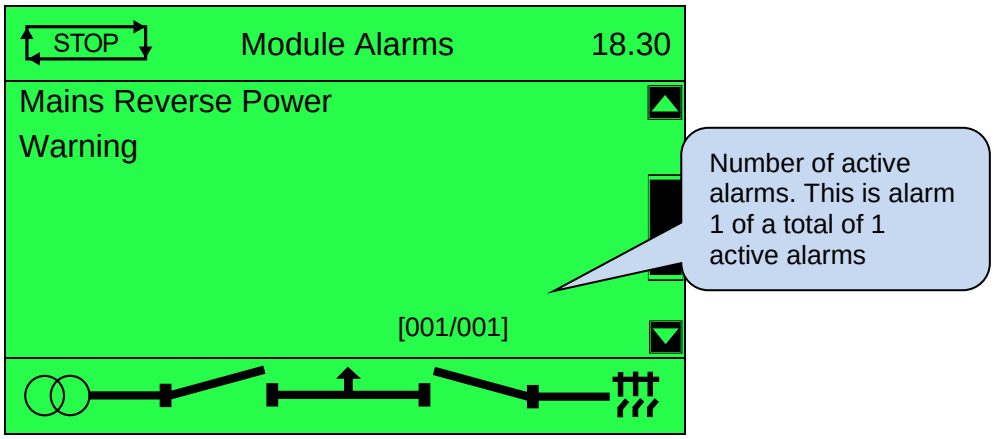
Example



Pressing the ***Tick***  button will remove the pop-up.

The audible alarm is silenced by pressing the ***Alarm Mute / Lamp Test***  button.

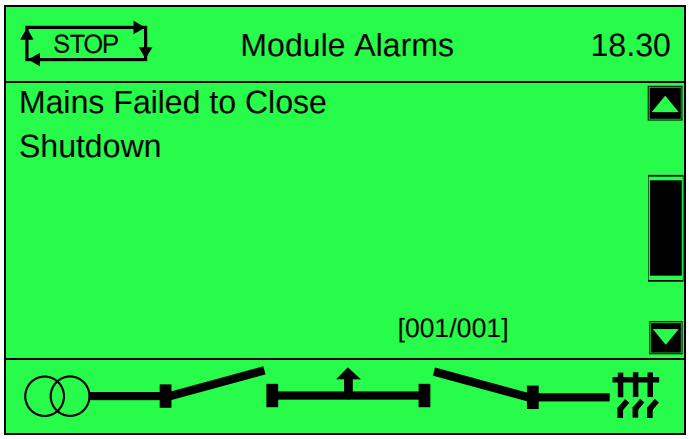
The LCD display jumps from the 'Information page' to display the Alarm Page



The LCD displays multiple alarms such as "*Mains Reverse Power*" and "*Warning*" ". These automatically scroll in the order that they occurred or press the ***Scroll***  buttons to scroll through manually.

In the event of an alarm, the LCD displays the appropriate text. If an additional alarm then occurs, the module displays the appropriate text.

Example:

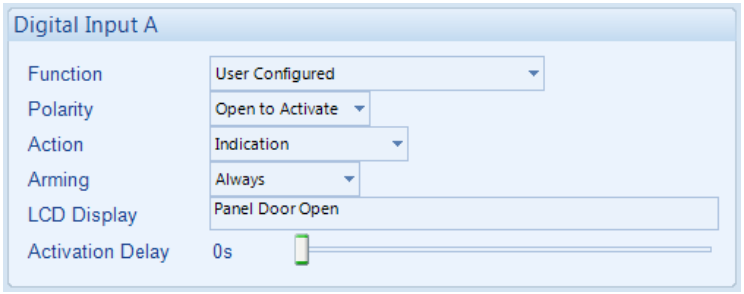

STOP
Module Alarms
18.30
Mains Failed to Close
Shutdown
[001/001]

8.2 INDICATIONS

Indications are non-critical and often status conditions which activate digital outputs.
The internal PLC allows the system designer to add functionality to the DSE module where such functions do not already exist, and this can be used to provide indication.

Example:

- Input configured for indication.
- The LCD text appears on the modules display



8.2.1 FRONT PANEL STATUS LEDS

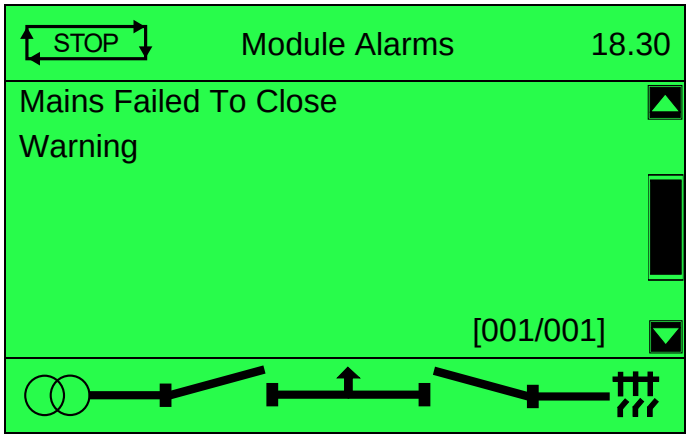
The LED indicators on the front panel adjacent to each button will illuminate to draw the operator's attention to an event that has occurred.

Button	LED Indication
Mode	Illuminated When *Auto Mode* selected
Alarm Mute / Lamp Test	Illuminated when the alarm sounder is active. Pressing will illuminate all facia LEDS (Lamp Test).
Transfer to Mains	Illuminated when a mains supply is available
Transfer to Generator/Bus	Illuminated when a generator is available to take load
Start	Flashed once every second to indicate the module is in Manual Mode, illuminated when the set is running in manual mode.
Stop	Flashes for warning alarms, Illuminated for electrical trip and shutdown alarms.

8.3 WARNING ALARMS

Warnings are non-critical alarm conditions and do not affect the operation of the engine system, they serve to draw the operator's attention to an undesirable condition.
When an alarm is active, the *Internal Audible Alarm* sounds and the *Common Alarm* output if configured, activates. A pop-up screen will also be displayed in-front of the *Home* menu.

Example:



By default, warning alarms are self-resetting when the fault condition is removed. However, enabling *All Warnings Are Latched* causes warning alarms to latch until reset manually. This is enabled using the DSE Configuration Suite in conjunction with a compatible PC.

Fault	Description
2130 ID 1 to 4 Analogue Input E to H High	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2130 had risen above the *Flexible Sensor High Pre-Alarm Trip* level.
2130 ID 1 to 4 Analogue Input E to H Low	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2130 had fallen below the *Flexible Sensor Low Pre-Alarm Trip* level.
2130 ID1 to 4 Digital Input A to H	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that a digital input configured to create a fault condition on a DSE2130 expansion module became active and the appropriate LCD message displayed.
2131 ID 1 to 4 Analogue Input A to J High	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2131 had risen above the *Flexible Sensor High Pre-Alarm Trip* level.

Continued over page…

Fault	Description
2131 ID 1 to 4 Analogue Input A to J Low	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2131 had fallen below the *Flexible Sensor Low Pre-Alarm Trip* level.
2131 ID 1 to 4 Analogue Input A to J	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that a digital input configured to create a fault condition on a DSE2131 expansion module became active and the appropriate LCD message displayed.
2133 ID 1 to 4 Analogue Input A to H High	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2133 had risen above the *Flexible Sensor High Pre-Alarm Trip* level.
2133 ID 1 to 4 Analogue Input A to H Low	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2133 had fallen below the *Flexible Sensor Low Pre-Alarm Trip* level.
Battery Detect Failure	The module detected that a battery charger connected by DSENet® had issued a *Battery Detect Failure* alarm.
Battery Failure Detection Output 1	The module detected that a battery charger connected by DSENet® had issued a *Battery Failure Detection* alarm on its Output 1.
Battery Failure Detection Output 2	The module detected that a battery charger connected by DSENet® had issued a *Battery Failure Detection* alarm on its Output 2.
Battery High Current Output 1	The module detected that a battery charger connected by DSENet® had issued a *Battery High Current* alarm on its Output 1.
Battery High Current Output 2	The module detected that a battery charger connected by DSENet® had issued a *Battery High Current* alarm on its Output 2.
Battery High Temperature Output 1	The module detected that a battery charger connected by DSENet® had issued a *Battery High Temperature* alarm on its Output 1.
Battery High Temperature Output 2	The module detected that a battery charger connected by DSENet® had issued a *Battery High Temperature* alarm on its Output 2.
Battery High Voltage IEEE 37.2 – 59 DC Overvoltage Relay	The module detected that its DC supply voltage had risen above the *Plant Battery Overvolts Warning Trip* level for the configured delay timer.

Continued over page…

Fault	Description
Battery High Voltage Output 1	The module detected that a battery charger connected by DSENet® had issued a *Battery High Voltage* alarm on its Output 1.
Battery High Voltage Output 2	The module detected that a battery charger connected by DSENet® had issued a *Battery High Voltage* alarm on its Output 2.
Battery Low Voltage IEEE 37.2 – 27 DC Undervoltage Relay	The module detected that its DC supply voltage had fallen below the *Plant Battery Undervolts Warning Trip* level for the configured delay timer.
Battery Low Voltage Output 1	The module detected that a battery charger connected by DSENet® had issued a *Battery Low Voltage* alarm on its Output 1.
Battery Low Voltage Output 2	The module detected that a battery charger connected by DSENet® had issued a *Battery Low Voltage* alarm on its Output 2.
Battery Temperature Sensor Fail Output 1	The module detected that a battery charger connected by DSENet® had issued a *Battery Temperature Fail* alarm on its Output 1.
Battery Temperature Sensor Fail Output 2	The module detected that a battery charger connected by DSENet® had issued a *Battery Temperature Fail* alarm on its Output 2.
Bus Asymmetry High	The module detected the bus voltage asymmetry had risen above the configurable *Trip* level for the configured delay timer.
Bus Over Negative Sequence	The module detected the bus voltage negative sequence had risen above the configurable *Trip* level for the configured delay timer.
Bus Over Zero Sequence	The module detected the bus voltage zero sequence had risen above the configurable *Trip* level for the configured delay timer.
Bus Under Positive Sequence	The module detected the bus voltage positive sequence had fallen below the configurable *Trip* level for the configured delay timer.
Charger Fan Locked	The module detected that a battery charger connected by DSENet® had a *Charger Failure* alarm.
Charger High Temperature	The module detected that a battery charger connected by DSENet® had a High Temperature alarm.
Charger Mains High Current	The module detected that a battery charger connected by DSENet® had a *Mains High Current* alarm.
Charger ID 0 to 3 Common Warning	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*** The module detected that a battery charger connected by DSENet® had issued a *Common Warning Alarm*.
Charger Mains High Voltage	The module detected that a battery charger connected by DSENet® had a *Mains High Voltage* alarm.
Charger Mains Low Voltage	The module detected that a battery charger connected by DSENet® had a *Mains Low Voltage* alarm.
Charger Voltage Drop Charging Cable Output 1	The module detected that a battery charger connected by DSENet® had issued a *Voltage Drop Charging Cable* alarm on its Output 1.
Charger Voltage Drop Charging Cable Output 2	The module detected that a battery charger connected by DSENet® had issued a *Voltage Drop Charging Cable* alarm on its Output 2.

