



DEEP SEA ELECTRONICS

DSE2160 Operator Manual

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DSE2160 Operator Manual

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Amendments Since Last Publication

Issue No.	Comments
1	Initial Release
2	Update to remove Positive Switching Configuration from section 2.6.1.2 and update to communication ports section 2.9

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

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1 INTRODUCTION

This document details the installation and operation requirements of the DSE2160 Input and Output Expansion Module and is part of the DSE **Genset**® range of products.

The manual forms part of the product and should be kept for the entire life of the product. If the product is passed or supplied to another party, ensure that this document is passed to them for reference purposes.

This is not a *controlled document*. DSE do not automatically inform on updates. Any future updates of this document are included on the DSE website at www.deepseaelectronics.com

The DSE2160 Input and Output Expansion module is designed to enhance the input capabilities of supported DSE modules. The module offers 8 Digital Input/Outputs, 6 Digital Inputs and 2 Analogue inputs. The configuration of the expansion module is done within the host module's configuration. The only configuration applied to DSE2160 is the selection of the ID switch to match the host module's configuration. For further details on configuring the host module, refer to the relevant host module's configuration software manual outlined in this manual's section entitled *Bibliography*.

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

1.1 CLARIFICATION OF NOTATION

Clarification of notation used within this publication.

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

1.2 GLOSSARY OF TERMS

Term	Description
DSE2000, DSE2xxx	All modules in the DSE2xxx range.
DSE2100I, DSE21xx	All modules in the DSE21xx range.
DSE2160	DSE2160 expansion module/controller
CAN	Controller Area Network Vehicle standard to allow digital devices to communicate to one another.
BMS	Building Management System A digital/computer-based control system for a building's infrastructure.
EMC	Electromagnetic Compatibility The ability of electrical equipment and systems to function in their electromagnetic environment.
ECU/ECM	Engine Control Unit/Management An electronic device that monitors engine parameters and regulates the fuelling.
FMI	Failure Mode Indicator A part of DTC that indicates the type of failure, e.g. high, low, open circuit etc.
HMI	Human Machine Interface A device that provides a control and visualisation interface between a human and a process or machine.
LED	Light Emitting Diode A semiconductor device that emits light when current flows through it.
PGN	Parameter Group Number A CAN address for a set of parameters that relate to the same topic and share the same transmission rate.
PLC	Programmable Logic Controller A programmable digital device used to create logic for a specific purpose.
NEMA	National Electrical Manufacturers Association A trade association of electrical equipment manufacturers in the United States.
PBB	Polybrominated Biphenyls A type of chemical that was added to plastics to make them difficult to burn.
PBDE	Polybrominated Diphenyl Ethers A type of chemical that was added to plastics to make them difficult to burn.
SPN	Suspect Parameter Number A part of DTC that indicates what the failure is, e.g. oil pressure, coolant temperature, turbo pressure etc.
WEEE	Waste Electrical and Electronic Equipment A European Community Directive, numbered 2012/19/EU, concerned with waste electrical and electronic equipment.

1.3 BIBLIOGRAPHY

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

1.3.1 INSTALLATION INSTRUCTIONS

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

DSE Part	Description
053-032	DSE2548 LED Expansion Annunciator Installation Instructions
053-033	DSE2130 Input Expansion Installation Instructions
053-034	DSE2157 Output Expansion Installation Instructions
053-049	DSE9xxx Battery Charger Installation Instructions
053-125	DSE2131 Ratio-metric Input Expansion Installation Instructions
053-126	DSE2133 RTD/Thermocouple Input Expansion Installation Instructions
053-134	DSE2152 Ratio-metric Output Expansion Installation Instructions
053-147	DSE9460 & DSE9461 Battery Charger Installation Instructions
053-185	DSE9473 & DSE9483 Battery Charger Installation Instructions
053-251	DSE BC2410Ei Installation Instructions
053-265	DSE BC2415i Installation Instructions
053-256	DSEG8600 Installation Instructions
053-253	DSEG8660 Installation Instructions
053-254	DSEG8680 Installation Instructions
053-268	DSE2160 Installation Instructions
053-269	DSE2170 Installation Instructions

1.3.2 MANUALS

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

DSE Part	Description
057-082	DSE2130 Operator Manual
057-083	DSE2157 Operator Manual
057-084	DSE2548 Operator Manual
057-085	DSE9xxx Operator Manual
057-139	DSE2131 Operator Manual
057-140	DSE2133 Operator Manual
057-141	DSE2152 Operator Manual
057-151	DSE Configuration Suite PC Software Installation & Operation Manual
057-176	DSE9460 & DSE9461 Battery Charger Operator Manual
057-322	DSEG8600 Configuration Suite PC Software Manual
057-324	DSEG8660 Configuration Suite PC Software Manual
057-326	DSEG8680 Configuration Suite PC Software Manual
057-323	DSEG8600 Operators Manual
057-325	DSEG8660 Operators Manual
057-327	DSEG8680 Operators Manual

1.3.3 TRAINING GUIDES

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

DSE Part	Description
056-006	Introduction to Comms
056-036	DSE Module Expansion
056-092	Best Practices for Wiring Restive Sensors
056-118	Configurable CAN

