DEEP SEA ELECTRONICS

DSEG8900 Operator Manual

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Author: Ian Roberts

Deep Sea Electronics
Highfield House
Hunmanby
North Yorkshire
YO14 0PH
ENGLAND

Sales Tel: +44 (0) 1723 890099

E-mail: sales@deepseaelectronics.com
Website: www.deepseaelectronics.com

DSEG8900 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.

TABLE OF CONTENTS

Section Page

1 INTRODUCTION

NOTE: This entire manual must be carefully read before working on the DSEG8900 module.

This document details the installation and operation requirements of the DSEG8900 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 DSEG8900 series is designed to provide differing levels of functionality across a common platform. This allows the generator OEM greater flexibility in the choice of controller to use for a specific application.

The DSEG8900 module has been designed to allow the operator to start, stop and synchronise the generator, and if required, transfer the load to the generator either manually or automatically. Mains (Utility) Supply sensing is also provided that allows for Automatic Mains Failure (A.M.F.) functionality along with mains parallel options.

The DSEG8900 module contains two software applications, Multi Set (MS) and Single Set (SS). This allows to convert the DSEG8900 module into an Multi Set (MS) for multiple generator synchronising application, by selection in the Application menu. Detailed instructions can be found in the *Multi Set (MS) & Single Set (SS) Application Selection Menu* elsewhere in this document.

Synchronising and Load Sharing features are included within the controller, along with the necessary protections for such a system. This provides the functionality to operate in parallel with the mains supply.

The DSEG8900 module monitors the engine, indicating the operational status and fault conditions, automatically shutting down the engine and giving a true first up fault condition of an engine failure by the text LCD display.

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

- *Colour LCD display*
- *True RMS Voltage*
- *Current and Power monitoring*
- *USB, RS485 and Ethernet Communications*
- *Engine parameter monitoring.*
- *Mains (Utility) Supply monitoring.*
- *Fully configurable inputs for use as alarms or a range of different functions.*
- *Engine ECU interface to* ***electronic engines including Tier 5 engines****.*
- *Synchronising and load sharing with the Mains source*
- *Integral PLC to help provide customisation where required*
- *Fuel tank level monitoring to track fuel filling operations and detect fuel leak/theft*
- *Data Logging*
- *Direct connection to governor / AVR for synchronising and load sharing*
- *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. For further information refer to section entitled *Terminal Specification* elsewhere in this document.

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
DSEG8900	DSEG8900 module/controller.
ADSL	Asymmetric Digital Subscriber Line. A technology for transmitting digital information over standard telephone lines.
AMSC	Advanced Multi-Set Communication. An advanced point to point cable connection of more than one device within a generator system.
AVR	Automatic Voltage Regulator. A device responsible for maintaining the generators output voltage at a set value.
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.
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). A protocol that provides quick, automatic, and central management for the distribution of IP addresses within a network.
DNS	Domain Name System. 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.
DPTC	Diesel Particulate Temperature Controlled Filter. A filter fitted to the exhaust of an engine to remove diesel particulate matter or soot from the exhaust gas which is temperature controlled.
DTC	Diagnostic Trouble Code. The name for the entire fault code sent by an engine ECU.
ECU/ECM	Engine Control Unit/Management. An electronic device that monitors engine parameters and regulates the fuelling.
EMC	Electromagnetic compatibility is the ability of electrical equipment and systems to function acceptably in their electromagnetic environment
FMI	Failure Mode Indicator. A part of DTC that indicates the type of failure, e.g. high, low, open circuit etc.

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Term	Description
GSM	Global System for Mobile communications. Cell phone technology used in most of the World.
HEST	High Exhaust System Temperature. Initiates when DPF filter is full in conjunction with an extra fuel injector in the exhaust system to burn off accumulated diesel particulate matter or soot.
IDMT	Inverse Definite Minimum Time. A characteristic of certain types of overcurrent relays used in electrical protection systems.
LAN	Local Area Network A Local Area Network (LAN) is a group of computers and other devices that are connected together over a network and are all in the same location.
LCD	Liquid Crystal Display. A flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers.
LED	Light Emitting Diode. A semiconductor device that emits light when an electric current passes through it.
MAC	Media Access Control Address. A hardware identification number that uniquely identifies each device on a network.
MPU	Magnetic Pickup Unit A Magnetic Pickup Unit (MPU) is a device that senses mechanical motion and converts it into an electrical signal.
NAPT	Network Address and Port Translation A technique in which port numbers and private Internet Protocol (IP) addresses are mapped from multiple internal hosts to one public IP address.
OEM	Original Equipment Manufacturer It refers to a company that produces parts and equipment that may be marketed by another manufacturer, known as a value-added reseller (VAR).
PCI	Peripheral Component Interconnect. A local computer bus for attaching hardware devices in a computer and is part of the PCI Local Bus standard.
PDU	Protocol Data Unit A Protocol Data Unit (PDU) is a single unit of information transmitted among peer entities of a computer network. It is composed of protocol-specific control information and user data.
PGN	Parameter Group Number. A CANbus address for a set of parameters that relate to the same topic and share the same transmission rate.
PID	Gain (P), Stability (I) and Derivative (D) settings of the engine's governor
PIN	PIN number. A 4 digit number used to access the modules Main Front Panel Configuration Editor.
PLC	Programmable Logic Controller. A programmable digital device used to create logic for a specific purpose.
RMS	Root Mean Square A statistical measure of the magnitude of a varying quantity. It's especially useful when quantifying the amplitude of waveforms and alternating current electricity.
ROCOF	Rate Of Change Of Frequency It is the time derivative of the power system frequency (df/dt). This quantity was traditionally of minor relevance for systems with generation mainly based on synchronous generators, because of the inertia of these generators, which inherently counteract to load imbalances and thus limit ROCOF in these cases.

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Term	Description
RPM	Revolutions Per Minute. The speed of rotation of a mechanical component.
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.
RTU	Remote Terminal Unit. A microprocessor-controlled electronic device that interfaces objects in the physical world to a distributed control system or SCADA (supervisory control and data acquisition) system.
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.
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.
TFT	A Thin-Film-Transistor Liquid-Crystal Display. A type of liquid-crystal display that uses thin-film-transistor technology to improve image qualities such as addressability and contrast.
USB	Universal Serial Bus. An industry standard that allows data exchange and delivery of power between many various types of electronics.
WAN	Wide Area Network A Wide Area Network (WAN) is a telecommunications network that extends over a large geographic area.

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
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
053-152	DSE123 Cummins PCC Variant Installation Instructions
053-185	DSE9473 & DSE9483 Battery Charger Installation Instructions
053-258	DSEG8900 Installation Instructions
053-263	DSE0123 Installation Instructions

1.3.2 MANUALS

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

DSE Part	Description
057-004	Electronic Engines and DSE Wiring Guide
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
057-350	DSEG0123 Operator Manual
N/A	DSEGencomm (Modbus protocol for DSE controllers)

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
056-010	Over Current Protection
056-013	Load Demand Scheme
056-018	Negative Phase Sequence
056-019	Earth Fault Protection
056-020	Loss of Excitation
056-021	Mains Decoupling
056-022	Breaker Control
056-023	Adding New CAN Files
056-024	GSM Modem
056-026	kW, kvar, kVA and pf.
056-029	Smoke Limiting
056-030	Module PIN Codes
056-033	Synchronising Requirements
056-036	Expansion Modules
056-043	Sync Process
056-045	PLC as Load Demand Controller
056-047	Out of Sync and Failed to Close
056-051	Modbus Control
056-053	Recommended Modems
056-055	Alternate Configurations
056-057	SW1 & SW2
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
056-084	Synchronising & Load sharing
056-086	G59
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 MULTI SET (MS) AND SINGLE SET (SS) APPLICATION SELECTION MENU

NOTE: The DSE module's USB port is inactive when the *Application Menu* is entered.

NOTE: It is not possible to Firmware Update the module when the Application menu is entered.

NOTE: Care must be taken when updating the module's firmware as this applies the configuration files for the Multi Set (MS) and the Single Set (SS) software applications back to their factory defaults.

NOTE: When a new software application is selected, the relevant software application's configuration file must be configured using the DSE Configuration Suite.

NOTE: The module contains two configuration files and event logs, one for each of the Multi Set (MS) and the Single Set (SS) software applications.

NOTE: The module contains one Data Logging file for both the Multi Set (MS) and the Single Set (SS) software applications. The logged data is maintained and is accessible after the software application is changed.

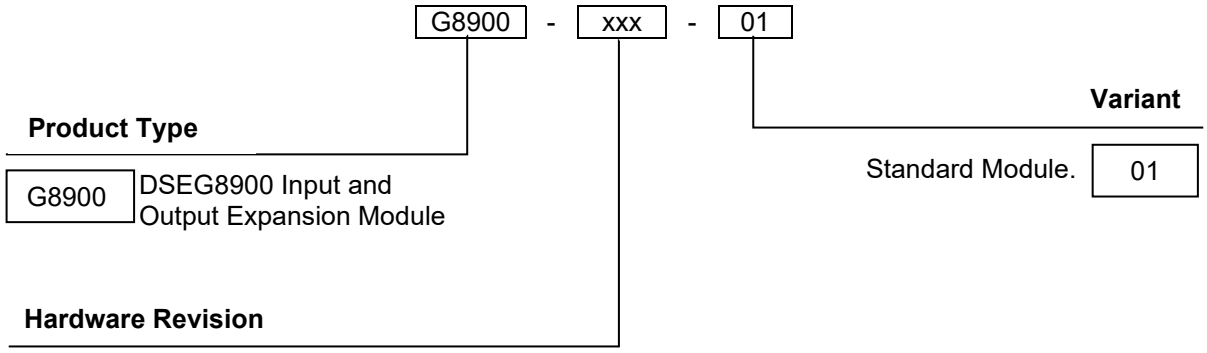
The DSEG8900 module contains two selectable software applications:

- Multi Set (MS)
- Single Set (SS)

The two software applications within the DSEG8900 module allows the user to easily switch between Multi Set (MS) and Single Set (SS) applications. This is useful when the system is upgraded to a multiple generator synchronising system as the Multi Set (MS) application enables the AMSC connection to other DSEG8900\DSEG8600 modules. For further details, refer to the section entitled *Main Configuration Editor* elsewhere in this document.

3 SPECIFICATION

3.1 PART NUMBERING



3.2 OPERATING TEMPERATURE

Module	Specification
DSEG89xx	-30 ºC +70 ºC (-22 ºF +158 ºF)
Display Heater	-40 ºC +70 ºC (-40 ºF +158 ºF)
Storage Temperature	-40 °C to +80 °C (-40 °F to +176 °F)

3.2.1 SCREEN HEATER OPERATION

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

3.3 REQUIREMENTS FOR UL

WARNING!: More than one live circuit exists, refer to the section entitled *Typical Wiring Diagram* elsewhere in this document.

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.
CTs	• Protection Class CTs must be used on the phases for the Short Circuit Protection.
Communication Circuits	• Must be connected to communication circuits of UL Listed equipment.

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Specification	Description
Fuel Output Relay	• The slave relay on the Fuel output must meet the UL 6200 requirements.
Digital Outputs A & B	• 30 V, 8 A resistive • 24 V, 15 A resistive • 2 A VA if used to control fuel safety shut off valve in a UL approved system.
DC Supply Outputs E to L	• 35 V, 2 A resistive • 1 A VA if used to control fuel safety shut off valve in a UL approved system.
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)
VTs	• When using voltage transformers (VTs) they must be fitted to both generator and bus sensing, have the same ratio from the primary to secondary windings, and a 0° phase offset between the primary and secondary windings.

3.4 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 20)	
Maximum Cable Size	2.5 mm² (AWG 13)	
Tightening Torque	0.5 Nm (4.5 lb-in)	
Wire Strip Length	7 mm (9/32 ”)	

3.5 POWER SUPPLY REQUIREMENTS

Description	Specification
Minimum Supply Voltage	5 V continuous
Cranking Dropouts	Able to survive 0 V for 100 mS, providing supply was at least 10 V before dropout and supply recovers to 5 V. This is achieved without the need for internal batteries. Backlight will not be maintained during cranking.
Maximum Supply Voltage	35 V continuous (60 V protection)
Reverse Polarity Protection	-35 V continuous
Maximum Operating Current	985 mA at 12 V 500 mA at 24 V
Maximum Standby Current	725 mA at 12 V 370 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

3.5.1 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)

3.6 VOLTAGE & FREQUENCY SENSING

NOTE: When using voltage transformers (VTs) they must be fitted to both generator and bus sensing, have the same ratio from the primary to secondary windings, and a 0° phase offset between the primary and secondary windings.

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

3.7 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 1 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)

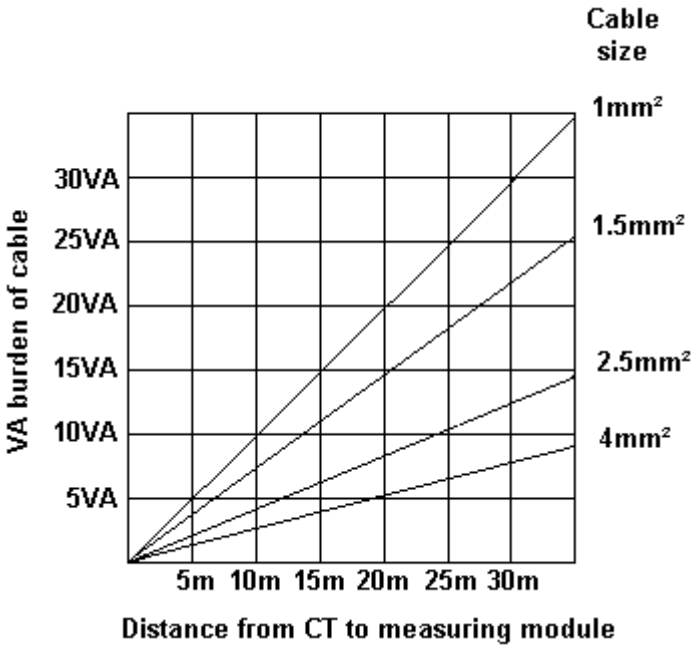
3.7.1 VA RATING OF THE CTS

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.



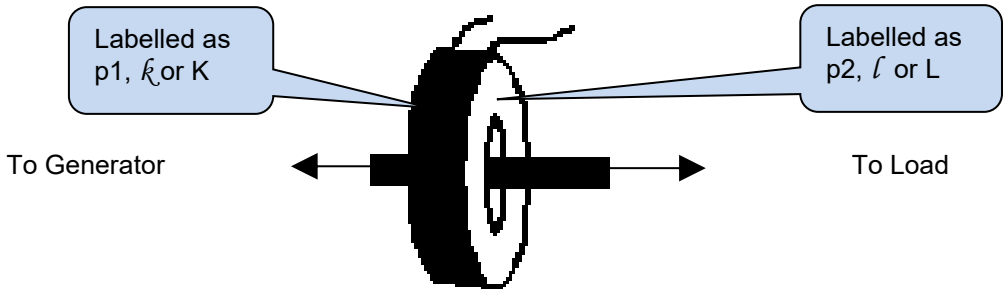
Example:
If 1.5 mm² cable is used and the distance from the CT to the measuring module is 20 m, then the burden of the cable alone is approximately 15 VA. As the burden of the DSE controller is 0.5 VA, then a CT with a rating of at least 15 VA + 0.5 VA = 15.5 VA must be used. 0.5 VA, then a CT with a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

3.7.2 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

3.7.3 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.

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.

3.7.4 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.

3.8 INPUTS

3.8.1 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

3.8.2 EMERGENCY STOP

Description	Specification
Arrangement	Contact between terminal and module supply positive
Closed Threshold	5 V minimum
Open Threshold	3 V maximum
Maximum Input Voltage	+35 V DC with respect to plant supply negative (60 V protection for 1 minute)
Minimum Input Voltage	-24 V DC with respect to plant supply negative
Open Circuit Voltage	0 V

3.8.3 ANALOGUE INPUTS

All the analogue inputs are flexible within the DSEG8900 module.

NOTE: The input display range is user configurable for all the analogue inputs from the flex sensor input type configuration. The range and fault thresholds are editable using the change axis range options. The fixed input functions such as oil pressure/ temperature / fuel level are editable from the engine oil / fuel / temperature input options.

3.8.3.1 ANALOGUE INPUT A

Description	Specification
Input Type	Flexible: Configured for *Oil Sensor* in the DSE default configuration. Flexible Options: Not used, Digital Input, Flexible Analogue Oil Sensor
Flexible Input Selection	Pressure Sensor, Percentage Sensor, or Temperature Sensor
Flexible Measured Quantity	Current, Restive or Voltage

Resistive Configuration

Description	Specification
Measurement Type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Differential resistance measurement input
Measurement Current	15 mA ± 2 mA %
Full Scale	3 kΩ (Hardware functionality to >30 kΩ) Software controlled Over range > 3000 Ω Software determined
Over Range / Fail	350 Ω
Resolution	±1 % of full scale
Accuracy	±2 % of full-scale resistance (±9.6 Ω) excluding sensor error
Max Common Mode Voltage	±2 V
Display Range	Configurable by PC Software

0 V to 10 V Configuration

Description	Specification
Full Scale	0 V to 10 V
Over Range / Fail	11 V
Resolution	±1% of full scale
Accuracy	±2% of full-scale voltage (±0.2 V) excluding sensor error
Max Common Mode Voltage	±2 V
Display Range	Configurable by PC Software

4 mA to 20 mA Configuration

Description	Specification
Full Scale	0 mA to 20 mA
Over Range / Fail	22 mA
Resolution	1 % of full scale
Accuracy	±2 % of full-scale current (±0.4 mA) excluding sensor error
Max Common Mode Voltage	±2 V
Display Range	Configurable by PC Software

3.8.3.2 ANALOGUE INPUTS B, C, D, E, F & G

Description	Specification
Analogue Input B Type	Flexible: Configured for *Temperature Sensor* in the DSE default configuration. Flexible Options: Not used, Digital Input and Flexible Analogue
Analogue Input C Type	Flexible: Configured for *Fuel Sensor* in the DSE default configuration. Flexible Options: Not used, Digital Input and Flexible Analogue
Analogue Input D Type	Flexible: Configured for *Flexible Analogue* in the DSE default configuration. Flexible Options: Not used, Digital Input and Flexible Analogue
Analogue Inputs E, F, G Type	Flexible Options: Not used, Digital Input and Flexible Analogue
Flexible Input Selection	Pressure Sensor, Percentage Sensor, or Temperature Sensor
Flexible Measured Quantity	Current, Restive or Voltage

Resistive Configuration

Description	Specification
Measurement Type	Resistance measurement by measuring voltage across sensor with a fixed current applied.
Arrangement	Differential resistance measurement input
Measurement Current	Nominal 10 mA into short circuit for resistance measurement
Full Scale	5 kΩ (Hardware functionality to >50 kΩ) Software controlled
Over Range / Fail	600 Ω
Resolution	±1 % of full scale
Accuracy	±2 % of full-scale resistance (±9.6 Ω) excluding sensor error
Max Common Mode Voltage	±2 V
Display Range	Configurable by PC Software

0 V to 10 V Configuration

Description	Specification
Full Scale	0 V to 10 V
Over Range / Fail	11 V
Resolution	±1 % of full scale
Accuracy	±2 % of full-scale voltage (±0.2 V) excluding sensor error
Max Common Mode Voltage	±2 V
Display Range	Configurable by PC Software

4 mA to 20 mA Configuration

Description	Specification
Full Scale	0 mA to 20 mA
Over Range / Fail	22 mA
Resolution	±1 % of full scale
Accuracy	±2 % of full-scale current (±0.4 mA) excluding sensor error
Max Common Mode Voltage	±2 V
Display Range	Configurable by PC Software

3.8.4 CHARGE FAIL INPUT

The charge fail input is a combined input and output. Whenever the generator is required to run, the terminal provides excitation current to the charge alternator field winding.

When the charge alternator is correctly charging the battery, the voltage of the terminal is close to the plant battery supply voltage. In a failed charge situation, the voltage of this terminal is pulled down to a low voltage. It is this drop in voltage that triggers the *Charge Failure* alarm. The level at which this operates and whether this triggers a warning or shutdown alarm is configurable using the DSE Configuration Suite Software.

Description	Specification
Minimum Voltage	0 V
Maximum Voltage	35 V
Resolution	0.2 V
Accuracy	±1 % of full scale
Excitation	Active circuit constant power output
Output Power	2.5 W nominal at 12 V and 24 V
Current At 12V	210 mA
Current At 24V	105 mA

3.8.5 MAGNETIC PICK-UP

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

Description	Specification
Type	Differential input
Minimum Voltage	0.5 V RMS
Maximum Voltage	70 V RMS
Max Common Mode Voltage	±2 V peak
Minimum Frequency	5 Hz
Maximum Frequency	10,000 Hz
Resolution	6.25 rpm
Accuracy	± 25 rpm
Flywheel Teeth	10 to 500

3.9 OUTPUTS

3.9.1 DC OUTPUTS A & B (FUEL & START)

Description	Specification
Type	Normally used as Fuel & Start outputs. Fully configurable for other purposes if the module is configured to control an electronic engine.
Rating	15 A resistive at Emergency Stop supply.

3.9.2 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

3.9.3 CONFIGURABLE DC OUTPUTS E, F, G, H, I, J, K & L

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

3.9.4 GOVERNOR CONTROL OUTPUT

Description	Specification
Arrangement	Supplied from DC supply terminal 2
Type	Isolated DC output, voltage controlled
Voltage Range	-10 V to +10 V DC
Max Common Mode Voltage	±1 kV
Resolution	Less than 1 mV
Accuracy	±1 %
Minimum Load	500 Ω
Current Mode	0-20 mA / 4-20 mA

3.9.5 AVR CONTROL OUTPUT

Description	Specification
Arrangement	Supplied from DC supply terminal 2
Type	Isolated DC output, voltage controlled
Voltage Range	-10 V to +10 V DC
Max Common Mode Voltage	±3 kV
Resolution	Less than 1 mV
Accuracy	±1 %
Minimum Load	500 Ω
Current Mode	0-20 mA / 4-20 mA

3.10 COMMUNICATION PORTS

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

Description	Specification
USB Server 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
RS485 1 & RS485 2 Serial Ports	Isolated Data connection 2 wire + common Half Duplex Data direction control for Transmit (by software 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.
CAN 2 (AMSC) CAN 3 (Redundant AMSC) CAN 4 (Redundant AMSC)	**NOTE: For additional length, the DSE124 CAN & AMSC 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 isolated Max distance 250 m (273 yards) using Belden 9841 Cable or equivalent
CAN 1 (ECU Port)	**NOTE: For additional length, the DSE124 CAN & AMSC Extender is available. For more information, refer to DSE Publication: *057-116 DSE124 Operator Manual.*** Engine CAN Port Standard implementation of 'Slow mode,' up to 250 kbit/s Non-Isolated. Internal Termination enabled by software configuration provided (120 Ω) Max distance 40 m (43.5 yards)
DSENet® (Expansion Comms) Port	Non-isolated Data connection 2 wire + common Half Duplex Data direction control for Transmit (by software protocol) Baud Rate of 115 kbaud Internal termination fitted (120 Ω) Max common mode offset ±5 V Max distance 1.2 km (¾ mile)

3.11 COMMUNICATION PORT USAGE

3.11.1 USB SERVER 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: *057-340 DSEG8900 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:

DSEG8900 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

3.11.2 USB A HOST PORT (DATA LOGGING)

USB Type A connection for an of 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.

3.11.3 RS485 PORT

NOTE: For a single module to PC connection and distances up to 6 m (20 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 port on the controller supports the Modbus RTU protocol and is for connection to a single Modbus client 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 32 devices) and allows for connection to PCs, PLCs, and Building Management Systems (to name just a few devices).

One advantage of the RS485 interface is the large distance specification (1.2 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.

3.11.3.1 CABLE SPECIFICATION

NOTE: DSE recommend Belden 9841 (or equivalent) cable for RS485 communication. This is rated to a maximum cable length of 1.2 km. DSE Stock Belden 9841 cable, DSE Part Number: 016-030.

Description	Specification
Cable Type	Two core screened and shielded twisted pair
Cable Characteristics	120 Ω impedance 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.
RS485 Topology	“Daisy Chain” Bus with no stubs (spurs)
RS485 Termination	120 Ω. Not fitted internally to module. Must be fitted externally to the ‘first’ and ‘last’ device on the RS485 link.

3.11.3.2 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 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)

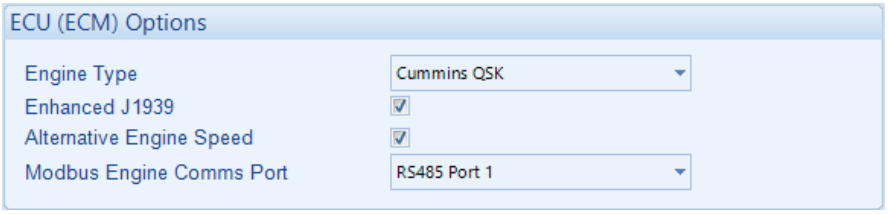
Supplier:
Brainboxes
Tel: +44 (0)151 220 2500
Web: http://www.brainboxes.com
Email: Sales: sales@brainboxes.com

3.11.3.3 RS485 USED FOR MODBUS ENGINE CONNECTION

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

In Single Set or Multi Set mode, when the *Modbus Engine Comms Port* is configured as DSENet®, RS485 Ports 1 & 2 have the option to be configured for PLC communications or as a Modbus server. If the *Modbus Engine Comms Port* is configured as RS485 Port 1, Port 1 will function as a Modbus server and Port 2 can function as either a Modbus server or for PLC communications.

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



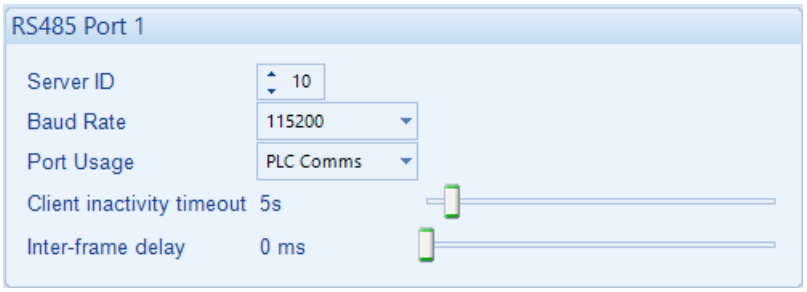
3.11.3.4 RS485 USED FOR PLC COMMUNICATION

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

NOTE: It is not possible for two clients to have control over the same RS485 network simultaneously.

The DSE module has the capability to communicate with other DSE modules through its RS485 when its *Port Usage* is set to *PLC Comms*.
This is accomplished through the use of the PLC by defining specific GenComm registers to poll. The resulting values are then used within the PLC to carry out specific tasks.
The modules being polled do not necessarily need to be DSE modules; they can be third-party modules. These modules must have their RS485 Port Usage set to Gencomm in order to function as a server and respond to the 'Client'. All the DSE modules must have the same *Baud Rate* and have assigned a unique *Server ID* range between 1 and 247.

Example of configuring the RS485 Port for PLC Comms using the DSE Configuration Suite Software:



3.11.4 ETHERNET PORT

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC 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.

3.11.4.1 MODBUS TCP

The Ethernet port on the controller supports the Modbus TCP protocol and is for connection for up to five Modbus client devices. The various operating parameters (such as coolant temperature, oil pressure, 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.

3.11.4.2 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 has the capability to establish communication with other DSE modules through the Ethernet Port. This functionality is configured in the PLC Editor, enabling it to read specific GenComm registers and carry out necessary tasks from the PLC from other modules over TCP/IP.
When the DSE module is configured to communicate with the other modules via the TCP/IP it becomes a Modbus TCP Client, hence care must be taken on the server TCP modules not to exceed their total supported five Modbus TCP clients.

3.11.4.3 SNMP

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC 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.

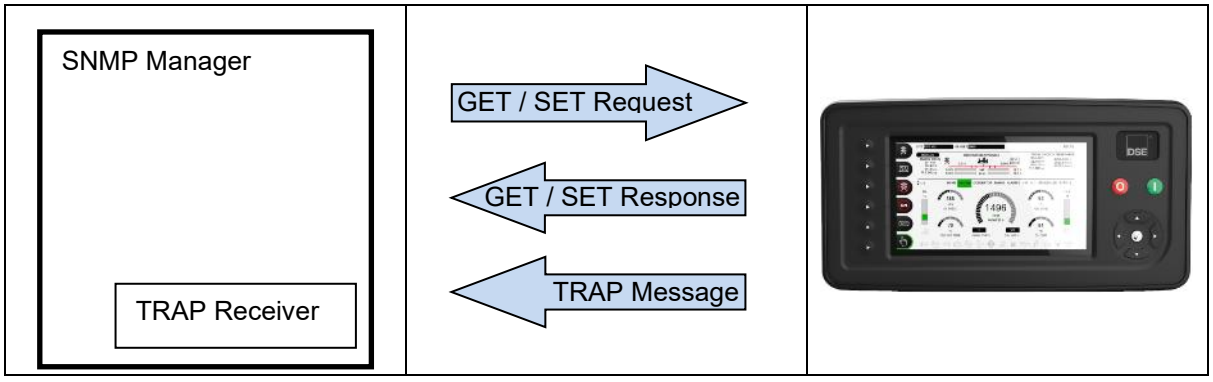
Notifications

	SNMP Trap
Named Alarms	☐
Unnamed Alarms	☐
Mode Change	☐
Power Up	☐
Engine Starts	☐
Engine Stops	☐
Mains Fail	☐
Mains Return	☐
ECU Lamps	☐
Fuel Level Monitoring	☐
Application Switched Multi Set	☐
Application Switched Single Set	☐
Generator Breaker Opened	☐
Generator Breaker Closed	☐

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.

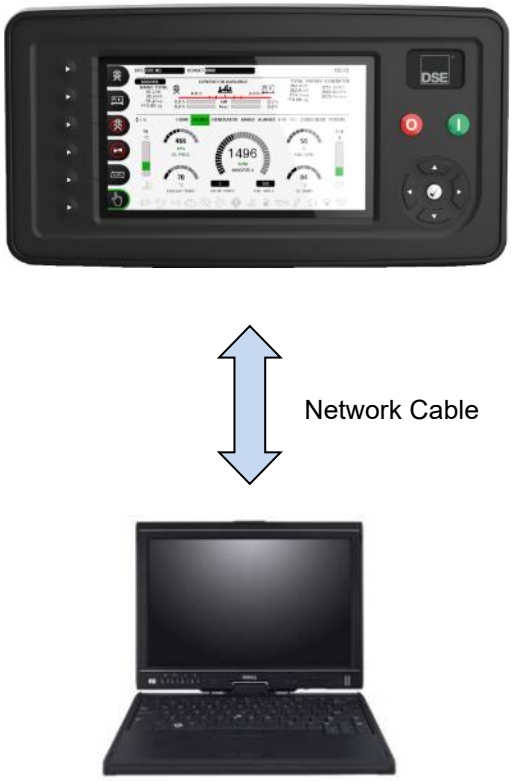
The DSE MIB file for the controller is available upon request from the DSE Technical Support Department or by downloading it from the DSE website, www.deepseaelectronics.com.



3.11.4.4 DIRECT PC CONNECTION

Requirements

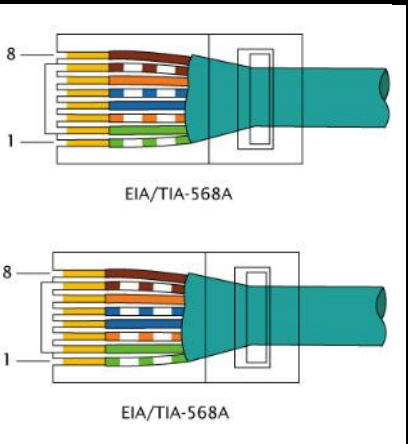
- Ethernet cable (see below)
- PC with Ethernet port



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.

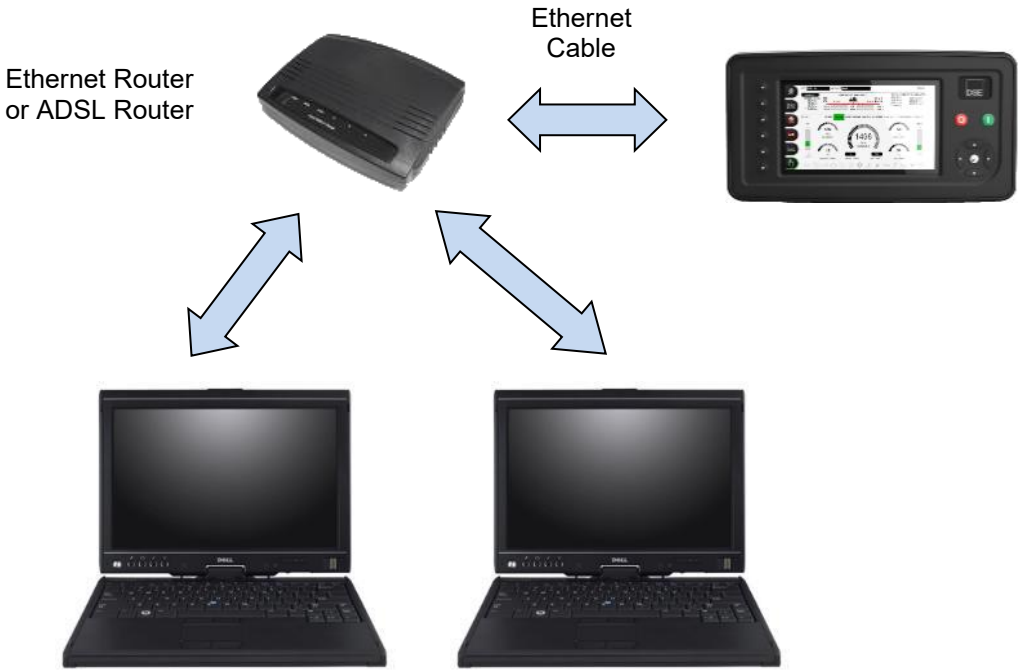
Pin	Connection 1 (T568A)	Connection 2 (T568A)
1	white/green stripe	white/green stripe
2	green solid	green solid
3	white/orange stripe	white/orange stripe
4	blue solid	blue solid
5	white/blue stripe	white/blue stripe
6	orange solid	orange solid
7	white/brown stripe	white/brown stripe
8	brown solid	brown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



3.11.4.5 CONNECTION TO BASIC ETHERNET

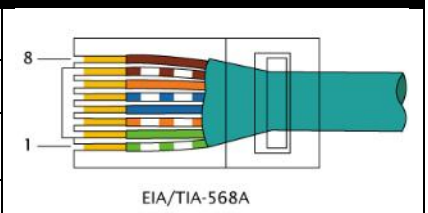
Requirements

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



Ethernet Cable Wiring Detail

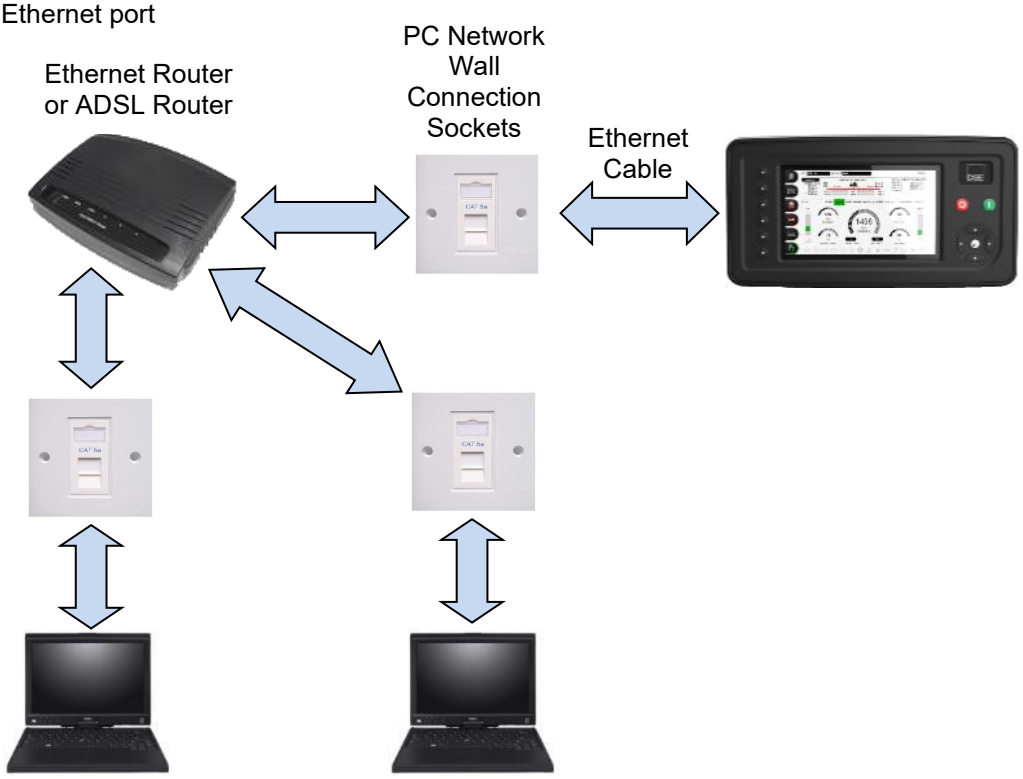
NOTE: DSE stock 2 m (6.5 feet) Ethernet Cable, DSE Part Number: 016-137. Alternatively, they can be purchased from any PC or IT store.

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	

3.11.4.6 CONNECTION TO COMPANY ETHERNET INFRASTRUCTURE

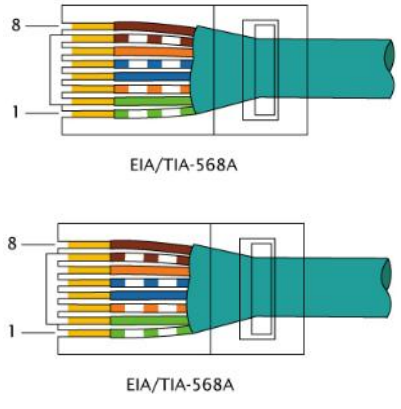
Requirements

- 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

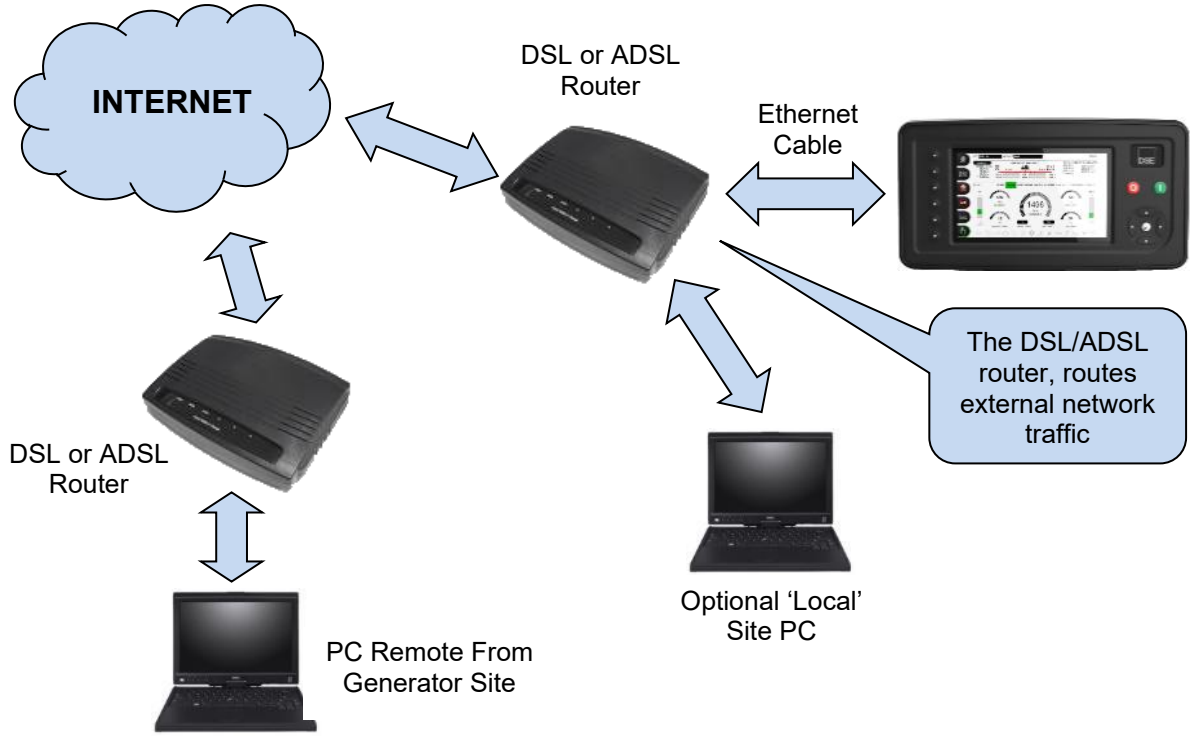
NOTE: DSE stock 2 m (6.5 feet) Ethernet Cable, DSE Part Number: 016-137. Alternatively, they can be purchased from any PC or IT store.

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	

3.11.4.7 CONNECTION TO THE INTERNET

Requirements

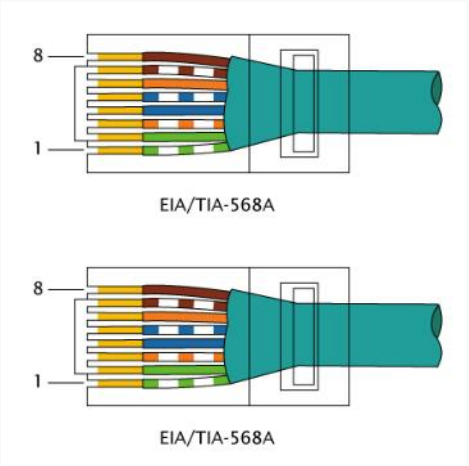
- Ethernet cable (see below)
- Working Ethernet (company or home network)
- Working Internet connection (ADSL or DSL recommended)



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



3.11.4.8 FIREWALL CONFIGURATION FOR INTERNET ACCESS

NOTE: For further details of module configuration, refer to DSE Publication: 057-340 *DSEG8900 Configuration Suite PC 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 (public external network) and a local 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.

3.11.5 AMSC (MULTI SET COMMUNICATIONS) LINK

NOTE: For further details of Multi Set (MS) *& Single Set (SS)* module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

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

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 DSEG89xx and DSEG86xx Modules	Total 4032 devices made up of DSEG8900 (up to 63) and DSEG8660 (up to 64)

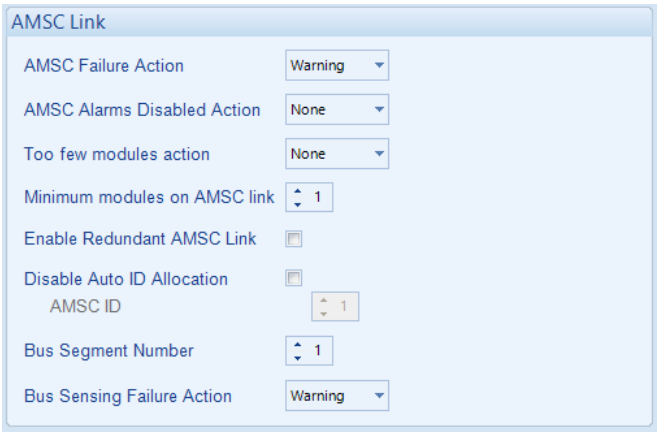
3.11.6 REDUNDANT AMSC LINK

NOTE: For further details about the *Redundant AMSC* activation on the *Multi Set (MS)* application, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

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

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 additional CAN port (CAN Port 3) can be used as a redundant AMSC link between the DSEG89xx 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 DSEG89xx modules revert to the Redundant AMSC Link connection using the CAN Port connection.



Description	Specification
Cable Type	Two core screened and shielded twisted pair
Cable Characteristics	120 Ω impedance Low capacitance
Recommended Cable	Belden 9841 Belden 9271
Maximum Cable Length	**NOTE: For additional length, the DSE124 CAN & AMSC 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.
Redundant AMSC Topology	“Daisy Chain” Bus with no stubs (spurs)
Redundant AMSC Termination	120 Ω. Must be fitted externally to the first and last module.
Maximum DSEG89xx and DSEG86xx Modules	Total 4032 devices made up of DSEG8900 (up to 63) and DSEG8660 (up to 64)

3.11.7 ECU PORT (J1939)

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

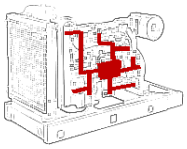
NOTE: Screened 120 Ω impedance cable specified for use with CAN must be used for the CAN link.
DSE stock and supply Belden cable 9841 which is a high quality 120 Ω impedance cable suitable for CAN use (DSE part number 016-030).

The *ECU Port* is used for connection of more than one device and allows for connection to engine ECU/ECMs, alternator AVRs, CAN Scanner, PLC, and CAN controllers (to name just a few devices). The operator is then able to view the various operating parameters.

3.11.7.1 CAN SUPPORTED ENGINES

NOTE: For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines And DSE Wiring*.

NOTE: For additional length, the DSE124 CAN & AMSC Extender is available. For more information, refer to DSE Publication: *057-116 DSE124 Operator Manual.*



The modules are fitted with a CAN interface as standard and are capable of receiving engine data from engine ECU/ECMs compliant with the CAN J1939 standard.

ECU/ECMs monitor the engine's operating parameters such as speed, oil pressure, coolant temperature (among others) in order to closely monitor and control the engine. The industry standard communications interface (CAN) transports data gathered by the engine's ECU/ECM using the J1939 protocol. This allows engine controllers such as DSE to access these engine parameters with no physical connection to the sensor device.

3.11.7.2 CAN SUPPORTED AVRS

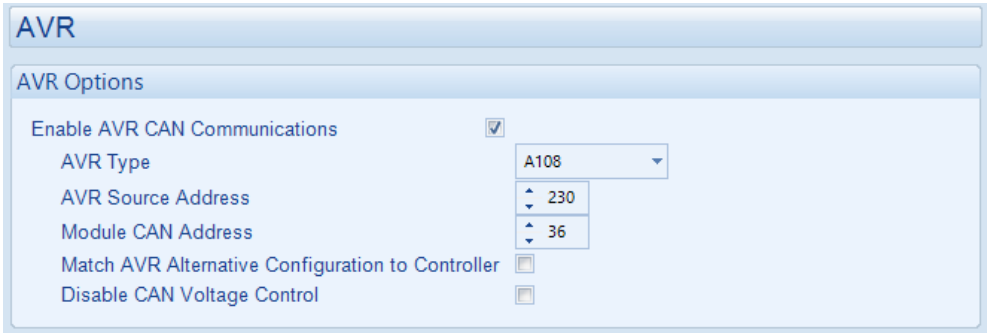
NOTE: At the time of writing this manual, only the DSEA108 & DSEA109 CAN AVRs are supported for voltage control via the CAN. For further details on connection to supported CANbus AVRs, contact DSE technical support: support@deepseaelectronics.com.

The modules are fitted with a CAN interface as standard and are capable of receiving alternator data from certain AVRs compliant with the CAN J1939 standard, as well as controlling the AVR.

AVRs are used to maintain the alternators' output voltage by controlling the excitation current in addition to closely monitoring and protecting the alternator. The industry standard communications interface (CAN) transports data gathered by the alternators' AVR using the J1939 protocol. This allows generator controllers such as DSE to access these alternator parameters with no physical connection to the sensor device.

When configured adequately, it is possible for the DSE module to control the AVR for voltage matching during the synchronisation process and to control the kvar during the load share operation through the ECU CAN Port by transmitting CAN messages to the CAN AVR. The DSE module transmits the idle state to the AVR when running the generator in idle mode, it also transmits the de-excite signal to the AVR when starting in *Dead Bus Sync Mode*. It is the responsibility of the user to make sure that these options are configured in the CAN AVR to receive these signals from the DSE module when requested.

When the *Match AVR Alternative Configuration to Controller* option is enabled the DSE module sends an Alternative Configuration request to the CAN AVR when required. The DSE module controls the CAN AVR through its ECU CAN port for voltage matching during the synchronisation process and to control the reactive power during the load share, but the AVR control is disabled when the *Disable CAN Voltage Control* option is enabled. These options are shown below. There are no additional display pages visible on the module when these options are selected.

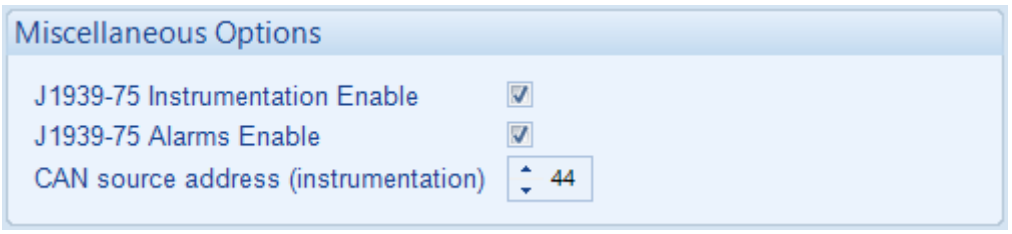


3.11.7.3 J1939-75

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

NOTE: For further details of CAN communication, refer to the section entitled CAN Interface Specification (J1939-75) elsewhere in this document.

When the J1939-75 is enabled in the module's configuration, the module's AC measurements and alarms are sent onto the CANbus using the *ECU Port* to be received by an external monitoring device. There are two check boxes in the *Engine Options* section to enable each of the two parts of the interface as shown below, AC measurement and AC related alarms. The module AC alarms are translated into J1939 DM1 diagnostic messages. There are no additional display pages visible on the module when these options are selected. The default CAN source address for additional J1939-75 messages is 44 however the generator supplier may change this.

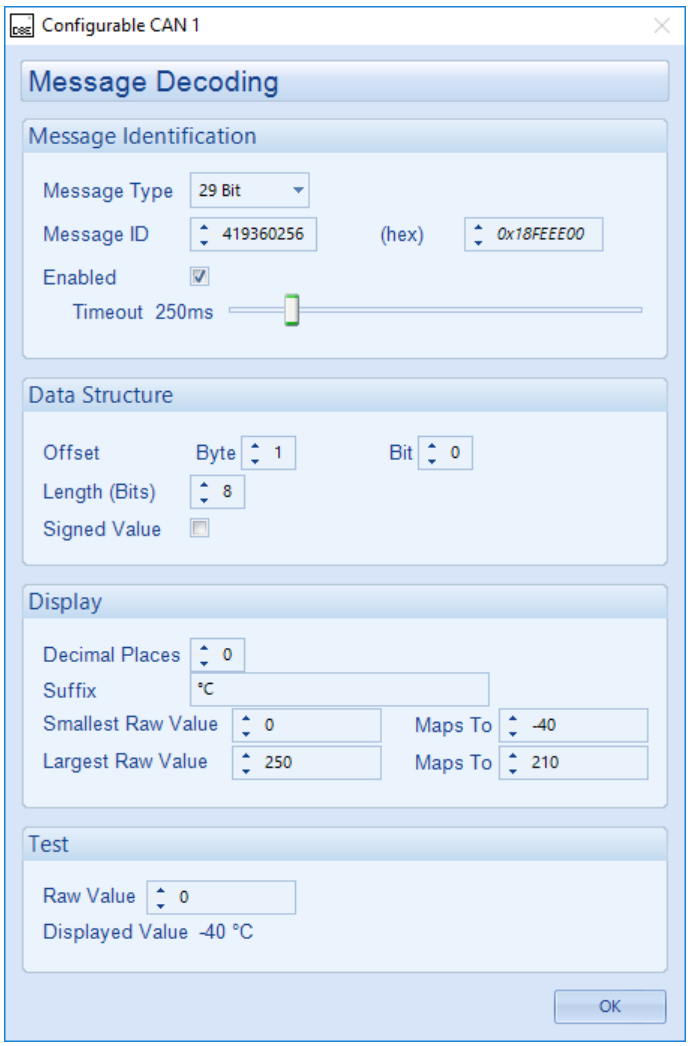


3.11.7.4 CONFIGURABLE CAN

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

The module's CAN port is used to connect third-party CAN devices (controllers, battery chargers…) and allows the module to read and transmit configurable CAN instruments.

The DSE module supports connection to a CAN device and is able to read up to 30 parameters and transmit up to 10 parameters; these parameters are configurable, and the read instrumentation is displayable on the module LCD and/or in SCADA.



3.11.8 DSENET® (EXPANSION MODULES)

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 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 the section entitled *Typical Arrangement of DSENet* elsewhere in this document.

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 impedance 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.

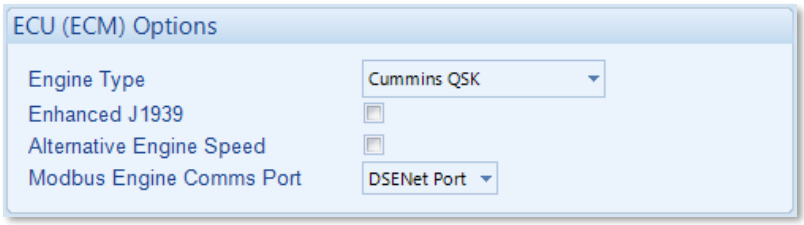
3.11.8.1 DSENET® USED FOR MODBUS ENGINE CONNECTION

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

As DSENet® utilizes an RS485 hardware interface, this port can be configured for connection to Cummins Modbus engines (Engines equipped with Cummins GCS - G-Drive Control System). This allows RS485 Port 1 to be available for connection to remote monitoring equipment, such as a Building Management System, PLC, or PC RS485 port.

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

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



3.12 SOUNDER

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

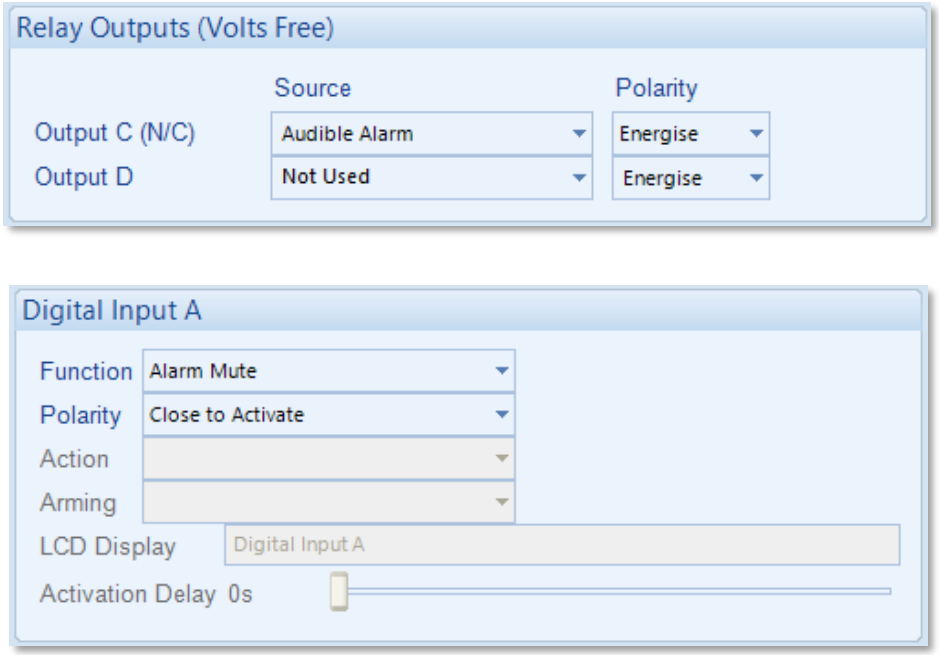
Description	Specification
Sounder Level	64 db at 1 m

3.12.1 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:



3.13 ACCUMULATED INSTRUMENTATION

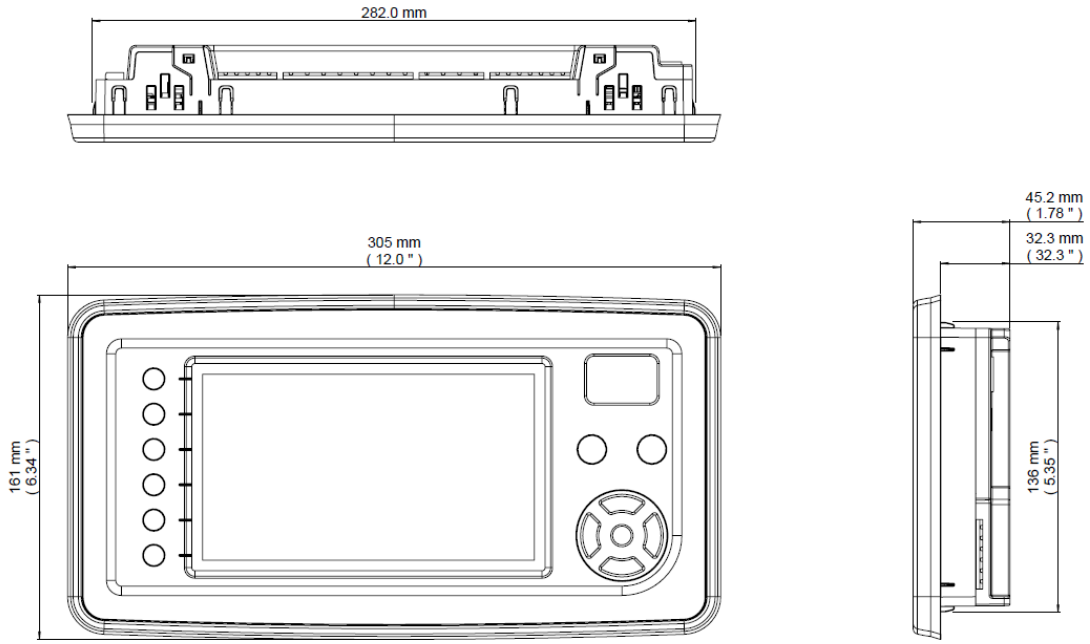
NOTE: When the number of logged *Engine Hours* and *Number of Starts* value exceeds the maximum number as listed below, the value is reset and begins counting from zero again.

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

Description	Specification
Engine Hours Run	Maximum 99999 hrs 59 minutes (Approximately 11yrs 4 months)
Number of Starts	1,000,000 (1 Million)
Accumulated Power	999999 kWh / kvarh / kVAh

3.14 DIMENSIONS AND MOUNTING

Parameter	Specification
Panel Cutout	228 mm x 136 mm (11.10 ” x 5.30 ”)
Overall Size	305.0 mm x 161.0 mm x 45.2 mm (12 ” x 6.33 ” x 1.77 ”)
Case Material	Polycarbonate
Keypad Material	Silicone
Protection Category	IP65 panel mounted with gasket.
Weight	1 kg (2.2 lb)
Mounting Type	Panel Mounting. Base mounted to a vertical surface with connection terminals to the rear.
Mounting Torque	Mounting Torque 4x 020-294 Clip M4 3 prong, mounting torque 0.2 Nm

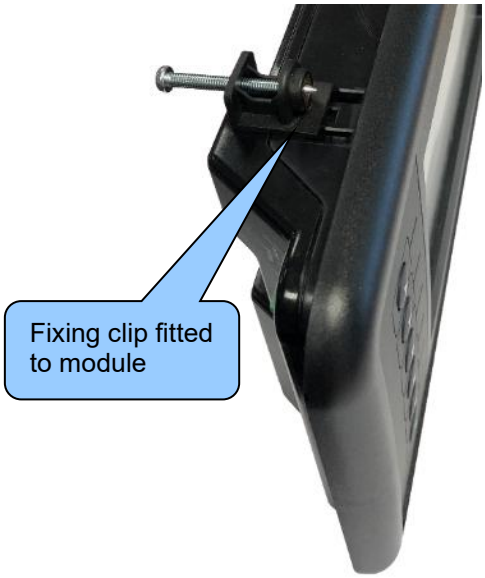


3.14.1 FIXING CLIPS

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:

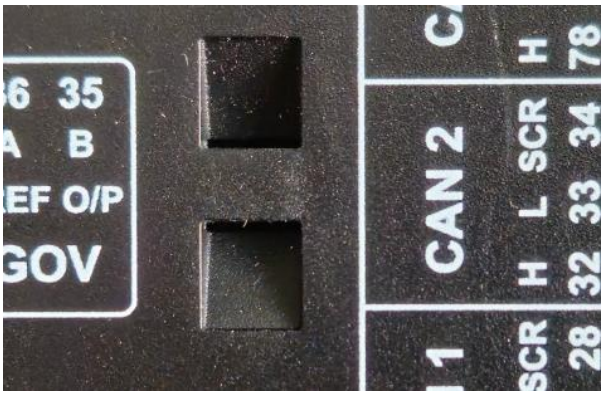
- Withdraw the fixing clip screw (turn anticlockwise) until only the pointed end is protruding from the clip.
- Insert the three ‘prongs’ of the fixing clip into the slots in the side of the module case.
- Pull the fixing clip backwards (towards the back of the module) ensuring all three prongs of the 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.



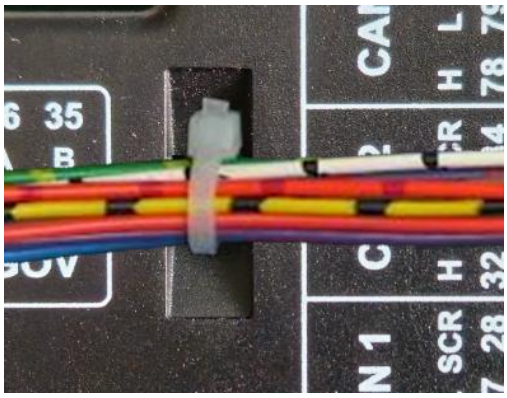
3.14.2 CABLE TIE FIXING POINTS

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

3.14.3 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.

