



## Features

- High temperature rated – 177°C
- Output voltage range (factory set):
  - NSE-5002-15/22-XXV: 40-60Vdc
  - NSE-5002-17/23-XXV: 20-40Vdc
- Output current @ 125°C
  - NSE-5002-15/17-XXV: 4.2Adc
  - NSE-5002-22/23-XXV: 5Adc
- Output current @ 177°C
  - NSE-5002-15/17-XXV: 4.2Adc
  - NSE-5002-22/23-XXV: 3.3Adc
- 93-97% efficiency
- Operating Input voltage: 100 – 600Vdc
- 18Vdc auxiliary output (optional)
- CAN Bus interface
- Short circuit output protection
- Input overvoltage protection
- CNC Machined aluminum housing



## Product Description

The **NSE HT-DCDC-MP1** Family is a high performance, high temperature DCDC converter design for demanding applications. It is targeted at downhole wireline and drilling tools in addition to other industrial applications where high temperature and large variation in input voltage may occur.

The DCDC converter has a specified input voltage range of 100 – 600Vdc. Outputs available are in the range between 20 and 60Vdc, and the converter can provide up to 4.2 / 5A (at 125°C) or 4.2 / 3.3A (at 177°C) output current over the entire voltage range. Maximum voltage for short intervals is 700Vdc. Voltages above this limit will cause the unit to shut down. Survival voltage is 900Vdc for maximum one second.

The **NSE HT-DCDC-MP1** Family is equipped with output short circuit protection that will protect the converter from failing even though its outputs are directly short circuited. Efficiency of the converter is above 93% (at full output power) for the entire temperature range.

The **NSE HT-DCDC-MP1** Family PCB layout is made with ruggedness in mind. A CNC machined aluminum chassis provides maximum mechanical support to allow the board to operate in a very high shock and vibration environment. The board has rugged power input and output connectors.

# 1 Product Specification

## 1.1 Electrical characteristics

Parameter	Conditions / Comments	NSE-5002-17	NSE-5002-15	NSE-5002-23	NSE-5002-22	Unit
ARTICLE NUMBER	XX = Voltage	NSE-5002-17-XXV	NSE-5002-15-XXV	NSE-5002-23-XXV	NSE-5002-22-XXV	
<b>INPUT CHARACTERISTICS</b>						
Operational Input Voltage	Minimum input voltage	100	100	100	100	Vdc
	Maximum input voltage	600	600	600	600	Vdc
Input Startup Voltage	Min. startup voltage	100	100	100	100	Vdc
Overvoltage trig voltage	Minimum trig. Voltage	700	700	700	700	Vdc
	Typical trig. Voltage	715	715	715	715	Vdc
	Maximum trig. Voltage	730	730	730	730	Vdc
Undervoltage shutdown		80	80	80	80	Vdc
Max transient voltage	Max 1sec / min.	900	900	900	900	V
Negative Voltage Protection		NO	NO	NO	NO	
<b>MAIN OUTPUT</b>						
Voltage setpoint	Factory set to XX volt.	XX	XX	XX	XX	Vdc
Output Voltage range		20 – 40	40 – 60	20 – 40	40 – 60	Vdc
Voltage accuracy		+ /- 3	+ /- 3	+ /- 3	+ /- 3	%
Step load regulation	Typical values @full load @Load step ON-OFF or OFF-ON	+ /- 0.4	+ /- 0.4	+ /- 0.4	+ /- 0.4	V
Output ripple	Typical value at full load @600V 177°C ambient	25	25	25	25	mV RMS
Max output current	@ 125°C ambient	4.2	4.2	5	5	Adc
	@ 177°C ambient	4.2	4.2	3.3	3.3	Adc
Max output power*	*Depend on output volt. @ 125°C ambient	84 – 168	168 – 250	100 – 200	200 – 300	W
	@ 177°C ambient	84 – 168	168 – 250	65 – 130	130 – 200	W
Over-current trigger limit	Min. trig. Limit	5	5	5	5	A
	Typical trig. Limit	5.2	5.2	5.2	5.2	A
	Max. trig. Limit	5.4	5.4	5.4	5.4	A
Max capacitive load		1000	1000	1000	1000	uF
Galvanic isolation	Input to output	NO	NO	NO	NO	

