



Features

- 300-1200Vdc input voltage range
- 600V output voltage
- Up to 3000W output power
- High temperature 177°C
- +18V/1A auxiliary voltage output with protection switch
- 1500V voltage tolerant (survival)
- Input reverse voltage protection
- Programmable output soft start
- Compact and rugged aluminium housing
- CANbus interface
- SW configurable CANbus termination
- High shock and vibration resistance



Product Description

The NSE 5002-09 HT DCDC is a rugged, high performance, high power DC/DC converter targeted downhole wireline applications and other high voltage DC transmission systems. The unit supports input voltage up to 1200V. It is also very well suited for other industrial and automotive applications.

The DC/DC converter has built-in support for NSE's downhole telemetry board (optional). In addition to the main high voltage output, the unit has also an auxiliary 18V output for external units. This may enable a simplified system architecture.

To operate reliably at high temperature, the converter has been designed to have extremely high efficiency to reduce the loss to a minimum. Typically the unit achieves above 99% efficiency at full load over the entire temperature range.

The PCB layout is designed with ruggedness in mind. A CNC machined aluminium chassis provides maximum mechanical support to allow the board to operate in an environment where very high shock and vibration may occur. The board is equipped with rugged high-temperature connectors.

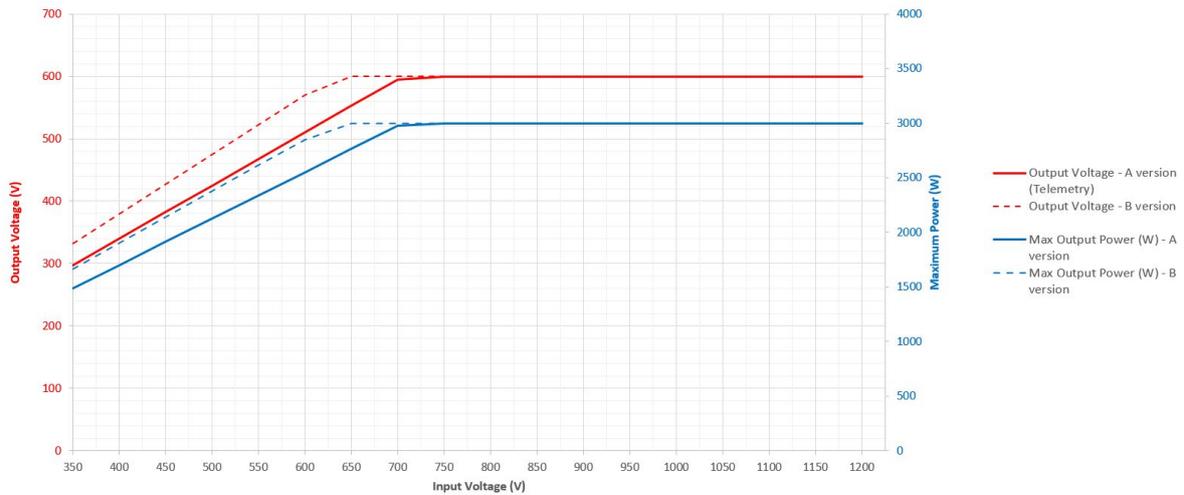
The unit can be supplied in two different housings: A slim rectangular shaped housing, of 592 x 36 x 33mm (L x W x H) suitable for most customers to design into their system (fits inside ID=48mm). Or a circular housing that will fit inside a ID=38mm diameter. STP (3D) file is available on request and custom housings can be designed if required