3.15 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 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 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 12 – Overspeed device 14 – Underspeed device

Continued over the page...

Standard	Description
IEEE C37.2 (Standard Electrical Power System Device Function Numbers and Contact Designations)	Continued… 15 – Speed or frequency matching device. 23 – Temperature control device 25 – Synchronising or synchronism check relay 26 – Apparatus thermal device 27AC – AC undervoltage relay 27DC – DC undervoltage relay 29 – Isolating contactor or switch 30 – Annunciator relay 31 – Separate Excitation Device 37 – Undercurrent or underpower relay (**USING INTERNAL PLC EDITOR**) 40 – Field relay / Loss of excitation 42 – Running circuit breaker 44 – Unit sequence relay 46 – Reverse-phase or phase-balance current relay 48 – Incomplete sequence relay 49 – Machine or transformer thermal relay 50 – Instantaneous overcurrent relay 51 – AC time overcurrent relay 52 – AC circuit breaker 53 – Exciter or DC generator relay 54 – Turning gear engaging device 55 – Power factor relay (**USING INTERNAL PLC EDITOR**) 59AC – AC overvoltage relay 59DC – DC overvoltage relay 62 – Time delay stopping or opening relay 63 – Pressure switch 71 – Level switch 74 – Alarm relay 78 – Phase-angle measuring relay 79 – Reclosing relay (**USING INTERNAL PLC EDITOR**) 81 – Frequency relay 83 – Automatic selective control or transfer relay 86 – Lockout relay

3.15.1 ENCLOSURE CLASSIFICATIONS

3.15.1.1 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).

3.15.1.2 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.

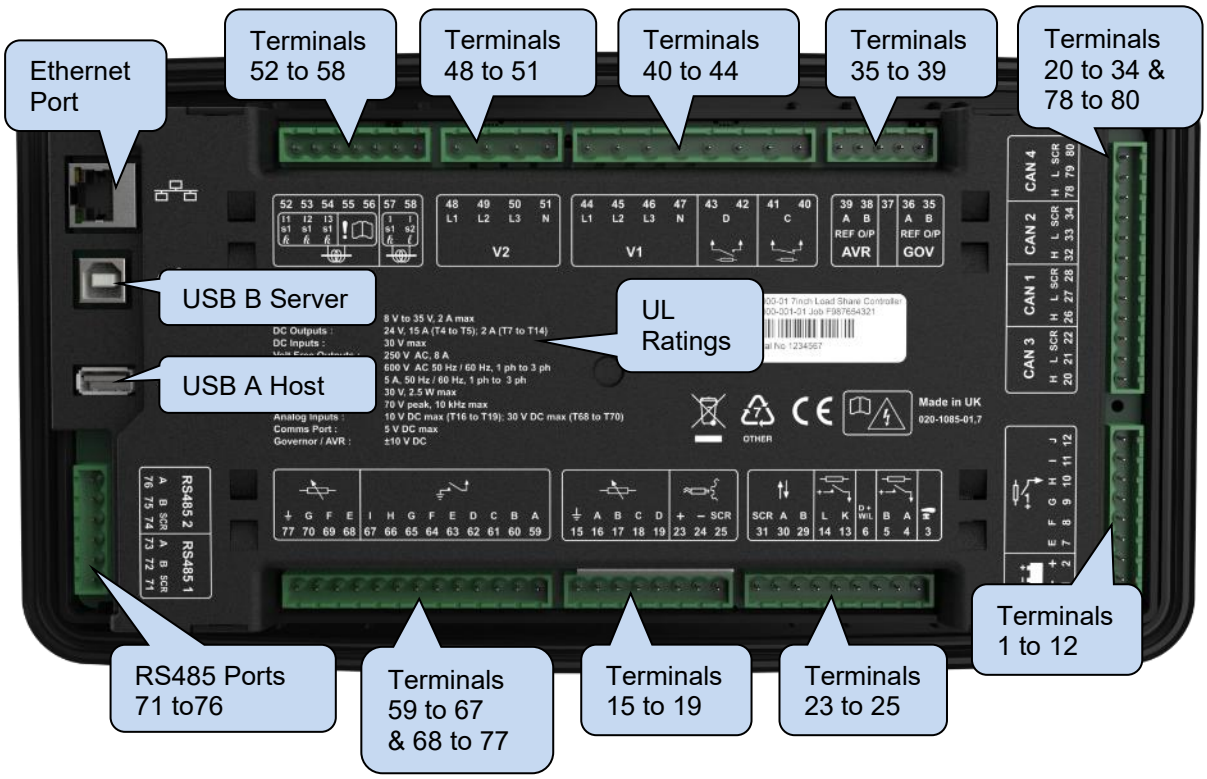
4 INSTALLATION

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

4.1 USER CONNECTIONS

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

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, E-STOP INPUT, DC OUTPUTS & CHARGE FAIL INPUT

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: *057-340 DSEG8900 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	Emergency Stop Input	2.5 mm² AWG 13	Plant Supply Positive. Supplies DC Outputs A & B.
	4	DC Output A (FUEL)	2.5 mm² AWG 13	Plant Supply Positive from terminal 3. 15 A DC rated Fixed as fuel relay if electronic engine is not configured.
	5	DC Output B (START)	2.5 mm² AWG 13	Plant Supply Positive from terminal 3. 15 A DC rated Fixed as start relay if electronic engine is not configured.
D+ W/L	6	Charge Fail / Excite	2.5 mm² AWG 13	Do not connect to ground (battery negative). If charge alternator is not fitted, leave this terminal disconnected.
	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	DC Output K	1.0 mm² AWG 18	Plant Supply Positive from terminal 2. 2 A DC rated.
	14	DC Output L	1.0 mm² AWG 18	Plant Supply Positive from terminal 2. 2 A DC rated.

4.2.2 ANALOGUE SENSOR INPUTS & CAN

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

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

NOTE: If PTFE insulating tape is used on the sensor thread when using earth return sensors, ensure not to insulate the entire thread, as this prevents the sensor body from being earthed via the engine block.

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	Sensor Common Return	0.5 mm² AWG 20	Ground Return Feed For Sensors
	16	Analogue Sensor Input A	0.5 mm² AWG 20	Connect To Oil Pressure Sensor
	17	Analogue Sensor Input B	0.5mm² AWG 20	Connect To Coolant Temperature Sensor
	18	Analogue Sensor Input C	0.5 mm² AWG 20	Connect To Fuel Level Sensor
	19	Analogue Sensor Input D	0.5 mm² AWG 20	Connect To Additional Sensor (User Configurable)
CAN 3 REDUNDANT AMSC 2 (MULTISET ONLY)	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 MPU, ECU, AMSC & DSENET®

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

NOTE: For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines and DSE Wiring*.

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).

NOTE: The AMSC port is only active when the module is converted to *Multi Set (MS)*

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 the section entitled *Typical Wiring Diagram* elsewhere in this document.

	Pin No	Description	Cable Size	Notes
	23	Magnetic Pickup Positive	0.5 mm² AWG 20	Connect To Magnetic Pickup Device
	24	Magnetic Pickup Negative	0.5 mm² AWG 20	Connect To Magnetic Pickup Device
	25	Magnetic Pickup Screen	Shield	Connect To Ground At One End Only
CAN 1	26	ECU Port H	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	27	ECU Port L	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	28	ECU 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
CAN 2 AMSC	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	Analogue Governor Output B	0.5mm² AWG 20	Analogue Governor DC Output
	36	Analogue Governor Output A	0.5mm² AWG 20	Analogue Governor Output Reference
	37	DO NOT CONNECT		DO NOT CONNECT
AVR	38	Analogue AVR Output B	0.5mm² AWG 20	Analogue AVR DC Output
	39	Analogue AVR Output A	0.5mm² AWG 20	Analogue AVR Output Reference

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

NOTE: The below table describes connections to a three phase, four wire alternator. For alternative wiring topologies, refer to sections entitled *Single Set Alternate Topology Schematic Diagrams and Multi Set Alternate Topology Schematic Diagrams* elsewhere in this document.

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

4.2.5 V2 MAINS(UTILITY) BUS VOLTAGE & BUS VOLTAGE SENSING

NOTE: The below table describes connections to a three phase, four wire supply. For alternative wiring topologies, refer to sections entitled *Single Set Alternate Topology Schematic Diagrams and Multi Set Alternate Topology Schematic Diagrams* elsewhere in this document.

	Pin No	Description	Cable Size	Notes
V2	48	L1 (R) Mains Voltage Sensing (SS) Bus Voltage Sensing (MS)	1.0 mm² AWG 18	Connect to Mains L1 (R) output (AC) (Recommend 2 A fuse)
	49	L2 (S) Mains Voltage Sensing (SS) Bus Voltage Sensing (MS)	1.0 mm² AWG 18	Connect to Mains L2 (S) output (AC) (Recommend 2 A fuse)
	50	L3 (T) Voltage Sensing Mains Voltage Sensing (SS) Bus Voltage Sensing (MS)	1.0 mm² AWG 18	Connect to Mains L3 (T) output (AC) (Recommend 2 A fuse)
	51	Mains Neutral (N) Input	1.0 mm² AWG 18	Connect to Mains Neutral terminal (AC)

4.2.6 CURRENT TRANSFORMERS

WARNING!: Do not disconnect this plug when the CTs are carrying current. Disconnection open circuits 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 0.25 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 with the CT supplier.

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

4.2.6.1 GENERATOR CURRENT TRANSFORMERS

	Pin No	Description	Cable Size	Notes
	52	CT Secondary for Generator L1	2.5 mm² AWG 13	Connect to s1 secondary of Generator L1 monitoring CT
	53	CT Secondary for Generator L2	2.5 mm² AWG 13	Connect to s1 secondary of Generator L2 monitoring CT
	54	CT Secondary for Generator L3	2.5 mm² AWG 13	Connect to s1 secondary of Generator L3 monitoring CT

NOTE: The function of terminals 55 and 56 changes depending upon what type of earth fault protection (if any) is being used:

	Topology	Pin No	Notes	Cable Size
	No earth fault measuring	55	DO NOT CONNECT	
		56	Connect to s2 of the CTs connected to Generator L1,L2,L3,N	2.5mm² AWG 13
	Restricted earth fault measuring	55	Connect to s2 of the CTs connected to Generator L1,L2,L3,N	2.5mm² AWG 13
		56	Connect to s1 of the CT on the Generator neutral conductor	2.5mm² AWG 13
	Un-restricted earth fault measuring (Earth fault CT is fitted in the neutral to earth link)	55	Connect to s1of the CT on the Generator neutral to earth link.	2.5mm² AWG 13
		56	Connect to s2 of the CT on the Generator neutral to earth link. Also connect to the s2 of CTs connected to Generator L1, L2, L3.	2.5mm² AWG 13

4.2.6.2 MAINS (UTILITY) CURRENT TRANSFORMERS

	Pin No	Description	Cable Size	Notes
	57	CT Secondary for Mains (utility) L1	2.5 mm² AWG 13	Connect to s1 secondary of Mains (utility) L1 earth fault monitoring CT Also connect to Earth
	58	CT Secondary for Mains (utility) L1	2.5 mm² AWG 13	Connect to s2 secondary of Mains (utility) L1 earth fault monitoring CT

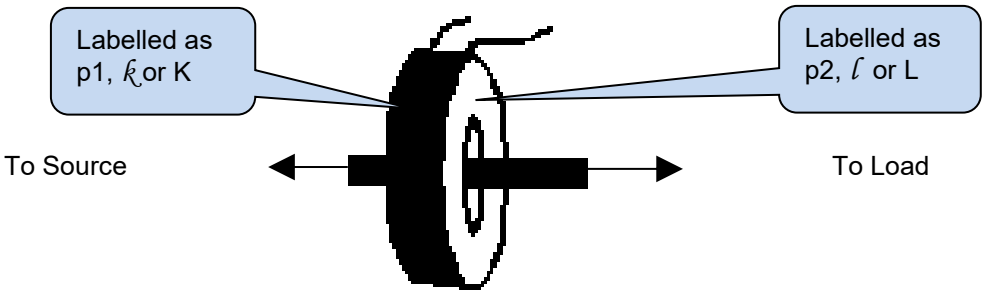
4.2.6.3 CT CONNECTIONS

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 relates to 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: 057-239 DSEG*8900 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

4.2.8 ANALOGUE SENSOR INPUTS & CAN

	Pin No	Description	Cable Size	Notes
	68	Analogue Sensor Input E	0.5 mm² AWG 20	Connect To Additional Sensor (User Configurable)
	69	Analogue Sensor Input F	0.5 mm² AWG 20	Connect To Additional Sensor (User Configurable)
	70	Analogue Sensor Input G	0.5 mm² AWG 20	Connect To Additional Sensor (User Configurable)
	77	Sensor Common Return	0.5 mm² AWG 20	Ground Return Feed For Sensors
CAN 4	78	CAN Port H	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	79	CAN Port L	0.5 mm² AWG 20	Use only 120 Ω CAN or RS485 approved cable
	80	CAN Port Screen	Shield	Use only 120 Ω CAN or RS485 approved cable

4.2.9 RS485

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 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

4.2.10 USB B PORT (PC CONFIGURATION) CONNECTOR

NOTE: The USB connection cable between the PC and the module must not be extended beyond 5 m (yards). 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.

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

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 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. 

4.2.11 USB A HOST (DATA LOGGING) CONNECTOR

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

NOTE: For further details on how to add and remove a USB storage device, refer to the section entitled *USB Safe Removal Procedure* elsewhere in this document.

	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.

4.3 TYPICAL SCHEMATIC DIAGRAM

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.

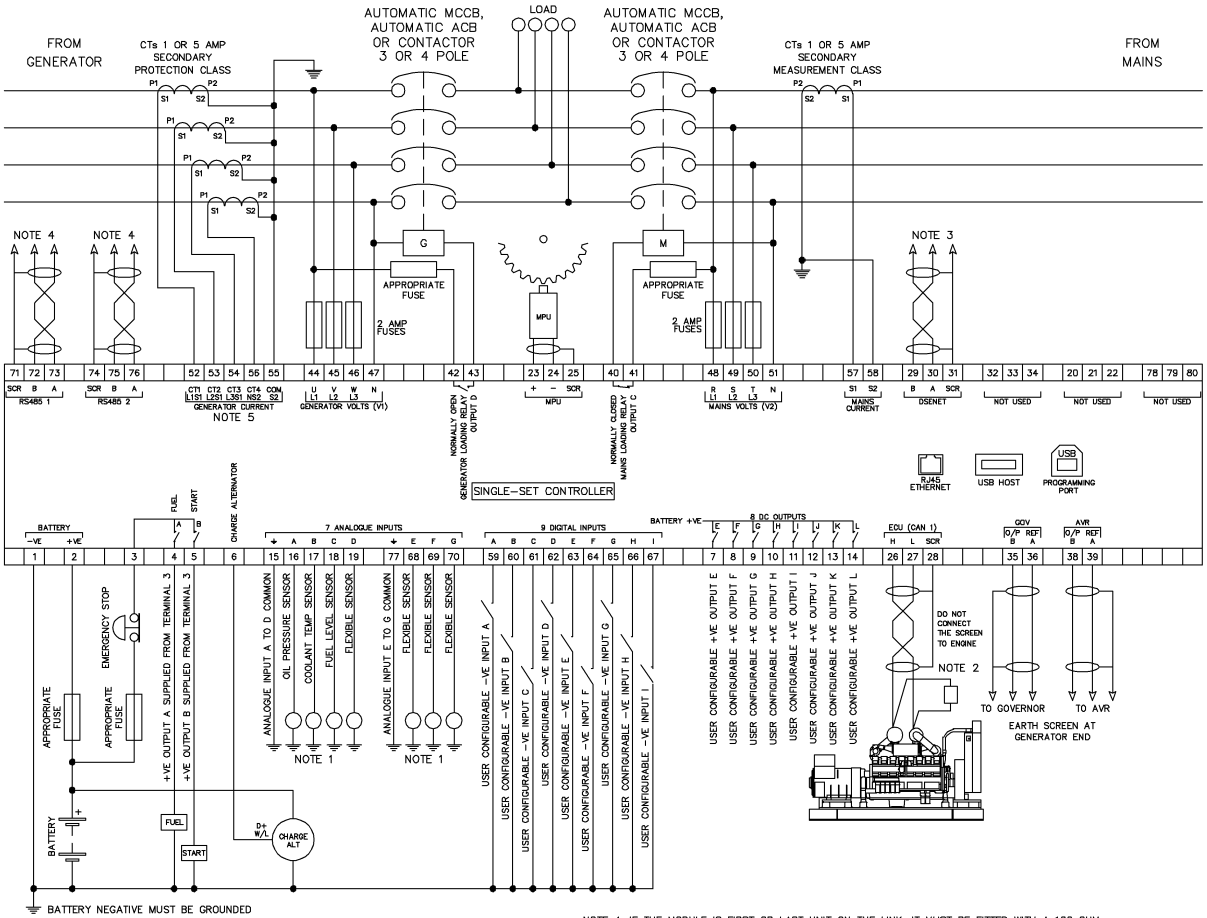
Further wiring suggestions are available in the following DSE publications, available at www.deepseaelectronics.com to website members.

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 3 PHASE 4 WIRE WITH RESTRICTED EARTH FAULT (SINGLE SET CONTROLLER)

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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

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



4.3.2 EARTH SYSTEMS

4.3.2.1 NEGATIVE EARTH

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

4.3.2.2 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).

4.3.2.3 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).

4.3.3 TYPICAL ARRANGEMENT OF DSENET®

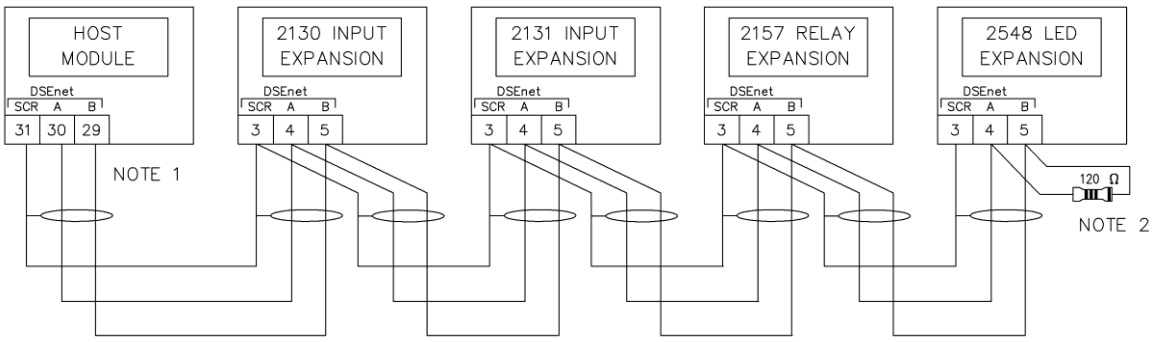
NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

NOTE: This feature is not available if the DSEG8900 module has been configured to use the DSENet® port as the interface to a Cummins Modbus GCS ECU.

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

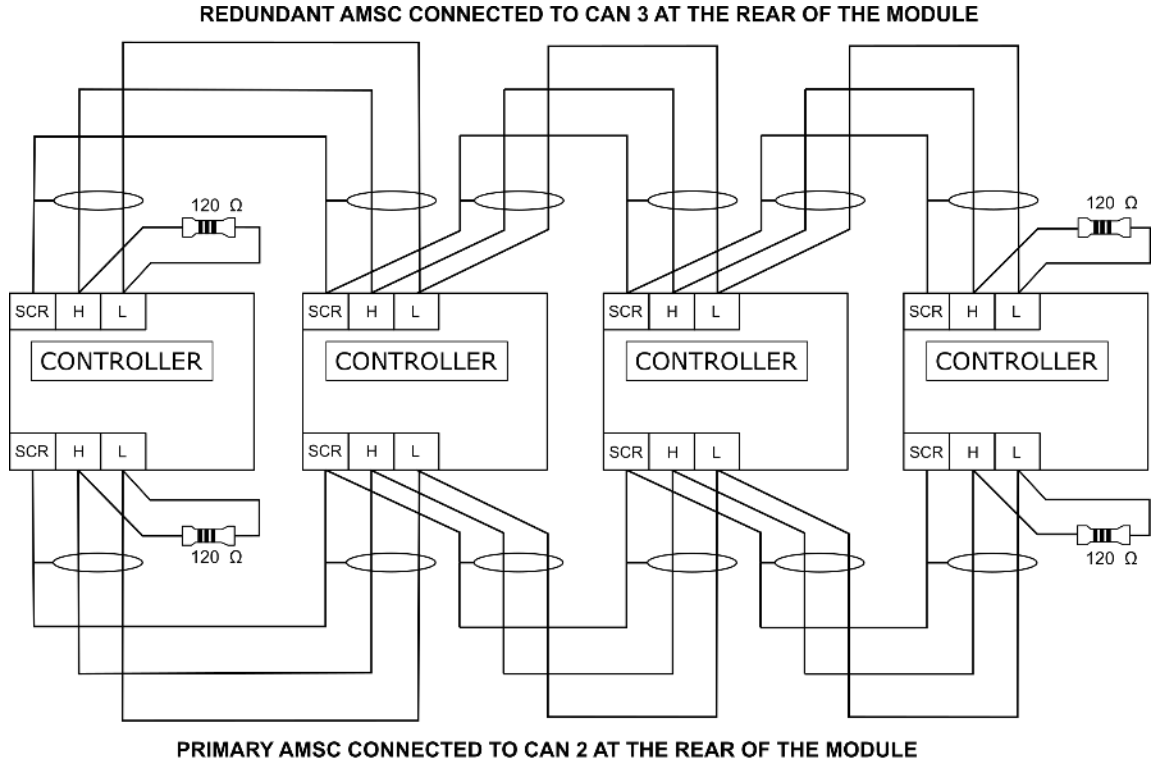
4.3.4 TYPICAL ARRANGEMENT OF AMSC LINK

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 entitled *AMSC (Multi-Set Communications) Link* and *CAN Port (Redundant AMSC)* elsewhere in this document.

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 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.

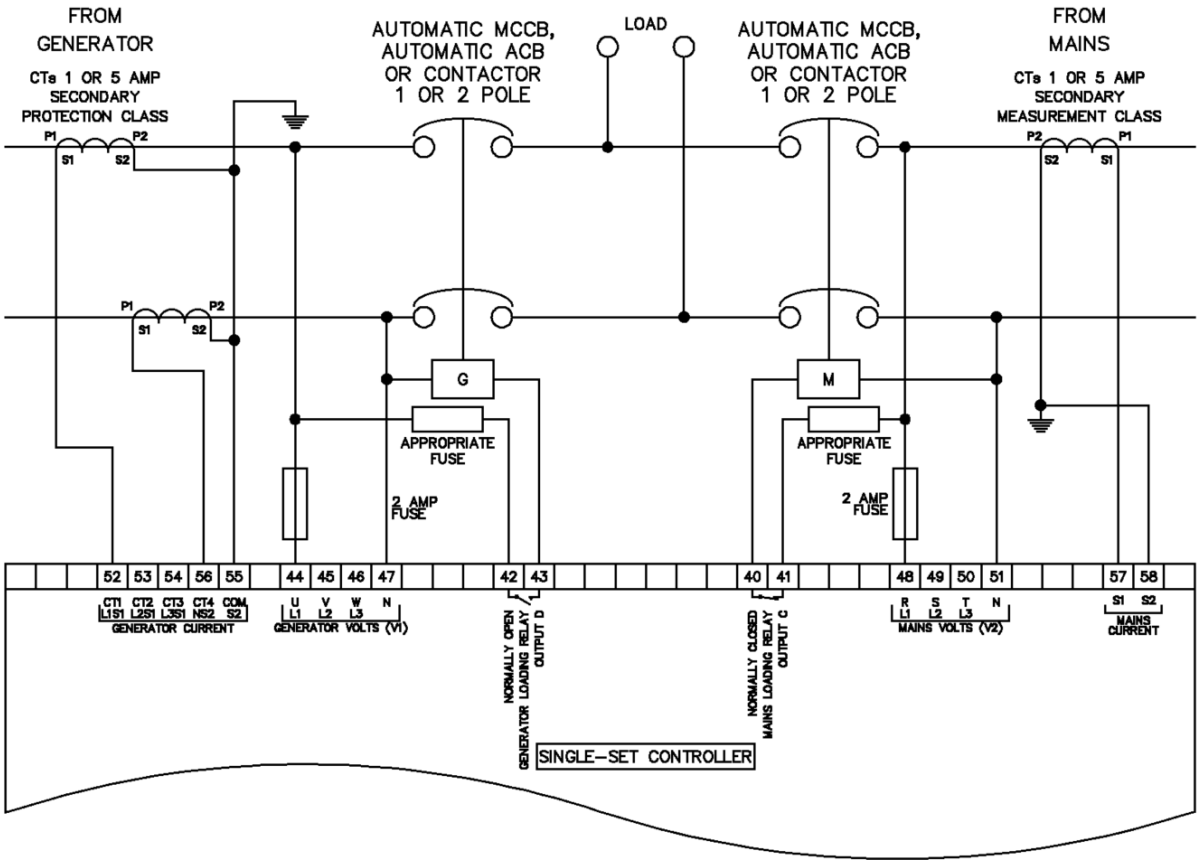


NOTE
A 120 OHM TERMINATION
RESISTOR MUST BE FITTED TO
THE FIRST AND LAST UNIT ON
THE AMSC LINK

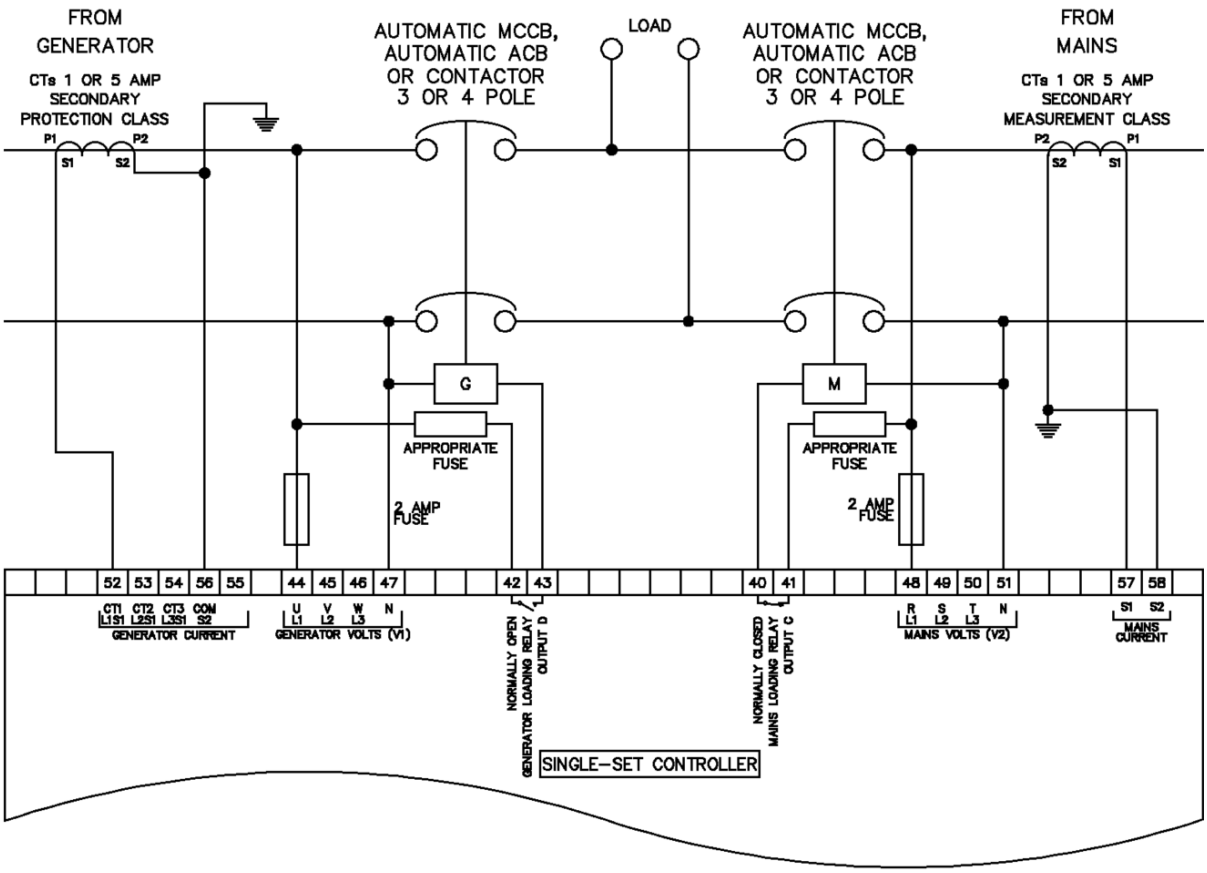
4.4 SINGLE SET ALTERNATE TOPOLOGY SCHEMATIC DIAGRAMS

4.4.1 SINGLE PHASE (L1 & N) 2 WIRE WITH RESTRICTED EARTH FAULT

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

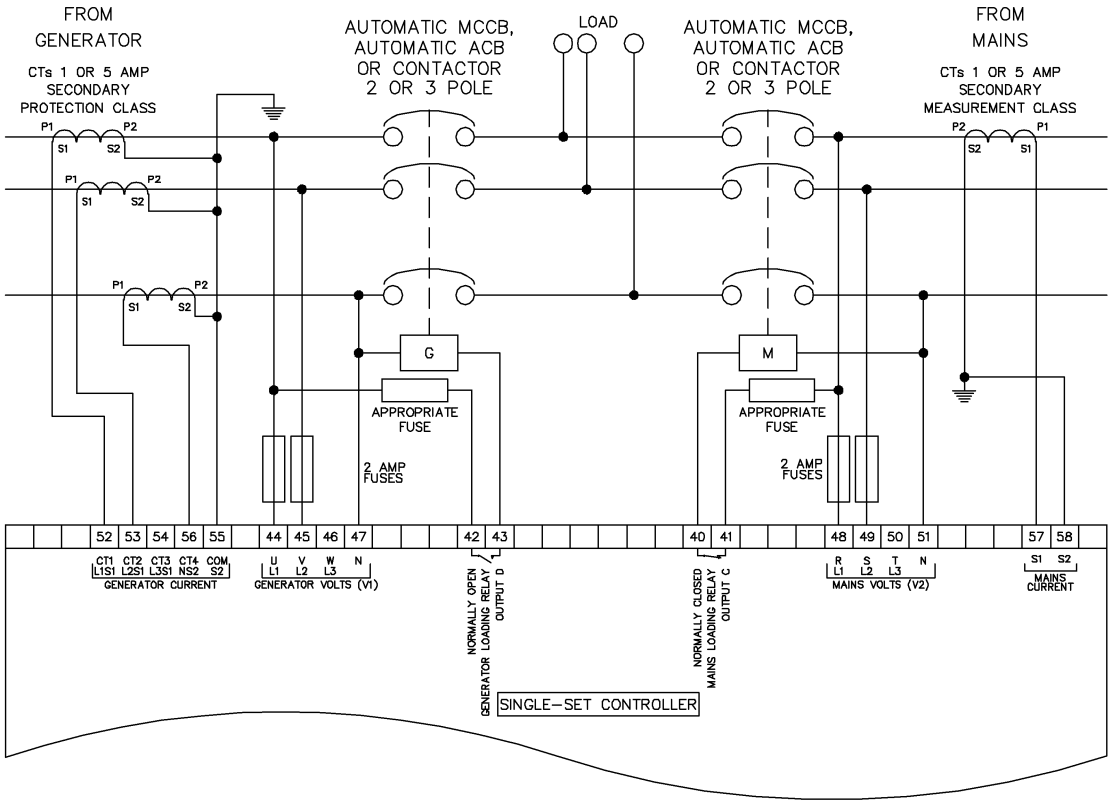


4.4.2 SINGLE PHASE (L1 & N) 2 WIRE WITHOUT EARTH FAULT

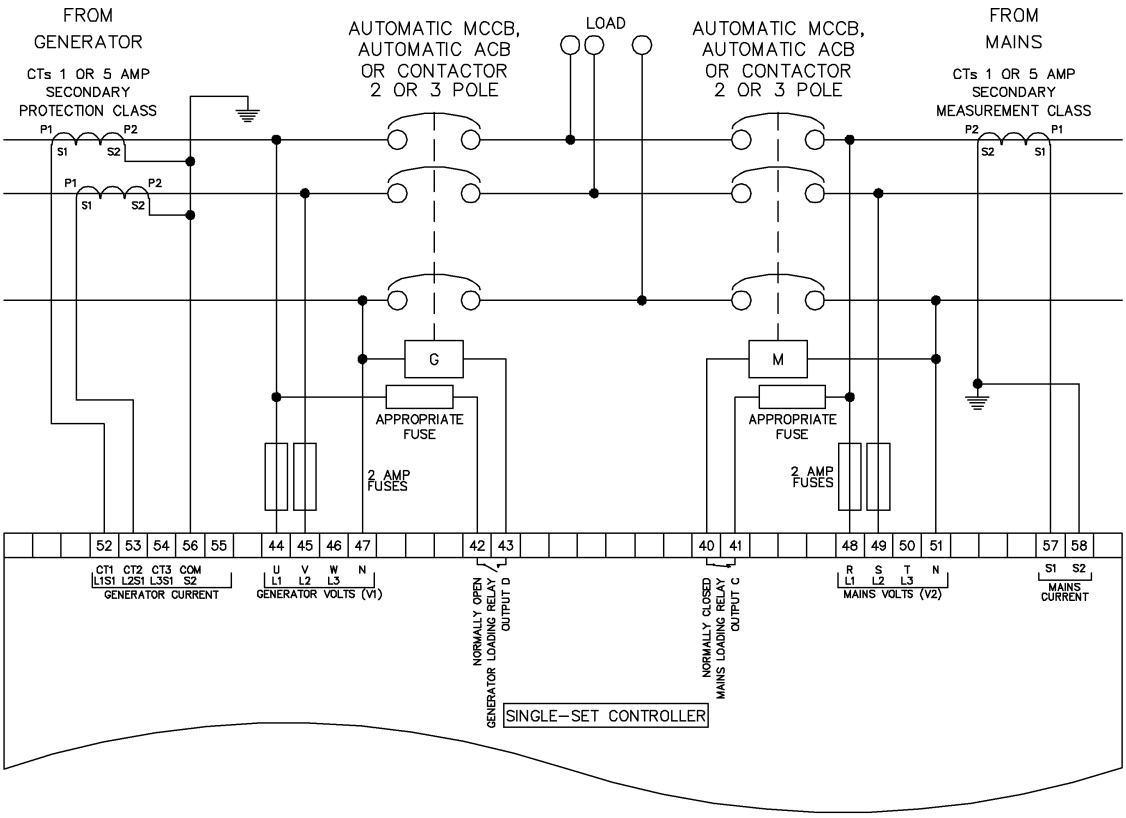


4.4.3 2 PHASE (L1 & L2) 3 WIRE WITH RESTRICTED EARTH FAULT

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

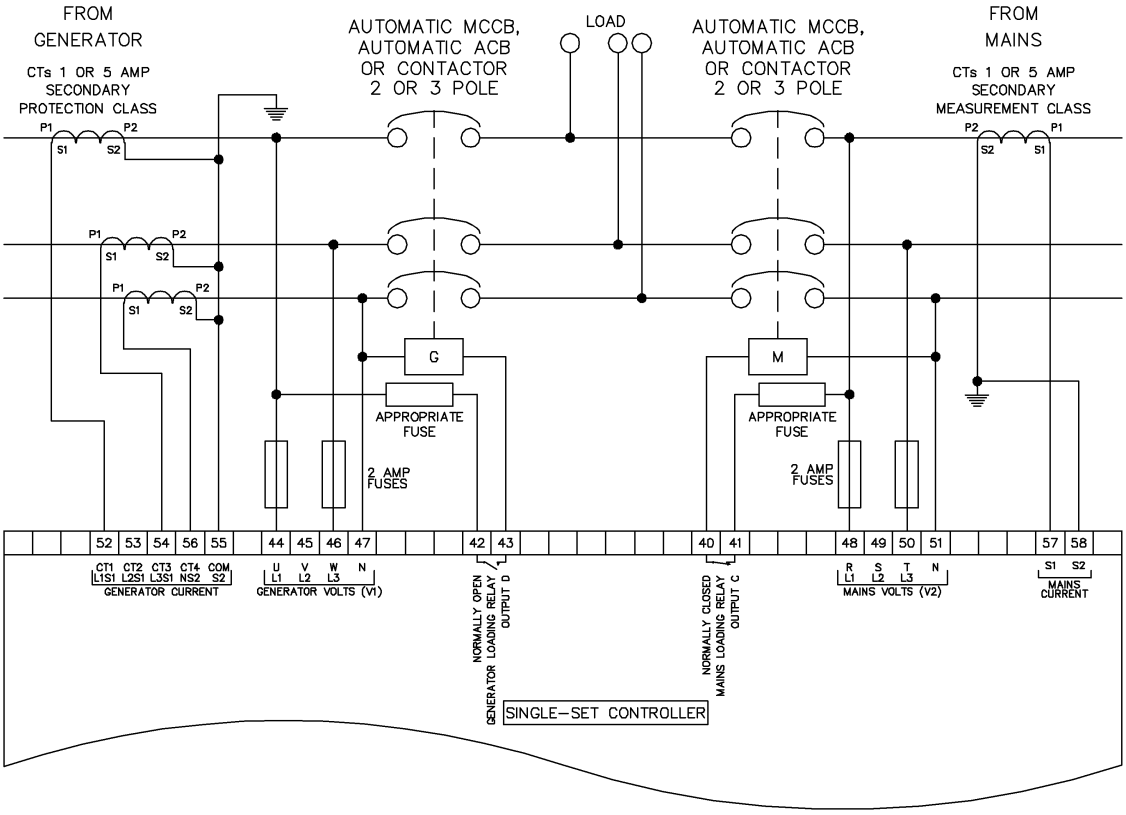


4.4.4 2 PHASE (L1 & L2) 3 WIRE WITHOUT EARTH FAULT

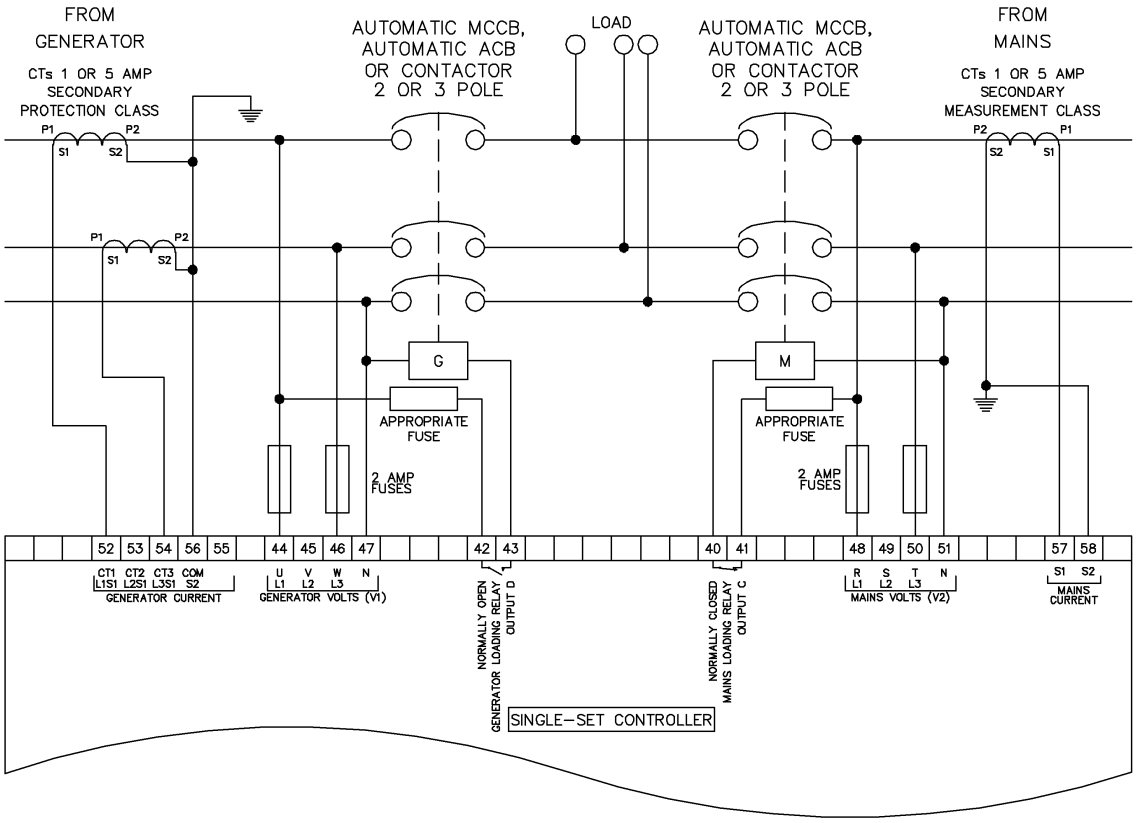


4.4.5 2 PHASE (L1 & L3) 3 WIRE WITH RESTRICTED EARTH FAULT

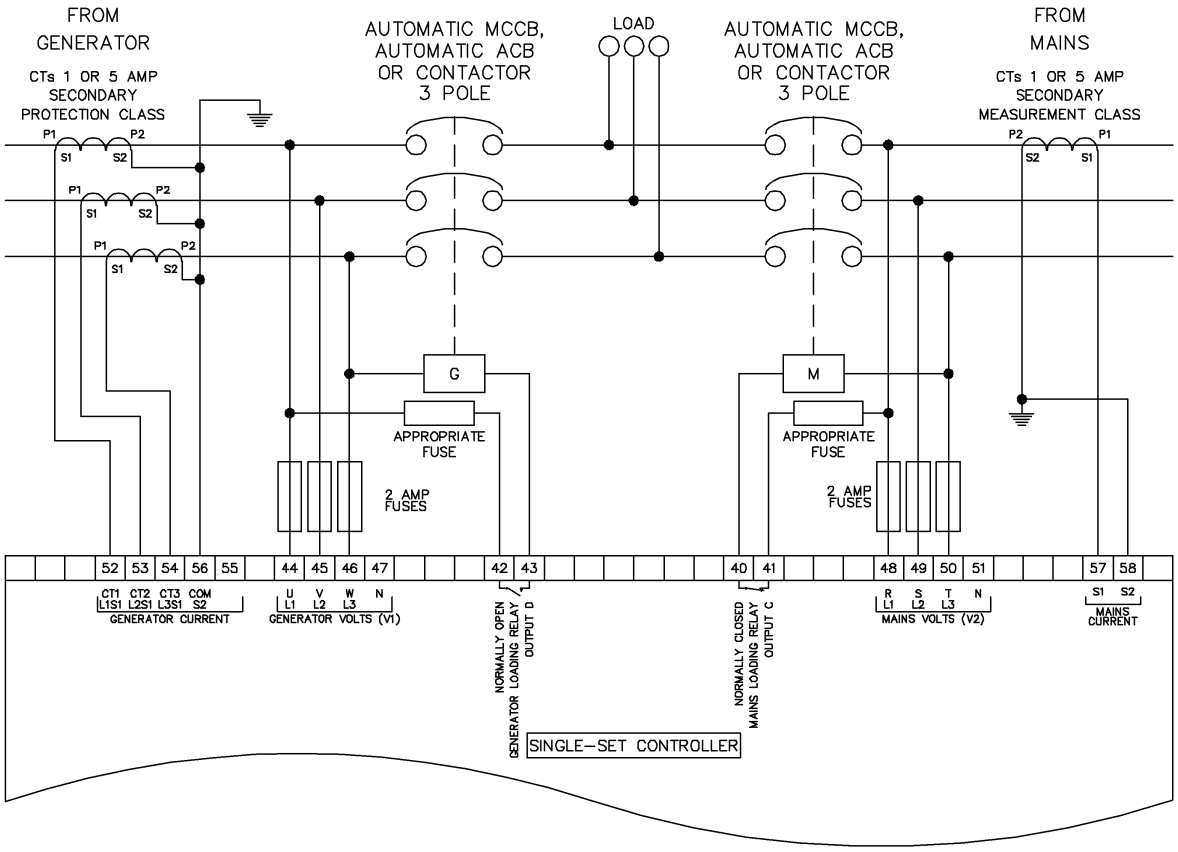
NOTE: Earthing the neutral conductor 'before' the neutral CT allows the module to read earth faults 'after' the CT only (Restricted to load / downstream of the CT).
Earthing the neutral conductor 'after' the neutral CT allows the module to read earth faults 'before' the CT only (Restricted to generator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



4.4.6 2 PHASE (L1 & L3) 3 WIRE WITHOUT EARTH FAULT MEASURING

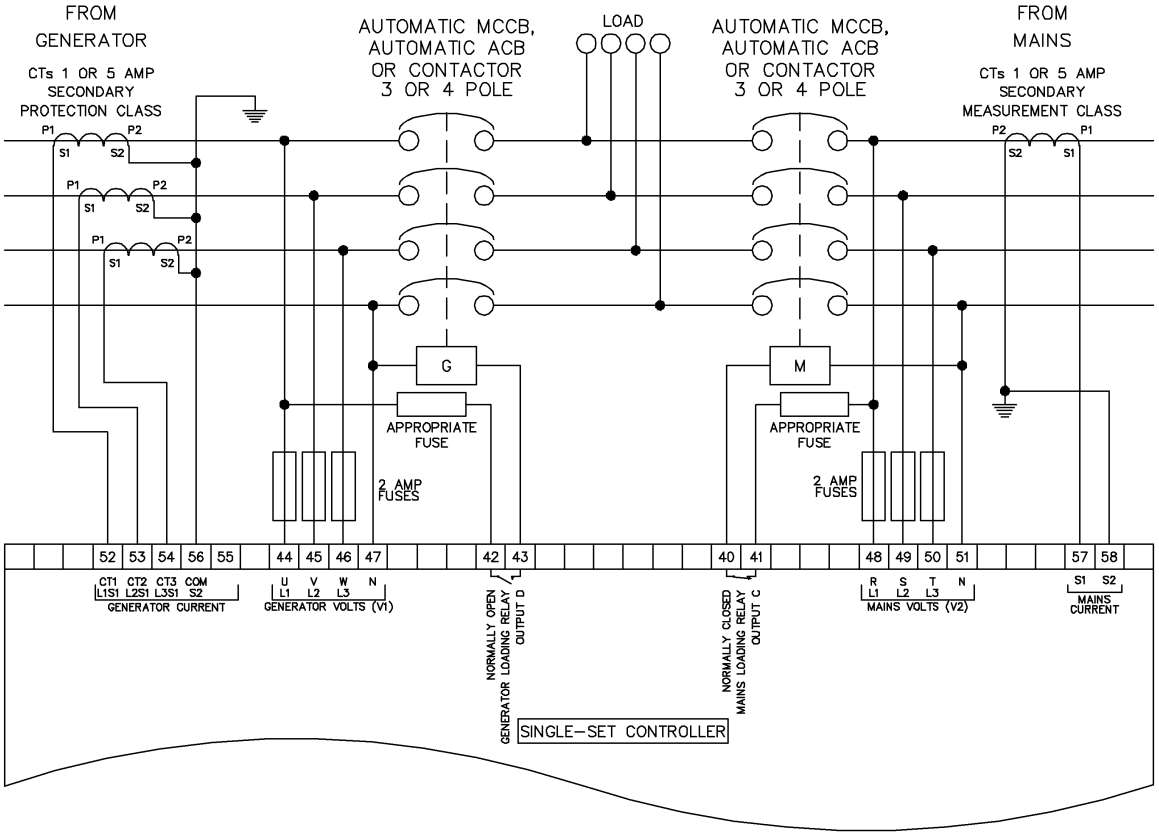


4.4.7 3 PHASE 3 WIRE DETLA WITHOUT EARTH FAULT



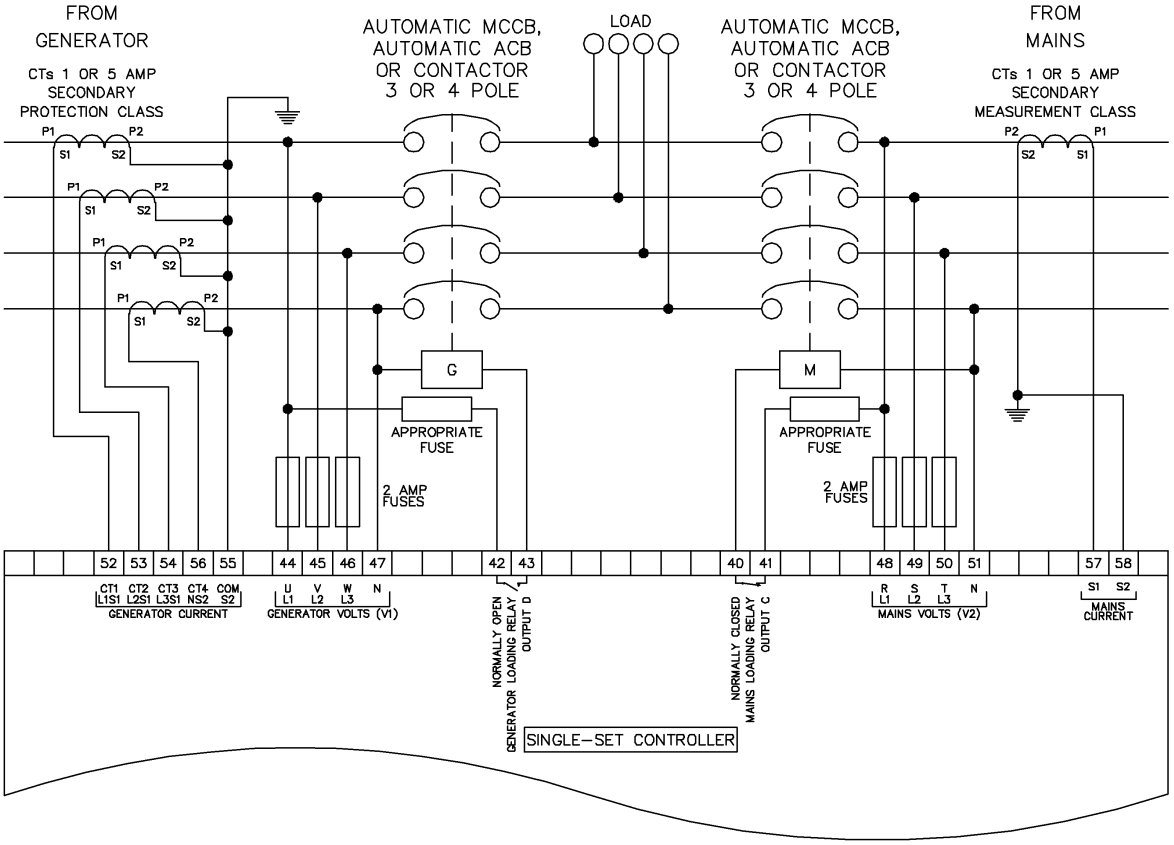
4.4.8 3 PHASE 4 WIRE WITHOUT EARTH FAULT

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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*



4.4.9 3 PHASE 4 WIRE WITH RESTRICTED EARTH FAULT

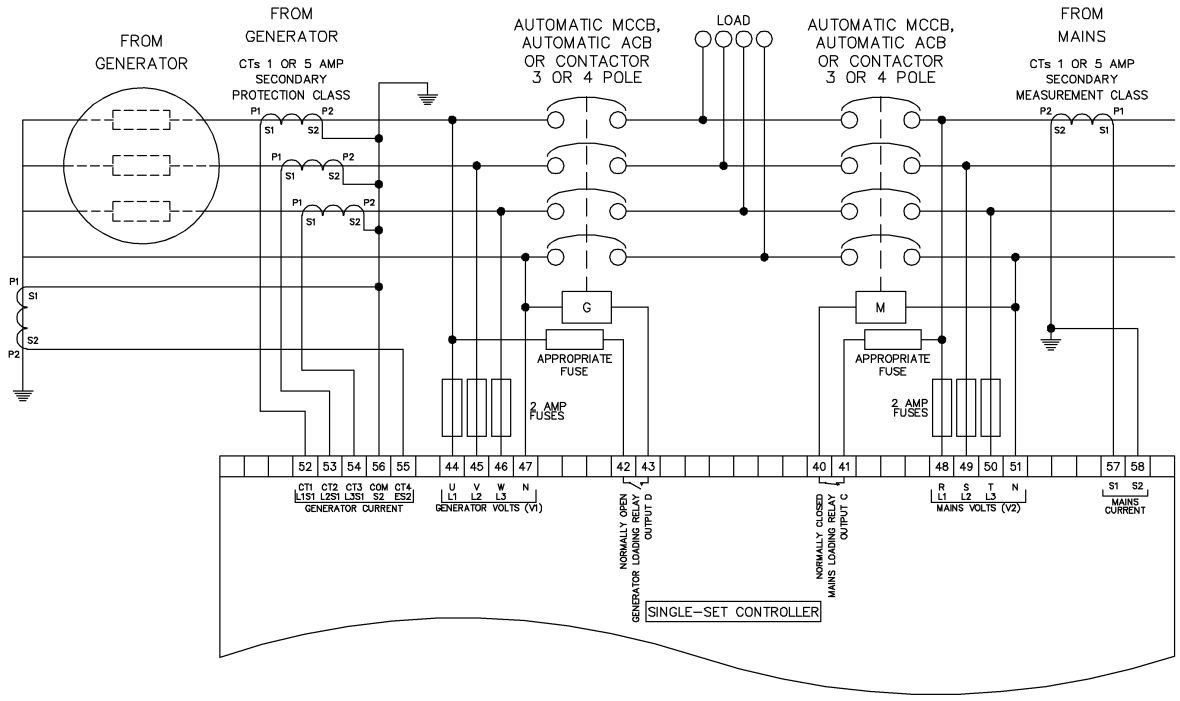
NOTE: The below diagram is applicable for the following AC topologies: 3 Phase 4 Wire Star, 3 Phase 4 Wire Delta L1-N-L2, 3 Phase 4 Wire Delta L1-N-L3 and 3 Phase 4 Wire Delta *L2-N-L3*. For further details of module configuration to suit these different topologies, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*



4.4.10 3 PHASE 4 WIRE WITH UNRESTRICTED EARTH FAULT

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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

This example shows the CTs in the neutral to earth link for a three phase four wire system to provide unrestricted earth fault protection, but the same philosophy is applicable to the other topologies.

