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DSE8721
Colour Remote Display Module

Document number 057-126

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DSE Model 8721 series Control and Instrumentation System Operators Manual

Amendments since last publication

Issue no.	Comments
1	First Release
2	Added 8760 information
3	Added ROCOF & Vector shift and page numbering.
3.1	Changed test on load function

Clarification of notation used within this publication.

NOTE:	Highlights an essential element of a procedure to ensure correctness.
CAUTION!	Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.
WARNING!	Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.

TABLE OF CONTENTS

Section Page

1 BIBLIOGRAPHY

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

1.1 INSTALLATION INSTRUCTIONS

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

DSE PART	DESCRIPTION
053-072	DSE8721 Installation Instructions
053-073	DSE8710 Installation Instructions
053-032	DSE2548 LED Expansion Annunciator Installation Instructions
053-033	DSE2130 Input Expansion Installation Instructions
053-034	DSE2157 Output Expansion Installation Instructions

1.2 TRAINING GUIDES

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

DSE PART	DESCRIPTION
056-001	Four Steps to Successful Synchronising
056-005	Using CTs With DSE Products
056-010	Overcurrent Protection
056-011	MSC Link
056-013	Load Demand Scheme
056-022	Breaker Control
056-018	Negative Phase Sequence
056-019	Earth Fault Protection
056-020	Loss of Excitation
056-021	Mains Decoupling
056-022	Breaker Control
056-024	GSM Modem
056-026	kW and kVAr
056-029	Smoke Limiting
056-030	Module PIN Codes
056-033	Synchronising Requirements
056-036	DSE Modules Expansion
056-043	Sync Process
056-057	SW1 and SW2

1.3 MANUALS

DSE PART	DESCRIPTION
057-004	Electronic Engines And DSE Wiring Manual
057-045	Synchronising and Load Sharing Part 1
057-046	Synchronising and Load Sharing Part 2
057-047	Load Share Design and Commissioning
057-082	DSE2130 Input Expansion Manual
057-083	DSE2157 Output Expansion Manual
057-084	DSE2548 Annunciator Expansion Manual
057-124	DSE8710 Controller Manual
057-127	DSE8700 Series Configuration Software Manual

2 INTRODUCTION

This document details the installation and operation requirements of the DSE8721 series display modules, part of the DSEPower® range of products.
The manual forms part of the product and should be kept for the entire life of the product. If the product is passed or supplied to another party, ensure that this document is passed to them for reference purposes.
This is not a *controlled document.* You will not be automatically informed of updates. Any future updates of this document will be included on the DSE website at www.deepseaplc.com

DSE8721 display module is used in conjunction with DSE8700 controller. The DSE8721 display is NOT a standalone module.

The **DSE8700 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 **DSE8700 series** module has been designed to allow the operator to start and stop the generator, and if required, transfer the load to the generator either manually (via fascia mounted push buttons) or automatically.

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

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

The **DSE8700** module monitors the engine, indicating the operational status and fault conditions, automatically shutting down the engine and giving a true first up fault condition of an engine failure by a COMMON AUDIBLE ALARM. The LCD display indicates the fault.

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

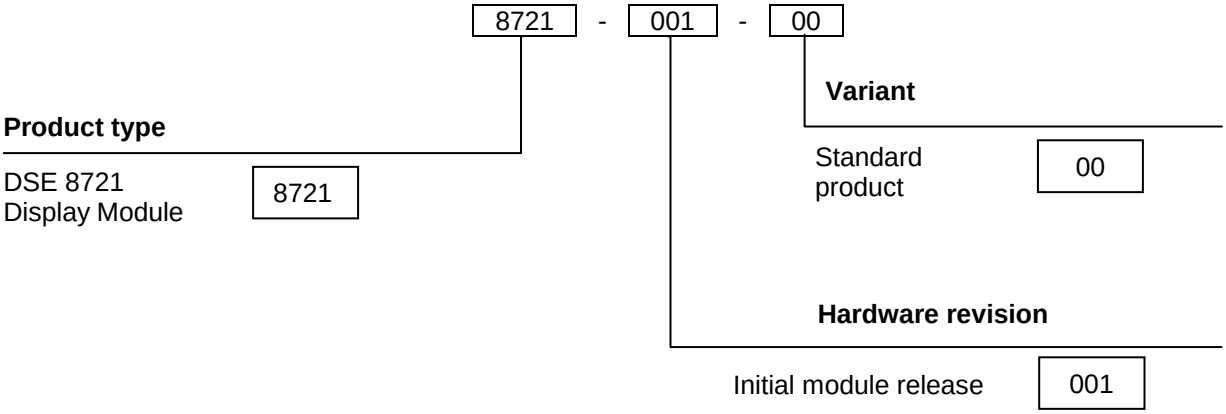
- *Text and image based colour 7” TFT LCD display (800 x 480 pixels)*
- ***True RMS** Voltage, Current and Power monitoring.*
- *Engine parameter monitoring.*
- *Fully configurable inputs for use as alarms or a range of different functions.*
- *Engine ECU interface to **electronic engines**.*
- *Direct connection to governor / AVR for synchronising and load sharing*
- *R.O.C.O.F. and Vector shift for detection of mains failure when in parallel with the mains supply.*

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

Additionally, the module’s integral fascia configuration editor allows adjustment of a subset of this information.
A robust plastic case designed for front panel mounting houses the module. Connections are via locking plug and sockets.

3 SPECIFICATIONS

3.1 PART NUMBERING



At the time of this document production, there are no variants of this product.

3.1.1 SHORT NAMES

Short name	Description
DSE8700, DSE87xx	All modules in the DSE8700 Series

3.2 TERMINAL SPECIFICATION

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

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

3.3 POWER SUPPLY REQUIREMENTS

Minimum supply voltage	8V continuous
Cranking dropouts	Able to survive 0V for 50mS providing the supply was at least 10V before the dropout and recovers to 5V afterwards. This is more than sufficient to allow the module to operate during engine cranking where the battery supply often falls as low as 4V (on a 12V system!) This is achieved without the need for internal batteries or other external requirements.
Maximum supply voltage	35V continuous (60V protection for surges)
Reverse polarity protection	-35V continuous
Maximum operating / standby current	150mA at 24V 300mA at 12V

Plant supply instrumentation display

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

3.4 COMMUNICATION PORTS

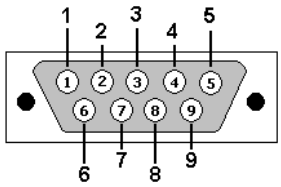
RS232 Serial port	Non – Isolated port Max Baud rate 115K baud subject to S/W TX, RX, RTS, CTS, DSR, DTR, DCD Male 9 way D type connector Max distance 15m (50 feet)
RS485 Serial port	Isolated Data connection 2 wire + common Half Duplex Data direction control for Transmit (by s/w protocol) Max Baud Rate 115K External termination required (120Ω) Max common mode offset 70V (on board protection transorb) Max distance 1.2km (¾ mile)

3.5 COMMUNICATION PORT USAGE

3.5.1 RS232 CONNECTION

Used for connecting the 8721 display to the host controller.

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



View looking into the male connector on the 8721 series module

3.5.2 RS485 CONNECTION

Used for connecting the 8721 display to the host controller.

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

3.5.3 USB CONNECTIONS

Reserved for future use. Currently fitted to the controller but not used.
User applicable firmware update file will be made available in the future to activate these ports.

3.5.4 ETHERNET CONNECTION

Reserved for future use. Currently fitted to the controller but not used.
User applicable firmware update file will be made available in the future to activate this port.

3.6 SOUNDER

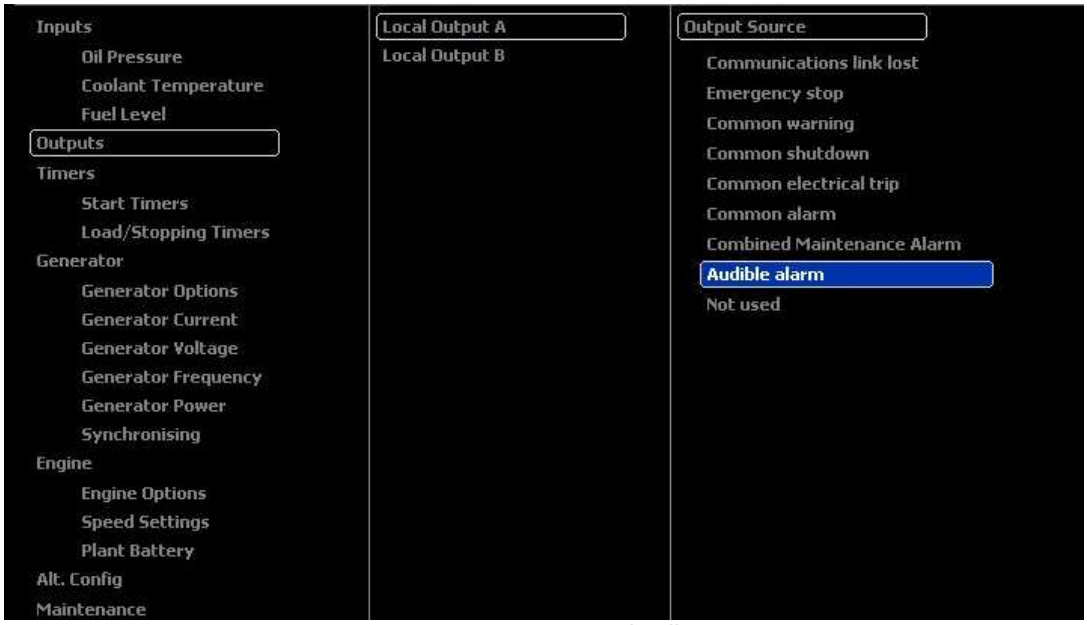
DSE8721 module features an internal sounder to draw attention to warning, shutdown and electrical trip alarms.

Sounder level	64db @ 1m

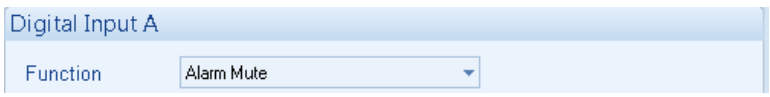
3.6.1 ADDING AN EXTERNAL SOUNDER TO THE APPLICATION

Should an external alarm or indicator be required, this can be achieved by using the DSE8721 front panel editor to configure an auxiliary output for “Audible Alarm”, and by using the DSE Configuration Suite, configure an auxiliary input for “Alarm Mute” (if required).
The audible alarm output activates and de-activates at the same time as the module’s internal sounder. The Alarm mute input and internal alarm mute button activate ‘in parallel’ with each other. Either signal will mute both the internal sounder and audible alarm output.

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



DSE8721 Front Panel Editor



DSE Config Suite Input selections

3.7 DIMENSIONS AND MOUNTING

3.7.1 DIMENSIONS

310mm x 160mm x 40mm (12.2” x 6.3” x 1.6”)

PANEL CUTOUT

282mm x 134mm (11.1”” x 5.3”)

WEIGHT

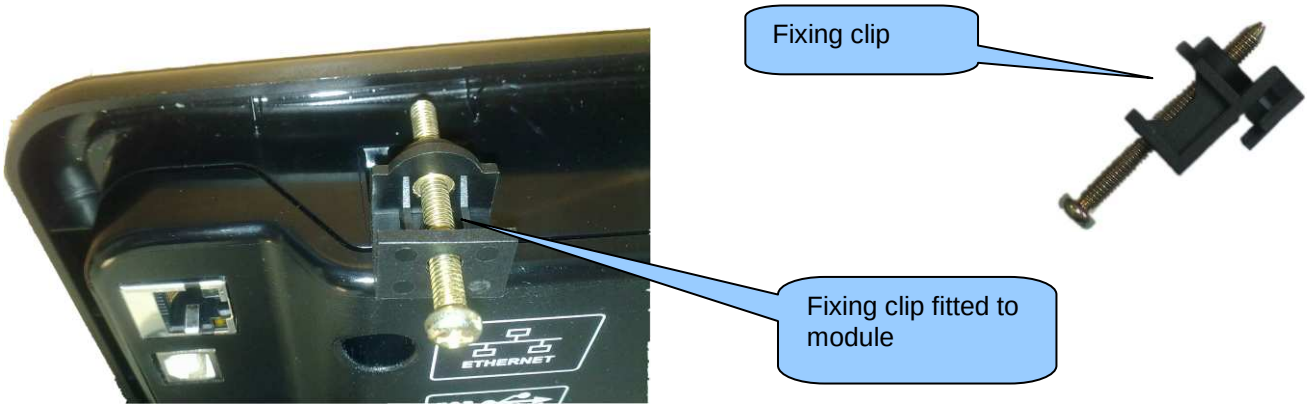
0.8kg (1.76lb)

3.7.2 FIXING CLIPS

Supplied fixing clips hold the module into the panel fascia.

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 8721 series module case.
- Pull the fixing clip backwards (towards the back of the module) ensuring all three prongs of the clip are inside their allotted slots.
- Turn the fixing clip screws clockwise until they make contact with the panel fascia.
- Turn the screws a little more to secure the module into the panel fascia. Take care not to over tighten the fixing clip screws.



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

3.7.3 SILICON SEALING GASKET

The supplied silicon gasket provides improved sealing between the 8721 display module and the panel fascia.
The gasket is fitted to the module before installation into the panel fascia.
Take care to ensure the gasket is correctly fitted to the module to maintain the integrity of the seal.

3.8 APPLICABLE STANDARDS

BS 4884-1	This document conforms to BS4884-1 1992 Specification for presentation of essential information.
BS 4884-2	This document conforms to BS4884-2 1993 Guide to content
BS 4884-3	This document conforms to BS4884-3 1993 Guide to presentation
BS EN 60068-2-1 (Minimum temperature)	-30°C (-22°F)
BS EN 60068-2-2 (Maximum temperature)	+70°C (158°F)
Vibration	2g, 10-500Hz, amplitude 0.15mm, 6g
Mechanical Shock	26 drops (6 sides, 8 corners, 12 edges) onto a concrete floor from 300mm.
Humidity	93%, relative, non-condensing.
Chemical resistance	Resistant to automotive and industrial chemicals and fluids.
Ingress protection	
BS EN 60950	Safety of information technology equipment, including electrical business equipment The unit is designed to comply with European directive 72/23/EEC by complying with harmonised European safety standard BS EN 60950
BS EN 61000-6-2 **BS EN 61000-6-4**	The unit is designed to comply with European directive 2004/108/EEC by complying with harmonised European standards EN 61000-6-2 (Generic Immunity) and EN 61000-6-4 EMC (Generic Emissions).
BS EN 60529 (Degrees of protection provided by enclosures) (see overleaf)	IP65 (front of module when installed into the control panel with the supplied sealing gasket) IP42 (front of module when installed into the control panel WITHOUT being sealed to the panel)
UL NEMA rating (Approximate) (see overleaf)	UL approval to FTPM2 with enclosure type 1
Harmonic Distortion immunity	Resistant to typical levels prevalent in UPS, Inverter Drives, VSD's etc. in accordance with EWI/26.
IEEE C37.2 (Standard Electrical Power System Device Function Numbers and Contact Designations)	8721 is a display module only. For IEEE C37.2 designation of the host controller, see the relevant operator manual.