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Fault	Description
Digital Input A to L	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that a digital input configured to create a fault condition became active and the appropriate LCD message is displayed.
Exp. Unit Failure	The module detected that communications to one of the DSENet® expansion modules had been lost.
Fail To Sync	If the module cannot synchronise within the time allowed by the Synchronising timer a warning is initiated. The LCD indicates *Failed To Sync*.
FRT event	**NOTE: For more details, see section 8.12 entitled *Fault Ride Through*.** The module activated the *Fault Ride Through* event
Insufficient Capacity	If the generator bus reaches full load when they are in parallel with the mains. The LCD indicates *Insufficient Capacity*.
Mains Asymmetry High	The module detected the mains voltage asymmetry had risen above the configurable *Trip* level for the configured delay timer.
Mains Decoupling High Frequency	If the module detects the mains frequency increase when in parallel with the generator(s) more than the configure value. The LCD indicates *Mains Decoupling High Frequency*.
Mains Decoupling High Voltage	If the module detects the mains voltage increase when in parallel with the generator(s) more than the configure value. The LCD indicates *Mains Decoupling High Voltage*.
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 indicates *Mains Decoupling Low Frequency.*
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 indicates *Mains Decoupling Low Voltage*.
Mains Decoupling ROCOF	If the module detects the mains frequency changing when in parallel with the generator(s) more than the configure value in a time frame. The LCD indicates *Mains Decoupling ROCOF.*
Mains Decoupling Vector Shift	If the module detects the mains phase angle changing when in parallel with the generator(s) more than the configure value in a time frame. The LCD indicates *Mains Decoupling Vector Shift.*
Mains Failed To Close	If the mains breaker fails to close, a warning is initiated. The LCD indicates *Mains Failed To Close.*
Mains Failed To Open	If the mains breaker fails to open, a warning is initiated. The LCD indicates *Mains Failed To Open.*
Mains Over Negative Sequence	The module detected the mains voltage negative sequence had risen above the configurable *Trip* level for the configured delay timer.
Mains Over Zero Sequence	The module detected the mains voltage zero sequence had risen above the configurable *Trip* level for the configured delay timer.
Mains Reverse Power IEEE C37.2 – 32 Directional Power Relay	If the module detects that the generator bus is exporting more than the configured limit, the LCD indicates *Mains Reverse Power*
Mains Under Positive Sequence	The module detected the mains voltage positive sequence had fallen below the configurable *Trip* level for the configured delay timer.

Continued over page…

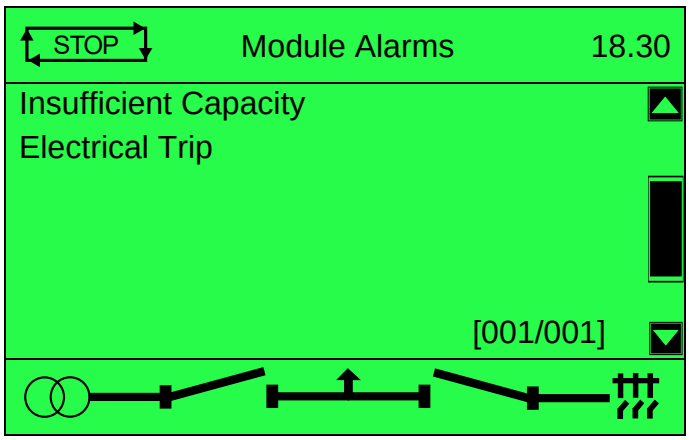
Fault	Description
AMSC Alarms Inhibited	The module detected that an input configured for *AMSC Alarms Inhibit* had become active disabling all the AMSC alarms.
AMSC 1 and 2 Failure	That module detected that the AMSC and Redudant AMSC communication failed, most likely caused by it being disconnected.
AMSC 1 Data Error	The module detected that data on the AMSC link had become corrupt, possibly caused by incorrect wiring or faulty cabling.
AMSC 1 Link Failure	That module detected that the AMSC communication failed, most likely caused by it being disconnected.
AMSC 1 Too Few Sets	That module detected that the number of modules on the AMSC was less then the configured *Minimum Modules on AMSC Link* setting.
AMSC 2 Data Error	The module detected that data on the Redundant AMSC link had become corrupt, possibly caused by incorrect wiring or faulty cabling.
AMSC 2 Link Failure	That module detected that the Redudant AMSC communication failed, most likely caused by it being disconnected.
AMSC 2 Too Few Sets	That module detected that the number of modules on the Redundant AMSC was less then the configured Minimum Modules on AMSC Link setting.

8.4 ELECTRICAL TRIP ALARMS

NOTE: The fault condition must be resolved before the alarm can be reset. If the fault condition remains, it is not possible to reset the alarm.

Electrical Trip Alarms are latching and open the bus breaker, and stop the connected generators When an alarm is active, the Internal Audible Alarm sounds and the Common Alarm output if configured, activates. A pop-up screen will also be displayed in-front of the Home menu.

Example:



Electrical Trip Alarms are latching alarms and to remove the fault, press the ***Stop/Reset Mode*** button on the module.

Fault	Description
2130 ID 1 to 4 Analogue Input E to H High	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2130 had risen above the *Flexible Sensor High Alarm Trip* level.
2130 ID 1 to 4 Analogue Input E to H Low	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2130 had fallen below the *Flexible Sensor Low Alarm Trip* level.
2130 ID1 to 4 Digital Input A to H	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that a digital input configured to create a fault condition on a DSE2130 expansion module became active and the appropriate LCD message displayed.

Continued over page…

Fault	Description
2131 ID 1 to 4 Analogue Input A to J High	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2131 had risen above the *Flexible Sensor High Alarm Trip* level.
2131 ID 1 to 4 Analogue Input A to J Low	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2131 had fallen below the *Flexible Sensor Low Alarm Trip* level.
2131 ID1 to 4 Digital Input A to J	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that a digital input configured to create a fault condition on a DSE2131 expansion module became active and the appropriate LCD message displayed.
2133 ID 1 to 4 Analogue Input A to H High	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2133 had risen above the *Flexible Sensor High Alarm Trip* level.
2133 ID 1 to 4 Analogue Input A to H Low	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*** The module detected that an analogue input value of a DSE2133 had fallen below the *Flexible Sensor Low Alarm Trip* level.
Bus Asymmetry High	The module detected the bus voltage asymmetry had risen above the configurable *Trip* level for the configured delay timer.
Bus Failed To Close	If the bus breaker fails to close, the LCD indicates *Bus Failed To Close.*
Bus Failed To Open	If the bus breaker fails to open, the LCD indicates *Bus Failed To Open.*
Bus Over Negative Sequence	The module detected the bus voltage negative sequence had risen above the configurable *Trip* level for the configured delay timer.
Bus Over Zero Sequence	The module detected the bus voltage zero sequence had risen above the configurable *Trip* level for the configured delay timer.
Bus Phase Sequence	The module detected a bus phase rotation error, an electrical trip is initiated. The LCD indicates *Bus Phase Seq Wrong*.

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Fault	Description
Bus Under Positive Sequence	The module detected the bus voltage positive sequence had fallen below the configurable *Trip* level for the configured delay timer.
Charger ID 0 to 3 Common Electrical Trip	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*** The module detected that a battery charger connected by DSENet® had issued a *Common Electrical Trip Alarm*.
Charger Failure	The module detected that a battery charger connected by DSENet® had a *Charger Failure* alarm.
Charger Fan Locked	The module detected that a battery charger connected by DSENet® had a *Charger Failure* alarm.
Charger High Temperature	The module detected that a battery charger connected by DSENet® had a *High Temperature* alarm.
Charger Input Fuse Fail	The module detected that a battery charger connected by DSENet® had an *Input Fuse Fail* alarm.
Charger Mains High Current	The module detected that a battery charger connected by DSENet® had a Mains High Current alarm.
Charger Mains High Voltage	The module detected that a battery charger connected by DSENet® had a Mains High Voltage alarm.
Charger Mains Low Voltage	The module detected that a battery charger connected by DSENet® had a Mains Low Voltage alarm.
Charger Reverse Polarity	The module detected that a battery charger connected by DSENet® had a Reverse Polarity alarm.
Charger Short Circuit	The module detected that a battery charger connected by DSENet® had a Short Circuit alarm.
Charger Short Circuit / Reverse Polarity	The module detected that a battery charger connected by DSENet® had a combined Short Circuit and Reverse Polarity alarm.
Combined Mains Decoupling	The module detected that the mains supply failed when the generator was in parallel with it.
Digital Input A to L	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*** The module detected that a digital input configured to create a fault condition became active and the appropriate LCD message is displayed.
Exp. Unit Failure	The module detected that communications to one of the DSENet® expansion modules had been lost.
Fail to Synchronise	The module failed to synchronise the generator before the *Fail to Sync Delay* timer had expired.
Insufficient Capacity	The module's governor output has reached its limit whilst attempting to control the generator to produce more kWs whilst in parallel. This indicates a fault with either the governor (including connection error), setting of SW2, or that the engine has reached its maximum capacity.
Mains Asymmetry High	The module detected the mains voltage asymmetry had risen above the configurable *Trip* level for the configured delay timer.

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Fault	Description
Mains Decoupling OF	The module detected that the mains frequency had risen above the *Mains Decoupling Over Frequency Trip* level when the generator was in parallel with the mains.
Mains Decoupling OV	The module detected that the mains voltage had risen above the *Mains Decoupling Over Voltage Trip* level when the generator was in parallel with the mains.
Mains Decoupling UF	The module detected that the mains frequency had fallen below the *Mains Decoupling Under Frequency Trip* level when the generator was in parallel with the mains.
Mains Decoupling UV	The module detected that the mains voltage had risen above the *Mains Decoupling Under Voltage Trip* level when the generator was in parallel with the mains.
Mains Over Negative Sequence	The module detected the mains voltage negative sequence had risen above the configurable *Trip* level for the configured delay timer.
Mains Over Zero Sequence	The module detected the mains voltage zero sequence had risen above the configurable *Trip* level for the configured delay timer.
Mains Phase Sequence Wrong	The module detected a mains phase rotation error, an electrical trip is initiated. The LCD indicates *Mains Phase Seq Wrong*.
Mains Reverse Power IEEE C37.2 – 32 Directional Power Relay	The module detected that the generator bus is exporting more than the configured limit, the LCD indicates *Mains Reverse Power*
Mains ROCOF	The module detected that the mains frequency had changed at a rate larger than the *Mains ROCOF Alarm Trip* level when the generator was in parallel with the mains.
Mains Under Positive Sequence	The module detected the mains voltage positive sequence had fallen below the configurable *Trip* level for the configured delay timer.
Mains Vector Shift	The module detected that the mains voltage waveform's vector had shifted more than the *Mains Vector Shift Alarm Trip* level when the generator was in parallel with the mains.
AMSC ID Error	The module detected that another module on the AMSC link had the same *GenSet AMSC ID* configured.
Invalid Units on AMSC	The module detected that another module on the AMSC link was incompatible. Check all the module firmware version numbers (under *About* | *Application Number* on the modules' displays) and ensure all are the latest version firmware. Use the DSE Configuration Suite Software to upgrade the firmware (*Tools* | *Update Firmware*) of the older modules.
AMSC 1 and 2 Failure	That module detected that the AMSC and Redudant AMSC communication failed, most likely caused by it being disconnected.
AMSC 1 Link Failure	That module detected that the AMSC communication failed, most likely caused by it being disconnected.
AMSC 1 Too Few Sets	That module detected that the number of modules on the AMSC was less then the configured *Minimum Modules on AMSC Link* setting.
AMSC 2 Link Failure	That module detected that the Redudant AMSC communication failed, most likely caused by it being disconnected.
AMSC 2 Too Few Sets	That module detected that the number of modules on the Redundant AMSC was less then the configured *Minimum Modules on AMSC Link* setting.
Out Of Sync Bus	**NOTE: For further details, refer to DSE Publication: 056-047 Out of Sync and Failed to Close Training Document.** If the module detects that the generator bus supply is not sync when the breaker is closed. The LCD indicates *Out Of Sync Bus.*

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Fault	Description
Out of Sync Mains	**NOTE: For further details, refer to DSE Publication: 056-047 Out of Sync and Failed to Close Training Document.** If the module detects that the mains supply is not sync when the breaker is closed. The LCD indicates *Out Of Sync Mains.*

8.5 MAINS DECOUPLING ALARMS

NOTE: These protections only operate only when the mains and generator bus are in parallel, it is disabled at all other times.