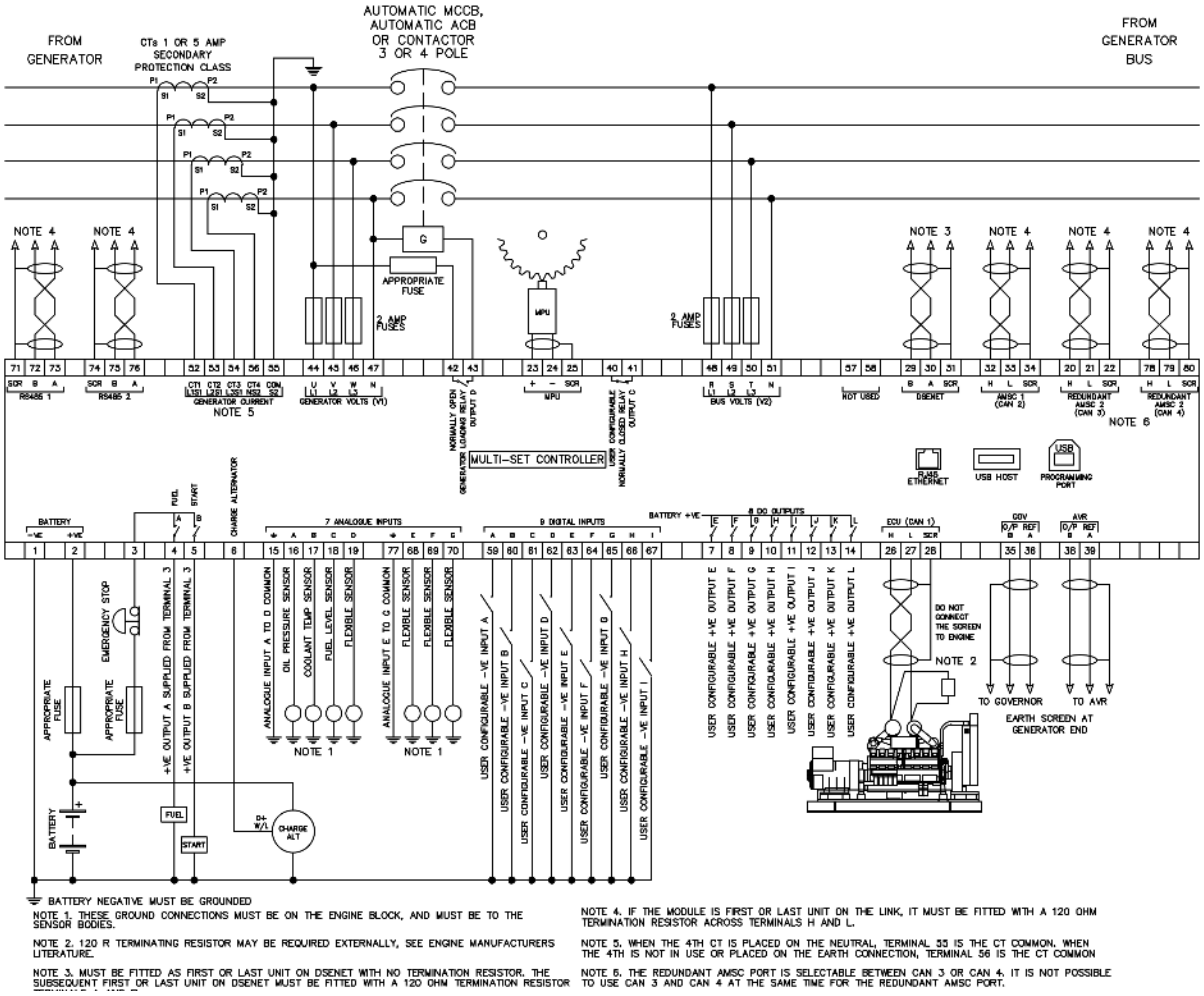


4.5 MULTI SET ALTERNATE TOPOLOGY SCHEMATIC DIAGRAMS

4.5.1 3 PHASE 4 WIRE WITH RESTRICTED EARTH FAULT (MULTISET CONTROLLER)

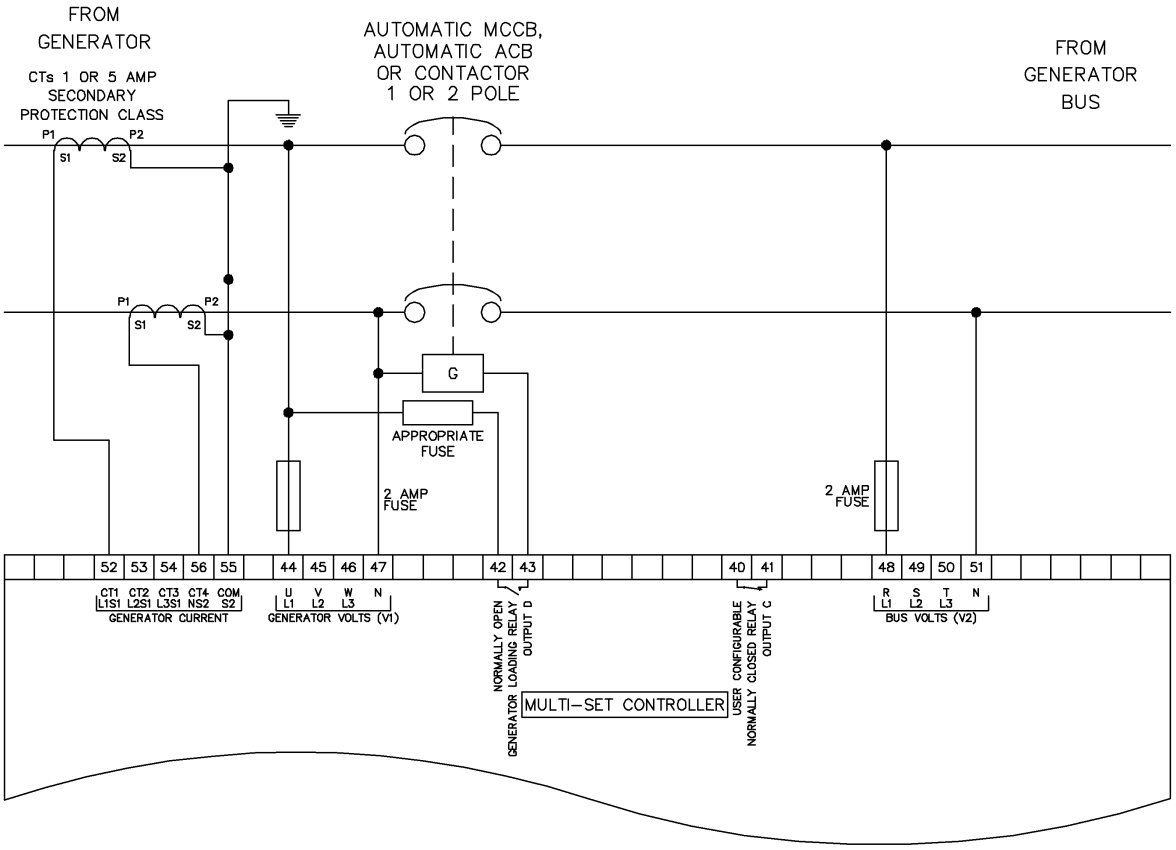
NOTE: The below diagram is applicable for the following AC topologies: 3 Phase 4 Wire Star, 3 Phase 4 Wire Delta L1-N-L2, 3 Phase 4 Wire Delta L1-N-L3 and 3 Phase 4 Wire Delta *L2-N-L3*. For further details of module configuration to suit these different topologies, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

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

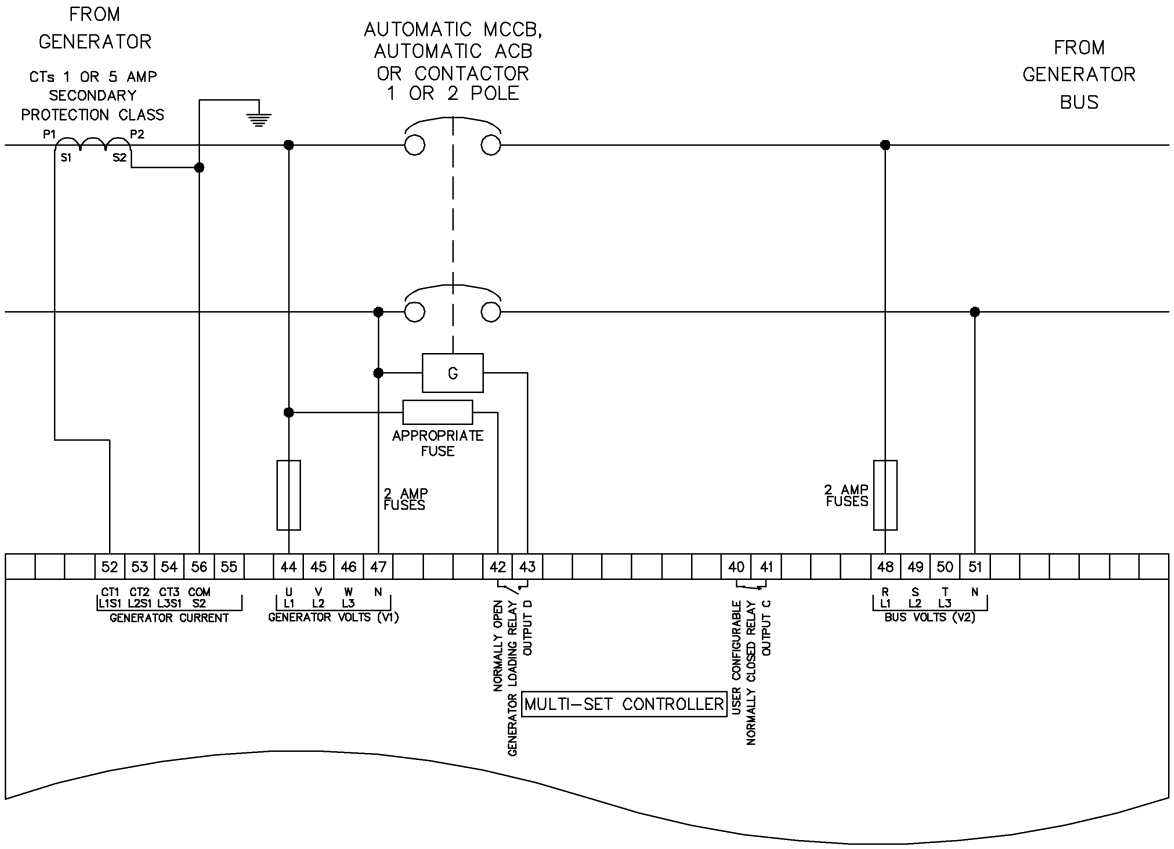


4.5.2 SINGLE PHASE (L1 & N) 2 WIRE WITH RESTRICTED EARTH FAULT

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

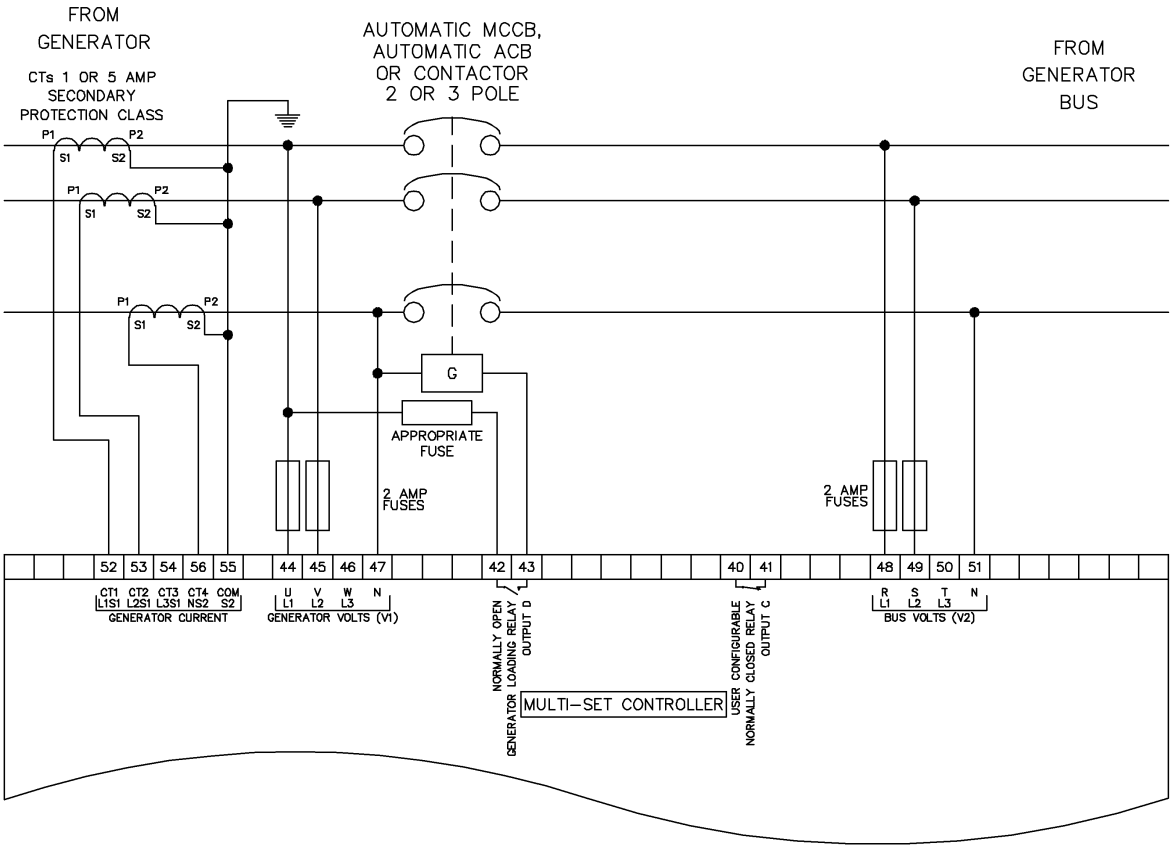


4.5.3 SINGLE PHASE (L1 & N) 2 WIRE WITHOUT EARTH FAULT

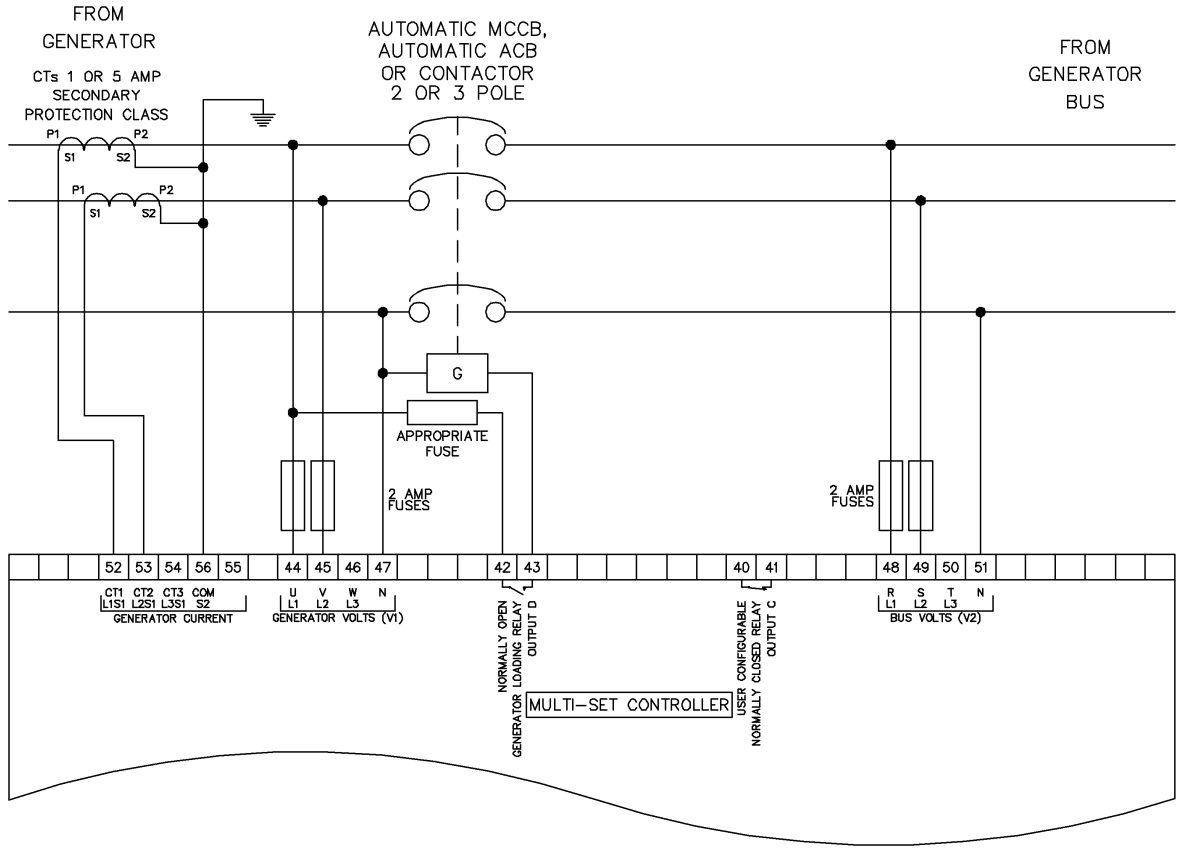


4.5.4 2 PHASE (L1 & L2) 3 WIRE WITH RESTRICTED EARTH FAULT

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

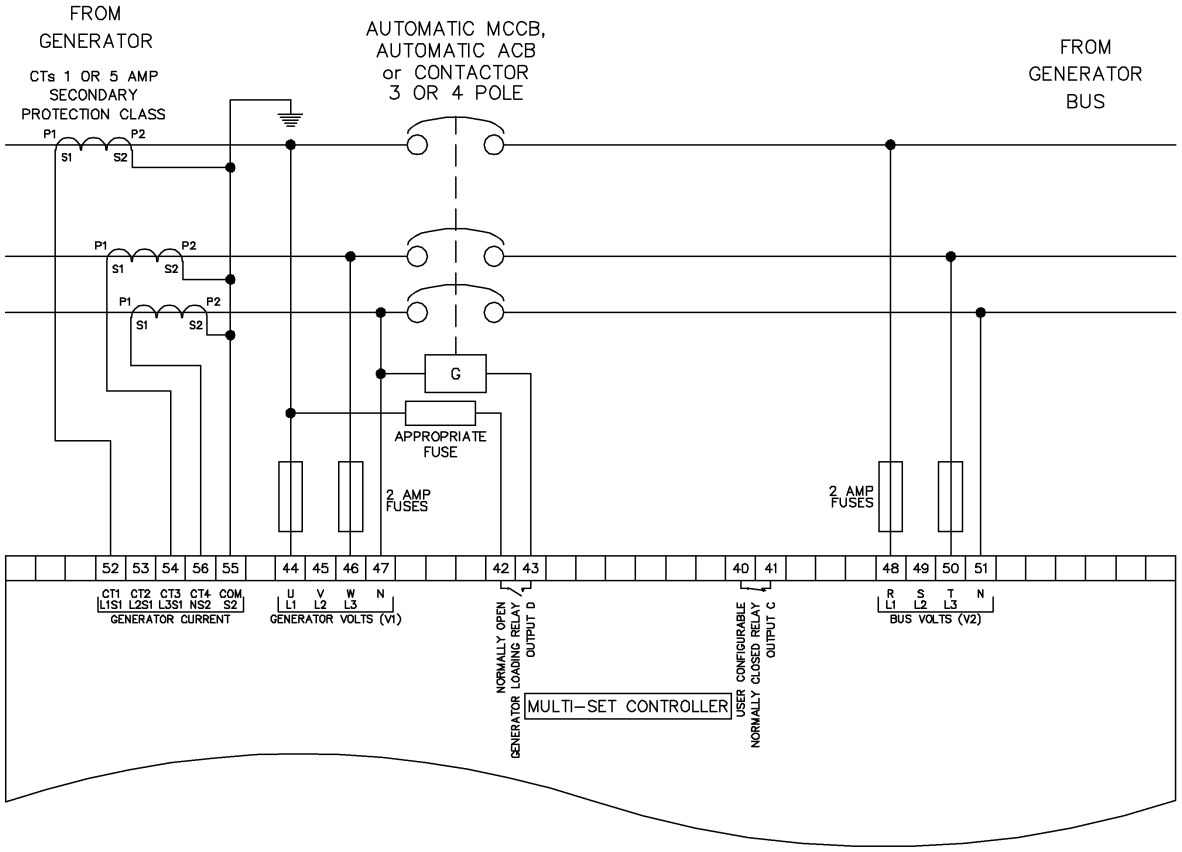


4.5.5 2 PHASE (L1 & L2) 3 WIRE WITHOUT EARTH FAULT

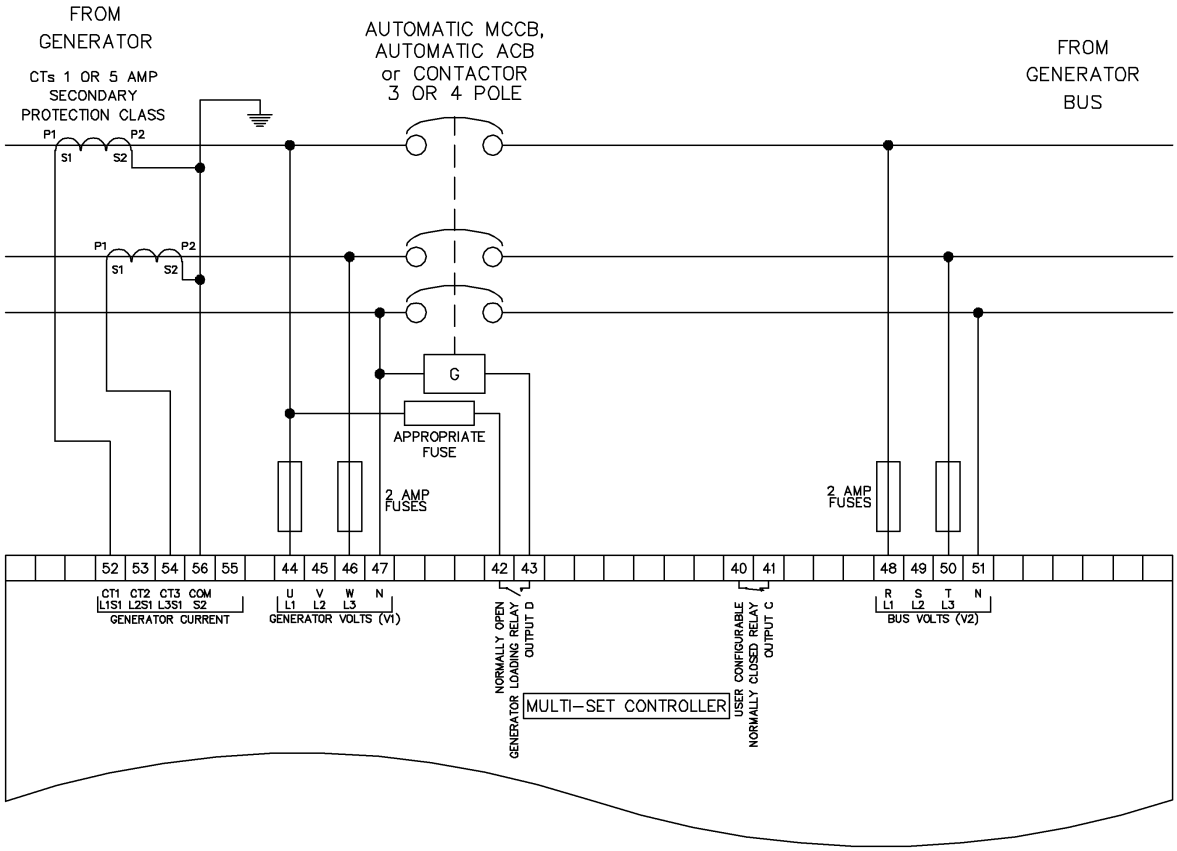


4.5.6 2 PHASE (L1 & L3) 3 WIRE WITH RESTRICTED EARTH FAULT

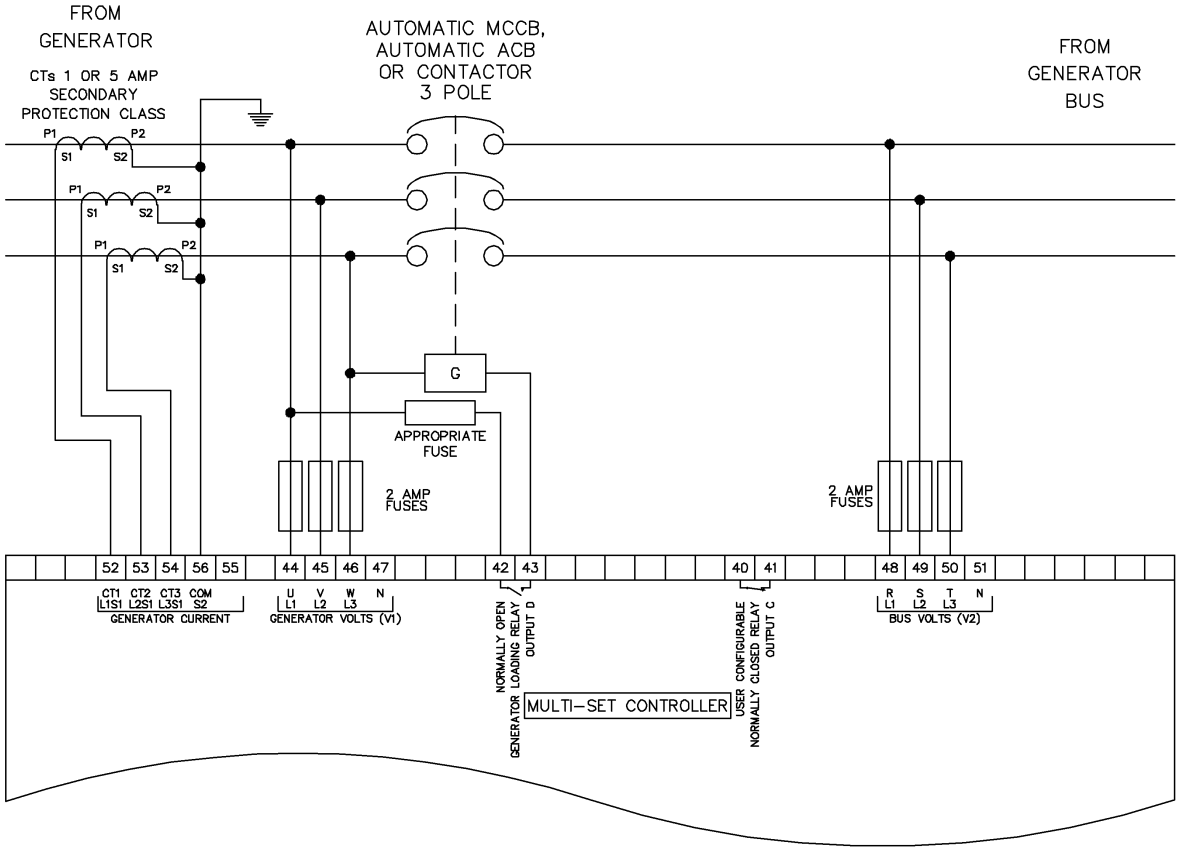
NOTE: Earthing the neutral conductor 'before' the neutral CT allows the module to read earth faults 'after' the CT only (Restricted to load / downstream of the CT).
Earthing the neutral conductor 'after' the neutral CT allows the module to read earth faults 'before' the CT only (Restricted to generator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



4.5.7 2 PHASE (L1 & L3) 3 WIRE WITHOUT EARTH FAULT

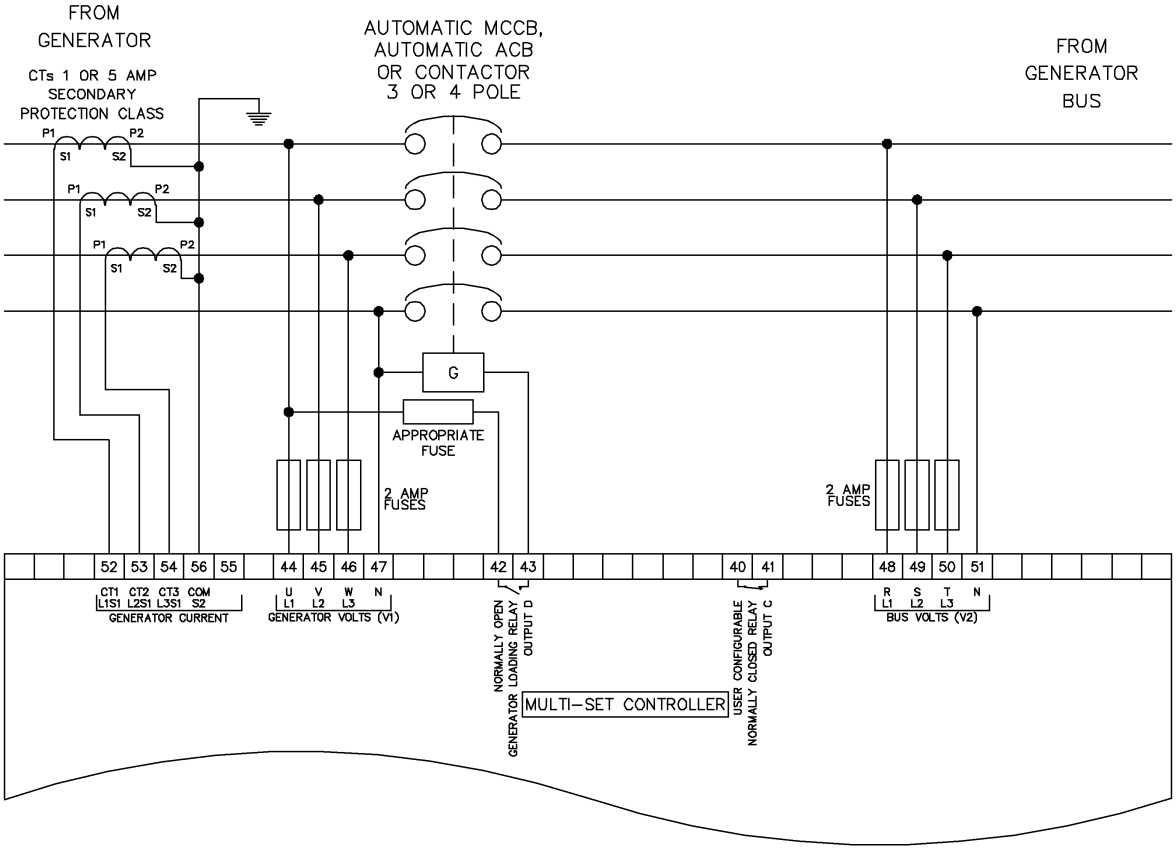


4.5.8 3 PHASE 3 WIRE DETLA WITHOUT EARTH FAULT



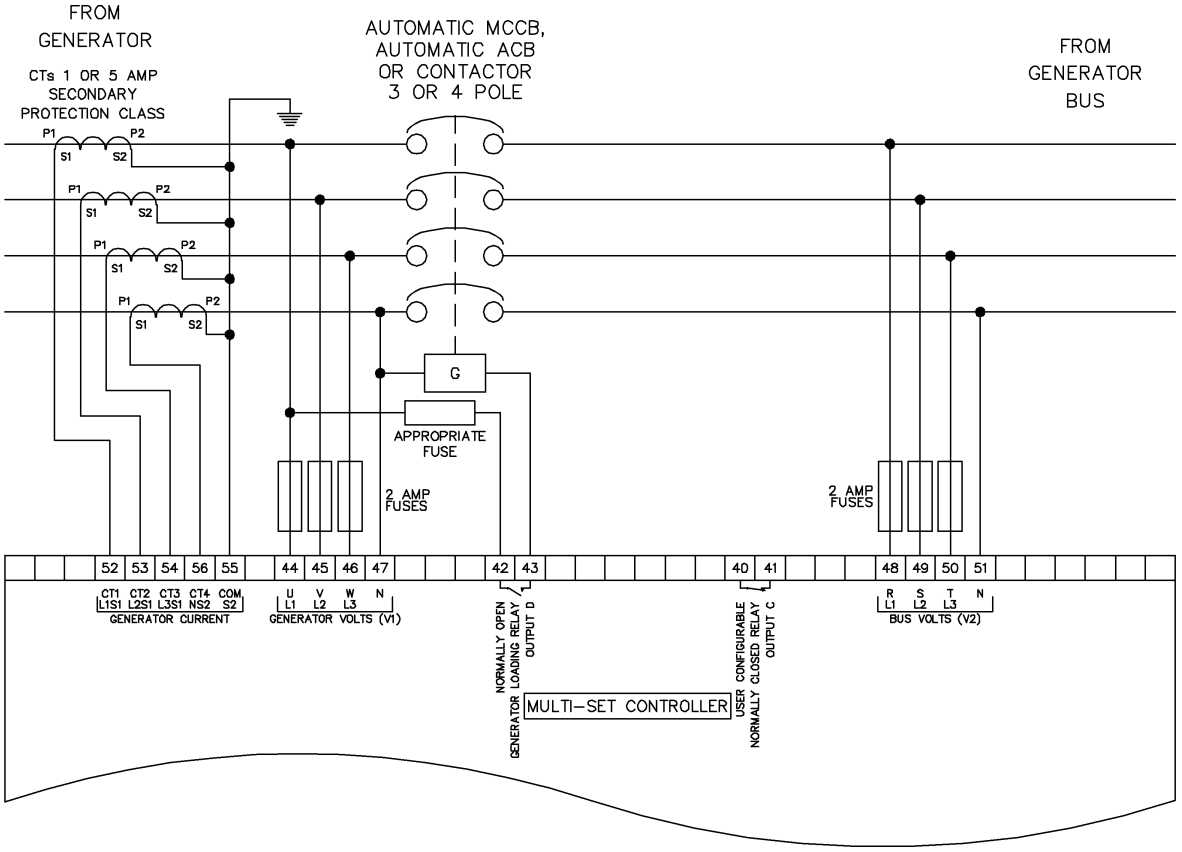
4.5.9 3 PHASE 4 WIRE WITHOUT EARTH FAULT

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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*



4.5.10 3 PHASE 4 WIRE WITH RESTRICTED EARTH FAULT

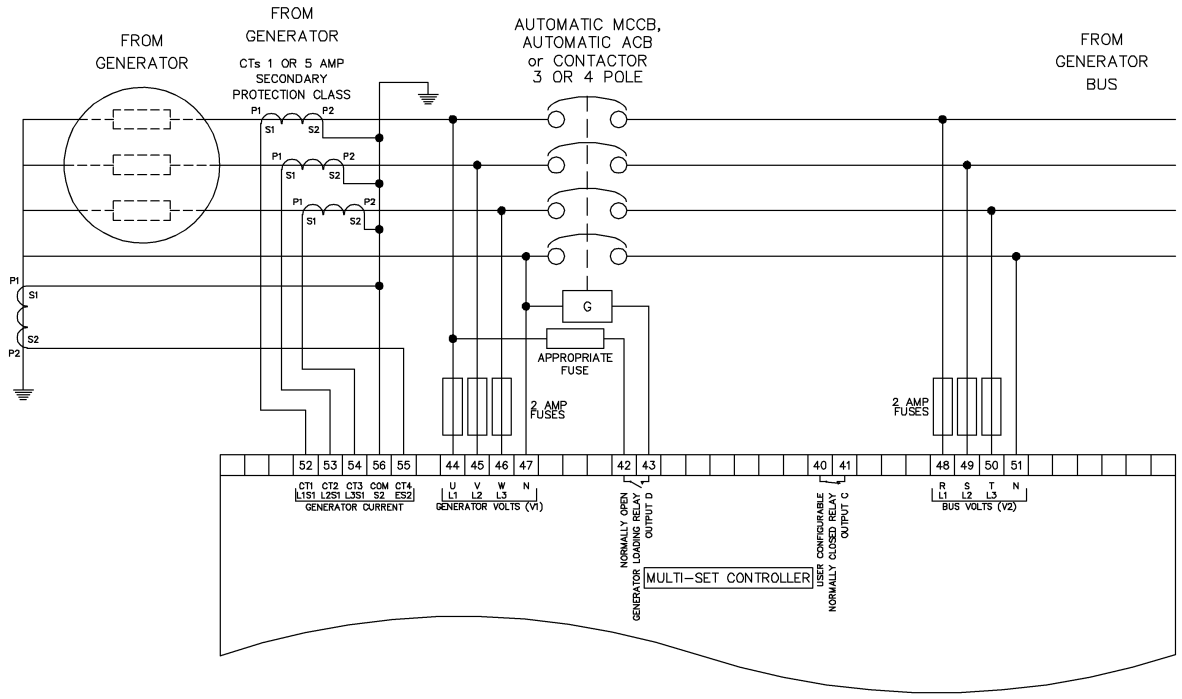
NOTE: The below diagram is applicable for the following AC topologies: 3 Phase 4 Wire Star, 3 Phase 4 Wire Delta L1-N-L2, 3 Phase 4 Wire Delta L1-N-L3 and 3 Phase 4 Wire Delta *L2-N-L3*. For further details of module configuration to suit these different topologies, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*



4.5.11 3 PHASE 4 WIRE WITH UNRESTRICTED EARTH FAULT

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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

This example shows the CTs in the neutral to earth link for a three phase four wire system to provide unrestricted earth fault protection, but the same philosophy is applicable to the other topologies.



5 DESCRIPTION OF CONTROLS

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

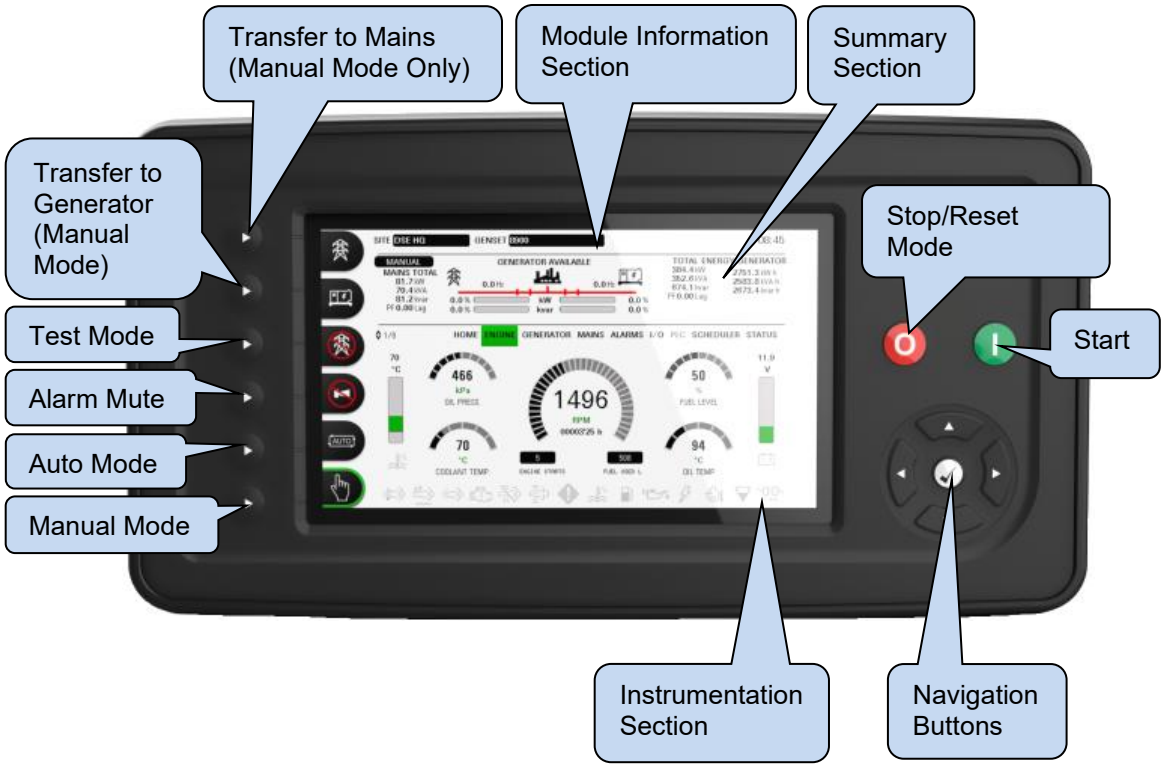
NOTE: The following descriptions detail the sequences followed by a module containing the standard factory configuration. Always refer to your configuration source for the exact sequences and timers observed by any module in the field.

Together with the start and stop buttons, the six buttons to the left of the screen are used to provide control. The navigation buttons are used to navigate through the numerous display pages. The display is a 7” TFT with 800x480 pixels.

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*** , ***Transfer to Generator*** and ***Transfer to Mains*** functions. For normal operation, these are the only controls which need to be operated.

The ***Manual Mode*** , ***Test Mode*** , ***Auto Mode*** , ***Transfer to Generator*** and ***Transfer to Mains*** functions are activated via their left buttons.

Details of their operation are provided in the following sections.



5.1 CONTROL PUSH BUTTONS

5.1.1 BUTTON HIGHLIGHTS

Icon	Description
	**No Highlight** The module is currently not in this operating mode.
	**Green Highlight** The module is currently in this operating mode.
	**Red Highlight** The module's internal audible alarm is active, press the ***Alarm Mute / Lamp Test***  button to reset.

5.1.2 BUTTON FUNCTIONS

NOTE: For further details, refer to the section entitled *Operation* elsewhere in this document.

Icon	Description
	**Transfer to Mains** The ***Transfer to Mains*** button control the operation of the mains load switching and is only active in ***Manual Mode*** once the generator is available. **'Normal' Breaker Button Control** • Synchronising NOT Enabled: Pressing the ***Transfer to Mains*** button when the Mains is available and off load, the generator load switch is opened *(**Close Generator Output*** becomes inactive*)* and the mains load switch is closed *(**Close Mains Output*** becomes active*).* Further presses of the ***Transfer to Mains*** button have no effect. • **Synchronising Enabled:** Pressing the ***Transfer to Mains*** button when the Mains is available and off load, the module synchronise the Generator to the Mains. The mains load switch is then closed in parallel with the Generator *(**Close Mains Output*** & ***Close Generator Output*** *are active)*. Further presses of the ***Transfer to Mains*** button ramps the entire load from the Generator to the Mains. Once done, the generator load switch opens *(**Close Generator Output*** becomes inactive) leaving just the mains supplying the load. **'Alternative' Breaker Button Control** • Synchronising NOT Enabled: Pressing the ***Transfer to Mains*** button when the Mains is available and off load, the generator load switch is opened *(**Close Generator Output*** becomes inactive*)* and the mains load switch is closed ***(Close Mains Output becomes active)***. Further presses of the ***Transfer to Mains*** button opens and closes the mains load switch *(**Close Mains Output*** changes state*)* and leaves the generator load switch in the open position *(**Close Generator Output*** remains inactive*).* • **Synchronising is enabled:** Pressing the ***Transfer to Mains*** button when the Mains is available and off load, the module synchronise the Generator to the Mains. The mains load switch is then closed in parallel with the Generator *(**Close Mains Output*** & ***Close Generator Output*** are active*)*. Further presses of the ***Transfer to Mains*** button ramps the entire load from the Mains to the Generator. Once done, the Mains load switch opens *(**Close Mains Output*** becomes inactive*)* leaving just the Generator supplying the load.

Continued overleaf…

Icon	Description
	**Transfer to Generator** The ***Transfer to Generator*** button controls the operation of the generator load switch and is only active in the ***Manual Mode*** once the generator is available. **'Normal' Breaker Button Control** • **Synchronising NOT Enabled:** Pressing the ***Transfer to Generator*** button when the Generator is available and off load, the Mains load switch is opened ***(Close Mains Output becomes inactive)*** and the Generator load switch is closed *(**Close Generator Output** becomes active)*. Further presses of the ***Transfer to Generator*** button have no effect. • **Synchronising Enabled:** Pressing the ***Transfer to Generator*** button when the Generator is available and off load, the module synchronises the Generator to the Mains. The Generator load switch is then closed in parallel with the Mains *(**Close Mains Output** & **Close Generator Output** are active)*. Further presses of the ***Transfer to Generator*** button ramps the entire load from the Mains to the Generator. Once done, the Mains load switch opens *(**Close Mains Output** becomes inactive)* leaving just the Generator supplying the load. **'Alternative' Breaker Button Control** • **Synchronising NOT Enabled:** Pressing the ***Transfer to Generator*** button when the Generator is available and off load, the Mains load switch is opened *(**Close Mains Output** becomes inactive)* and the Generator load switch is closed *(**Close Generator Output** becomes active)*. Further presses of the ***Transfer to Generator*** button opens and closes the Generator load switch *(**Close Generator Output** changes state)* and leaves the Mains load switch in the open position *(**Close Mains Output** remains inactive)*. • **Synchronising Enabled:** Pressing the ***Transfer to Generator*** button when the Generator is available and off load, the module synchronises the Generator to the Mains. The Generator load switch is then closed in parallel with the Mains *(**Close Mains Output** & **Close Generator Output** are active)*. Further presses of the ***Transfer to Generator*** button ramps the entire load from the Generator to the Mains. Once done, the Generator load switch opens *(**Close Generator Output** becomes inactive)* leaving just the Mains supplying the load.

Continued overleaf…

Icon	Description
	**Test Mode** This button places the module into its ***Test Mode***  this allows an on-load test of the generator. Once in ***Test Mode***  , the module responds to the ***Start***  button to start the generator. Once the set has started and becomes available, it is automatically placed on load *(**Close Generator Output** becomes active)*, synchronising to the Mains if required. Depending upon module configuration, the generator remains in constant parallel with the Mains or proceeds to run in island operation *(**Close Mains Output** becomes inactive)*. The generator remains on load until either the ***Stop/Reset Mode***  or ***Auto Mode***  is selected.
	**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.
	**Auto Mode** This button places the module into its ***Auto Mode***  . This mode allows the module to control the function of the generator automatically. The module monitors various ***Start Signals*** (through inputs, *Load Levels* and *Mains Failure Detection*) and when one has been made, the set is automatically started. Once the generator is available the generator is place on load *(**Close Generator Output** becomes active), synchronising to the Mains if required.* Upon removal of the starting signal, the module starts the *Return Delay Timer* and once expired, the load is automatically ramped off the generator and then it is taken off load *(**Close Generator Output** becomes inactive).* The generator then continues to run for the duration of the *Cooling Timer* until it stops. The module then waits for the next start event.

Continued overleaf…

Icon	Description
	**Manual Mode** This button places the module into its ***Manual Mode*** . Once in ***Manual Mode*** **,** the module responds to the ***Start*** button to start the generator and run it off load. To place the generator on load, use the ***Transfer to Generator*** button. The module automatically instructs the generator to synchronise to the mains (if on load) and once in sync, to be place the generator on load *(**Close Generator Output** becomes active).* To place the generator off load, use the ***Transfer to Mains*** button. The module automatically ramps the load off the generator and then takes it off load *(**Close Generator Output** becomes inactive).* Additional digital inputs are available to perform these functions. If the generator is running off-load in ***Manual Mode*** and on load signal becomes active, the module automatically instructs the generator to synchronise and once in sync, to be place the generator on load *(**Close Generator Output** becomes active)*. Upon removal of the on-load signal, the module automatically ramps the load off the generator and then takes it off load *(**Close Generator Output** becomes inactive.* Also, in ***Manual Mode*** **,** the module responds to the ***Transfer to Mains*** button to place the mains on load (***Close Mains Output*** *becomes active)*. Synchronising occurs automatically if required.

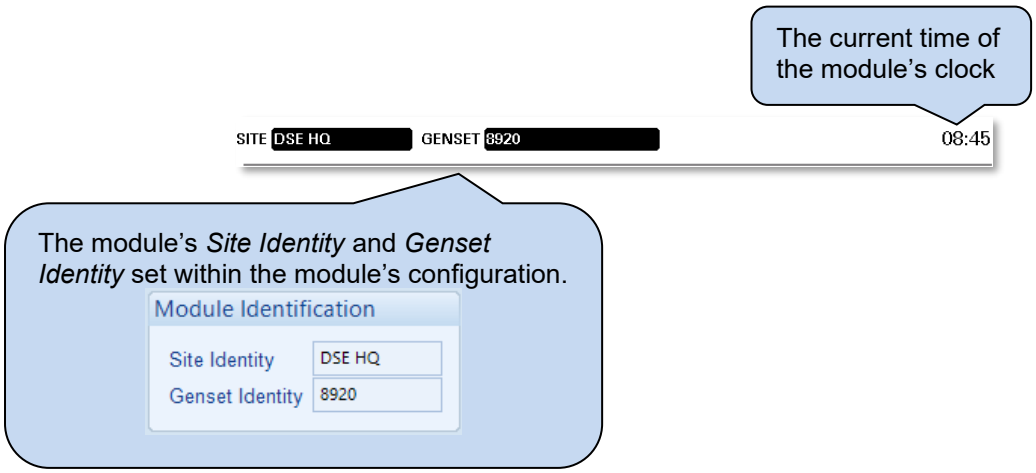
Continued overleaf…

NOTE: For further details, refer to the section entitled *Operation* elsewhere in this document.

Icon	Description
	**Menu Navigation** Used for navigating the instrumentation, event log and configuration pages.
	**Start** This button is only active in the ***Stop/Reset Mode*** O, ***Manual Mode***  Pressing the ***Start*** I button in ***Stop/Reset Mode*** O powers up the engine's ECU but does not start the engine. This can be used to check the status of the CAN communication and to prime the fuel system. Pressing the ***Start*** I button in ***Manual Mode***  starts the generator and runs it off load in ***Manual Mode*** 
	**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. If the engine is running and the module is put into ***Stop/Reset Mode*** O, the module automatically instructs the generator off load *(**Close Generator Output** becomes inactive)* ***Stop/Reset Mode*** O the generator remains at rest

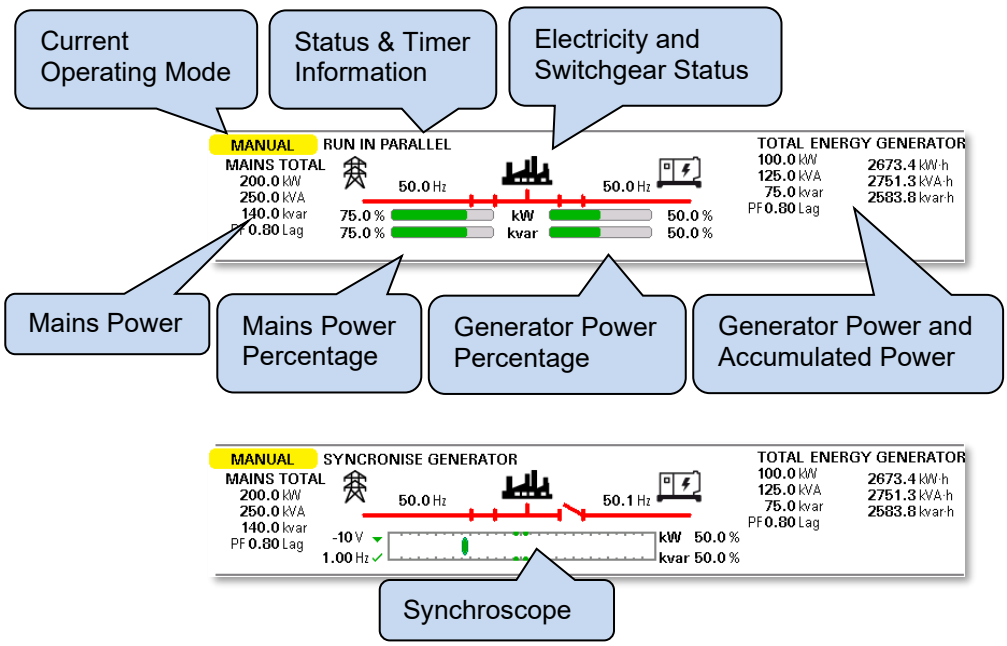
5.2 MODULE INFORMATION SECTION

The content of the *Module Information Section* is arranged as shown in the example below. This section displays the configured *Site Identity* and *Genset Identity* within the module's configuration.



5.3 SUMMARY SECTION

The content of the *Summary Section* is arranged as shown in the example below. This section displays summary of the generator's current operating state. Further details of their operation are provided in the following sections.



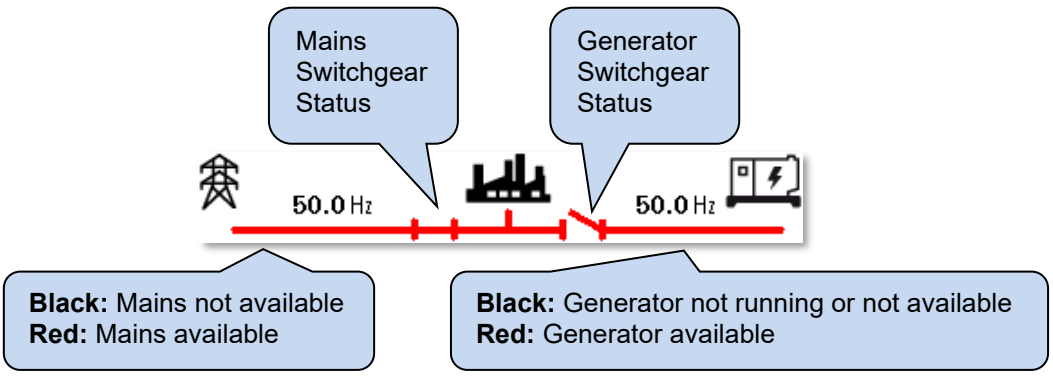
5.3.1 CURRENT OPERATING MODE

This icon is used to indicate the module's currently selected operating mode and what the most severe active alarm where applicable (if there is an active alarm).

Colour	Description
STOP	The module has no alarms active.
STOP	The module's most severe active alarm is a *Warning*.
STOP	The module's most severe active alarm is an *Electrical Trip*. Unless the alarm is reset the generator cannot be started.
STOP	The module's most severe active alarm is a *Shutdown*. Unless the alarm is reset the generator cannot be started.

5.3.2 ELECTRICITY AND SWITCHGEAR STATUS

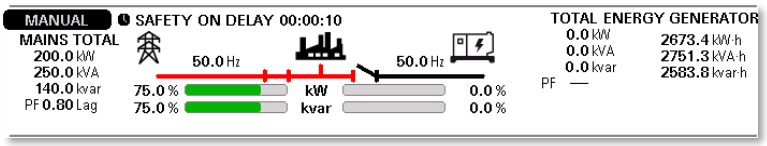
These icons are used to indicate if the supplies are available to take load and their switchgear status.



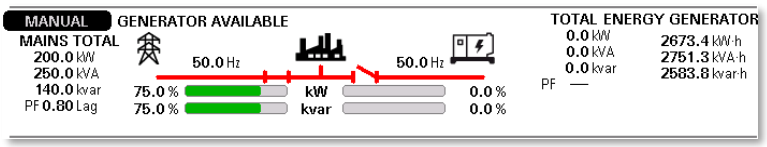
5.3.3 STATUS & TIMER INFORMATION

The information displayed for the *Status & Timer Information* changes depending upon the operation the module is performing. Below are two examples showing status information and a timer counting down.

Example Timer

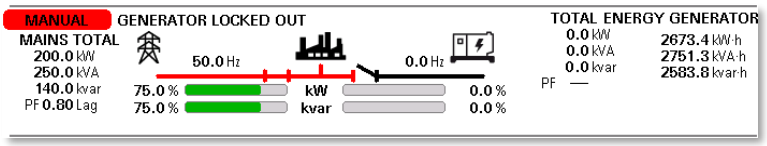


Example Status



5.3.3.1 GENERATOR LOCKED OUT

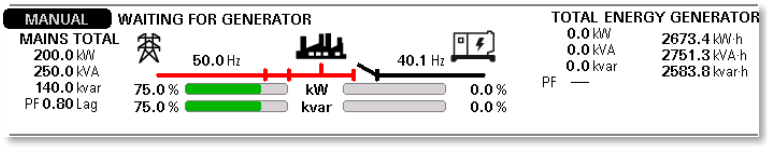
Generator Locked Out indicates that the Generator cannot be started due to an active *Shutdown* or *Electrical Trip Alarm* on the module. Press the ***Right or Left***  button to scroll to the *ALARMS* page to investigate. Press the ***Stop/Reset Mode***  button to clear the alarm, if the alarm does not clear the fault is still active.



5.3.3.2 WAITING FOR GENERATOR

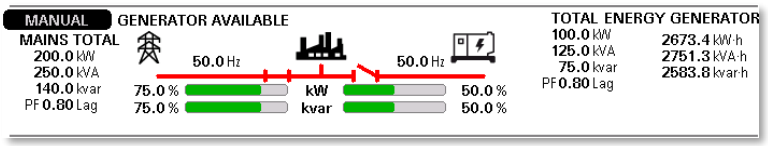
NOTE: For further details of module configuration, refer to DSE Publication: 057-340 DSEG*8900 Configuration Suite PC Software Manual.*

Waiting For Generator indicates that the Generator has started but has not reached the required *Loading Voltage* and/or *Loading Frequency* as set in the module's configuration. Press the ***Right or Left***  buttons to scroll to the *Generator* page to check to see if the generator voltage and frequency is higher than the configured *Loading Voltage* and *Loading Frequency*.

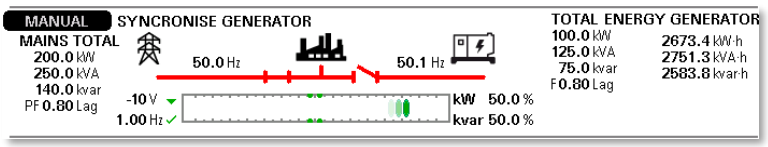


5.3.4 SYNCHROSCOPE

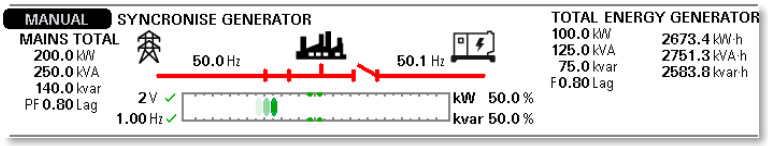
During normal operation, the synchroscope is not displayed and only appears when the synchronising process begins.



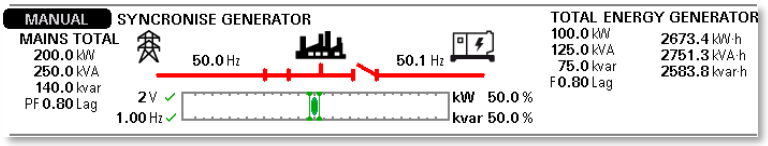
Once the synchronising process begins, the synchroscope initially shows the difference between the mains and generator supplies. Here the display is showing a frequency mismatch of +1.0 Hz and a voltage mismatch of -10 V. The genset voltage is too low (indicated by the arrow) and must be increased. The frequency is high but is within the *Check Sync* limits set for synchronising (indicated by the tick).



When both the frequency and the voltage differences are within acceptable limits, the phase matching begins. The moving bar shows the phase difference between the two supplies. The engine speed is automatically adjusted to adjust the phase, until the moving bar enters the centre of the scope.

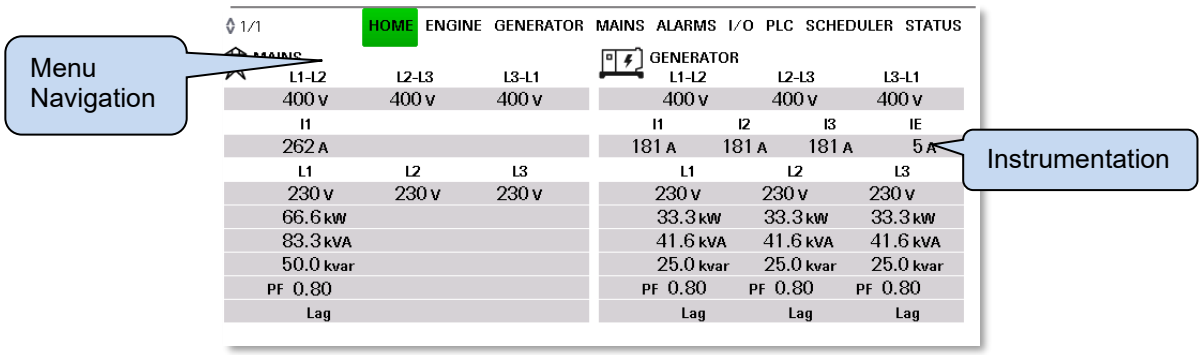


Once the mains and generator supplies are in sync (indicated by the two vertical green lines in the middle of the phase window), the module initiates a close signal to the generator's switchgear to close the generator onto the mains. If synchronism is broken the moving bar will pass out of the synchronising window and the *Out of Sync* alarm activates.



5.4 INSTRUMENTATION

The content of the area is arranged as shown in the example below. This serves as an overview of the measured instruments of the module.



5.4.1 VIEWING THE INSTRUMENT PAGES

NOTE: Depending upon the module's configuration, some display pages may be disabled. For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

The module's display is split into sections containing multiple pages per section where applicable. It is possible to scroll to between the different sections of information by repeatedly operating the

Right & Left  buttons. The currently selected section highlights with a green background.

If you want to view one of the instrument pages towards the end of the list, it may be quicker to scroll left through the pages rather than right!

HOME  **ENGINE**  **GENERATOR**

Further presses of the ***Right***  button returns to the *HOME* page.

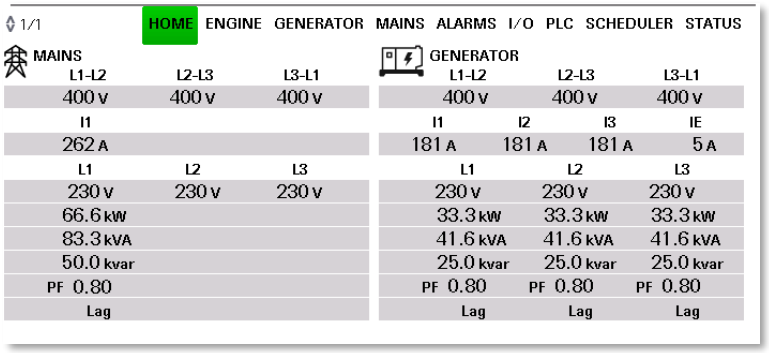
The complete order and contents of the available instruments within each page are given in the following sections. To scroll through all the instruments for the currently selected page, press the

Up/Down  buttons.

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

5.4.2 HOME

The *HOME* page contains a summary of the generator and mains electrical parameters, measured, or derived from the module's voltage and current inputs. The available information changes depending on how the module is configured.



The *HOME* page is the default page the display automatically reverts to after an extended period of inactivity (*Page Timer*) of the ***Menu Navigation***  buttons being pressed.

The page the module reverts to after an extended period of inactivity is configurable within the *Running Configuration Editor* by editing the *HOME SELECTION* parameter. This is useful if the desired page is the *ENGINE* page to display the *Engine Fault Lamps.* For details on how to select this, refer to the section entitled *Running Configuration Editor* elsewhere in this document.

5.4.3 ENGINE

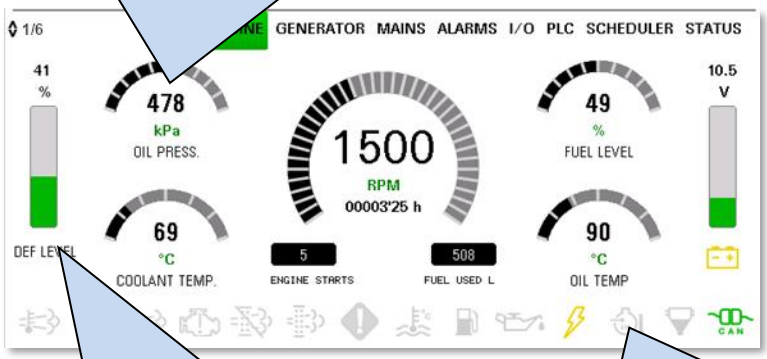
NOTE: Instruments marked with a * suffix are only available when the module is connected to an engine's ECU (ECM). For further details of support engine, refer to DSE Publication: *057-004 Electronic Engines and DSE Wiring Guide.*

NOTE: Depending upon the module's configuration, some display pages may be disabled. For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

The *ENGINE* pages contain instrumentation relating the engine, measured, or derived from the module's inputs or obtained from the engine's ECU (ECM). The available information changes depending on how the module is configured.

Press the ***Up/Down*** buttons scroll through the available ***Engine*** parameters, examples of are shown below.

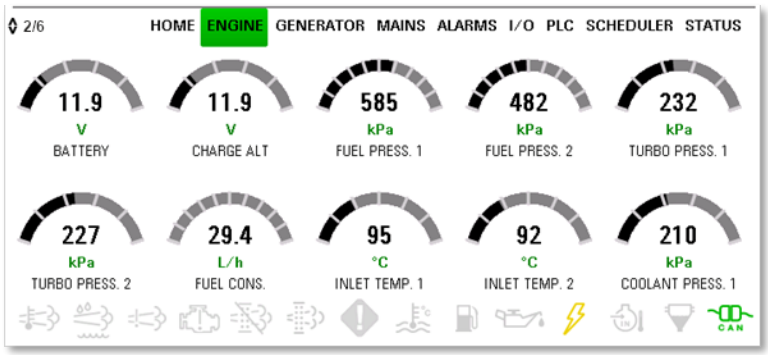
In addition to providing the required instrument a gauge is able to display the following fault conditions:
---- Below Measurable Range
++++ Above Measurable Range
XXXX Sensor Disconnected



Engine Speed
DEF Level*
Oil Pressure
Coolant Temperature
Battery Voltage
Number of Hours Run
Number of Starts
Fuel Level
Oil Temperature*
Fuel Used*
Engine Fault Lamps*
CAN Link Status to Engine ECU*

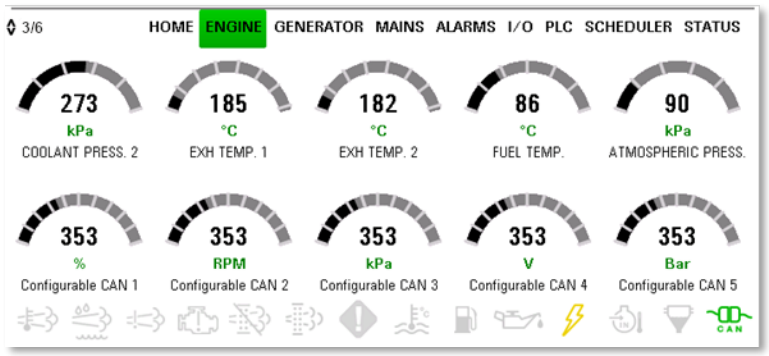
The left side bar instrument is selectable between *Coolant Temperature* or *DEF Level* using the *BAR SELECTION* parameter. For details on how to select this, refer to section 8.2 entitled *Running Configuration Editor*.

The *Engine Fault Lamps* are not solely confined to the engine section.
For further details refer to the section entitled *Engine Fault Lamps* elsewhere in this document.



Battery Voltage
Charge Alternator Voltage
Fuel Pressure*
Turbo Pressure*
Fuel Consumption
Inlet Temperature*
Coolant Pressure*
Engine Fault Lamps*
CAN Link Status to Engine ECU*

NOTE: Instruments marked with a * suffix are only available when the module is connected to an engine's ECU (ECM). For further details of support engine, refer to DSE Publication: *057-004 Electronic Engines and DSE Wiring Guide.*



Coolant Pressure*
Exhaust Temperature*
Fuel Temperature*
Atmospheric Pressure*
Configurable CAN Instruments 1 to 30
Engine Fault Lamps*
CAN Link Status to Engine ECU*

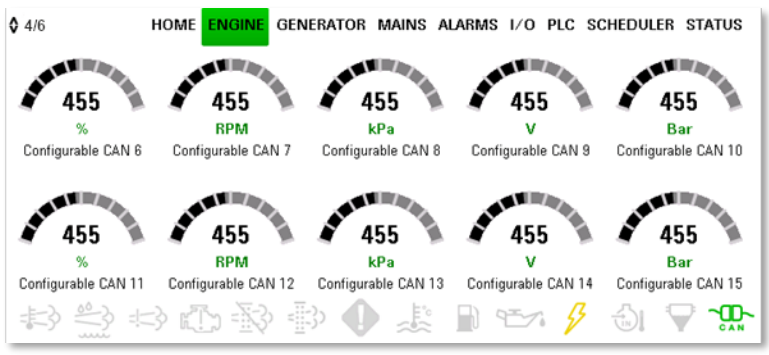
Depending on the engine's supported instrumentation and the module configuration, more instrumentations are available as follows:

Flexible Sensors
After Treatment Exhaust Gas Temperature*
Oil Level*
Crank Case Pressure*
Coolant Level*
Injector Rail Pressure*
Intercooler Temperature*
Turbo Oil Pressure*
Fan Speed*
Water In Fuel*
Air Inlet Pressure*
Soot Levels*
DEF Tank Temperature*
DEF Reagent Cons*
DEF Counter Minimum*

5.4.3.1 CONFIGURABLE CAN

The configurable CAN instruments are intended to display CAN information from external third-party CAN devices such as fuel flow meters. The contents of these pages vary depending upon configuration by the engine manufacturer or supplier.