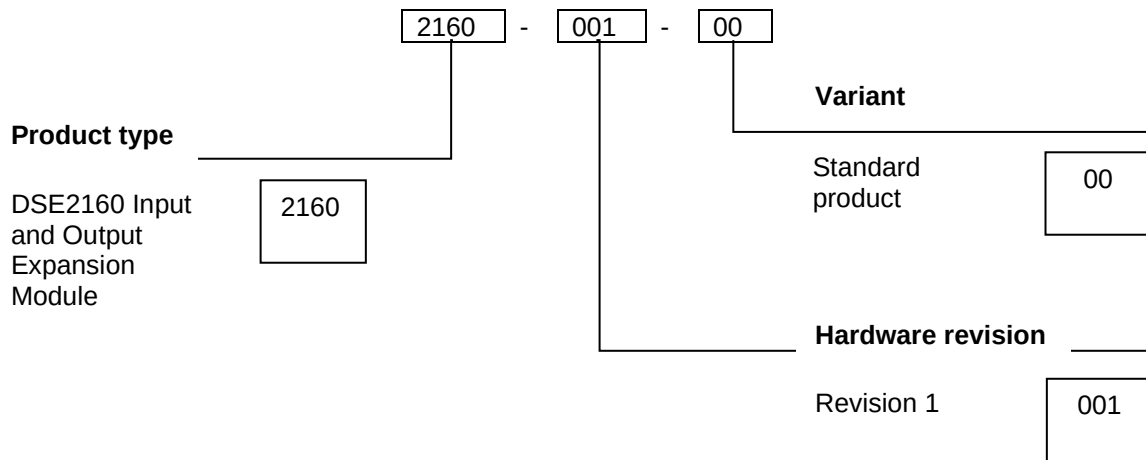
1.3.4 THIRD PARTY DOCUMENTS

The following third-party documents are also referred to:

Reference	Description
ISBN 1-55937-879-4	IEEE Std C37.2-1996 IEEE Standard Electrical Power System Device Function Numbers and Contact Designations. Institute of Electrical and Electronics Engineers Inc
ISBN 0-7506-1147-2	Diesel Generator Handbook. L.L.J. Mahon
ISBN 0-9625949-3-8	On-Site Power Generation. EGSA Education Committee.

2 SPECIFICATION

2.1 PART NUMBERING



At the time of this document production, there are no variants of this product and there have been no revisions of the module hardware.

2.2 OPERATING TEMPERATURE

Parameter	Specification
Operating Temperature Range	-30 °C +70 °C (-22 °F +158 °F)
Storage Temperature Range	-40 °C +85 °C (-40 °F +185 °F)

2.3 REQUIREMENTS FOR UL


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

Specification	Description
Screw Terminal Tightening Torque	4.5 lb-in (0.5 Nm)
Conductors	- Terminals suitable for connection of conductor size 13 AWG to 20 AWG (0.5 mm² to 2.5 mm²). - Conductor protection must be provided in accordance with NFPA 70, Article 240 (USA). - Low voltage circuits (35 V or less) must be supplied from the engine starting battery or an isolated secondary circuit and protected by a Listed fuse rated max. 2A. - The communication, sensor, and/or battery derived circuit conductors shall be separated and secured to maintain at least ¼" (6 mm) separation from the generator and mains connected circuit conductors unless all conductors are rated 600 V or greater. - Use only copper conductors rated for a minimum operating temperature of 158 °F (70 °C).
Communication Circuits	Must be connected to communication circuits of UL Listed equipment (if working to UL requirements).

Parameter descriptions are continued overleaf...

Specification	Description
DC Output	- The current pilot duty of the DC outputs is not rated. - The DC outputs must not be used for control of a fuel safety valve.
Mounting	- The device must be installed within an unventilated Type 1 enclosure minimum, or ventilated Type 1 enclosure minimum provided with filters to maintain a pollution degree 2 or controlled environment. - For flat surface mounting in Type 1 Enclosure Type rating provided with filters to maintain a pollution degree 2 or controlled environment. Surrounding air temperature -22 °F to +158 °F (-30 °C to +70 °C).

2.4 TERMINAL SPECIFICATION

Description	Specification	
Connection Type	Two-part connector. Male part fitted to module Female part supplied in module packing case - Screw terminal, rising clamp, no internal spring.	 Example showing cable entry and screw terminals of a 10-way connector
Minimum Cable Size	0.5 mm ² (AWG 20)	
Maximum Cable Size	2.5 mm ² (AWG 13)	
Tightening Torque	0.5 Nm (4.5 lb-in)	
Wire Strip Length	7 mm (9/32")	

2.5 POWER SUPPLY REQUIREMENTS

Description	Specification
Minimum Supply Voltage	8 V continuous
Cranking Dropouts	Able to survive 0 V for 50 ms providing the supply was at least greater than 10 V for 2 seconds before the dropout and recovers to 5 V afterwards.
Maximum Supply Voltage	35 V continuous (60 V protection)
Reverse Polarity Protection	-35 V continuous
Maximum Operating Current	190 mA at 12 V 90 mA at 24 V
Maximum Standby Current	34 mA at 12 V 20 mA at 24 V

2.6 INPUTS

2.6.1 DIGITAL INPUTS

Description	Specification
Number	8 (A to F)

2.6.1.1 DIGITAL INPUT A

Digital Input Configuration

Description	Specification
Measurement Type	Negative switching digital input
Arrangement	Contact between terminal and module supply negative
Closed Voltage Threshold	Less than 2.1 V
Open Voltage Threshold	Greater than 6.6 V
Maximum Input Voltage	+60 V DC with respect to module supply negative
Minimum Input Voltage	-24 V DC with respect to module supply negative
Contact Wetting Current	7 mA typical
Open Circuit Voltage	12 V typical

High Frequency Input Configuration

Description	Specification
Measurement Type	Negative switching digital input
Arrangement	Contact between terminal and module supply negative
Low Level Threshold	Less than 2.1 V
High Level Threshold	Greater than 6.6 V
Minimum Frequency	5 Hz
Maximum Frequency	10 kHz
Maximum Input Voltage	+70 V DC with respect to module supply negative
Minimum Input Voltage	-24 V DC with respect to module supply negative
Contact Wetting Current	7 mA typical
Open Circuit Voltage	12 V typical

2.6.1.2 DIGITAL INPUTS B TO F

Description	Specification
Number	5 (B to F)

Negative Switching Configuration

Description	Specification
Measurement Type	Negative switching digital input
Arrangement	Contact between terminal and module supply negative
Closed Voltage Threshold	Less than 2.1 V
Open Voltage Threshold	Greater than 6.6 V
Maximum Input Voltage	+60 V DC with respect to module supply negative
Minimum Input Voltage	-24 V DC with respect to module supply negative
Contact Wetting Current	7 mA typical
Open Circuit Voltage	12 V typical