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

3.8.1 ENCLOSURE CLASSIFICATIONS

IP CLASSIFICATIONS

8721 series specification under BS EN 60529 Degrees of protection provided by enclosures

IP65 (Front of module when module is installed into the control panel with the optional sealing gasket).
IP42 (front of module when module is installed into the control panel WITHOUT being sealed to the panel)

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

NEMA CLASSIFICATIONS

8721 series NEMA Rating (Approximate)

12 (Front of module when module is installed into the control panel with the optional sealing gasket).
2 (front of module when module is installed into the control panel WITHOUT being sealed to the panel)

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

1 **IP30**	Provides a degree of protection against contact with the enclosure equipment and against a limited amount of falling dirt.
2 **IP31**	Provides a degree of protection against limited amounts of falling water and dirt.
3 **IP64**	Provides a degree of protection against windblown dust, rain and sleet; undamaged by the formation of ice on the enclosure.
3R **IP32**	Provides a degree of protection against rain and sleet:; undamaged by the formation of ice on the enclosure.
4 (X) **IP66**	Provides a degree of protection against splashing water, windblown dust and rain, hose directed water; undamaged by the formation of ice on the enclosure. (Resist corrosion).
12/12K **IP65**	Provides a degree of protection against dust, falling dirt and dripping non corrosive liquids.
13 **IP65**	Provides a degree of protection against dust and spraying of water, oil and non corrosive coolants.

4 INSTALLATION

The DSE8721 display module is designed to be mounted on the panel fascia. For dimension and mounting details, see the section entitled *Specification, Dimension and mounting* elsewhere in this document.

NOTE: USB and Ethernet sockets are reserved for future use. They are currently fitted to the controller but not used. User applicable firmware update file will be made available in the future to activate these ports.

4.1 CONNECTIONS

4.1.1 SUPPLY AND OUTPUTS

	Pin	Description	Recommended Cable size	Notes
	1	Plant Supply negative	1.0mm² AWG 18	
	2	Plant Supply positive	1.0mm² AWG 18	(Recommended Maximum Fuse 5A anti-surge) Supplies the module (2A anti-surge requirement) and Outputs C & D
	3	FET Output C	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.
	4	FET Output D	1.0mm² AWG 18	Plant Supply Positive from terminal 2. 3 Amp rated.

4.1.2 RS485

Use either RS485 OR RS232 to connect the DSE8721 display to the host controller.
RS485 is suited to longer distances. Max 1.2km (1600yds) when using recommended cable type Belden 9841 (DSE part 016-030)

Pin	Description	Notes
A	RS485 A	Use Screened Twisted Pair cable suitable for RS485 use. 120Ω termination resistors must be fitted at each end of the connection.
B	RS485 B	
SCR	RS485 Screen	

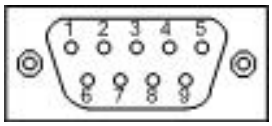
4.1.3 RS232

Use either RS485 OR RS232 to connect the DSE8721 display to the host controller.
RS232 is suited to shorter distances and where a single point to point connection is required. Max 15m (15yds).

The 9 pin D connector on the DSE8721 is DTE (Data Terminal Equipment).
For connection to the DSE8700 (also DTE) use 'null modem' cable (crossover).

Description	Notes
RS232	9 way, D connector. To connect to DSE8710 controller, use NULL modem cable (crossover),

Null modem cabling	9 Pin A	9 Pin B
FG (Frame Ground)	-	-
TD (Transmit Data)	3	2
RD (Receive Data)	2	3
RTS (Request To Send)	7	8
CTS (Clear To Send)	8	7
SG (Signal Ground)	5	5
DSR (Data Set Ready)	6	4
DTR (Data Terminal Ready)	4	6

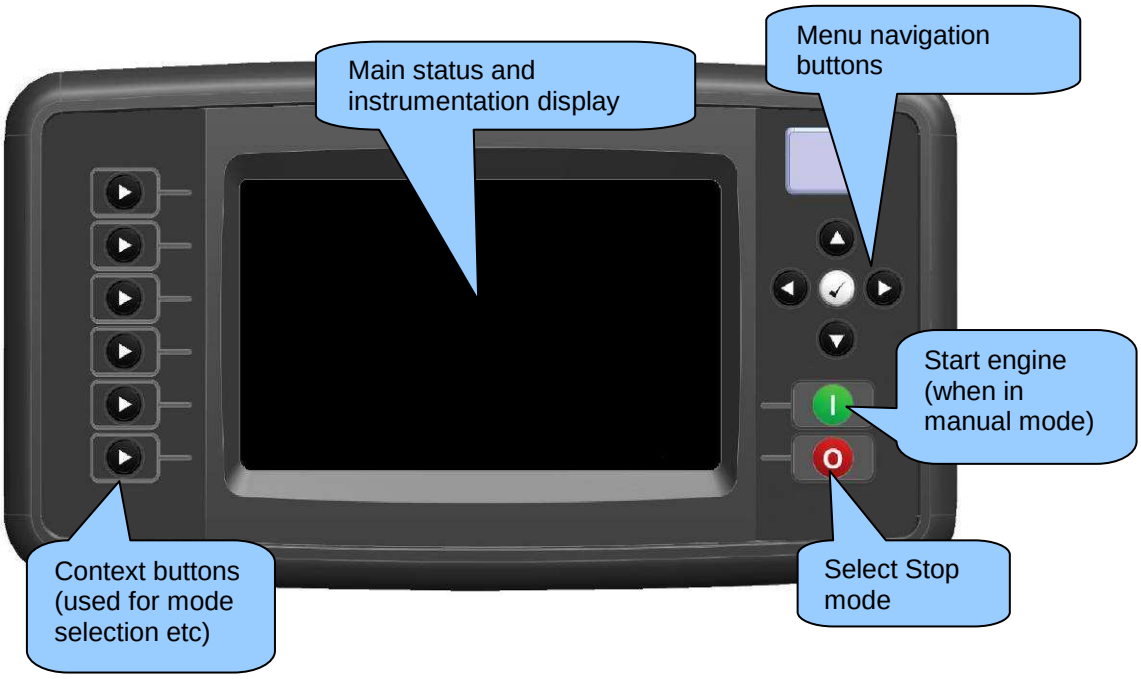


4.2 DESCRIPTION OF CONTROLS

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

4.3 DSE8721 AUTOSTART CONTROL MODULE

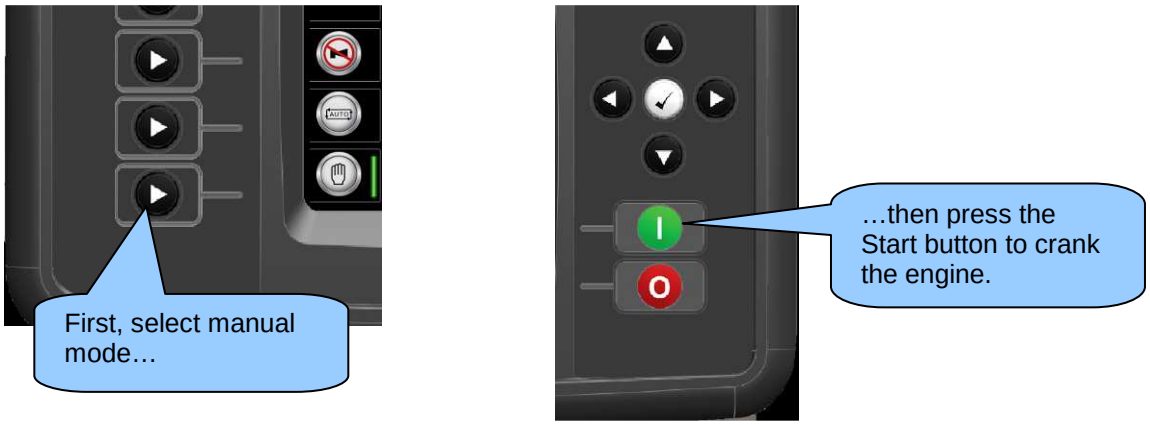
Together with the start and stop button, the six buttons to the left of the screen are used to provide control of the attached 8700 unit. The four directional buttons and the tick button are used to navigate the 8721 user interface. The display is a 7" TFT with 800x480 pixels.



4.4 QUICKSTART GUIDE

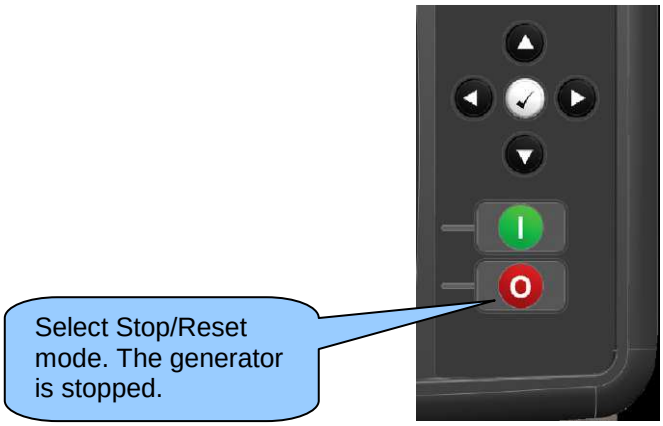
This section provides a quick start guide to the module's operation.

4.4.1 STARTING THE ENGINE



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

4.4.2 STOPPING THE ENGINE



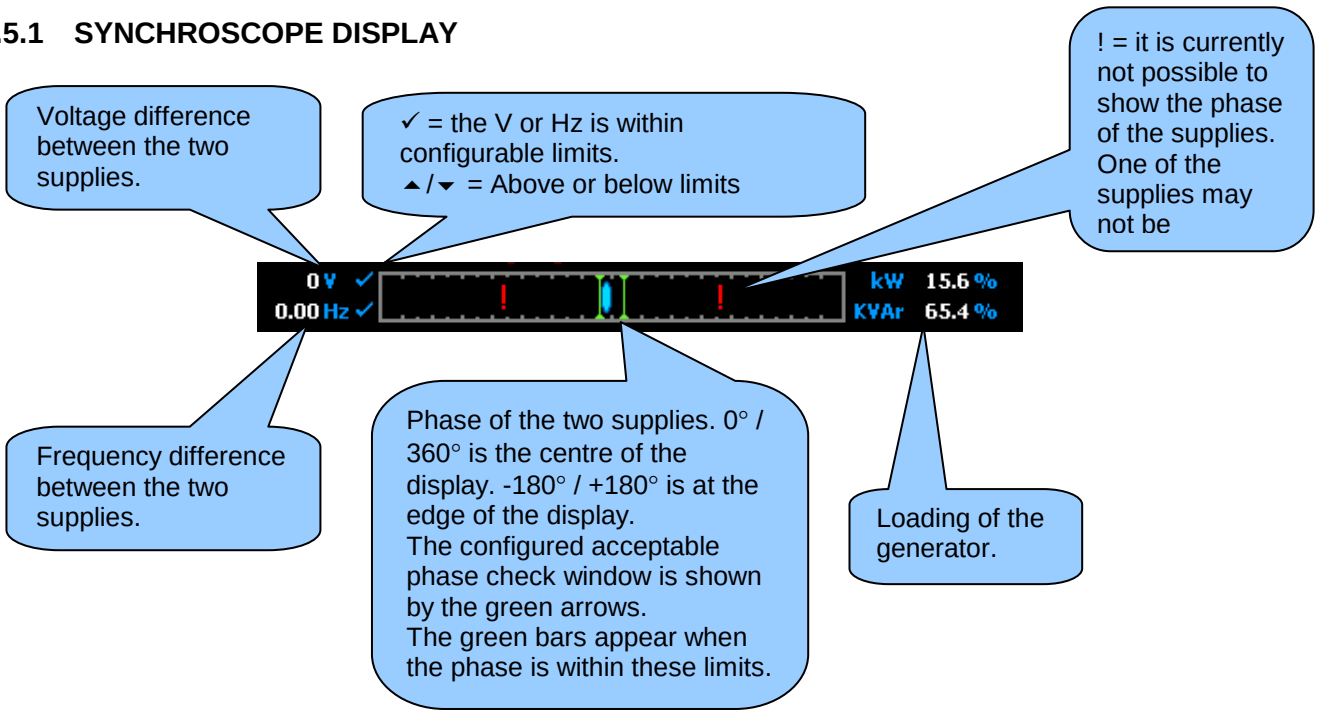
NOTE:- For further details, see the section entitled 'OPERATION' elsewhere in this manual.

4.5 GENERATOR SUMMARY WHEN CONNECTED TO DSE8710 CONTROLLER

The content of the generator summary area is arranged as shown in the figure below.
This serves as an overview of the system. Further information is gained using the Instrument Pages as detailed below.

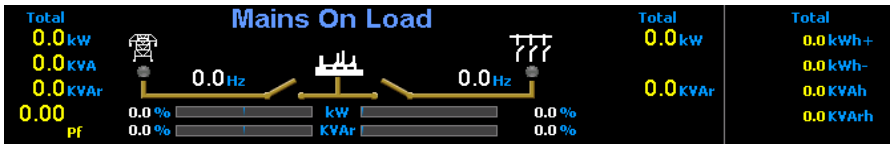
When the synchroscope is active (during synchronisation) the kW and kVAr instrumentation bars are replaced with the synchroscope :

4.5.1 SYNCHROSCOPE DISPLAY



4.6 MAINS SUMMARY WHEN CONNECTED TO DSE8660 CONTROLLER

The content of the mains summary area is arranged as shown in the figure below.
This serves as an overview of the system. Further information is gained using the Instrument Pages as detailed below.



4.7 VIEWING THE INSTRUMENT PAGES

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

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!

Example when connected to DSE8710 controller

Example when connected to DSE8760 controller

Press  **to view the next instrument page (Engine) etc.**

The currently selected page is lit with a Blue background.