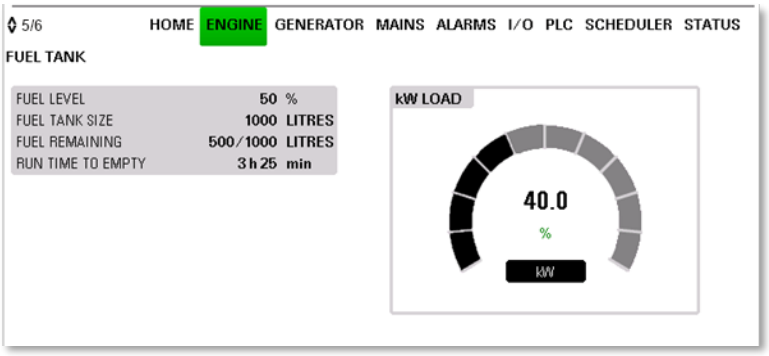
Under default factory settings the configurable CAN instruments are not viewable. They are configurable by the system designer using the DSE Configuration Suite PC Software.



Configurable CAN Instruments 1 to 30
Engine Fault Lamps*
CAN Link Status to Engine ECU*

5.4.3.2 FUEL TANK

The *FUEL TANK* page is intended to consolidate all fuel related instruments into one section. The generator's kW load level is also displayed to provide further indication of efficiency of fuel consumption. The contents of this page vary depending upon configuration by the engine manufacturer or supplier.



Fuel Level
Fuel Tank Size
Fuel Remaining
Run Time to Empty
kW Load

5.4.3.3 ENGINE FAULT LAMPS

NOTE: For further details of module configuration, refer to DSE Publication: 057-340 DSEG*8900 Configuration Suite PC Software Manual.*

The fault lamps that activate are shown across multiple pages and are determined by the Engine Type and protections selected in the module's configuration.

Lamp			
No Alarm	Warning	Electrical Trip or Shutdown	Description
			**HEST (High Exhaust System Temperature)*** Indicates that high exhaust temperatures may exist due to aftertreatment DPF regeneration.
			**DEF (Diesel Exhaust Fluid) Level Low*** Indicates that the DEF level is low.
			**SCR (Selective Catalytic Reduction) Anomaly*** Indicates that there is an issue with the SCR system.
			**MIL (Malfunction Indication Lamp)*** Indicates that a scheduled service is due. May activate in conjunction with other lamps.
			**Aftertreatment DPF (Diesel Particulate Filter) Inhibited*** Indicates that the aftertreatment DPF has been inhibited from performing a regeneration.
			**Aftertreatment DPF (Diesel Particulate Filter)*** Indicates that the aftertreatment DPF requires a regeneration.
			**DPF (Diesel Particulate Filter) Soot Load*** Indicates there is too much Soot in the DPF filter.
			**Coolant Temperature** Indicates the coolant temperature is too high or low.

Continued overleaf…

No Alarm	Lamp Warning	Electrical Trip or Shutdown	Description
			**Fuel Level** Indicates the fuel level is too high or low.
			**Low Oil Pressure** Indicates the oil pressure is too low.
			**Charge Alternator** Indicates the charger alternator voltage is too low.
			**Inlet Temperature*** Indicates the inlet temperature is too high.
			**Water In Fuel** Indicates water has been detected in the fuel.
			**Battery Voltage** Indicates the battery voltage is too high or low.

CAN Link Unknown	Lamp CAN Link Active	CAN Link Lost	Description
			**CAN Link** Indicates the status of the CAN communication between the module and engine's ECU (ECM).

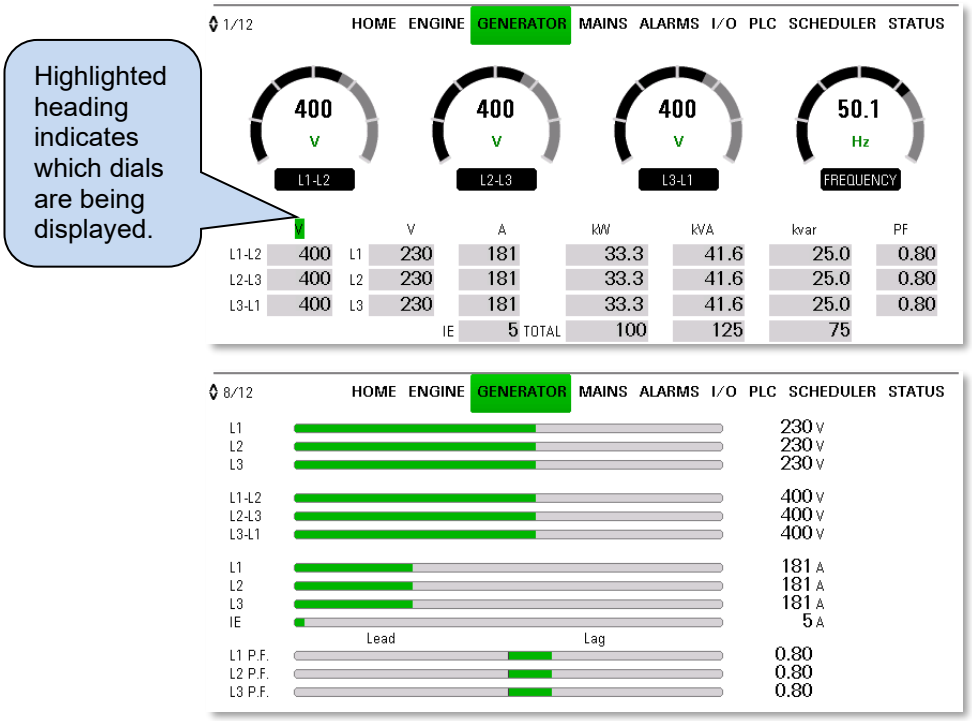
5.4.4 GENERATOR

Contains electrical values of the Generator, measured, or derived from the module's voltage and current inputs. The available information changes depending on how the module is configured but consists of:

Generator Voltage (Line to Line)
Generator Voltage (Line to Neutral)
Generator Frequency
Generator Current (A)
Generator Single Phase and Total Active Power (kW)
Generator Single Phase and Total Apparent Power (kVA)
Generator Single Phase and Total Reactive Power (kvar)
Generator Single Phase Power Factors
Commissioning Screens
Voltage Transformer (VT) Screen

Press the ***Up/Down*** buttons to cycle between the parameters. The instrumentation values are displayed in the form of either analogue meters or bar graphs depending on the module's configuration. The meters or bar graphs change accordingly depending on the displayed instrument.

Examples of generator instrumentation are shown below.



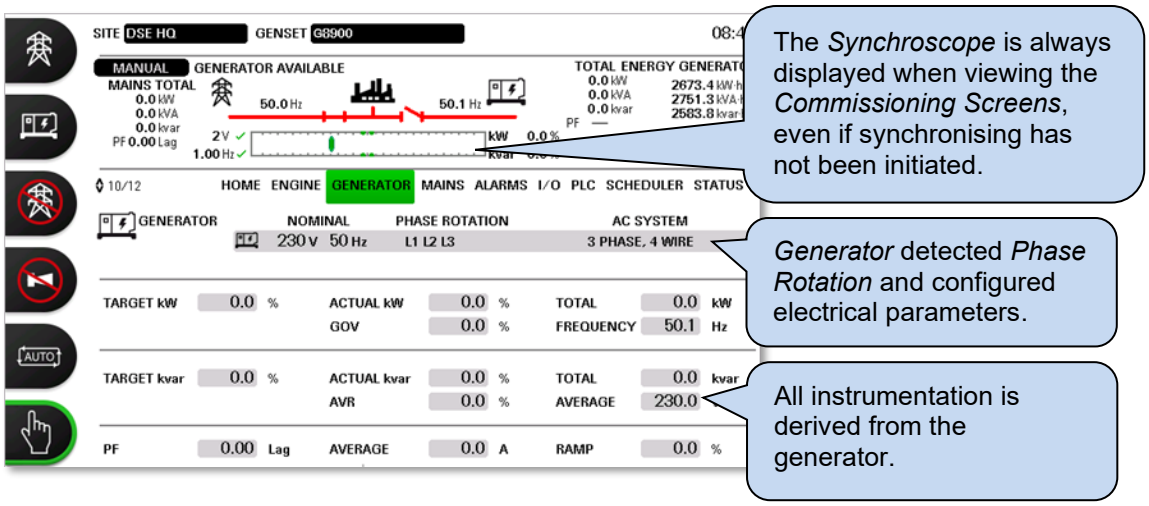
5.4.4.1 COMMISIONING SCREENS

NOTE: Some of the items will not be displayed on the commissioning screens when they are not applicable to the selected application.

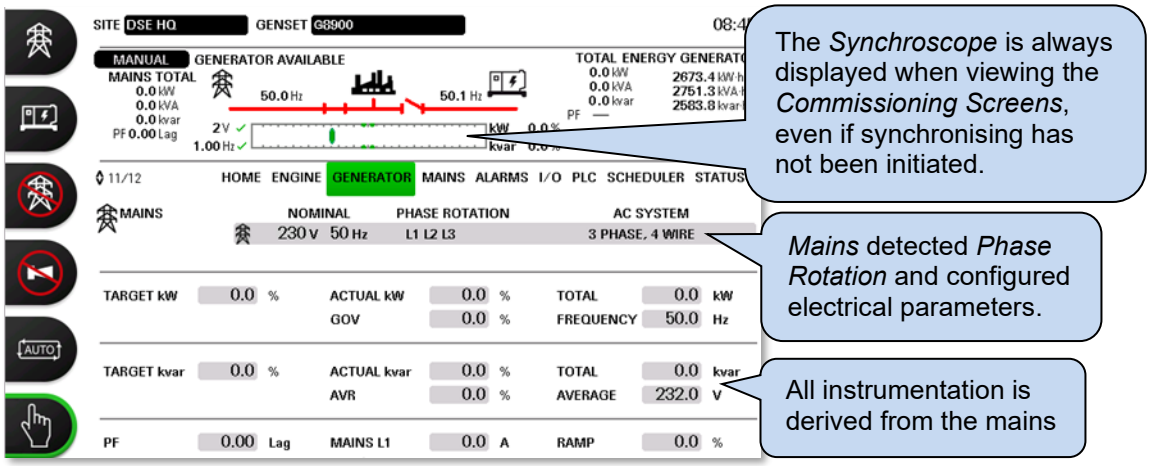
NOTE: The *Commissioning Screens* are used to gauge how well the module is controlling the generator for when in parallel with the mains. For further details on how to utilise these pages, refer to the section entitled *DSE Steps to Successful Loadsharing* elsewhere in this document.

The *Commissioning Screens* are provided to aid the commissioning process and to provide additional information about the synchronising and loadsharing process. These are enabled and disabled within the modules configuration.

Commissioning Screen 1 Generator (Single Set Mode)

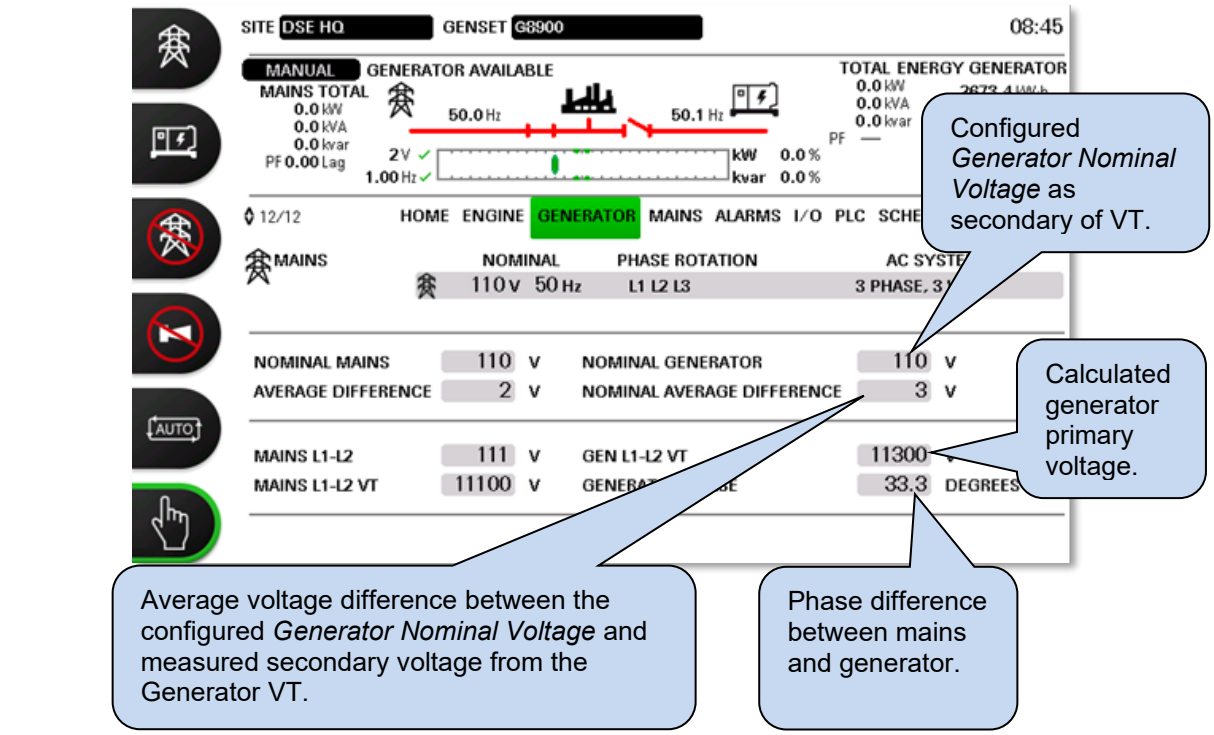


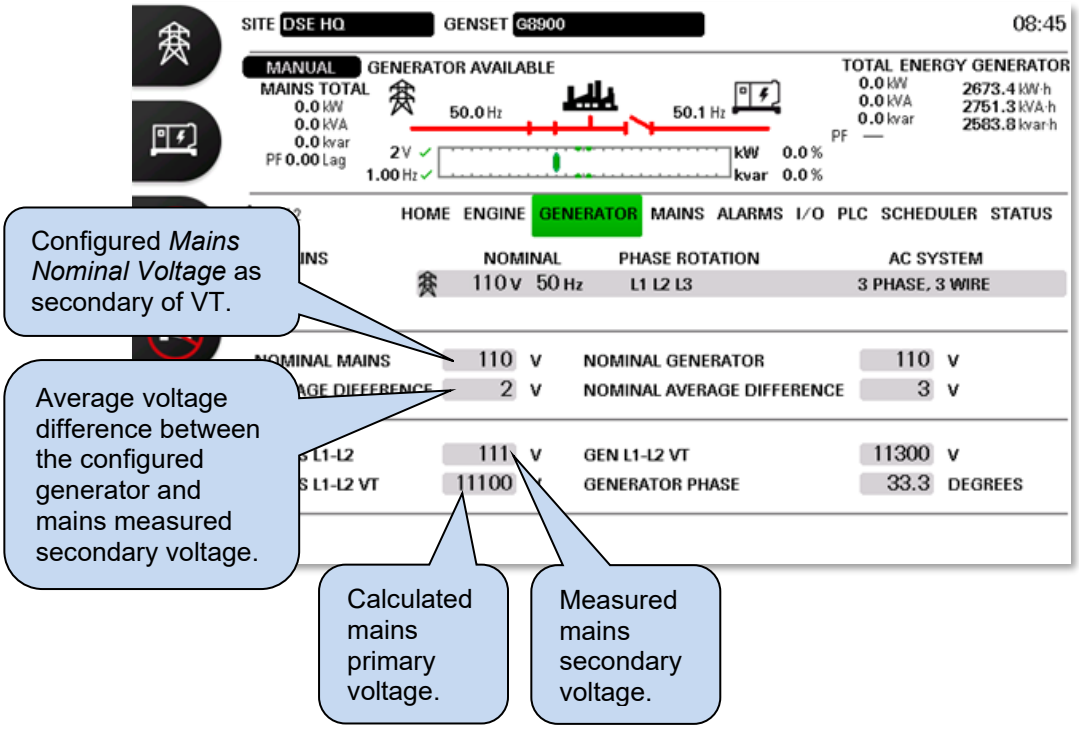
Commissioning Screen 2 Mains (Single Set Mode)



5.4.4.2 VOLTAGE TRANSFORMER (VT) SCREEN

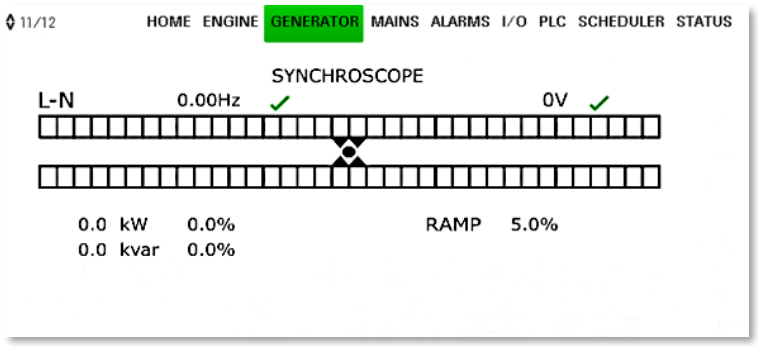
The *Voltage Transformer (VT)* screen is provided to aid the commissioning process when voltage transformers are connected to the module. This page is disabled if voltage transformers are not configured within the module.





5.4.4.3 SYNCHROSCOPE

Once the mains and generator supplies are in sync (indicated by the two vertical green lines in the middle of the phase window), the module initiates a close signal to the generator's switchgear to close the generator onto the mains. If synchronism is broken the moving bar will pass out of the synchronising window and the *Out of Sync* alarm activates. For a detailed explanation please refer to the section entitled *Synchroscope* in the *Summary Section* elsewhere in this document.



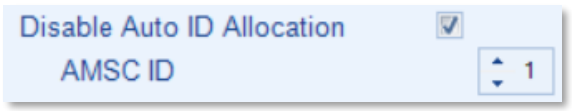
5.4.4.4 AMSC (MULTISET)

NOTE: The *AMSC ID* is configured only using the DSE Configuration Suite Software. For further details, refer to DSE Publication: *057-340 G8900 Configuration Suite PC Software Manual.*

NOTE: Depending on the module's configuration, the *AMSC ID* is set automatically or manually. For further details, refer to DSE Publication: *057-340 G8900 Configuration Suite PC Software Manual.*

Every module connected on the AMSC link has a unique *AMSC 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.

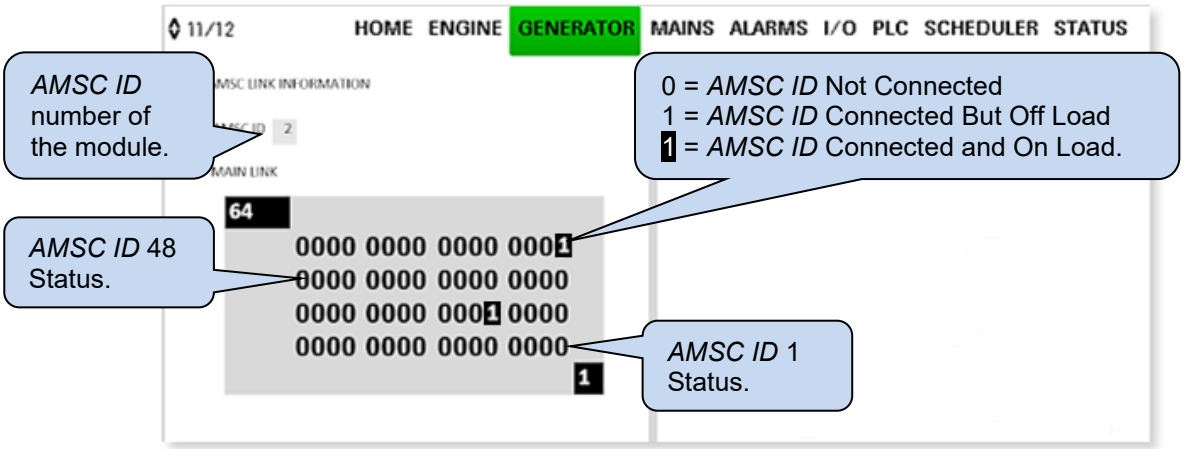


If *Disable Auto-ID Allocation* is not enabled, the *AMSC-ID* is automatically assigned when modules are powered up one at a time. If all the modules are powered up together, this may result in the *AMSC ID Error* alarm activating.

Manually setting the *AMSC 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 and is also required for PLC comms across AMSC as the user needs to know which module is being addressed.

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

This display page shows this module's *AMSC ID* and shows which *AMSC IDs* are currently communicating on the AMSC link by the number '1' indication. *AMSC ID's* that are currently not communicating or not connected are indicated by the number '0'. Additionally, a bold '1' indicates that the *AMSC ID* is connected and currently on load. If the *AMSC ID* for each module is known, this display page is used to determine which module is not communicating on the AMSC link. 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.



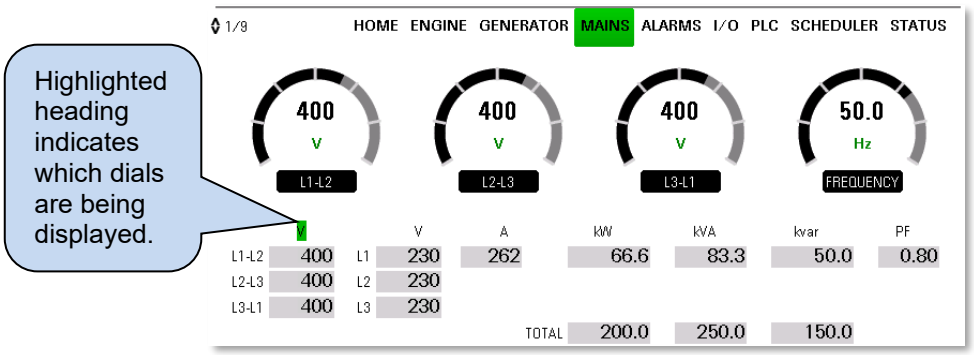
5.4.5 MAINS (SINGLESET)

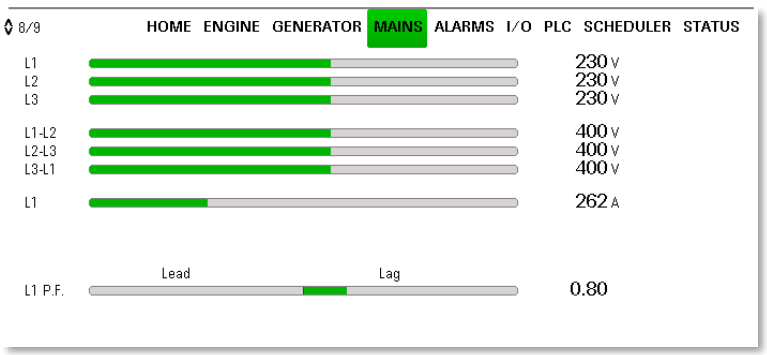
Contains electrical values of the mains measured from the module's inputs. The available information changes depending on how the module is configured but consists of:

Generator Voltage (Line to Line)
Generator Voltage (Line to Neutral)
Generator Frequency
Mains L1 Current (A)
Mains L1 Power and Total Active Power (kW)
Mains L1 Power and Total Apparent Power (kVA)
Mains L1 Power and Total Reactive Power (kvar)
Mains L1 Power Factor

Press the ***Up/Down***  buttons to cycle between the parameters. The instrumentation values are displayed in the form of either analogue meters or bar graphs depending on the module's configuration. The meters or bar graphs change accordingly depending on what parameter is being viewed.

Examples of mains instrumentation are shown below.





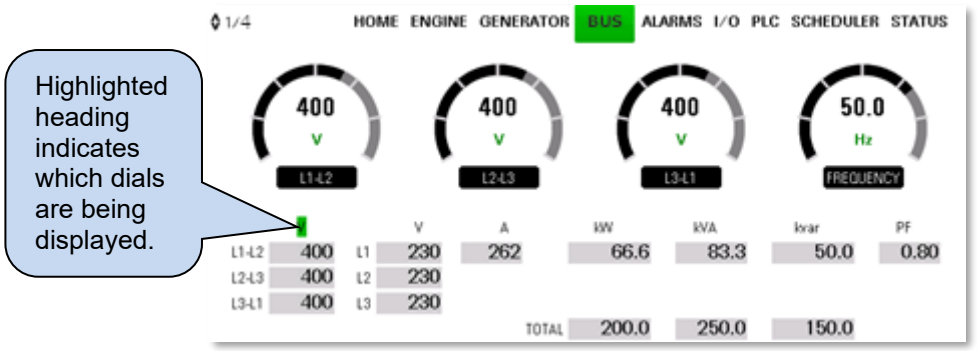
5.4.6 BUS (MULTISET)

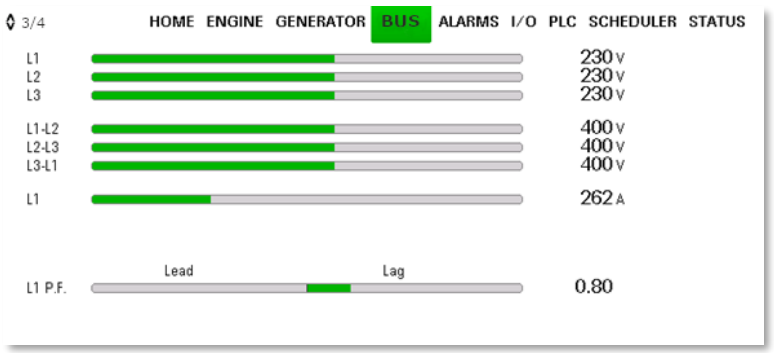
Contains electrical values of the bus measured from the module's inputs. The available information changes depending on how the module is configured but consists of:

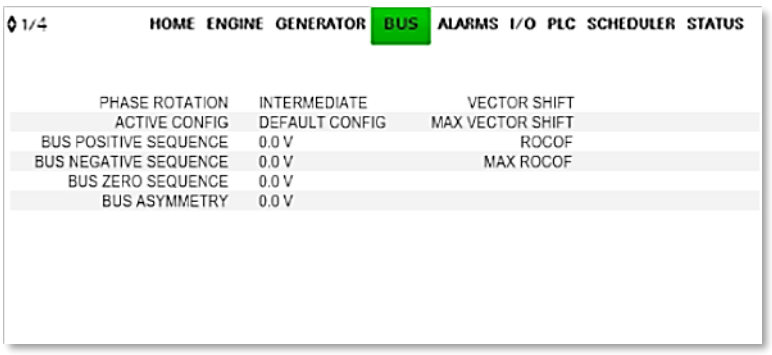
Bus Voltage (Line to Line)
Bus Voltage (Line to Neutral)
Bus Frequency
Bus L1 Current (A)
Bus L1 Power and Total Active Power (kW)
Bus L1 Power and Total Apparent Power (kVA)
Bus L1 Power and Total Reactive Power (kvar)
Bus L1 Power Factor

Press the ***Up/Down*** buttons to cycle between the parameters. The instrumentation values are displayed in the form of either analogue meters or bar graphs depending on the module's configuration. The meters or bar graphs change accordingly depending on what parameter is being viewed.

Examples of bus instrumentation are shown below.







5.4.7 ALARMS

The *Alarms* pages contain active and previous faults that have occurred on the generator and Engine's ECU (ECM).

Press the ***Up/Down*** buttons to cycle between the parameters.

5.4.7.1 ALARM POP-UP

When an alarm is active, the *Internal Audible Alarm* sounds, and the *Alarm Pop-up* appears.

The audible alarm is silenced by pressing the ***Alarm Mute / Lamp Test*** button and the *Alarm Pop-up* is cleared by pressing the ***Tick*** button.

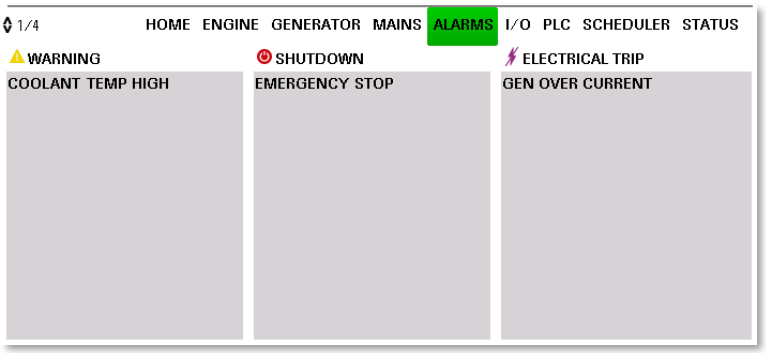
Upon clearing the *Alarm Pop-up*, the display automatically navigates to the *Active Alarm* page.

The *Alarm Pop-up* is colour coded to indicate the action of the alarm; an example is of which is shown below.

Alarm Action	Colour
Warning	Warning
Electrical Trip	Electrical Trip
Shutdown	Shutdown

5.4.7.2 ACTIVE ALARMS

The module displays multiple active alarms such as *Coolant Temp High*, *Emergency Stop* and *Gen Over Current* on the one page. Each alarm is categorised by the alarm action it is generating. In the event of a new alarm, the module displays the appropriate text in the appropriate column.

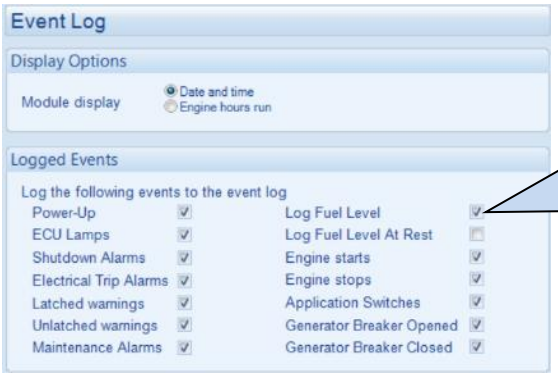


5.4.7.3 EVENT LOG

NOTE: For further details of module configuration, refer to DSE Publication: *057-340* DSEG*8900 Configuration Suite PC Software Manual.*

The module maintains a log of past alarms and/or selected status changes.
At the time of writing, the modules log stores the last 250 entries and is always subject to change.

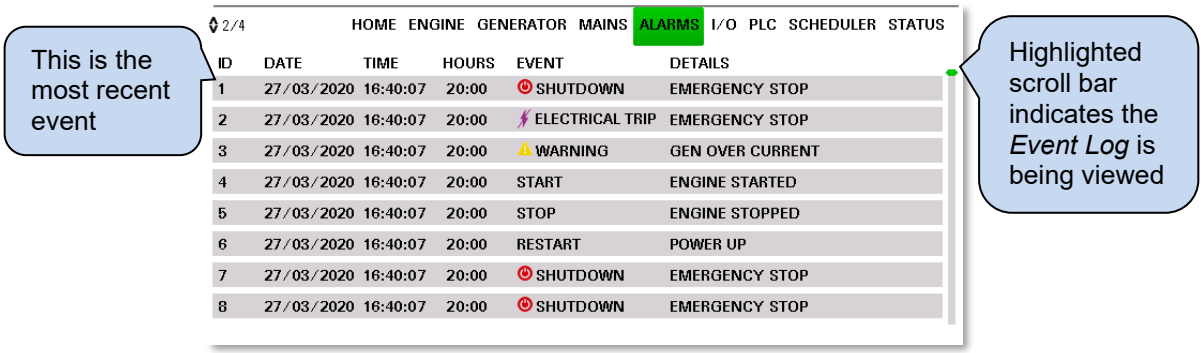
Under default factory settings, the event log is configured to include all feasible options; however, this is configurable by the system designer using the DSE Configuration Suite software.



Example showing the possible configuration of the event log (DSE Configuration Suite Software).

This also shows the factory settings of the module.

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).



This is the most recent event

Highlighted scroll bar indicates the *Event Log* is being viewed

To scroll through the events, press the ***Tick*** button. The scroll bar on the right-hand side illuminates green.

Press the ***Up/Down*** buttons to cycle between the events.

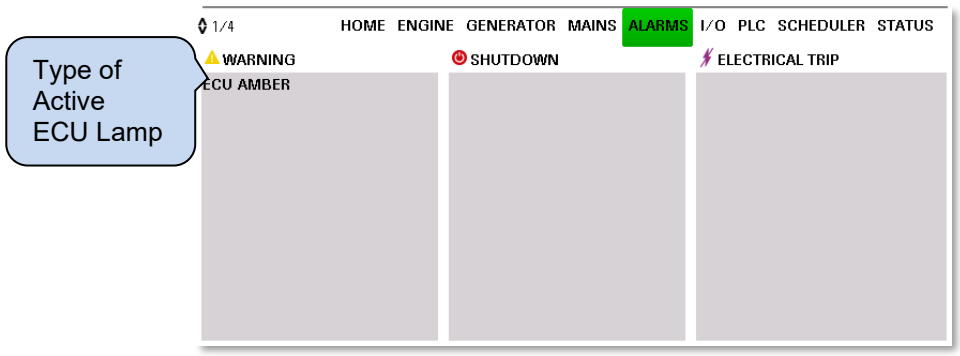
To stop viewing the *Event Log,* press the ***Tick*** button. The scroll bar on the right-hand side is no longer illuminated green.

5.4.7.4 ECU ALARMS (ECU FAULT CODES / DTC)

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

NOTE: For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines And DSE Wiring*

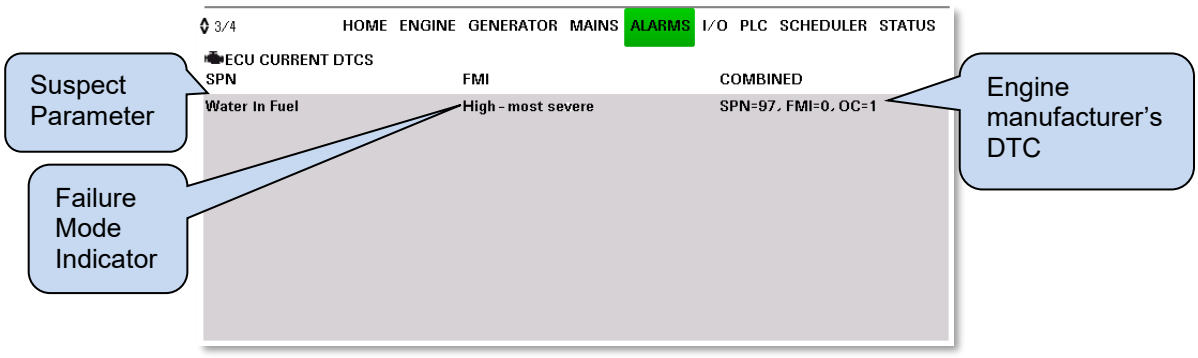
When connected to a suitable CAN engine, the controller displays alarm status messages from the ECU in the *Alarms* page on the display under the relevant alarm type.



Press the ***Up/Down*** buttons to access the list of *ECU Current DTCs* (Diagnostic Trouble Codes) from the ECU which are DM1 messages.

Press the ***Up/Down*** buttons again to access the list of *ECU Prev DTCs* (Diagnostic Trouble Codes) from the ECU which are DM2 messages.

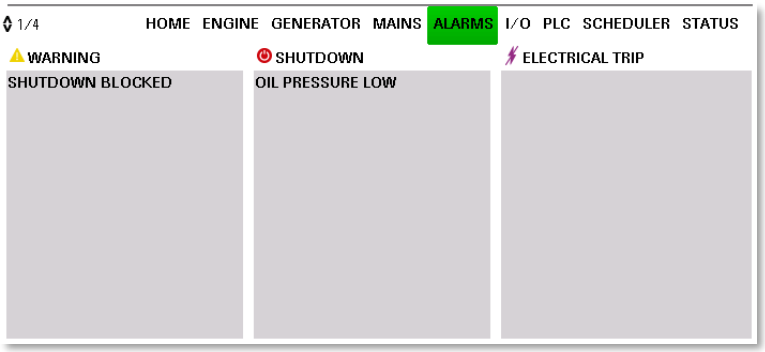
The DTCs are interpreted by the module and shown as a text message. In addition to this, the manufacturer's DTC is also provided.



5.4.7.5 PROTECTIONS DISABLED

NOTE: For further details on *Protections Disabled*, refer to the section entitled *Protections* elsewhere in this document.

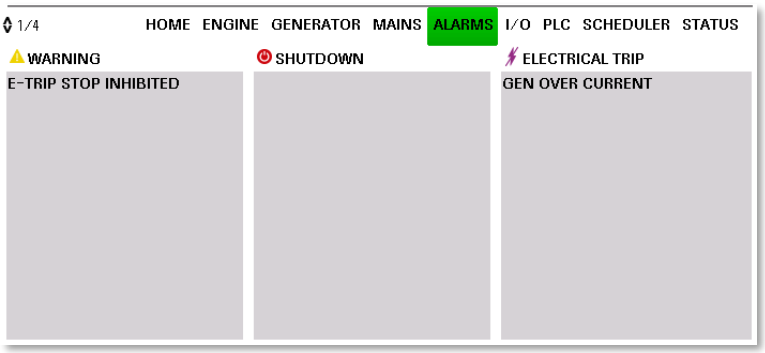
Configuration is possible to prevent *Shutdown* and *Electrical Trip* alarms from stopping the generator. Under such conditions the operator is informed the events were blocked.



5.4.7.6 RESET ELECTRICAL TRIP

NOTE: For further details on *Reset Electrical Trip*, refer to the section entitled *Protections* elsewhere in this document.

Configuration is possible to enable the operator to reset *Electrical Trip* alarms a configurable number of times before the generator has stopped. This is to allow the generator to retake the load without having to perform a cooling run first. Under such conditions the operator is informed the events were overridden.

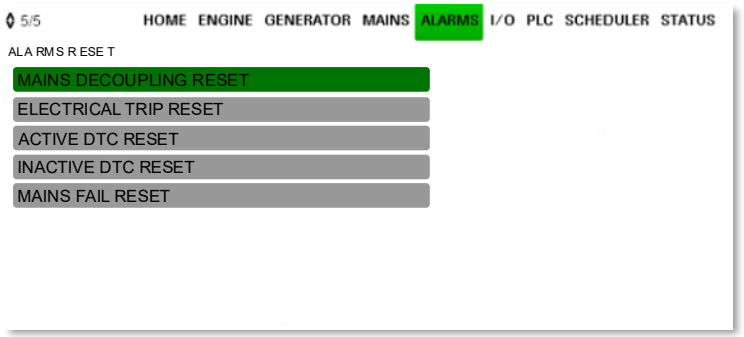


5.4.7.7 ALARMS RESET

The Alarms Reset page allows resetting of the following alarms.

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

Press the ***Up/Down***  buttons to access the alarm and press the ***Tick***  button.



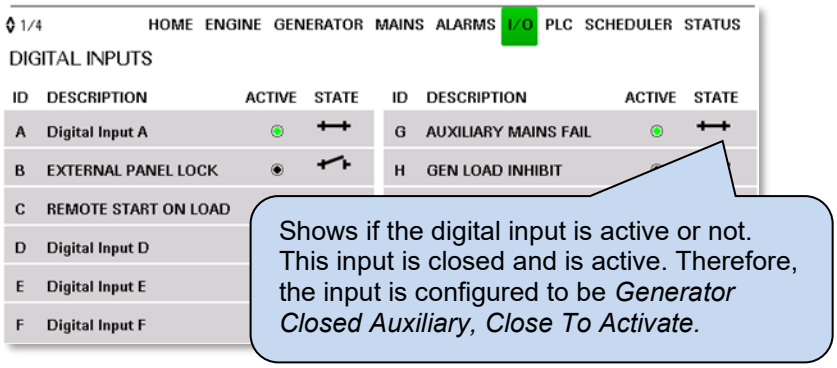
5.4.8 I/O

The *I/O* (Input/Output) section includes numerous pages that present the configuration and status of the module's inputs and outputs along with any applicable DSE2130, DSE2131, DSE2133, DSE2152, DSE2157 and DSE2548 expansion units including the DSE Intelligent Chargers.

Press the ***Up/Down***  to cycle through the active I/O pages, starting with the module's inputs and then followed by the module's outputs and expansion modules.

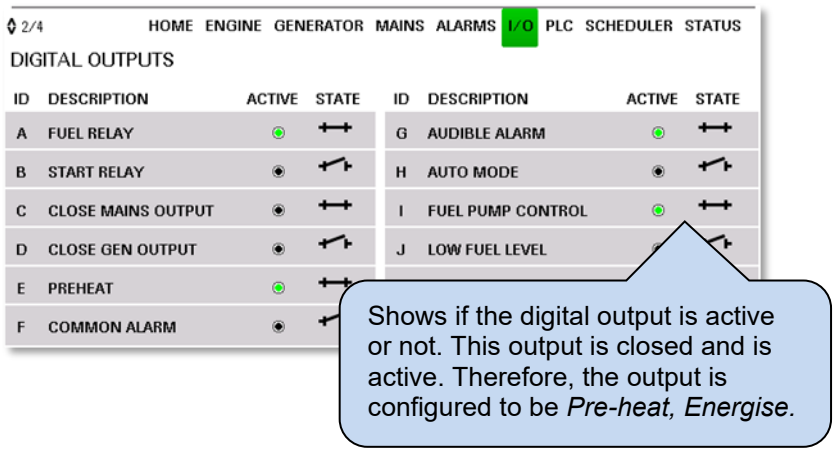
5.4.8.1 DIGITAL INPUTS

The *Digital Inputs* page displays the status of each digital inputs on the module. The page shows the configuration description and the currently active and open/closed status of the digital inputs.



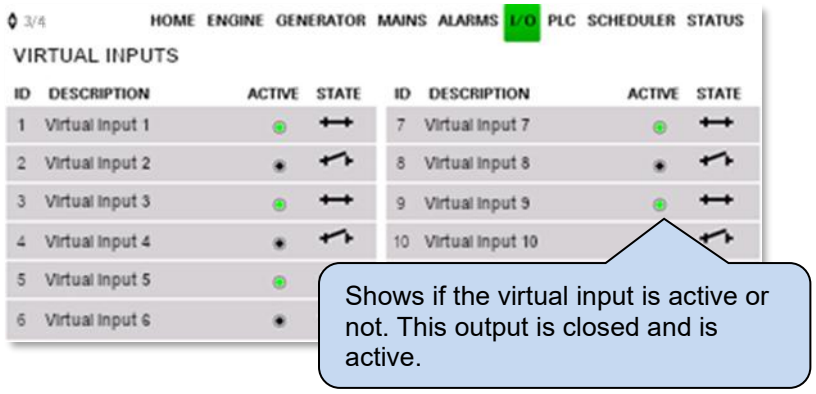
5.4.8.2 DIGITAL OUTPUTS

The *Digital Outputs* page displays the status of each digital outputs on the module. The page shows the configuration description and the currently active and open/closed status of the digital outputs.



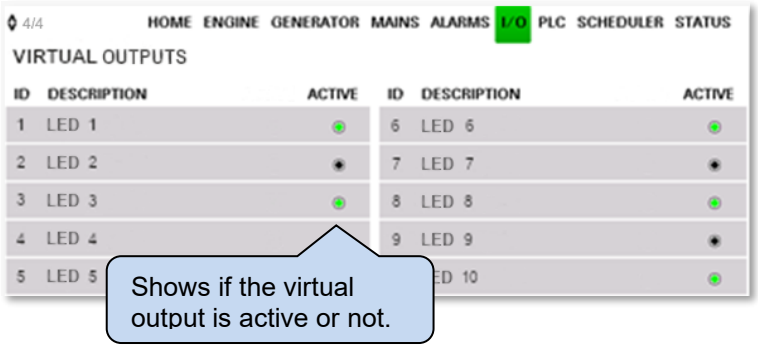
5.4.8.3 VIRTUAL INPUTS

The *Virtual Inputs* page displays the status of each of the 12 Virtual Inputs on the module. The page shows the configuration description and the currently active and open/closed status of the digital input.



5.4.8.4 VIRTUAL OUTPUTS

The *Virtual Outputs* page displays the status of each of the 10 Virtual Outputs that are able to be shown on the module. The page shows the configuration description and the currently active status of the virtual output.

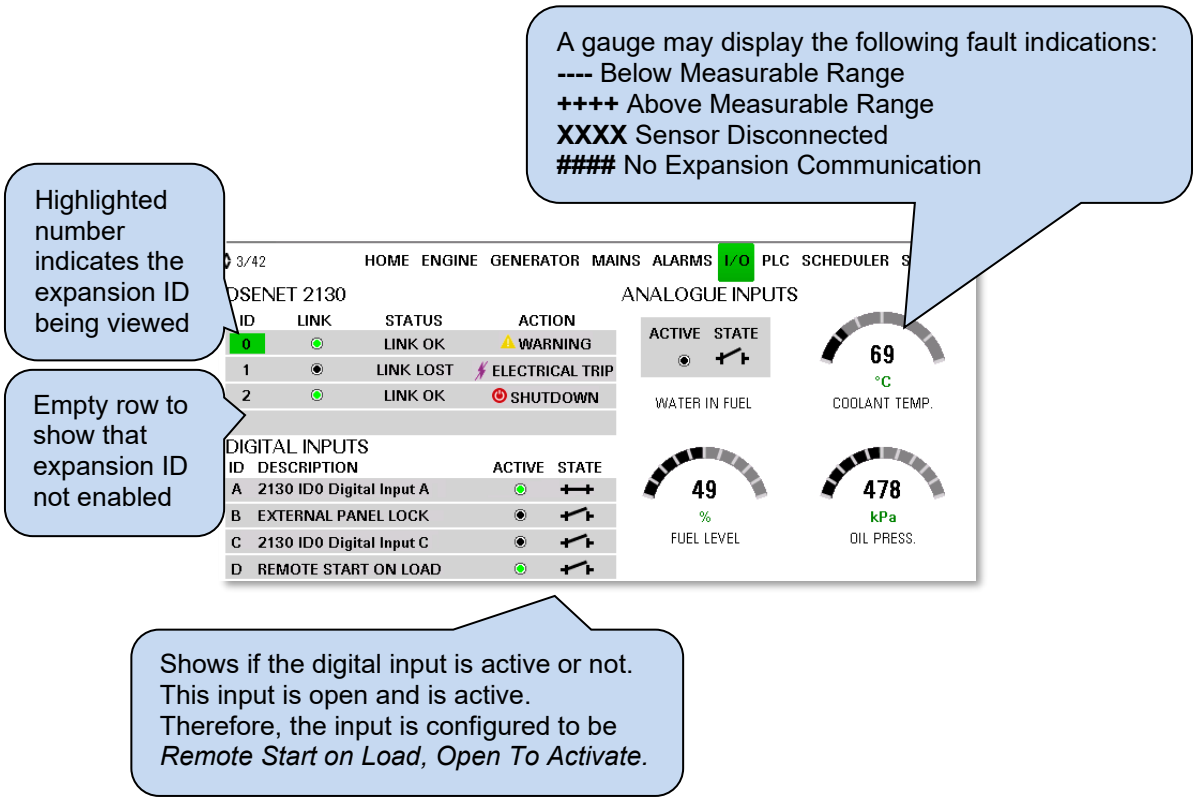


5.4.8.5 DSE2130 EXPANSION MODULE

The *DSENET 2130* page displays the status of each DSE2130 device connected to the module with the currently selected unit highlighted in green. The alarm action is displayed when a *Link Lost* situation is present for the relevant unit. The Link lamp is green for good communication or grey for *Link Lost*.

For the selected DSE2130 unit, the page shows the digital input configuration description, the digital input currently active status, the open/closed status of the digital inputs, the analogue input configuration description, and current values of the analogue inputs. When an analogue input is configured as a digital input, the dial is replaced with active and open/closed status of the digital input.

Press the ***Up/Down***  to select the required DSE2130 module.

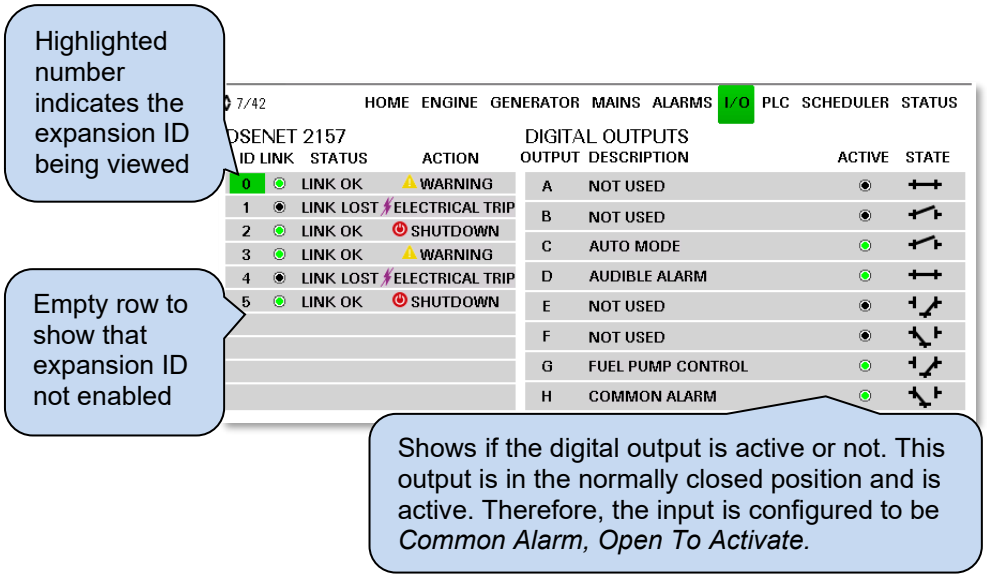


5.4.8.6 DSE2157 EXPANSION MODULE

The *DSENET 2157* page displays the status of all attached DSE2157 device connected to the module with the currently selected unit highlighted in green.

The alarm action is displayed when a *Link Lost* situation is present for the relevant unit. The *Link* lamp is green for good communication or grey for *Link Lost*. For the selected DSE2157 unit, the page shows the configuration descriptions and the current active and open/closed status of the digital outputs.

Press the ***Up/Down***  to select the required DSE2157 module.

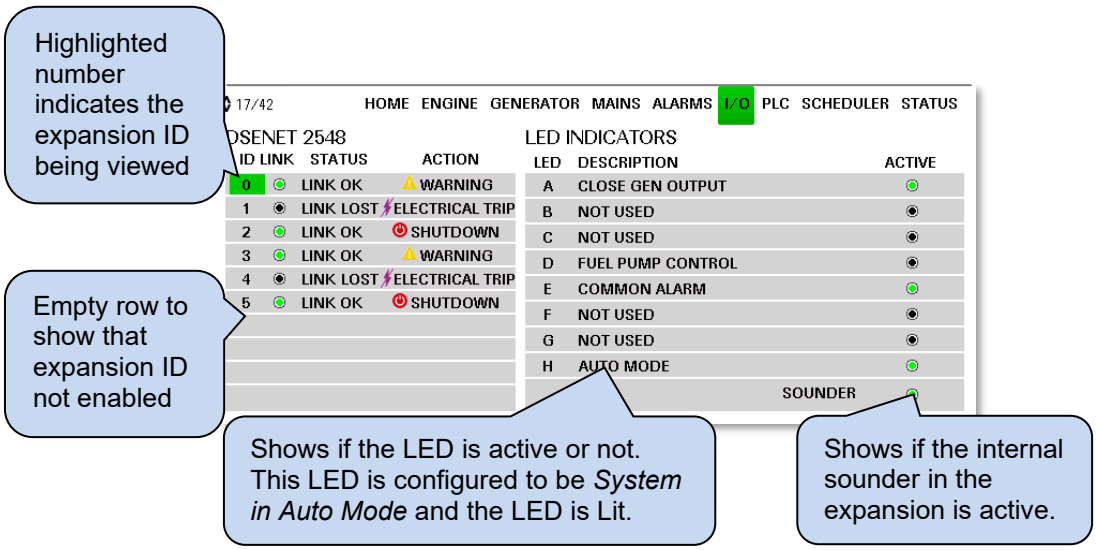


5.4.8.7 DSE2548 EXPANSION MODULE

The *DSENET 2548* page displays the status of each DSE2548 device connected to the module with the currently selected unit highlighted in green. The alarm action is displayed when a *Link Lost* situation is present for the relevant unit. The *Link* lamp is green for good communication or grey for *Link Lost*.

For the selected DSE2548 unit, the page shows the configuration description and the currently active and open/closed status of the digital inputs and the configuration descriptions and the current active status of the LEDs.

Press the ***Up/Down***  to select the required DSE2548 module.

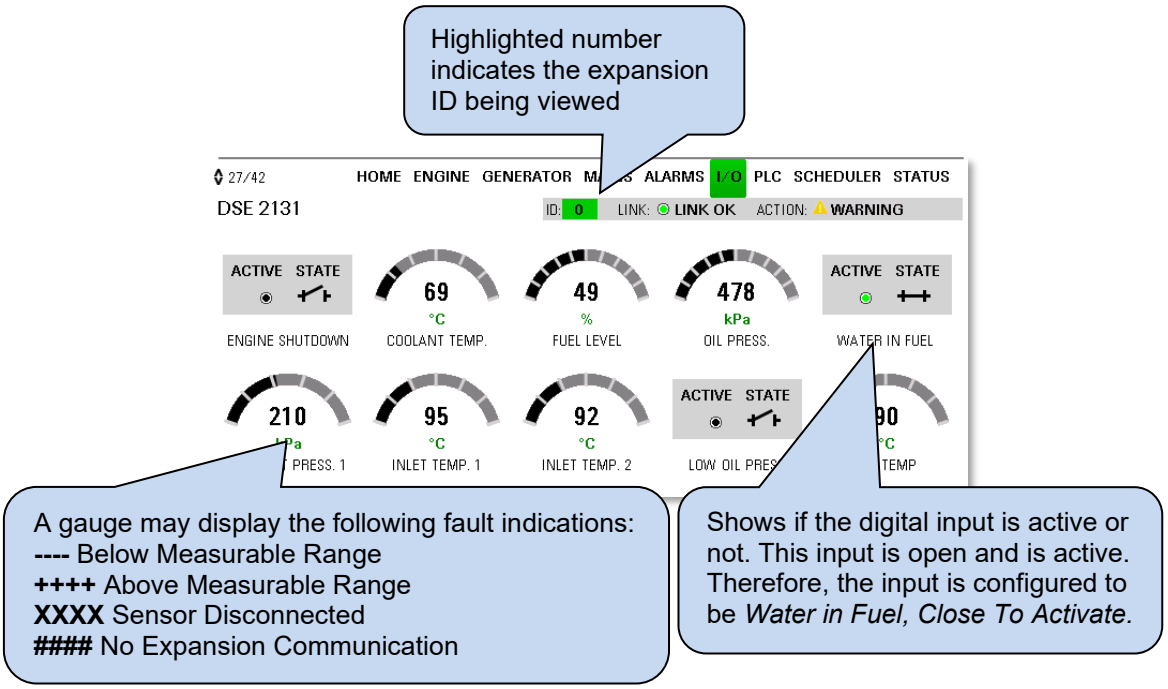


5.4.8.8 DSE2131 EXPANSION MODULE

The *DSE 2131* page displays the status of each DSE2131 device connected to the module with the currently selected unit highlighted in green. The alarm action is displayed when a *Link Lost* situation is present for the relevant unit. The *Link* lamp is green for good communication or grey for *Link Lost*.

For the selected DSE2131 unit, the page shows the configuration description and current values of the analogue inputs. If an analogue input is configured as a digital input, the dial is replaced with active and open/closed status of the digital input.

Press the ***Up/Down***  to select the required DSE2130 module.

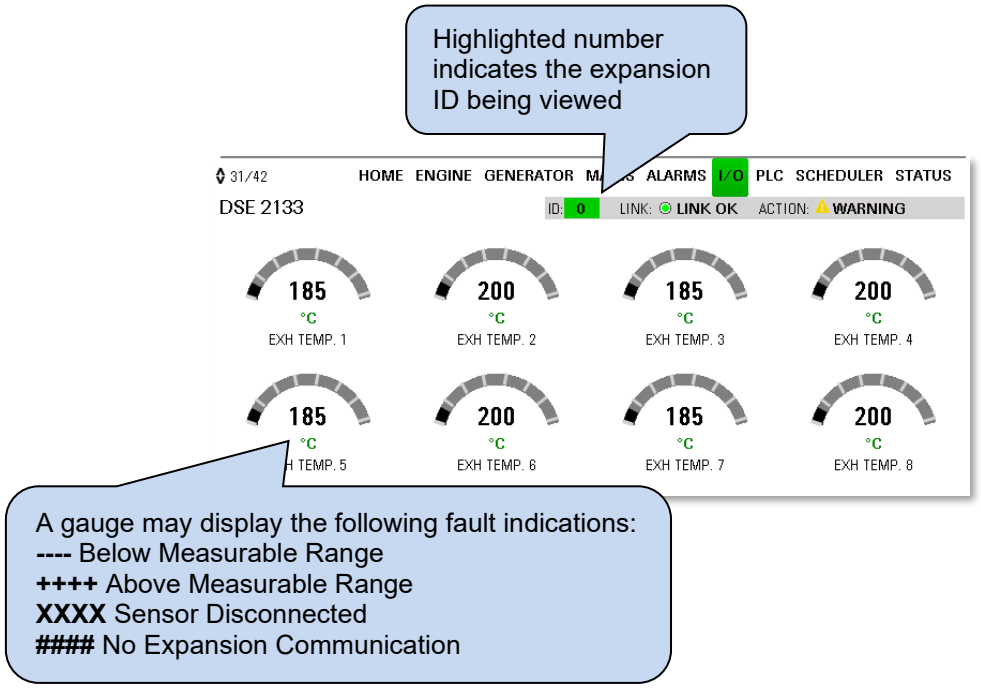


5.4.8.9 DSE2133 EXPANSION MODULE

The *DSE 2133* page displays the status of each DSE2133 device connected to the module with the currently selected unit highlighted in green. The alarm action is displayed when a *Link Lost* situation is present for the relevant unit. The *Link* lamp is green for good communication or grey for *Link Lost*.

For the selected DSE2131 unit, the page shows the configuration description and current values of the analogue inputs.

Press the ***Up/Down***  to select the required DSE2133 module.

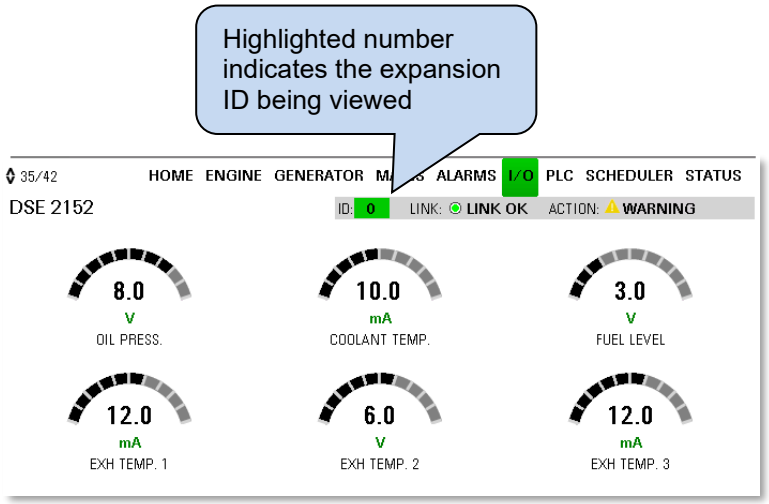


5.4.8.10 DSE2152 EXPANSION MODULE

The *DSE 2152* page displays the status of each DSE2152 device connected to the module with the currently selected unit highlighted in green. The alarm action is displayed when a *Link Lost* situation is present for the relevant unit. The *Link* lamp is green for good communication or grey for *Link Lost*.

For the selected DSE2152 unit, the page shows the configuration description and current values of the analogue outputs.

Press the ***Up/Down***  to select the required DSE2152 module.

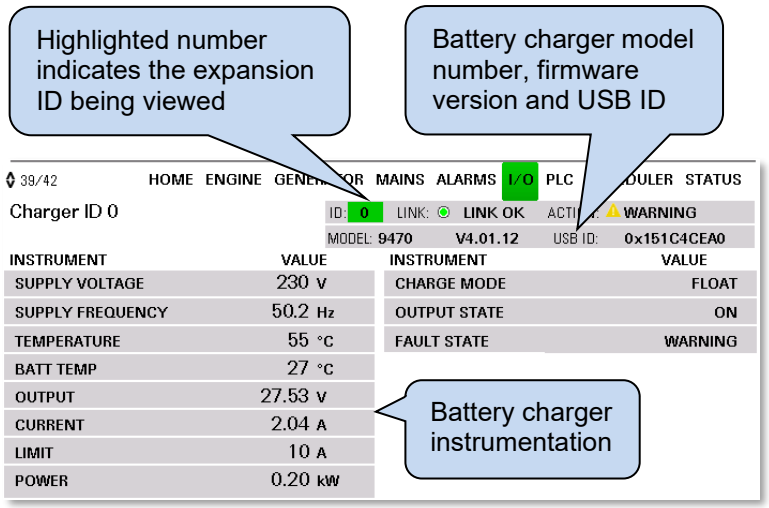


5.4.8.11 DSE INTELLIGENT BATTERY CHARGER

The *Charger* page displays the status of each DSE Intelligent Battery Charger connected to the module with the currently selected unit highlighted in green. The alarm action is displayed when a *Link Lost* situation is present for the relevant unit. The *Link* lamp is green for good communication or grey for *Link Lost*.