2.6.2 ANALOGUE INPUTS

Description	Specification
Number	2 (A to B)
Input Type	Digital Input or Flexible Analogue
Flexible Analogue Measured Quantity	Resistive

Digital Input Configuration

Description	Specification
Measurement Type	Negative switching digital input
Arrangement	Contact between analogue input terminal and analogue common terminal
Closed Voltage Threshold	Less than 2.1 V
Open Voltage Threshold	Greater than 6.6 V
Maximum Input Voltage	+60 V DC with respect to module supply negative
Minimum Input Voltage	-24 V DC with respect to module supply negative
Contact Wetting Current	9.3 mA typical
Open Circuit Voltage	12 V typical

Resistive Configuration

Description	Specification
Measurement Type	Resistance measurement by measuring voltage across sensor with a fixed current applied
Arrangement	Contact between analogue input terminal and analogue common terminal
Measurement Current	9.3 mA
Full Scale	3 k Ω
Over Range / Fail	5 k Ω
Resolution	± 1 % of full-scale resistance (± 30 Ω) excluding sensor error
Accuracy	± 2 % of full-scale resistance (± 60 Ω) excluding sensor error
Max Common Mode Voltage	± 3 V
Display Range	Configurable by PC Software

2.7 DIGITAL INPUTS / OUTPUTS

Description	Specification
Number	8 (A to H)
Type	Digital Input, Positive Digital Output or Negative Digital Output

Digital Input Configuration

Description	Specification
Measurement Type	Negative switching digital input
Arrangement	Contact between terminal and module supply negative terminal
Closed Voltage Threshold	Less than 2.1 V
Open Voltage Threshold	Greater than 6.6 V
Maximum Input Voltage	+60 V DC with respect to module supply negative
Minimum Input Voltage	-24 V DC with respect to module supply negative
Contact Wetting Current	7 mA typical
Open Circuit Voltage	12 V typical

Positive Digital Output Configuration

Description	Specification
Type	Positive switching DC output supplied from module supply positive.
Arrangement	Contact from terminal to load, load to module supply negative terminal
Rating	0.5 A resistive at module supply positive.

Negative Digital Output Configuration

Description	Specification
Type	Negative switching DC output supplied from an external DC supply with a maximum rating of 35 V.
Arrangement	Contact from terminal to load, load to module supply positive terminal
Rating	0.5 A resistive at a maximum of 35 V from external supply that is referenced to module supply negative.

2.8 COMMUNICATION PORTS

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

Description	Specification
CAN Port	 NOTE: For additional length, the DSE124 CAN & MSC Extender is available. For more information, refer to DSE Publication: 057-116 <i>DSE124 Operator Manual</i> CAN Port Standard implementation of 'Slow mode,' up to 250 kbit/s Max common mode offset ± 70 V (on board protection transorb) Max distance 40 m (43.5 yards)
DSENet® (Expansion Comms) Port	Data connection 2 wire + common Half Duplex Data direction control for Transmit (by software protocol) Baud Rate of 115 kbaud Max common mode offset ± 70 V (on board protection transorb) Max distance 1.2 km ($\frac{3}{4}$ mile)

2.9 COMMUNICATION PORT USAGE

2.9.1 DSENET® (EXPANSION MODULES)

 **NOTE:** Simultaneous use of the DSENet and CAN interface is not supported. For further details, contact DSE technical support: support@deepseaelectronic.com

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

 **NOTE :** As a termination resistor is internally fitted to the host controller, the host controller must be the 'first' unit on the DSENet®. A termination resistor **MUST** be fitted to the 'last' unit on the DSENet®. For further details, refer to section entitled *Typical Schematic Diagram* elsewhere in this document

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

Description	Specification
Cable Type	Two core screened and shielded twisted pair
Cable Characteristics	120 Ω impedance, low capacitance
Recommended Cable	Belden 9841 Belden 9271
Maximum Cable Length	1.2 km ($\frac{3}{4}$ mile) when using Belden 9841 or direct equivalent. 600 m (656 yards) when using Belden 9271 or direct equivalent.
DSENet® Topology	"Daisy Chain" Bus with no stubs (spurs)
DSENet® Termination	120 Ω . Fitted internally to host controller. Must be fitted externally to the 'last' expansion module.

2.9.2 CAN

 **NOTE:** Simultaneous use of the DSENet and CAN interface is not supported. For further details, contact DSE technical support: support@deepseaelectronic.com

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

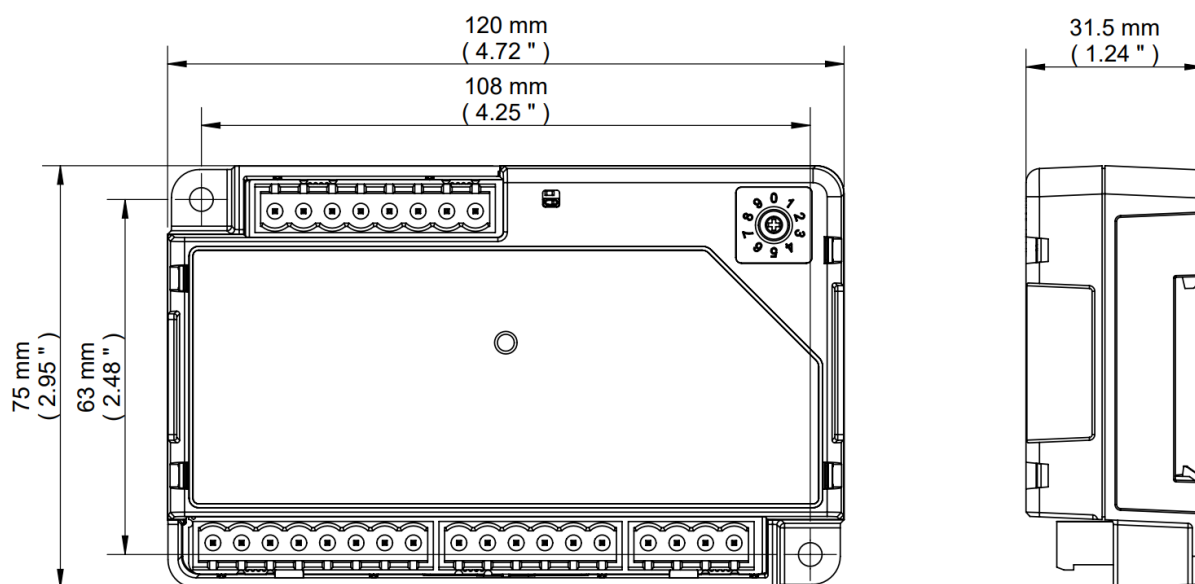
The module is fitted with a Controller Area Network (CAN) interface as standard. The *CAN Port* is used for point-to-point cable connection of more than one device and allows for connection to CAN Scanner, PLC, and CAN controllers (to name just a few devices).