When the mains (utility) and the generator bus supplies are in parallel, the module monitors for a Mains failure by detecting ROCOF, Vector Shift or UV / OV /UF / OF stage 1 and 2 fault which are set in the module's configuration.

If either of these alarms operate, the module performs an electrical trip of the common generator bus, a mains failure, a warning, or an AMF. The alarm can be enabled using rest mode from the running editor. This operation must be manually reset by:

- Pressing the ***Stop/Reset Mode*** button. The generator bus load switch opens, and the generator start request is removed if it is still running and the alarm is cleared.
- Activation of a digital input configured to ***Clear Mains Decoupling Alarms*** if it has been configured.
- Pressing the ***Alarm Mute/Lamp Test*** and ***Tick*** buttons together for a small duration.

8.6 BUS SEQUENCE ALARMS

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

Zero Sequence Alarm

The alarm activates when the difference in potential between the Earth and the calculated Neutral position of a 3-wire delta exceeds the configured Zero Sequence Alarm Trip level for the configured Delay time.

Positive Sequence Alarm

The alarm activates when the *Positive Sequence* voltage falls below the configured *Positive Sequence Alarm Trip* level for the configured *Delay* time.

Negative Sequence Alarm

The alarm activates when the *Negative Sequence* voltage exceeds the configured *Negative Sequence Alarm* level for the configured *Delay* time.

Asymmetry Alarm

The alarm activates when the voltage between any two phases exceeds the configured *Asymmetry Alarm Trip* level for the configured *Delay time*.

8.7 OUT OF SYNC MAINS

An *Out of Sync Mains* alarm means that the DSEG8660 module has detected that the supplies either side of the mains breaker are not in sync when the mains breaker is closed. This is normally caused by the mains load switching device not closing quickly enough or not at all or tripping on a fault.

If the alarms activate, the module performs an electrical trip of the mains load switch and causes a mains failure event. This operation must be manually reset by:

- Pressing the ***Stop/Reset Mode*** button. The generator bus load switch opens, and the generator start request is removed if it is still running and the alarm is cleared.
- Activation of a digital input configured to ***Alarm Reset*** if it has been configured.
- To clear the *Out of Sync Mains* alarm without pressing the ***Stop/Reset Mode*** button or activating a digital input configured for *Alarm Reset.*
    - Press the **Next Page** button  to access the *Main Menu*.
    - Use the ***Scroll***  buttons and press the ***Tick***  button to access the *Alarms* page.
    - Use the ***Scroll***  buttons and press the ***Tick***  button to access the *Alarms* Reset page.
    - Press the ***Tick***  button repeatedly to cycle through the list of alarms.
    - Press the ***Next Page*** button  button to select the alarm to be reset.

8.8 MAINS SEQUENCE ALARMS

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

When the mains (utility) is available, the DSEG8660 module monitors the mains supply to detect a *Mains Asymmetry High*, or *Mains Over Negative Sequence*, or *Mains Zero Over Sequence*, or *Mains Under Positive Sequence* fault which are set in the module's configuration.

If any of these alarms operate, the module performs an electrical trip of the mains load switch and causes a mains failure event. This operation must be manually reset by:

- Pressing the ***Stop/Reset Mode*** button. The generator bus load switch opens, and the generator start request is removed if it is still running and the alarm is cleared.
- Activation of a digital input configured to ***Alarm Reset*** if it has been configured.
- To clear the *Mains Sequence* alarm without pressing the ***Stop/Reset Mode*** button or activating a digital input configured for *Alarm Reset.*
  - Press the **Next Page** button to access the *Main Menu*.
  - Use the ***Scroll*** buttons and press the ***Tick*** button to access the *Alarms* page.
  - Use the ***Scroll*** buttons and press the ***Tick*** button to access the *Alarms* Reset page.
  - Press the ***Tick*** button repeatedly to cycle through the list of alarms.
  - Press the ***Next Page*** button button to select the alarm to be reset.

8.9 MAINS VOLTAGE ALARMS

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

When the mains (utility) is available, the DSEG8660 module monitors the mains supply to detect a Mains Under Frequency or Mains Over Voltage in the event of the Mains Voltage falling below or above the configured level. The alarm is reset, and the Mains is considered within limits when the Mains Voltage rises above the configured *Under Voltage or below the Over Voltage Return* level.

If any of these alarms operate, the module performs an electrical trip of the mains load switch and causes a mains failure event. This operation must be manually reset by:

- Pressing the ***Stop/Reset Mode*** button. The generator bus load switch opens, and the generator start request is removed if it is still running and the alarm is cleared.
- Activation of a digital input configured to ***Alarm Reset*** if it has been configured.
- To clear the *Mains Sequence* alarm without pressing the ***Stop/Reset Mode*** button or activating a digital input configured for *Alarm Reset.*

8.10 MAINS FREQUENCY ALARMS

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

When the mains (utility) is available, the DSEG8660 module monitors the mains supply to detect a Mains Under Frequency or Mains Over Frequency in the event of the Mains frequency falling below or above the configured *Trip* value. The *Trip* value is adjustable to suit the application. The alarm is reset, and the Mains is considered within limits when the Mains frequency rises above the configured *Under Frequency or below the Over frequency Return* level.

If any of these alarms operate, the module performs a mains failure event. This operation must be manually reset by:

- Pressing the ***Stop/Reset Mode*** button. The generator bus load switch opens, and the generator start request is removed if it is still running and the alarm is cleared.
- Activation of a digital input configured to ***Alarm Reset*** if it has been configured.
- To clear the *Mains Sequence* alarm without pressing the ***Stop/Reset Mode*** button or activating a digital input configured for *Alarm Reset.*

8.11 CURRENT ALARMS

NOTE: For further details of module configuration, refer to DSE Publication: 057-324 DSEG8660 Configuration Suite PC Software Manual.

Overcurrent Alarm

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

If the Over Current IDMT Alarm is enabled, the controller begins following the IDMT 'curve' when the current on any phase passes the Trip setting.

If the *Immediate Warning* is enabled, the controller generates a *warning alarm* as soon as the *Trip* level is reached.

Short Circuit Alarm

If the Short Circuit Alarm is enabled, the controller begins following the IDMT 'curve' when the current on any phase passes the Trip setting.

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

If any of these alarms operate, the module performs an electrical trip of the mains load switch and causes a mains failure event. This operation must be manually reset by:

- Pressing the ***Stop/Reset Mode*** button. The generator bus load switch opens, and the generator start request is removed if it is still running and the alarm is cleared.
- Activation of a digital input configured to ***Alarm Reset*** if it has been configured.
- To clear the *Short Circuit* alarm without pressing the ***Stop/Reset Mode*** button or activating a digital input configured for *Alarm Reset.*

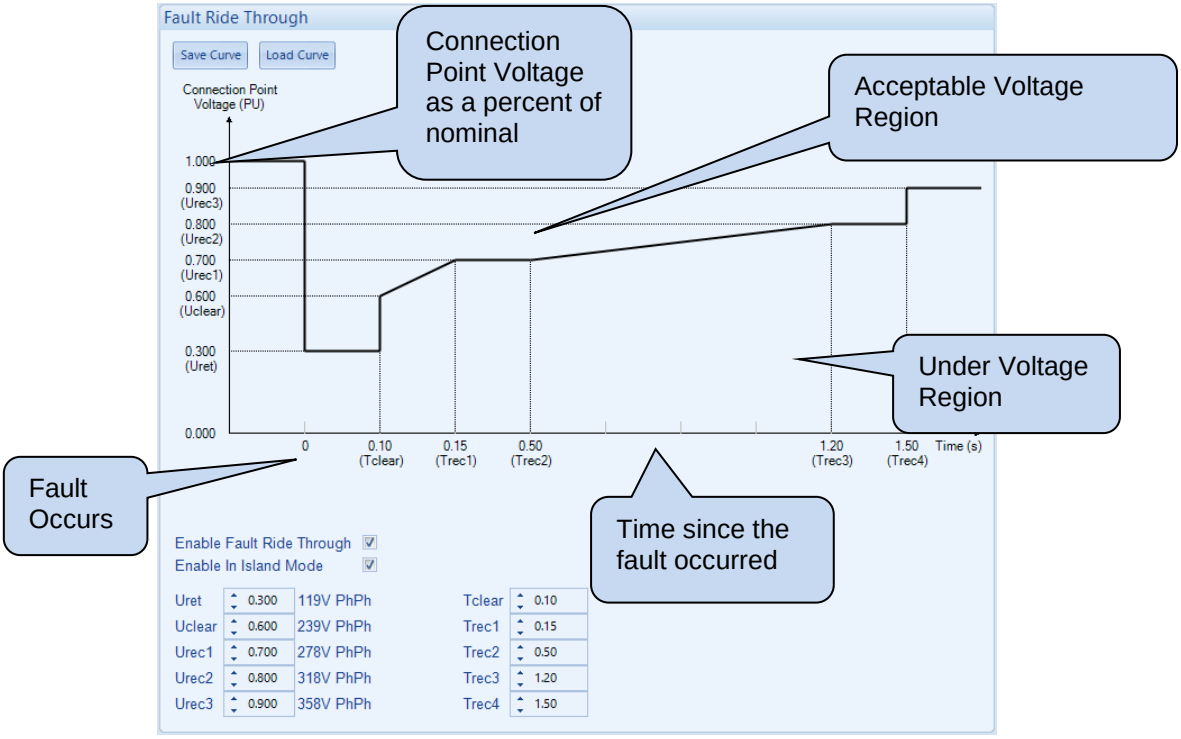
8.12 FAULT RIDE THROUGH

CAUTION! Care MUST be taken during configuration of the *Fault Ride Through* function as prolonged time in parallel with a failed mains might cause a substantial damage to the generators. For guidance on how to configure the *Fault Ride Through* function, refer to the relevant standards for paralleling with the mains.

NOTE: Depending on module configuration, *Fault Ride Through* function operates when the generators are in parallel with the mains or when they are running in island. For further details of module configuration, refer to DSE Publication:
057-324 DSEG8660 Configuration Suite PC Software Manual.

The *Fault Ride Through* function is applicable for generators in parallel with the mains and generators that are paralleling with each other to supply critical power distribution networks. The *Fault Ride Through* function prevents the generators bus disconnecting from the grid if the voltage momentarily decreases due to faults on the distribution network. This is achieved by using a curve that is formed from a sequence of *Connection Point Voltages* which increase at consecutive time intervals. This is done to enable the network voltage to recover over time after a fault has occurred and been cleared. If the generators bus (and others) were to trip during a momentary fault, after the fault cleared the amount of available power may not be enough to supply the demand. This would cause further protections to activate (such as under frequency) resulting in more generation tripping, leading to a power outage.