For the selected DSE Intelligent Battery Charger, the page shows the instrumentation and status information derived from that battery charger's sensing terminals.

Press the ***Up/Down***  to select the required DSE Intelligent Battery Charger.



5.4.9 PLC INSTRUMENTS

NOTE: Depending upon the module's configuration, some display pages may be disabled. For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*
For further details of PLC configuration, refer to DSE Publication: *057-314 Advanced PLC Software Manual.*

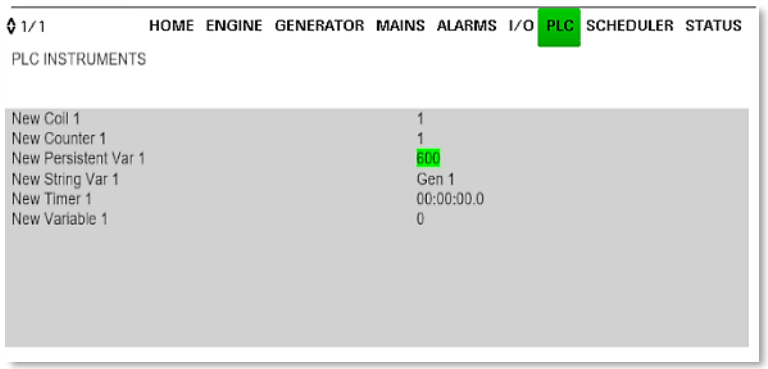
The *PLC* pages contain values from various elements from the module's internal PLC editor to enable the user to view them from the module's facia.

Press the ***Up/Down***  buttons to cycle between the parameters.

Pressing the ***Tick*** button will indicate the editable parameters in green and allow for editing of the selected parameter. This only applies to specific PLC instruments.

5.4.9.1 PLC INSTRUMENTS

The *PLC Instruments* page displays the name and value for each *Instrument* configured within the module's PLC.



5.4.10 SCHEDULER

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

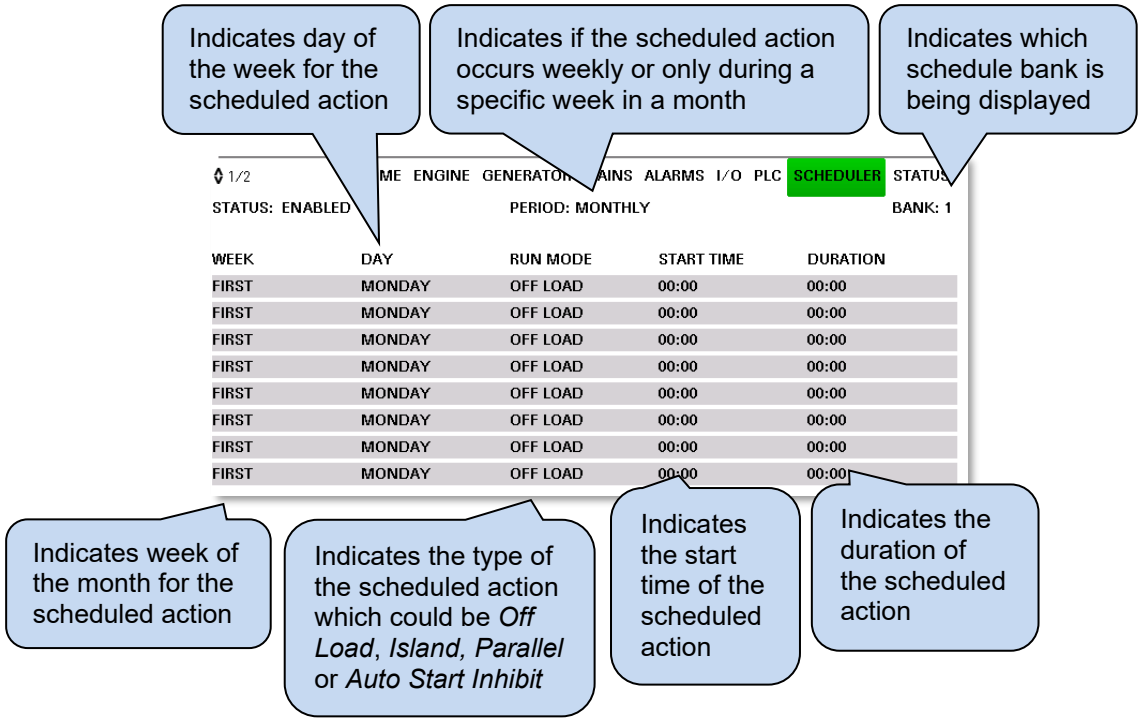
NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

The *Scheduler* pages contain information about the module's inbuilt generator scheduler feature. The exercise run scheduler is 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.

Under default factory settings the Schedule is not viewable. It is enabled by the system designer using the DSE Configuration Suite software.

Press the ***Up/Down***  buttons to cycle between the scheduler banks.



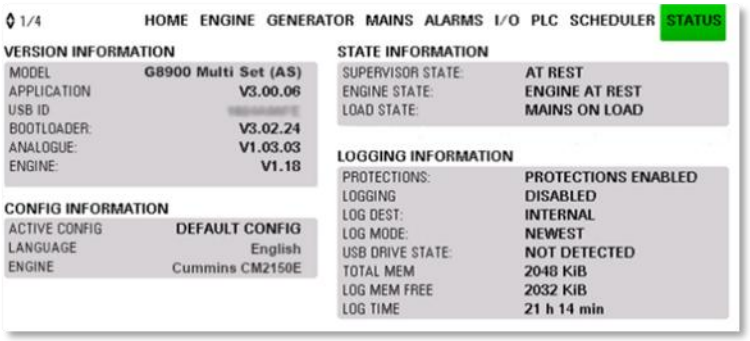
5.4.11 STATUS

The *Status* pages contain information about the module's software, communication statuses and generator maintenance intervals.

Press the ***Up/Down***  buttons to cycle between the parameters.

5.4.11.1 MODULE INFORMATION

This page shows the module Version Information, State Information and Data Logging Information.



Version Information

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

Item	Description
Model	This indicates the module application, DSEG8900
Display Application	The version of the module's display software application.
Application	The version of the module's main firmware file (Updatable using the Firmware Update Wizard in the DSE Configuration Suite Software).
USB ID	Unique identifier for PC USB connection
Display Bootloader	The module's display bootloader software version.
Bootloader	Firmware Update bootloader software version
Analogue	Analogue measurements software version
Engine	The name of the engine file selected in the configuration

Config Information

Provides information about which of the module's multiple configurations is currently being used.

Item	Description
Active Config	This indicates which of the module's configurations is currently active.

State Information

Provides information status about the module operations.

Item	Description
Supervisor State	Indicates the active timer on the module. Such as the *Safety On Delay* timer.
Engine State	Indicates if engine is running or stopped
Mains Detect State	Indicates if the mains is available or not.
Load State	The load switches statuses, indicates load switch is closed or open.

Logging Information

NOTE: For further details on how to remove a USB storage device, refer to the section entitled *USB Safe Removal Procedure* elsewhere in this document. Failure to follow the correct removal procedure results in the data on the USB memory device becoming corrupt.

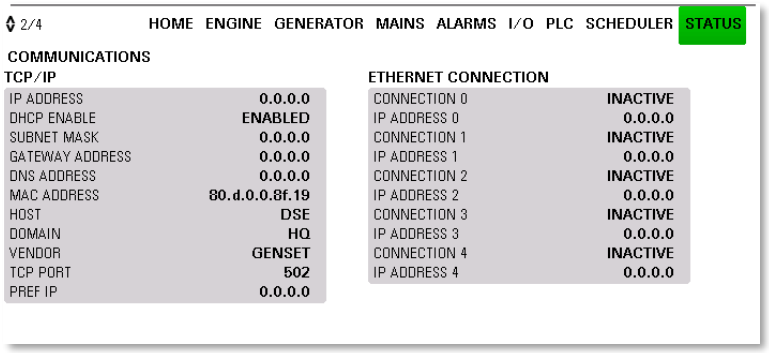
This shows the Data Logging information and settings.

Item	Description
Protections	Indicates if protections enabled or disabled.
Logging	Indicates if data logging is active or inactive.
Log Dest	Location of logged data. Displays either internal module memory or external USB memory.
Log Mode	Indicates if data logging replaces the oldest data with newest data or stops logging once the memory is full.
USB Drive State	If external USB storage device is connected
Total Mem	Memory space, this depends on what size memory drive is fitted (max 16 GB) or allocated internal (2 MB) memory.
Log Mem Free	Memory space remaining, this depends on what size memory drive is fitted (Max 16 GB) or allocated internal (2 MB) memory left available.
Log Time	Remaining time available for logging information.

5.4.11.2 COMMUNICATIONS

The *Communications* pages show information about the module's Ethernet, RS485, USB and DSENet ports.

Press the ***Up/Down***  buttons to cycle between the parameters.

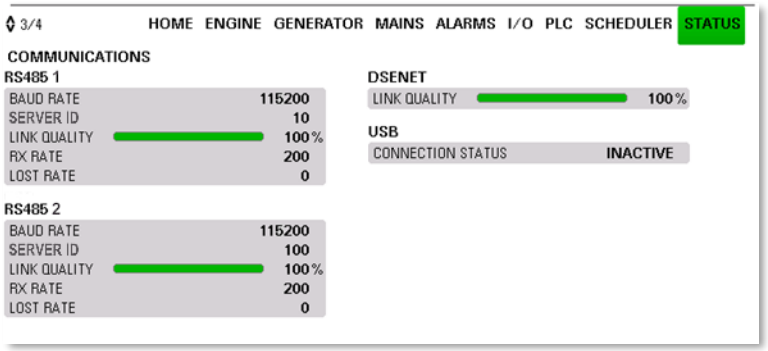


TCP/IP

Item	Description
IP Address	The IP address of the module.
DHCP Enable	Indicates if the Dynamic Host Configuration Protocol (DHCP) is enabled and if the unit automatically attains an IP address from the network it is connected.
Subnet Mask	The subnet mask is to determine whether the module is on the local subnet or on a remote network.
Gateway Address	IP address of the internet router that module is connected to.
DNS Address	IP address of the Domain Name Service (DNS). Usually this is the same as the module's IP address.
MAC Address	The MAC address of the module, this cannot be changed and is unique to every ethernet device.
Host	The hostname of the device which is used for DHCP requests and acknowledgements. Consult the network IT manager for suitable naming
Domain	Additional description string for DHCP
Vendor	Additional description string for DHCP
TCP Port	The port number which the module serves Modbus traffic on.
Pref IP	The module allows up to five Modbus clients to connect to it. The *Preferred IP Address* enables the unit to reserve one of the five connections for a specific IP address, such as for a remote display module to ensure it always connects.

Ethernet Connection

Item	Description
Connection 0 to 4	The module allows up to five Modbus client to connect to it. This indicates if one of the 5 connections in use.
IP Address 0 to 4	The IP address of the device that is connected to the module and using one of the five connections.



RS485

Provides information about module's RS485 port.

Item	Description
Baud Rate	This indicates what baud rate (communication speed) the module's RS485 port is configured to.
Server ID	This indicates what unique identification number the module's RS485 port is configured to.
Link Quality	The quality of the RS485 connection.
RX Rate	The number of received message during the packet timeout
Lost Rate	The number of messages that are discarded (invalid messages)

USB

Provides information about which of the module's multiple configurations is currently being used.

Item	Description
Connection Status	This indicates if the module's USB is currently connected.

DSENet

Provides information about module's DSENet (expansion) port.

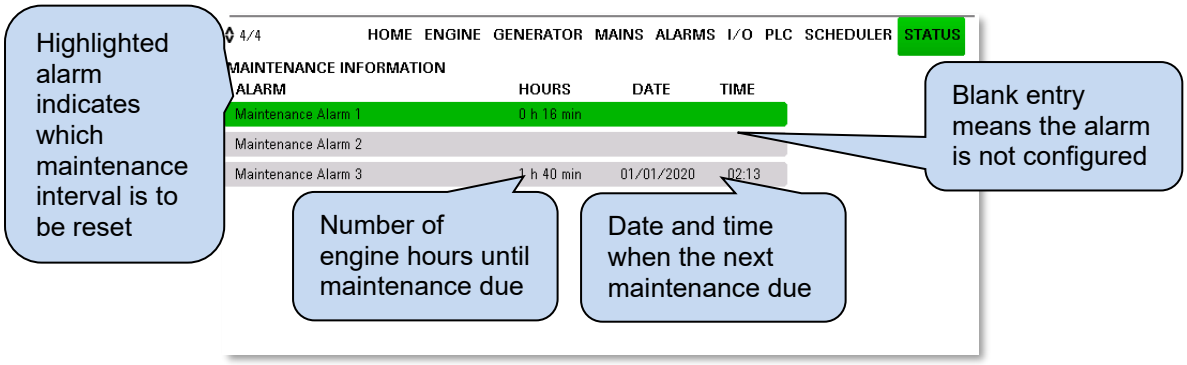
Item	Description
Link Quality	The quality of the DSENet connection.

5.4.11.3 MAINTENANCE INFORMATION

This *Maintenance Information* page shows information maintenance alarms configured within the module. Resetting the maintenance alarm is normally actioned by the site service engineer after performing the required maintenance.

Depending on module configuration, it is possible to reset the maintenance alarms from this page by:

- Pressing the ***Up/Down***  buttons to select the *Alarm*, the *Alarm* highlights green to indicate it has been selected.
- Pressing and holding the ***Stop/Reset Mode***  button for 5 seconds, the number of hours until next maintenance and the due date reset.



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 ENGINE

To manually start the generator, press the ***Manual Mode*** button once to put the module into manual mode, and then the ***Start*** button to start the generator.

6.1.2 STOPPING THE ENGINE

To manually stop the generator, press the ***Stop/Reset Mode*** button.

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: *057-340 DSE8900 Configuration Suite PC Software Manual.*

Stop/Reset Mode is activated by pressing the ***Stop/Reset Mode*** button and is also confirmed by the word *STOP* on the display.

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

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

- Engine speed is zero as detected by the 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 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 engine is not started when in ***Stop/Reset Mode***. If start signals are given, the input is ignored until ***Auto Mode*** is entered.

6.2.1 ECU OVERRIDE

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

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

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

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

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

- In ***Stop/Reset Mode*** pressing the **Start** button will put the module into ***Manual Mode***.
- The *ECU Override* will be triggered and will remain powered until ***Manual Mode*** is exited to either stop or ***Auto Mode*** is selected (Test Mode Single Set).

This is useful if the engine manufacturer's tools need to be connected to the engine, for instance to configure the engine as the ECU needs to be powered up to perform this operation, also to check the status of the CAN communication and to prime the fuel system.

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 can be activated by pressing the designated button, which will then illuminate with a green highlight to indicate that ***Manual Mode*** is in operation.

In ***Manual Mode*** 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: If the unit has been configured for CAN, compatible ECUs receive the start command via CAN.

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

The fuel relay is energised, and the engine is cranked.

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the *Crank Rest Timer* duration after which the next start attempt is made. If this sequence continues beyond the configured *Number Of Attempts*, the start sequence is terminated, and the display shows *Fail to Start.*

The starter motor is disengaged when the engine fires. Speed detection is factory configured to be derived from the AC alternator output frequency but can additionally be measured from a Magnetic Pickup mounted on the flywheel or from the CANbus link to the engine ECU depending on module configuration.

Additionally, rising oil pressure can be used to disconnect the starter motor (but cannot detect underspeed or overspeed).

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

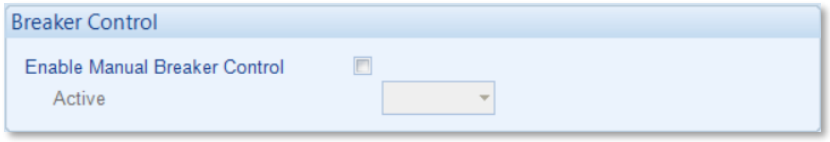
6.3.2 ENGINE RUNNING

NOTE: The load transfer signal remains inactive until the generator is available. This prevents excessive wear on the engine and alternator.

NOTE: For further information on enabling Manual Breaker Control, refer to DSE Publication: *057-340 DSEG8900 Configuration Software Manual*.

When in ***Manual Mode***  , the generator does not synchronise and close its switchgear unless a 'loading request' is made. The possible sources for 'loading requests' are limited dependant on the state of the *Manual Breaker Control* function.

6.3.2.1 MANUAL BREAKER CONTROL DISABLED



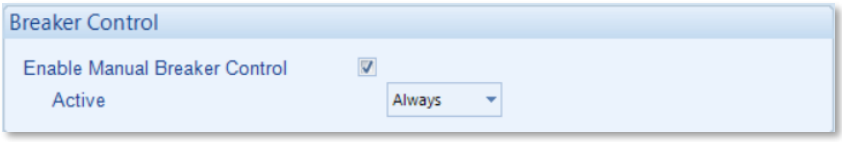
A loading request may come from any of the following sources:

- Press the ***Transfer to Generator*** button.
- Failure of mains supply
- Activation of an auxiliary input assigned the function *Remote Start On Load, Transfer To Generator / Open Mains* or *Auxiliary Mains Fail.*
- Activation of the inbuilt exercise scheduler if configured for Parallel or Island runs.
- Instruction from external remote telemetry devices using the RS485 or Ethernet interface.

Once the generator has been instructed to synchronise and placed on load, it is not automatically removed. Depending on loading request state, one of the following methods is used to manually open the load switch:

- If the loading request has been removed:
  - Press the ***Transfer to Mains*** button
  - Activation of an auxiliary input assigned the function *Transfer To Mains / Open Generator.*
  - Press the ***Auto Mode*** button to return to automatic mode. The set observes all ***Auto Mode*** start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.
- If the loading request remains active:
  - Press the ***Stop/Reset Mode*** button to remove load and stop the generator.
  - Activation of an auxiliary input assigned the function *Generator Load Inhibit (no ramping occurs).*

6.3.2.2 MANUAL BREAKER CONTROL ENABLED



Loading request sources are limited to:

- Press the ***Transfer to Generator*** button.
- Activation of an auxiliary input assigned the function *Transfer To Generator / Open Mains.*

Once the generator is placed on load, it is not automatically removed. Any one of the following methods are used to manually open the load switch:

- Press the ***Transfer to Mains*** button
- Activation of an auxiliary input assigned the function *Transfer To Mains / Open Generator.*
- Press the ***Auto Mode*** button to return to automatic mode. The set observes all ***Auto Mode*** start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.
- Press the ***Stop/Reset Mode*** button to remove load and stop the generator.
- Activation of an auxiliary input assigned the function *Generator Load Inhibit (*no ramping occurs*).*

6.3.3 STOPPING SEQUENCE

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

- The ***Stop/Reset Mode*** button is pressed – The *Close Gen* outputs de-activated immediately and the set immediately stops.
- The ***Auto Mode*** button is pressed. The set observes all ***Auto Mode*** start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.

6.4 TEST MODE

This button places the module into its ***Test Mode*** this allows an on-load test of the generator.

Once in ***Test Mode***, the module responds to the **Start** button to start the generator.
Once the set has started and becomes available, it is automatically placed onload (‘Close Generator Output’ becomes active), synchronising to the Mains if required. Depending upon module configuration, the generator remains in constant parallel with the Mains or proceeds to run in island operation (‘Close Mains Output’ becomes inactive).

The generator remains on load until either the ***Stop/Reset Mode*** or ***Auto Mode*** is selected.

6.5 AUTOMATIC MODE

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

Auto Mode can be activated by pressing the designated button, which will then illuminate with a green highlight to indicate that Auto Mode is in operation.

The ***Auto Mode*** feature enables the generator to function autonomously, initiating and terminating operations as needed without any manual input from the user.

6.5.1 WAITING IN AUTO MODE

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

- Failure of Mains supply
- High mains load (when the module is set for Mains mode)
- Activation of an auxiliary input assigned the function *Remote Start* function.
- Activation of an auxiliary input assigned the function *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

NOTE: If the unit has been configured for CAN, compatible ECUs receive the start command via CAN and transmit the engine speed to the DSE controller.

NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

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 fuel relay is energised, and the engine is cranked.

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the *Crank Rest* duration after which the next start attempt is made. If this sequence continues beyond the set number of attempts, the start sequence is terminated, and the display shows *Fail to Start.*

The starter motor is disengaged when the engine fires. Speed detection is factory configured to be derived from the AC alternator output frequency but can additionally be measured from a Magnetic Pickup mounted on the flywheel or from the CAN link to the engine ECU depending on module.

Additionally, rising oil pressure, or charge alternator, or generator voltage can be used to disconnect the starter motor (but cannot detect underspeed or overspeed).

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

6.5.3 ENGINE RUNNING

NOTE: The load transfer signal remains inactive until the generator is available. This prevents excessive wear on the engine and alternator.

The generator synchronises to the mains and is placed on load if configured to do so.

If all start requests are removed, the stopping sequence begins.

6.5.4 LOADING THE GENERATOR

A marker will appear next to the ***Transfer to Generator*** button when the generator becomes available, indicating that its load switch can be closed.

In ***Auto Mode***, the generator load switch is closed automatically (if instructed to) when the generator 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 assigned the function *Remote Start On Load* or *Remote Start In Island Mode* function.
- Activation of an auxiliary input assigned the function *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.

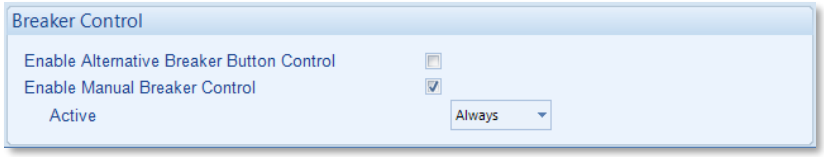
The generator is then instructed to go into continuous parallel with the mains or into island operation, for further details refer to the section entitled *Continuous Parallel Operation* and/or *Island Operation* elsewhere in this document.

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

6.5.5 UNLOADING THE GENERATOR

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

- Press the ***Auto Mode*** button. The module observes all ***Auto Mode*** start requests and stopping timers before beginning the *Auto Mode Stopping Sequence*.
- Press the ***Stop/Reset Mode*** button to open the generator load switch and to stop the generator.
- Activation of an auxiliary input assigned the function *Generator Load Inhibit* (no ramping occurs)
- With *Manual Breaker Control* enabled, the following unloading requests take affect:



  - Press the ***Manual Mode*** button followed by the ***Transfer to Mains*** button. The operation of ***Transfer to Mains*** button is dependent on module configuration, for further details refer to the section entitled *Control Push Buttons* elsewhere in this document.

6.5.6 STOPPING SEQUENCE

The *Return Delay* timer operates to ensure that the starting request has been permanently removed and is not just a short-term removal. If another start request is made during the cooling down period, the set returns on load.

If there are no starting requests at the end of the *Return Delay* timer, the generator ramps its load off and open its load switch, the *Cooling Down* timer is initiated.

The *Cooling Down* timer allows the set to run off load and cool sufficiently before being stopped. This is particularly important where turbo chargers are fitted to the engine.

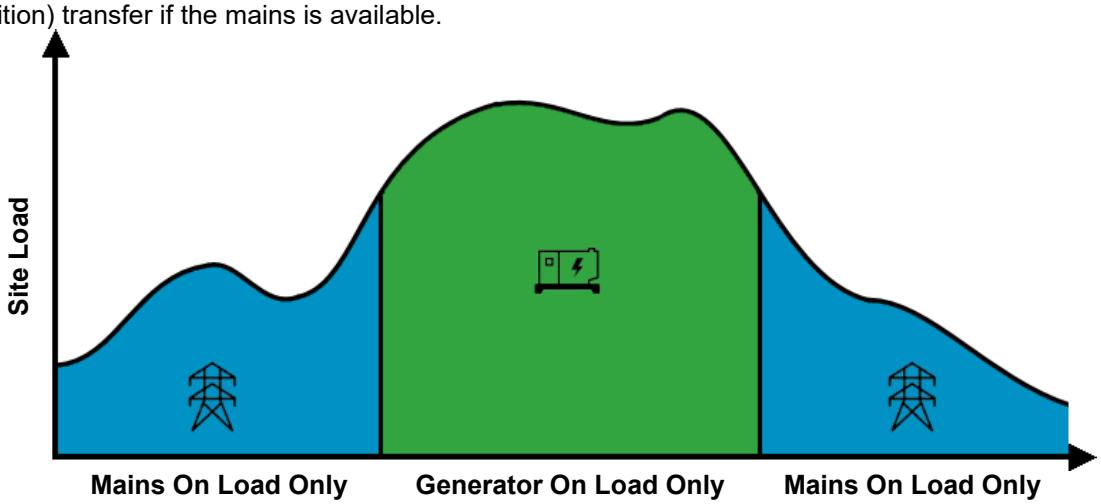
After the *Cooling Down* timer has expired, the set is stopped.

6.6 ISLAND OPERATION

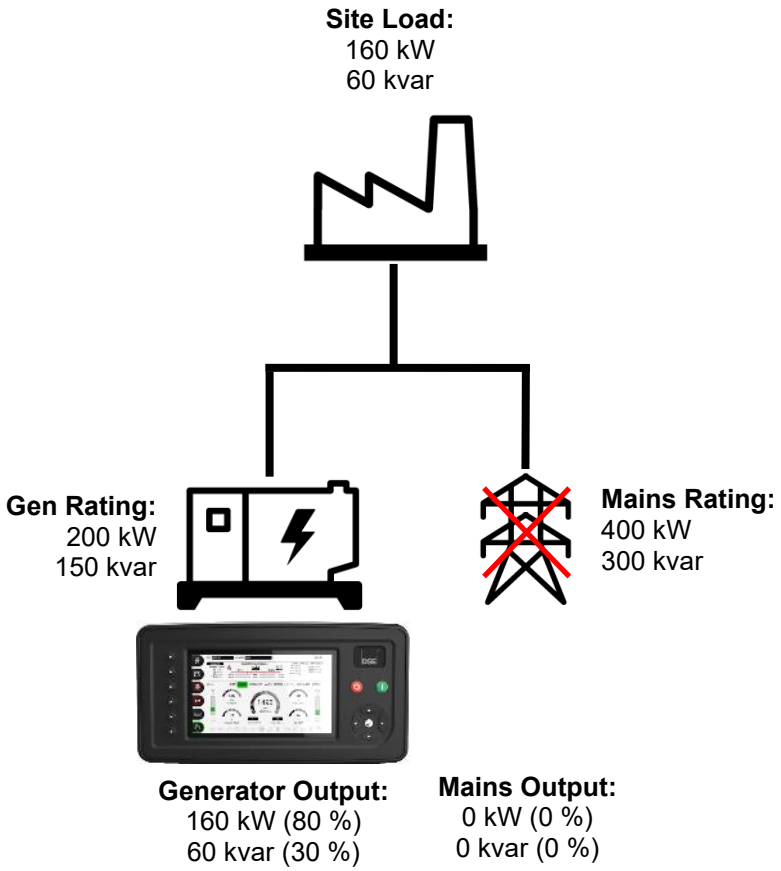
The generator can be started during a mains failure or activation of *Remote Start in Island Mode*. The generator in this case must be capable of supplying the entire load during this time. The generator can then be used to power the load by:

- Performing a *No-Break (Closed Transition)* changeover by synchronising if the mains is available.
- Performing a *Break (Open Transition)* changeover if the mains is not available.

This leaves the generator running in *Island Operation*, supplying 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.



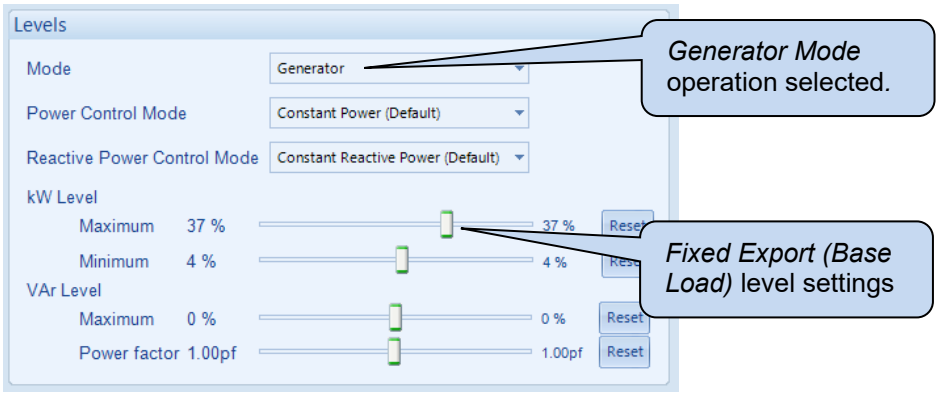
When the generators in *Island Operation*, the amount of power it produces is governed by the demand of the load.



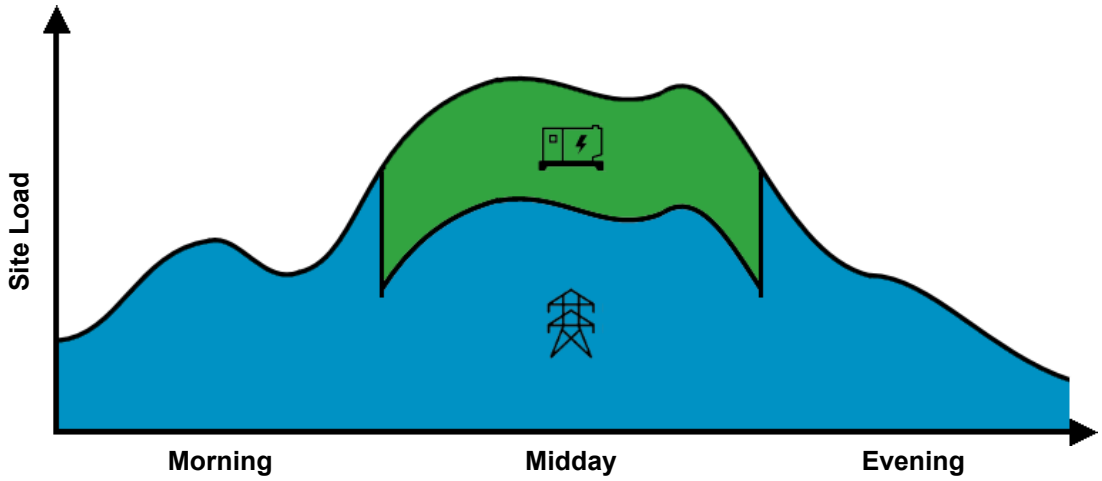
6.7 CONTINOUS PARRALLEL OPERATION

6.7.1 GENERATOR MODE (FIXED EXPORT / BASE LOAD)

During specified times of the day, the generator can be started and parallel to the mains using the *Remote Start on Load* input to the DSEG8900. When the DSEG8900 is set to *Generator Mode,* synchronising to the mains prior to closing the generator breaker enables the generator to generate a fixed (base) level of power.



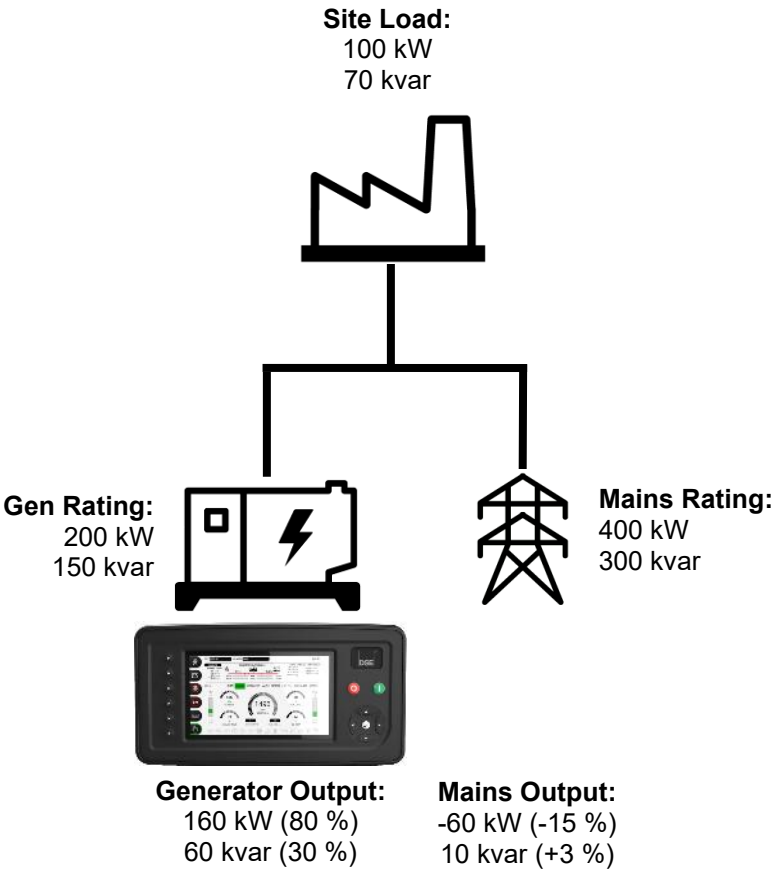
This leaves the generator running in *Continuous Fixed Export (Base Load) Parallel Operation*. The fixed (base) level of power produced by the generator supplies the local load and any excess is exported to the mains. This is the case until the *Remote Start on Load* signal is removed from the DSEG8900 module.



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

It is the job of the DSEG8900 to make precise changes to the amount *Active Power* (kW) and *Reactive Power* (kvar) produced by the 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.

When the generator is paralleled to the mains, the DSEG8900 instructs its generator to produce the pre-set percentage of its rating. This pre-set percentage is changeable whilst the generator is running via a multitude of different interfaces. In the example below, the generator is instructed to produce 80 % of its kW rating and 30 % of its kvar rating. This results in 60 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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

It is sometimes required that when a generator is placed in parallel with the mains, that it does not simply produce 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

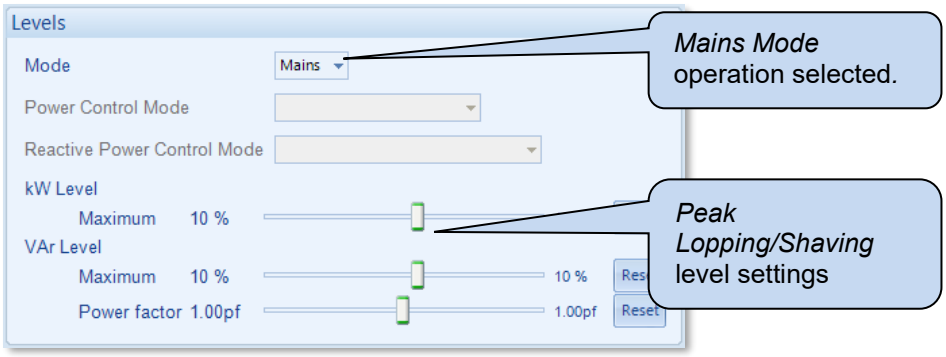
In this mode of exporting power to the mains (utility); the DSE load share controller varies the amount of reactive power produced with regards to the *Control Curve* depending on the measured voltage.
This mode allows the generator to support the mains (utility) voltage stability by monitoring the voltage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

Power - Power Factor Mode

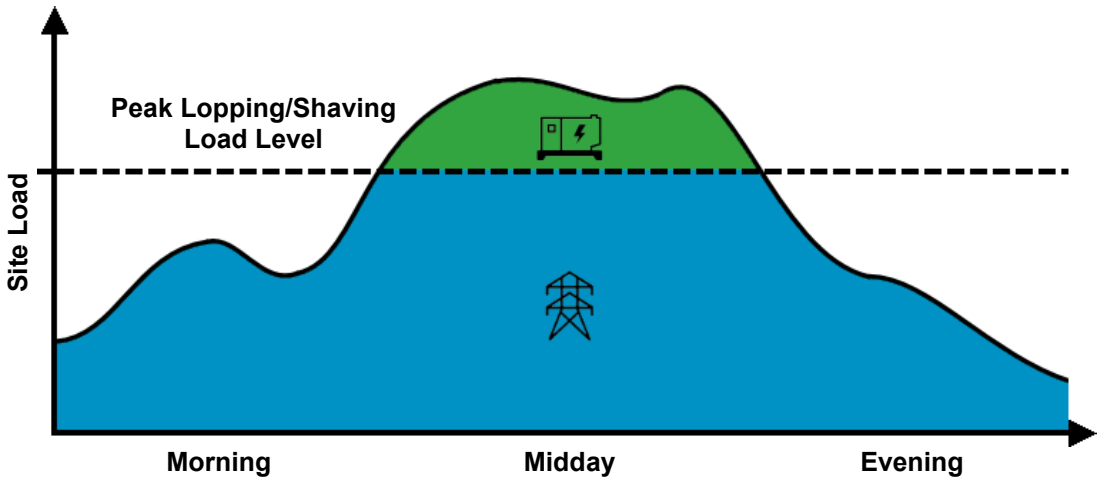
In this mode of exporting power to the mains (utility); the DSE load share controller varies the amount of reactive power produced with regards to maintaining the required power factor. This power factor is derived from the averaged power using the *Control Curve.*
This mode allows the generator to support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

6.7.3 MAINS MODE (PEAK LOPPING/SHAVING)

During specified times of the day, the generator can be started and paralleled to the mains using the *Remote Start on Load* input to the DSEG8900. When the DSEG8900 is set to *Mains Mode,* this causes the generator to only start and synchronise to the mains when the load level rises above a pre-defined mains load level.



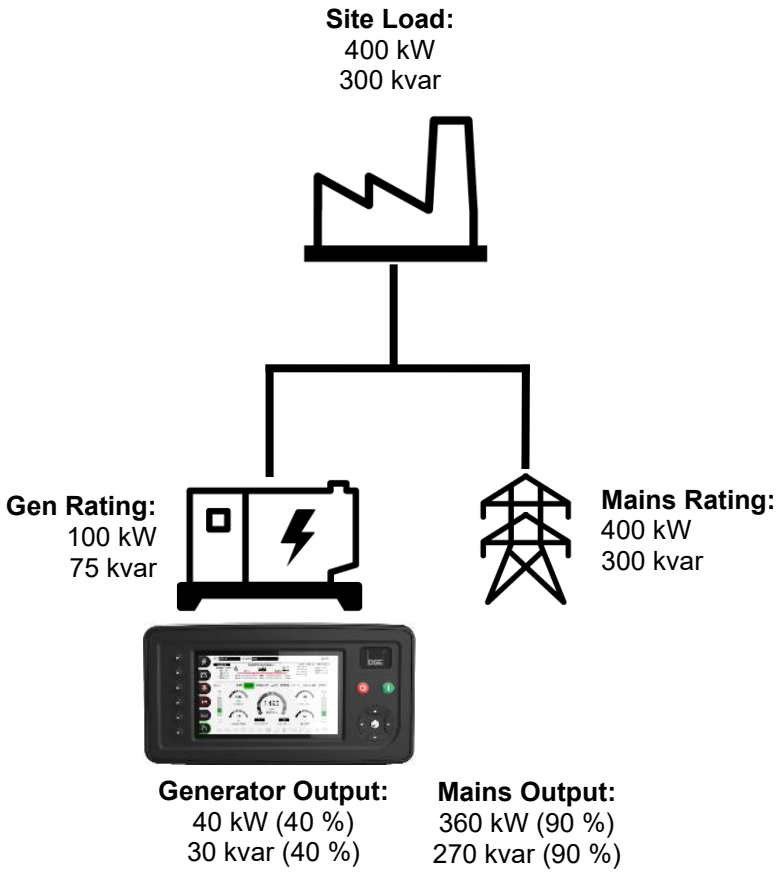
This leaves the generator running in *Continuous Peaking Lopping/Shaving Parallel Operation*. The amount of power produced by the generator whilst in parallel with the mains is constantly varied to maintain the mains at the pre-defined load level. This is the case until the *Remote Start on Load* signal is removed from the DSEG8900 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 DSEG8900 to make precise changes to the amount *Active Power* (kW) and *Reactive Power* (kvar) produced by the 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.

When the generator is paralleled to the mains, the DSEG8900 instructs its generator to produce a certain amount of power 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 90%. The generator is then instructed to produce the excess requirement from the load. The generator produces 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 the generator produces the additional 40 kW and 30 kvar to the load.



6.8 SCHEDULER

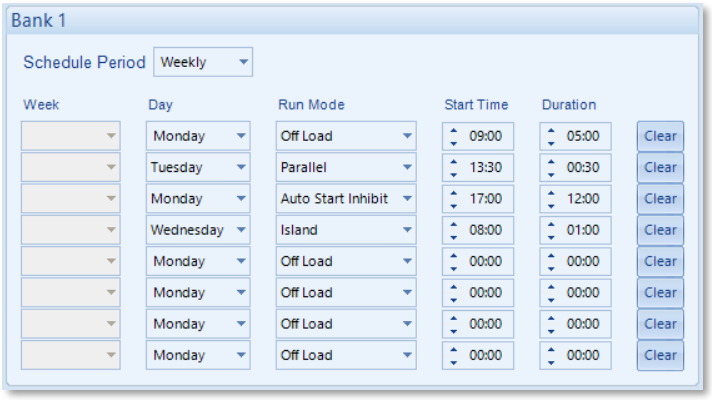
The controller contains an inbuilt exercise run scheduler, capable of automatically starting and stopping the set or inhibiting the set from starting. Up to 16 scheduled (in two banks of 8) start/stop/inhibiting start sequences can be configured to repeat on a 7-day or 28-day cycle.

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

Example:

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

In this example the set starts at 09:00 on Monday and run for 5 hours off load, then start at 13:30 on Tuesday and run for 30 minutes on load, the set is inhibited from automatically starting on Monday from 17:00 for 12 hours and runs in Island mode at 8:00 on Wednesday and runs for an hour.



6.8.1 STOP MODE

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

6.8.2 MANUAL MODE

- Scheduled runs do not occur when the module is in ***Manual Mode*** waiting for a start request.
- Activation of a scheduled run *On Load* when the module is operating *Off Load* in ***Manual Mode*** forces the set to run *On Load*.

6.8.3 AUTO MODE

- Scheduled runs operate only if the module is in ***Auto Mode*** with no *Shutdown* or *Electrical Trip* alarm active.
- If the module is in ***Stop/Reset Mode*** or ***Manual Mode*** when a scheduled run begins, the engine is not started. However, if the module is moved into ***Auto Mode*** during a scheduled run, the engine is called to start.
- Depending upon configuration by the system designer, an external input can be used to inhibit a scheduled run.
- If the engine is running *Off Load* in ***Auto Mode*** and a scheduled run configured to *On Load* begins, the set is placed *On Load* for the duration of the Schedule.

6.9 ALTERNATIVE CONFIGURATIONS

Depending upon the configuration of the system by the generator supplier, the system may have selectable configurations (for example to select between 50 Hz and 60 Hz). If this has been enabled the generator supplier will advise how this selection can be made (usually by operating an external selector switch or by selecting the required configuration file in the module's front panel configuration editor).

6.10 DUMMY LOAD / LOAD SHEDDING CONTROL

If the load is low, 'dummy loads' (typically resistive load banks) are introduced to ensure the engine is not too lightly loaded. Conversely, as the load increases towards the maximum rating of the set, non-essential loads are shed to prevent overload of the generator.

6.10.1 DUMMY LOAD CONTROL

The *Dummy Load Control* feature, when enabled, supports up to five stages of dummy load activation. Initially, all dummy load outputs are turned off. Once the generator begins supplying power, its load is continuously monitored by the control system.

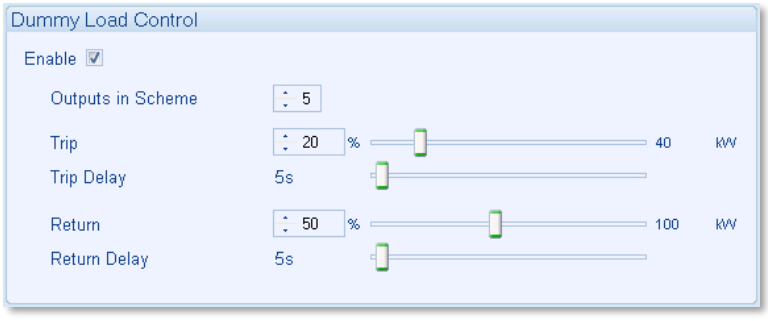
If the generator's load drops below the configured *Dummy Load Control Trip* threshold (in kW), the *Dummy Load Control Trip Delay* timer starts. If the low load condition persists for the duration of this timer, the system activates the first *Dummy Load Control* output to connect a resistive load bank, thereby increasing the generator's load.

After the first dummy load is activated and the generator load increases, the system continues to monitor the load. If necessary, additional dummy loads are activated sequentially until all configured outputs are in use.

When the generator load exceeds the *Dummy Load Return* threshold, a return delay timer begins. If the higher load condition remains stable through the timer duration, the system begins deactivating dummy loads, starting with the most recently activated one, until all dummy loads are turned off.

If the generator begins its shutdown sequence for any reason, all dummy load outputs are immediately deactivated at the same time the generator load switch is signalled to open.

Example screen shot of *Dummy Load Control* setup in the DSE Configuration Suite



6.10.2 LOAD SHEDDING CONTROL

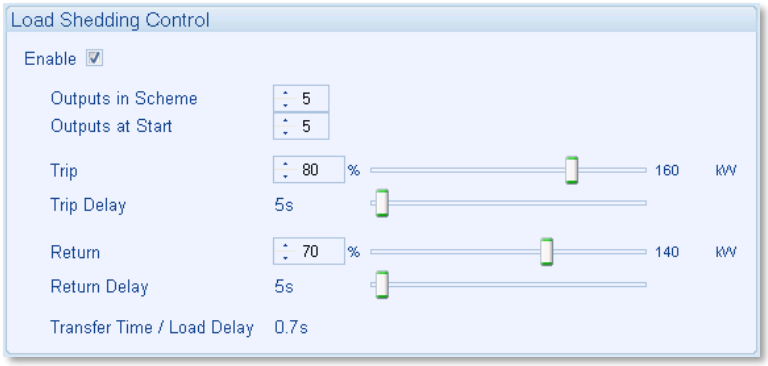
The *Load Shedding Control* feature supports up to five stages of load shedding. When the generator is preparing to take on load, the configured number of *Load Shedding Control Outputs* at start are activated. This allows selected non-essential loads to be disconnected before the generator's load switch closes, helping to ensure that the initial load remains below the generator's *Load Acceptance* specification.

Once the generator is on load, the *Load Shedding Control* scheme begins monitoring its output. If the generator load exceeds the configured *Load Shedding Trip* level, the *Trip Delay* timer starts. If the high load condition persists through the timer duration, the first *Load Shedding Control* output is activated to shed a load. If the load remains high, subsequent outputs are activated in sequence until all configured *Load Shedding Control* outputs are energised.

When the generator load drops below the *Load Shedding Return* level, the *Return Delay* timer begins. If the lower load condition continues through the timer duration, the most recently activated *Load Shedding Control* output is de-energised. This process continues until all shed loads are de-energised.

If the generator begins a stopping sequence for any reason, all *Load Shedding Control* outputs are de-energise simultaneously when the generator load switch opens.

Example screen shot of *Load Shedding Control* setup in the DSE Configuration Suite:



7 PROTECTIONS

7.1 ALARMS

When an alarm is active, the *Internal Audible Alarm* sounds, and the *Alarm Pop-up* appears.

The audible alarm is silenced by pressing the ***Alarm Mute / Lamp Test*** button and the *Alarm Pop-up* is cleared by pressing the ***Tick*** button.

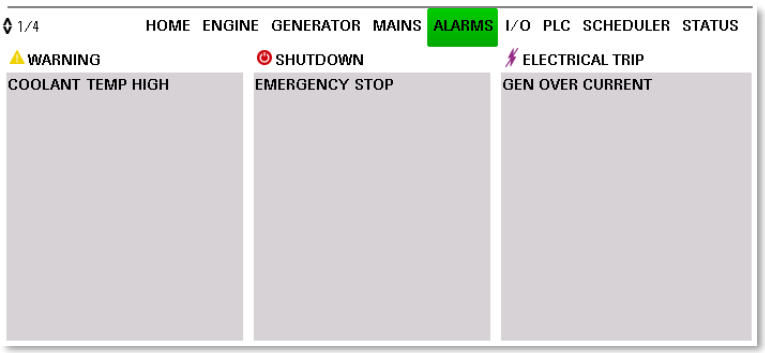
Upon clearing the *Alarm Pop-up*, the display the automatically navigates to the *Active Alarm* page.

The *Alarm Pop-up* is colour coded to indicate the action of the alarm; an example is of which is shown below.

Alarm Action	Colour
Warning	Warning
Electrical Trip	Electrical Trip
Shutdown	Shutdown

Use the ***Right & Left*** buttons to scroll to the *Alarms* page to view the alarm details. More information is detailed in the section entitled *Description Of Controls* elsewhere in this document.

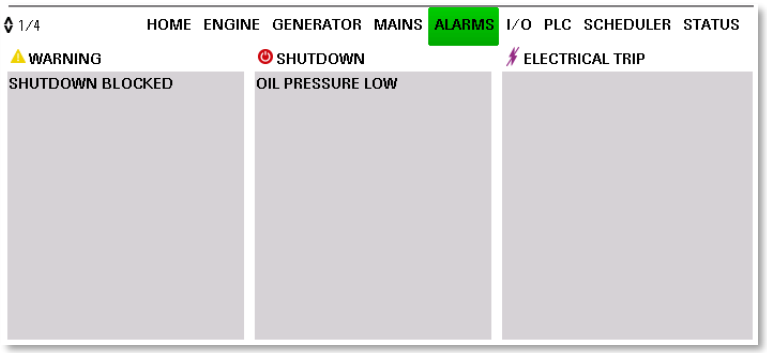
In the event of an alarm, the module displays the appropriate text. If an additional alarm then occurs, the module displays the appropriate text.



7.1.1 PROTECTIONS DISABLED

Configuration is possible to prevent *Shutdown* and *Electrical Trip* alarms from stopping the generator. Under such conditions, *Shutdown Blocked Warning* alarm appears on the module display to inform the operator. *Shutdown* and *Electrical Trip* alarms still appear however, the operator is informed the alarms are blocked.

Example



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

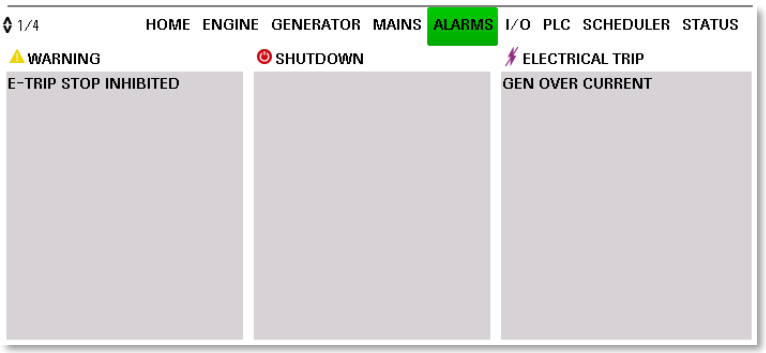
The feature is configurable in the PC configuration software for the module. Writing a configuration to the controller that has *Protections Disabled* configured, results in a warning message appearing on the PC screen for the user to acknowledge before the controller's configuration is changed. This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

7.1.2 RESET ELECTRICAL TRIP

Configuration is possible to enable the operator to *Reset Electrical Trip* alarm a configurable number of times before the generator has stopped. This is to allow the generator to go back on load without having to perform a cooling run first.

It is also possible to prevent an *Electrical Trip* alarm from stopping the generator. Under such conditions, the *E-Trip Stop Inhibited Warning* alarm appears on the module display to inform the operator. *Electrical Trip* alarms still appear however, the operator is just informed the generator is inhibited from stopping.

Example



This feature is provided to assist the system designer in meeting specification requirements to ensure the generator (if running) can take load again after the alarm has been reset. Depending upon configuration, the generator may go into a cooling run or be inhibited from stopping after the *Electrical Trip* alarm activates.

When configuring this feature in the PC software, the system designer chooses to make the *Electrical Trip* alarms resettable by using a switch connected to an input configured for *Reset Electrical Trip* and/or by pressing the ***Transfer to Generator*** button. The system designer provides this switch (not DSE), so its location varies depending upon manufacturer, however it normally takes the form of a key operated switch to prevent inadvertent activation. If the DSE module is in the ***Manual Mode*** , a further press of the ***Transfer to Generator*** button is required to place the generator on load if no other on load request is active.

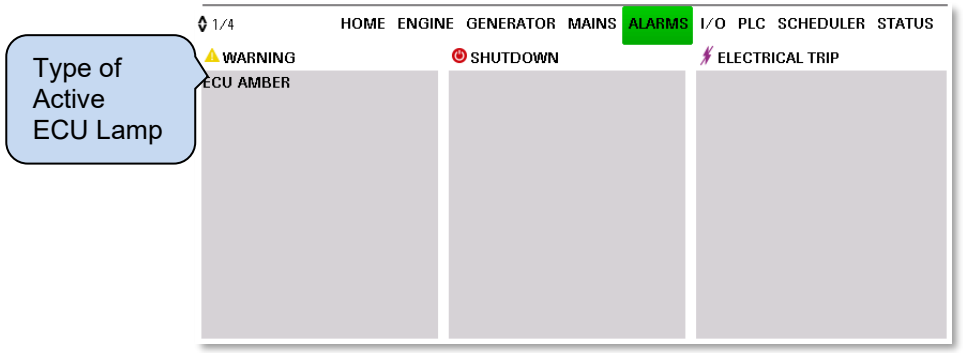
The feature is configurable in the PC configuration software for the module. Writing a configuration to the controller that has *Reset Electrical Trip* enabled, results in a warning message appearing on the PC screen for the user to acknowledge before the controller's configuration is changed. This prevents inadvertent activation of the feature.

7.1.3 ECU ALARMS (CAN FAULT CODES / DTC)

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

NOTE: For further details on connection to electronic engines, refer to DSE Publication: *057-004 Electronic Engines And DSE Wiring*

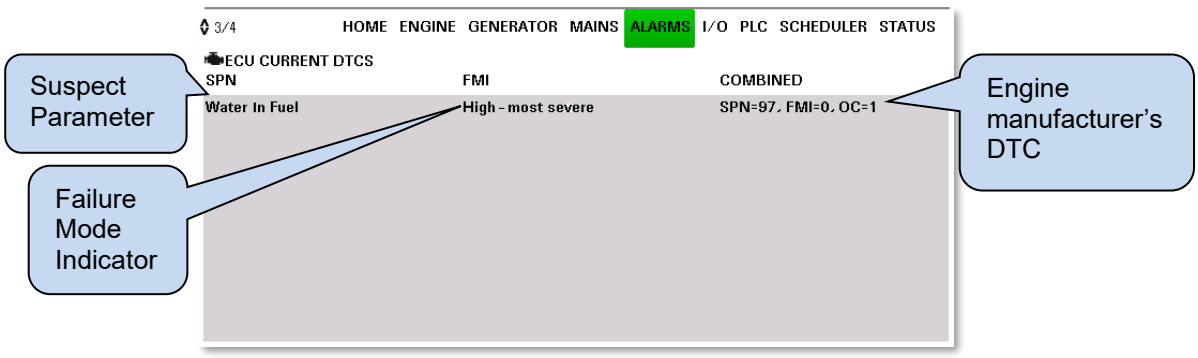
When connected to a suitable CAN engine, the controller displays alarm status messages from the ECU in the *Alarms* page on the display under the relevant alarm type.



Press the ***Up/Down*** buttons to access the list of *ECU Current DTCs* from the ECU which are DM1 messages.

Press the ***Up/Down*** buttons again to access the list of *ECU Prev. DTCs* from the ECU which are DM2 messages.

The DTCs as interpreted by the module and is shown as a text message. In addition to this, the manufacturer's DTC is also provided.

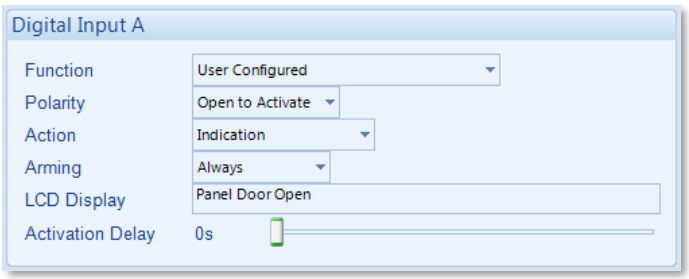


7.2 INDICATIONS

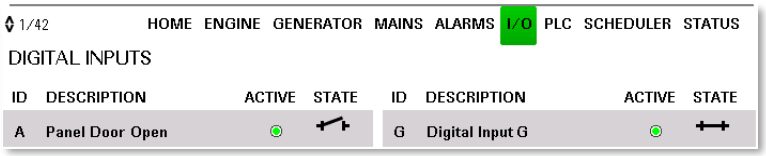
Indications are non-critical and often status conditions. They do not appear on the display of the module as a text message in the *Status, Event Log* or *Alarms* pages. However, the *IO* page shows the relevant digital input showing the status of the input.

Example:

- Input configured for indication.
- The *IO* display page shows when the relevant Digital Input is active along with its *LCD Display* text.
- As the input is configured to *Indication* there is no alarm generated.



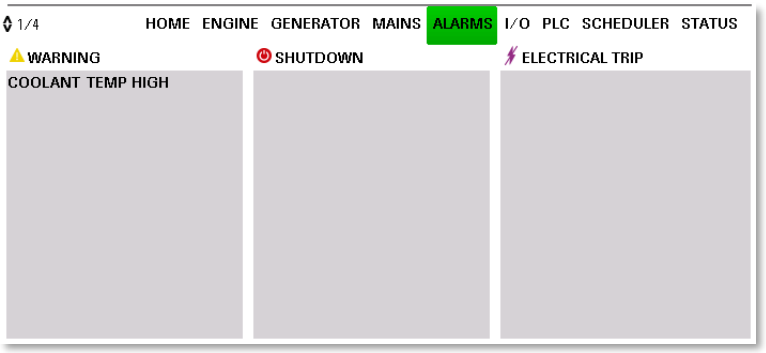
- Example showing operation of the *IO* page on the module's display.



7.3 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.

Example



In the event of an alarm the display jumps to the alarms page and displays all active alarms.

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.

If the module is configured for CAN and receives an error message from the ECU, "ECU Warning" is shown on the module's display as a warning alarm.

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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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.
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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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.
AMSC Data Error Redundant	The module detected a fault in the redundant communication link between AMSC modules.
Analogue Input A to D (Digital)	**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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input configured as a digital input to create a fault condition became active and the appropriate LCD message is displayed.
Battery Detect Failure	The module detected that a battery charger connected by DSENet® had issued a *Battery Detect Failure* alarm.

Continued over page…

Fault	Description
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 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 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.
AVR Maximum Trim Limit	The module's AVR output has reached its limit whilst attempting to control the generator to produce more kvar whilst in parallel. This indicates a fault with either the AVR (including connection error), setting of SW2, or that the alternator has reached its maximum capacity.
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.
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.
Calibration Lost	The module detected that its internal calibration has failed. The unit must be sent back to DSE to be investigated and repaired. Contact DSE Technical Support for more details.
Charge Alt Failure IEEE 37.2 – 27 DC Undervoltage Relay	The module detected that the output voltage of the charge alternator had fallen below the *Charge Alternator Warning Trip* level for the configured delay timer.
Charge Air Temperature	The module detects that the engine ECU has detected the Charge Air Temperature has exceeded the pre-alarm trip level.
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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that a battery charger connected by DSENet® had issued a *Common Warning Alarm*.

Continued over page…

Fault	Description
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.
Coolant Temp High IEEE C37.2 – 26 Apparatus Thermal Device	The module detected that the engine coolant temperature had risen above the *High Coolant Temperature Pre-Alarm Trip* level after the *Safety On Delay* timer had expired.
DEF Level Low	The module received a fault condition from the engine ECU alerting about the DEF level.
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: *057-340 DSEG8900 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.
DPTC Filter	The module received a fault condition from the engine ECU alerting that the DPF/DPTC had activated.
Earth Fault IEEE C37.2 – 51G or 51N Generator IDMT Earth Fault Relay	**NOTE: For more details, refer to the section entitled *Earth Fault IDMT Alarm* elsewhere in this document.** The module detected that the generator earth fault current had risen above the *Earth Fault Trip Level* for the duration of the IDMT function.
ECU Amber	The module received an amber fault condition from the engine ECU.
ECU Data Fail	The module is configured for CAN operation but has not detected data being sent from the engine's ECU.
ECU Malfunction.	The module received a malfunction fault condition from the engine ECU.
ECU Protect	The module received a protect fault condition from the engine ECU.
ECU Red	The module received a red fault condition from the engine ECU.
Electrical Trip Stop Inhibited	The module created an electrical trip alarm due to a fault, but the generator is prevented from stopping. This is due to the Reset Electrical Trip Inhibit Engine Stop being enabled. To stop the generator, remove the starting request or press the ***Stop/Reset Mode*** button.
Engine Over Speed Delayed IEEE C37.2 - 12 Overspeed Device	The module detected that the engine speed had risen above the *Over Speed Trip* level but was below the *Over Speed Overshoot Trip* for the configured *Overshoot Delay* timer during starting.
Engine Under Speed IEEE C37.2 - 14 Underspeed Device	The module detected that the engine speed had fallen below the *Under Speed Pre-Alarm Trip* level for the configured delay timer after the *Safety On Delay* timer had expired.