The module is capable of receiving certain J1939 messages and a set of DSE specific proprietary messages. The CAN interface serves as a supplementary method for controlling and obtaining information from the module. This enables the operator is to view the various operating parameters of the module via CAN.

Description	Specification
Cable Type	Two core screened and shielded twisted pair
Cable Characteristics	120 Ω impedance, low capacitance
Recommended Cable	Belden 9841
Maximum Cable Length	40 m (43.7 yards) when using Belden 9841 or direct equivalent.
CAN Topology	"Daisy Chain" Bus with no stubs (spurs)
CAN Termination	120 Ω . Must be fitted externally to the 'first' and 'last' device

2.10 DIMENSIONS AND MOUNTING

Parameter	Specification
Enclosure Type	For use indoors or enclosed spaces only.
Protection Category	IP21, NEMA 1
Overall Size	120 mm x 75 mm x 31.5 mm (4.72 " x 2.95 " x 1.24 ")
Weight	0.20 kg (0.44 lb)
Mounting Type	DIN Rail or Chassis Mounting. Base mounted to a vertical surface with connection terminals to the bottom.
Mounting Holes	Diameter 4.5 mm (0.18 "), 108 mm X 63 mm (4.25 " x 2.48 ") centres
Operating Temperature	-30 °C +70 °C (-22 °F +158 °F)
Storage Temperature	-40 °C +85 °C (-40 °F +185 °F)



2.11 APPLICABLE STANDARDS

Standard	Description
BS EN 60068-2-1 (Minimum temperature)	-30 °C (-22 °F)
BS EN 60068-2-2 (Maximum temperature)	+70 °C (158 °F)
BS EN 60068-2-6 (Vibration)	Ten sweeps in each of three major axes 5 Hz to 8 Hz at ± 7.5 mm 8 Hz to 500 Hz at 2 gn
BS EN 60068-2-27 (Shock)	Three shocks in each of three major axes 15 gn in 11 ms
BS EN 60068-2-30 (Damp heat cyclic)	20 °C to 55 °C at 95% relative humidity for 48 hours
BS EN 60068-2-78 (Damp heat static)	40 °C at 95% relative humidity for 48 hours
BS EN61010 (Electrical safety)	Safety of Electrical Equipment for Measurement, Control and Laboratory use.
BS EN 61000-6-2 (Electro-magnetic Compatibility)	EMC Generic Immunity Standard (Industrial)
BS EN 61000-6-4 (Electro-magnetic Compatibility)	EMC Generic Emission Standard (Industrial)
BS EN 60529 (Degrees of protection provided by enclosures)	IP21
UL508 NEMA rating (Approximate)	Type 1 (indoor use only)

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

2.11.1 ENCLOSURE CLASSIFICATIONS

2.11.1.1 IP CLASSIFICATIONS

The modules specification under BS EN 60529 Degrees of protection provided by enclosures

IP21	
First Digit	Second Digit
Protection against contact and ingress of solid objects	Protection against ingress of water
0 No protection	0 No protection
1 Protected against ingress solid objects with a diameter of more than 50 mm. No protection against deliberate access, e.g. with a hand, but large surfaces of the body are prevented from approach.	1 Protection against dripping water falling vertically. No harmful effect must be produced (vertically falling drops).
2 Protected against penetration by solid objects with a diameter of more than 12 mm. Fingers or similar objects prevented from approach.	2 Protection against dripping water falling vertically. There must be no harmful effect when the equipment (enclosure) is tilted at an angle up to 15° from its normal position (drops falling at an angle).
3 Protected against ingress of solid objects with a diameter of more than 2.5 mm. Tools, wires etc. with a thickness of more than 2.5 mm are prevented from approach.	3 Protection against water falling at any angle up to 60° from the vertical. There must be no harmful effect (spray water).
4 Protected against ingress of solid objects with a diameter of more than 1 mm. Tools, wires etc. with a thickness of more than 1 mm are prevented from approach.	4 Protection against water splashed against the equipment (enclosure) from any direction. There must be no harmful effect (splashing water).
5 Protected against harmful dust deposits. Ingress of dust is not totally prevented but the dust must not enter in sufficient quantity to interface with satisfactory operation of the equipment. Complete protection against contact.	5 Protection against water projected from a nozzle against the equipment (enclosure) from any direction. There must be no harmful effect (water jet).
6 Protection against ingress of dust (dust tight). Complete protection against contact.	6 Protection against heavy seas or powerful water jets. Water must not enter the equipment (enclosure) in harmful quantities (splashing over).