When the *Fault Ride Through* function is enabled and the mains voltage falls below the *Urec3* level, the *FRT Event* alarm activates to indicate a *Fault Ride Through* event is active. During a *Fault Ride Through* event the *Mains Low Voltage* alarm conditions are ignored if the voltage level stays above the *Fault Ride Through* curve (within the *Acceptable Voltage Region*). If the voltage falls below the curve, the module alarms are enabled which may result in an disconnection due to the mains decoupling alarm. The *Fault Ride Through* event is cleared when the *Trec4* timer expires, and the voltage rises above the *Urec3* level. If the voltage does not rise above *Urec3* when the *Trec4* time expires, the *FRT Event* alarm remains active and does not clear. During this period all the alarms are no longer ignored until the voltage raises above the *Urec3* and another *FRT event* condition occurs.



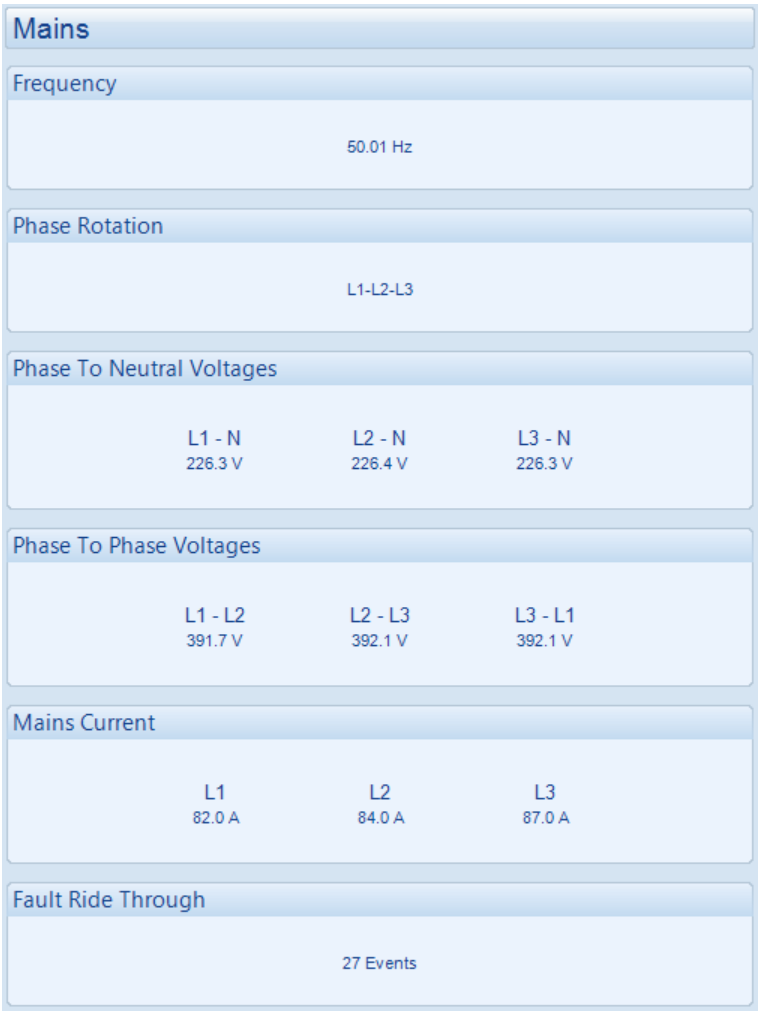
The *Connection Point Voltages* (*Uret*, *Uclear*, *Urec1*, *Urec2*, *Urec3*) and time intervals (*Tclear*, *Trec1*, *Trec2*, *Trec3*, *Trec4*) are configured in the *Fault Ride Through* section of the module's configuration. For guidance on how to configure these settings, refer to the relevant standards for *Fault Ride Through* protection which are normally governed by mains parallel standards.

When the *Fault Ride Through* function activates, the following *Auxiliary Mains Fail* and *Electrical Trip* alarms are also ignored to prevent the generators bus tripping:

- *Under Voltage*
- *Over Voltage*
- *Under Frequency*
- *Over Frequency*
- *Mains Decoupling Voltage & Frequency Stage Alarms*
- *Voltage Symmetry*
- *Zero Sequence*
- *Negative Sequence*
- *Positive Sequence*
- *Phase Rotation*

The *Warning* alarms are NOT ignored during the *Fault Ride Through* event.

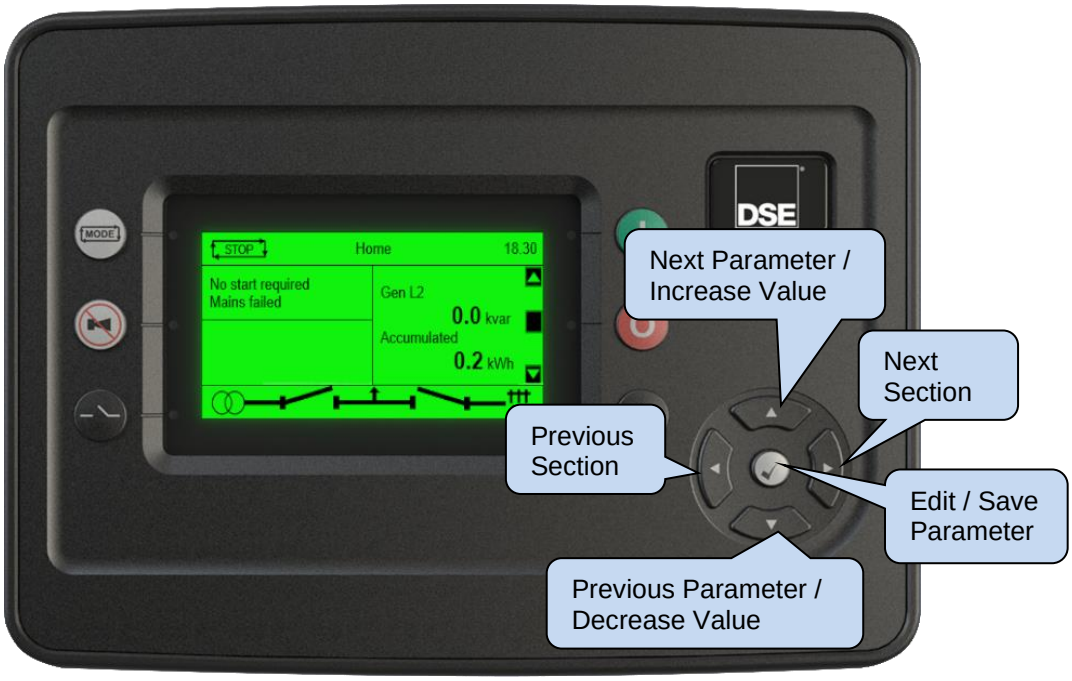
The module records of the number of times the *Fault Ride Through* event has occurred with an inbuilt counter. The module increments this counter every time it activates the *Fault Ride Through* feature. This counter is accessed using the SCADA section of the DSE Configuration Suite Software, under the *Bus* section's *Fault Ride Through*. The *Fault Ride Through Events* counter is resettable from the *Accumulated Instrumentation* in the SCADA's *Maintenance* section.



9 FRONT PANEL CONFIGURATION

This configuration mode allows the operator to fully configure the module through its display without the use of the DSE Configuration Suite PC Software.

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



9.1 FRONT PANEL EDTIOR

9.1.1 ACCESSING THE FRONT PANEL EDITOR

NOTE: More comprehensive module configuration is possible via PC configuration software. For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite PC Software Manual.*

NOTE: Depending upon module configuration, some parameters in the Main Editor may not be available. For more information refer to DSE publication *057-324 DSEG8660 Configuration Suite PC Software Manual* available from www.deepseaelectronics.com

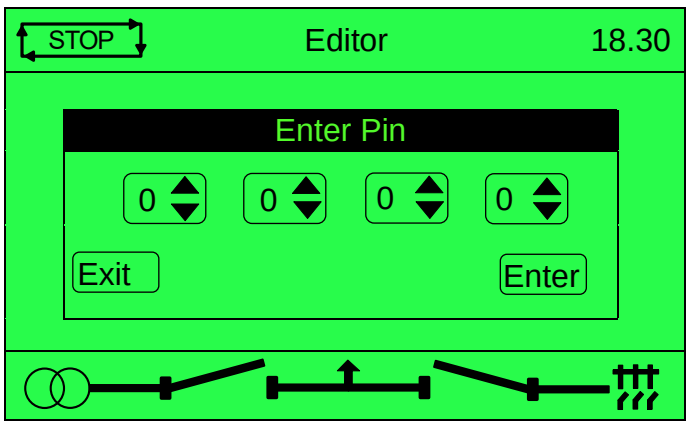
- Ensure the engine is at rest and the module by pressing the ***Stop/Reset Mode*** button.
- Press the Press the ***Left*** button followed by either the ***Up*** or ***Down*** buttons or the ***Right*** or ***Left*** buttons to locate the *Editor* page.

9.1.2 ENTERING PIN

NOTE: The PIN is not set by DSE when the module leaves the factory. If the module has a PIN code set, the generator supplier has entered this. Contact the generator supplier if the code is required. If the code has been 'lost' or 'forgotten', the module must be returned to the DSE factory to have the PIN removed. A charge is made for this procedure. This procedure cannot be performed away from the DSE factory.

NOTE: The PIN is automatically reset when the editor is exited manually or when the *Page Timer* expires (default 5 min) to ensure security.

- If a module security PIN has been set, the PIN request is then shown.



- Press the ***Tick***  button, the first '#' changes to '0'. Press the ***Up*** or ***Down***  buttons to adjust it to the correct value.

- Press the ***Right***  button when the first digit is correctly entered. The digit previously entered now shows as '#' for security.

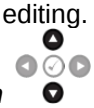
- Repeat this process for the other digits of the PIN number. Press the ***Left***  button to move back to adjust one of the previous digits.

- When the ***Tick***  button is pressed after editing the final PIN digit, the PIN is checked for validity. If the number is not correct, the PIN must be re-entered.

- If the PIN has been successfully entered (or the module PIN has not been enabled), the editor is displayed.

9.1.3 EDITING A PARAMETER

NOTE: Pressing and holding the *Menu Navigation*  **buttons provides the auto-repeat functionality. Values can be changed quickly by holding the navigation buttons for a prolonged period.**

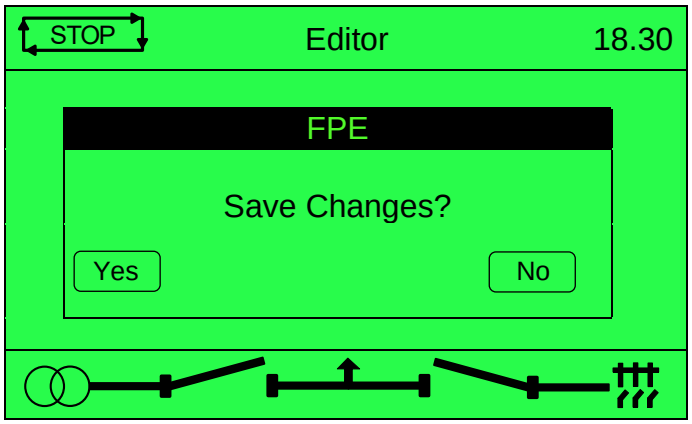
- Press the ***Right*** or ***Left***  buttons to cycle to the section to view/change.
- Press the ***Up*** or ***Down***  buttons to select the parameter to view/change within the currently selected section.
- To edit the parameter, press the ***Tick***  button to enter edit mode. The parameter is highlighted to indicate editing.
- Press the ***Up*** or ***Down***  buttons or ***Right*** or ***Left***  buttons to change the parameter to the required value.