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Fault	Description
Exp. Unit Failure	The module detected 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. The generator continues to synchronise until it is either achieved or runs out of fuel.
Flexible Sensor A to D 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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input value had risen above the *Flexible Sensor High Pre-Alarm Trip* level.
Flexible Sensor A to D 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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input value had fallen below the *Flexible Sensor Low Pre-Alarm Trip* level.
Fuel Level High IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine fuel level had risen the *High Fuel Level Pre-Alarm* level for the configured delay.
Fuel Level Low IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine fuel level had fallen below the *Low Fuel Level Pre-Alarm* level for the configured delay
Fuel Level Low Switch IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine low fuel level switch had activated.
Fuel Tank Bund Level High IEEE C37.2 - 71 Liquid Level Switch	The module detected that the fuel tank bund level switch had activated.
Fuel Usage IEEE C37.2 – 80 Flow Switch	The module detected that the fuel consumption was more than the configured *Running Rate* or *Stopped Rate*.
Gen Earth Fault IEEE C37.2 – 51G or 51N Generator IDMT Earth Fault Relay	**NOTE: For more details, refer to the section entitled *Earth Fault IDMT Alarm* elsewhere in this document.** The module detected that the generator earth fault current had risen above the *Earth Fault Trip Level* for the duration of the IDMT function.
Gen Failed to Open IEEE C37.2 – 52b AC Circuit Breaker Position (Contact Open when Breaker Closed)	The module detected that the generator load switch had failed to open as the *Generator Closed Auxiliary* input stayed activate for the Generator Fail to Open Delay time after the Open Gen Output activated.
Gen Loading Frequency	The module detected that the generator output frequency had not risen above the *Generator Loading Frequency* setting after the *Warming Up* timer had expired.
Gen Loading Voltage	The module detected that the generator output voltage had not risen above the *Generator Loading Voltage* setting after the *Warming Up* timer had expired.
Gen Over Current IEEE C37.2 – 50 Instantaneous Overcurrent Relay IEEE C37.2 – 51 IDMT Overcurrent Relay	**NOTE: For more details, refer to the section entitled *Over Current Alarm* elsewhere in this document.** The module detected that the generator output current had risen above the *Generator Over Current Trip*.

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Fault	Description
Gen Over Frequency IEEE C37.2 – 81 Frequency Relay	The module detected that the generator output frequency had risen above the *Over Frequency Pre-Alarm Trip* level for the configured delay timer.
Gen Over Frequency Delayed IEEE C37.2 – 81 Frequency Relay	The module detected that the generator output frequency had risen above the *Over Frequency Trip* level but was below the *Over Frequency Overshoot Trip* for the configured *Overshoot Delay* timer during starting.
Gen Over Voltage IEEE C37.2 – 59 AC Overvoltage Relay	The module detected that the generator output voltage had risen above the *Over Voltage Pre-Alarm Trip* level for the configured delay timer.
Gen Reverse Power IEEE C37.2 – 32 Directional Power Relay	The module detected that the generator output kW had fallen below the *Reverse Power Trip* for the configured delay timer.
Gen Short Circuit IEEE C37.2 – 51 IDMT Short Circuit Relay	**NOTE: For more details, refer to the section entitled *Short Circuit IDMT Alarm* elsewhere in this document.** The module detected that the generator output current had risen above the *Short Circuit Trip* for the duration of the IDMT function.
Gen Under Frequency IEEE C37.2 – 81 Frequency Relay	The module detected that the generator output frequency had fallen below the *Under Frequency Pre-Alarm Trip* level for the configured delay timer after the *Safety On Delay* timer had expired.
Gen Under Voltage IEEE C37.2 – 27 AC Undervoltage Relay	The module detected that the generator output voltage had fallen below the *Under Voltage Pre-Alarm Trip* level for the configured delay timer after the *Safety On Delay* timer had expired.
HEST Active	The module received a fault condition from the engine ECU alerting that the HEST had activated.
Inlet Temperature	The module detected that the engine's ECU measurement of inlet temperature had risen above the *Inlet Temperature Pre-Alarm Trip* level.
Insufficient Capacity	The module's governor output has reached its limit whilst attempting to control the generator to produce more kW 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.
kW Overload IEEE C37.2 – 32 Directional Power Relay	The module detected that the generator output kW had risen above the *Overload Protection Trip* for the configured delay timer
Loss Of Excitation	The module detected that the generator output kvar had fallen below the *Loss of Excitation Pre-Alarm Trip* level.
Loss of Mag-PU	The module detected that the magnetic pick up was not producing a pulse output after the required *Crank Disconnect* criteria had been met.
Low Coolant Warning	The module detected that the engine coolant temperature had fallen below the *Low Coolant Temperature Pre-Alarm Trip* level.
Maintenance Due	**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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that one of the configured maintenance alarms is due as its configured maintenance interval has expired.
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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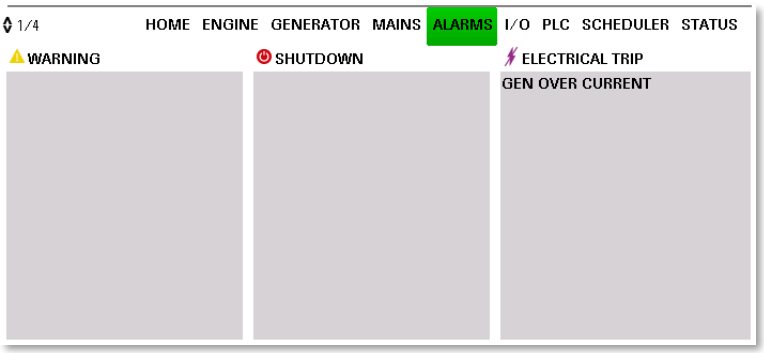
Fault	Description
Mains Breaker Failed To Close	The module detected that the mains breaker failed to close.
Mains Breaker Failed To Open	The module detected that the mains breaker failed to open.
Mains Decoupling High Frequency	If the module detects the mains frequency increase when in parallel with 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 Negative Sequence Voltage High	The module detected the mains voltage negative sequence had risen above the configurable *Trip* level for the configured delay timer.
Mains Zero Sequence Voltage High	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 is exporting more than the configured limit, the LCD indicates *Mains Reverse Power*
Mains Positive Sequence Voltage Low	The module detected the mains voltage positive sequence had fallen below the configurable *Trip* level for the configured delay timer.
Negative Phase Sequence IEEE C37.2 - 46 Phase-Balance Current Relay	The module detected that there was an imbalance of current across the generator phases greater than the *Negative Phase Sequence Trip Level* percentage setting.
Oil Pressure Low IEEE C37.2 - 63 Pressure Switch	The module detected that the engine oil pressure had fallen below the *Low Oil Pressure Pre-Alarm Trip* level after the *Safety On Delay* timer had expired.
Protections Disabled	The module detected that an input configured for Protections Disable became active.
SCR Inducement	The module received a fault condition from the engine ECU alerting about the SCR Inducement.
Water in Fuel	The module received a fault condition from the engine ECU alerting that water in the fuel had been detected or that the *Water in Fuel* input switch had activated.

7.4 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 (the exception to this is the *Coolant Temp High* alarm and similar *Active From Safety On* alarms, as the coolant temperature could be high with the engine at rest).

Electrical Trip Alarms are latching and stop the Generator but in a controlled manner. On initiation of the electrical trip condition the module de-activates the *Close Gen Outputs* to remove the load from the generator. Once this has occurred the module starts the *Cooling Timer* and allows the engine to cool off-load before shutting down the engine. To restart the generator the fault must be cleared, and the alarm reset.

Example



In the event of an alarm the display jumps to the alarms page and displays all active alarms.

Electrical Trip Alarms are latching alarms and to clear 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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.

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Fault	Description
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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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.

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Fault	Description
Analogue Input A to D (Digital)	**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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input configured as a digital input to create a fault condition became active and the appropriate LCD message is displayed.
AVR Maximum Trim Limit	The module's AVR output has reached its limit whilst attempting to control the generator to produce more kvar whilst in parallel. This indicates a fault with either the AVR (including connection error), setting of SW2, or that the alternator has reached its maximum capacity.
Calibration Fault	The module detected that its internal calibration has failed. The unit must be sent back to DSE to be investigated and repaired. Contact DSE Technical Support for more details.
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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that a battery charger connected by DSENet® had issued a *Common Electrical Trip Alarm*.
Coolant Temp High IEEE C37.2 – 26 Apparatus Thermal Device	The module detected that the engine coolant temperature had risen above the *High Coolant Temperature Electrical Trip* level after the *Safety On Delay* timer had expired.
DEF Level Low	The module received a fault condition from the engine ECU alerting about the DEF level.
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: *057-340 DSEG8900 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.
DPTC Filter	The module received a fault condition from the engine ECU alerting that the DPF/DPTC had activated.
ECU Amber	The module received an amber fault condition from the engine ECU.
ECU Data Fail	The module is configured for CAN operation but has not detected data being sent from the engine's ECU.
ECU Malfunc.	The module received a malfunction fault condition from the engine ECU.
ECU Protect	The module received a protect fault condition from the engine ECU.
ECU Red	The module received a red fault condition from the engine ECU.
Engine Under Speed IEEE C37.2 - 14 Underspeed Device	The module detected that the engine speed had fallen below the *Under Speed Alarm Trip* level for the configured delay timer after the *Safety On Delay* timer had expired.

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Fault	Description
Exp. Unit Failure	The module detected communications to one of the DSENet® expansion modules had been lost.
Flexible Sensor A to D 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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input value had risen above the *Flexible Sensor High Alarm Trip* level.
Flexible Sensor A to D 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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input value had fallen below the *Flexible Sensor Low Alarm Trip* level.
Fuel Level High IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine fuel level had risen the *High Fuel Level Alarm* level for the configured delay.
Fuel Level Low IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine fuel level had fallen below the *Low Fuel Level Alarm* level for the configured delay
Fuel Level Low Switch IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine low fuel level switch had activated.
Fuel Tank Bund Level High IEEE C37.2 - 71 Liquid Level Switch	The module detected that the fuel tank bund level switch had activated.
Fuel Usage IEEE C37.2 – 80 Flow Switch	The module detected that the fuel consumption was more than the configured Running Rate or Stopped Rate.
Gen Earth Fault IEEE C37.2 – 51G or 51N Generator IDMT Earth Fault Relay	**NOTE: For more details, refer to the section entitled Earth Fault IDMT Alarm elsewhere in this document.** The module detected that the generator earth fault current had risen above the *Earth Fault Trip Level* for the duration of the IDMT function.
Gen Failed to Close IEEE C37.2 – 52b AC Circuit Breaker Position (Contact Open when Breaker Closed)	The module detected that the generator load switch had failed to close as the *Generator Closed Auxiliary* input did not activate within the *Generator Fail to Close Delay* time after the *Close Gen Output* activated.
Gen Over Current IEEE C37.2 – 51 IDMT Overcurrent Relay	**NOTE: For more details, refer to the section entitled Over Current Alarm elsewhere in this document.** The module detected that the generator output current had risen above the Generator Over Current Trip for the duration of the IDMT function.
Gen Phase Seq Wrong IEEE C37.2 – 47 Phase Sequence Relay	The module detected that the phase rotation of the generator was different to the configured Generator Phase Rotation Alarm setting.
Gen Reverse Power IEEE C37.2 – 32 Directional Power Relay	The module detected that the generator output kW had fallen below the *Reverse Power Trip* for the configured delay timer.

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Fault	Description
Gen Short Circuit IEEE C37.2 – 51 IDMT Short Circuit Relay	**NOTE: For more details, refer to the section entitled *Short Circuit IDMT Alarm* elsewhere in this document.** The module detected that the generator output current had risen above the *Short Circuit Trip* for the duration of the IDMT function.
Inlet Temperature	The module detected that the engine's ECU measurement of inlet temperature had risen above the *Inlet Temperature Alarm Trip* level.
Insufficient Capacity	The module's governor output has reached its limit whilst attempting to control the generator to produce more kW 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.
kW Overload IEEE C37.2 – 32 Directional Power Relay	The module detected that the generator output kW had risen above the Overload Protection Trip for the configured delay timer.
Loss of Excitation	The module detected that the generator output kvar had fallen below the *Loss of Excitation Alarm Trip* level for the configured delay.
Loss of Mag-PU	The module detected that the magnetic pick up was not producing a pulse output after the required Crank Disconnect criteria had been met.
Mains Asymmetry High	The module detected the mains voltage asymmetry had risen above the configurable *Trip* level for the configured delay timer.
Mains Decoupling Combined	The module detected that the mains supply failed when the generator was in parallel with it.
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 Zero Sequence Voltage High	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 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 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.

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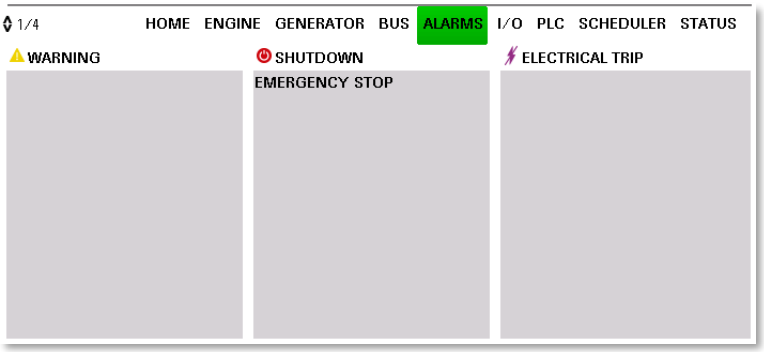
Fault	Description
Maintenance Due	**NOTE: Due to module configuration the alarm message that appears on the display may be different. For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that one of the configured maintenance alarms is due as its configured maintenance interval has expired.
Negative Phase Sequence IEEE C37.2 - 46 Phase-Balance Current Relay	The module detected that there was an imbalance of current across the generator phases greater than the *Negative Phase Sequence Trip Level* percentage setting.
Out Of Sync	The module has detected during parallel operation that the phase of both supplies has exceeded the *Out of Sync Angle* for longer than the duration of the *Out of Sync Timer*.
Out Of Sync Generator	**NOTE: For further details, refer to DSE Publication: *056-047 Out of Sync and Failed to Close Training Document.*** The module detected that the generator voltage has drifted out of sync from the mains. This is caused by some form of external logic tripping open the generator load switch without it informing the DSE module.
Out Of Sync Mains	**NOTE: For further details, refer to DSE Publication: *056-047 Out of Sync and Failed to Close Training Document.*** The module detected that the mains voltage has drifted out of sync from the generator. This is caused by some form of external logic tripping open the mains load switch without it informing the DSE module.
SCR Inducement	The module received a fault condition from the engine ECU alerting about the SCR Inducement.
Water in Fuel	The module received a fault condition from the engine ECU alerting that water in the fuel had been detected or that the *Water in Fuel* input switch had activated.

7.5 SHUTDOWN 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 (the exception to this is the *Oil Pressure Low* alarm and similar *Active From Safety On* alarms, as the oil pressure is low with the engine at rest).

Shutdown Alarms are latching and immediately stop the Generator. On initiation of the shutdown condition the module de-activates the *Close Gen Outputs* to remove the load from the generator. Once this has occurred, the module shuts the generator set down immediately to prevent further damage. To restart the generator the fault must be cleared, and the alarm reset.

Example



In the event of an alarm the display jumps to the alarms page and displays all active alarms.

Shutdown Alarms are latching alarms and to clear 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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.

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Fault	Description
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: *057-340 DSEG8900 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: *057-340 DSEG8900 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*: 057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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: *057-340 DSEG8900 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.

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Fault	Description
Analogue Input A to D (Digital)	**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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input configured as a digital input to create a fault condition became active and the appropriate LCD message is displayed.
Air Flap Closed	The module detected that a digital input configured for *Air-Flap Closed Auxiliary* became active.
Auto Sense Fail	The module detected that the output voltage of the generator had risen above the *Over Voltage During Auto Sensing Trip* level during starting whilst attempting to detect which alternative configuration to use.
AVR Maximum Trim Limit	The module's AVR output has reached its limit whilst attempting to control the generator to produce more kvar whilst in parallel. This indicates a fault with either the AVR (including connection error), setting of SW2, or that the alternator has reached its maximum capacity.
Battery Temp	The module detected that a battery charger connected by DSENet® had issued a *Battery Temperature* alarm
Calibration Fault	The module detected that its internal calibration has failed. The unit must be sent back to DSE to be investigated and repaired. Contact DSE Technical Support for more details.
Charge Air Temperature	The module detects that the engine ECU has detected the Charge Air Temperature has exceed the trip level.
Charge Alt Failure IEEE C37.2 – 27DC Undervoltage Relay	The module detected that the output voltage of the charge alternator had risen above the *Charge Alternator Shutdown Trip* level for the configured delay timer.
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 ID 0 to 3 Common Shutdown	**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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that a battery charger connected by DSENet® had issued a *Common Shutdown 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.

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Fault	Description
Charger Short Circuit / Reverse Polarity	The module detected that a battery charger connected by DSENet® had a combined *Short Circuit* and *Reverse Polarity* alarm.
Coolant Temp High IEEE C37.2 – 26 Apparatus Thermal Device	The module detected that the engine coolant temperature had risen above the *High Coolant Temperature Shutdown Trip* level after the *Safety On Delay* timer had expired.
Coolant Temp High Switch IEEE C37.2 – 26 Apparatus Thermal Device	The module detected that the high engine coolant temperature switch had activated after the *Safety On Delay* timer had expired.
DEF Level Low	The module received a fault condition from the engine ECU alerting about the DEF level.
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: *057-340 DSEG8900 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.
DPTC Filter	The module received a fault condition from the engine ECU alerting that the DPF/DPTC had activated.
ECU Amber	The module received an amber fault condition from the engine ECU.
ECU Data Fail	The module is configured for CAN operation but has not detected data being sent from the engine's ECU.
ECU Malfunc.	The module received a malfunction fault condition from the engine ECU.
ECU Protect	The module received a protect fault condition from the engine ECU.
ECU Red	The module received a red fault condition from the engine ECU.
Emergency Stop IEEE C37.2 - 5 Stopping Device	The module detected that emergency stop button had been pressed removing a positive voltage supply from the emergency stop input terminal. This input is failsafe (normally closed to emergency stop) and immediately stops the generator when the signal is removed.
Engine Over Speed Run Away	This is the highest RPM value that the engine is expected to run at before triggering an immediate shutdown. This alarm is active always and cannot be disabled. If the engine experiences a sudden increase in RPM which trips the Over Speed alarm but does not exceed the trip level delay this could still damage the engine. For this reason, the Run Away Trip alarm exists.
Engine Over Speed IEEE C37.2 - 12 Overspeed Device	The module detected that the engine speed had risen above the *Over Speed Alarm Trip* level for the configured delay timer.
Engine Over Speed Overshoot IEEE C37.2 - 12 Overspeed Device	The module detected that the engine speed had risen above the *Over Speed Overshoot Trip* during the configured *Overshoot Delay* timer whilst starting.
Engine Under Speed IEEE C37.2 - 14 Underspeed Device	The module detected that the engine speed had fallen below the *Under Speed Alarm Trip* level for the configured delay timer after the *Safety On Delay* timer had expired.
Exp. Unit Failure	The module detected communications to one of the DSENet® expansion modules had been lost.

Continued over page…

Fault	Description
Fail To Reach Loading Frequency	The module detected that the generator output voltage had not risen above the *Generator Loading Frequency* setting after the *Warming Up* timer had expired.
Fail To Reach Loading Voltage	The module detected that the generator output voltage had not risen above the *Generator Loading Voltage* setting after the *Warming Up* timer had expired.
Failed to Start IEEE C37.2 - 48 Incomplete Sequence Relay	The module detected that the generator had failed to start as it did not meet the required Crank Disconnect criteria during the configured number of Crank Attempts.
Failed to Stop IEEE C37.2 - 48 Incomplete Sequence Relay	**NOTE: *Fail to Stop* could indicate a faulty oil pressure sensor. If engine is at rest, check the oil pressure sensor wiring and configuration.** The module detects a condition that indicates the generator is running when the DSE module has instructed it to stop.
Flexible Sensor A to D 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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input value had risen above the *Flexible Sensor High Alarm Trip* level.
Flexible Sensor A to D 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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that an analogue input value had fallen below the *Flexible Sensor Low Alarm Trip* level.
Fuel Level High IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine fuel level had risen the *High Fuel Level Alarm* level for the configured delay.
Fuel Level Low IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine fuel level had fallen below the *Low Fuel Level Alarm* level for the configured delay
Fuel Level Low Switch IEEE C37.2 - 71 Liquid Level Switch	The module detected that the engine low fuel level switch had activated.
Fuel Sensor Fault	The module detected that circuit to the engine fuel level sensor had become open circuit.
Fuel Tank Bund Level High IEEE C37.2 - 71 Liquid Level Switch	The module detected that the fuel tank bund level switch had activated.
Fuel Usage IEEE C37.2 – 80 Flow Switch	The module detected that the fuel consumption was more than the configured Running Rate or Stopped Rate.
Gen Earth Fault IEEE C37.2 – 51G or 51N Generator IDMT Earth Fault Relay	**NOTE: For more details, refer to the section entitled Earth Fault IDMT Alarm elsewhere in this document.** The module detected that the generator earth fault current had risen above the *Generator Earth Fault Trip Level* for the duration of the IDMT function.

Continued over page…

Fault	Description
Gen Over Current IEEE C37.2 – 51 IDMT Overcurrent Relay	**NOTE: For more details, refer to the section entitled Over Current Alarm elsewhere in this document.** The module detected that the generator output current had risen above the *Generator Over Current Trip* for the duration of the IDMT function.
Gen Over Frequency IEEE C37.2 – 81 Frequency Relay	The module detected that the generator output frequency had risen above the *Over Frequency Alarm Trip* level for the configured delay timer.
Gen Over Frequency Overshoot IEEE C37.2 – 81 Frequency Relay	The module detected that the generator output frequency had risen above the *Over Frequency Overshoot Trip* during the configured *Overshoot Delay* timer whilst starting.
Gen Over Frequency Runaway IEEE C37.2 – 81 Frequency Relay	In the event of the generator output frequency rising above the configured Trip value, the Run Away Shutdown alarm is immediately triggered.
Gen Over Voltage IEEE C37.2 – 59 AC Overvoltage Relay	The module detected that the generator output voltage had risen above the *Over Voltage Alarm Trip* level for the configured delay timer.
Gen Phase Seq Wrong IEEE C37.2 – 47 Phase Sequence Relay	The module detected that the phase rotation of the generator was different to the configured *Generator Phase Rotation Alarm* setting.
Gen Reverse Power IEEE C37.2 – 32 Directional Power Relay	The module detected that the generator output kW had fallen below the *Reverse Power Trip* for the configured delay timer.
Gen Short Circuit IEEE C37.2 – 51 IDMT Short Circuit Relay	**NOTE: For more details, refer to the section entitled *Short Circuit IDMT Alarm* elsewhere in this document.** The module detected that the generator output current had risen above the *Short Circuit Trip* for the duration of the IDMT function.
Gen Under Frequency IEEE C37.2 – 81 Frequency Relay	The module detected that the generator output frequency had fallen below the *Under Frequency Alarm Trip* level for the configured delay timer after the *Safety On Delay* timer had expired.
Gen Under Voltage IEEE C37.2 – 27 AC Undervoltage Relay	The module detected that the generator output voltage had fallen below the *Under Voltage Alarm Trip* level for the configured delay timer after the *Safety On Delay* timer had expired.
Inlet Temperature	The module detected that the engine's ECU measurement of inlet temperature had risen above the *Inlet Temperature Alarm Trip* level.
Insufficient Capacity	The module's governor output has reached its limit whilst attempting to control the generator to produce more kW 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.
kW Overload IEEE C37.2 – 32 Directional Power Relay	The module detected that the generator output kW had risen above the Overload Protection Trip for the configured delay timer.
Loss of Excitation	The module detected that the generator output kvar had fallen below the *Loss of Excitation Alarm Trip* level for the configured delay.
Loss of Mag-PU	The module detected that the magnetic pick up was not producing a pulse output after the required Crank Disconnect criteria had been met.
Mag-PU Fault	The module detected that circuit to the magnetic pick-up sensor had become open circuit.

Continued over page…

Fault	Description
Maintenance Alarm	**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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*** The module detected that one of the configured maintenance alarms is due as its configured maintenance interval has expired.
Negative Phase Sequence IEEE C37.2 - 46 Phase-Balance Current Relay	The module detected that there was an imbalance of current across the generator phases greater than the *Negative Phase Sequence Trip Level* percentage setting.
Oil Press Sender Fault	The module detected that circuit to the engine oil pressure sensor had become open circuit.
Oil Pressure Low IEEE C37.2 - 63 Pressure Switch	The module detected that the engine oil pressure had fallen below the *Low Oil Pressure Shutdown Trip* level after the *Safety On Delay* timer had expired.
Oil Pressure Low Switch IEEE C37.2 - 63 Pressure Switch	The module detected that the low oil pressure switch had activated after the *Safety On Delay* timer had expired.
SCR Inducement	The module received a fault condition from the engine ECU alerting about the SCR Inducement.
Temp Sensor Fault	The module detected that circuit to the engine coolant temperature sensor had become open circuit.
Water in Fuel	The module received a fault condition from the engine ECU alerting that water in the fuel had been detected or that the *Water in Fuel* input switch had activated.

7.6 MAINTENANCE ALARMS

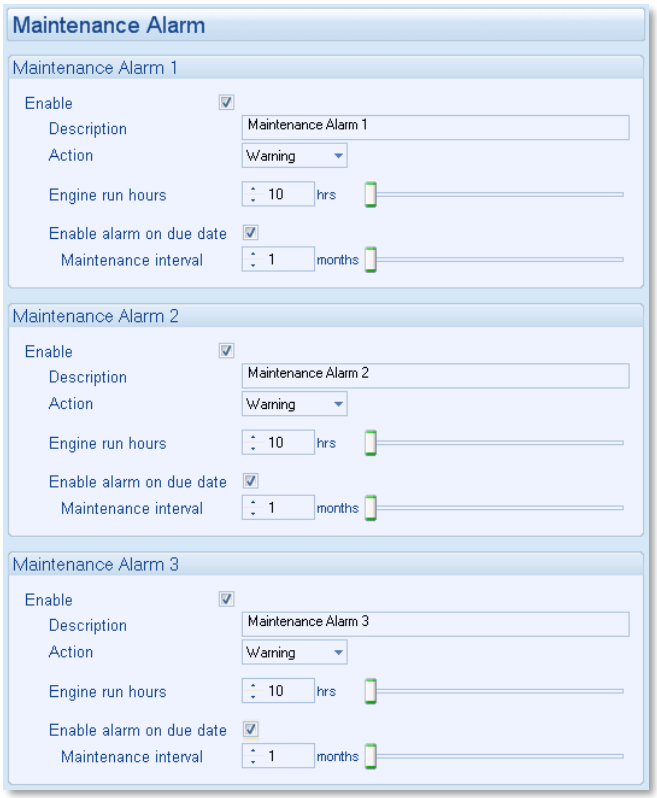
Depending upon module configuration one or more levels of engine maintenance alarm may occur based upon a configurable schedule.
When activated, the maintenance alarm can be either a *warning* (set continues to run) or *shutdown* (running the set is not possible).

Resetting the maintenance alarm is normally actioned by the site service engineer after performing the required maintenance.
The method of reset is either by:

- Activating an input that has been configured to *Reset Maintenance Alarm* 1, 2 or 3.
- Clicking the *Maintenance Reset Button* in the DSE Configuration Suite *Scada, Maintenance Section.*
- Scrolling down to select the appropriate maintenance alarm on the *Status Page* and pressing and holding the ***Stop/Reset Mode*** button for 5 seconds.
- Accessing *Maintenance Reset* section in the *Main Configuration Editor*.

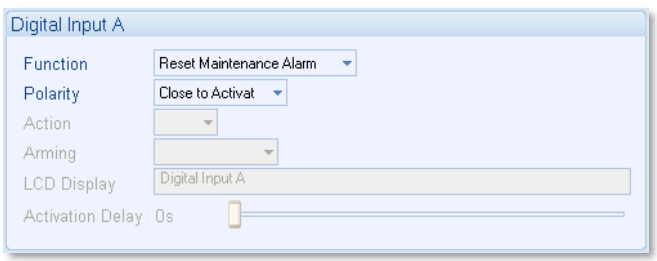
Example 1

Screen capture from DSE Configuration Suite Software showing the configuration of the *Maintenance Alarm* for 1, 2 and 3.



Example 2

Screen capture from DSE Configuration Suite Software showing the configuration of a digital input for *Reset Maintenance Alarm*.

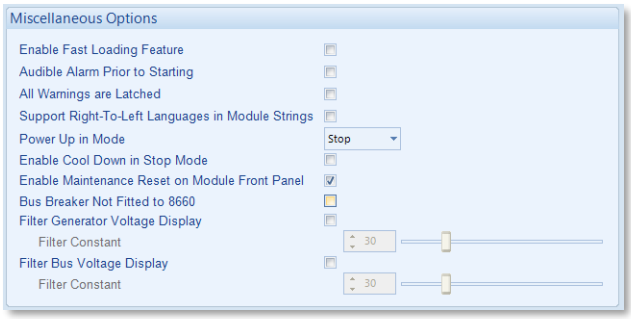


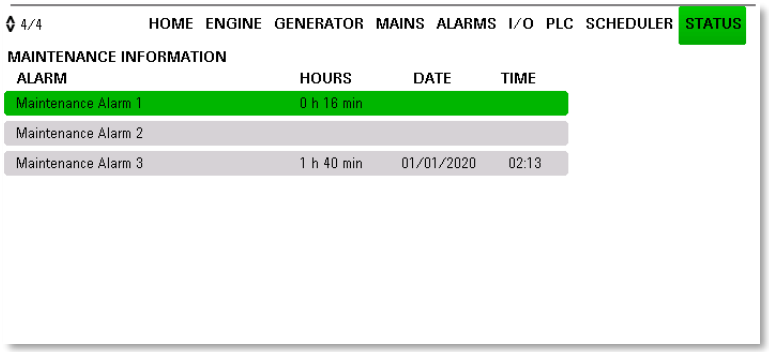
Example 3

Screen capture from DSE Configuration Suite Software showing the Maintenance Alarm Reset 'button' in the DSE Configuration Suite *Scada* | *Maintenance Section*.

Example 4

Screen capture from DSE Configuration Suite Software showing *Enable Maintenance Reset on Module Front Panel* option and the *Status* page showing the maintenance alarms. The alarms are reset by configuration holding the ***Stop/Reset Mode*** button for 5 seconds. For further details, refer to the section entitled *Maintenance Information* elsewhere in this document.





7.7 MAINS DECOUPLING ALARMS

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

When generator is in parallel with the mains, the module monitors for a Mains failure by detecting ROCOF or Vector Shift fault which are set in the module's configuration.

If either of these alarms operate, the module performs an electrical trip of the generator breaker. This operation must be manually reset by:

- Pressing the ***Stop/Reset Mode*** button.
- Activation of a digital input configured to ***Clear Mains Decoupling Alarms*** if it has been configured.
- Pressing the ***Alarm Mute*** and ***Tick*** buttons together for a small duration.

7.8 OUT OF SYNC MAINS ALARM

An *Out of Sync Mains* alarm means that the module has detected that the supplies either side of the mains breaker are not in sync when the mains breaker should be closed. This is normally caused by the mains switchgear not closing quickly enough, not at all or being tripped open by a third-party protection device.

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

- Pressing the ***Stop/Reset Mode*** button. The generator 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 and hold the ***Tick***  button to access the *Running Configuration Editor.*
  - Press the ***Up*** or ***Down***  buttons to select the *Mains* section. The current selected section highlights in green.
  - Press the ***Right***  button followed by the ***Down***  button to select the *Out of Sync* parameter to be edited. The current selected item highlights in green.
  - To edit the parameter, press the ***Tick***  button to enter the edit mode. The parameter is no longer highlighted green to indicate editing.
  - Press the ***Up***  button to change the parameter to *Enabled.*
  - Press the ***Tick***  button to stop editing the parameter. The *Out of Sync* highlights in green that the parameter is no longer being edited.
  - Press and hold the ***Tick***  button to exit the *Running Configuration Editor.*

7.9 MAINS SEQUENCE ALARMS

When the mains (utility) is available, the module monitors the mains supply to detect a *Mains Over Asymmetry Voltage*, or *Mains Over Negative Sequence Voltage*, or *Mains Over Zero Sequence Voltage*, or *Mains Under Positive Sequence Voltage* 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 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 and hold the ***Tick*** button to access the *Running Configuration Editor.*
  - Press the ***Up*** or ***Down*** buttons to select the *Mains* section. The current selected section highlights in green.
  - Press the ***Right*** button followed by the ***Down*** button to select the *Sequence Alarm Reset* parameter to be edited. The current selected item highlights in green.
  - To edit the parameter, press the ***Tick*** button to enter the edit mode. The parameter is no longer highlighted green to indicate editing.
  - Press the ***Up*** button to change the parameter to *Enabled.*
  - Press the ***Tick*** button to stop editing the parameter. The *Sequence Alarm Reset* highlights in green that the parameter is no longer being edited.
  - Press and hold the ***Tick*** button to exit the *Running Configuration Editor.*

7.10 OVER CURRENT ALARM

The *Over Current Alarm* combines a simple warning trip level with a fully functioning IDMT curve for thermal protection.

7.10.1 IMMEDIATE WARNING

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

7.10.2 INVERSE DEFINITE MINIMUM TIME (IDMT) ALARM

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

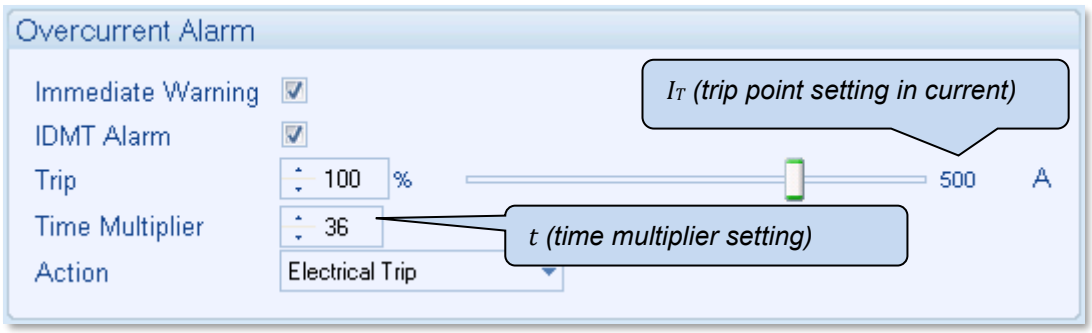
The larger the over circuit fault, the faster the trip. The speed of the trip is dependent upon the fixed formula:

$$T = \frac{t}{\left(\frac{I_A}{I_T} - 1\right)^2}$$

Where:

T is the tripping time in seconds
I_A is the actual measured current of the most highly loaded line (L1, L2 or L3)
I_T is the delayed trip point setting in current
t is the time multiplier setting and represents the tripping time in seconds at twice full load (when $^{I_A}/_{I_T} = 2$).

The settings shown in the example below are a screen capture of the DSE factory settings, taken from the DSE Configuration Suite PC Software for a brushless alternator.



These settings provide for normal running of the generator up to 100% full load. If full load is surpassed, the *Immediate Warning* alarm is triggered, and the set continues to run.

The effect of an overload on the generator is that the alternator windings begin to overheat; the aim of the *IDMT Alarm* is to prevent the windings being excessively loaded. The amount of time that the alternator can be safely overloaded is governed by how high the overload condition is.

The default settings as shown above allow for an overload of the alternator to the limits of the *Typical Brushless Alternator* whereby 110% overload is permitted for 1 hour or 200% overload is permitted for 36 seconds.

If the alternator load reduces, the controller then follows a cooling curve. This means that a second overload condition may trip soon after the first as the controller knows if the windings have not cooled sufficiently.

For further details on the *Thermal Damage Curve* of your alternator, refer to the alternator manufacturer and generator supplier.

7.10.2.1 CREATING A SPREADSHEET FOR THE OVER CURRENT IDMT CURVE

The formula used:

$$T = \frac{t}{\left(\frac{I_A}{I_T} - 1\right)^2}$$

Where:

T is the tripping time in seconds
I_A is the actual measured current of the most highly loaded line (L1, L2 or L3)
I_T is the delayed trip point setting in current
t is the time multiplier setting and represents the tripping time in seconds at twice full load (when $^{I_A}/_{I_T} = 2$).

The equation can be simplified for addition into a spreadsheet. This is useful for 'trying out' different values of t *(time multiplier setting)* and viewing the results, without testing this on the generator.

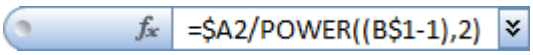
	A	B	C	D	E	F
1		1.01	1.02	1.03	1.05	1.06
2	36	360000	90000	40000	14400	10000

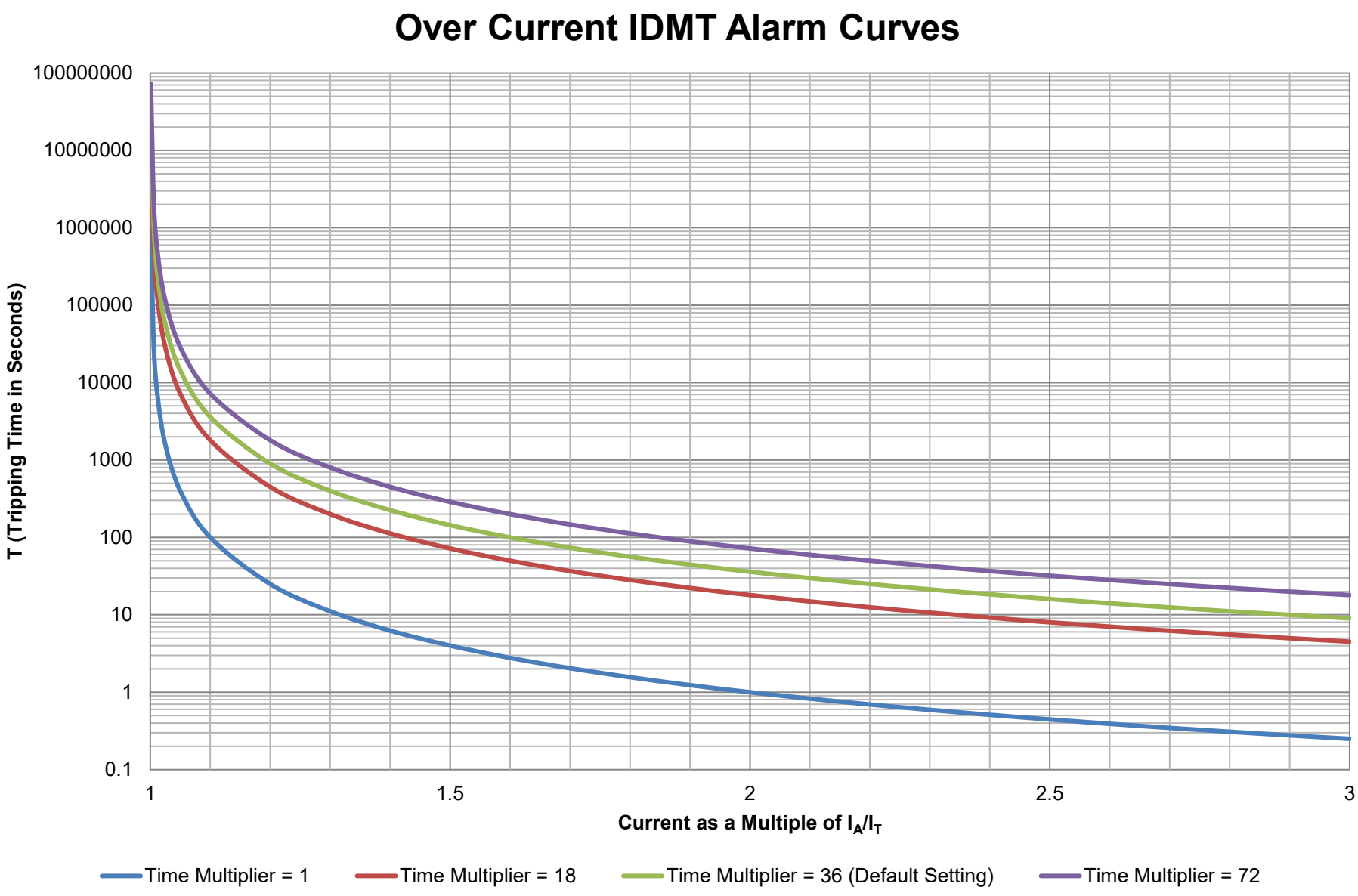
$^{I_A}/_{I_T}$ *(multiple of the Trip setting from 1.01 to 3.0 in steps of 0.1)*

t *(time multiplier setting)*

T *(tripping time in seconds)*

The formula for the *Tripping Time* cells is:




Over Current IDMT Alarm Curves
T (Tripping Time in Seconds)
100000000
10000000
1000000
100000
10000
1000
100
10
1
0.1
1
1.5
2
2.5
3
Current as a Multiple of I_A/I_T
Time Multiplier = 1
Time Multiplier = 18
Time Multiplier = 36 (Default Setting)
Time Multiplier = 72

7.11 SHORT CIRCUIT IDMT 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*).

The larger the short circuit fault, the faster the trip. The speed of the trip is dependent upon the fixed formula:

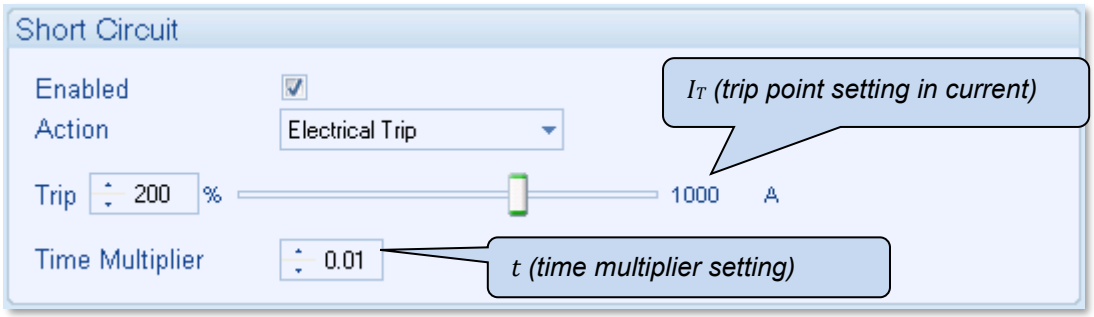
$$T = \frac{t \times 0.14}{\left(\left(\frac{I_A}{I_T}\right)^{0.02} - 1\right)}$$

Where:

T is the tripping time in seconds (accurate to +/- 5% or +/- 50 ms (whichever is the greater))
I_A is the actual measured current
I_T is the trip point setting in current
t is the time multiplier setting

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

NOTE: Due to large inrush currents from certain loads, such as motors or transformers, the default settings for the *Short Circuit* alarm may need adjusting to compensate.



The effect of a short circuit on the generator is that the alternator stator and rotor begin to overheat; the aim of the *IDMT alarm* is to prevent the stator and rotor being overload (heated) too much. The amount of time that the alternator can be safely overloaded is governed by how high the short circuit condition is.

For further details on the *Thermal & Magnetic Damage Curve* of your alternator, refer to the alternator manufacturer and generator supplier.

7.11.1 CREATING A SPREADSHEET FOR THE SHORT CIRCUIT IDMT CURVE

The formula used:

$$T = \frac{t \times 0.14}{\left(\left(\frac{I_A}{I_T}\right)^{0.02} - 1\right)}$$

Where:

T is the tripping time in seconds (accurate to +/- 5% or +/- 50 ms (whichever is the greater))
I_A is the actual measured current
I_T is the trip point setting in current
t is the time multiplier setting

The equation can be simplified for addition into a spreadsheet. This is useful for 'trying out' different values of t *(time multiplier setting)* and viewing the results, without testing this on the generator.

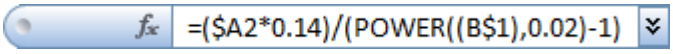
	A	B	C	D	E	F
1		1.01	1.02	1.03	1.05	1.06
2	0.01	7.03	3.53	2.37	1.43	1.20

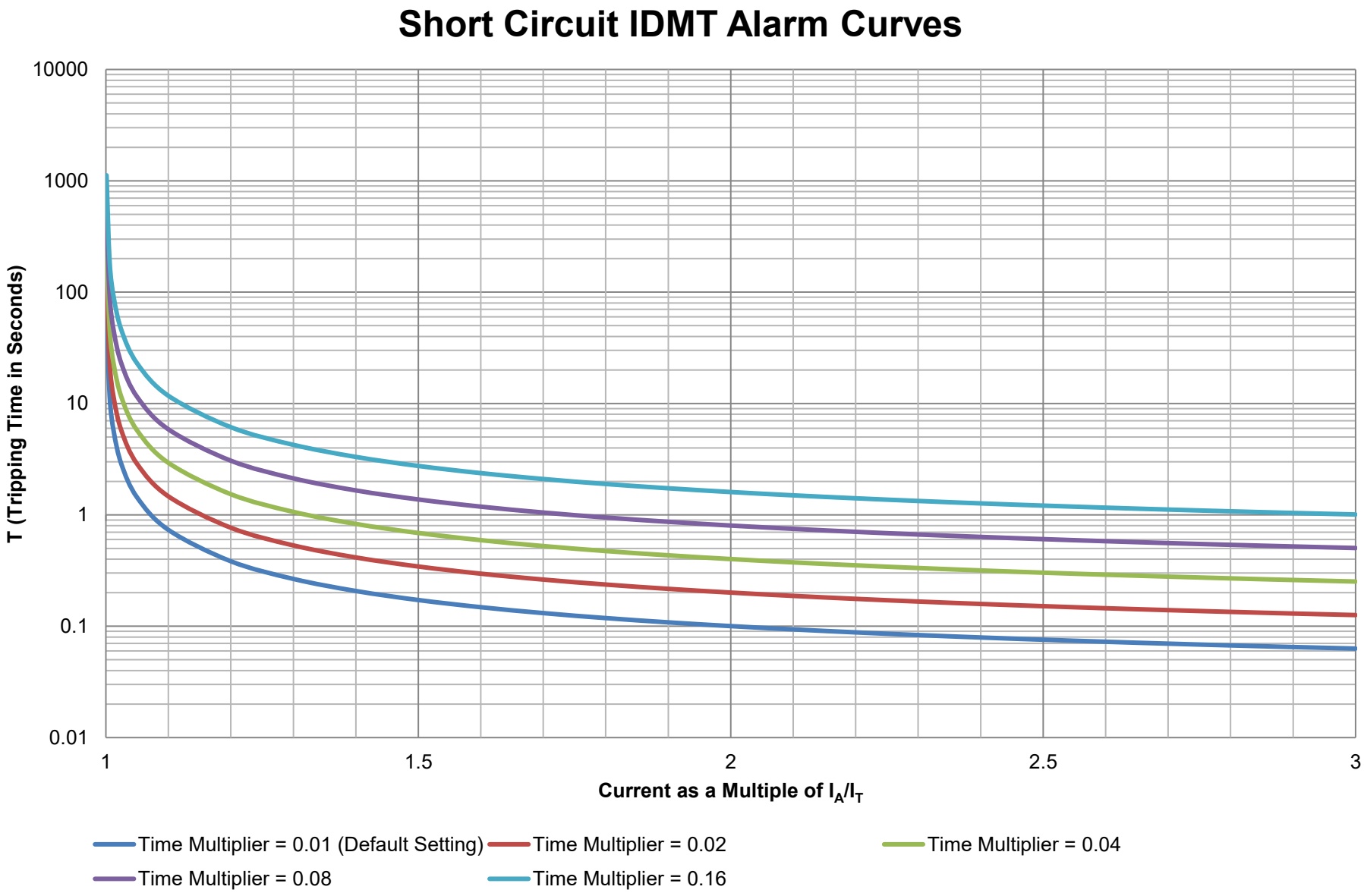
I_A/I_T (multiple of the Trip setting from 1.01 to 3.0 in steps of 0.1)

t (time multiplier setting)

T (tripping time in seconds)

The formula for the *Tripping Time* cells is:




Short Circuit IDMT Alarm Curves
T (Tripping Time in Seconds)
10000
1000
100
10
1
0.1
0.01
1
1.5
2
2.5
3
Current as a Multiple of I_A/I_T
Time Multiplier = 0.01 (Default Setting)
Time Multiplier = 0.02
Time Multiplier = 0.04
Time Multiplier = 0.08
Time Multiplier = 0.16

7.12 EARTH FAULT IDMT ALARM

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

If the *Earth Fault Alarm* is enabled, the controller begins following the IDMT 'curve' when the earth fault current 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*).

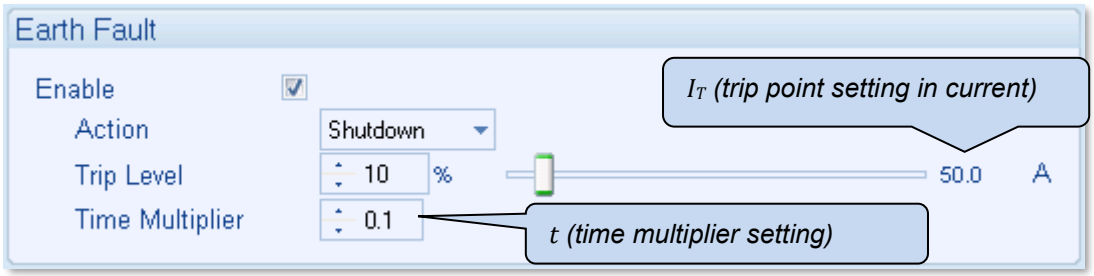
The larger the earth fault, the faster the trip. The speed of the trip is dependent upon the fixed formula:

$$T = \frac{t \times 0.14}{\left(\left(\frac{I_A}{I_T}\right)^{0.02} - 1\right)}$$

Where:

T is the tripping time in seconds (accurate to +/- 5% or +/- 50ms (whichever is the greater))
I_A is the actual measured current
I_T is the trip point setting in current
t is the time multiplier setting

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



7.12.1 CREATING A SPREADSHEET FOR THE EARTH FAULT IDMT CURVE

The formula used:

$$T = \frac{t \times 0.14}{\left(\left(\frac{I_A}{I_T}\right)^{0.02} - 1\right)}$$

Where:

T is the tripping time in seconds (accurate to +/- 5% or +/- 50 ms (whichever is the greater))
I_A is the actual measured current
I_T is the trip point setting in current
t is the time multiplier setting

The equation can be simplified for addition into a spreadsheet. This is useful for 'trying out' different values of t *(time multiplier setting)* and viewing the results, without testing this on the generator.

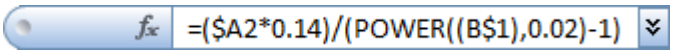
	A	B	C	D	E	F
1		1.01	1.02	1.03	1.05	1.06
2	0.01	7.03	3.53	2.37	1.43	1.20

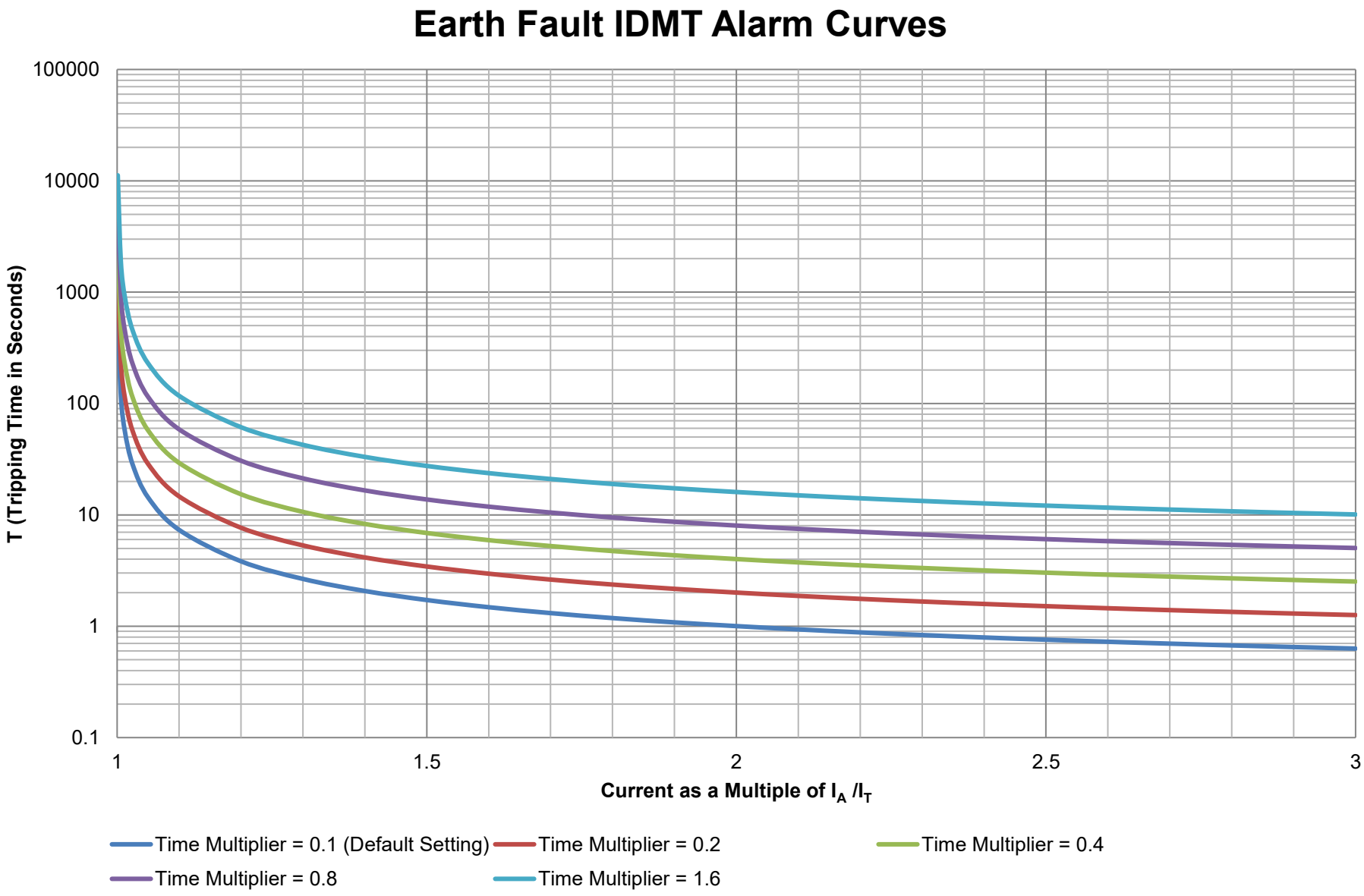
I_A/I_T (multiple of the Trip setting from 1.01 to 3.0 in steps of 0.1)

t (time multiplier setting)

T (tripping time in seconds)

The formula for the *Tripping Time* cells is:




Earth Fault IDMT Alarm Curves
100000
10000
1000
100
10
1
0.1
T (Tripping Time in Seconds)
1
1.5
2
2.5
3
Current as a Multiple of I_A /I_T
Time Multiplier = 0.1 (Default Setting)
Time Multiplier = 0.2
Time Multiplier = 0.4
Time Multiplier = 0.8
Time Multiplier = 1.6

7.13 DEFAULT CURRENT PROTECTION TRIPPING CHARACTERISTICS

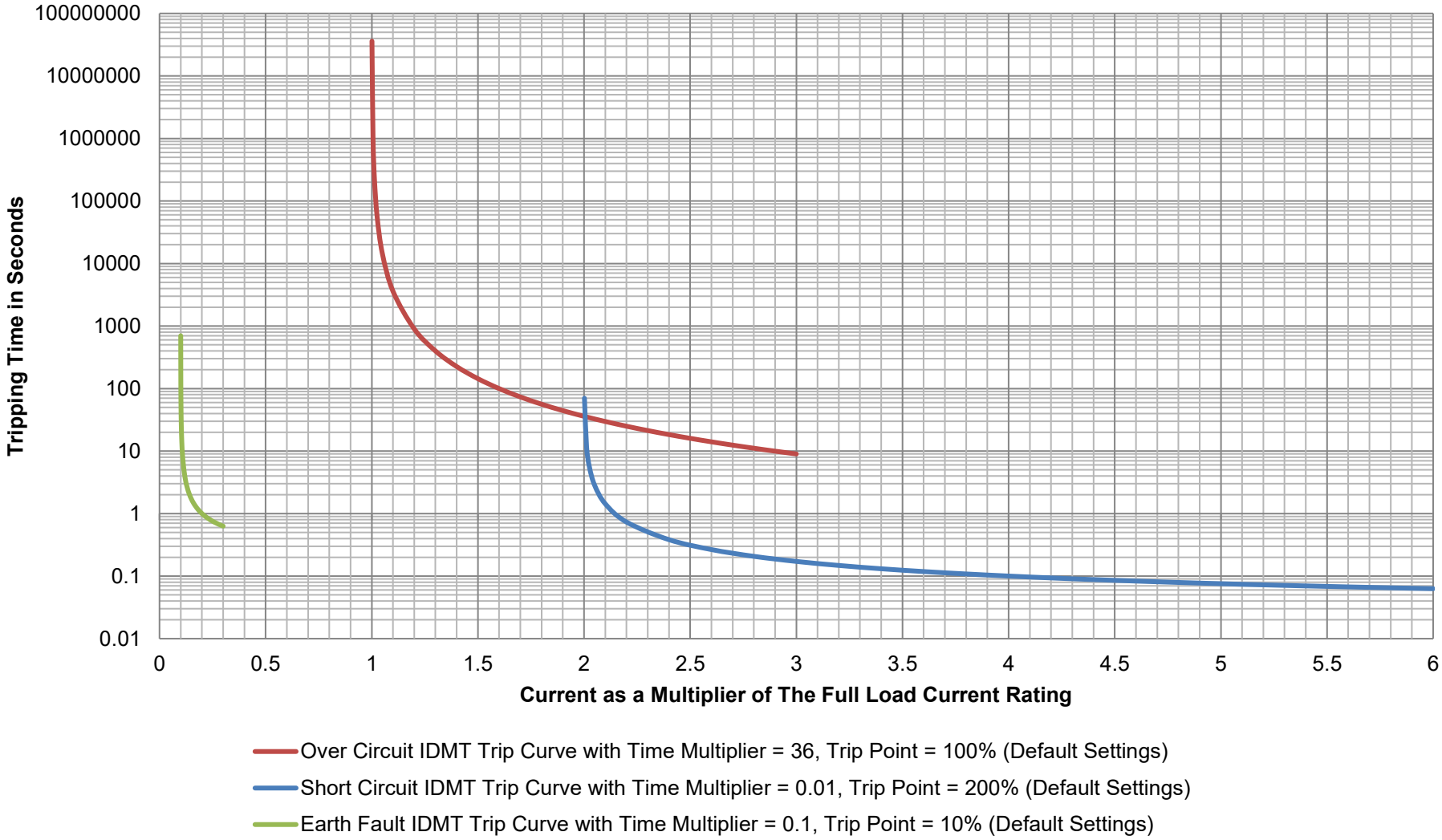
The graph on the following page shows the default settings for the IDMT tripping curves for the *Over Current, Short Circuit* and *Earth Fault* protections.

The default setting for the *Over Current* alarm allows for an overload of an alternator to the limits of the *Typical Brushless Alternator* whereby 110% overload is permitted for 1 hour or 200% overload is permitted for 36 seconds. In an over current situation, the alternator begins to overheat. The aim of the *Over Current IDMT Alarm* is to prevent damage to the windings from being excessively loaded. The amount of time that the alternator can be safely overloaded is governed by how high the overload condition is.

The default setting for the *Short Circuit* alarm allows for an alternator to supply a high current caused by a genuine short circuit or an inrush current of a motor/transformer. Whereby 300% overload is permitted for 0.17 seconds or 600% overload is permitted for 0.06 seconds. In a short circuit situation, the alternator begins to overheat to the point the insulation breaks down, potentially causing a fire. The aim of the *Short Circuit IDMT Alarm* is to prevent the insulation from melting due to excessive heat. The amount of time that the alternator can be safely in a short circuit condition is governed by the alternator's construction.

The default setting for the *Earth Fault* alarm allows for an alternator to supply a fault current caused by an imbalanced load, a high impedance short to earth or motor drives. Whereby anything less than 10% is considered normal (caused by imbalanced loads) and permitted, 12% fault current is permitted for 3.83 second or 20% fault current is permitted for 1 second.

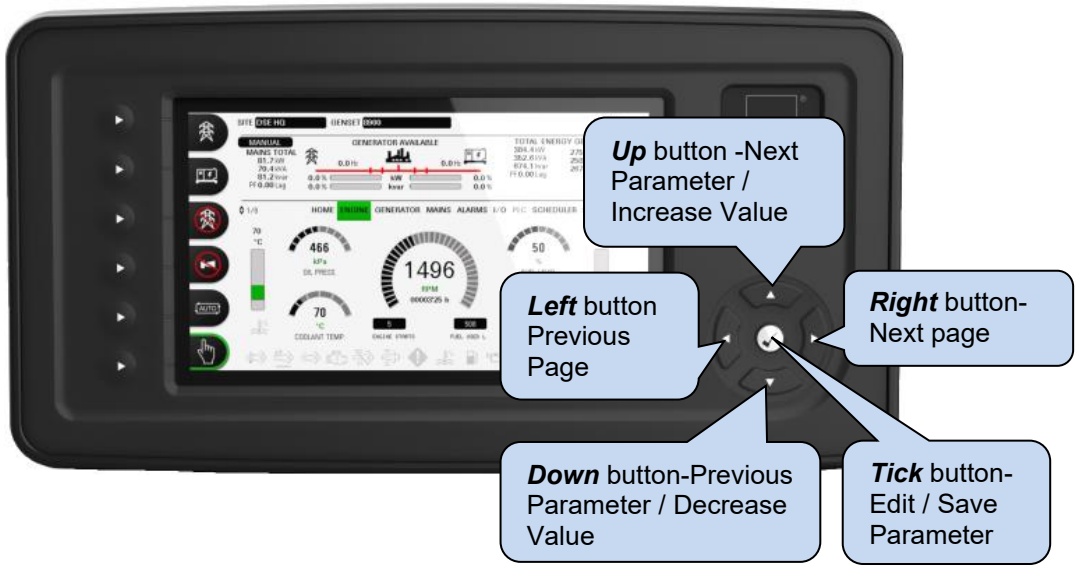
DSE Default Configratuion of Over Current, Short Circuit & Earth Fault IDMT Alarm Curves



8 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:



8.1 MAIN CONFIGURATION EDITOR

8.1.1 ACCESSING THE MAIN CONFIGURATION EDTIOR

NOTE: More comprehensive module configuration is possible via PC configuration software. For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 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 *057-340 DSEG8900 Configuration Suite PC Software Manual* available from www.deepseaelectronics.com

NOTE: When transitioning between Single Set and Multi Set mode using the front panel editor or vice versa, changing the configuration into another mode does not automatically switch editing into the other mode. The existing configuration remains in edit mode until exiting and re-entering the editor.