1 Product Specification

Parameter	Conditions / Comments	Min	Typ	Max	Unit
Supply voltage <i>Input High Voltage</i> <i>Input High Voltage</i>	<i>Operational</i> <i>Survival max 1 sec pulse</i>	350	>600	1200 1500	Vdc Vdc
High Voltage Output <i>Output Voltage range</i>	<i>Ref. output voltage graph</i>	585	600	615	Vdc
<i>Voltage Variation</i>	<i>100% dynamic load change / 1ms</i> <i>Ref. output power graph</i>			15	V
<i>Output Power</i>	<i>@600V output</i>			3000	W
Low Voltage Output <i>Output Voltage range</i>		17.5	18	18.5	Vdc
<i>Voltage Variation</i>	<i>100% dynamic load change / 1ms</i>			250	mV
<i>Output Power</i>				18	W
Efficiency	<i>Over temperature, at full load@600V output</i>	98.5	99		%
Load Transient Response <i>Voltage variation (% of initial Regulation value)</i>	<i>For all parameters:</i> <i>Load step from min to full loading or opposite</i>			1	%
Power Filters <i>Built-in Input capacitance</i> <i>Built-in Output capacitance</i>			3.0 6.0		μ F μ F
Optional Input capacitance <i>Additional input capacitance</i> <i>Additional input capacitance</i>	<i>Product code -A-A & -C-A</i> <i>Product code -A-B & -C-B</i>		4.0 2.0		μ F μ F
Modem Interface <i>Modem power line filter</i>	<i>Integrated</i>		Yes		
Switching and efficiency <i>Switching frequency</i>		120		250	kHz
<i>Frequency stability</i>		1			%
<i>Power Loss</i>				30	W
Protection <i>Reverse Polarity Protection</i>	<i>Continuous without degradation</i>			-600	Vdc
<i>Overvoltage protection</i>	<i><1 second</i>			1500	Vdc
<i>Thermal shutdown</i>			No		

<p>CAN Bus Interface <i>Baud rate</i></p> <p><i>CANbus specification</i></p> <p><i>Noise filter</i></p> <p><i>CAN Shield wiring</i></p> <p><i>CANBus termination (136 Ohm differential)</i></p>	<p><i>Termination resistor configurable from menu</i></p>	<p>125</p>	<p>125</p> <p>CAN 2.0</p> <p>Yes</p> <p>TP</p> <p>Yes</p>	<p>250</p>	<p><i>kbits/s</i></p>
<p>Temperature Sensor <i>Sensor range</i></p> <p><i>Accuracy</i></p>		<p>0</p> <p>+/- 3</p>		<p>190</p>	<p>°C</p> <p>°C</p>
<p>MECHANICAL DIMENSIONS <i>Chassis Length</i> <i>Chassis Width</i> <i>Chassis Height</i></p> <p><i>Chassis Length</i> <i>Chassis Outer Diameter</i></p>	<p><i>Rectangular housing</i> <i>Rectangular housing</i> <i>Rectangular housing</i></p> <p><i>Circular housing</i> <i>Circular housing</i></p>		<p>592</p> <p>36</p> <p>33</p> <p>581</p> <p>38</p>		<p><i>mm</i></p> <p><i>mm</i></p> <p><i>mm</i></p> <p><i>mm</i></p> <p><i>mm</i></p>
<p>OPERATIONAL LIFETIME <i>Expected Lifetime</i></p>	<p><i>< 125°C Ambient Temperature</i></p> <p><i>125 – 150°C (4 x acc. Factor)</i></p> <p><i>150- 177°C (8 x acc. Factor)</i></p>	<p>2000</p> <p>500</p> <p>250</p>			<p><i>Hours</i></p> <p><i>Hours</i></p> <p><i>Hours</i></p>
<p>ENVIRONMENTAL AND THERMAL AMBIENT TEMPERATURE</p>	<p><i>Min and Max temperature on the surface of the outer housing given that thermal resistance is within the specification</i></p>	<p>-20</p>		<p>177</p>	<p>°C</p>
<p>THERMAL RESISTANCE</p>	<p><i>Surface of OUTER HOUSING to NSE UNIT</i></p> <p><i>*Refer to the Section "Thermal properties" for further definition</i></p>			<p>0.1</p>	<p>°C/W</p>

1.1 Output voltage and power graphs



1.2 Thermal properties

The NSE-5002-09 DCDC is designed to operate in a 177°C environment.

In a typical assembly, the **NSE UNIT** is mounted to a **MOUNTING PROFILE** that is located inside an **OUTER HOUSING**.

The **OUTER HOUSING** surface temperature should not rise above the specified maximum ambient temperature, and the mechanical design and interface between the **OUTER HOUSING**, **MOUNTING PROFILE** and the **NSE UNIT** should be such that the thermal resistance specification is achieved.