<b>AUXILIARY OUTPUT</b>						
Voltage setpoint		18	18	18	18	Vdc
Voltage accuracy		+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	Vdc
Maximum output current		250	250	250	250	mA
Maximum output power		4.5	4.5	4.5	4.5	W
Short circuit protection		NO	NO	NO	NO	
Galvanic isolation		NO	NO	NO	NO	
<b>DYNAMIC CHARACTERISTICS</b>						
Max Voltage Drop	0 -> 5A load step.	1.5	1.5	1.5	1.5	V
Max Voltage Overshoot	5A -> 0A load step.	1.5	1.5	1.5	1.5	V
Switching frequency	Dynamically adjusted					
	Minimum frequency	120	120	120	120	kHz
	Maximum frequency	200	200	200	200	kHz
<b>EFFICIENCY</b>						
Min. Converter efficiency	$I_{OUT} = 3.3A$ $V_{IN} = 200VDC$ $I_{OUT} = 3.3A$ $V_{IN} = 600VDC$	<b>90</b> <b>88</b>	<b>96</b> <b>93</b>	<b>90</b> <b>88</b>	<b>96</b> <b>93</b>	% %
<b>CANBUS INTERFACE</b>						
Baud Rate	Default Maximum	125 250	125 250	125 250	125 250	kbits/s kbits/s
<b>ENVIRONMENTAL AND THERMAL*</b>						
	*Ref thermal spec. for more information					
Storage	Minimum Maximum	-20 70	-20 70	-20 70	-20 70	°C °C
Ambient temperature (Operational)	Minimum Maximum	0 177	0 177	0 177	0 177	°C °C
Min. Thermal Resistance	Outer housing to unit	0.5	0.5	0.5	0.5	°C/W
<b>OPERATIONAL LIFETIME</b>						
Expected Lifetime	< 125°C	2000	2000	2000	2000	Hours
	125 - 150°C	500	500	500	500	Hours
	150- 177°C	250	250	250	250	Hours

## 1.2 Thermal properties

The NSE High Temperature 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

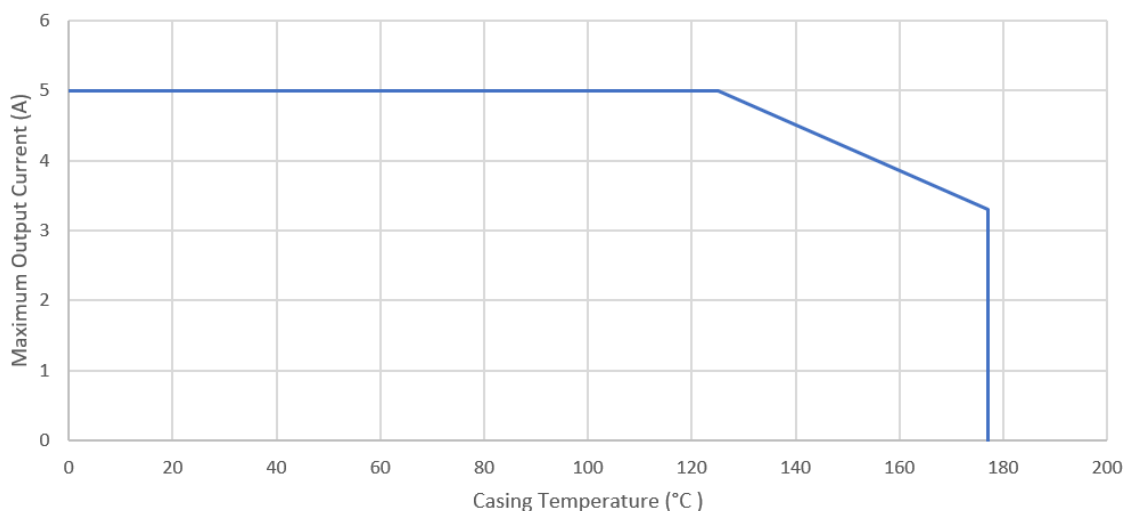
This product is delivered with no conformal coating.