- Ensure the engine is at rest and the module by pressing the ***Stop/Reset Mode*** button.
- Press and hold the ***Tick*** button and the ***Stop/Reset Mode*** button to enter the main configuration editor.

8.1.2 EDITING A PARAMETER

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

- Enter the Main Configuration Editor as described above.
- Press the ***Up*** or ***Down*** buttons to select the section to view/change. The current selected section highlights in green.
- Press the ***Tick*** button to select the Subsection/Parameter to be edited. The current selected then highlights in green.
- Press the ***Tick*** button again to select the parameter to be edited. The current selected then highlights in white.
- Press the ***Left*** or ***Right*** buttons to change the parameter to the required value.

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

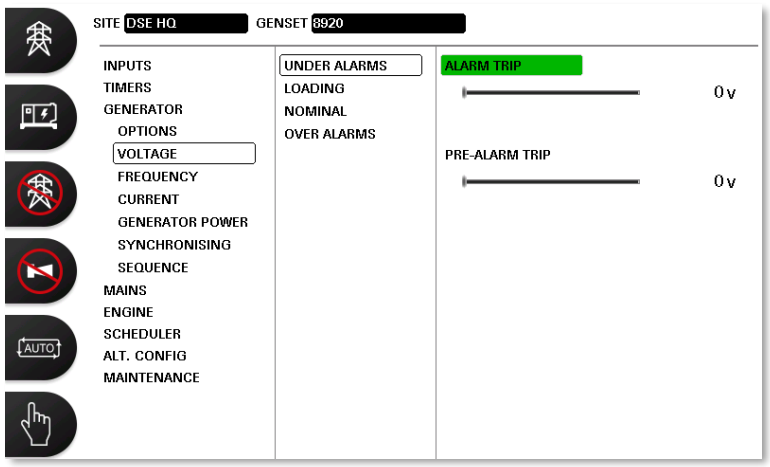
8.1.3 EXITING THE MAIN CONFIGURATION EDITOR

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

- Press and hold the ***Stop/Reset Mode*** button to exit the editor without saving changes.
- Press and hold the ***Tick***  button to exit the editor and save the changes.

8.1.4 MAIN CONFIGURATION EDITOR PARAMETERS

The parameters in the *Front Panel Editor* are arranged in a hierarchical tree menu as shown in the example below, the subsequent tables are laid out to reflect this.



Section	Sub Section	Parameter Group	Parameter	Value
Inputs	Oil Pressure	Low Alarms	Alarm Trip	0.00 bar
			Pre-Alarm Trip	0.00 bar
	Coolant Temp	High Alarms	Pre-Alarm Trip	0 ºC
			Electrical Trip	0 ºC
			Shutdown Trip	0 ºC
		Low Alarms	Pre-Alarm Trip	0 ºC
	Fuel	Fuel Usage	Running Rate	0 %/h
			Stopped Rate	0 %/h
Timers	Start	Starting Delays	Off Load	0 h 0 m 0 s
			On Load	0 h 0 m 0 s
			Telemetry	0 h 0 m 0 s
			Mains Fail	0 h 0 m 0 s
		Start Timers	Delay Crank	0 h 0 m 0 s
			Cranking Rest	0 h 0 m 0 s
			Smoke Limit Off	0 h 0 m 0 s
			Smoke Limiting	0 h 0 m 0 s
			Safety on Delay	0 h 0 m 0 s
			Warning	0 h 0 m 0 s
			Mains Transient Delay	0 h 0 m 0 s
	Load/ Stopping	Load	Transfer Time	0 m 0.0 s
		Stopping	Return Delay	0 h 0 m 0 s
			Cooling Time	0 h 0 m 0 s
			Fail to Stop Delay	0 h 0 m 0 s
			Generator Transient Delay	0.0 s

Continued over page...

Section	Sub Section	Parameter Group	Parameter	Value
Generator	Options	Topology	AC System	3 Phase, 4 Wire
		Rating	kW	0 kW
			-kvar	0 kvar
			kvar	0 kvar
	Voltage	Under Alarms	Alarm Trip	0 V
			Pre-Alarm Trip	0 V
		Loading	Voltage	0 V
		Nominal	Voltage	0 V
		Over Alarms	Pre-Alarm Trip	0 V
			Alarm Trip	0 V
	Frequency	Under Alarms	Alarm Trip	0.0 Hz
			Pre-Alarm	0.0 Hz
		Loading	Frequency	0.0 Hz
		Nominal	Frequency	0.0 Hz
		Over Alarms	Pre-Alarm Trip	0.0 Hz
			Alarm Trip	0.0 Hz
	Current	Options	CT Primary	0 A
			CT Secondary	1 A / 5 A
			Full Load Rating	0 A
			Earth CT Primary	0 A
		Over Current	IDMT Alarm	Enable / Disable
			Alarm Trip	0 %
		Short Circuit	Alarm Trip	0 %
		Earth Fault	Enable	Enable / Disable
			Alarm Trip	0 %
	Generator Power	Overload	kW Overload Trip	0 %
		Reverse Power	Alarm Trip	0 kW
			Delay	0.0 s
	Synchronising	kvar Control	Control Mode	Fixed Export / None
		Ramp	Up Rate	0.0 %/s
			Down Rate	0.0 %/s
		Insufficient Cap	Action	None / Indication / Warning / Electrical Trip / Shutdown
			Delay	0 h 0 m 0 s
	Sequence	Zero	Enable	Enable / Disable
			Alarm Trip	0.0 V
			Delay	0.0 s
		Positive	Enable	Enable / Disable
			Alarm Trip	0.0 V
			Delay	0.0 s
		Negative	Enable	Enable / Disable
			Alarm Trip	0.0 V
			Delay	0.0 s
		Asymmetry	Enable	Enable / Disable
			Alarm Trip	0.0 V
			Delay	0.0 s

Continued over page...

Section	Sub Section	Parameter Group	Parameter	Value
Mains	Voltage	Under Alarms	Alarm Trip	0 V
		Nominal	Voltage	0 V
		Over Alarms	Alarm Trip	0 V
	Sequence	Zero	Enable	Enable / Disable
			Alarm Trip	0.0 V
			Delay	0.0 s
		Positive	Enable	Enable / Disable
			Alarm Trip	0.0 V
			Delay	0.0 s
		Negative	Enable	Enable / Disable
			Alarm Trip	0.0 V
			Delay	0.0 s
		Asymmetry	Enable	Enable / Disable
			Alarm Trip	0.0 V
			Delay	0.0 s
	Frequency	Under Alarms	Alarm Trip	0.0 Hz
		Nominal	Frequency	0.0 Hz
		Over Alarms	Alarm Trip	0.0 Hz
	Current	Options	CT Primary	0 A
			CT Secondary	1 A / 5 A
			Full Load Rating	0 kW
			Full kvar Rating	0 kvar
Engine	Options	Droop	Enable	Enable / Disable
			Droop	0.0 %
		Preheat	Enable	Enable / Disable
			Preheat Temperature	0 ºC
			Duration	0 h 0 m 0 s
		Postheat	Enable	Enable / Disable
			Postheat Temperature	0 ºC
			Duration	0 h 0 m 0 s
		ECU	CAN Termination	Enable / Disable
	Speed	Under Alarms	Alarm Enable	Enable / Disable
			Alarm Trip	0 RPM
			Pre-Alarm Enable	Enable / Disable
			Pre-Alarm Trip	0 RPM
		Over Alarms	Pre-Alarm Enable	Enable / Disable
			Pre-Alarm Trip	0 RPM
			Alarm Trip	0 RPM
		Overspeed	Overspeed	0 %
			Delay	0 s
	Plant Battery	Voltage	Under Enable	Enable / Disable
			Under Delay	0 h 0 m 0 s
			Under Pre-Alarm Trip	0.0 V
			Over Enable	Enable / Disable
			Over Delay	0 h 0 m 0 s
			Over Pre-Alarm Trip	0.0 V
		Charge Alt	Alarm Enable	Enable / Disable
			Alarm Trip	0.0 V
			Alarm Delay	0 h 0 m 0 s
			Pre-Alarm Enable	Enable / Disable
			Pre-Alarm Trip	0.0 V
			Pre-Alarm Delay	0 h 0 m 0 s
	Fuel	Density	Specific Gravity	0.00
	DPF	Auto Regen	Inhibit	Enable / Disable

Continued over page...

Section	Sub Section	Parameter Group	Parameter	Value
Scheduler	Options	Enable	Enable	Enable / Disable
	Bank 1 & Bank 2	Period	Option	Monthly / Weekly
		Event 1 to 8 Day	Week	1st / 2nd / 3rd / 4th
			Day	Monday to Sunday
		Event 1 to 8 Schedule	Run Mode	Auto Start Inhibit / On Load / Off Load
			Start Time	0 h 0 m
			Duration	0 h 0 m
Alt. Config		Options	Active Config	Default Config / Alt. Config 1 to 3
Maintenance		Module	Time	0 h 0 m 0 s
			Date	DD / MM / YYYY
		Reset	Maintenance Alarm 1 to 3	Reset / Not Reset

8.2 RUNNING CONFIGURATION EDITOR

8.2.1 ACCESSING THE RUNNING CONFIGURATION EDITOR

NOTE: Depending upon module configuration, some parameters in the Running Configuration Editor may not be available. For more information refer to DSE publication *057-340 DSEG8900 Configuration Suite PC Software Manual* available from www.deepseaelectronics.com

- The *Running Configuration Editor* is accessible without stopping the engine. All protections remain active whilst using the *Running Configuration Editor*.
- Press and hold the ***Tick***  button to access the *Running Configuration Editor.*

8.2.2 ENTERING PIN

Even if a module security PIN has been set, the PIN is not requested whilst entering the *Running Configuration Editor.*

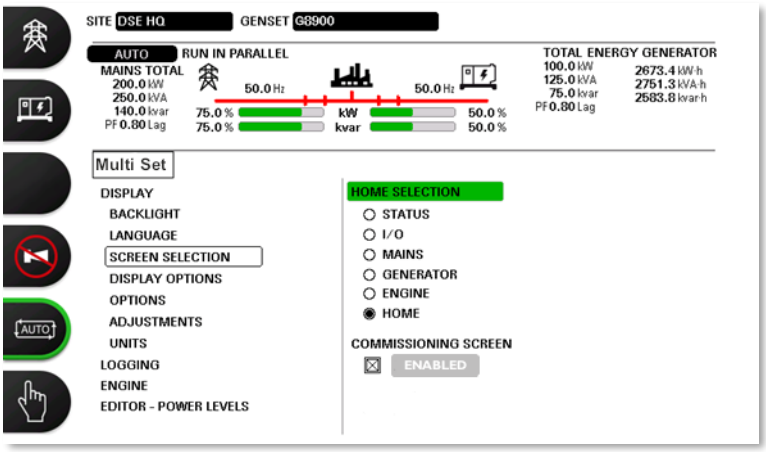
8.2.3 EDITING A PARAMETER

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

- Enter the Running Configuration Editor as described above.
- Press the ***Up*** or ***Down***  buttons to select the section to view/change. The current selected section highlights in green.
- Press the ***Left*** or ***Right***  buttons to select the Subsection/Parameter to be edited. The current selected item highlights in green.
- To edit the parameter, press the ***Tick***  button to enter the edit mode. The parameter is no longer highlighted green to indicate editing.
- Press the ***Up*** or ***Down***  buttons to change the parameter to the required value.
- Press the ***Tick***  button to save the value. The parameter highlights green to indicate that it has been saved.

8.2.4 RUNNING CONFIGURATION EDITOR PARAMETERS

The parameters in the *Running Configuration Editor* are arranged in a hierarchical tree menu as shown in the example below, the subsequent tables are laid out to reflect this.

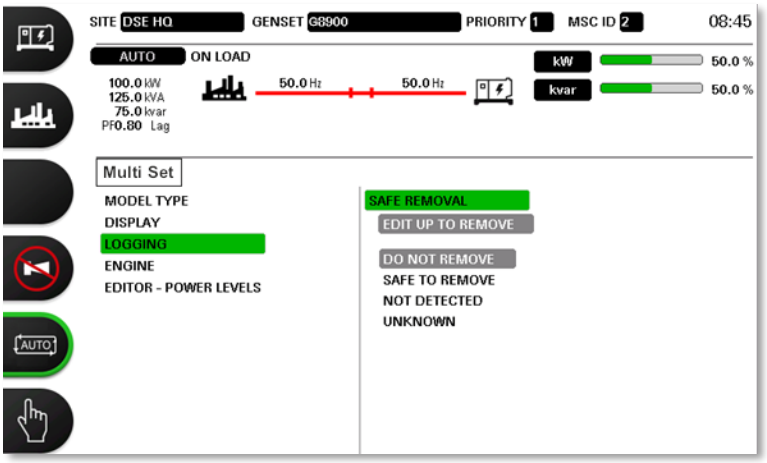


Section	Sub Section	Parameter	Value
Display	Backlight	Backlight Level	0 %
	Language	Language	English
	Screen Selection	Home Selection	Home / Engine / Generator / Mains / I/O / Status
		Commissioning Screen	Enable / Disable
	Display Options	Graphics	Bars / Meters
		Bar Selection	DEF Level / Coolant Temp
		Alarm Pop Up	Enable / Disable
	Options	Override Starting Alarms	Enable / Disable
		Synchroscope Display	Display Both / Summary Page Only / Main Page Only
	Adjustments	Frequency Adjust	0 %
		Voltage Adjust	0 %
	Units	Pressure	kPa / bar / psi
		Temperature	°C / °F
		Volume	Litres / Imperial Gal / US Gal
Logging		Safe Removal	Safe Removal / Off
		Freq Adjust Offset	c
		DPF Auto Inhibit	Enable / Disable
		DPF Manual Regen	Enable / Disable
Engine		Frequency Adjust Offset	0.0 %, 0.00 Hz
		DPF Auto Inhibit	Enable / Disable
		DPF Manual Regen	Enable / Disable
Editor Power Levels	Control Mode	Power Control Mode	Const Power / Frequency-Power / Voltage - Power
		kvar Control Mode	Const Power Factor / Voltage-Reactive Power / Power-Power Factor / Const Reactive Power
	Load	Load Parallel Power	0 % kW
		Load Reactive Power	0 % kvar
		Load Parallel PF	0.00 PF

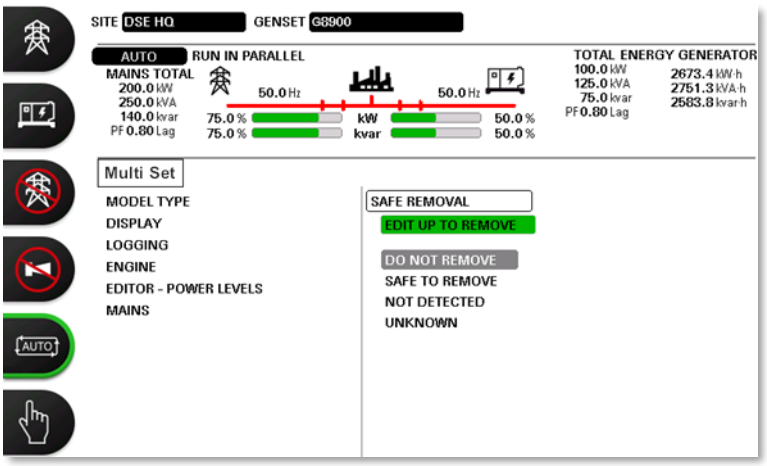
8.2.4.1 USB SAFE REMOVAL PROCEDURE

NOTE: Removal of the USB memory device MUST only be carried out using the following method, failing to do so causes the data on the USB memory device to corrupt.

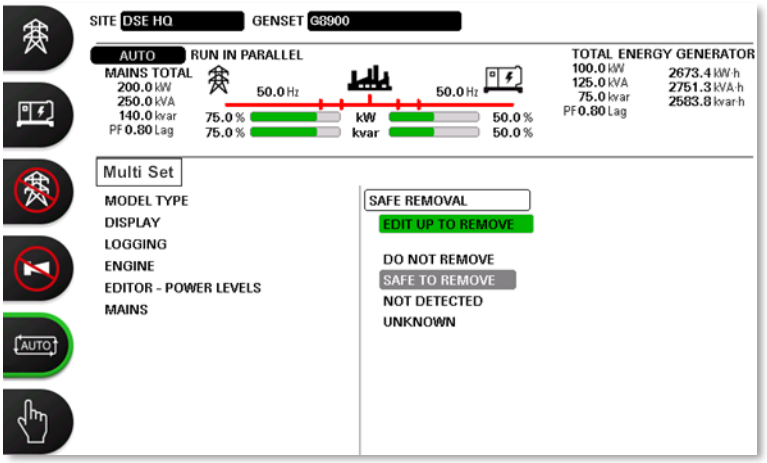
- The *Running Configuration Editor* is accessible without stopping the engine. All protections remain active whilst using the *Running Configuration Editor*.
- Press and hold the ***Tick*** button to access the *Running Configuration Editor.*
- Press the ***Up*** or ***Down*** buttons to select the *Logging* section. The current selected section highlights in green.
- Press the ***Left*** or ***Right*** buttons to select the *Safe Removal* Parameter to be edited. The current selected item highlights in green.



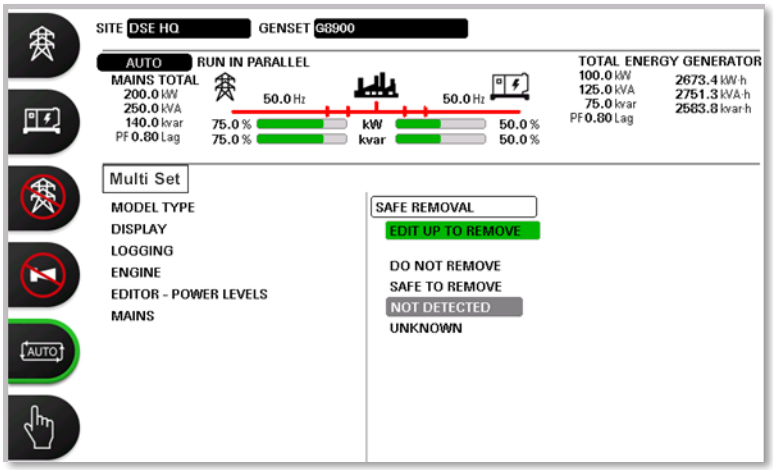
- To edit the parameter, press the ***Tick*** button to enter the edit mode. The parameter is no longer highlighted green to indicate editing.



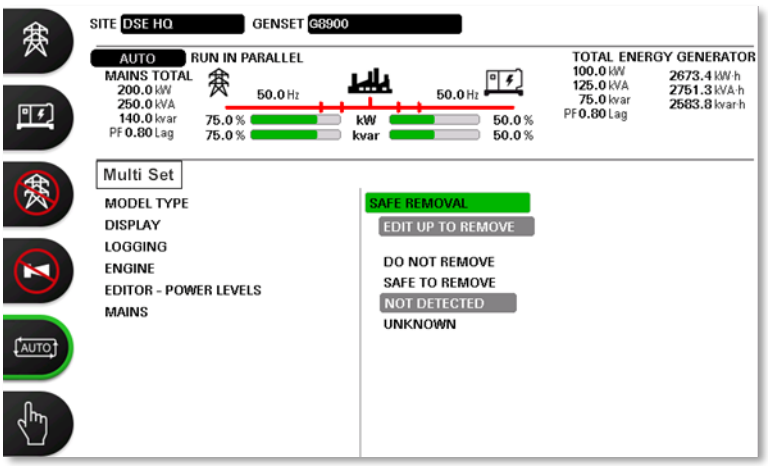
- Press the ***Up*** button, the status changes from *Do Not Remove* to *Safe To Remove*.



- Remove the USB memory device from the rear of the module, the status changes from *Safe To Remove* to *Not Detected.*



- Press the ***Tick*** button to stop editing the parameter. The parameter highlights green to indicate that it has been saved.
-



- Press and hold the ***Tick*** button to exit the *Running Configuration Editor.*

8.2.5 EXITING THE RUNNING CONFIGURATION EDITOR

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

- Press and hold the ***Tick*** button to exit the editor and save the changes.

9 COMMISSIONING

NOTE: If satisfactory operation cannot be achieved, despite repeated checking of the connections between the module and the system, then contact DSE Technical Support Department: support@deepseaelectronics.com

9.1 BASIC CHECKS

NOTE: If Emergency Stop feature is not required, link the input to the DC Positive.

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

1. The unit is adequately cooled and all the wiring to the module is of a standard and rating compatible with the system. Check all mechanical parts are fitted correctly and that all electrical connections (including earths) are sound.
2. The unit DC supply is fused and connected to the battery and that it is of the correct polarity.
3. The Emergency Stop input is wired to an external normally closed switch connected to DC positive.
4. To check the start cycle operation, take appropriate measures to prevent the engine from starting (disable the operation of the fuel solenoid). After a visual inspection to ensure it is safe to proceed, connect the battery supply. To manually start the generator, press the ***Manual Mode*** button once to put the module into manual mode, and then the ***Start*** button to start the generator.
5. The starter engages and operates for the pre-set crank period. After the starter motor has attempted to start the engine for the pre-set number of attempts, the screen displays *Failed to Start*. To manually stop the generator, press the ***Stop/Reset Mode*** button.
6. Restore the engine to operational status (reconnect the fuel solenoid).
7. Press the ***Manual Mode*** button once to put the module into manual mode, and then press the ***Start*** button. This time the engine is expected to start, and the starter motor is expected to disengage automatically. If not then check that the engine is fully operational (fuel available, etc.) and that the fuel solenoid is operating. The engine must now run up to operating speed. If not, and an alarm is present, check the alarm condition for validity, then check input wiring. The engine is expected to continue running for an indefinite period. It is possible currently to view the engine and alternator parameters - refer to the 'Description of Controls' section of this manual.
8. Upon activation of the ***Auto Mode*** button, the engine is programmed to operate for the designated cooling-down duration before automatically shutting down. The generator is expected to stay in standby mode. If it does not, check that the *Remote Start* input is not active.
9. Initiate an automatic start by supplying the remote start signal (if configured). The start sequence commences, and the engine runs up to operational speed. Once the generator is available the delayed load outputs (after *Load Timer* delay) activate, and the Generator accepts the load. If not, check the wiring to the delayed load output contactors. Check the Warming timer has timed out.
10. Remove the remote start signal. The return sequence begins. After the return delay time, the generator is unloaded. The generator then runs for the pre-set cooling down period, then shutdown into its standby mode.
11. Set the modules internal clock/calendar to ensure correct operation of the scheduler and event logging functions. For details of this procedure see the section entitled *Front Panel Configuration* elsewhere in this document.

9.2 DSE FOUR STEPS TO SUCCESSFUL SYNCHRONISING SINGLE SET MODE

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

The following information covers the DSE Four Steps to Successful Synchronising in full detail and must be completed on the generator.

Once in parallel, further commissioning may be required to fine tune the Gain (P), Stability (I) and Derivative (D) of the governor/AVR and DSE module.

9.2.1 CONTROL

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.

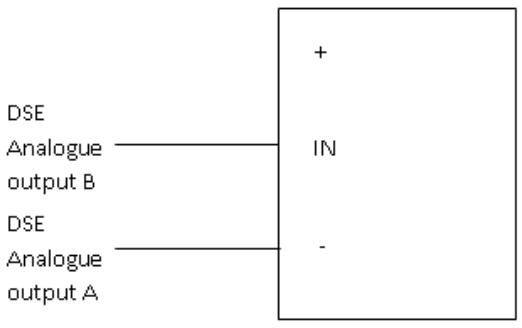
NOTE: For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

9.2.1.1 DETERMINING CONNECTIONS AND SETTINGS FOR GOVERNORS

Setting up the Governor (Adjustment of SW1 and SW2)

Before You Start

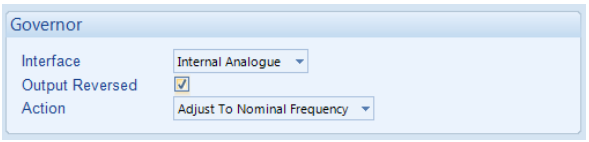
1. Ensure inputs are configured for "*Mains Load Inhibit*" and "*Generator Load Inhibit*."
2. Ensure that the generator is connected to a **dead bus bar with no loads** connected, and the mains breaker is open.
3. With the generator breaker open, set the generator to run at the **Nominal Frequency** without the DSE module connected to the Governor. To achieve this, the settings on the governor require adjusting.
4. 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.



5. With the generator stationary, adjust the Governor SW1 setting to 10 and measure the voltage across the "-" and "IN" governor terminals. Assuming the sensing probes had the correct polarity, a reading of +10 V needs to be present across the "-" and "IN" governor terminals. If this is not the case, check the polarity of the wiring and sensing probes.
6. Once successful, reset the Governor SW1 setting back to 0.

Adjustment of Governor SW1 (Sync Options)

7. **Ensure the inputs configured for "*Mains Load Inhibit*" and "*Generator Load Inhibit*" are active.**
8. Start the generator and ensure that the breaker is left open.
9. 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 or, ensure the *Enhanced J1939* option is enabled, and the *CAN Source Address* is correct within the module when connected to an ECU.

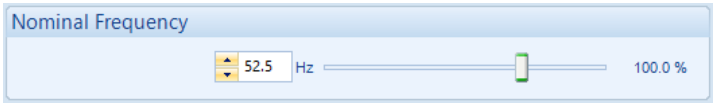


10. Adjust the SW1 setting for the Governor until the generator runs at **Nominal Frequency (50 Hz or 60 Hz)**
11. Stop the generator. SW1 is now complete and must not be adjusted further.

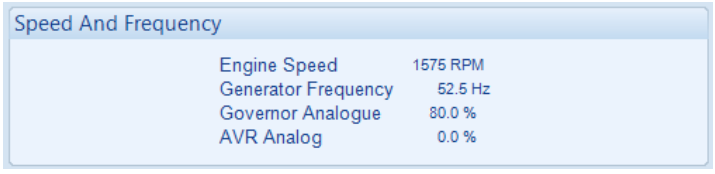
Adjustment of Governor SW2

NOTE: If it is not possible to achieve ±2.5 Hz adjustment with the governor, contact DSE Technical Support for further advice: support@deepseaelectronics.com

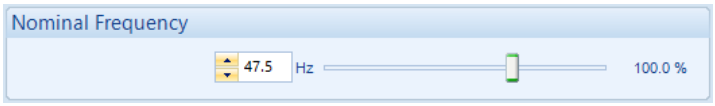
12. **Ensure the input configured for "*Mains Load Inhibit*" is active, but the input configured for "*Generator Load Inhibit*" is not active.**
13. Increase the setting of the Nominal Frequency by **2.5 Hz** (52.5 Hz or 62.5 Hz).



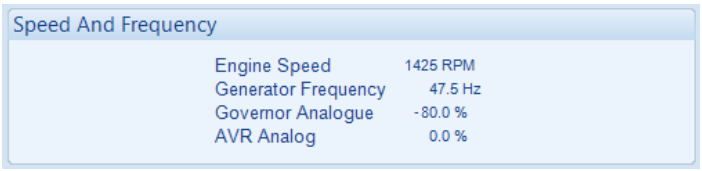
14. Start the generator. With the breaker open, the generator runs at the setting of SW1 (50 Hz or 60 Hz).
15. Once the generator is detected as available, close the generator breaker onto a **DEAD BUS BAR WITH NO LOADS** connected. The generator frequency shall start to increase towards the new Nominal Frequency setting (52.5 Hz or 62.5 Hz); however, it may not achieve this.
16. Adjust SW2 until the frequency increases to the new Nominal Frequency (52.5 Hz or 62.5 Hz).
17. Keep adjusting SW2 further to ensure Governor Drive reads between **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. If the Governor Drive is between 100% and 85%, increase the SW2 setting until the Governor Drive reads ideally 80%. If the Governor Drive is between 75% and 0%, decrease the SW2 setting until the Governor Drive reads ideally 80%.



18. Open the generator breaker and stop the generator.
19. Decrease the setting of the Nominal Frequency by **2.5 Hz** (47.5 Hz or 57.5 Hz).



20. Start the generator. With the breaker open, the generator runs at the setting of SW1 (50 Hz or 60 Hz).
21. Once the generator is detected as available, 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).
22. SW2 is then adjusted further to ensure Governor Drive reads within **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. If the Governor Drive is between 100% and 85%, increase the SW2 setting until the Governor Drive reads ideally 80%. If the Governor Drive is between 75% and 0%, decrease the SW2 setting until the Governor Drive reads ideally 80%.
    NOTE: Any change made to the driving down percentage changes the driving up percentage. For example, if the driving down percentage is increased by 5% (70% to 75%), the driving up percentage increases by 5% (80% to 85%).



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

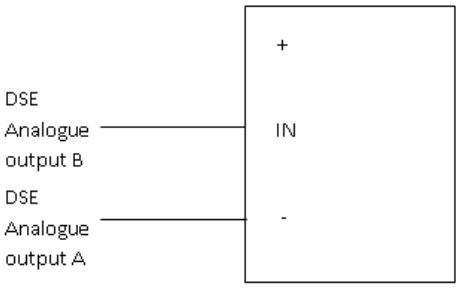
9.2.1.2 DETERMINING CONNECTIONS AND SETTINGS FOR AVRS

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

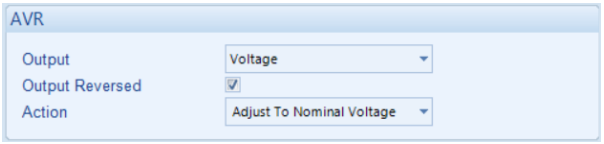
1. **Ensure inputs are configured for "*Mains Load Inhibit*" and "*Generator Load Inhibit*."**
2. Ensure that the generator is connected to a **DEAD BUS BAR WITH NO LOADS** connected, and the Mains breaker is open.
3. With the generator breaker open, set the generator to run at the **Nominal Voltage** without the DSE module connected to the AVR. The settings on the AVR require adjusting for this to be achieved.
4. Stop the generator and connect the DSE module to the AVR. 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.



5. With the generator stationary, adjust the AVR SW1 setting to 10 and measure the voltage across the "-" and "IN" AVR terminals. Assuming the sensing probes had the correct polarity, a reading of +5 V needs to be present across the "-" and "IN" governor terminals. If this is not the case, check the polarity of the wiring and sensing probes.
6. Once successful, reset the AVR SW1 setting back to 0.

Adjustment of AVR SW1 (Sync Options)

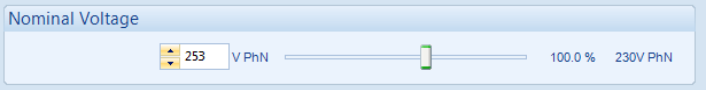
7. **Ensure the inputs configured for "*Mains Load Inhibit*" and "*Generator Load Inhibit*" are active.**
8. Start the generator and ensure that the breaker is left open.
9. Check the direction of drive by increasing and decreasing SW1. If the voltage increases whilst SW1 is being decreased tick the option 'Output Reversed'. If moving SW1 does not change the voltage, check the wiring to the AVR for faults.



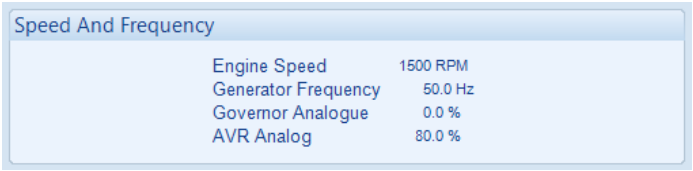
10. Adjust the SW1 setting for the AVR until the generator runs at **Nominal Voltage (230V for example).**
11. Stop the generator. SW1 is now complete and must not be adjusted further.

Adjustment of AVR SW2

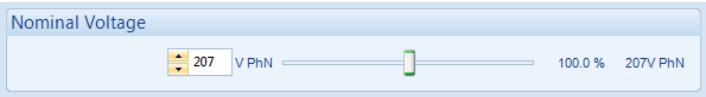
12. **Ensure the input configured for "*Mains Load Inhibit*" is active, but the input configured for "*Generator Load Inhibit*" is not active.**
13. Increase the setting of the Nominal Voltage by 10% (230 V to 253 V for example).



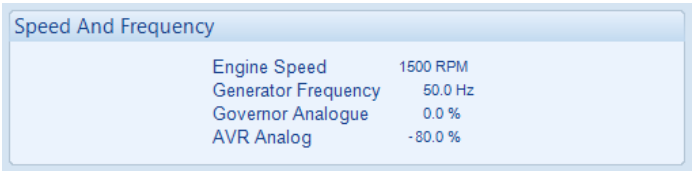
14. Once the generator is detected as available, close the generator breaker onto a **DEAD BUS BAR WITH NO LOADS** connected. The generator voltage shall start to increase towards the new Nominal Voltage setting (+10% [253 V for example]), however it may not achieve this.
15. Adjust SW2 to until the voltage increases to the new Nominal Frequency ((+10% [253 V for example]).
16. Keep adjusting SW2 further to ensure AVR Drive reads between **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. If the AVR Drive is between 100% and 85%, increase the SW2 setting until the AVR Drive reads ideally 80%. If the AVR Drive is between 75% and 0%, decrease the SW2 setting until the AVR Drive reads ideally 80%.



17. Open the generator breaker and stop the generator.
18. Decrease the setting of the Nominal Voltage by **10%** (230 V to 207 V for example).



19. Start the generator. With the breaker open the generator runs at setting of SW1 (230V for example).
20. Once the generator is detected as available, 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 ((-10% [207 V for example])
21. SW2 is then adjusted further to ensure AVR Drive reads within **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. If the AVR Drive is between 100% and 85%, increase the SW2 setting until the AVR Drive reads ideally 80%. If the AVR Drive is between 75% and 0%, decrease the SW2 setting until the AVR Drive reads ideally 80%.
    NOTE: Any change made to the driving down percentage changes the driving up percentage. For example, if the driving down percentage is increased by 5% (70% to 75%), the driving up percentage increases by 5% (80% to 85%).



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

9.2.2 METERING

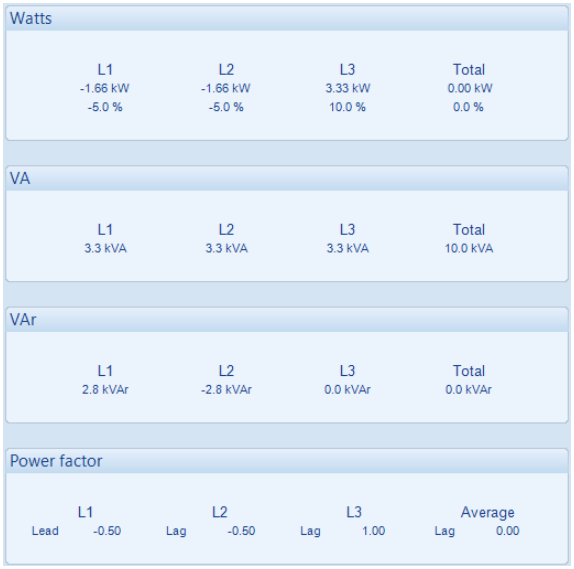
WARNING!: Do not disconnect the CT wires from the DSE module when the CTs are carrying current. Disconnection open circuits the secondary of the CT's and dangerous voltages may then develop. Always ensure the CTs are not carrying current and the CTs are short circuit connected before making or breaking connections to the module.

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.

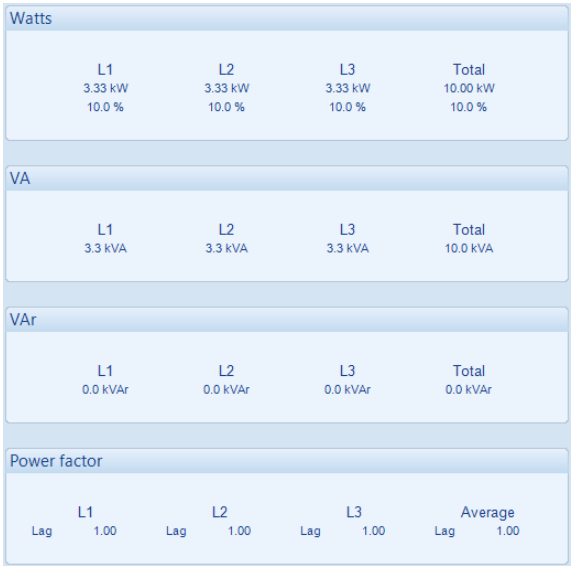
9.2.2.1 GENERATOR CTS ON THE RIGHT PHASE

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

1. Ensure that bus is not live, the mains breaker is open, and the *Mains Load Inhibit* digital input is active.
2. Start the generator and once available, close the generator breaker.
3. Apply purely resistive load (around 10% of the generator's size) across the three phases.
4. If the CTs on L1, L2 & L3 are wired to the correct terminals on the module, it displays unity power factor (1.0 pf) across all three phases. If unity power factor (1.0 pf) is not displayed across all three phases, the CTs have been wired to the wrong phases on the module.



Cables from the CTs on L1 and L2 are swapped over at the module's terminals.



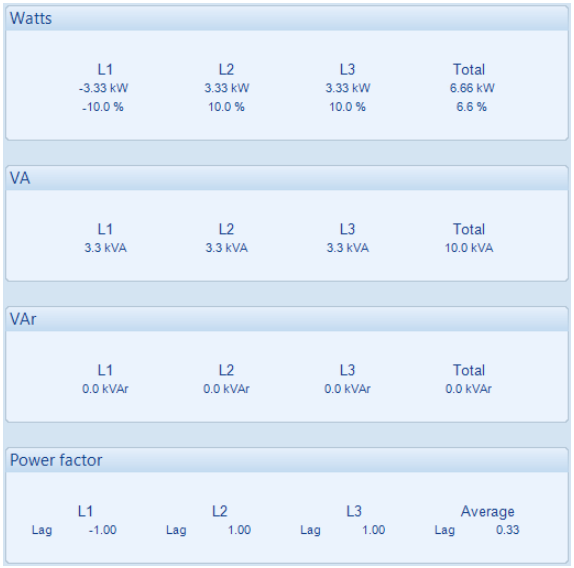
Cables from the CTs on L1 and L2 are connected correctly to module's terminals.

9.2.2.2 GENERATOR CTS IN THE RIGHT DIRECTION

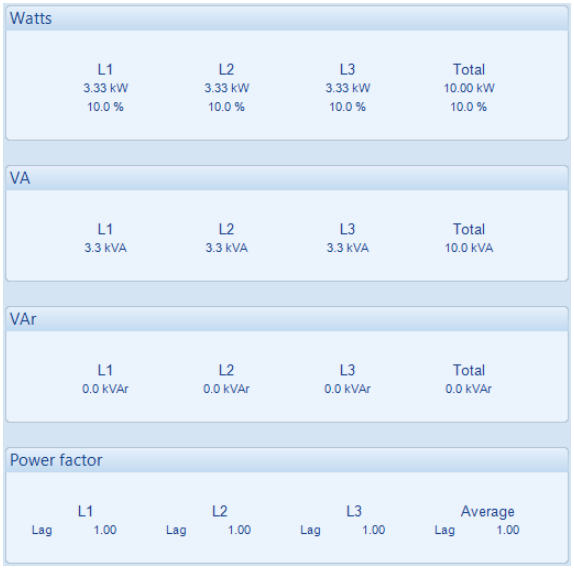
NOTE: Checking that the CTs are on the right phase MUST be completed prior to checking if the CTs are in the correct direction. CTs on the wrong phase also cause negative kWs.

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.

1. Ensure that the CTs are connected on the correct phase by performing the previous test.
2. Ensure that bus is not live, the mains breaker is open, and the *Mains Load Inhibit* digital input is active.
3. Start the generator and once available, close the generator breaker.
4. Apply purely resistive load (around 10% of the generator's size) across the three phases.
5. If the CT's S1 and S2 are wired correctly to the DSE module, it displays positive kW. If negative kWs is displayed, the CTs' s1 and s2 have been swapped around.



The CT on L1 has been mounted with the incorrect orientation, or the s1 and s2 connections on the CT have been swapped over.

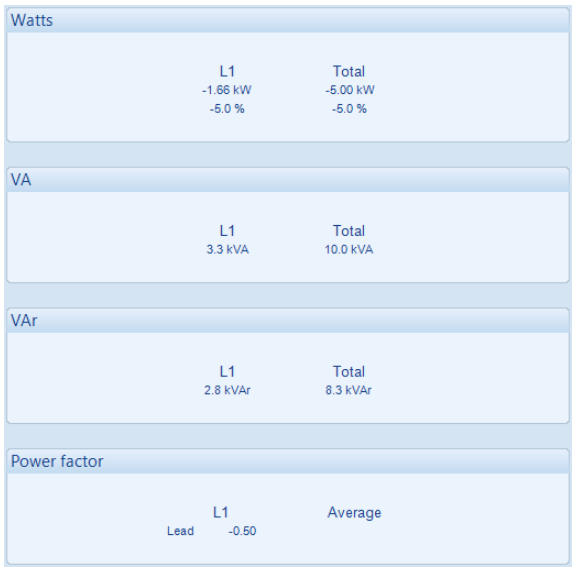


The CT on L1 has been mounted and wired correctly.

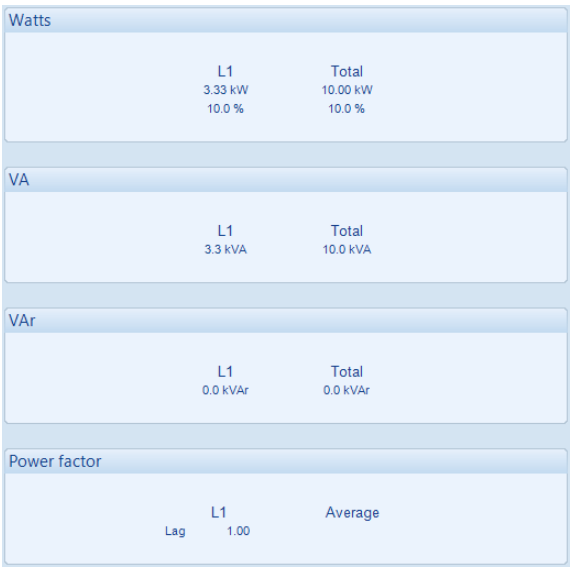
9.2.2.3 MAINS CT ON THE RIGHT PHASE (SINGLE SET ONLY)

Check to ensure that the Mains CT is on phase L1 of the mains (utility) supply.

1. Ensure that generator breaker is open, close the mains breaker when it is available.
2. Apply purely resistive load across the three phases of the mains (utility).
3. If the Mains CT is on L1 and wired correctly on the module, it displays unity power factor (1.0 pf) on L1. If unity power factor (1.0 pf) is not displayed on L1, the CT has been installed on a wrong phase of the mains supply.



The mains CT is on a wrong phase of the mains supply.



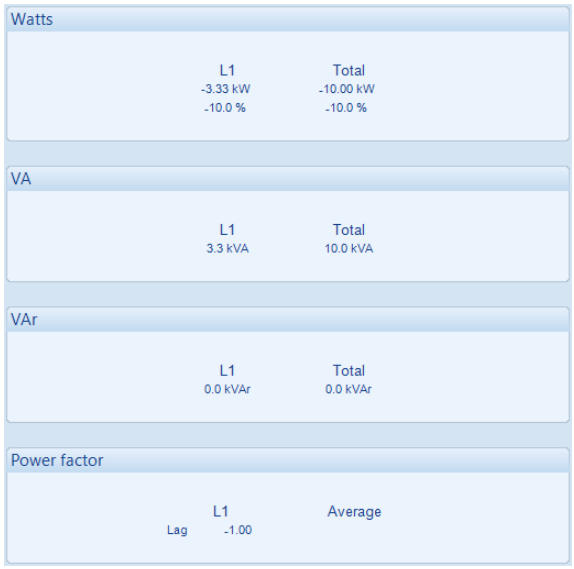
The mains CT is correctly connected to L1 of the mains supply.

9.2.2.4 MAINS CT IN THE RIGHT DIRECTION

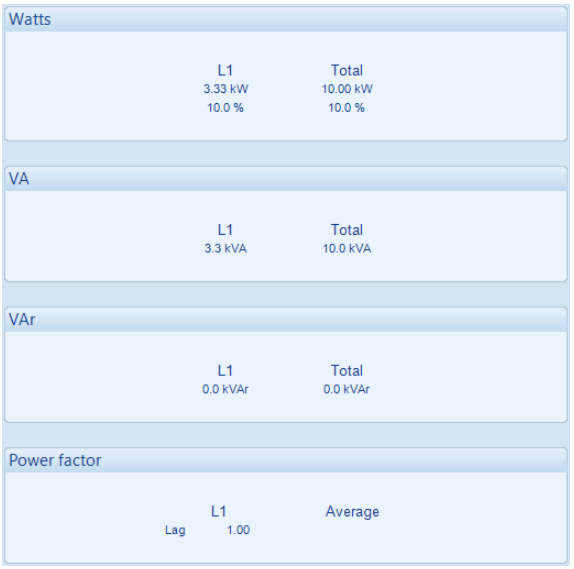
NOTE: Checking that the CT is on the right phase MUST be completed prior to checking if the CT is in the correct direction.

Check to ensure that the Mains CT on L1 has been mounted for the correct orientation for current flow and that the S1 and S2 have not been swapped over.

1. Ensure that the Mains CT is connected on the correct phase (L1) by performing the previous test.
2. Ensure that generator breaker is open.
3. Close the Mains breaker.
4. Apply purely resistive load across L1 phase of the Mains.
5. If the CT's S1 and S2 are wired correctly to the DSE module, it displays positive kW. If negative kW is displayed, the CT' s1 and s2 have been swapped around.



The mains CT on L1 has been mounted with the incorrect orientation, or the s1 and s2 connections on the CT have been swapped over.



The CT on mains L1 has been mounted and wired correctly.

9.2.3 COMMUNICATIONS

NOTE: The Step 3 (Communications) of the *Four Steps to Successful Synchronisation* is not applicable on DSEG8600 modules configured as a Single Set. However, it is applicable to DSEG8600 modules configured as *Multi Set*.

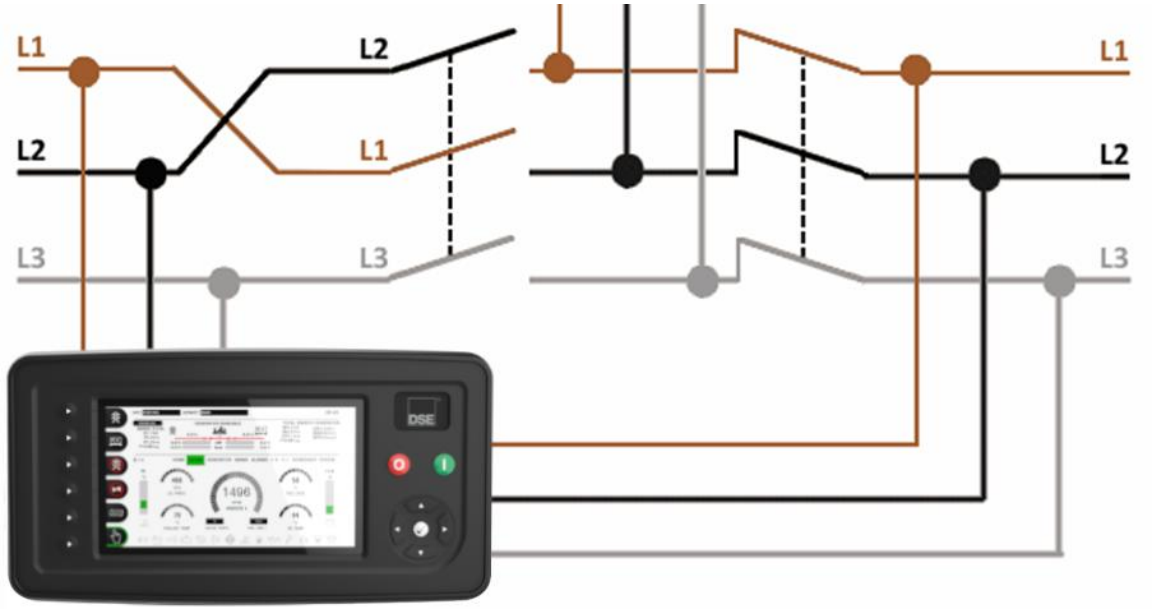
Check to ensure that all the modules are connected are communicating correctly on the AMSC link and Redundant AMSC (if used).

Please refer to the section entitled *AMSC (Multi Set*) elsewhere in this document.

9.2.4 SYNC CHECKS

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

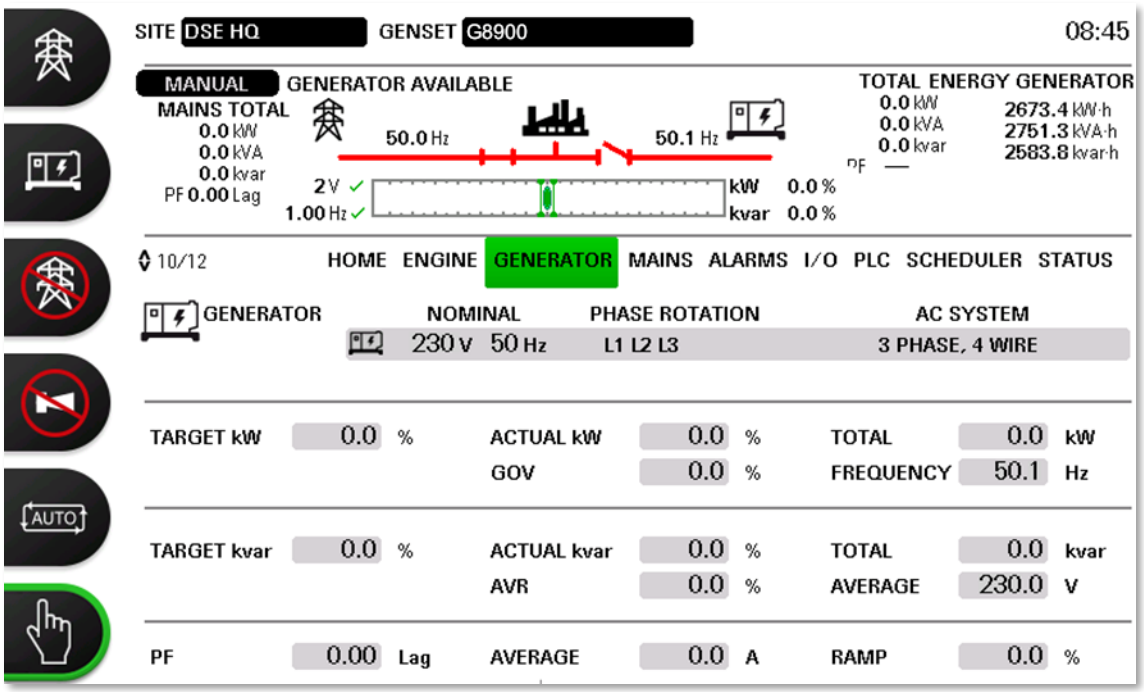
Check to ensure that all the module's sensing cables have been connected to the correct phases and that the generator's load switch has been correctly connected. Failing to perform such tests may lead to the DSE module sensing both sides of the breaker as in sync

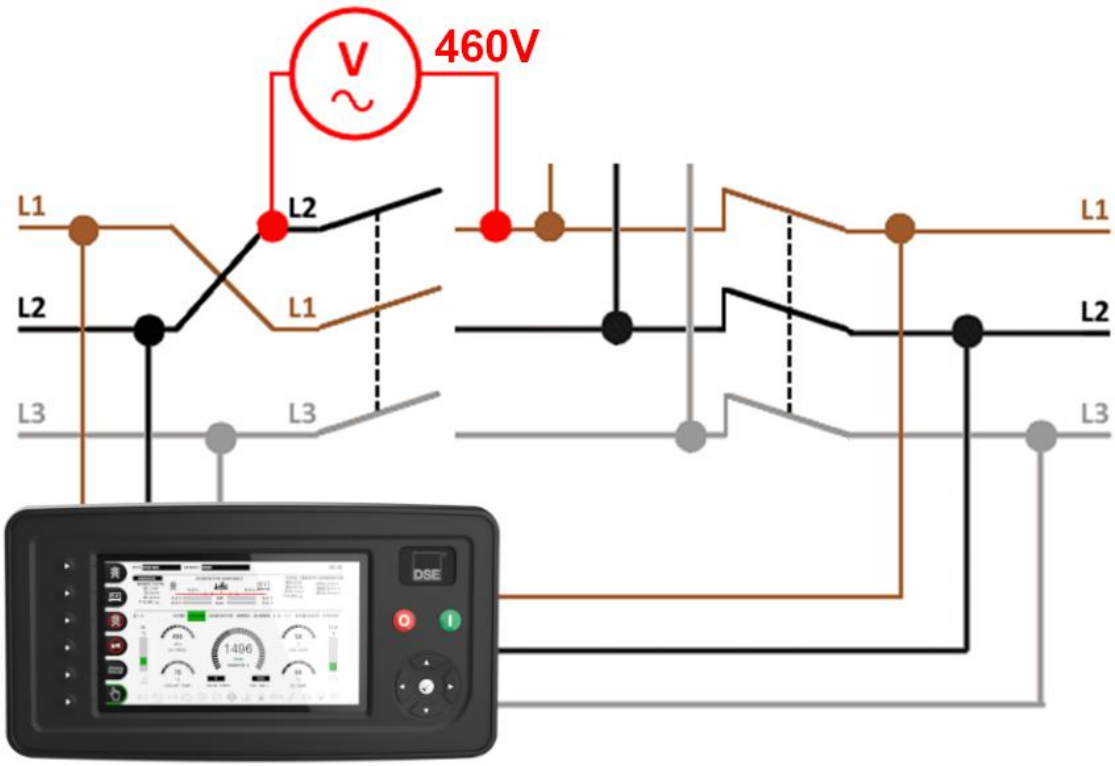


This is tested by starting the generator with the DSE module and ensuring the generator load switch is left open (activate an input configured for *Generator Load Inhibit*). Then the load side is to be made live, this is achieved by closing the mains load switch. Across the open load switch, connect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

9.2.4.1 INCORRECTLY WIRED BREAKER

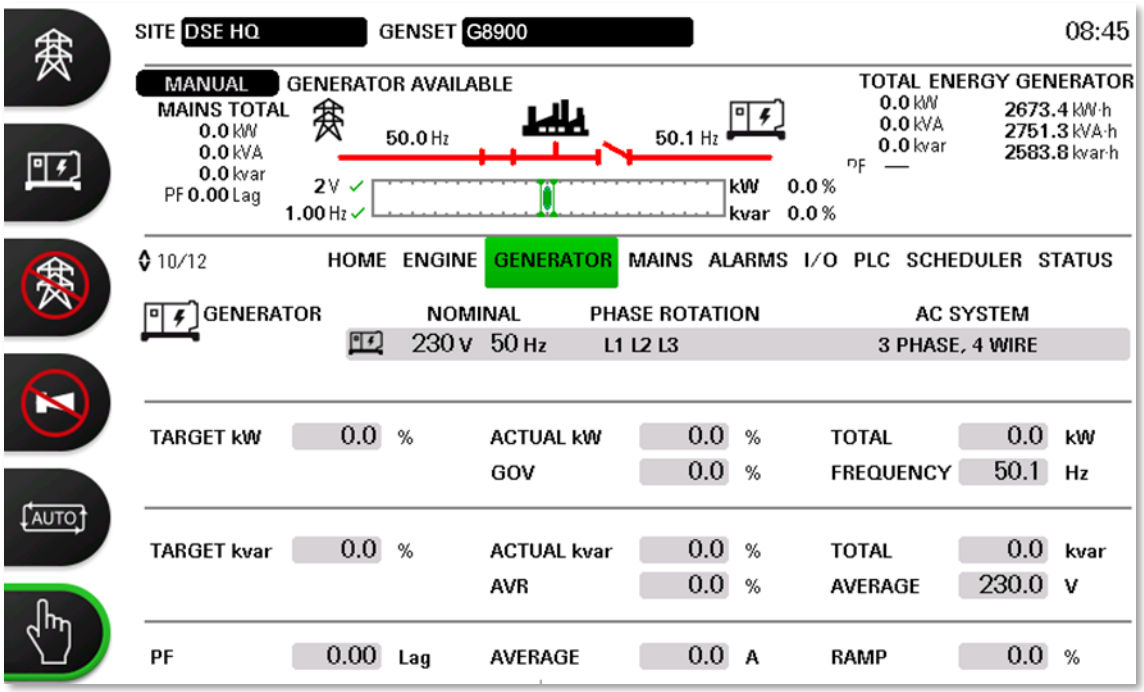
When the DSE module's synchroscope shows the two supplies in sync, if the voltage meter shows a voltage difference the breaker is wired incorrectly. This is shown in the example below.

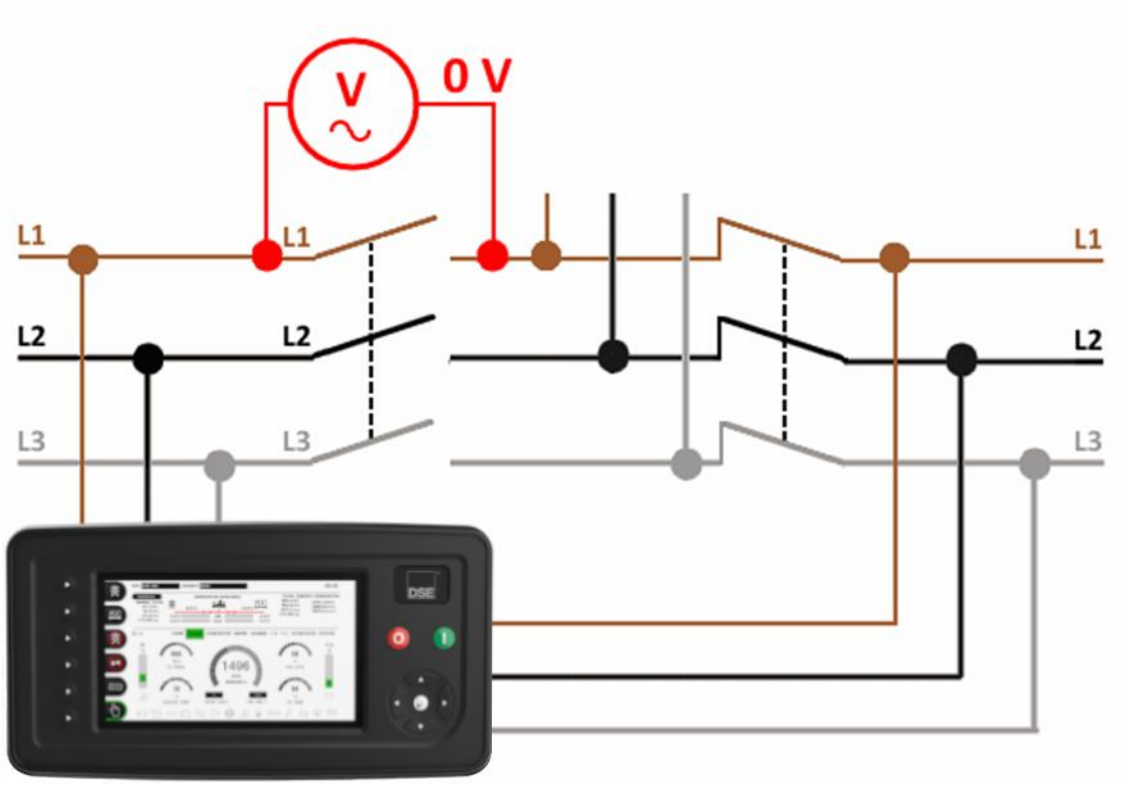




9.2.4.2 CORRECTLY WIRED BREAKER

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.





9.3 DSE FOUR STEPS TO SUCCESSFUL SYNCHRONISING MULTI SET MODE

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

The following information covers the DSE Four Steps to Successful Synchronising in full detail and must be completed on the generator.

Once in parallel, further commissioning may be required to fine tune the Gain (P), Stability (I) and Derivative (D) of the governor/AVR and DSE module.