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

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

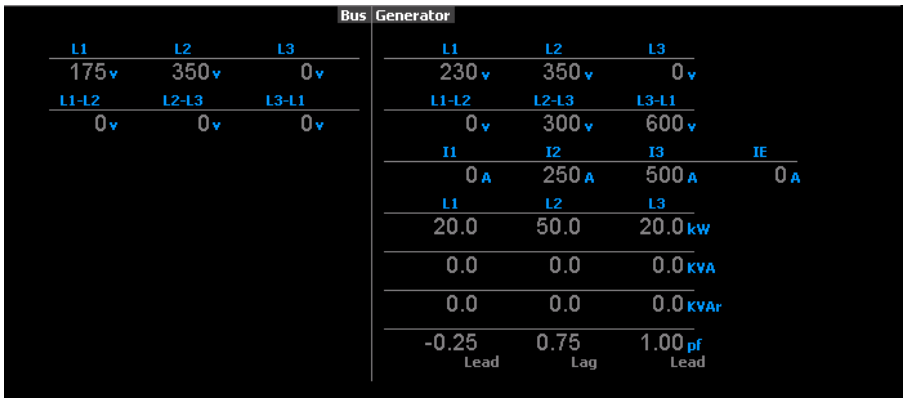
Indicates that page 1 of 3 within this section is displayed.

To select additional pages within the current section, press the scroll  buttons.

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

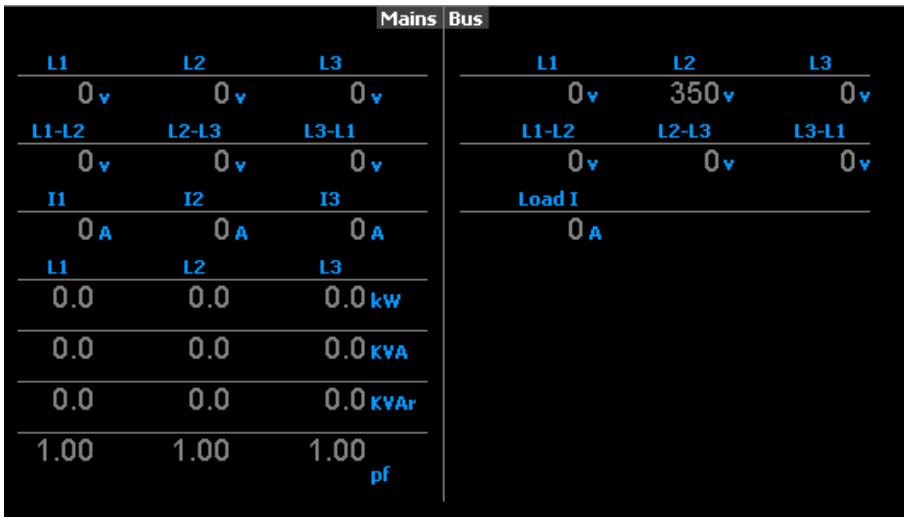
4.7.1 HOME WHEN CONNECTED TO DSE8710 CONTROLLER

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



4.7.1 HOME WHEN CONNECTED TO DSE8760 CONTROLLER

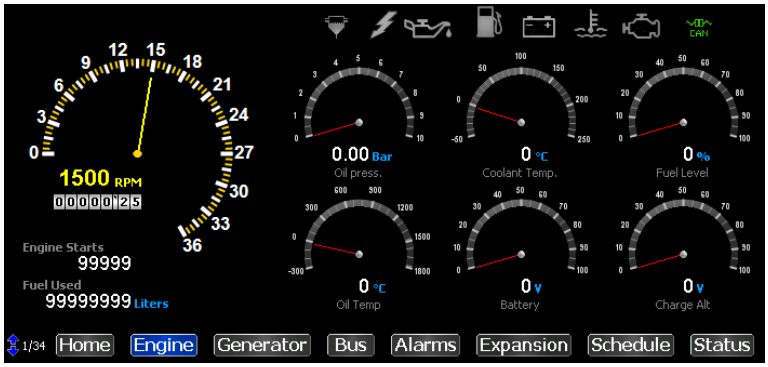
This is the ‘home’ page, the page that is displayed when no other page has been selected, and the page that is automatically displayed after a period of inactivity (*LCD Page Timer)* of the module control buttons.

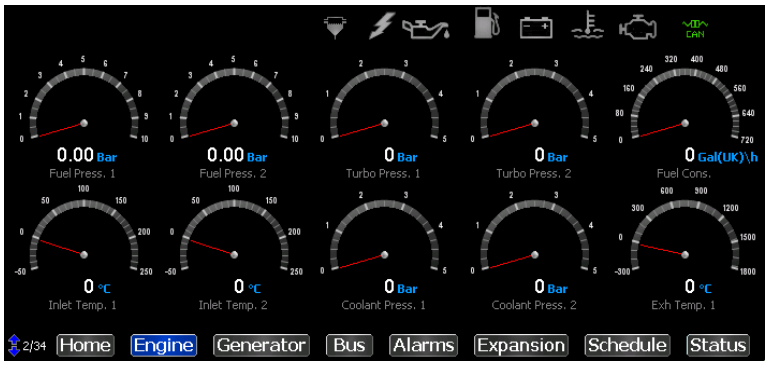


4.7.2 ENGINE

Applicable when connected to DSE8710 controller only.

Contains instrumentation gathered about the engine itself, some of which may be obtained using the CAN or other electronic engine link. The content may change depending upon the selected engine and the features supported by the engine. Examples of engine data are shown below.





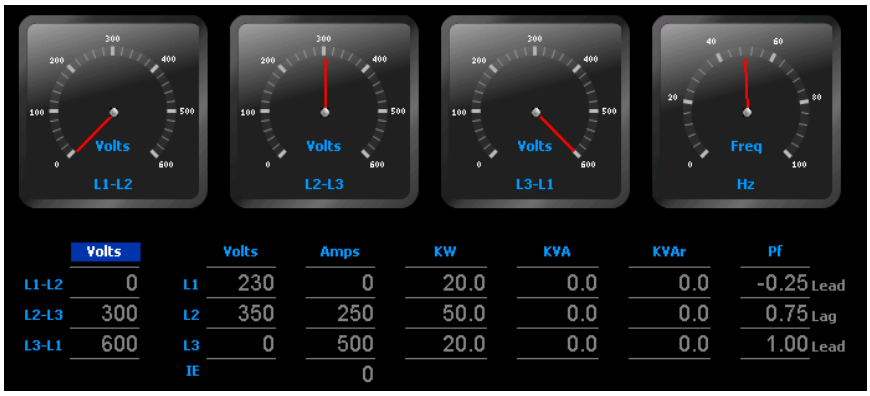
The alarm icons above the instruments are shown as below:

Parameter	Inactive (grey)	Warning (yellow)	Shutdown (red)
Charge alternator			
Oil pressure			
Fuel level			
Battery voltage			
Coolant temperature			
ECU lamp			
Water in fuel			

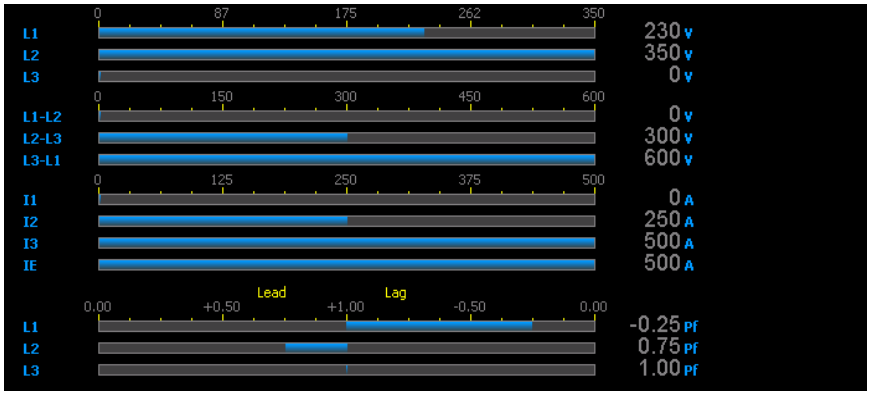
Parameter	CAN link unknown (grey)	CAN link active (green)	CAN link lost (red)
CAN link status	CAN	CAN	CAN

4.7.3 GENERATOR

Applicable when connected to DSE8710 controller only.

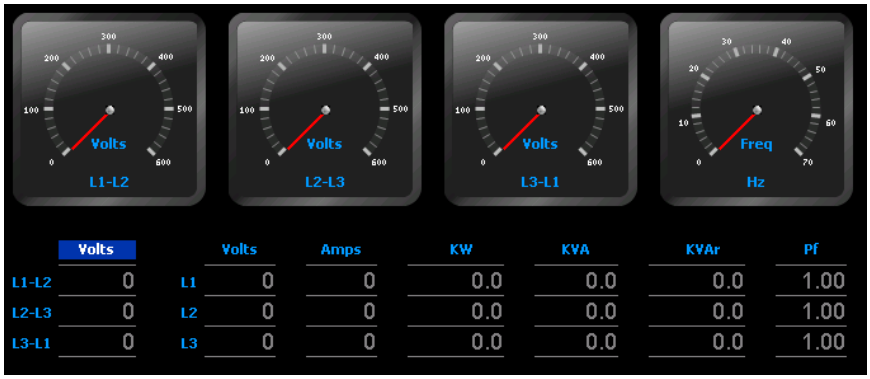


Press the up or down to change between volts L-L, volts L-N, amps, kW etc. The analogue meters change accordingly. The last two displays of the Generator page display the information in a bar graph.
The bar graph is shown in blue for positive, red for negative. For power factor, blue is used for lagging pf, red is used for leading pf.

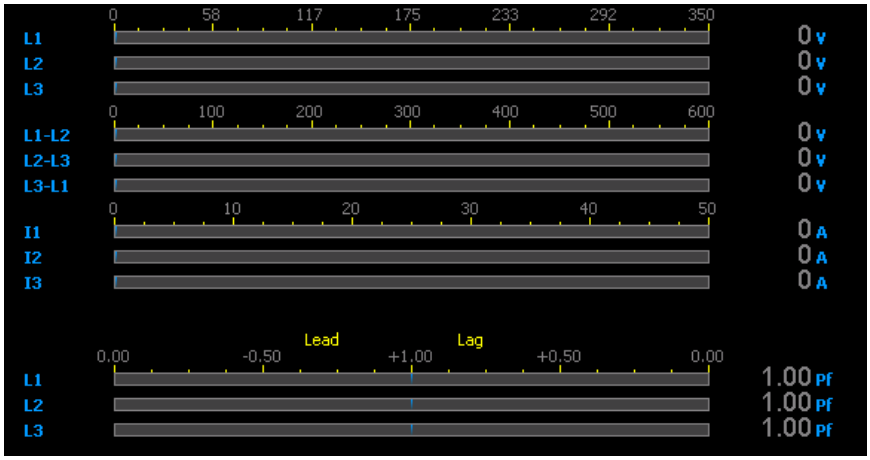


4.7.4 MAINS

Applicable when connected to DSE8760 controller only.



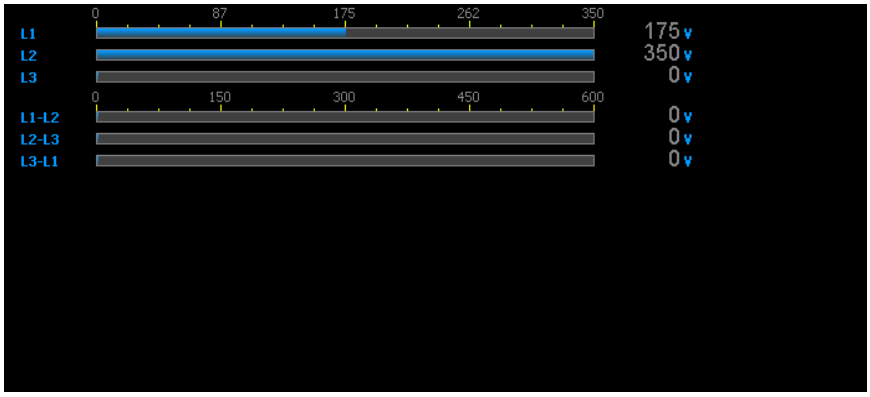
Press the up or down to change between volts L-L, volts L-N, amps, kW etc. The analogue meters change accordingly. The last two displays of the Mains page display the information in a bar graph.
The bar graph is shown in blue for positive, red for negative. For power factor, blue is used for lagging pf, red is used for leading pf.



4.7.5 BUS

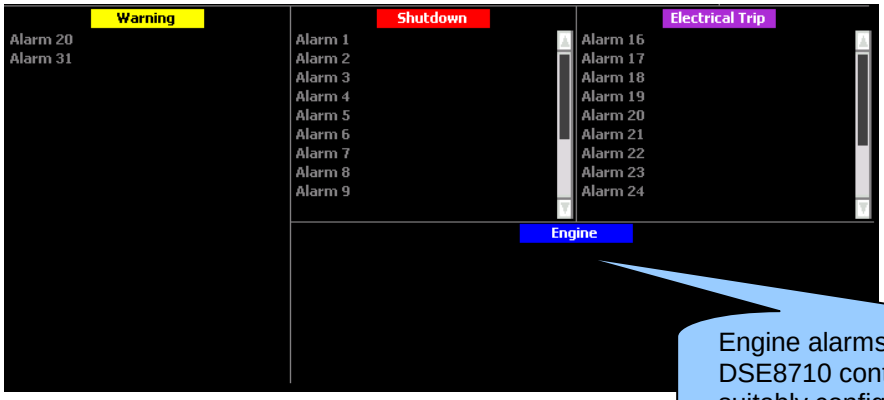
Contains electrical values of the common generator bus measured or derived from the module's bus inputs.

Press the up or down to change between volts L-L, volts L-N and the bar graph display. The analogue meters change accordingly.



4.7.6 ALARMS

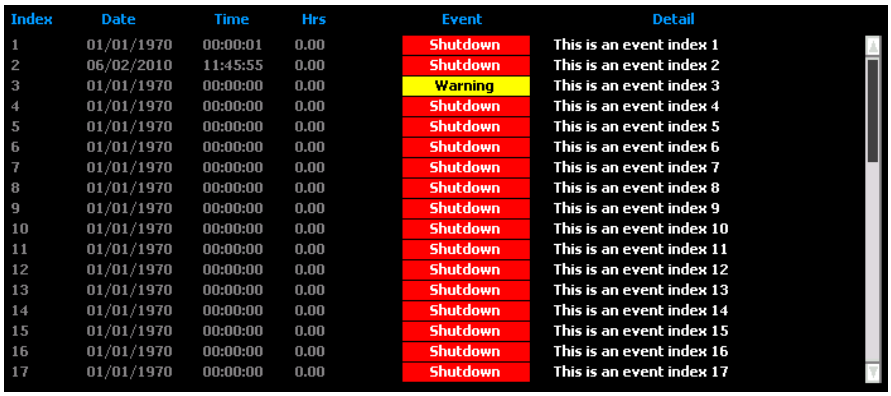
There are two screens on the alarms page, one displaying the current alarms and another displaying the event log. The alarms displays any current warnings, electrical trip and shutdown alarms and any CAN engine DTCs that are present.