2.11.1.2 NEMA CLASSIFICATIONS

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

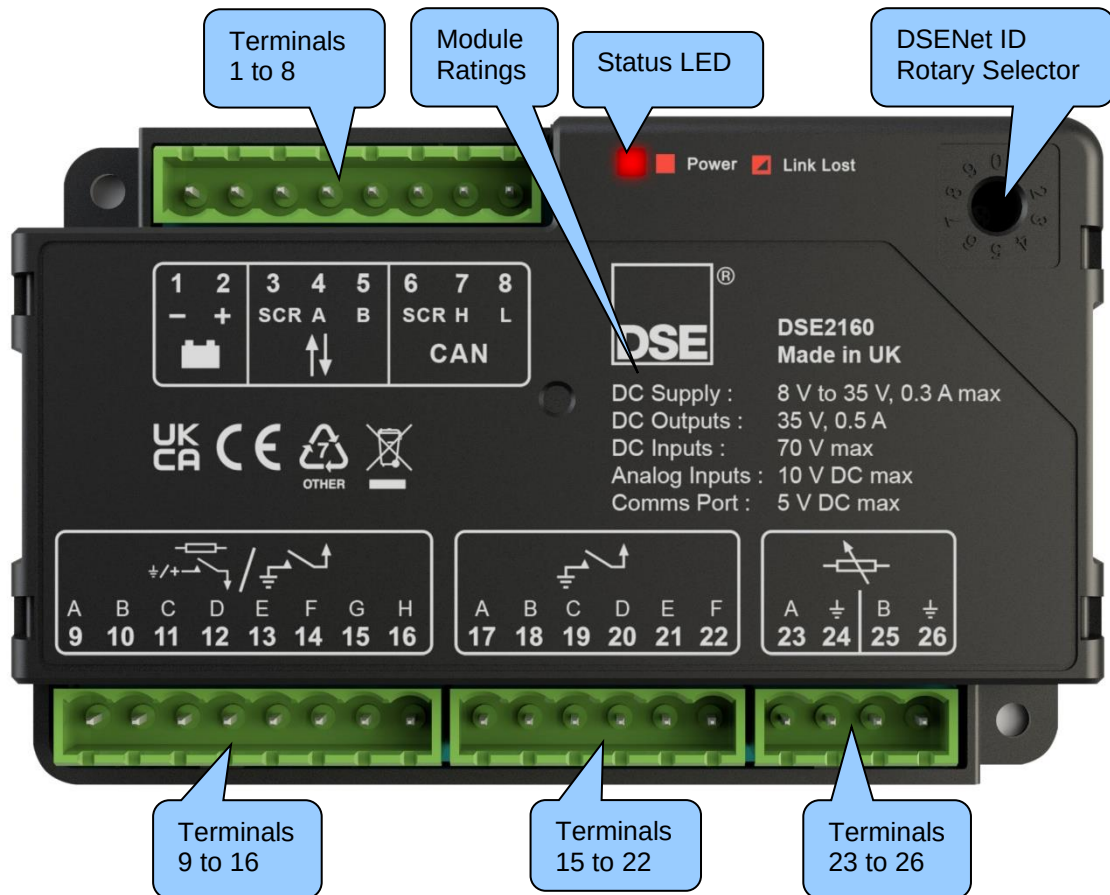
1	
1 IP30	Provides a degree of protection against contact with the enclosure equipment and against a limited amount of falling dirt.
2 IP31	Provides a degree of protection against limited amounts of falling water and dirt.
3 IP64	Provides a degree of protection against windblown dust, rain, and sleet; 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.

3 INSTALLATION

The module is designed to be mounted within an enclosure using the integral DIN rail mounts, or chassis mount holes. For dimension and mounting details, see the section entitled *Dimension and Mounting* elsewhere in this document.

3.1 USER CONNECTIONS

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



3.2 CONNECTION DESCRIPTIONS

3.2.1 DC SUPPLY, DSENET® & RS485

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

 **NOTE:** As a termination resistor is NOT fitted to the module. A 120 Ω termination resistor must be fitted across terminals A and B / H and L if the DSE module is the first or last device on the DSENet® / CAN link. For connection details, refer to section entitled *Typical Wiring Diagram* elsewhere in this document.

	Pin No	Description	Cable Size	Notes
	1	DC Plant Supply Input (Negative)	2.5 mm ² AWG 13	Connect to ground where applicable.
	2	DC Plant Supply Input (Positive)	2.5 mm ² AWG 13	Supplies the module and Digital Outputs
	3	DSENet® Expansion Screen	Shield	Use only 120 Ω CAN or RS485 approved cable
	4	DSENet® Expansion A	0.5 mm ² AWG 20	
	5	DSENet® Expansion B	0.5 mm ² AWG 20	
CAN	6	CAN Screen	Shield	Use only 120 Ω CAN or RS485 approved cable
	7	CAN H	0.5 mm ² AWG 20	
	8	CAN L	0.5 mm ² AWG 20	

3.2.2 DIGITAL INPUT/OUTPUTS

	Pin No	Description	Cable Size	Notes
	9	Digital Input/Output A	1.0mm ² AWG 18	When configured as a digital output, switches module supply positive or negative depending on configuration. When configured as digital input, switch to negative.
	10	Digital Input/Output B	1.0mm ² AWG 18	
	11	Digital Input/Output C	1.0mm ² AWG 18	
	12	Digital Input/Output D	1.0mm ² AWG 18	
	13	Digital Input/Output E	1.0mm ² AWG 18	
	14	Digital Input/Output F	1.0mm ² AWG 18	
	15	Digital Input/Output G	1.0mm ² AWG 18	
	16	Digital Input/Output H	1.0mm ² AWG 18	

3.2.3 DIGITAL INPUTS

	Pin No	Description	Cable Size	Notes
	17	Digital/High Frequency Input A	1.0mm ² AWG 18	Switch to negative.
	18	Digital Input B	1.0mm ² AWG 18	
	19	Digital Input C	1.0mm ² AWG 18	
	20	Digital Input D	1.0mm ² AWG 18	
	21	Digital Input E	1.0mm ² AWG 18	
	22	Digital Input F	1.0mm ² AWG 18	

3.2.4 ANALOGUE INPUTS

 **NOTE:** It is VERY important that terminals 24 and 26 (sensor common) are connected to an earth point on the ENGINE BLOCK, not within the control panel, and must be a sound electrical connection to the sensor bodies. This connection MUST NOT be used to provide an earth connection for other terminals or devices. The simplest way to achieve this is to run a SEPARATE earth connection from the system earth star point to terminal 24 and 26 directly, and not use this earth for other connections.