9.3.1 CONTROL

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: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

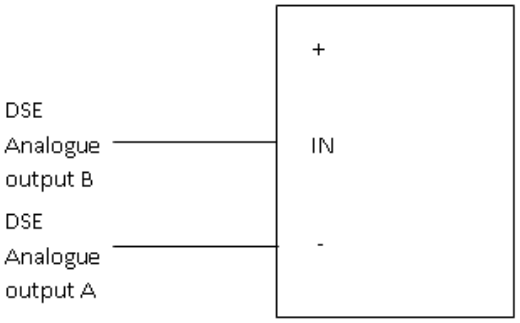
Continued overleaf…

9.3.1.1 DETERMINING CONNECTIONS AND SETTINGS FOR GOVERNORS

Setting up the Governor (Adjustment of SW1 and SW2)

Before You Start

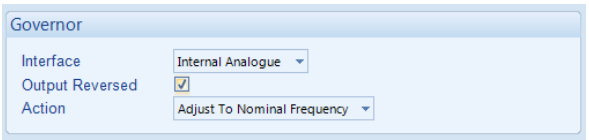
24. Ensure inputs are configured for "*Mains Load Inhibit*" and "*Generator Load Inhibit*."
25. Ensure that the generator is connected to a **dead bus bar with no loads** connected, and the mains breaker is open.
26. With the generator breaker open, set the generator to run at the **Nominal Frequency** without the DSE module connected to the Governor. To achieve this, the settings on the governor require adjusting.
27. 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.



28. With the generator stationary, adjust the Governor SW1 setting to 10 and measure the voltage across the "-" and "IN" governor terminals. Assuming the sensing probes had the correct polarity, a reading of +5 V needs to be present across the "-" and "IN" governor terminals. If this is not the case, check the polarity of the wiring and sensing probes.
29. Once successful, reset the Governor SW1 setting back to 0.

Adjustment of Governor SW1 (Sync Options)

30. **Ensure the inputs configured for "*Mains Load Inhibit*" and "*Generator Load Inhibit*" are active.**
31. Start the generator and ensure that the breaker is left open.
32. 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 or, ensure the *Enhanced J1939* option is enabled, and the *CAN Source Address* is correct within the module when connected to an ECU.

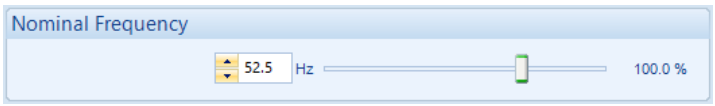


33. Adjust the SW1 setting for the Governor until the generator runs at **Nominal Frequency (50 Hz or 60 Hz)**
34. Stop the generator. SW1 is now complete and must not be adjusted further.

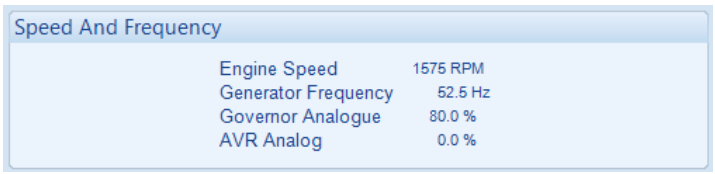
Adjustment of Governor SW2

NOTE: If it is not possible to achieve ±2.5 Hz adjustment with the governor, contact DSE Technical Support for further advice: support@deepseaelectronics.com

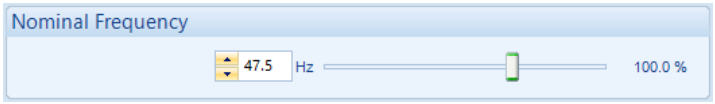
35. **Ensure the input configured for "*Mains Load Inhibit*" is active, but the input configured for "*Generator Load Inhibit*" is not active.**
36. Increase the setting of the Nominal Frequency by **2.5 Hz** (52.5 Hz or 62.5 Hz).



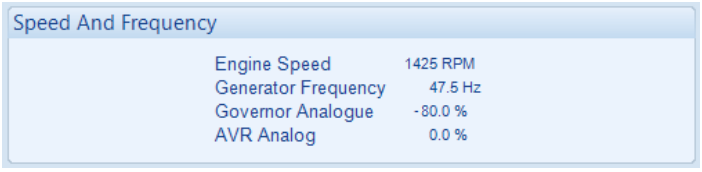
37. Start the generator. With the breaker open, the generator runs at the setting of SW1 (50 Hz or 60 Hz).
38. Once the generator is detected as available, close the generator breaker onto a **DEAD BUS BAR WITH NO LOADS** connected. The generator frequency shall start to increase towards the new Nominal Frequency setting (52.5 Hz or 62.5 Hz); however, it may not achieve this.
39. Adjust SW2 until the frequency increases to the new Nominal Frequency (52.5 Hz or 62.5 Hz).
40. Keep adjusting SW2 further to ensure Governor Drive reads between **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. If the Governor Drive is between 100% and 85%, increase the SW2 setting until the Governor Drive reads ideally 80%. If the Governor Drive is between 75% and 0%, decrease the SW2 setting until the Governor Drive reads ideally 80%.



41. Open the generator breaker and stop the generator.
42. Decrease the setting of the Nominal Frequency by **2.5 Hz** (47.5 Hz or 57.5 Hz).



43. Start the generator. With the breaker open, the generator runs at the setting of SW1 (50 Hz or 60 Hz).
44. Once the generator is detected as available, 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).
45. SW2 is then adjusted further to ensure Governor Drive reads within **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. If the Governor Drive is between 100% and 85%, increase the SW2 setting until the Governor Drive reads ideally 80%. If the Governor Drive is between 75% and 0%, decrease the SW2 setting until the Governor Drive reads ideally 80%.
    NOTE: Any change made to the driving down percentage changes the driving up percentage. For example, if the driving down percentage is increased by 5% (70% to 75%), the driving up percentage increases by 5% (80% to 85%).



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

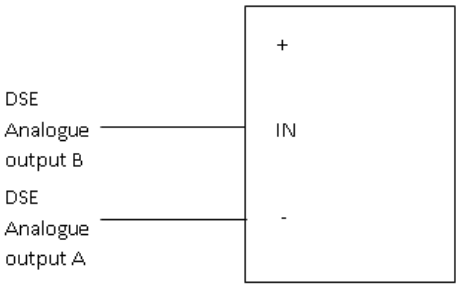
9.3.1.2 DETERMINING CONNECTIONS AND SETTINGS FOR AVRS

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

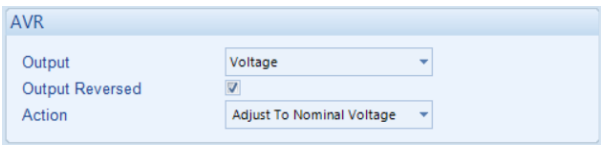
23. **Ensure inputs are configured for "*Mains Load Inhibit*" and "*Generator Load Inhibit*."**
24. Ensure that the generator is connected to a **DEAD BUS BAR WITH NO LOADS** connected, and the Mains breaker is open.
25. With the generator breaker open, set the generator to run at the **Nominal Voltage** without the DSE module connected to the AVR. The settings on the AVR require adjusting for this to be achieved.
26. Stop the generator and connect the DSE module to the AVR. 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.



27. With the generator stationary, adjust the AVR SW1 setting to 10 and measure the voltage across the "-" and "IN" AVR terminals. Assuming the sensing probes had the correct polarity, a reading of +5 V needs to be present across the "-" and "IN" governor terminals. If this is not the case, check the polarity of the wiring and sensing probes.
28. Once successful, reset the AVR SW1 setting back to 0.

Adjustment of AVR SW1 (Sync Options)

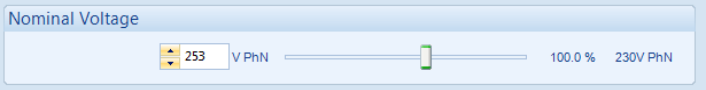
29. **Ensure the inputs configured for "*Mains Load Inhibit*" and "*Generator Load Inhibit*" are active.**
30. Start the generator and ensure that the breaker is left open.
31. Check the direction of drive by increasing and decreasing SW1. If the voltage increases whilst SW1 is being decreased tick the option 'Output Reversed'. If moving SW1 does not change the voltage, check the wiring to the AVR for faults.



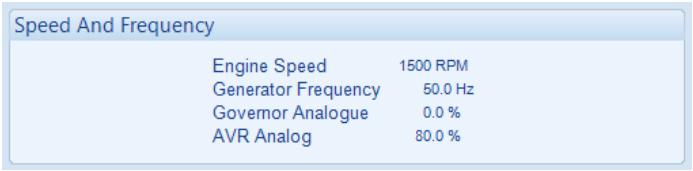
32. Adjust the SW1 setting for the AVR until the generator runs at **Nominal Voltage (230V for example).**
33. Stop the generator. SW1 is now complete and must not be adjusted further.

Adjustment of AVR SW2

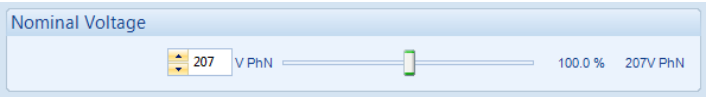
34. **Ensure the input configured for "*Mains Load Inhibit*" is active, but the input configured for "*Generator Load Inhibit*" is not active.**
35. Increase the setting of the Nominal Voltage by 10% (230 V to 253 V for example).



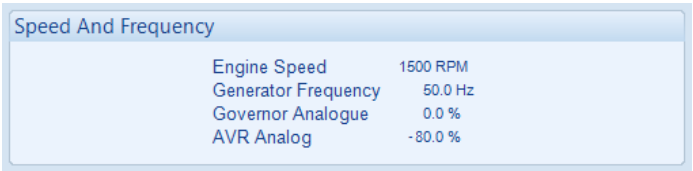
36. Once the generator is detected as available, close the generator breaker onto a **DEAD BUS BAR WITH NO LOADS** connected. The generator voltage shall start to increase towards the new Nominal Voltage setting (+10% [253 V for example]), however it may not achieve this.
37. Adjust SW2 to until the voltage increases to the new Nominal Frequency ((+10% [253 V for example]).
38. Keep adjusting SW2 further to ensure AVR Drive reads between **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. If the AVR Drive is between 100% and 85%, increase the SW2 setting until the AVR Drive reads ideally 80%. If the AVR Drive is between 75% and 0%, decrease the SW2 setting until the AVR Drive reads ideally 80%.



39. Open the generator breaker and stop the generator.
40. Decrease the setting of the Nominal Voltage by **10%** (230 V to 207 V for example).



41. Start the generator. With the breaker open the generator runs at setting of SW1 (230V for example).
42. Once the generator is detected as available, 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 ((-10% [207 V for example])
43. SW2 is then adjusted further to ensure AVR Drive reads within **75% to 85%**, the sign of the drive (+ or - percentage) does not matter. If the AVR Drive is between 100% and 85%, increase the SW2 setting until the AVR Drive reads ideally 80%. If the AVR Drive is between 75% and 0%, decrease the SW2 setting until the AVR Drive reads ideally 80%.
    NOTE: Any change made to the driving down percentage changes the driving up percentage. For example, if the driving down percentage is increased by 5% (70% to 75%), the driving up percentage increases by 5% (80% to 85%).



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

9.3.2 METERING

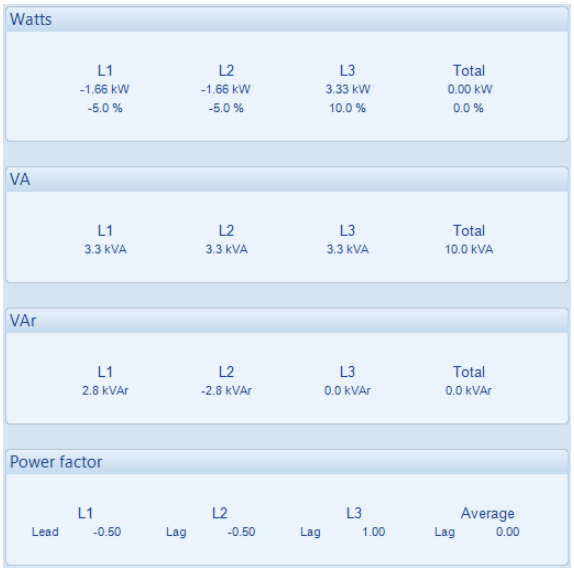
WARNING!: Do not disconnect the CT wires from the DSE module when the CTs are carrying current. Disconnection open circuits the secondary of the CT's and dangerous voltages may then develop. Always ensure the CTs are not carrying current and the CTs are short circuit connected before making or breaking connections to the module.

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.

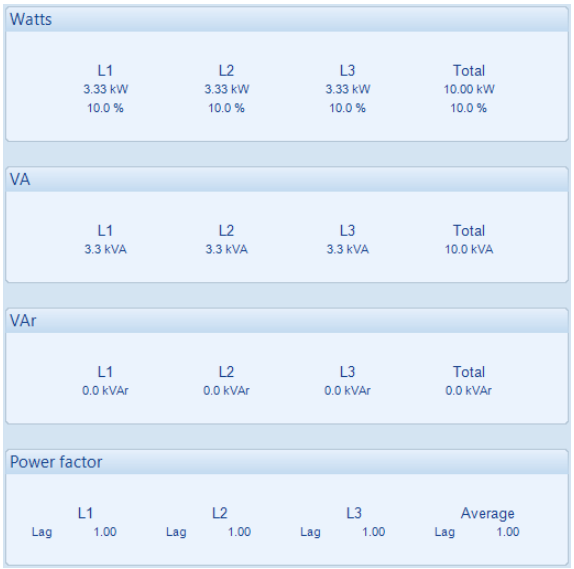
9.3.2.1 CTS ON THE RIGHT PHASE

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

5. Ensure that generator bus is not live and the other generator's breakers are open.
6. Start the generator and once available, close the generator breaker.
7. Apply purely resistive load (around 10% of the generator's size) across the three phases.
8. If the CTs on L1, L2 & L3 are wired to the correct terminals on the module, it displays unity power factor (1.0 pf) across all three phases. If unity power factor (1.0 pf) is not displayed across all three phases, the CTs have been wired to the wrong phases on the module.



Cables from the CTs on L1 and L2 are swapped over at the module's terminals.



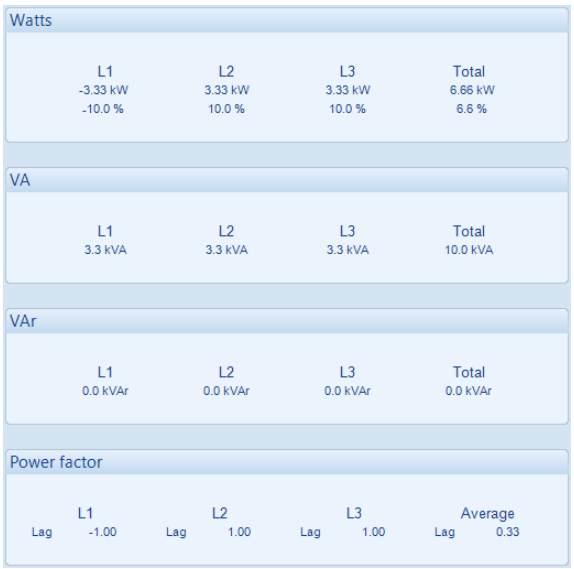
Cables from the CTs on L1 and L2 are connected correctly to module's terminals.

9.3.2.2 CTS IN THE RIGHT DIRECTION

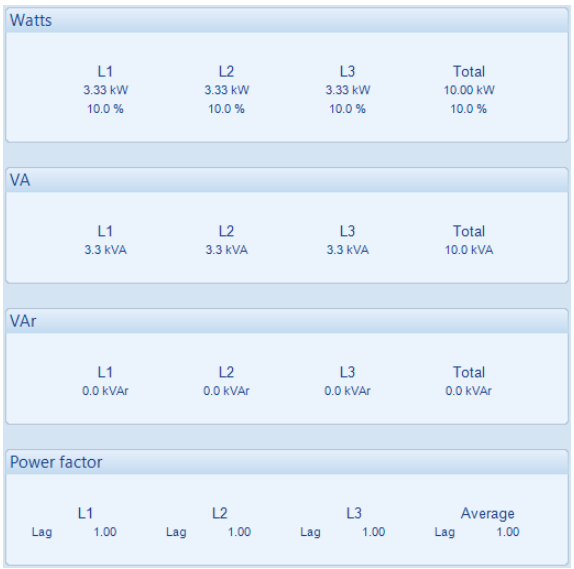
NOTE: Checking that the CTs are on the right phase MUST be completed prior to checking if the CTs are in the correct direction. CTs on the wrong phase also cause negative kWs.

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.

6. Ensure that the CTs are connected on the correct phase by performing the previous test.
7. Ensure that generator bus is not live and the other generator's breakers are open.
8. Start the generator and once available, close the generator breaker.
9. Apply purely resistive load (around 10% of the generator's size) across the three phases.
10. If the CT's 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.



The CT on L1 has been mounted with the incorrect orientation, or the s1 and s2 connections on the CT have been swapped over.



The CT on L1 has been mounted and wired correctly

9.3.3 COMMUNICATIONS

NOTE: The Step 3 (Communications) of the *Four Steps to Successful Synchronisation* is not applicable on DSEG8600 modules configured as a Single Set. However, it is applicable to DSEG8600 modules configured as *Multi Set*.

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

Please refer to the section entitled *AMSC (Multi Set*) elsewhere in this document.

9.3.3.1 SEGMENTING CHECKS

NOTE: Observing both the *Bus Live* LED and the *Bus Sensing Fail* alarm is crucial during the segmenting checks.

NOTE: When a generator is started and closed onto the bus, only the controllers in the same segment display the Bus Live LED as active. This helps confirm that the segment is correctly isolated and live.

Before You Start

Ensure the entire system is dead, with all switchgear open.

1. Start and close one generator onto the bus. This action energizes only a small section of the system.
2. Check each controller:

- Confirm that only controllers in the same segment show the Bus Live status.
- Look for the *Bus Sensing Fail* alarm. This indicates that a controller expects the segment to be live but does not detect voltage.
- If this alarm is present, it may mean:
    - The controller has the wrong segment number.
    - Another controller with the same segment number is detecting the bus as live.

3. Fix any issues before proceeding.
4. Verify all connected controllers show correct bus voltage.
5. Continue energising each segment in turn. Once a segment is verified, it can be used to energise the next.
6. Perform checks for each segment and correct any errors before moving on.
7. During segment checks, avoid placing sources into parallel. If unavoidable, pause segment checks and perform synchronising checks on these sources before allowing parallel operation. Resume segment checks after synchronising checks are completed.

Additional Alarms Useful During Segmenting

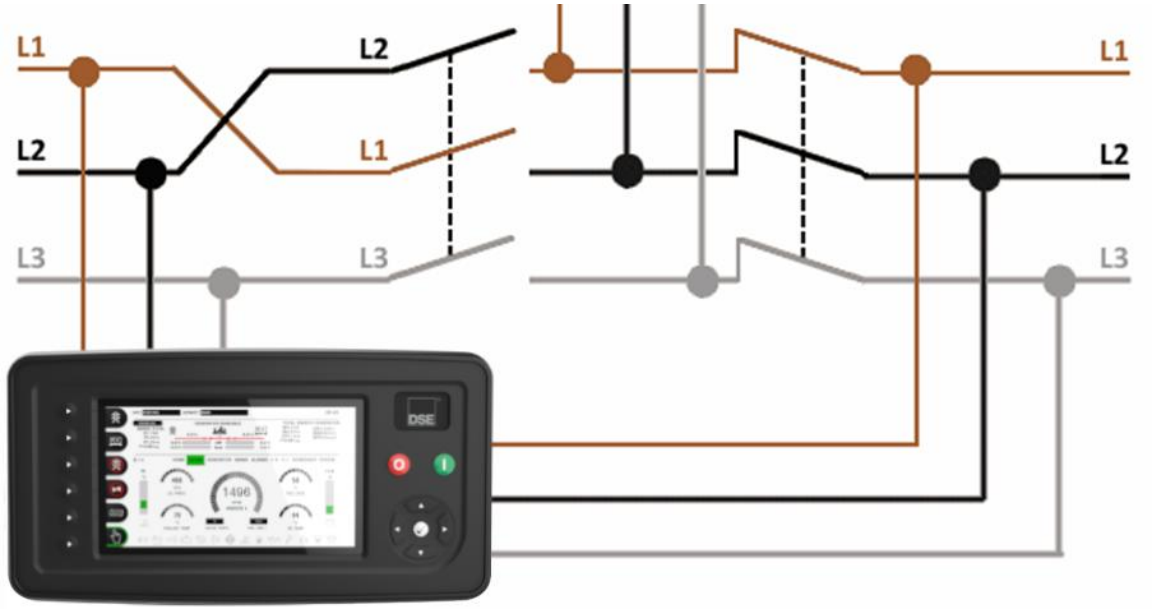
To enhance commissioning accuracy, monitor the following alarms:

- Bus Phase Rotation - Confirms correct phase sequence.
- Bus Breaker Failed To Close / Open - Verifies breaker operation during segment activation.
- Bus Over Current - Detects wiring or load issues early.
- Bus Left To Right / Right To Left Power Alarm or Warning - Helps confirm correct power flow direction.
- Bus Live Group Primary - Indicates live status of specific controller groups.

9.3.4 SYNC CHECKS

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

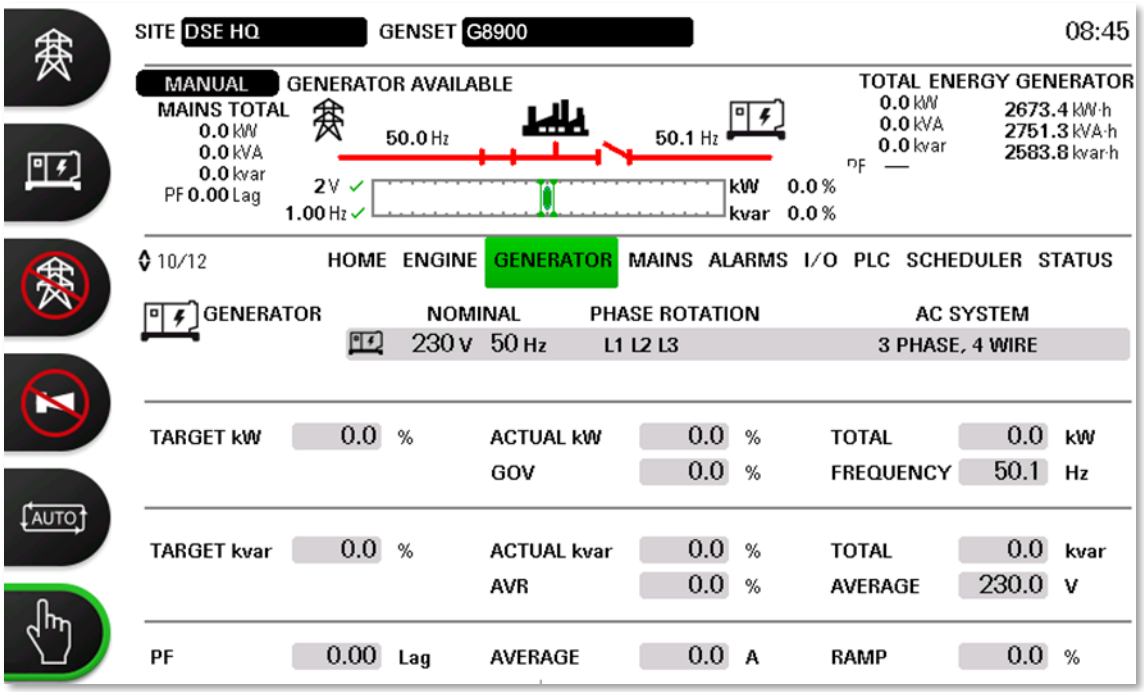
Check to ensure that all the module's sensing cables have been connected to the correct phases and that the generator's load switch has been correctly connected. Failing to perform such tests may lead to the DSE module sensing both sides of the breaker as in sync

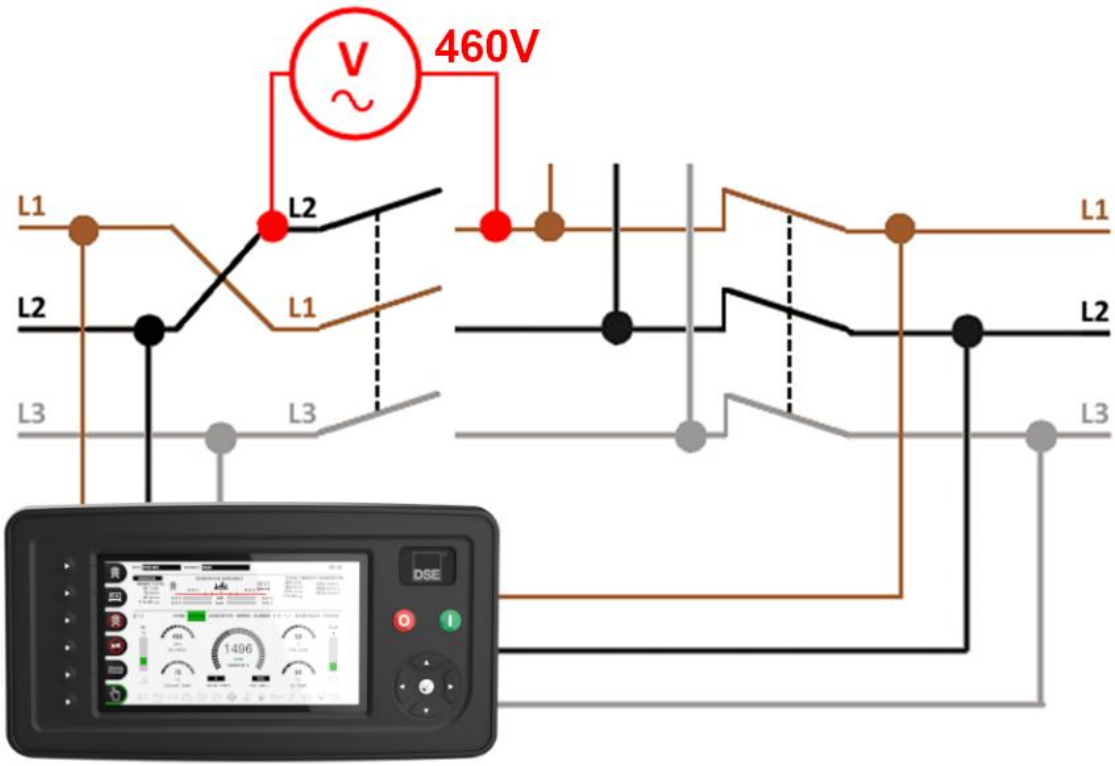


This is tested by starting the generator with the DSE module and ensuring the generator load switch is left open (activate an input configured for *Generator Load Inhibit*). Then the load side is to be made live, this is achieved by closing the mains load switch. Across the open load switch, connect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

9.3.4.1 INCORRECTLY WIRED BREAKER

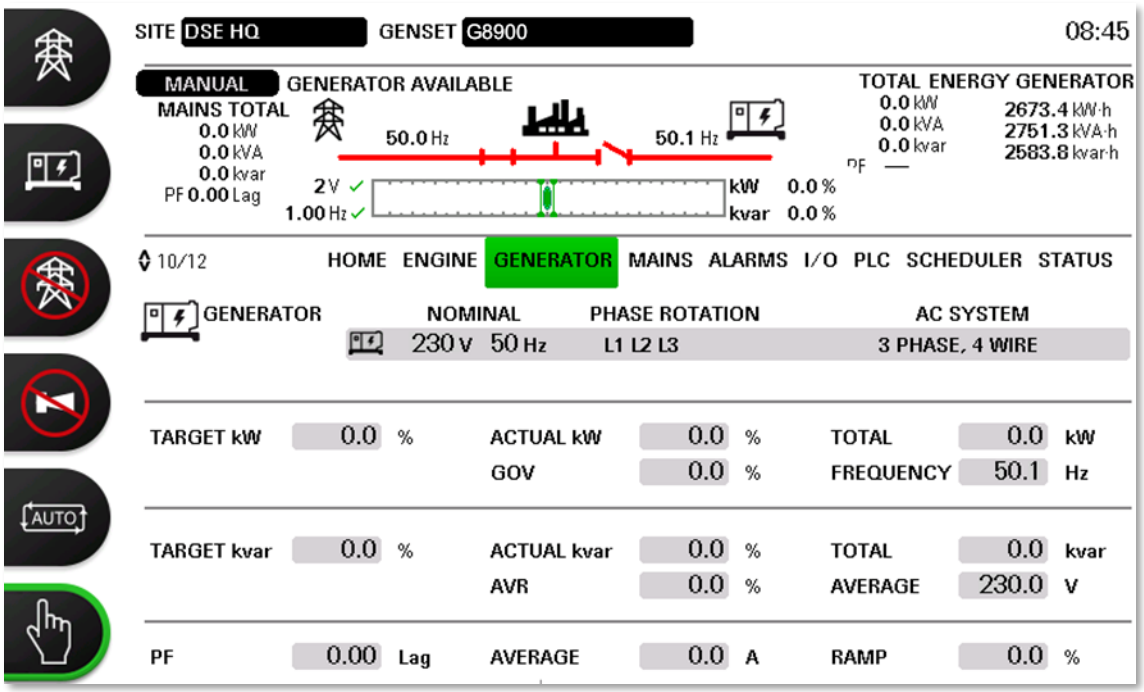
When the DSE module's synchroscope shows the two supplies in sync, if the voltage meter shows a voltage difference the breaker is wired incorrectly. This is shown in the example below.

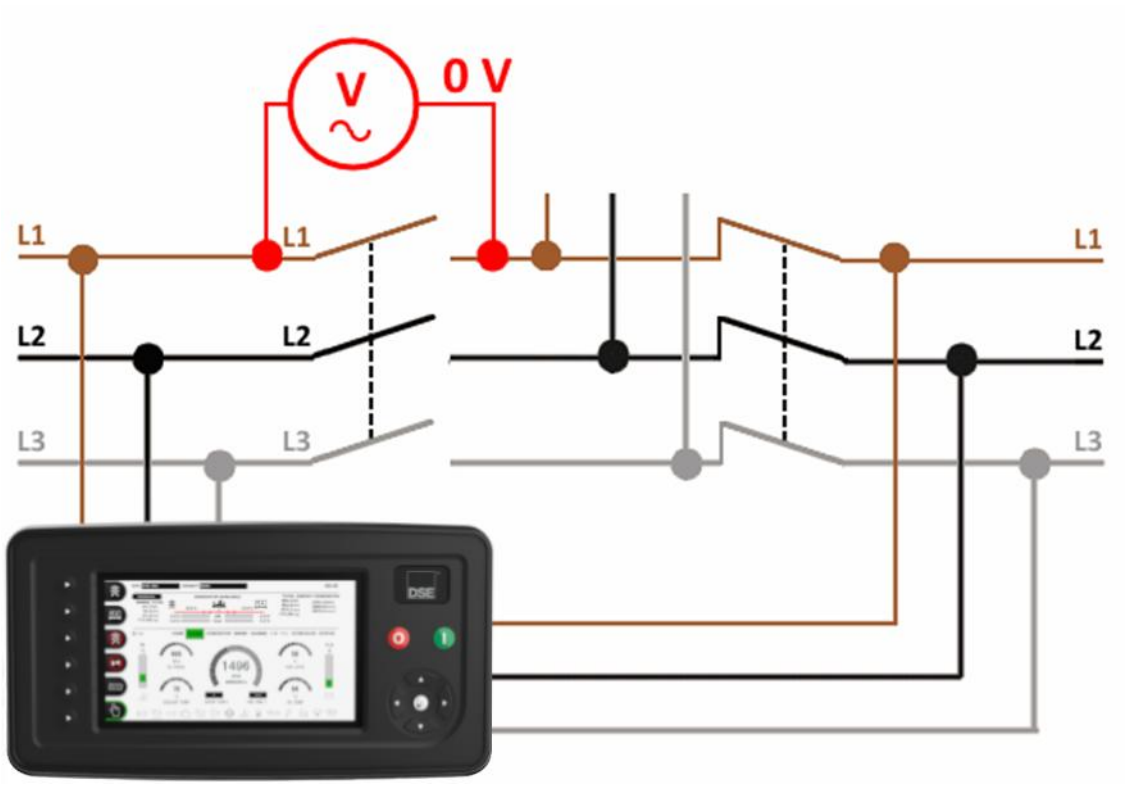




9.3.4.2 CORRECTLY WIRED BREAKER

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.





9.4 DSE STEPS TO SUCCESSFUL LOADSHARING

Synchronising and load sharing may seem complex at first glance, but they become straightforward when broken down into manageable steps. Before attempting parallel operation between generators or other power sources, it's **essential** to follow the *DSE Four Steps to Successful Synchronising* for each generator involved. These steps ensure safe and stable connection to the bus.

Once synchronising is complete, the next phase involves load sharing, the process of distributing electrical load evenly across all connected sources. The following section outlines the *DSE Steps to Successful Load Sharing*, providing guidance for setup, fault finding, and fine-tuning load sharing performance.

9.4.1 EXPECTED OPERATION

It is the job of the module to make precise changes to the amount of power supplied to the resistive element (*Active Power (kW)*) and capacitive/inductive element (*Reactive Power (kvar)*) from the generator when in parallel with the mains. The module controls the generator to produce the required amount of power depending on the configured *Mode* and *Load Levels* as set in the *SCADA* | *Generator* | *Load Levels* section of the DSE Configuration Suite Software. This process is displayed on the module's *Commissioning Screen,* found at the bottom of the *Generator* section of the module's display.

9.4.1.1 MAINS MODE

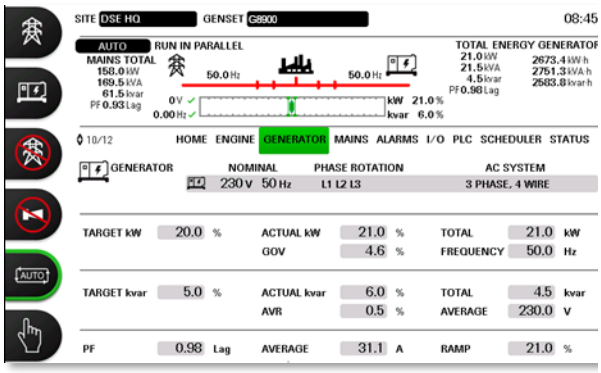
In this mode, the generator is used to provide a variable amount of active power (kW) and reactive power (kvar), to maintain the mains import/export levels at the configured *Load Levels* values. The generator starts when the active power (kW) taken from the mains exceeds the *kW Maximum Level* and a digital input configured for *Remote Start on Load* is active.

In the example below, the *kW Maximum Level* has been configured at 80 % and the *kvar Maximum Level* has been configured at 42 %. Hence, the value of the mains target kW is 80% and the value for the mains target kvar is 40%. As the active load (kW) has exceeded 80 % of the mains rating, the generator was started. Once in parallel, the module derives a generator target kW and kvar value. The generator target kW and kvar values vary depending on the actual load to ensure the Mains Actual kW and kvar values are held at the Mains Target kW and kvar values.

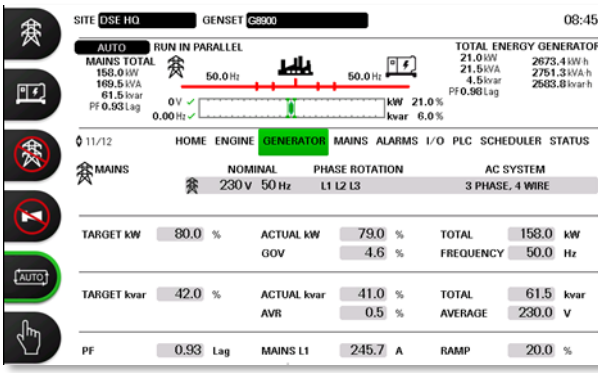
In a correctly commissioned system with a steady load, the actual kW/kvar percentage would be within ±1 % of the target kW/kvar percentage. The module achieves this by adjusting the *Gov* percentage to affect kW and the *AVR* percentage to affect kvar. Typical magnitudes of the *Gov* and *AVR* percentage at full load, with the switchgear closed and running in parallel are as follows:

- No more than 10% when there is no external droop enabled
- No more than 30% when external droop is enabled

Commissioning Screen 1 (Generator)



Commissioning Screen 2 (Mains)



If the generator target kW/kvar percentage is fluctuating due to a rapidly mains target kW/kvar percentage, it suggests that the *Mains Stability Timer* needs increasing to average out fluctuations in load.

If the generator actual kW/kvar percentage is not within ±1 % of the generator target kW/kvar percentage when they are not changing with a steady load, it suggests that the *Gain (P)* and *Stability (I)* settings need adjusting. Refer to section entitled *Adjusting Gain (P)* and *Stability (I)* for further details elsewhere in this document.

If the generator target kW/kvar percentage is changing rapidly with a steady load, repeat the *DSE 4 Steps to Successful Synchronising* as it suggests there is an issue with wiring of the CTs. Refer to the section entitled *DSE Four Steps to Successful Synchronising* elsewhere in this document.

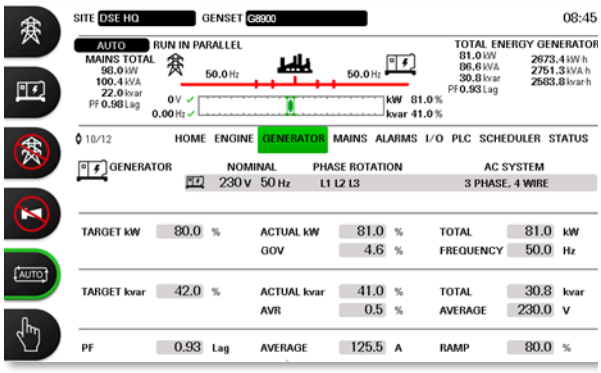
9.4.1.2 GENERATOR MODE

In this mode, the generator is used to provide a base amount of active power (kW) and reactive power (kvar) as configured by the *Load Levels* values. The generator starts when a digital input configured for *Remote Start on Load* is active.

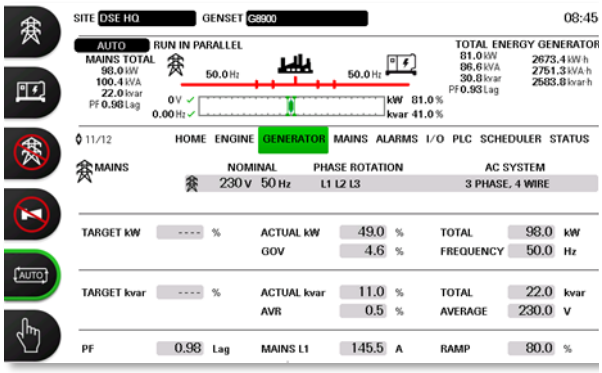
In the example below, the *kW Maximum Level* has been configured at 80 % and the *kvar Maximum Level* has been configured at 42 %. Hence, the value of the generator target kW is 80% and the value for the generator target kvar is 42%. As the module is in *Generator Mode,* the mains target kW, and mains target kvar are not applicable and appear as on the module's display.
The module then regulates its generator's kW and kvar production to match their respective target values. In a correctly commissioned system with a steady load, the actual kW/kvar percentage would be within ±1 % of the target kW/kvar percentage. The module achieves this by adjusting the *Gov* percentage to affect kW and the *AVR* percentage to affect kvar. Typical magnitudes of the *Gov* and *AVR* percentage at full load, with the switchgear closed and running in parallel are as follows:

- No more than 10% when there is no external droop enabled
- No more than 30% when external droop is enabled

Commissioning Screen 1 (Generator)



Commissioning Screen 2 (Mains)



If the actual kW/kvar percentage is not within ±1 % of the target kW/kvar percentage, and the target kW/kvar percentage is not changing with a steady load, it suggests that the *Gain (P)* and *Stability (I)* settings need adjusting. Refer to the section entitled *Adjusting Gain (P)* and *Stability (I)* elsewhere in this document.

If the actual kW/kvar percentage is changing rapidly with a steady load, repeat the *DSE Four Steps to Successful Synchronising* as it suggests there is an issue with wiring of the CTs. Refer to the section entitled *DSE Four Steps to Successful Synchronising* elsewhere in this document.

9.4.2 ADJUSTING GAIN (P) AND STABILITY (I)

9.4.2.1 INITIAL SETUP

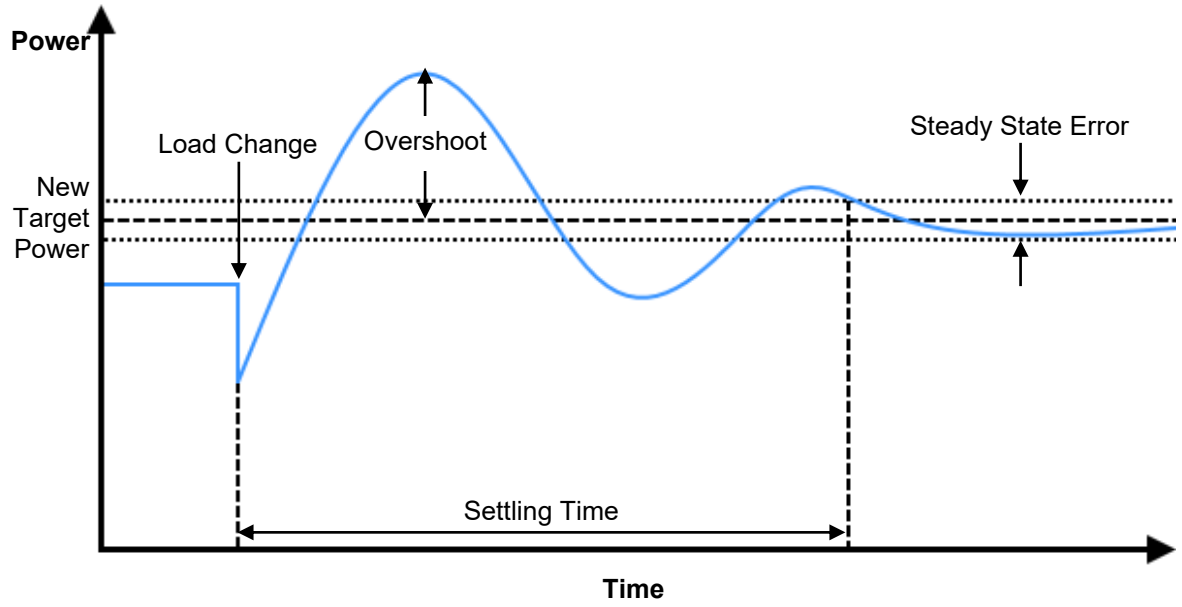
In most cases the DSE factory settings of 20% for *Gain (P)* and *Stability (I)* are suitable for most systems. This is because the DSE module's control is limited by the *Gain (P)* and *Stability (I)* settings of the engine's governor / alternator's AVR. Before adjusting the DSE module's settings, adjust the *Gain (P)* and *Stability (I)* settings of the engine's governor / alternator's AVR in accordance with the manufacturer's recommendations.

9.4.2.2 CALIBRATION

If the power control of the generator is not satisfactory after adjusting the *Gain (P)* and *Stability (I)* settings of the engine's governor / alternator's AVR, then start to adjust the DSE's settings by:

1. Starting with the *Gain (P)* and *Stability (I)* at 5 %. Place the generator in parallel with the mains.
2. Gradually increase the *Gain (P)* setting until the generator power production becomes unstable. Very slowly decrease the *Gain (P)* setting, until the power production stabilises. Reduce the setting further by approximately 10 %.
3. Gradually increase the *Stability (I)* setting until the generator power production becomes unstable. Very slowly decrease the *Stability (I)* setting, until the power production stabilises.
4. Attempt to 'knock' the governor actuator or change the 'slip frequency' setting to disturb the engine speed and force the controller into making further changes.

The affect the *Gain (P)* and *Stability (I)* settings have on the response of a load step being applied to the generator are shown below.



PID Adjustment	Overshoot	Settling Time	Steady State Error
Increase Gain (P)	Increases	Minimal Effect	Decreases
Increase Stability (I)	Increases	Increases	Eliminates

9.4.2.3 TROUBLESHOOTING

NOTE: An over damped response results in a slower control process. An under damped response (overshooting the target) leads to an unstable control process.
Either case leads to undesirable consequences such as overcurrent or reverse power, resulting in generator shutdown, and loss of supply to the load.

If the load is oscillating quickly between the generators it suggests that the setting for the *Gain (P)* on the generator(s) is too high or too low. A slow rolling oscillation usually indicates that the *Stability (I)* is too high or too low. These oscillations are caused by incorrect settings on the engine's governor / alternator's AVR and/or the DSE module.

10 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 distinctive features, always refer to the source of the module configuration if in doubt.

10.1 STARTING

Symptom	Possible Remedy
Unit is inoperative Read/Write configuration does not operate	Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse.
Unit shuts down	Check DC supply voltage is not above 35 Volts or below 5 Volts Check the operating temperature is not above 70°C. Check the DC fuse.
Fail to Start is activated after pre-set number of attempts to start	Check wiring of fuel solenoid. Check fuel. Check battery supply. Check battery supply is present on the Fuel output of the module. Check the speed-sensing signal is present on the module's inputs. Refer to engine manual.
Continuous starting of generator when in the ***Auto Mode*** AUTO	Check that there is no signal present on the *Remote Start* input. Check configured polarity is correct.
Generator fails to start on receipt of Remote Start signal.	Check Start Delay timer has timed out. Check signal is on *Remote Start* input. Confirm correct configuration of input is configured to be used as *Remote Start*. Check that the oil pressure switch or sensor is indicating low oil pressure to the controller. Depending upon configuration, the set does not start if oil pressure is not low.
Pre-heat inoperative	Check wiring to engine heater plugs. Check battery supply. Check battery supply is present on the Pre-heat output of module. Check pre-heat configuration is correct.
Starter motor inoperative	Check wiring to starter solenoid. Check battery supply. Check battery supply is present on the Starter output of module. Ensure oil pressure switch or sensor is indicating the "low oil pressure" state to the controller.

10.2 LOADING

Symptom	Possible Remedy
Engine runs but generator does not take load	Check Warm up timer has timed out. Ensure generator load inhibit signal is not present on the module inputs. Check connections to the switching device. Note that the set does not take load in ***Manual Mode*** MANUAL unless there is an active load signal.
Incorrect reading on Engine gauges Fail to stop alarm when engine is at rest	Check engine is operating correctly. Check that sensor is compatible with the module and that the module configuration is suited to the sensor.

10.3 ALARMS

Symptom	Possible Remedy
Oil pressure low fault operates after engine has fired	Check engine oil pressure. Check oil pressure switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e., Normally Open or Normally Closed) or that sensor is compatible with the module and is correctly configured.
Coolant temp high fault operates after engine has fired.	Check engine temperature. Check switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e., Normally Open or Normally Closed) or that sensor is compatible with the module.
Shutdown fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Electrical Trip fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Warning fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
ECU Amber ECU Red	This indicates a fault condition detected by the engine ECU and transmitted to the DSE controller.
ECU Data Fail	Indicates failure of the CAN data link to the engine ECU. Check all wiring and termination resistors (if required).
Incorrect reading on Engine gauges Fail to stop alarm when engine is at rest	Check engine is operating correctly. Check sensor and wiring paying particular attention to the wiring to terminal 14. Check that sensor is compatible with the module and that the module configuration is suited to the sensor.

10.4 COMMUNICATIONS

Symptom	Possible Remedy
ECU Data Fail	Indicates failure of the CAN data link to the engine ECU. Check all wiring and termination resistors (if required).

10.5 INSTRUMENTS

Symptom	Possible Remedy
Inaccurate generator measurements on controller display	Check that the CT primary, CT secondary and VT ratio settings are correct for the application. Check that the CTs are wired correctly with regards to the direction of current flow (p1,p2 and s1,s2) and additionally ensure that CTs are connected to the correct phase (errors occur if CT1 is connected to phase 2). Remember to consider the power factor (kW = kVA x power factor). The controller is true RMS measuring so gives more accurate display when compared with an ‘averaging’ meter such as an analogue panel meter or some lower specified digital multimeter. Accuracy of the controller is better than 1% of full scale. Generator voltage full scale is 415 V ph-N, accuracy is ±4.15 V (1 % of 415 V).

10.6 SYNCHRONISING & LOAD SHARING

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

10.7 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 module is in Stop Mode prior to writing back any configuration. When editing a configuration using the fascia editor, be sure to press the ***Tick*** ✓ button to save the change before moving to another item or exiting the fascia editor

11 CAN INTERFACE SPECIFICATION (J1939-75)

The ECU port is used for live operational communications between the DSE module and other CAN enabled devices. The specification below details all broadcast messages which are transmitted when the J1939-75 is enabled, and the relevant engine file is selected.

Parameter	Description
Protocol	S.A.E. J1939 with PGNs as listed in the following subsections.
Bit Rate	250 kb/s
Isolation	±2.5 kVrms
Termination	120 Ω termination resistor, with the option for switchable resistor by software.

11.1 BROADCAST MESSAGES J1939-75

NOTE: All broadcast CAN messages are priority 3 by default, it is not possible to change the priority of the configurable CAN messages. For further details of module configuration, refer to DSE Publication: *057-340 DSEG8900 Configuration Suite PC Software Manual.*

NOTE: SPNs that are not implemented in the module have all bits set to '1'.

NOTE: *PDU Format* and *PDU Specific* are shown in Hexadecimal.

NOTE: Values larger than 8 bits utilise *Little-Endian* format. For example, a 16-bit value, occupying two Bytes has Byte1 as the most significant Byte and Byte2 as the least significant Byte.

Parameter Groups below are broadcast by the module and are detailed in the following subsections.

11.1.1 ACS - AC SWITCHING DEVICE STATUS

PGN 64913

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	91	8	250 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0DD9	3545	Generator Breaker Status - This parameter indicates the measured state of the generator circuit breaker	Byte 1 Bits 1 to 3	***000:*** Open ***001:*** Closed ***010:*** Locked Out ***011-101:*** Available for SAE assignment ***110:*** Error ***111:*** Not available	0	N/A
0DDA	3546	Utility Circuit Breaker Status - This parameter indicates the measured state of the utility circuit breaker.	Byte 1 Bits 4 to 6	***000:*** Open ***001:*** Closed ***010:*** Locked Out ***011-101:*** Available for SAE assignment ***110:*** Error ***111:*** Not available	0	N/A

11.1.2 GC1 - GENERATOR CONTROL 1

PGN 64915

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	93	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0DEF	3567	Generator Control Not In Automatic Start State - This parameter indicates whether the generator set is in a condition to automatically start up and provide power. If not, this status parameter is in the ACTIVE state.	Byte 1 Bits 4 to 5	***00:*** Inactive (ready to start automatically) ***01:*** Active (not ready to start automatically) ***10:*** Error ***11:*** Not available	0	N/A

11.1.3 GAAC - GENERATOR AVERAGE BASIC AC QUANTITIES

PGN 65030

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	06	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0988	2440	Generator Avg. L-L AC Voltage	Byte 1 to 2	1	0	V
098C	2444	Generator Avg. L-N AC Voltage	Byte 3 to 4	1	0	V
0984	2626	Generator Avg. AC Frequency	Byte 5 to 6	1/128 Hz/bit	0	Hz
0990	2448	Generator Avg. AC RMS Current	Byte 7 to 8	1	0	A

11.1.4 GPAAC - GENERATOR PHASE A BASIC AC QUANTITIES

PGN 65027

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	03	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0985	2627	Generator Phase A AC Frequency	Byte 5 to 6	128	0	V
0989	2441	Generator Phase A Line AC RMS Voltage	Byte 1 to 2	1	0	V
098D	2445	Generator Phase A Line Neutral AC RMS Voltage	Byte 3 to 4	1	0	A
0991	2449	Generator Phase A AC RMS Current	Byte 7 to 8	1	0	Hz

11.1.5 GPAACP - GENERATOR PHASE A AC POWER

PGN 65026

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	02	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0993	2453	Generator Phase A Real Power	Byte 1 to 4	1	$-2*10^9$	W
099D	2461	Generator Phase A Apparent Power	Byte 5 to 8	1	$-2*10^9$	W

11.1.6 GPAACR - GENERATOR PHASE A AC REACTIVE POWER

PGN 65025

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	00	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0999	2457	Generator Phase A Reactive Power	Byte 1 to 4	1	$-2*10^9$	var

11.1.7 GPBAC - GENERATOR PHASE B BASIC AC QUANTITIES

PGN 65024

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	00	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0986	2628	Generator Phase B AC Frequency	Byte 5 to 6	0.0078125	0	Hz
098A	2442	Generator Phase B Line AC RMS Voltage	Byte 1 to 2	1	0	V
098E	2446	Generator Phase B Line Neutral AC RMS Voltage	Byte 3 to 4	1	0	V
0992	2450	Generator Phase B AC RMS Current	Byte 7 to 8	1	0	A

11.1.8 GPBACP - GENERATOR PHASE B AC POWER

PGN 65023

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	FF	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0996	2454	Generator Phase B Real Power	Byte 1 to 4	1	$-2*10^9$	W
099E	2462	Generator Phase B Apparent Power	Byte 5 to 8	1	$-2*10^9$	W

11.1.9 GPBACR - GENERATOR PHASE B AC REACTIVE POWER

PGN 65022

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	FE	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
099A	2458	Generator Phase B Reactive Power	Byte 1 to 4	1	$-2*10^9$	var

11.1.10 GPCAC - GENERATOR PHASE C BASIC AC QUANTITIES

PGN 65021

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	FD	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0987	2629	Generator Phase C AC Frequency	Byte 5 to 6	0.0078125	0	Hz
098B	2443	Generator Phase C Line AC RMS Voltage	Byte 1 to 2	1	0	V
098F	2447	Generator Phase C Line Neutral AC RMS Voltage	Byte 3 to 4	1	0	V
0993	2451	Generator Phase C AC RMS Current	Byte 7 to 8	1	0	A

11.1.11 GPCACP - GENERATOR PHASE C AC POWER

PGN65020

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	FF	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0997	2455	Generator Phase C Real Power	Byte 1 to 4	1	$-2*10^9$	W
099F	2463	Generator Phase C Apparent Power	Byte 5 to 8	1	$-2*10^9$	W

11.1.12 GPCACR - GENERATOR PHASE C AC REACTIVE POWER

PGN 65019

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	FB	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
099B	2459	Generator Phase C Reactive Power	Byte 1 to 4	1	$-2*10^9$	var

11.1.13 GTACPP - GENERATOR TOTAL AC PERCENT POWER

PGN 64911

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	8F	8	250 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0E06	3590	Generator Total Percent kW as a percentage of rated power	Byte 1 to 2	0.0078125	-251	%

11.1.14 GTACE - GENERATOR TOTAL KW HOURS EXPORT

PGN 65018

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	FA	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
09A4	2468	Generator Total kW Hours Export	Byte 1 to 4	1	0	kWh

11.1.15 GTACER - GENERATOR TOTAL AC REACTIVE ENERGY

PGN64910

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	8E	8	250 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0E09	3593	Generator Total kVAr Hours Export	Byte 1 to 4	1	0	kvarh

11.1.16 GTACP - GENERATOR TOTAL AC POWER

PGN65029

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	05	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0994	2452	Generator Total Real Power	Byte 1 to 4	1	$-2*10^9$	W
099C	2460	Generator Total Apparent Power	Byte 5 to 8	1	$-2*10^9$	VA

11.1.17 GTACR - GENERATOR TOTAL AC REACTIVE POWER

PGN65028

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	04	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0988	2456	Generator Total Reactive Power	Byte 1 to 4	1	$-2*10^9$	var
09A0	2464	Generator Overall Power Factor	Byte 5 to 6	-1	$6.103515625*10^{-5}$	pF
09D6	2518	Generator Overall Power Factor Lagging	Byte 7 to 8	1	0	+/-

11.2 BROADCAST MESSAGES ENGINE INSTRUMENTATION

NOTE: The availability of the Engine Instrumentation PGNs are dependent upon the engine file selected within the DSE module's configuration. Contact DSE technical support: support@deepseaelectronics.com for more information.

11.2.1 DD - DASH DISPLAY

PGN 65276

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	FC	8	1000 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
060	96	Ratio of volume of fuel to the total volume of fuel storage container.	Byte 2	0.4	0	%

11.2.2 EC2 - ENGINE CONFIGURATION 2

PGN64895

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	7F	8	Request

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0E56	3670	Maximum Crank Attempts per Start Attempt	Byte 1	1	0	N/A

11.2.3 EEC1- ENGINE SPEED

PGN61444

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	F0	04	8	100 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0BE	190	Engine Speed	Byte 4 to 5	0.125	0	RPM

11.2.4 EEC4 - CRANK ATTEMPT COUNT ON PRESENT START ATTEMPT

PGN65214

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	FB	8	Request

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0E57	3671	Crank Attempt Count on Present Start Attempt	Byte 6	1	0	N/A

11.2.5 EFL_P1 - OIL PRESSURE

PGN65263

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	EF	8	500 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
064	100	Oil Pressure	Byte 4	4	0	kPa

11.2.6 EOI - EMERGENCY STOP

PGN64914

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FD	92	8	250 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0E17	3607	Emergency Stop ***00:*** Off (No Shutdown Requested) ***01:*** On (Shutdown Requested) ***10:*** Reserved ***11:*** Don't care / take no action	Byte 6 Bit 6 to 8	1	0	N/A

11.2.7 ET1 - COOLANT TEMPERATURE

PGN65262

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	EE	8	1000 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
06E	110	Engine Coolant Temperature	Byte 1	1	-40	°C

11.2.8 HOURS - ENGINE HOURS REVOLUTIONS

PGN65253

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	E5	8	Request

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0F7	247	Engine Total Hours of Operation	Byte 1 to 4	0.05	0	hr

11.2.9 VEP1 - VEHICLE ELECTRICAL POWER

PGN65271

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
3	0	0	FE	F7	8	1000 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
0A7	167	Charge Alternator Voltage	Byte 3 to 4	0.05	0	V
0A8	168	Plant Battery Voltage	Byte 5 to 6	0.05	0	V

11.2.10 DM01 - CONDITIONS ACTIVE DIAGNOSTIC TROUBLE CODES

NOTE: The availability of the Engine Alarm SPN and FMI is dependent upon the engine file selected within the DSE module's configuration. Contact DSE technical support: support@deepseaelectronics.com for more information.

NOTE: If only one DM1 alarm is active the DM1 priority will remain as six. If two or more DM1 alarms are active the priority will be seven.

PGN65226

Priority	Ext Data Page	Data Page	PDU Format	PDU Specific	Size (Bytes)	Rate
6/7	0	0	FE	CA	8	1000 ms

SPN Hex	SPN Decimal	Instrument	Byte / Bit	Scaling	Offset	Units
04BE	1214	Suspect Parameter Number	Byte 3 Bits 1 to 19	1	0	N/A
04BF	1215	Failure Mode Identifier	Byte 5 Bits 1 to 5	1	0	N/A
06AA	1706	SPN Conversion Method	Byte 6 Bit 7	1	0	N/A

DM1 Conditions

Key	Value
Low Fault - Least Severe	17
High Fault - Least Severe	15
Low Fault - Most Severe	1
High Fault - Most Severe	0
Erratic - Incorrect Data	2

Generator Alarm Condition	SPN	Warning FMI	Shutdown FMI
Generator Average AC Frequency Under	2626	17	1
SPN Generator Average Line-Line AC RMS Voltage Over	2626	15	0
Generator Average Line-Line AC RMS Voltage Under	2440	17	1
Generator Average Line-Line AC RMS Voltage Over	2440	15	0
Generator Average Line-Neutral AC RMS Voltage Under	2444	17	1
Generator Average Line-Neutral AC RMS Voltage Over	2444	15	0
Generator Average AC RMS Current Over	2448	15	0

Engine Alarm Condition	SPN	Warning FMI	Shutdown FMI
Fuel Level Low	96	17	1
Oil Pressure Low (Analogue Sensor)	100	17	1
Oil Pressure Low (Digital Input)	100	17	1
Oil Pressure Sensor Fault	100	2	2
Coolant Temperature High (Analogue Sensor)	110	15	0
Coolant Temperature High (Digital Input)	110	15	0
Coolant Temperature Sensor Fault	110	2	2
Charge Alternator Failed	167	17	1
Plant Battery Voltage High	168	15	0
Plant Battery Voltage Low	168	17	1
Overspeed	190	15	0
Underspeed	190	17	1

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).

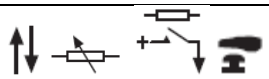
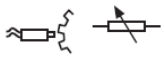
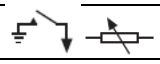
12.1 PURCHASING ADDITIONAL CONNECTOR PLUGS FROM DSE

If additional plugs are required, contact our Sales department using the part numbers below.

12.1.1 PACK OF PLUGS

Module Type	Plug Pack Part Number
DSEG8900	007-1081

12.1.2 INDIVIDUAL PLUGS

Module Terminal Designation	Plug Description	Part No.
1 to 12 	8-way 5.08 mm	007-164
13 to 31  **D+W/L**	9-way 5.08 mm	007-167
15 to 25 	8-way 5.08 mm	007-164
20 to 80 **CAN 1 to CAN 4**	12-way 5.08 mm	007-109
35 to 39 **AVR GOV**	5-way 5.08 mm	007-445
40-44 **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

12.2 PURCHASING ADDITIONAL FIXING CLIPS FROM DSE

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

12.3 DSENET® EXPANSION MODULES

NOTE: A maximum of twenty (20) expansion modules may be connected to the DSEG8500 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 V to 10 V and 4 mA to 20 mA 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 V to 10 V and 4 mA to 20 mA 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
	4	Model DSE2160 Input and Output Expansion Module provides 8 Digital Input/Outputs, 6 Digital Inputs and 2 Analogue inputs.	2160-01	057-361	053-268
	4	Model DSE2170 RTD/Thermocouple Input & Analogue Output Expansion Module provides 4 Analogue Outputs and 4 inputs for Thermocouples and RTDs	2170-01	057-362	053-269

Continued overleaf…

Item	Max No. Supported	Description	DSE Part Numbers		
			Model Order Number	Operator Manual	Installation Instructions
	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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