1.3 Conformal Coating

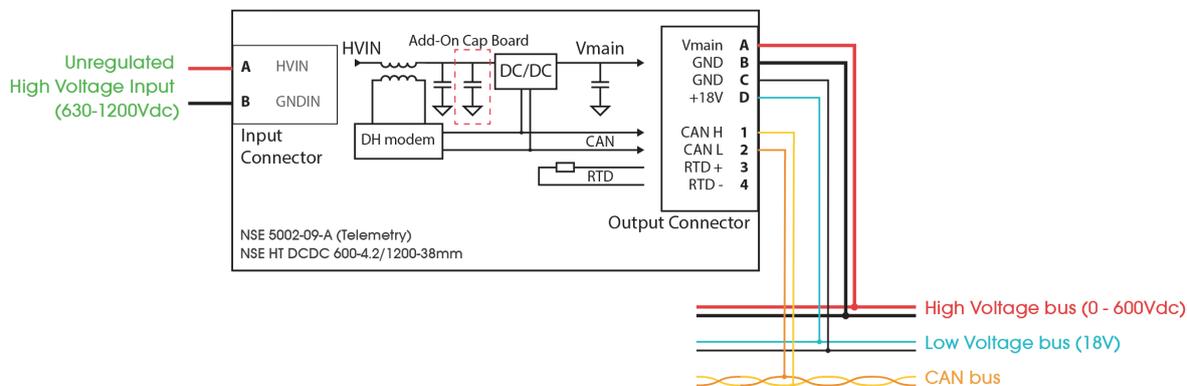
This product is delivered without conformal coating.

1.4 Environmental requirements

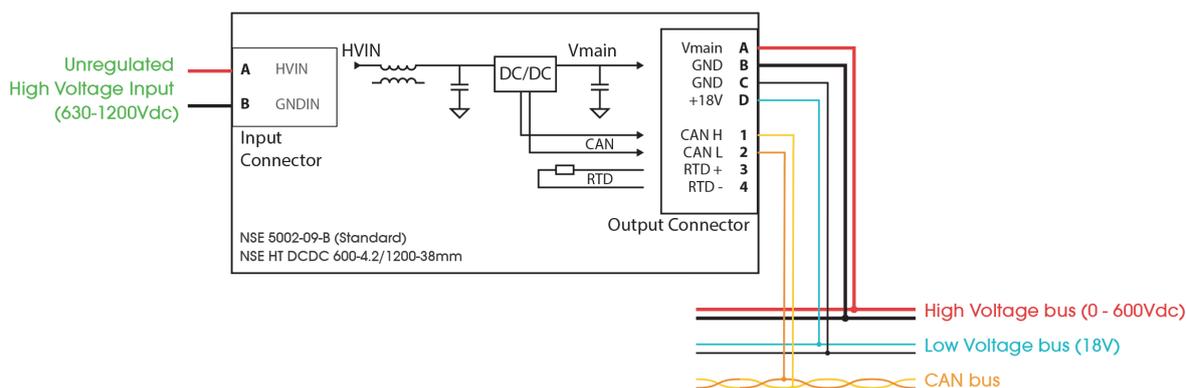
NSE boards must be installed in dry air at atmospheric pressure (1atm). Avoid humid atmosphere or under / overpressure. Refer to general NSE installation guidelines for more information.