Engine alarms applicable when connected to DSE8710 controller and where connected to suitably configured CAN (ECU) engine.

Press the up or down  to change between current alarms and the event log page.

The event log display a list of events. The number of events displayed depends on the space available with the chosen font. The event log page will display the event index, event type, date, time and number of hours run for each event. Electronic engine diagnostic trouble codes are displayed as single events in the event log.



Index	Date	Time	Hrs	Event	Detail
1	01/01/1970	00:00:01	0.00	Shutdown	This is an event index 1
2	06/02/2010	11:45:55	0.00	Shutdown	This is an event index 2
3	01/01/1970	00:00:00	0.00	Warning	This is an event index 3
4	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 4
5	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 5
6	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 6
7	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 7
8	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 8
9	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 9
10	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 10
11	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 11
12	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 12
13	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 13
14	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 14
15	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 15
16	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 16
17	01/01/1970	00:00:00	0.00	Shutdown	This is an event index 17

Alarm level	Colour/Title graphic
Warning	Warning
Electrical trip	Electrical Trip
Shutdown	Shutdown
ECU code	Engine

Engine alarms applicable when connected to DSE8710 controller and where connected to suitably configured CAN (ECU) engine.

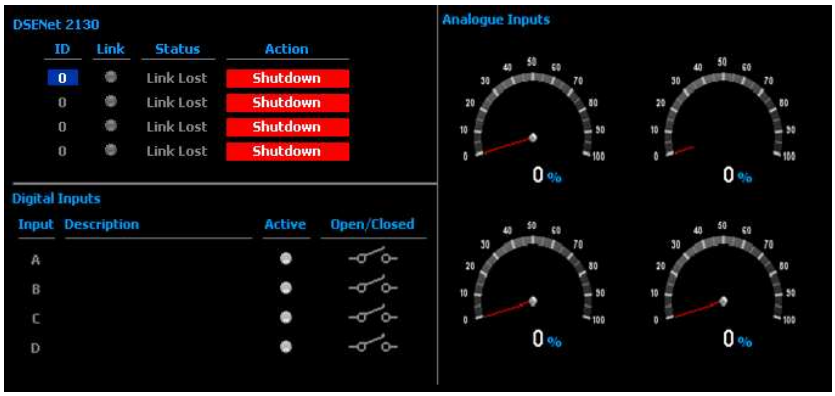
4.7.7 EXPANSION

The expansion page includes three screen arrangements that present the configuration and status of the inputs and outputs for the 2130, 2157 and 2548 expansion units attached to the **8700**.

The up or down buttons move through the active expansion units starting with the 2130 screens, then 2157 and 2548.

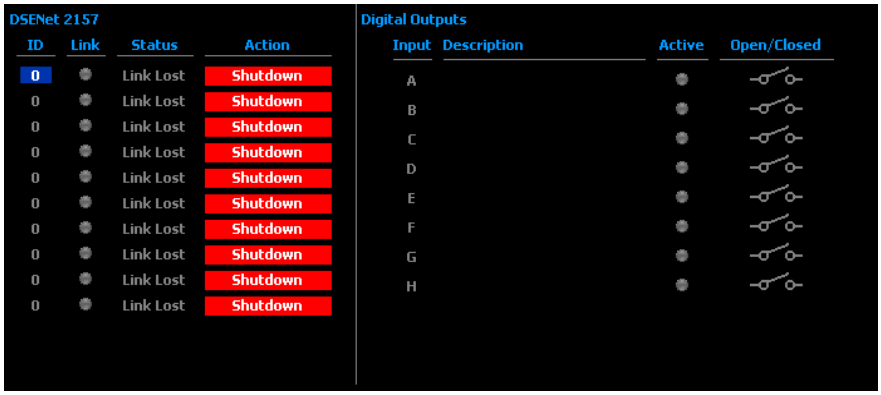
4.7.7.1 2130 EXPANSION PAGE

The 2130 screen displays the status of each attached 2130 device. 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 2130 unit, the screen shows the configuration description and the currently active and open/closed status of the digital inputs and the configuration description and current values of the analogue inputs. If an analogue input is configured as a digital input, a dial displayed with a low/high message instead of the value.



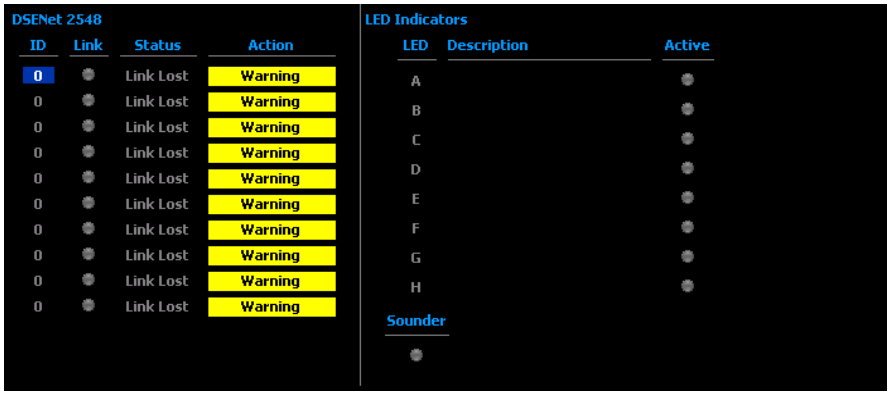
4.7.7.2 2157 EXPANSION PAGE

The 2157 screen displays the current status of all attached 2157 modules with the currently selected unit highlighted in blue.
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 2157 unit, the screen shows the configuration descriptions and the current active and open/closed status of the digital outputs. Press up and down to select the required 2157 module.



4.7.7.3 2548 EXPANSION PAGE

The 2548 screen displays the status of all attached 2548 modules with the currently selected unit highlighted in blue.
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 2548 unit, the screen shows the configuration descriptions and the current active and on/off status of the LEDs and sounder. Press up and down  to select the required 2157 module.



4.7.8 SCHEDULE

This shows the current configuration of the 8700 scheduler.

The scheduler configuration status is displayed on the top half of the screen. A title string (shown here as Scheduler Disabled) shows the scheduler enabled, mode and load configuration status and a table shows each scheduler entry details.
The lower half of the screen shows the maintenance configuration status and time remaining. The lamp to the left indicates the configuration status of the maintenance alarm, not the alarm condition.

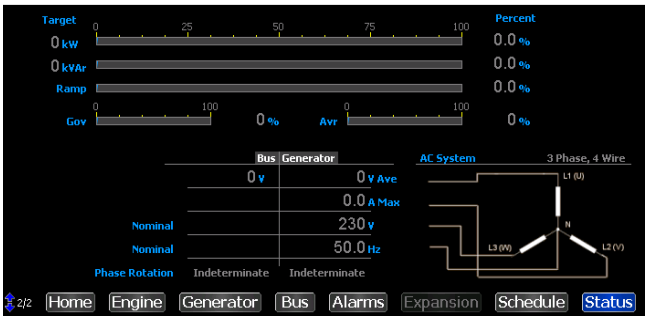
4.7.9 STATUS

This page shows the status and configuration of the attached 8721 communication ports.

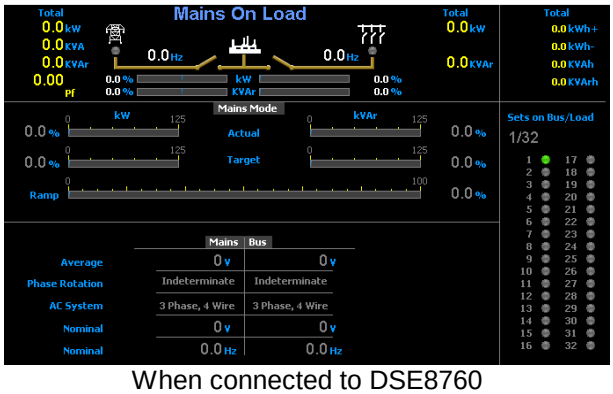
Instrumentation on Status Page	Label
Active port	Active port
Active baud rate	Baud
link state	link state
good / bad packet ratio	Error rate
8721 software version	
8721 USB ID	
8721 Bootloader version	
Modem status	Modem status
Modem line status (RTS, CTS. DSR, DTR, DCD)	modem line status
8700 product variant	
8700 software version	
8700 USB ID	
8700 boot loader version	
8700 analogue processor version	
8700 engine module version	
8700 supervisor state machine string	
8700 engine state machine string	
8700 load state machine string	
8700 protections enabled status string	

An optional commissioning screen is available via an option in the running editor. When enabled, press up or down

to change between the two pages.



When connected to DSE8710

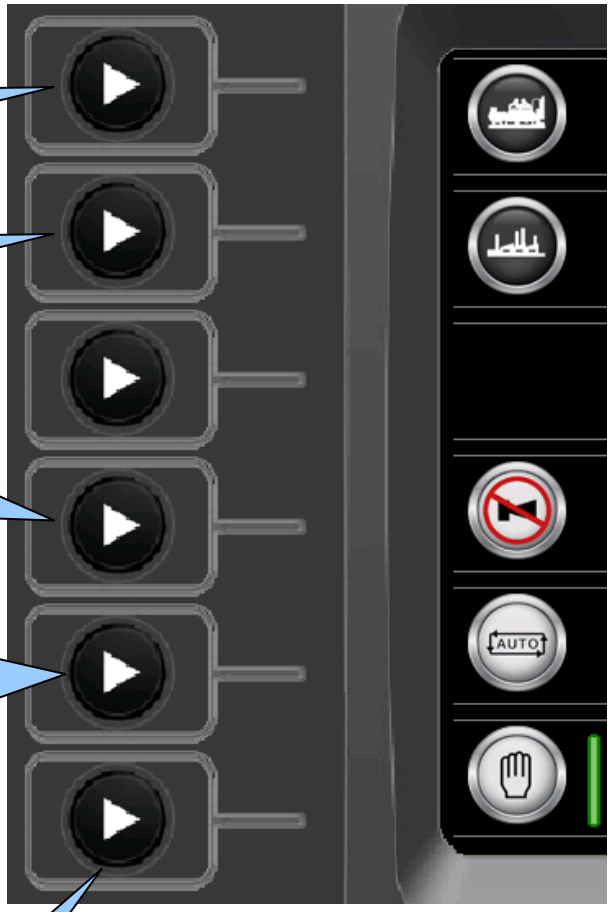


When connected to DSE8760

5 CONTROLS

5.1 CONTEXT BUTTONS WHEN CONNECTED TO DSE8710

The function of the context buttons down the left side of the 8721 are indicated on the LCD display :



Close Generator
Allows the operator to transfer the load to the generator, synchronising first if required. (when in Manual mode only)

Open generator
Allows the operator to open the generator breaker (when in Manual mode only)

Mute / Lamp Test
This button silences the audible alarm if it is sounding and illuminates all of the LEDs as a lamp test feature/
When correctly configured and fitted to a compatible engine ECU, pressing this button in STOP/RESET mode after pressing the START button (to power the ECU) will cancel any “passive” alarms on the engine ECU.

Auto
This button places the module into its ‘Automatic’ mode. This mode allows the module to control the function of the generator automatically. The module will monitor the remote start input and mains supply status and once a start request is made, the set will be automatically started and placed on load.
Upon removal of the starting signal, the module will automatically transfer the load from the generator and shut the set down observing the stop delay timer and cooling timer as necessary. The module will then await the next start event. For further details, please see the more detailed description of ‘Auto operation’ elsewhere in this manual.

Manual
This mode allows manual control of the generator functions. Once in Manual mode the module will respond to the start button, start the engine, and run off load. If the engine is running off-load in the Manual mode and a remote start signal becomes present, the module will automatically instruct the changeover device to place the generator on load (‘Close Generator’ becomes active (if used)). Upon removal of the remote start signal, the generator remains on load until either selection of the ‘STOP/RESET’ or ‘Auto’ modes.
For further details, please see the more detailed description of ‘Manual operation’ elsewhere in this manual.

5.2 CONTEXT BUTTONS WHEN CONNECTED TO DSE8760

The function of the context buttons down the left side of the 8721 are indicated on the LCD display:

Test
This push button places the module into its 'Test' mode. This mode is used to test the function and timing of the bus generators start and load sequence. The start sequence is initiated by pressing the START button and the bus generators will be automatically started, the mains will then synchronise to the generator bus to provide a Test on load function. Depending upon configuration this can be **continuous parallel** or **island mode operation.**

To test the off-loading and stopping sequence return the set to the 'Auto' mode, the module will automatically transfer the load from the bus and shut the set down observing the stop delay timer and cooling timer as necessary. The module will then await the next start event.

Mute / Lamp Test
This button silences the audible alarm if it is sounding and illuminates all of the LEDs as a lamp test feature/
When correctly configured and fitted to a compatible engine ECU, pressing this button in STOP/RESET mode after pressing the START button (to power the ECU) will cancel any "passive" alarms on the engine ECU.

Auto
This button places the module into its 'Automatic' mode. This mode allows the module to control the function of the generator automatically. The module will monitor the remote start input and mains supply status and once a start request is made, the set will be automatically started and placed on load.
Upon removal of the starting signal, the module will automatically transfer the load from the generator and shut the set down observing the stop delay timer and cooling timer as necessary. The module will then await the next start event. For further details, please see the more detailed description of 'Auto operation' elsewhere in this manual.

Manual
This mode allows manual control of the generator functions. Once in Manual mode the module will respond to the start button, start the engine, and run off load. If the engine is running off-load in the Manual mode and a remote start signal becomes present, the module will automatically instruct the changeover device to place the generator on load ('Close Generator' becomes active (if used)). Upon removal of the remote start signal, the generator remains on load until either selection of the 'STOP/RESET' or 'Auto' modes.
For further details, please see the more detailed description of 'Manual operation' elsewhere in this manual.

Transfer to Bus

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

Synchronising is NOT enabled. Pressing this button when the generator is running off load and in MANUAL mode, the generator load switch is closed. Further presses of this button will have no effect.

Synchronising is enabled. Pressing this button when the generator is running and in MANUAL mode, the 7510MK1 controller, will volts match and synchronise with the Bus. The generator load switch is then closed in parallel with the Bus.

NOTE:- This button is only active in MANUAL mode.

NOTE:- If the bus is live when the manual button is pressed, synchronising will take place before the load switch is closed.