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

	Pin No	Description	Cable Size	Notes
	23	Analogue Input A	0.5 mm ² AWG 20	Connect to the output of the sensor.
	24	Analogue Input A Return	0.5 mm ² AWG 20	Ground return feed for Analogue Input A.
	25	Analogue Input B	0.5mm ² AWG 20	Connect to the output of the sensor.
	26	Analogue Input B Return	0.5 mm ² AWG 20	Ground return feed for Analogue Input B.

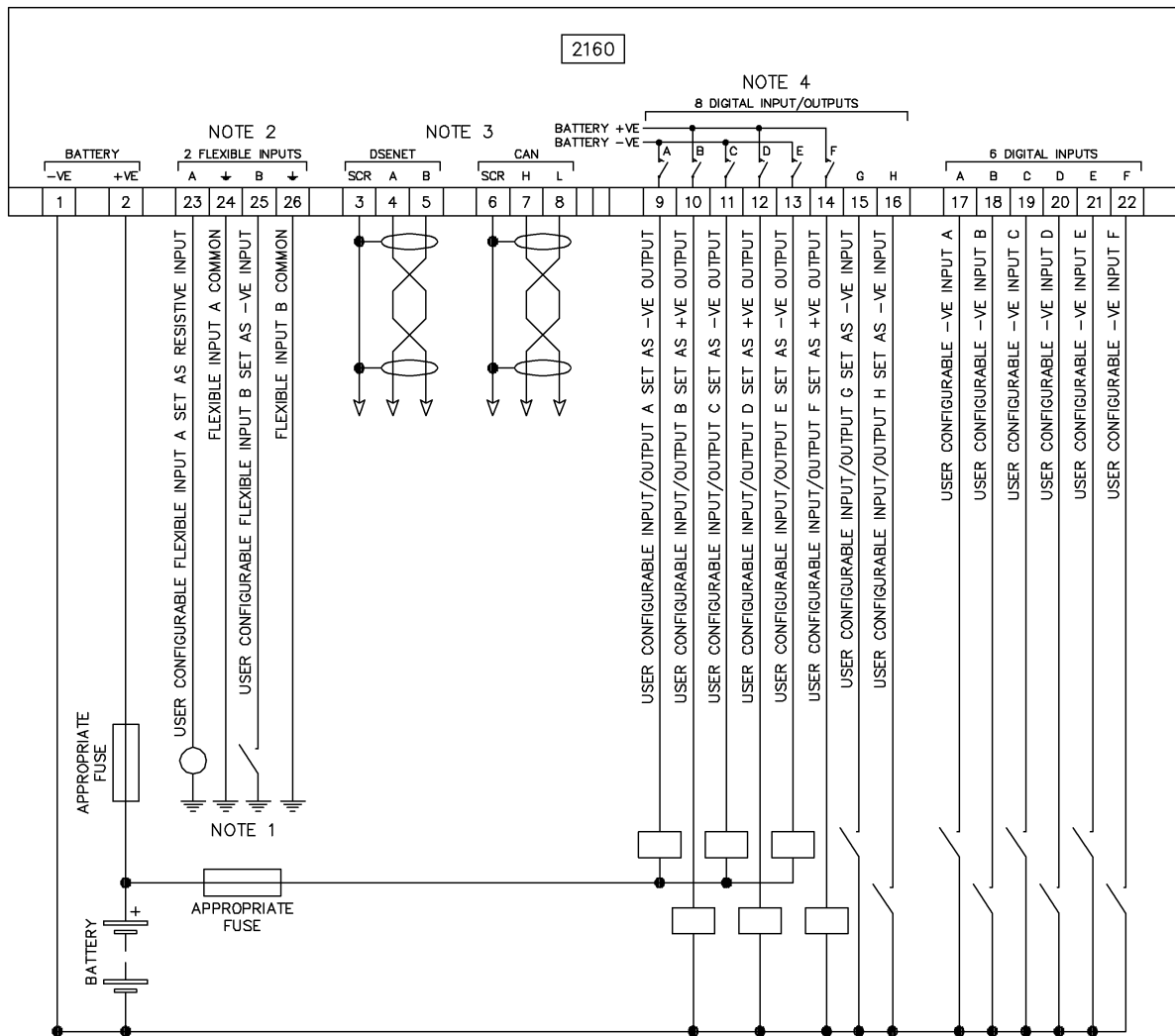
3.3 TYPICAL SCHEMATIC DIAGRAM

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

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

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

DSE Part	Description
056-091	Equipotential Earth Bonding
056-092	Best Practices for Wiring Resistive Sensors



NOTE 1. THESE GROUND CONNECTIONS MUST BE ON THE ENGINE BLOCK, AND MUST BE TO THE SENSOR BODIES.

NOTE 2. THE 2 FLEXIBLE INPUTS ARE INDIVIDUALLY CONFIGURABLE AS -VE DIGITAL INPUT OR RESISTIVE INPUT

NOTE 3. IF THE MODULE IS FIRST OR LAST UNIT ON THE LINK, IT MUST BE FITTED WITH A 120 OHM TERMINATION RESISTOR ACROSS TERMINALS A AND B FOR DSENET OR H AND L FOR CAN.

NOTE 4. THE 8 DIGITAL INPUT/OUTPUTS ARE INDIVIDUALLY CONFIGURABLE AS -VE DIGITAL INPUT, -VE DIGITAL OUTPUT. OR +VE DIGITAL OUTPUT.