2 Connections

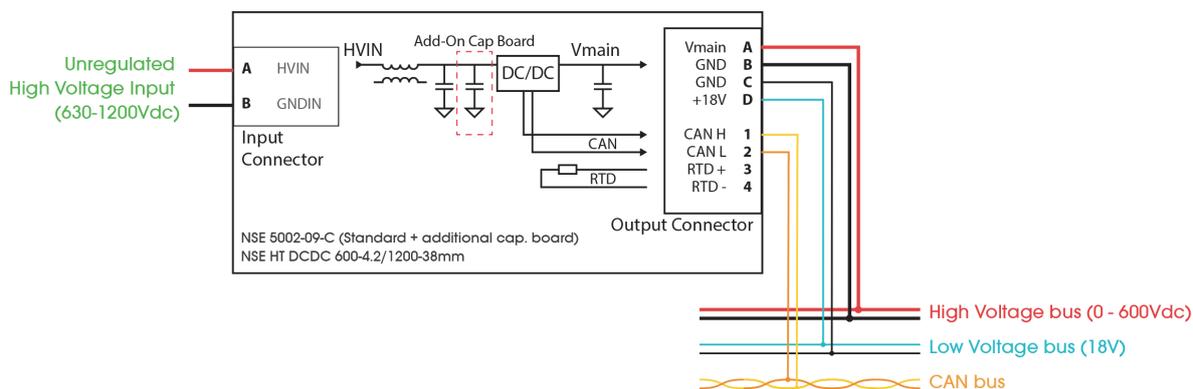
2.1 System drawing



**Figure 1 – System drawing – Option A
Integrated telemetry**



**Figure 2 – System drawing – Option B
Standard version - No Telemetry**



**Figure 3 – System drawing – Option C
Standard version with additional input capacitance**

2.2 Application Drawing

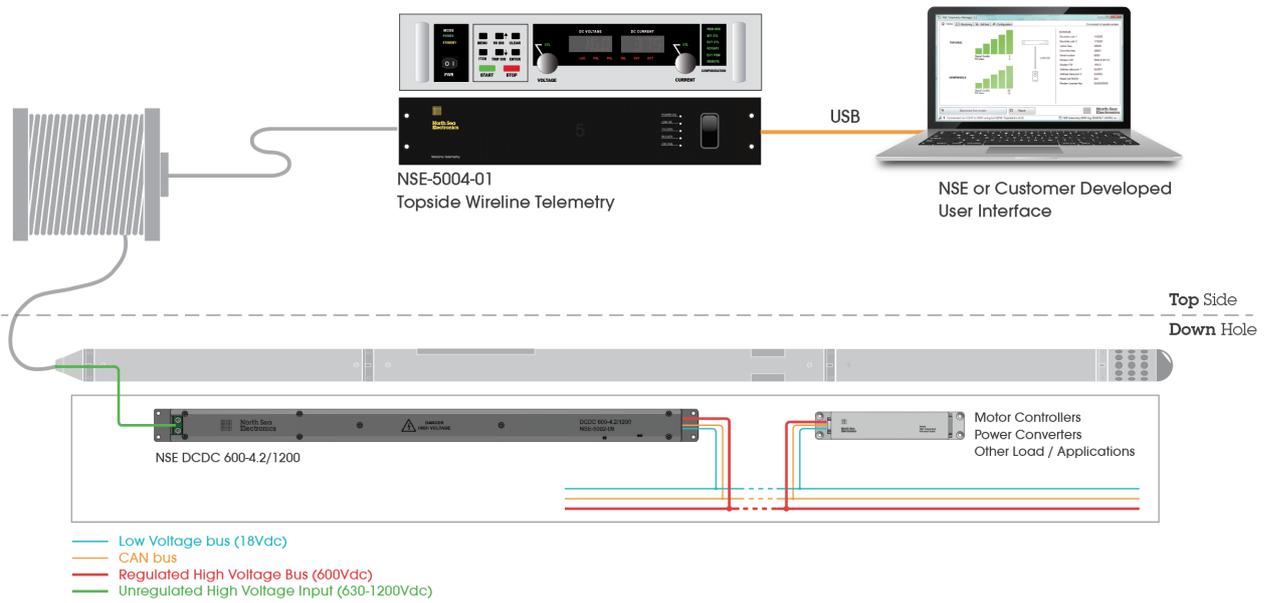
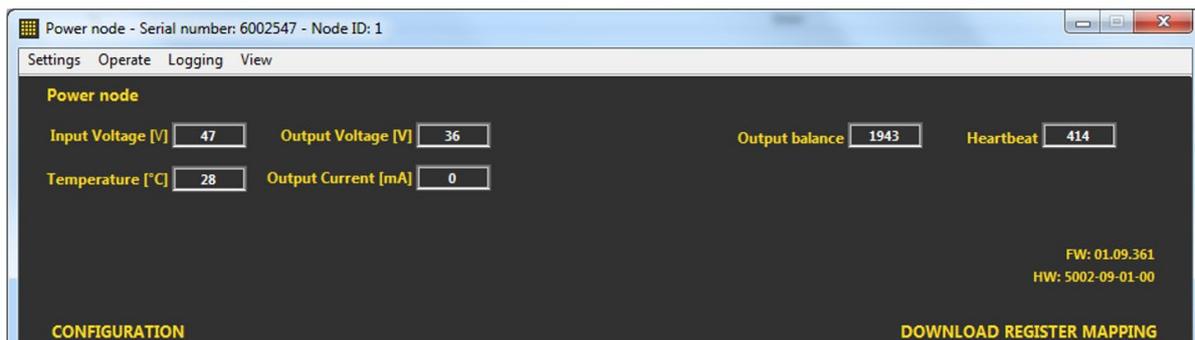