Transfer to mains

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

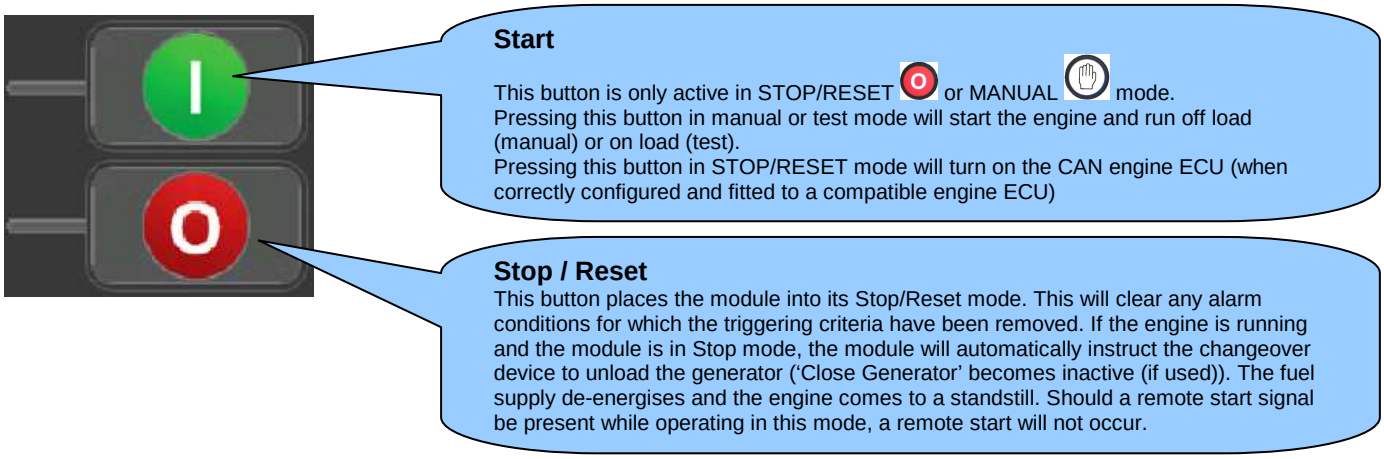
Synchronising is NOT enabled. Pressing this button when the mains is available off load and in MANUAL mode, the bus load switch is opened and the mains load switch is closed. Further presses of this button will have no effect.

Synchronising is enabled. Pressing this button when the mains is available and in MANUAL mode, the 7510MK1 controller, will volts match and synchronise with the Bus. The mains load switch is then closed in parallel with the Bus.

NOTE:- This button is only active in MANUAL mode.

NOTE:- If the bus is live when the manual button is pressed, synchronising will take place before the load switch is closed.
mode.

5.3 START/STOP BUTTONS



6 OPERATION

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

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

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

6.1 ALTERNATIVE CONFIGURATIONS

Depending upon the configuration of your system by the generator supplier, the system may have selectable configurations (for example to select between 50Hz and 60Hz running). If this has been enabled your generator supplier will advise how this selection can be made (usually by externally operated selector switch or by selecting the required configuration file in the DSE8700 series front panel configuration editor).

6.2 DUMMY LOAD / LOAD SHEDDING CONTROL

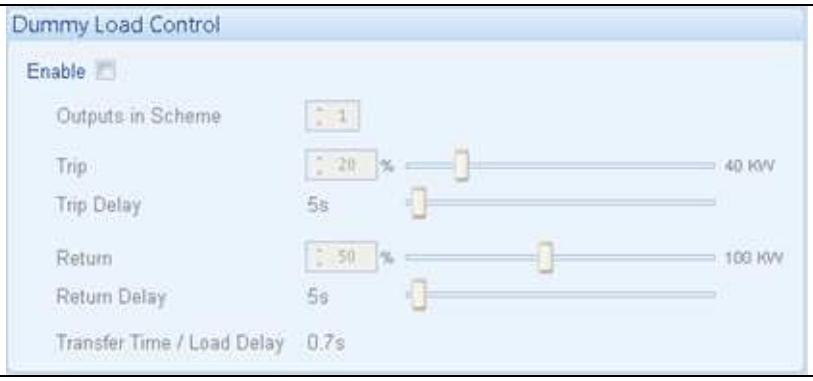
This feature may be enabled by the system designer to ensure the loading on the generator is kept to a nominal amount. If the load is low, 'dummy loads' (typically static load banks) can be introduced to ensure the engine is not too lightly loaded. Conversely, as the load increases towards the maximum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

6.2.1 DUMMY LOAD CONTROL

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

If the generator loading falls below the *Dummy Load Control Trip* setting (kW), the *Dummy Load Control Trip Delay* is displayed on the module display. If the generator loading remains at this low level for the duration of the timer, the first *Dummy Load Control* output is energised. This is used to energise external circuits to switch in (for instance) a static load bank.
The generator loading has now been increased by the first dummy load. Again, the generator loading is monitored. This continues until all configured *Dummy Load Control* outputs are energised.

Should the generator loading rise above the *Dummy Load Return* level, the *Dummy Load Return Delay* begins.
If the loading remains at these levels after the completion of the timer, the 'highest' active *Dummy Load Control* output is de-energised. This continues until all *Dummy Load Control* outputs have been de-energised.



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

6.3 PROCESS OF SYNCHRONISATION

This section describes the stages of control of a DSE synchronising and load sharing controller

6.3.1 OFF LOAD RUNNING

The engine starts and runs off load. If the analogue governor output is being used, this output is at the level configured by SW1 in the *SCADA* | *GENERATOR* | *GOV / AVR* section of the PC configuration software. During this time the DSE module makes no changes to the engine speed.

6.3.2 FIRST SET ON THE BUS DETERMINATION

In a Multiset system, after the *warming timer* has expired, the controllers communicate with each other to ensure that only one module closes it's breaker to the dead bus, even in the case of bus sensing failure (missing connections, broken fuse etc). This is achieved using a 'virtual key' and is totally transparent to the user.

6.3.3 RUNNING ON LOAD, NOT IN PARALLEL

If configured to *Adjust to nominal* (frequency/voltage) in the module's configuration file, sets running on load, but not in parallel, will automatically adjust the generator to produce the voltage and frequency set as *nominal* in the module's configuration *(Generator volts / frequency alarms page)*

6.3.4 SYNCHRONISING

If the bus is measured as being 'live', the DSE module adjusts the generator voltage to be within the *Check sync RMS voltage* window, and adjusts the engine speed to make the output frequency a little higher than the existing generator bus. How much higher the frequency is, is set by the *Slip Frequency*, on the *SCADA* page of the DSE configuration software.
The phase of the supplies is shown on the module's synchrosocope display and when the two supplies are within the *phase check* window, the breaker is closed in parallel with the other supply.

6.3.5 RUNNING ON LOAD, IN PARALLEL

During parallel operation, the modules communicate with each other to maintain an equal load share as a percentage of the set's capacity. Additionally, the modules will also adjust the output of the sets to produce the voltage and frequency set as *nominal* in the module's configuration *(Generator volts / frequency alarms page).* It is important that each module in the system has the **same settings** for both *nominal voltage* and *nominal frequency*.

6.3.6 LOAD SHEDDING CONTROL

The *Load Shedding Control* feature (if enabled) allows for a maximum of five load-shedding steps.
When the generator is about to take load, the configured number of *Load Shedding Control Outputs at Startup* will energise. This configurable setting allows (for instance) the removal of non-essential loads from the generator prior to the closure of the set's load switch. This keeps the initial loading of the set to a minimum, below the *Load Acceptance* specification of the generating set.
The generator is placed on load. The *Load Shedding Control* scheme begins.
When the load reaches the *Load Shedding Trip* level, the *Trip Delay* timer will start. If the generator loading is still high when the timer expires, the first *Load shedding Control* output will energise. When the load has been above the trip level for the duration of the timer the 'next' *Load shedding Control* output will energise and so on until all *Load Shedding Control outputs are energised.*
If at any time the load falls back below the *Load Shedding Return* level, the *Return Time* will start. If the load remains below the return level when the timer has expired, the 'highest' numbered energised *Load Shedding Control* output is de-energised. This process will continue until all outputs have been de-energised.
When the set enters a stopping sequence, the *Load Shedding control* outputs de-energise at the same time as the generator load switch is signalled to open.

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

6.4 STOP MODE WHEN CONNECTED TO DSE8710

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

STOP mode is activated by pressing the button.

In STOP mode, the module will immediately remove the generator from load (if necessary) before stopping the engine if it is already running. No cooling run is provided for this operation. Where a cooling run is required, switch to MANUAL mode and open the breaker manually. Allow the set to cool off load, before pressing the STOP button to stop the engine.

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

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

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

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

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

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

6.4.1 ECU OVERRIDE

NOTE:- 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:

- Select STOP mode on the DSE controller.
- Press and hold the START button to power the ECU. As the controller is in STOP mode, the engine will not be started.
- Continue to hold the start button for as long as you need the ECU to be powered.
- The ECU will remain powered until a few seconds after the START button is released.

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

6.5 STOP MODE WHEN CONNECTED TO DSE8760

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

STOP mode is activated by pressing the  button.

In STOP mode, the module will immediately remove the bus from load (if necessary) before requesting the set(s) to stop if already running.

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

The engines will not be started by the DSE8760 when in STOP mode. If remote start signals are given, the input is ignored until AUTO mode is entered.

6.6 AUTOMATIC MODE

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

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

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

6.6.1 WAITING IN AUTO MODE

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

- Detection of mains failure (DSE8760 controller only)
- Activation of an auxiliary input that has been configured to *remote start on load* or *remote start off load.*
- Request from DSE8760 mains controller or from another DSE8710 autostart controller over the MSC link.
- Activation of the inbuilt exercise scheduler.
- Instruction from external remote telemetry devices using the RS232 or RS485 interface.

6.6.2 STARTING SEQUENCE

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

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

If a start request is still present at the end of the *start delay* timer, the fuel relay is energised and the engine will be cranked.

6.6.2.1 STARTING – DSE8710 CONTROLLER

NOTE:- If the unit has been configured for CAN, compatible ECU's will receive the start command via CAN.

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 begins. Should this sequence continue beyond the set number of attempts, the start sequence will be 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 main alternator output frequency, but can additionally be measured from a Magnetic Pickup mounted on the flywheel (Selected by PC using the 8700 series configuration software).

Additionally, the module can be configured such that rising oil pressure or charge alternator voltage will disconnect the starter motor (but cannot detect underspeed or overspeed using these values).

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

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

6.6.2.2 STARTING – DSE8760 CONTROLLER

DSE8760 waits until the set(s) have started before further action is taken,

6.6.3 ENGINE RUNNING – DSE8710 CONTROLLER

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

If the common bus is measured to be 'dead bus', the load breaker is closed.
If the bus is measured to be 'live bus', synchronising takes place before the breaker is closed.

NOTE:-The load transfer signal remains inactive until the Oil Pressure has risen. This prevents excessive wear on the engine.

As the load increases and decreases, the DSE8700 series module (may (depending upon configuration) add dummy loads or remove non-essential loads. This is configured as part of the *Load Shedding* and *Dummy Load* control settings in the DSE Configuration Suite Software.
See section entitled *Dummy Load / Load Shedding* elsewhere in this document for further details.

Additionally, when configured as part of a MultiSet package, the generator may be automatically started and stopped depending upon load requirements.

If in doubt, consult your system supplier for details of how your particular system has been configured.

If all start requests are removed, the *stopping sequence* will begin.

6.6.1 ENGINES RUNNING – DSE8760 CONTROLLER

Once the bus is available, the *Warm Up* timer, if selected, begins, allowing the generator bus to stabilise before accepting the load.

If the mains supply is not bus available, the load breaker is closed.
If the mains is available, synchronising takes place before the breaker is closed.

As the load increases and decreases, the DSE8760 series module (may (depending upon configuration) instruct the sets to automatically started and stop depending upon load requirements.

If in doubt, consult your system supplier for details of how your particular system has been configured.

If all start requests are removed, the *stopping sequence* will begin.

6.6.2 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. Should another start request be made during the cooling down period, the set(bus) will return on load.

If there are no starting requests at the end of the *return delay* timer, the load is ramped off the generator(bus), the breaker is opened and the *cooling* timer is initiated.

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

If the set(bus) is called to return to load before the *cooling timer* has expired, the *Engine Running* operation is again followed.

After the *cooling* timer has expired, the set(s) is(are) stopped.

6.7 MANUAL MODE

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

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

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

6.7.1 WAITING IN MANUAL MODE

When in manual mode, the set will not start automatically.

To begin the starting sequence, press the button.

6.7.2 STARTING SEQUENCE – DSE8710 CONTROLLER

NOTE:- There is no *start delay* in this mode of operation.

The fuel relay is energised and the engine is cranked.

NOTE:- If the unit has been configured for CAN, compatible ECU's will receive the start command via CAN.

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. Should this sequence continue beyond the set number of attempts, the start sequence will be terminated and the display shows ***Fail to Start.***

When the engine fires, the starter motor is disengaged. Speed detection is factory configured to be derived from the main alternator output frequency but can additionally be measured from a Magnetic Pickup mounted on the flywheel (Selected by PC using the 8700 series configuration software).

Additionally, the module can be configured such that rising oil pressure or charge alternator voltage will disconnect the starter motor (but cannot detect underspeed or overspeed using these values).

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

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

6.7.1 STARTING SEQUENCE – DSE8760 CONTROLLER

NOTE:- There is no *start delay* in this mode of operation.

Start request command is sent to all DSE8710 controllers in the system.

6.7.2 ENGINE RUNNING

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

- Pressing the *Close generator* button.
- Request from another DSE8710 controller or DSE8760 mains controller over the MSC link.
- Activation of an auxiliary input that has been configured to *remote start on load*
- Activation of the inbuilt exercise scheduler if configured for 'on load' runs.

NOTE:-The load transfer signal remains inactive until the Oil Pressure has risen. This prevents excessive wear on the engine.

If the common bus is measured to be 'dead bus', the load breaker is closed.
If the bus is measured to be 'live bus', synchronising takes place before the breaker is closed.

Once the load has been transferred to the generator, the load switch will not be automatically opened unless:

- Press the *Open Generator* button
- Press the *Auto Mode* button to return to automatic mode.

6.7.3 MANUAL FUEL PUMP CONTROL

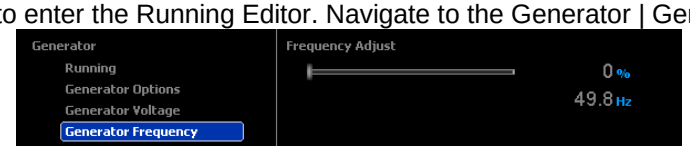
NOTE:-Manual fuel pump control is not applicable to DSE8760 controller.

- Navigate to the Engine Page (1/3) using the buttons and locate FUEL LEVEL.
- is shown on the module display to indicate that this feature is available (when *manual fuel pump control* is enabled in the module's configuration.
- The function of the button is now changed. Press and hold the button to energise the transfer pump. The pump starts two seconds after the button is pressed.
- Release the button to de-energise the transfer pump.