- Press the ***Tick***  button to save the value. The parameter ceases flashing to indicate that it has been saved.

9.1.4 EXITING THE FRONT PANEL EDITOR

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

- Press the ***Right*** or ***Left*** buttons to select *Yes* or *No*
- Press and hold the ***Tick*** button to exit the editor and save the changes.



9.1.5 MAIN CONFIGURATION EDITOR PARAMETERS

Section	Parameter As Shown On Display	Values
Display	Contrast	0%
	Language	English, Other.
	Current Date and Time	DD:MM:YY, hh:mm:ss
Alt Config	Default Config	Default Config / Alternative Config
Bus	Start Delay On Load	0 h 0 m 0 s
	Battery Under Voltage Warning	Active / Inactive
	Battery Under Voltage Warning Delay	0 h 0 m 0 s
	Battery Under Voltage Warning	0.0 V
	Battery Over Voltage Warning	Active / Inactive
	Battery Over Voltage Warning Delay	0 h 0 m 0 s
	Battery Over Voltage Warning	0.0 V
	Load Level For More Sets	0 %
	Load Level For Less Sets	0 %
	Ramp Up Rate	0.0 %
	Ramp Down Rate	0.0 %
	Bus Over Zero Seq Volts	Active / Inactive
	Bus Over Zero Seq Volts	0.0 V
	Bus Under Pos Seq Volts	Active / Inactive
	Bus Under Pos Seq Volts	0.0 V
	Bus Over Neg Seq Volts	Active / Inactive
	Bus Over Neg Seq Volts	0.0 V
	Bus Asymmetry High	Active / Inactive
	Bus Asymmetry High	0.0 V

Continued over page...

Section	Parameter As Shown On Display	Values
Mains	Under Voltage Trip	0 V
	Over Voltage Trip	0 V
	Under Frequency Trip	0 Hz
	Over Frequency Trip	0 Hz
	Transient Delay	0.0 s
	CT Primary	0 A Power Cycle After Exit
	CT Secondary	0 A Power Cycle After Exit
	Full kW Rating	0 kW
	Full kVar Rating	0 kvar
	Mains Over Zero Seq Volt	Active / Inactive
	Mains Over Zero Seq Volt	0 V
	Mains Under Pos Seq Volt	Active / Inactive
	Mains Under Pos Seq Volt	0 V
	Mains Over Neg Seq Volt	Active / Inactive
	Mains Over Neg Seq Volt	0 V
	Mains Asymmetry High	Active / Inactive
	Mains Asymmetry High	0 V
Timers	LCD Page Delay	0 h 0 m 0 s
	LCD Scroll Delay	0 h 0 m 0 s
	Engine Pre Heat Timer	0 h 0 m 0 s
	Engine Post Heat Timer	0 h 0 m 0 s
	Engine Cranking	0 m 0 s
	Engine Cranking Rest	0 m 0 s
	Engine Safety On Delay	0 m 0 s
	Engine Smoke Limiting	0 m 0 s
	Engine Smoke Limiting Off	0 m 0 s
	Engine Warming	0 h 0 m 0 s
	Engine Cooling	0 h 0 m 0 s
	Engine Overspeed Overshoot	0 m 0 s
	Engine Fail To Stop Delay	0 m 0 s
	Battery Under Voltage Warning Delay	0 h 0 m 0 s
	Battery Over Voltage Warning Delay	0 h 0 m 0 s
	Return Delay	0 h 0 m 0 s
	Generator Transient Delay	0 s
	Mains Transient Delay	0 s
	Mains Transfer Time	0 s
	Mains Over Zero Seq Volt Delay	0.0 s
	Mains Under Pos Seq Volt Delay	0.0 s
	Mains Over Neg Seq Volts Delay	0.0 s
	Mains Asymmetry High Delay	0.0 s
	Gen Over Zero Seq Volt Delay	0.0 s
	Gen Under Pos Seq Volt Delay	0.0 s
	Gen Over Neg Seq Volts Delay	0.0 s
	Gen Asymmetry High Delay	0.0 s
Schedule	Schedule	Active / Inactive
	Schedule Bank 1 Period	Weekly / Monthly,
	Island / Parallel / Off Load / Auto Start Inhibit, Week, Start Time, Run Time, and Day. Selection (1 to 8)	Press the ***Tick*** ✓ button to begin editing then up or down when selecting the different parameters.
	Schedule Bank 2 Period	Weekly / Monthly,
	Island / Parallel / Off Load / Auto Start Inhibit, Week, Start Time, Run Time, and Day. Selection (1 to 8)	Press the ***Tick*** ✓ button to begin editing then up or down when selecting the different parameters.

9.2 'RUNNING' CONFIGURATION EDITOR

9.2.1 ACCESSING THE 'RUNNING' CONFIGURATION EDITOR

NOTE: Depending upon module configuration, some parameters in the 'Running' Editor may not be available. For more information refer to DSE publication *057-324 DSEG8660 Configuration Suite PC Software Manual* available from www.deepseaelectronics.com

- The *'Running' Configuration Editor* is accessible without stopping the module. All protections remain active whilst using the ''*Running' Configuration Editor*.
- Press the ***Next Page***  button to access the Main Menu page.
- Press the Press the ***Previous Page***  button followed by either the ***Scroll***  buttons or the

  Next or ***Previous Page***  buttons to locate the *'Running' Configuration Editor.*

9.2.2 EDITING A PARAMETER

NOTE: Pressing and holding the *Menu Navigation* buttons provides the auto-repeat functionality. Values can be changed quickly by holding the navigation buttons for a prolonged period.

- Press the ***Next*** or ***Previous Page***  buttons to cycle to the section to view/change.
- Press the ***Scroll***  buttons to select the parameter to view/change within the currently selected section.
- To edit the parameter, press the ***Tick***  button to enter edit mode. The parameter begins to flash to indicate editing.
- Press the ***Scroll***  buttons to change the parameter to the required value.
- Press the ***Tick***  button to save the value. The parameter ceases flashing to indicate that it has been saved.

9.2.3 EXITING THE 'RUNNING' CONFIGURATION EDITOR

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

- Press the ***Previous Page***  button to exit the editor and save the changes.

9.2.4 'RUNNING' CONFIGURATION EDITOR PARAMETERS

Section	Parameter As Shown On Display	Values
Display Settings	Contrast	75 %
	Units Pressure	kPa, bar, psi
	Units Temperature	°C, ° F
	Units Volume	Litres. Imp gal. Us gal
	Language	English, Other
Synchronising	Commissioning Screen	Active / Inactive
	Override Starting Alarms	Active / Inactive
	Voltage Adjust (Manual Mode Only With Gen Open)	0 %
	Frequency Adjust (Manual Mode Only With Gen Open)	0 %
Load Control	Injection Port	Active / Inactive
	Mains Decoupling Test Mode	Active / Inactive
	Power Control Mode	Constant Power / Frequency-Power / Voltage-Power
	Load Parallel Power	0 %
	kVAr Control Mode	Constant Power Factor / Voltage-Reactive Power / Power-Power Factor / Constant Reactive Power
	Load Parallel kVArs	0 %
	Load Parallel PF	0.00 pf
	Governor Droop Offset	0%
	Governor Ramp Rate	0%
	AVR Droop Offset	0%
	AVR Ramp Rate	0%
	Load Priority	1-64

10 COMMISSIONING

10.1 BASIC CHECKS

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.

Check all mechanical parts are fitted correctly and that all electrical connections (including earths) are good. The unit **DC** supply is fused and connected to the battery and that it is of the correct polarity.

Check the operation of the AMSC Link. Use the DSE Configuration Suite to check this in the *SCADA* | *BUS* | *AMSC Link* page. Verify the number of *Set On The Bus* is equal to that of the number of DSEG8600 (Multi Set) modules.

Ensure all DSEG8600 (Multi Set) module in the system has been fully commissioned using the DSE "Four Steps to Successful Synchronising". For more information, see section 10.2 entitled *DSE 4 Steps to Successful Synchronising*.

Place the DSEG8660 module into ***Stop/Reset Mode***  . Place the DSEG8600 (Multi Set) into ***Auto Mode***  . Initiate a start request by pressing the ***Manual Mode***  followed by the ***Start***  button on the DSEG8660 module. The DSEG8600 (Multi Set) module starts upon receipt of the AMSC start request. The generator bus remains off load so long as the mains supply is healthy and on load.

Place the DSEG8660 module into ***Stop/Reset Mode***  . The generator bus switch opens and the AMSC start request is removed from the DSEG8600 (Multi Set).

Set the modules internal clock/calendar to ensure correct operation of the scheduler and event logging functions. For details of this procedure, see section 9 entitled *Front Panel Configuration*

If, despite repeated checking of the connections between the controller and the customer's system, satisfactory operation cannot be achieved, then the customer is requested to the DSE Technical Support Department

International Tel: +44 (0) 1723 890099
E-mail: support@deepseaelectronics.com
Website: www.deepseaelectronics.com

10.2 DSE 4 STEPS TO SUCCESSFUL SYNCHRONISING

NOTE: The DSE 4 Steps To Successful Synchronising must be performed on the load sharing controllers. Steps 1, 2, 3 & 4 are to be performed on every DSEG8600 (Multi Set) in the system, whereas Steps 2, 3 & 4 are to be performed on every controller.

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 *DSE 4 Steps* **must** be followed before any parallel operation is attempted.

The following information covers the DSE 4 Steps to Successful Synchronising in full detail and must be completed on all generators in the system.

The full video presentation of the *4 Steps* is available on the DSE website. www.deepseaelectronics.com. Registration on the website is required. This is free of charge, along with all other downloads.

10.2.1 CONTROL (DSEG8600)

NOTE: Step 1 is only applicable to DSEG8600 controllers.

CAUTION!: Failure to perform the *Control* steps results in poor control over the engine and alternator. This causes long and unstable synchronising as well as unstable kW and kvar load sharing.

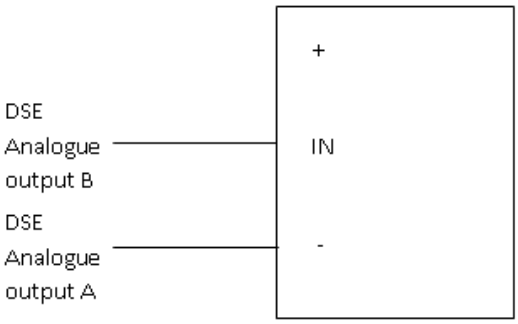
NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

10.2.1.1 DETERMINING CONNECTIONS AND SETTINGS FOR GOVERNORS

Setting up the Governor (Adjustment of SW1 and SW2)

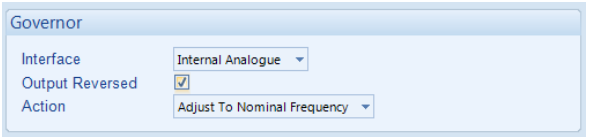
Before You Start

1. Ensure that the generator is connected to a **DEAD BUS BAR WITH NO LOADS** connected.
2. With the generator breaker open, set the generator to run at the **Nominal Frequency** without the DSE module connected to the Governor. To achieve this, you will have to adjust the settings on the governor.
3. Connect the DSE module to the Governor once completed. The DSE controller connects only to the "-" and "IN" terminals and provides the varying DC voltage to simulate the turning of a potentiometer. The Analogue output terminals of the DSE controller are connected as follows. Note that the "+" terminal of the governor is left unconnected.