Figure 4. Typical application

2.3 Software support

The DCDC is supported by the NSE Node manager software package.

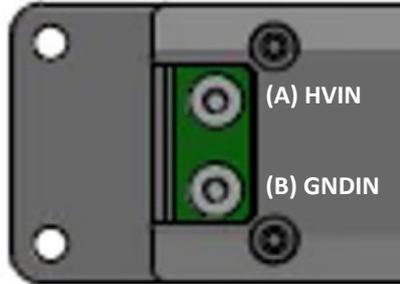
The NSE node manager allow for monitoring and configuration of the unit.



2.4 Input Connector

The input is connected to a two terminal screw terminal for GND and HV input.

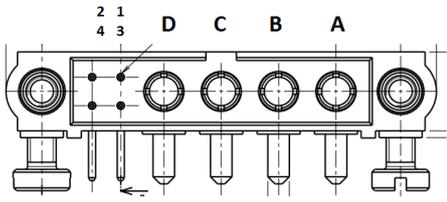
Dimension is M3, suitable for ring terminal connection. Suggested wire dimension is AWG20-AWG18

Pin	Signal name	Description / Function (NSE Standard color)	Connector Pinout (Face View)
A	HVIN	HV Input Voltage (RED)	
B	GNDIN	HV Input ground (BLACK)	

2.5 Output connector

DCDC connector: Harwin M80-5L10405M5-02-333-00-000 4+4 pin connector.

Mating connector: Harwin M80-4C10405F1-02-325-00-000

Pin	Signal name	Description / Function (NSE Standard color)	Connector Pinout (Face View)
A	VMAIN	Main Output Voltage (RED)	
B	GND	Main Ground wire (BLACK)	
C	GND	AUX Ground wire (BLACK)	
D	+18Vout	+18V auxiliary output (ORANGE)	
1	CANH	CAN Positive (YELLOW)	
2	CANL	CAN Negative (GREEN)	
3	RTD+/ TXD	RTD terminals 1 (BROWN) UART TXD modem Status port	
4	RTD- / RXD	RTD terminals 2 (VIOLET) UART RXD modem Status port	