3.3.1 EARTH SYSTEMS

3.3.1.1 NEGATIVE EARTH

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

3.3.1.2 POSITIVE EARTH

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

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

3.3.1.3 FLOATING EARTH

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

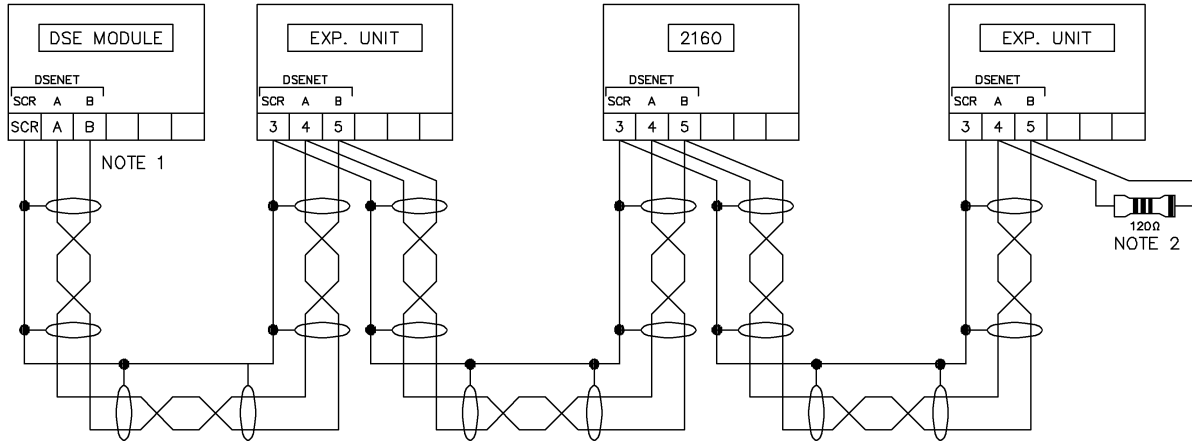
Follow the typical wiring diagram as normal for all sections **except** the earth points.
All points shown as Earth on the typical wiring diagram should connect to **battery negative** (not earth).

3.3.2 TYPICAL ARRANGEMENT OF DSENET® CONNECTION

NOTE: Screened 120 Ω impedance cable specified for use with RS485 must be used for the DSENet® (RS485) connection.

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

A typical DSENet® connection for the module is shown below.



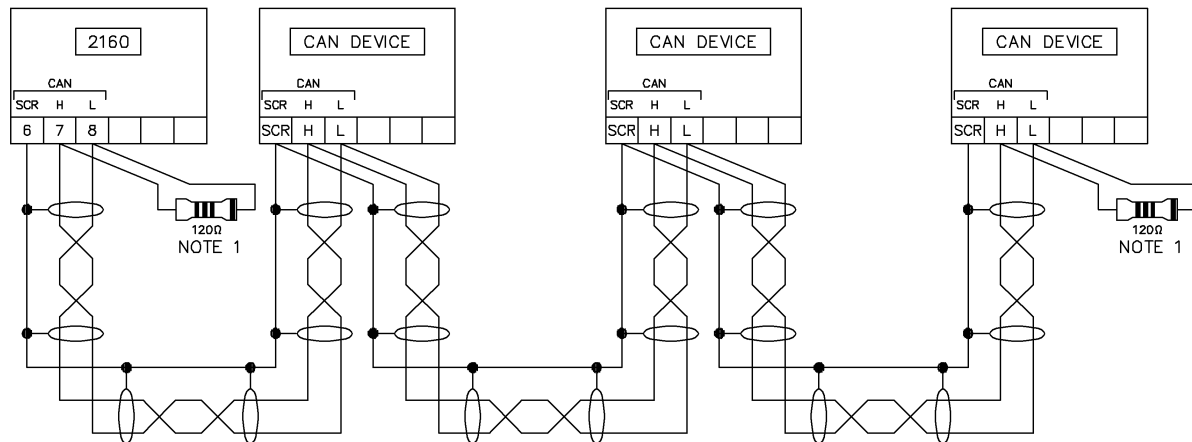
NOTE 1. A 120 OHM TERMINATION RESISTOR IS FITTED INTERNALLY TO THE HOST DSE MODULE AND MUST NOT BE FITTED EXTERNALLY
NOTE 2. A 120 OHM TERMINATION RESISTOR MUST BE FITTED TO THE LAST MODULE ON THE DSENET LINK.

3.3.3 TYPICAL ARRANGEMENT OF CAN CONNECTION

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

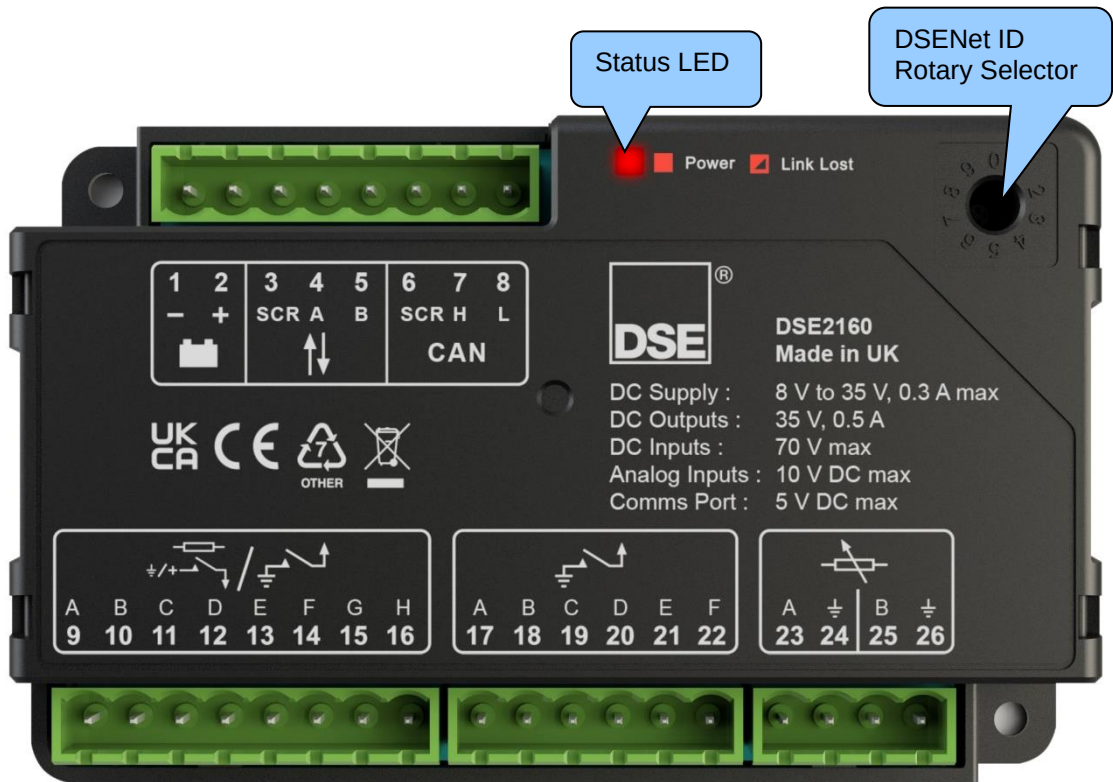
DSE stock and supply Belden cable 9841 which is a high quality 120 Ω impedance cable suitable for DSENet® use (DSE part number 016-030)