Adjustment of Governor SW1

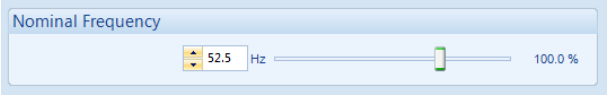
4. Start the generator and ensure that the breaker is left open.
5. Check the direction of drive by increasing and decreasing SW1. If the frequency increases whilst SW1 is being decreased tick the option 'Output Reversed'. If moving SW1 does not change the frequency, check the wiring to the governor for faults.



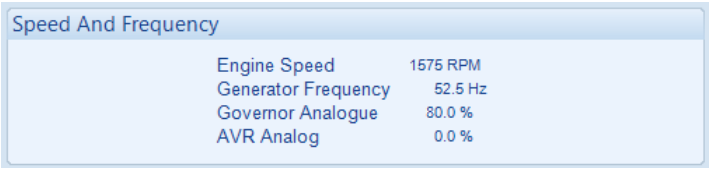
6. Adjust the SW1 setting for the Governor until the generator runs at **Nominal Frequency (50 Hz or 60 Hz)**
7. Stop the generator. SW1 is now complete and needs to be left alone.

Adjustment of Governor SW2

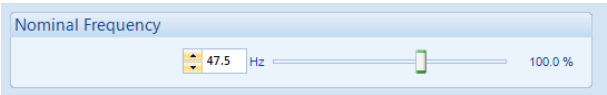
8. Increase the setting of the Nominal Frequency by **2.5 Hz** (52.5 Hz or 62.5 Hz)



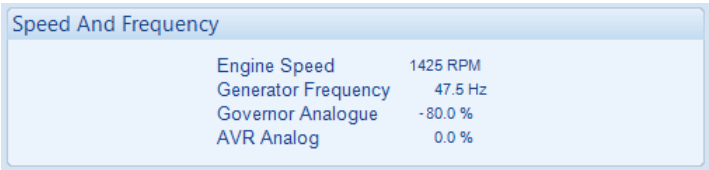
9. Start the generator. With the breaker open the generator will run at setting of SW1 (50 Hz or 60 Hz).
10. Close the generator breaker onto a **DEAD BUS BAR WITH NO LOADS** connected. The generator frequency shall start to increase towards the new Nominal Frequency setting (52.5 Hz or 62.5 Hz) however it may not achieve this.
11. Adjust SW2 to allow the frequency to increase to the new Nominal Frequency (52.5 Hz or 62.5 Hz)
12. Keep adjusting SW2 further to ensure Governor Drive reads within **75% to 85%**, the sign of the drive (+ or - percentage) does not matter.



13. Stop the Generator
14. Decrease the setting of the Nominal Frequency by **2.5 Hz** (47.5 Hz or 57.5 Hz)



15. Start the generator. With the breaker open the generator will run at setting of SW1 (50 Hz or 60 Hz).
16. Close the generator breaker onto a **DEAD BUS BAR WITH NO LOADS** connected. The generator frequency shall start to decrease towards the new Nominal Frequency (47.5 Hz or 57.5 Hz).
17. SW2 is then adjusted further to ensure Governor Drive reads within **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. Note that any change made to the lower percentage will be the same for the upper percentage. For example, if the lower percentages from 70% to 75%, the upper will increase from 80% to 85%.



18. Change the setting of the Nominal Frequency back to the actual Nominal Frequency (50 Hz or 60 Hz).

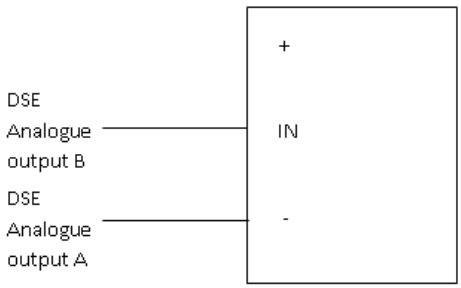
10.2.1.2 DETERMINING CONNECTIONS AND SETTINGS FOR AVRS

NOTE: Determining the settings of SW1 and SW2 for the AVR MUST only be done once the setup for SW1 and SW2 for the governor has been complete. Changing engine speed affects the level of voltage produced.

Setting up the AVR (Adjustment of SW1 and SW2)

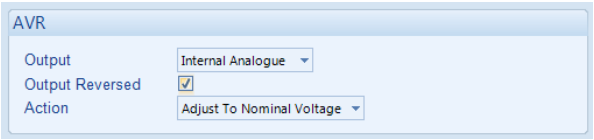
Before You Start

1. Ensure that the generator is connected to a **DEAD BUS BAR WITH NO LOADS** connected.
2. With the generator breaker open, set the generator to run at the **Nominal Voltage** without the DSE module connected to the AVR. To achieve this, you will have to adjust the settings on the AVR.
3. Connect the DSE module to the AVR once completed. The DSE controller connects only to the "-" and "IN" terminals and provides the varying DC voltage to simulate the turning of a potentiometer. The Analogue output terminals of the DSE controller are connected as follows. Note that the "+" terminal of the AVR is left unconnected.



Adjustment of AVR SW1

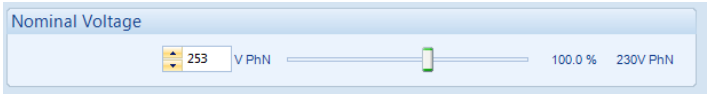
4. Start the generator and ensure that the breaker is left open.
5. Check the direction of drive by increasing and decreasing SW1. If the voltage increases whilst SW1 is being decreased tick the option 'Output Reversed'. If moving SW1 does not change the voltage, check the wiring to the AVR for faults.



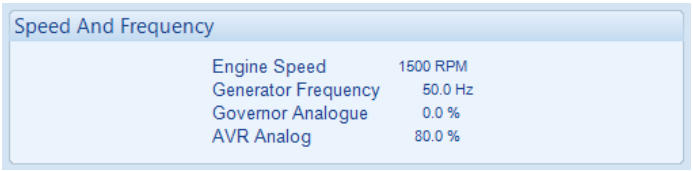
6. Adjust the SW1 setting for the AVR until the generator runs at **Nominal Voltage (230V for example).**
7. Stop the generator. SW1 is now complete and needs to be left alone.

Adjustment of AVR SW2

8. Increase the setting of the Nominal Voltage by **10%** (230 v to 253 V for example)

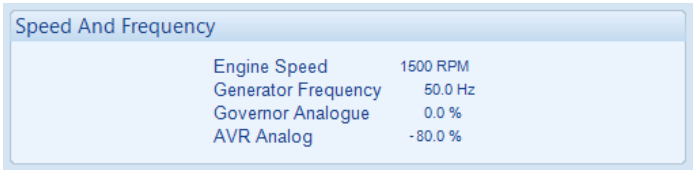


9. Start the generator. With the breaker open the generator will run at setting of SW1 (230V for example).
10. Close the generator breaker onto a **DEAD BUS BAR WITH NO LOADS** connected. The generator voltage shall start to increase towards the new Nominal Voltage setting (253V for example) however it may not achieve this.
11. Adjust SW2 to allow the voltage to increase to the new Nominal Voltage setting (253V for example)
12. Keep adjusting SW2 further to ensure AVR Drive reads within **75% to 85%**, the sign of the drive (+ or - percentage) does not matter.



13. Stop the Generator
14. Decrease the setting of the Nominal Voltage by **10%** (207 V for example)

15. Start the generator. With the breaker open the generator will run at setting of SW1 (230V for example).
16. Close the generator breaker onto a **DEAD BUS BAR WITH NO LOADS** connected. The generator voltage shall start to decrease towards the new Nominal Voltage (207 V for example).
17. SW2 is then adjusted further to ensure AVR Drive reads within **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. Note that any change made to the lower percentage will be the same for the upper percentage. For example, if the lower percentages from 70% to 75%, the upper will increase from 80% to 85%.



18. Change the setting of the Nominal Voltage back to the actual Nominal Voltage (230 V for example).

10.2.2 METERING

CAUTION!: Failure to perform the Metering steps results in incorrect power factor and kW calculations leading to problems with kW and kvar load sharing if not corrected.

WARNING!: Steps must be taken to ensure that when a CT is open circuit, the system/generator is in a safe state to work around.

10.2.2.1 CTS ON THE RIGHT PHASE

Check to ensure that the CTs on L1, L2 & L3 are connected to their respective connection on the DSE module.

This is tested by loading the mains with a purely resistive load (around 10% of the main's size) across the three phases. If the CTs are wired correctly to the DSE module, it displays unity power factor (1.0 pf) across all three phases. If unity power factor is not displayed the CTs have been wired to the wrong phases on the DSE module.

10.2.2.2 CTS IN THE RIGHT DIRECTION

NOTE: Checking that the CTs are on the right phase MUST be completed prior to checking if the CTs are in the correct direction. CTs on the wrong phase also cause negative kWs.

Check to ensure that the CTs on L1, L2 & L3 have been mounted for the correct orientation for current flow and that the S1 and S2 have not been swapped over.

This is tested by loading the mains with a purely resistive load (around 10% of the main's size) across the three phases. If the CTs' S1 and S2 are wired to correctly to the DSE module, it displays positive kW. If negative kWs is displayed the CTs' S1 and S2 have been swapped around.

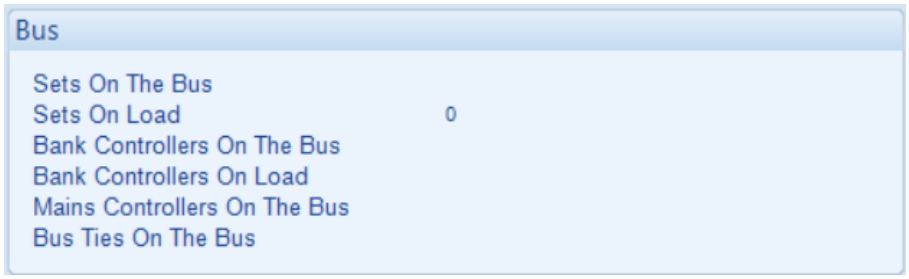
10.2.3 COMMUNICATIONS

CAUTION!: Failure to perform the Communications steps results in the controllers being unable to communicate to the other DSE controllers leading to problems during load sharing.

NOTE: For further details of module configuration, refer to DSE Publication: *057-324 DSEG8660 Configuration Suite Software Manual.*

Check to ensure that all the modules are connected are communicating correctly on the AMSC link and Redundant AMSC (if used).

This is tested by connecting the DSE module to a PC with the DSE Configuration Suite PC Software installed and going to the *SCADA* | *Bus* | *AMSC Link* section. The information shown in this section changes dynamically depending on whether the AMSC Link or Redundant AMSC Link is in use. The number of *Sets On The Bus* must be the same as the number of DSEG8600 (Multi Set)s on the link. The number of *Mains Controllers ON The Bus* must be the same as the combined number of DSEG8660s and DSE8x80s on the link.