*modem UART status port has 3.3V level

3 Features

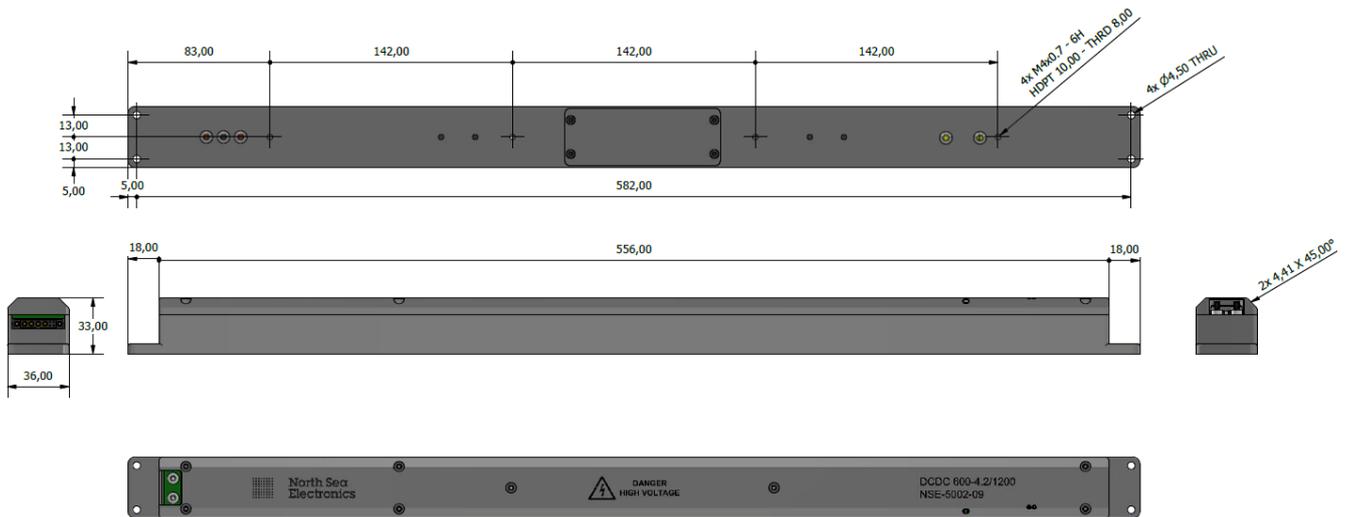
Feature	Description
Output voltage	The unit has a fixed regulated output voltage, nominally set to 600Vdc. The unit can be delivered with other output voltage settings. Consult NSE for non-standard output voltage.
Output Voltage switches	The unit has output voltage control switches both on the HV output and the +18V auxiliary output. These switches are used for startup voltage control and protection.
Input Filter/Capacitor bank	The unit has on-board input high voltage filter supporting typical power applications. For the telemetry option, extra capacitance is added to the system by installing additional capacitance boards inside the chassis. The C-Version has the add-on capacitor board only. The additional capacitor board is not required for normal operation but can add stability and damping of voltage transients in some applications.
Output filter	The output filter is included to reduce the output ripple and improve noise immunity from external units, such as high power motor drives.
Voltage and current sensing	The unit monitors: <ul style="list-style-type: none"> • Input voltage • Output voltage • Output current
Temperature sensing	The unit has embedded temperature sensors. The internal temperature can be read from CAN. Besides, there is an RTD connected to the output plug pin 3-4 for monitoring the temperature from an external controller. The RTD is a PT1000 element.
Soft Start	The HV output voltage is controlled by an control circuit. This enables the output voltage to be ramped up at the desired rate. The default setting is 1V/ms. This setting can be modified by NSE.
Pass through mode	When the input voltage is below the regulated voltage, the unit enters pass-through mode. In this mode, the output voltage is regulated to ~95% of the input voltage (~85% when telemetry is included).
Firmware	The unit has a bootloader installed, enabling FW upgrades via CANbus without the need for opening the system. The Unit has an internal EEPROM to store calibration data and custom settings. The EEPROM data is not affected by FW upgrades.
Bootloader	The controller is provided with a bootloader that allows for easy updates of the firmware. NSE is constantly making improvements and adding features to its firmware-base and the bootloader allows the customer to upgrade firmware if desired.
Graphical User Interface	The "NSE Node Manager" software (graphical user interface) is a free of charge software that can be used to monitor the DC/DC. This software uses the standard NSE protocol to communicate with the controller and allows the user to set up and run the system in short time.