## 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.

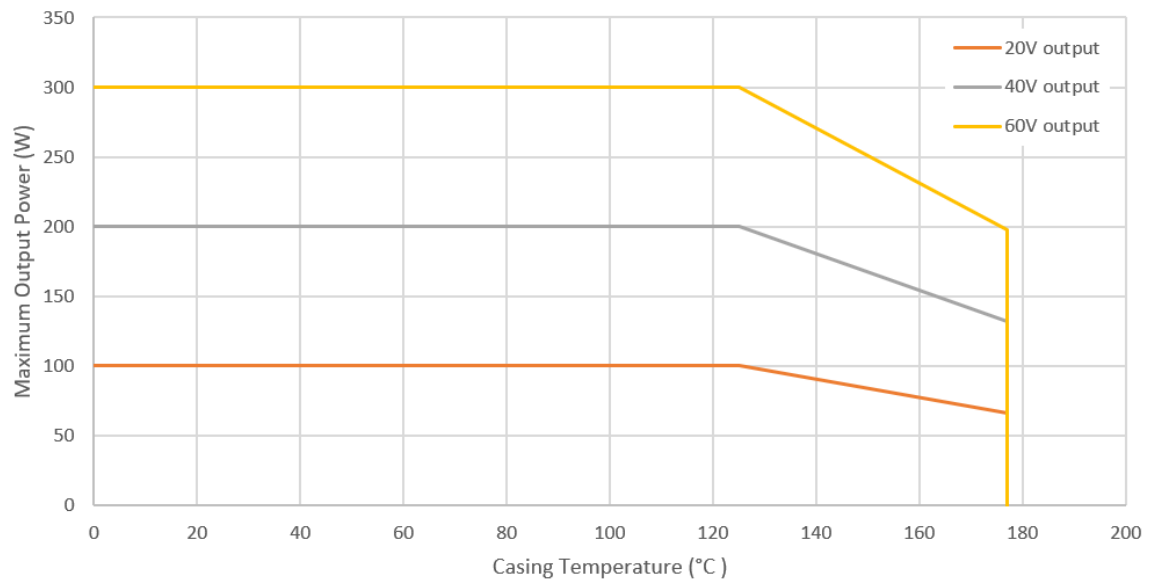
## 1.5 Maximum output current- and power

### 1.5.1 Maximum output current (NSE-5001-22 and -23)



Maximum output current as a function of Casing (outer housing) Temperature

### 1.5.2 Maximum output power (NSE-5001-22 and -23)

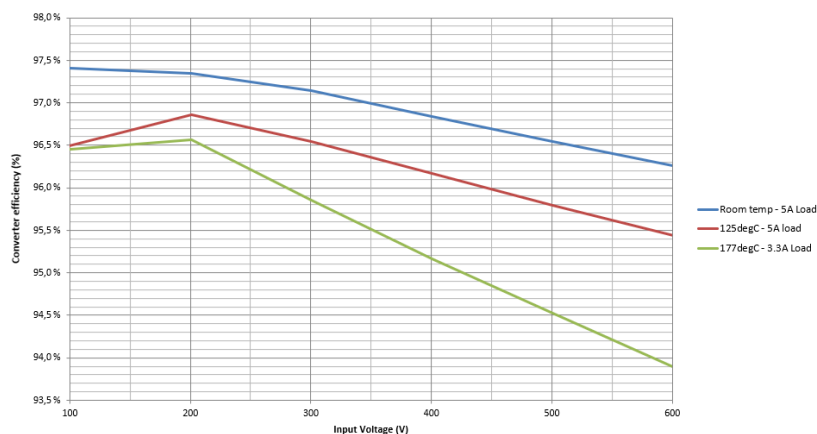


Maximum output power for different output voltages as a function of Casing (outer housing) Temperature

## 1.6 Efficiency

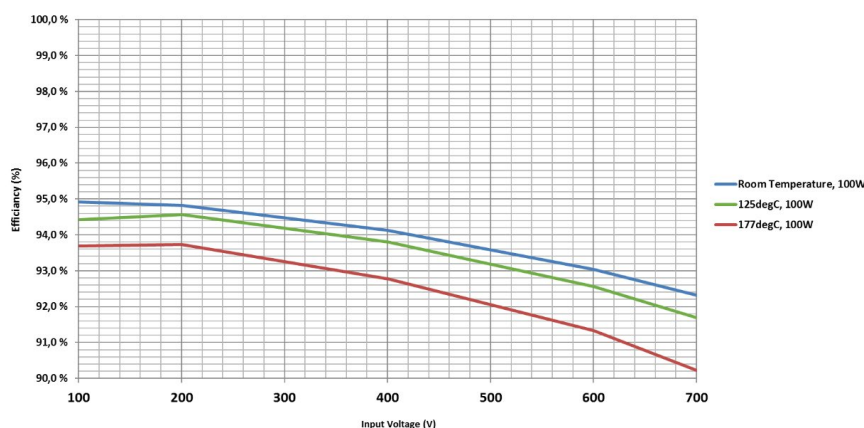
### 1.6.1 Efficiency for 60V output version (NSE-5001-22)

Efficiency is measured at 25°C Room temperature, 125°C and 177°C at full load (5/5/3.3Adc).