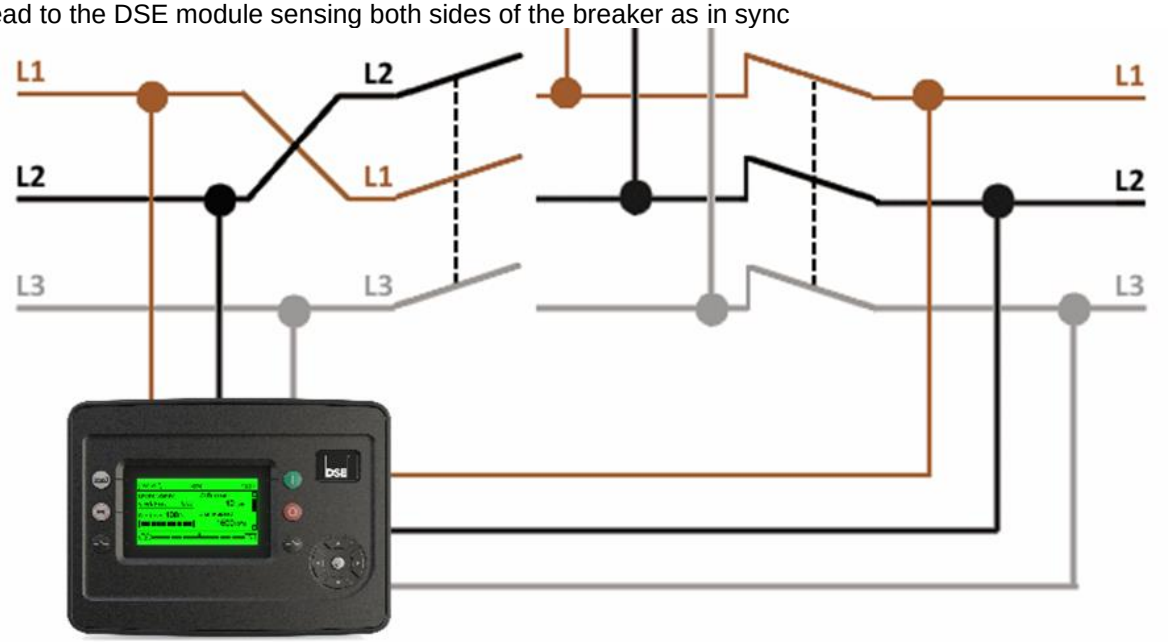
If these numbers do not match up there is a fault on the active link. To find the module with the fault, connect into each module individually until the *Sets On The Bus* or *Mains Controllers On The Bus* reports 1.

If these numbers do match up, then the link which is currently in use is working correctly. To test the other link, remove the active link connection from any module. All the modules should then alarm with the same number link failure (*AMSC 1 Link Failure or AMSC 2 Link Failure*). If all the modules do not have the same number link failure, then at some point the AMSC and CAN connections have been crossed. If all the modules do have the same number link failure, the communication is automatically transferred onto the other link. Check the numbers in SCADA again to ensure the other link is operating correctly.

10.2.4 SYNC CHECKS

⚠CAUTION!: Failure to perform the Metering steps results in in serious damage to the system (breakers, bus bars, alternators, engines etc) caused by out of sync closures.

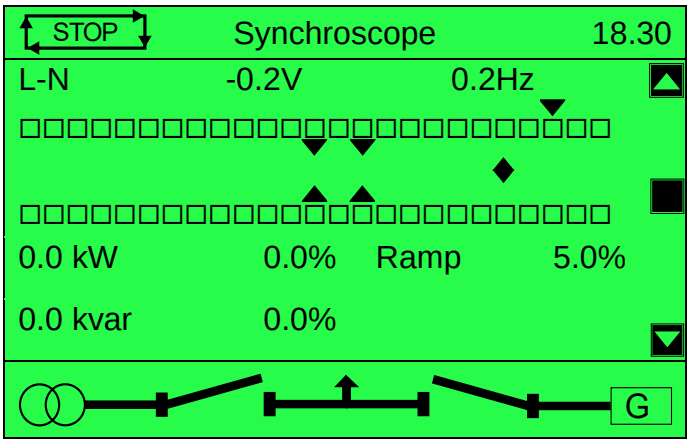
Check to ensure that all the module's sensing cables have been connected to the correct phases and that the generator bus load switch has been correctly connected. Failing to perform such tests may lead to the DSE module sensing both sides of the breaker as in sync

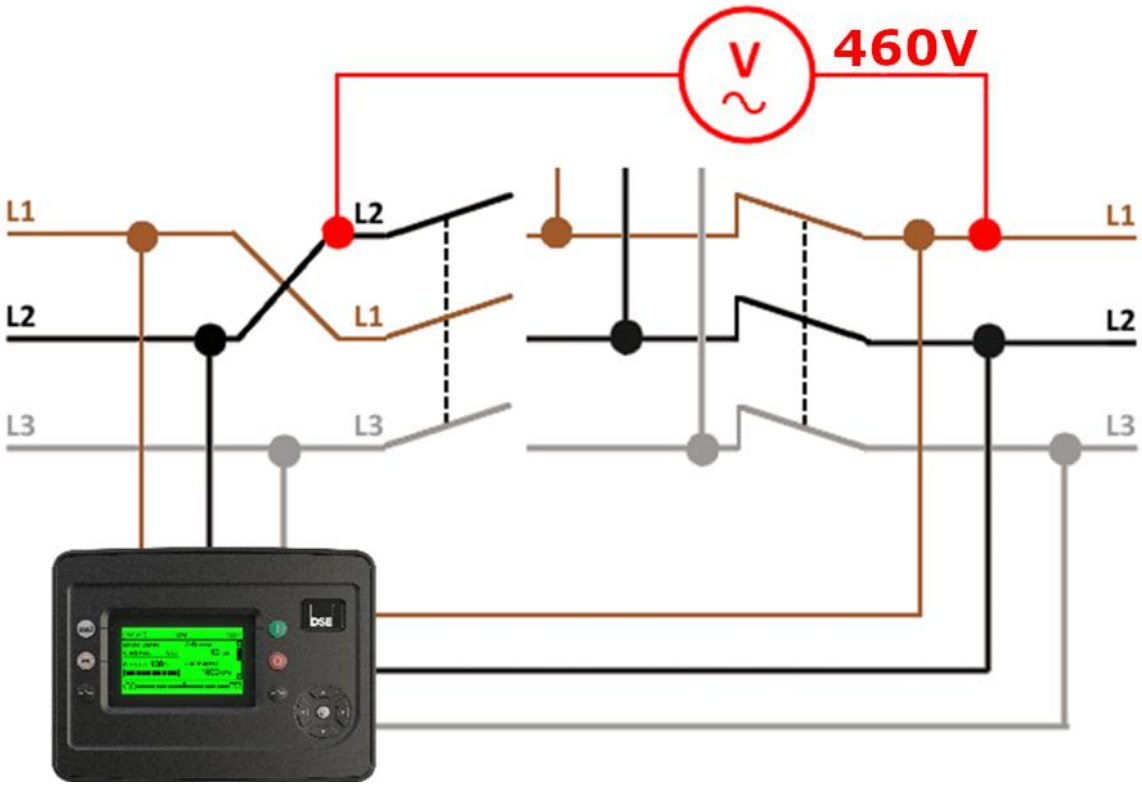


This is tested by starting the generator bus with the DSEG8660 module and ensuring the generator bus load switch is left open (activate an input configured for *Bus Load Inhibit*). Then the load section is to be made live, this is achieved by applying mains voltage to the unit so that the mains load switch closes. Across the open bus load switch, connect a voltage meter to measure the AC voltage when the DSE module shows the two supplies in sync.

10.2.4.1 INCORRECTLY WIRED BREAKER

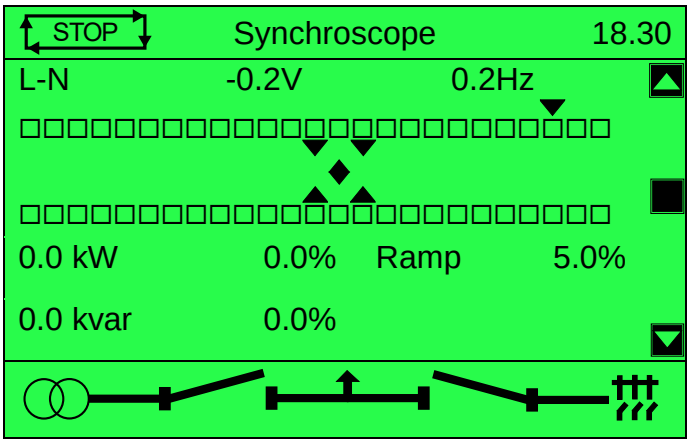
When the DSE module's synchroscope shows the two supplies in sync, if the voltage meter shows a voltage difference the breaker is wired incorrectly. This is shown in the example below.

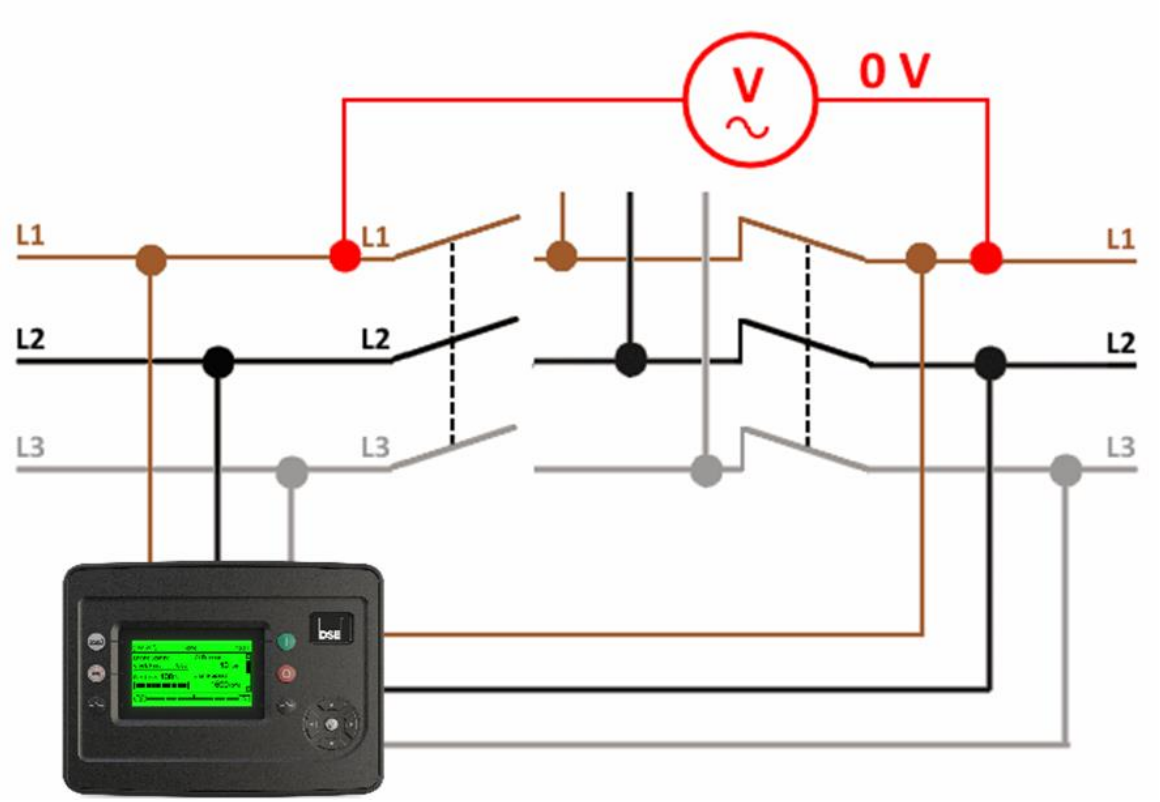




10.2.4.2 CORRECTLY WIRED BREAKER

When the DSE module's synchroscope shows the two supplies in sync, if the voltage meter shows no voltage difference the breaker is wired correctly. This is shown in the example below.