Feature	Description
Overvoltage Protection	<p>The unit has two-stage protection circuits for input voltage. For overvoltage protection, the unit turns off the output voltage when the input voltage reading is above approximately 1250V. Resume from this condition is at around 1200V. These settings are programmed limits.</p> <p>The second stage in protection shuts down all internal circuitry and enables the overvoltage protection circuit to survive at least 1500V conditions without damage. Resume from this condition is around 1000V. These settings are HW controlled and not adjustable.</p>
Over-current protection	<p>The unit monitors the output current. When over-voltage exceeds the maximum current, the output shuts down. The unit will try to resume after about 1 second.</p> <p>The overcurrent protection allows short bursts of current exceeding the current limit without interruption.</p>
Short circuit protection	<p>In short circuit protection mode, the unit detects the output voltage dropping below a minimum setting. When this occurs the unit quickly reacts and shuts down. The unit tolerates 0-ohm short circuit at startup, and 2 ohms "short circuit" after full voltage (600Vdc) is reached.</p> <p>After the short circuit is detected the unit performs a full reset before re-attempting to start up. The unit will resume as soon as the short circuit situation is resolved.</p>
Under-voltage protection	<p>The units' default programmed setting is to start up the HV output when the voltage reaches 330V. When the voltage drops below 300V, the unit turns off the output.</p> <p>The auxiliary voltage output (18Vdc) has a separate control setting. The default input voltage is 100V for startup and 80V for shutdown.</p> <p>These values can be tailored for different needs by NSE and can be useful for firmware updating the unit without applying a high voltage to the secondary systems.</p>
Reverse voltage protection	<p>The reverse voltage protection is designed by a high voltage transistor circuit, enabling low leakage in reverse voltage mode and low losses in forward operation mode. The circuit tolerates reverse voltage up to 600V.</p>
CAN Bus Termination	<p>The CANbus termination is user-configurable as either "not terminated" or "terminated by 136 Ohm resistance differential". The setting is stored in non-volatile memory.</p>
Internal RTD temperature sensing	<p>The unit has an internal RTD temperature sensor that can be used by external boards to sense the temperature inside the DCDC.</p>

4 Mechanical Dimensions

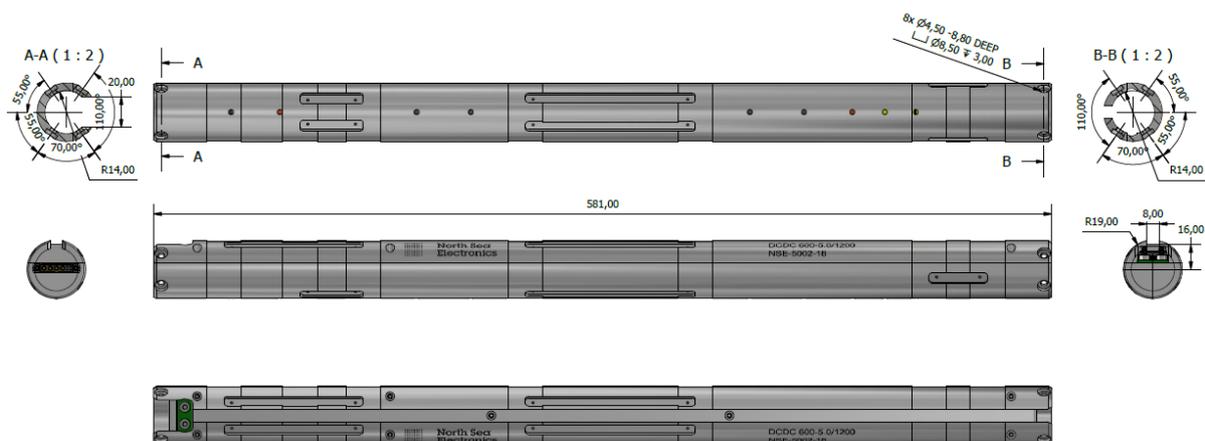
4.1 Rectangular housing – chassis option A

Fit inside $\varnothing 48\text{mm}$.



4.2 Circular housing – chassis option B

Fits inside ID=38mm.



5 Datasheet Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	09.10.2020	Initial release	RFY	GLK
B	08.01.2020	Updated low voltage output power rating. Updated housing options.	RFY	GLK
C	25.02.2021	Minor document changes	GLK	AJA
D	06.09.2021	Minor document changes	GLK	AJA
E	03.02.2023	Cable color codes. Output Power Graph.	EEN	AJA

6 Product Code

Product code:		NSE-5002	-09	-X1	-X2
Category	NSE-5002	= NSE DC/DC converters			
Model	- 09	= 600V DC/DC High Temperature Power Converter			
Option	- A	= Telemetry option			
	- B	= Standard (without telemetry)			
	- C	= Standard with additional input capacitor board			
Chassis	- A	= Rectangular chassis (fits inside Ø48mm)			
	- B	= Circular chassis (fits inside Ø38mm)			

6.1 Where to buy

Email: sales@nse.no
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 Phone: +47 406 48 400