6.7.4 MANUAL SPEED CONTROL

NOTE:-Manual speed control is not applicable to DSE8760 controller.

- Press and hold to enter the Running Editor. Navigate to the Generator | Generator Frequency section



- Press the button to enter edit mode
- Press (up or down) to change the engine speed.
- Press the button again to exit the editor and leave the engine running at the newly selected speed.

6.7.5 STOPPING SEQUENCE

In manual mode the set(s) will continue to run until either:

- DSE8710 - The *stop button* is pressed; the set immediately stops.
- DSE8760 - The *stop button* is pressed; the sets are requested to stop over the MSC link.
- The *auto button* is pressed; the set observes all *auto mode* start requests and stopping timers before beginning the *Auto mode stopping sequence*.

6.8 TEST MODE

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

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

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

6.8.1 WAITING IN TEST MODE

When in test mode, the set will not start automatically.

To begin the starting sequence, press the button.

6.8.2 ENGINE RUNNING

Parallel operation is governed by configuration. See the previous section entitled *Auto Mode: Engine Running* for further details.

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

- The *stop button* is pressed – The generator bus breaker is opened and the set(s) are called to stop.
- The *auto button* is pressed. The set(s) will observe all auto mode start requests and stopping timers before beginning the *Auto mode stopping sequence*.

7 PROTECTIONS

When an alarm is present, the Audible Alarm will sound and a marker is displayed next to the mute button.

The audible alarm is silenced by pressing the *Mute button* 

The Alarm popup box is colour coded to indicate the level of the alarm.

ALARM LEVEL	COLOUR/TITLE GRAPHIC
WARNING	Warning
ELECTRICAL TRIP	Electrical Trip
SHUTDOWN	Shutdown
ECU CODE	Engine

Engine alarms applicable when connected to DSE8710 controller and where connected to suitably configured CAN (ECU) engine.

7.1 PROTECTIONS DISABLED

NOTE:- Protections Disabled function is not applicable to DSE8760 controller

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

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

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

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

7.1.1 INDICATION / WARNING ALARMS

Under Indication or Warning alarms:

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

7.1.2 SHUTDOWN / ELECTRICAL TRIP ALARMS

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

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

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

7.2 WARNINGS

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

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

By default, warning alarms are self-resetting when the fault condition is removed. However enabling 'all warnings are latched' will cause warning alarms to latch until reset manually. This is enabled using the 8700 series configuration suite in conjunction with a compatible PC.

Not applicable to DSE8760 controller : If the module is configured for, **CAN** and receives an "error" message from the engine control unit, 'Can ECU Warning" is shown on the module's display and a warning alarm is generated.

7.3 HIGH CURRENT WARNING ALARM

NOTE:- High Current Alarm is not applicable to DSE8760 controller

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

By default, High Current Warning Alarm is self-resetting when the overcurrent condition is removed. However enabling 'all warnings are latched' will cause the alarm to latch until reset manually. This is enabled using the 8700 series configuration suite in conjunction with a compatible PC.

7.4 SHUTDOWNS

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

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

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

7.5 ELECTRICAL TRIPS

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

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

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

7.6 HIGH CURRENT SHUTDOWN / ELECTRICAL TRIP ALARM

NOTE:- High Current Alarm is not applicable to DSE8760 controller

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

7.6.1 IMMEDIATE WARNING

If the *Immediate Warning* is enabled, the DSE8700 controller generates a *warning alarm* as soon as the *Trip* level is reached. The alarm automatically resets once the generator loading current falls below the *Trip* level (unless *All Warnings are latched* is enabled). For further advice, consult your generator supplier.

7.6.2 IDMT ALARM

If the *IDMT Alarm* is enabled, the DSE8700 controller begins following the IDMT 'curve' when the *trip* level is passed.

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

High current shutdown is a latching alarm and stops the Generator.

Remove the fault then press Stop/Reset to reset the module.

High current electrical trip is a latching alarm and removes the generator from the load, before stopping the Generator after the off load *cooling* timer.

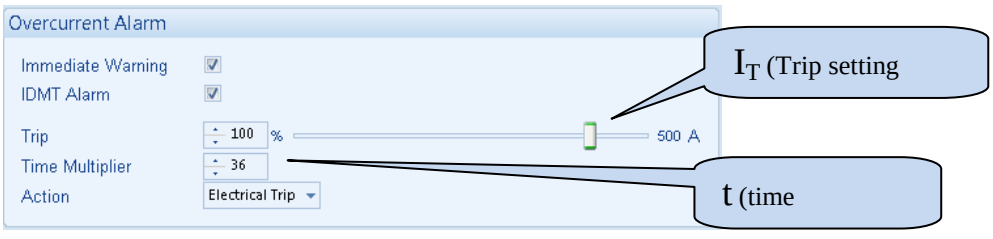
Remove the fault then press Stop/Reset to reset the module.

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

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

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

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

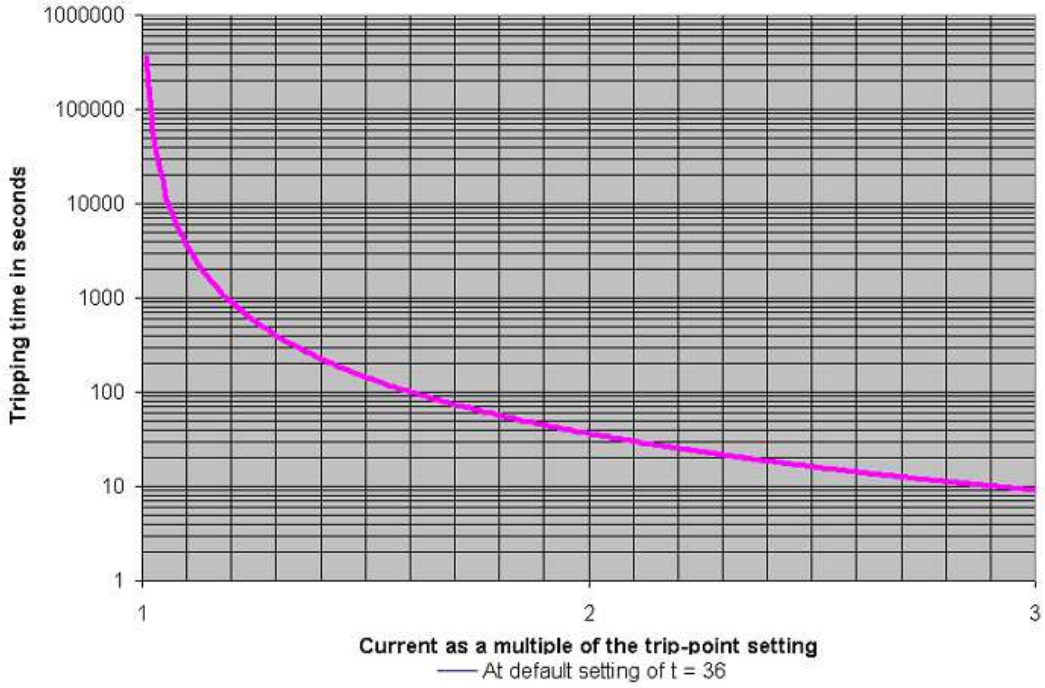


These settings provide for normal running of the generator up to 100% full load. If full load is surpassed, the *Immediate Warning* alarm is triggered, the set continues to run.
The effect of an overload on the generator is that the alternator windings begin to overheat; the aim of the *IDMT alarm* is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

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

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

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



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

7.7 SHORT CIRCUIT AND EARTH FAULT SHUTDOWN / ELECTRICAL TRIP ALARM

NOTE:- Short Circuit and Earth Fault alarms are not applicable to DSE8760 controller

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

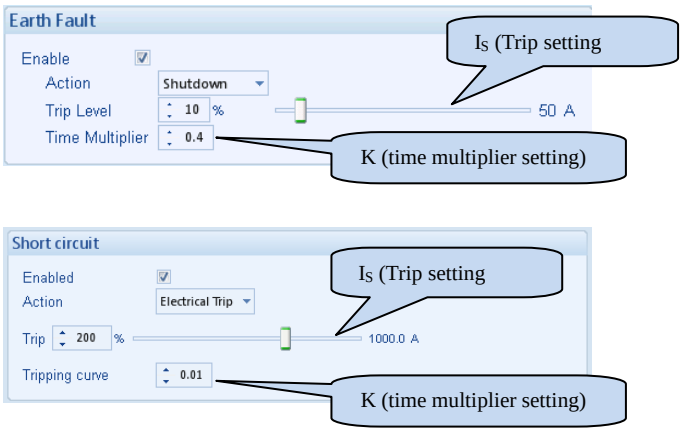
Short Circuit alarm operates in the same way as the Earth Fault, using the same curve formula, but typically uses a lower value for K (time multiplier) to give a faster acting trip.

If the A*larm* is enabled, the DSE8700 controller begins following the IDMT 'curve'. If the current surpasses the *Trip* for an excess of time, the Alarm triggers (*Shutdown* or *Electric trip* as selected in *Action*).

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

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

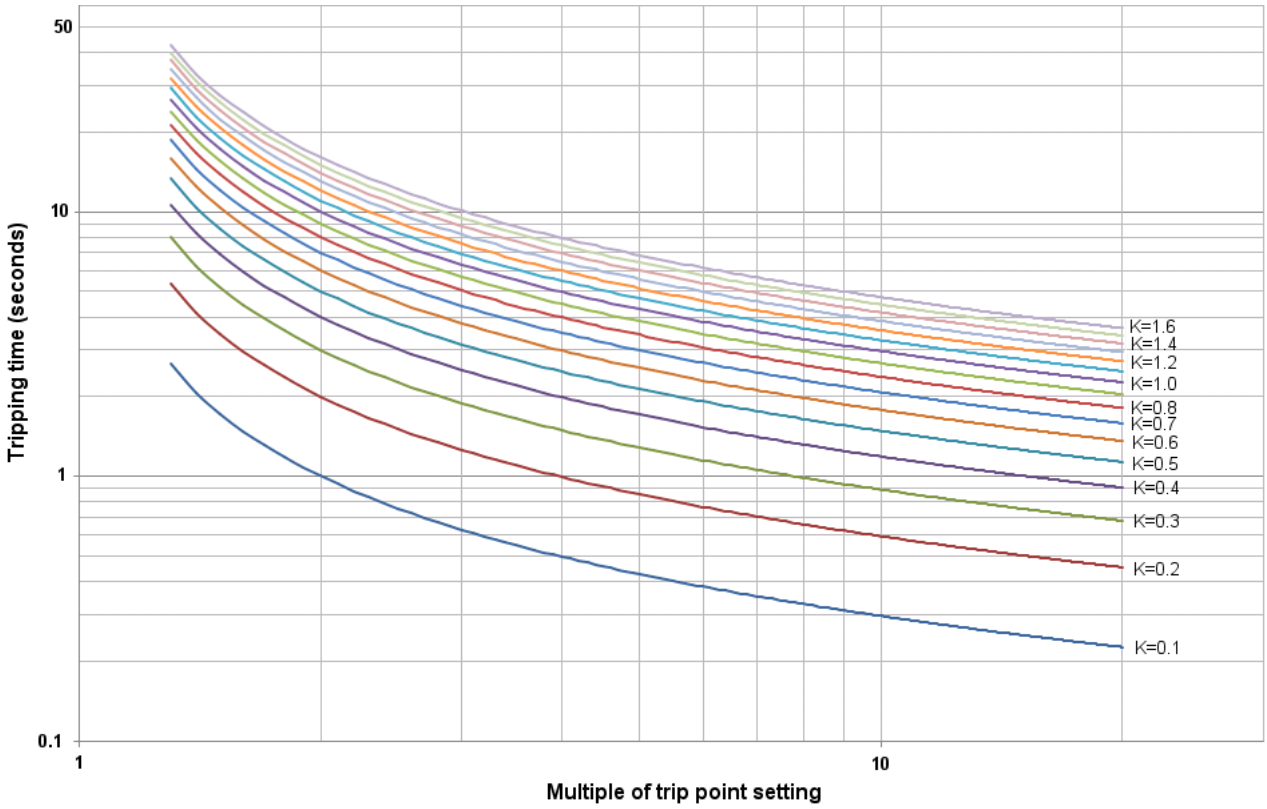
Where: T is the tripping time in seconds (accurate to +/- 5% or +/- 50ms (whichever is the greater)
K is the time multiplier setting
I is the actual earth current measured
Is is the trip setting value