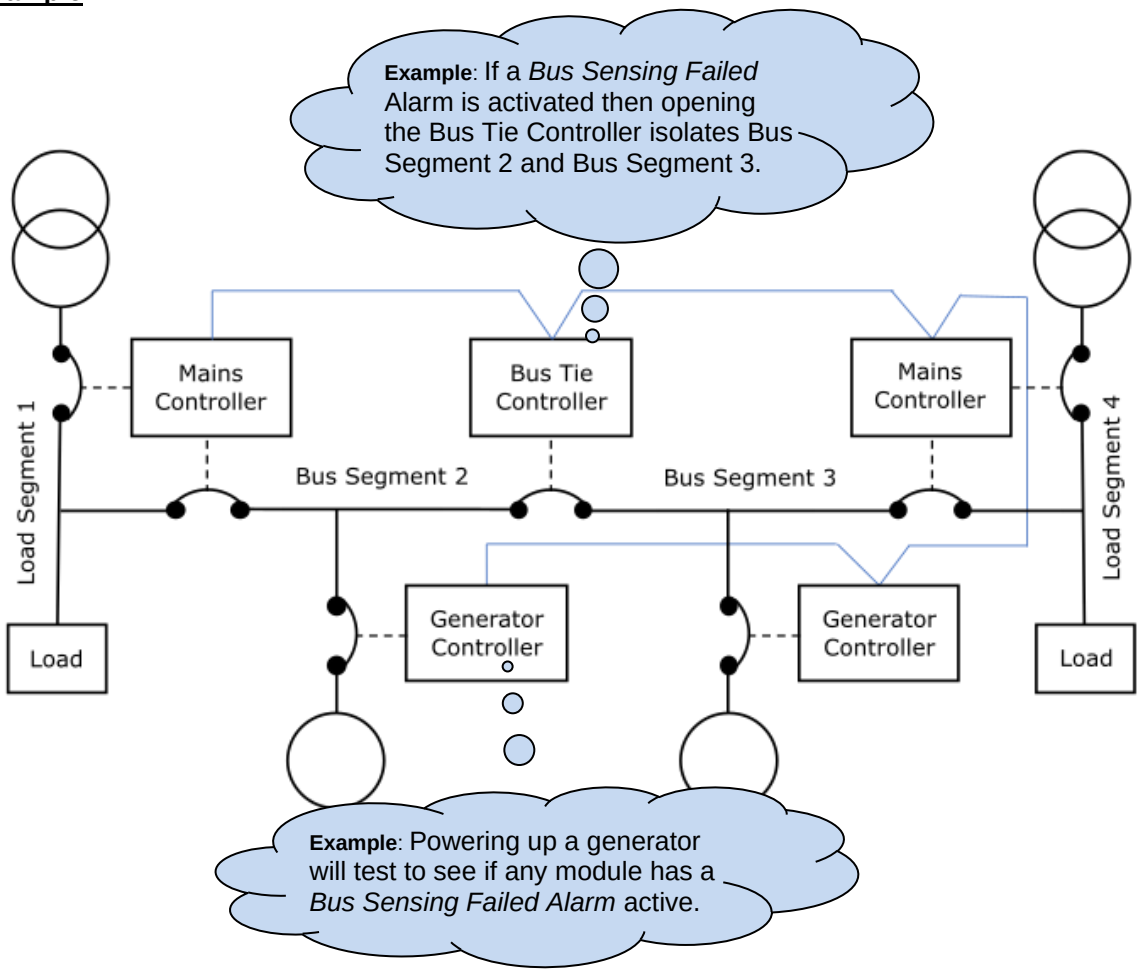


10.3 SEGMENTATION OF THE BUS

The G Series allows the system to act locally and allows each isolated section to work either independently or as part of combined system. For this to be safe it is vitally important that the segmentation is set up correctly.

When a Bus Sensing Failed alarm is activated, it is important that each segment is isolated and that breakers (G8660 bus breakers and G8680 ties) are opened.

Example



To check each segment is live, a generator needs to be powered up to ensure that there are no modules with the Bus Sensing Failed alarm that are active. This ensures that there are no modules on a different segment that have this segment ID. See section 3.8.5.2 in document 057-324 entitled DSEG8660 Configuration Suite PC Software Manual for further information.

The user must then disconnect each module's bus sensing on this segment and check that the alarm occurs, this confirms that the modules on this segment are correctly configured.

WARNING!: The Bus Segment number and Load Segment number cannot be the same! They must be set differently, even if no bus breaker is fitted. Care must also be taken around the load CT and segment number allocation. This is critical for safe control!

11 FAULT FINDING

NOTE: The below fault finding is provided as a guide checklist only. As the module can be configured to provide a wide range of different features, always refer to the source of the module configuration if in doubt.

11.1 STARTING

Symptom	Possible Remedy
Unit is inoperative Read/Write configuration does not operate	Check: • The battery and wiring to the unit. • The DC supply. • The DC fuse.
Unit shuts down	Check: • DC supply voltage is not above 35 V or below 8 V • The operating temperature is not above 70 °C. • The DC fuse.
Fail to Start is activated on DSEG8600 (Multi Set) after pre-set number of attempts to start	Check: • Wiring of fuel solenoid. • Fuel supply. • Battery supply. • Battery supply is present on the Fuel output of the module. • The speed-sensing signal is present on the module's inputs.
Continuous starting of generator when in ***Auto Mode*** (AUTO).	Check: • That there is no signal present on the "Remote Start" input. • Input polarity is correct correctly. • The mains supply is available and within configured limits • Telemetry Start is not active. • There is no PLC start request.
Generator fail to start on receipt of Remote Start signal.	Check: • Start Delay timer has timed out. • Signal is on "Remote Start" input. Confirm correct configuration of input is configured to be used as "Remote Start". • AMSC link operation • G8600 is in Multi Set mode • Segments numbers are correct • Bus ties are not open between the G8600 and G8680

11.2 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. • 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 occur if CT1 is connected to phase 2). • Remember to consider the power factor: (kW = kV A x Power Factor) • The DSE8660 modules 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 multimeter. • Accuracy of the controller is better than 1% of full scale. Voltage full scale is 415 V AC ph-N so accuracy is ±4.15 V (1% of 415 V).

11.3 LOADING

Symptom	Possible Remedy
Bus does not take load	Check: • The generator bus available LED is lit • The mains is configured with a bus breaker • Remember that the generator bus does not take load in ***Manual Mode*** unless the mains supply fails, a remote start on load input is present or the ***Transfer to Generator Bus*** is pressed.
Inaccurate measurements on controller display	Check: • That the CT primary, CT secondary and VT ratio settings are correct for the application. • 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 occur if CT1 is connected to phase 2). • Remember to consider the power factor: (kW = kV A x Power Factor) • The DSE8xxx MII modules 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 multimeter. • Accuracy of the controller is better than 1% of full scale. Voltage full scale is 415 V AC ph-N so accuracy is ±4.15 V (1% of 415 V).

11.4 COMMUNICATIONS

Symptom	Possible Remedy
RS485 inoperative	Check: • Connection cable – Belden 9841 or equivalent • 120 Ω 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
DSENet inoperative	Check: • Connection cable – Belden 9841 or equivalent • 120 Ω termination resistors are correctly fitted to the last expansion module only. • Slave ID of the expansion module is the same as configured in the module's configuration.
Ethernet comms direct to PC inoperative	Check : • Ethernet rated cable is used • Check the IP address of the DSE controller is correct • Check the PC is not set to obtain IP address automatically • Check PC firewall allows traffic on the configured port.
Ethernet connected to a router.	Check : • Ethernet rated cable is used • Check the IP address of the DSE controller is correct • Check all firewalls and routers allow traffic on the configured port. • Test the controller connected directly to a PC for test purposes to eliminate router problems.

11.5 SYNCHRONISING & LOAD SHARING

Symptom	Possible Remedy
Synchronising not available	Check Synchronising is enabled in the configuration suite software Generator, Synchronising section
Generator does not loadshare correctly	Ensure that all the DSE Four Steps to Synchronising have been completed. Check kW Share & kvar Share are enabled, check generator rating is correctly configured in the DSE configuration suite PC Software and check the AMSC link is connected correctly.
Synchronising or load sharing is not operating satisfactorily	Follow the DSE “4 Steps To Synchronising” as detailed in the following section.

11.6 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. Ensure the bus breaker is open prior to writing back any configuration. When editing a configuration using the fascia editor, be sure to exit the editor by pressing the ***Previous Page***  button to save changes.

12 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, contact your original equipment manufacturer (OEM).

12.1 PURCHASING ADDITIONAL CONNECTOR PLUGS FROM DSE

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

12.1.1 PACK OF PLUGS

Module Type	Plug Pack Part Number
DSEG8660	007-1072

12.1.2 INDIVIDUAL PLUGS

Module Terminal Designation	Plug Description	Part No.
1 to 14 **D+W/L**	14 way 5.08 mm	007-428
15 to 22 **CAN 3**	8 way 5.08 mm	007-164
23 to 39 **CAN 1 CAN2** **GOV AVR**	17 way 5.08 mm	007-452
40 to 47 **V1**	8 way 7.62 mm	007-454
48 to 51 **V2**	4 way 7.62 mm	007-171
52 to 58	7 way 5.08 mm	007-447
59 to 77	13 way 5.08 mm	007-166
71 to 76 **RS485 Port 1 Port 2**	6 way 5.08 mm	007-446
	PC Configuration interface lead (USB type A – USB type B)	016-125

12.1.3 PURCHASING ADDITIONAL FIXING CLIPS FROM DSE

Item	Description	Part No.
	Module Fixing Clips (Packet of 4)	020-294

12.2 DSENET® EXPANSION MODULES

NOTE: A maximum of twenty (20) expansion modules can be connected to the DSEG8660 DSENet® Port

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

Item	Max No. Supported	Description	DSE Part Numbers		
			Model Order Number	Operator Manual	Installation Instructions
	4	Model DSE2130 input module provides additional analogue and digital inputs for use with the controller.	2130-00	055-060	057-082
	4	Model DSE2131 Ratio-metric input expansion module provides additional restive, digital, 0-10V and 4-20ma inputs for use with the controller.	2131-00	055-115	057-139
	4	Model DSE2133 RTD/Thermocouple input expansion module provides additional RTD and thermocouple inputs for use with the controller.	2133-00	055-114	057-140
	4	Model DSE2152 Ratio-metric output expansion module provides additional 0-10V and 4-20ma outputs for use with the controller.	2152-00	055-112	057-141
	10	Model DSE2157 expansion relay module provides eight additional voltage free relays for use with the controller	2157-00	055-061	057-083
	10	Model DSE2548 expansion LED module provides additional LED indications, internal sounder, and remote lamp test/alarm mute for use with the controller.	2548-00	057-084	053-032
	4	DSE Intelligent Battery Charger monitored by the controller	Various DSE Intelligent Battery Chargers are supported, contact DSE Technical Support; support@deepseaelectronics.com for further details.		

13 WARRANTY

DSE Provides limited warranty to the equipment purchaser at the point of sale. For full details of any applicable warranty, refer to the original equipment supplier (OEM)

14 DISPOSAL

14.1 WEEE (WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT)

If you use electrical and electronic equipment you must store, collect, treat, recycle, and dispose of WEEE separately from your other waste

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