A typical CAN connection for the module is shown below.



NOTE 1. A 120 OHM TERMINATION RESISTOR MUST BE FITTED TO THE START AND THE END OF THE CAN LINK.

4 CONTROLS AND INDICATION



4.1 STATUS LED

The *Status LED* indicates the operating state of the module.

Status LED	Condition
Off	Module is not powered.
Red Flashing	Module is powered but there is no communication.
Red Constant	Module is powered and communication is working.

4.2 DSENet® ID ROTARY SELECTOR

NOTE: The DSENet® ID selected must match the ID configured within the host DSE module.

NOTE: The DSENet® ID be set to be a unique number compared to any other DSE2160. The DSENet® ID of the DSE2160 does not interfere with the DSENet® ID of any other type of expansion module. For instance it's OK to have a DSE2160 with a DSENet® ID of 1 and a DSE2170 with a DSENet® ID of 1.

The *DSENet ID Rotary Selector* selects the communication ID that the module uses for DSENet or the source address that the module uses for CAN, as it is capable of being connected to multiple DSE2160 modules/devices at the same time.

The DSENet® ID rotary switch must be operated using an isolated adjustment tool.

Rotary Position	DSENet ID	CAN Source Address
0	0	150 (0x96)
1	1	151 (0x97)
2	2	152 (0x98)
3	3	153 (0x99)
4	4	154 (0x9A)
5	5	155 (0x9B)
6	6	156 (0x9C)
7	7	157 (0x9D)
8	8	158 (0x9E)
9	9	159 (0x9F)

When being used for DSENet communication, enable the *Expansion Enabled* feature within the host controllers configuration (for example DSENet ID 0) and then select the matching number on the *DSENet ID Rotary Selector* (for example 0).

An example of this is shown below.

2160 Expansion Enable

DSENet ID 0

2160 Expansion Enable

Expansion Enabled ☒

Link Lost Alarm Action Shutdown ▾

Parameter	Description
Expansion Enabled	☐ = The expansion module with the selected ID is not enabled. ☒ = The expansion module with the selected ID is enabled. If the expansion module is not connected / detected by the module, the module generates an <i>Exp.Unit Failure</i> alarm with the configured <i>Link Lost Alarm Action</i> severity.

5 FAULT FINDING



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

Fault	Suggestion
Inputs don't activate on the host module	Ensure the host module is correctly configured to accept the DSE2160.
Status LED does not illuminate	Check the DC supply voltage across terminals 1 and 2 of the module are within specification (8 V to 35 V) and that the polarity is correct.
Status LED flashes	This means the communications link to the host module has been lost. Check the connection of the DSENet® between the host controller and the module, paying particular attention to the cable type being used and the positioning of the termination resistors. Check to ensure that the DSENet® ID Rotary Selector switch is in the correct position to match the configuration of the host module.

6 DSE EXPANSION J1939 PROTOCOL LIBRARY

 **NOTE:** This section details the factory settings of compatible expansion devices upon manufacture. Due to the configurable nature of the device, this may (or may not) reflect the configuration of the device in use. For further details of module configuration, refer to DSE Publication: 057-298 *DSE EXPANSION J1939 Protocol Library*.

The Controller Area Network (CAN) interface on the module device does not offer the same level of flexibility as the CAN or Engine Control Unit (ECU) ports on other DSE modules. It serves as a supplementary method for controlling and obtaining information from the module. It is important to note that the module only comprehends a limited set of proprietary DSE-specific J1939 messages.

Parameter	Factory Setting
Baud Rate	250 kB/s
Rx Priority	6
Tx Priority	6
Device Source Address	Set by DSENet ID Rotary Selector 0 to 9 = 150 to 159 (0x96 to 0x9F)
Rx Source Address	Any

7 MAINTENANCE, SPARES, REPAIR AND SERVICING

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

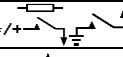
7.1 PURCHASING ADDITIONAL CONNECTOR PLUGS FROM DSE

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

7.1.1 PACK OF PLUGS

Module Type	Plug Pack Part Number
DSE2160	007-1151

7.1.2 INDIVIDUAL PLUGS

Module Terminal Designation	Plug Description	Part No.
1 to 8  CAN	8-way 5.08 mm	007-164
9 to 16 	8-way 5.08 mm	007-164
17 to 22 	6-way 5.08 mm	007-446
23 to 26 	4-way 5.08 mm	007-444

8 WARRANTY

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

9 DISPOSAL

9.1 WEEE (WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT)

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



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