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

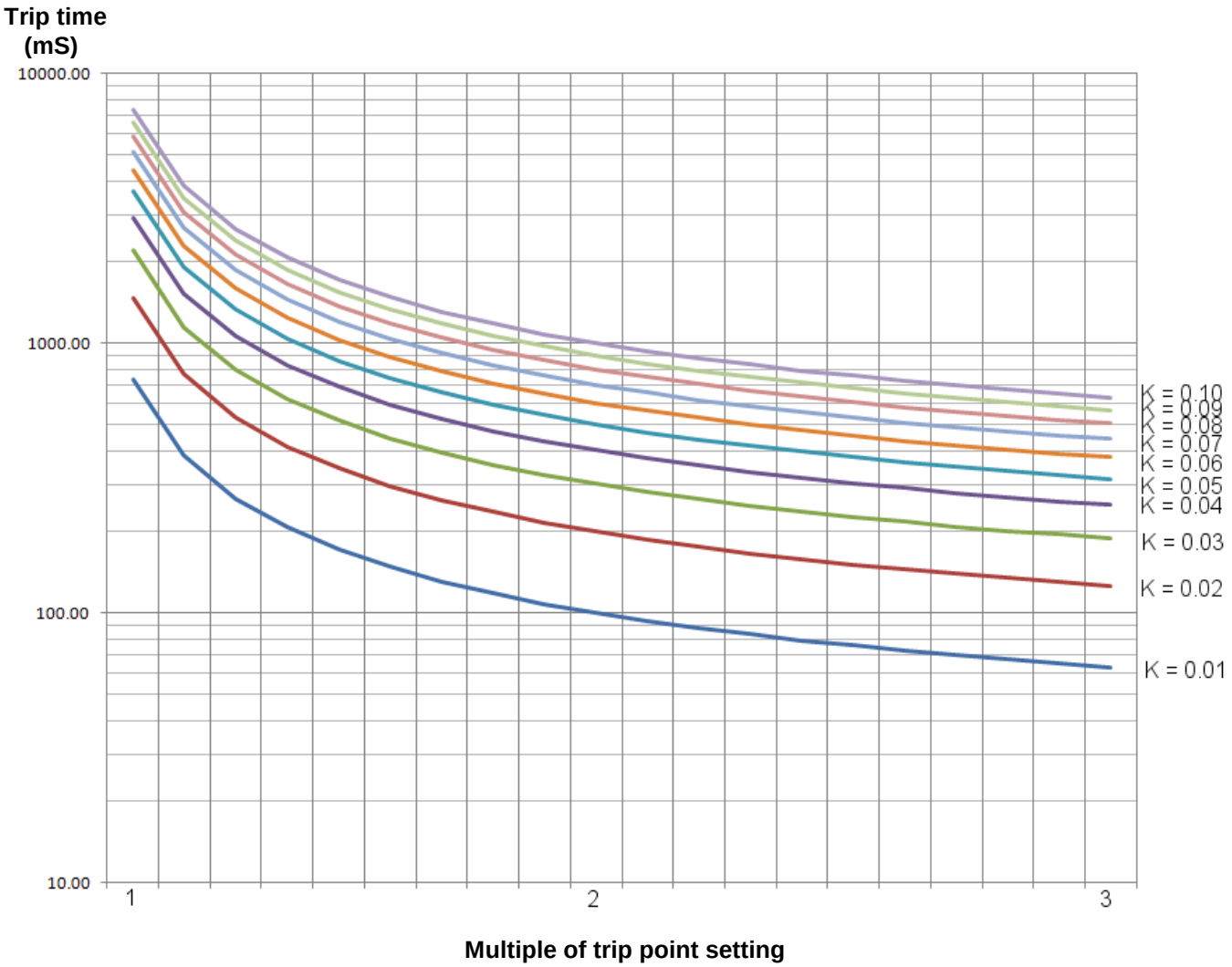
7.7.1 EARTH FAULT TRIPPING CURVES

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



7.7.1 SHORT CIRCUIT TRIPPING CURVES

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



7.8 ROCOF / VECTOR SHIFT

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

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

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

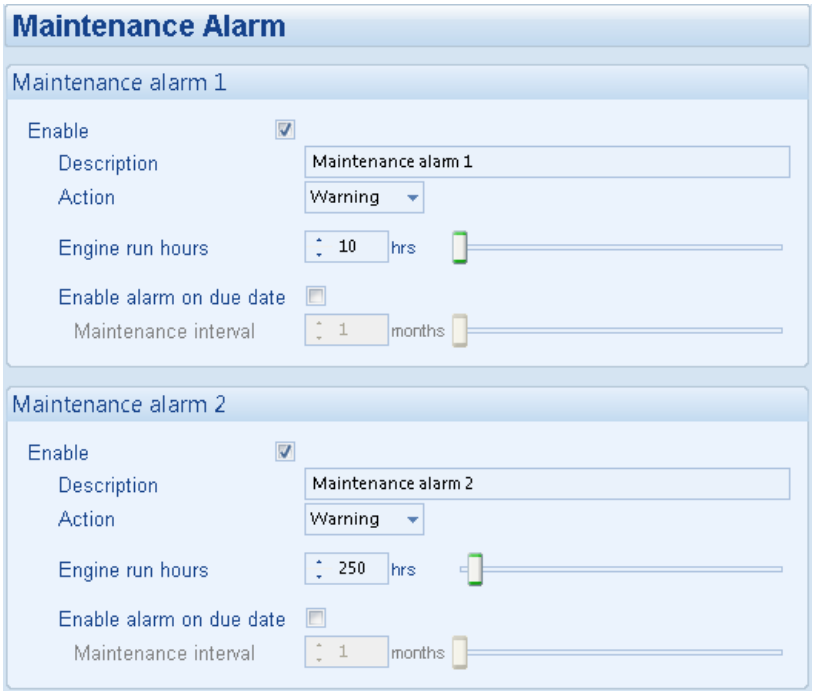
1) Press O button. The engine will stop if it is still running and the alarm is cleared.
2) Activate digital input configured to "Clear ROCOF/Vector shift" if this has been provided.
3) Press and button together and hold for 5 seconds. The ROCOF/Vector shift instrument is displayed and all 'peak hold'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

For details on activating and configuring the ROCOF/Vector shift protection, you are referred to the 8700 configuration software manual.

8 MAINTENANCE ALARM

NOTE:- Maintenance Alarm is not applicable to DSE8760 controller

Depending upon module configuration one or more levels of maintenance alarm may occur based upon a configurable schedule.



Example 1

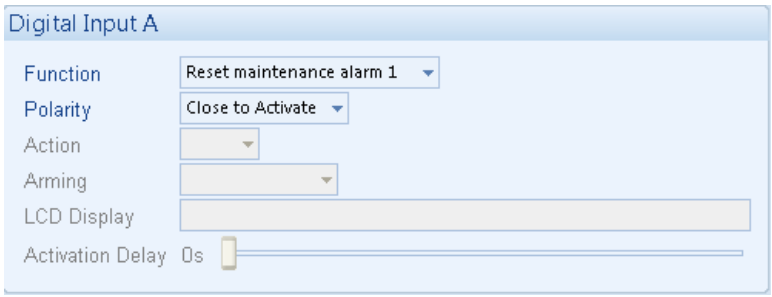
Screen capture from DSE Configuration Suite Software showing the configuration of Maintenance Alarm 1 and Maintenance Alarm 2.

When activated, the maintenance alarm can be either a **warning** (set continues to run) or **shutdown** (running the set is not possible). The site service engineer normally performs resetting the maintenance alarm after performing the required maintenance. The method of reset is either by:

- Activating an input that has been configured to maintenance x reset, where x is the number of the maintenance alarm (1 to 3).
- Pressing the maintenance reset button in the DSE Configuration Suite, Maintenance section.

Example 2

Screen capture from DSE Configuration Suite Software showing the configuration of a digital input for Reset Maintenance Alarm 1.



Example 3

Screen capture from DSE Configuration Suite Software showing the Maintenance Alarm Reset 'button' in the DSE Configuration Suite SCADA | MAINTENANCE section.

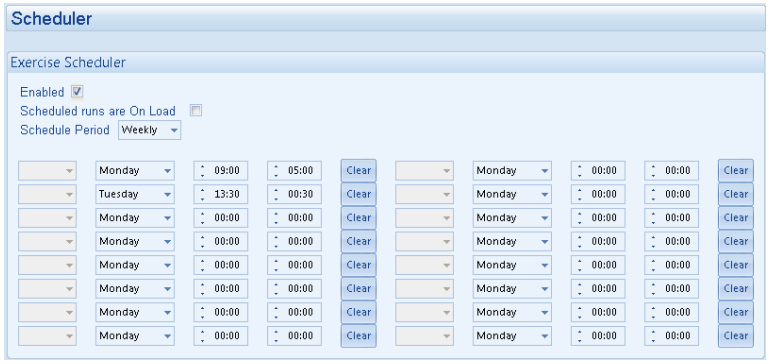
9 SCHEDULER

DSE8700 Series contains an inbuilt exercise run scheduler, capable of automatically starting and stopping the set. Up to 16 scheduled start/stop sequences can be configured to repeat on a 7-day or 28-day cycle. Scheduled runs may be on load or off load depending upon module configuration.

Example

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

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



9.1.1 STOP MODE

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

9.1.2 MANUAL MODE

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

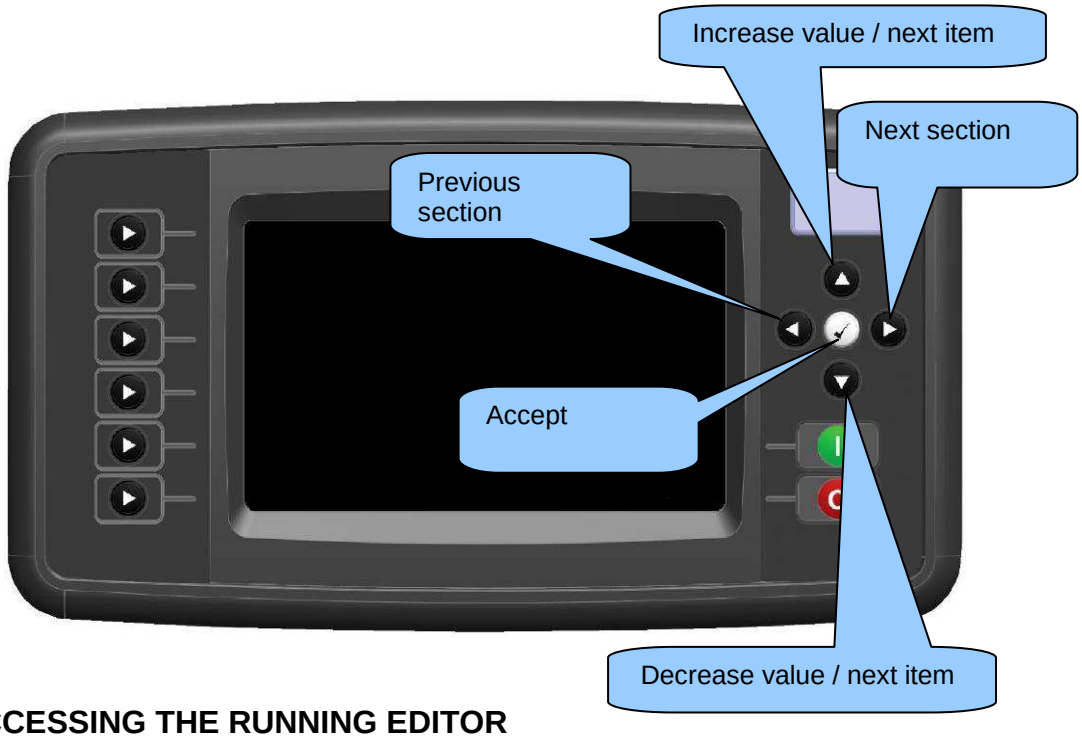
9.1.3 AUTO MODE

- Scheduled runs will operate ONLY if the module is in AUTO mode with no Shutdown or Electrical Trip alarm present.
- If the module is in STOP or MANUAL mode when a scheduled run begins, the engine is not started. However, if the module moves 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.

10 FRONT PANEL CONFIGURATION

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

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



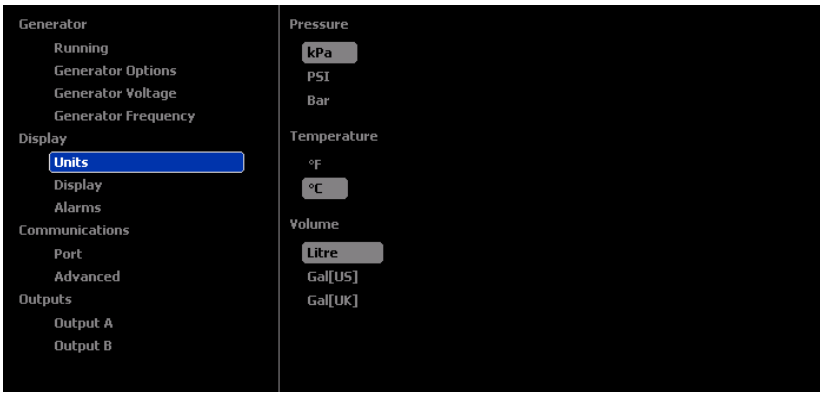
10.1 ACCESSING THE RUNNING EDITOR

The running editor can be entered, adjusted and exited without stopping the engine.

A press and hold of the tick button, when in the instrumentation or alert mode, enters the running editor. A press and hold of the tick button exits the editor.
The running editor causes immediate changes to the parameters.

When in the running editor mode, the instrumentation area of the screen is replaced with the running editor display, as shown below.

The running editor display area is split into two, the left hand side shows the running editor items available for editing and the right hand side shows the current value.



10.1.1 RUNNING EDITOR PARAMETERS

When connected to DSE8710
Load Demand Priority
Load Power Factor
Load Parallel Power
Override Starting Alarms
Voltage Adjust
Frequency Adjust
Mains decoupling test mode
Pressure units
Temperature units
Volume unit
Metering graphic
Commissioning screen
Alarm alert
Communications
Baud rate RS232
Baud rate RS485
Slave ID
Inactivity Timeout
Packet Timeout
Date format

When connected to DSE8760
Load Power Factor
Load Parallel Power
Mains decoupling test mode
Voltage Adjust
Frequency Adjust
Pressure units
Temperature units
Volume unit
Metering graphic
Commissioning screen
Alarm alert
Communications
Baud rate RS232
Baud rate RS485
Slave ID
Inactivity Timeout
Packet Timeout
Date format

10.2 FRONT PANEL EDITOR ACCESS

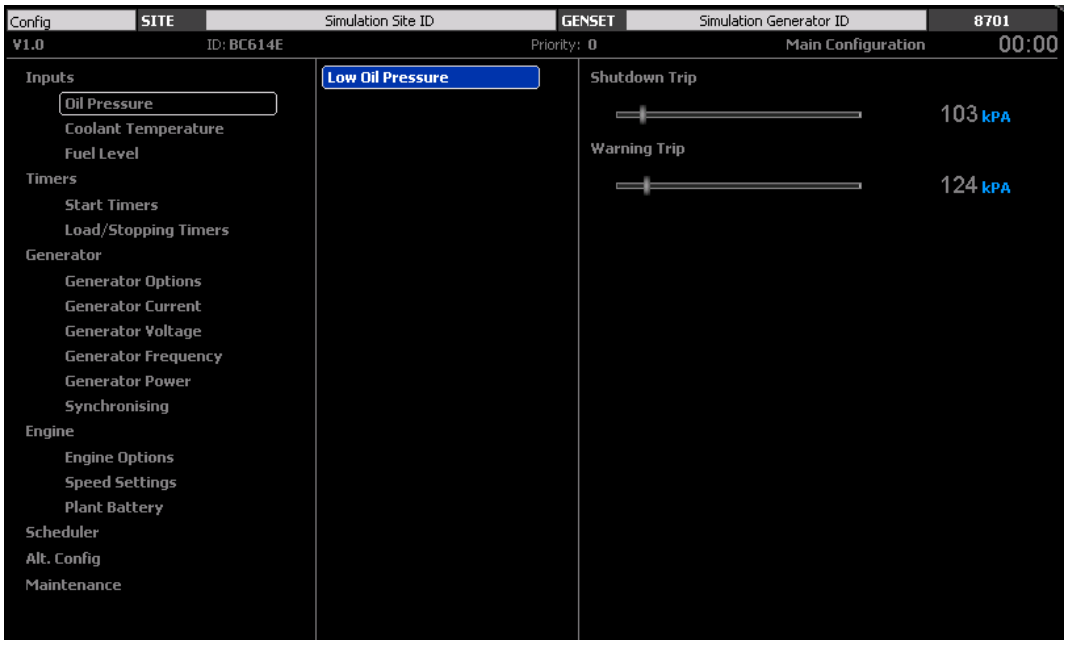
A simultaneous press of the stop and tick button enters the front panel editor. A press and hold of the tick button exits the FPE, with changes to the 8700 configuration file saved. A press and hold of the stop button will exit the FPE, without saving changes to the 8700 configuration file.

10.2.1 FRONT PANEL EDITOR SECURITY

If configured in the 8700, the user is required to enter a 4-digit pin number before entering the front panel editor. # Symbols mask the digits of the pin number, unless being edited. A press of the tick button begins and ends the editing process. The up and down buttons modify a digit and the right and left buttons select them. At the end of editing, as the tick button is pressed, the pin is checked and access granted if correct.

10.2.2 FRONT PANEL EDITOR OPERATION

When in the front panel editor, the display is arranged as shown in the figure below. The left segment shows the 'title sections', the middle segment shows the 'sub sections' and the right segment shows the editor items available within that 'sub section'.



The user navigates to the editor item using the up/down/left/right buttons. The current selected item is shown highlighted in blue, with the path for the relevant 'title section' and 'sub sections' shown with a box.

In order to start editing an item, press the tick button, at which point the item and current value are highlighted. In addition, the image shown below appears to the right of the current value to indicate how the value is adjusted. i.e. with the up/down buttons. Complete editing by pressing the tick button, after which the navigation buttons select the next item.

Press and hold the tick button to exit the front panel editor. If changes have been made, they are saved to the attached 8700 unit.

⚠ NOTE: - More comprehensive module configuration is possible using the 87xx series PC configuration suite software. Please contact us for further details.

10.2.3 ADJUSTABLE PARAMETERS – DSE8710 CONTROLLER

Front Panel Configuration Editor. For descriptions of the parameters, refer to The DSE8700 series Configuration Suite Manual, DSE Part 057-127.

Section	Item	Selection
Oil Pressure	Low Oil Pressure Alarms	Shutdown trip
		Pre alarm trip
Coolant Temperature	High Coolant Temperature Alarm	Pre-alarm trip
		Electrical Trip
		Shutdown trip
	Low Coolant Temperature Alarm	Pre-alarm trip
Fuel Level	Fuel Usage Alarm	Running Rate
		Stopped Rate
Outputs	Output A	Output source
	Output B	Output source
Start Timers	Start Delay	Remote Start Delay Off Load
		Remote Start Delay On Load
		Telemetry Start
	Start Timers	Pre-Heat
		Cranking Time
		Crank Rest Time
		Smoke Limit
		Smoke Limit Off
		Safety On Delay
		Warming Up Time
Load/Stopping Timers	Stopping Timers	Return Delay
		Cooling Time
		Fail to Stop Delay
		Generator Transient Delay
Generator Options	Generator Options	AC System
	Generator Rating	kW Rating
		kVAr Rating
Generator Voltage	Under Voltage Alarms	Shutdown Trip
		Pre Alarm Trip
	Nominal Voltage	Nominal Voltage
	Over Voltage Alarms	Pre Alarm Trip
		Shutdown Trip
Generator Frequency	Under Frequency Alarms	Shutdown Trip
		Pre Alarm Trip
	Nominal Frequency	Nominal Frequency
	Over Frequency Alarms	Pre Alarm Trip
		Shutdown Trip

Section	Item	Selection
Generator Current	Generator Current Options	CT Primary (L1,L2,L3,N)
		CT Secondary
		Load Rating
		Earth CT Primary
	Overcurrent Alarm	IDMT Alarm
		Trip
	Short Circuit	Trip
	Earth Fault	Earth Fault Trip Enable
		Earth Fault Trip
Generator Power	Overload Protection	Alarm Trip
	Reverse Power Alarm	Trip
		Delay
Synchronising Load Control	Load Options	Reactive Load Control Mode
	Ramp	Ramp Speed
	Load Demand	Calling for More Sets
		Calling for Less Sets
	Insufficient Capacity	Action
		Delay
	Running	Load parallel power
		Load power factor (p.f.) edited
		Run priority
Engine Options	Overspeed Options	Overspeed Overshoot
		Overshoot Delay
	Droop	Enable
		Value
Speed Settings	Under Speed	Shutdown
		Shutdown Trip
		Pre Alarm
		Pre-Alarm Trip
	Over Speed	Pre Alarm Enable
		Pre Alarm Trip
		Shutdown Trip
Plant Battery	Voltage Alarms	Undervolts
		Undervolts Delay
		Undervolts Warning
		Overvolts
		Overvolts Delay
		Overvolts Warning
	Charge Alternator Alarm	Shutdown
		Shutdown Trip
		Shutdown Delay
		Warning Enable
		Warning Trip
		Warning Delay

Section	Item	Selection
Alternative Config Options	Alternative Config Options	Default Configuration
Time	Module Time	Time
		Date

10.2.1 ADJUSTABLE PARAMETERS – DSE8760 CONTROLLER

Front Panel Configuration Editor. For descriptions of the parameters, you are referred to The DSE8700 series Configuration Suite Manual, DSE Part 057-127.

Front Panel Configuration Editor. For descriptions of the parameters, refer to The DSE8700 series Configuration Suite Manual, DSE Part 057-127.

Section	Item	Selection	
Outputs	Output A	Output source	
	Output B	Output source	
Start Timers	Start Delay	Remote Start Delay Off Load	
		Remote Start Delay On Load	
		Telemetry Start	
Load/Stopping Timers	Stopping Timers	Return Delay	
		Transfer time / Load delay	
Mains	Mains Options	AC System	
	Mains Current	CT Primary (L1,L2,L3,N)	
		CT Secondary	
	Mains Voltage	Under Voltage Alarms	Pre-alarm trip
		Nominal Voltage	Nominal voltage
		Over Voltage Alarms	Pre-alarm trip
	Mains Frequency	Under Frequency Alarms	Pre-alarm trip
		Nominal Frequency	Nominal Frequency
		Over Frequency Alarms	Pre-alarm trip
Bus	Ramp	Ramp Speed	
	Load Demand	Calling for more sets	
		Calling for less sets	
	Running	Load parallel ppower	
		Load power factor	
System	Insufficient Capacity	Action	
		Delay	
	Plant Battery	Voltage Alarms	Undervolts
			Undervolts Delay
			Undervolts Warning
			Overvolts
			Overvolts Delay
			Overvolts Warning
Maintenance	Module Time	Time	
		Date	

11 COMMISSIONING

11.1.1 PRE-COMMISSIONING

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

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

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

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

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

10.4. Make all checks on the engine and alternator as detailed by their respective manufacturer documentation.
10.5. Check all other parts in the system according to the manufacturer documentation.
10.6. Thoroughly review the configuration of the DSE controller and check that all parameters meet the requirements of your system.
10.7. To check the start cycle operation, take appropriate measures to prevent the engine from starting (disable the operation of the fuel solenoid). After a visual inspection to ensure it is safe to proceed, connect the battery supply. Select **"MANUAL"** and then press **"START"** the unit start sequence will commence.

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

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

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

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

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

10.13. If despite repeated checking of the connections between the **8700** series controller and the customer's system, satisfactory operation cannot be achieved, then the customer is requested to contact the factory for further advice on:-

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

12 FAULT FINDING

SYMPTOM	POSSIBLE REMEDY
Connection lost with host controller	Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse. Check connection to the host controller. Factory settings are for RS232 null modem (crossover cable) for connection. This can be adjusted by the user using Config Suite software if required.
Unit is inoperative Read/Write configuration does not operate	Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse.
Unit shuts down	Check DC supply voltage is not above 35 Volts or below 9 Volts Check the operating temperature is not above 70℃. Check the DC fuse.
Unit locks out on Emergency Stop	If no Emergency Stop Switch is fitted, ensure that a DC positive signal is connected to the Emergency Stop input. Check emergency stop switch is functioning correctly. Check Wiring is not open circuit.
Intermittent Magnetic Pick-up sensor fault	Ensure that Magnetic pick-up screen only connects to earth at one end, if connected at both ends, this enables the screen to act as an aerial and will pick up random voltages. Check pickup is correct distance from the flywheel teeth.
Low oil Pressure fault operates after engine has fired	Check engine oil pressure. Check oil pressure switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sensor is compatible with the 73x0 Module and is correctly configured.
High engine temperature fault operates after engine has fired.	Check engine temperature. Check switch/sensor and wiring. Check configured polarity (if applicable) is correct (i.e. Normally Open or Normally Closed) or that sensor is compatible with the 8700 series module.
Shutdown fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Warning fault operates	Check relevant switch and wiring of fault indicated on LCD display. Check configuration of input.
Fail to Start is activated after pre-set number of attempts to start	Check wiring of fuel solenoid. Check fuel. Check battery supply. Check battery supply is present on the Fuel output of the module. Check the speed-sensing signal is present on the 8700 series module's inputs. Refer to engine manual.
Continuous starting of generator when in **AUTO**	Check that there is no signal present on the "Remote Start" input. Check configured polarity is correct.
Generator fails to start on receipt of Remote Start signal.	Check Start Delay timer has timed out. Check signal is on "Remote Start" input. Confirm correct configuration of input Check that the oil pressure switch or sensor is indicating low oil pressure to the controller. Depending upon configuration, then set will not start if oil pressure is not low.
Pre-heat inoperative	Check wiring to engine heater plugs. Check battery supply. Check battery supply is present on the Pre-heat output of module. Check pre-heat configuration is correct.
Starter motor inoperative	Check wiring to starter solenoid. Check battery supply. Check battery supply is present on the Starter output of module. Ensure that the Emergency Stop input is at Positive. Ensure oil pressure switch or sensor is indicating the "low oil pressure" state to the 8721 series controller.
Engine runs but generator will not take load	Check Warm up timer has timed out. Ensure generator load inhibit signal is not present on the module inputs. Check connections to the switching device. Note that the set will not take load in manual mode unless there is an active remote start on load signal.
Synchronising or load sharing is not operating satisfactorily	Follow the DSE "4 Steps To Synchronising" as detailed in the following section.

SYMPTOM	POSSIBLE REMEDY
Incorrect reading on Engine gauges. Fail to stop alarm when engine is at rest.	Check engine is operating correctly. Check sensor and wiring paying particular attention to the wiring to the sensor earth terminal. Check that sensor is compatible with the 8700 series module and that the module configuration is suited to the sensor.
Module appears to 'revert' to an earlier configuration	When editing a configuration using the PC software it is vital that the configuration is first 'read' from the controller before editing it. This edited configuration must then be "written" back to the controller for the changes to take effect. When editing a configuration using the fascia editor, be sure to press the Accept button to save the change before moving to another item or exiting the fascia editor
Set will not take load	Ensure the generator available LED is lit Check that the output configuration is correct to drive the load switch device and that all connections are correct. Remember that the set will not take load in manual mode unless a remote start on load input is present or the close generator button is pressed.
Inaccurate generator measurements on controller display	Check that the CT primary, CT secondary and VT ratio settings are correct for the application. Check that the CTs are wired correctly with regards to the direction of current flow (p1,p2 and s1,s2) and additionally ensure that CTs are connected to the correct phase (errors will occur if CT1 is connected to phase 2). Remember to consider the power factor. Ie (kW = kVA x power factor) The 8700 series controller is true RMS measuring so gives more accurate display when compared with an 'averaging' meter such as an analogue panel meter or some lower specified digital multimeters. Accuracy of the controller is better than 1% of full scale. I.e. Gen volts full scale is 333V ph-n so accuracy is ±3.33V (1% of 333V).

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

13 DSE 4 STEPS TO SUCCESSFUL SYNCHRONISING

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

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

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

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

13.1 CONTROL

Check the control of the engine is working:

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

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

13.2 METERING

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

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

13.3 COMMUNICATIONS

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

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

13.4 SYNC CHECKS

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

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

14 MAINTENANCE, SPARES, REPAIR AND SERVICING

The DSE8700 Series controller is *Fit and Forget*. As such, there are no user serviceable parts within the controller. In the case of malfunction, you should contact your original equipment manufacturer (OEM).

14.1 PURCHASING ADDITIONAL CONNECTOR PLUGS FROM DSE

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

14.1.1.1 INDIVIDUAL PLUGS

8721 terminal designation	Plug description	Part No.
1-5 	5 way 5.08mm	007-445
RS485 A,B,SCR	3 way 5.08mm	007-174
	PC Configuration interface lead (USB type A – USB type B)	016-125

14.2 PURCHASING ADDITIONAL FIXING CLIPS FROM DSE

Item	Description	Part No.
	8700 series fixing clips (packet of 4)	020-294

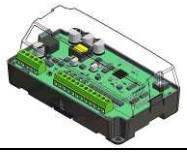
14.3 PURCHASING ADDITIONAL SEALING GASKET FROM DSE

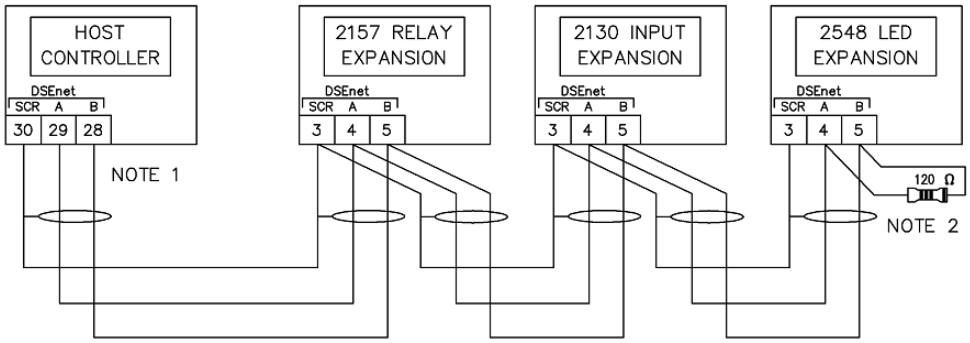
Item	Description	Part No.
	8721 series silicon sealing gasket	020-509

14.4 DSENET EXPANSION MODULES

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

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

Item	Max No. supported	Description	DSE Part numbers			
			Model order number	Sales literature	Operator manual	Installation Instructions
	4	Model DSE2130 expansion input module provides additional analogue(DSE8710 only) and digital inputs for use with the DSE8700 series controller.	2130-001-00	055-060	057-082	053-033
	10	Model DSE2157 expansion relay module provides eight additional voltage free relays for use with the DSE8700 series controller	2157-001-00	055-061	057-083	053-034
	10	Model DSE2548 expansion LED module provides additional LED indications, internal sounder and remote lamp test/alarm mute for use with the DSE8700 series controller.	2548-001-00	055-062	057-084	053-032



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

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

15 WARRANTY

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

16 DISPOSAL

16.1 WEEE (WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT)

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

16.2 ROHS (RESTRICTION OF HAZARDOUS SUBSTANCES)

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

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

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

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