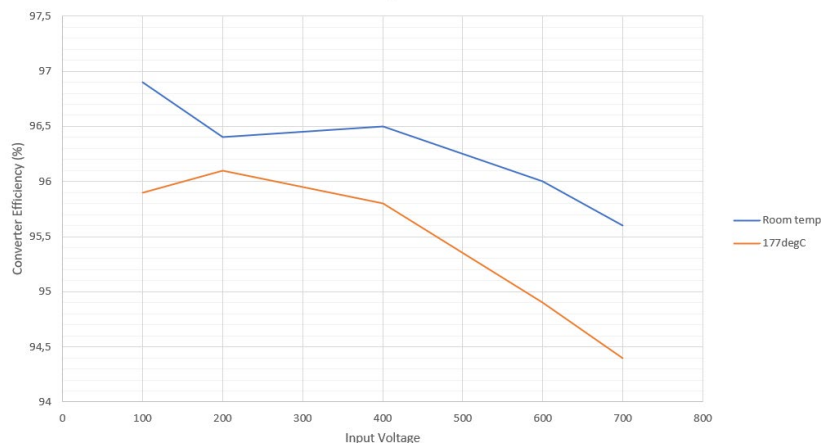
### 1.6.2 Efficiency for 24V output version (NSE-5001-15)

Efficiency is measured at 25°C Room temperature, 125°C and 177°C at full load (4.2Adc).



### 1.6.3 Efficiency for 48V output version (NSE-5001-17)

Efficiency is measured at 25°C Room temperature and 177°C at full load (4.2Adc).





## 2 Connectors

### 2.1 Input

DCDC Connector: **Harwin M80-5000000M5-02-333-00-000 2 pin connector.**

Mating connector: **Harwin M80-4000000F1-02-325-00-000**

NSE connector kit: **NSE-5002-03-CON**

Pin	Signal name	Description / Function	NSE Connector kit wire type	NSE Connector kit wire color
A	GND	GROUND	120cm 20AWG 600V	BLACK 
B	HV in	HV Input Voltage	120cm 20AWG 600V	RED 

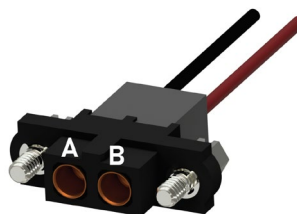
#### DCDC connector

(Note – the guide slot is facing down)



#### Mating cable connector

(NOTE - the guide slot is facing up)









### 2.2 Output

DCDC Connector: **Harwin M80-5L10405M5-02-333-00-000 - 6 pin connector**

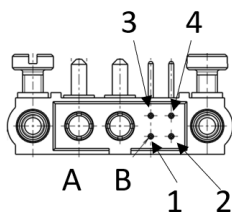
Mating connector: **Harwin M80-4C10405F1-02-325-00-000**

NSE connector kit: **NSE-5002-03-CON**

Pin	Signal name	Description / Function	NSE Connector kit wire type	NSE Connector kit wire color
A	Vmain	Main output voltage	120cm 20AWG 600V	RED 
B	GND	Ground	120cm 20AWG 600V	BLACK 
1	CAN H	CAN High	120cm 26AWG 600V	YELLOW 
2	Vaux	+18Vdc (AUX)	120cm 26AWG 600V	ORANGE 
3	CAN L	CAN Low	120cm 26AWG 600V	GREEN 
4	GND	GND (AUX)	120cm 26AWG 600V	BLACK 

#### DCDC connector

(Note – the guide slot is facing down)



#### Mating cable connector



### 3 Features

Feature	Description
<b>Integrated Sensors</b>	<p>The <b>NSE HT-DCDC-MP1</b> has the following integrated sensors that are continuously sampled and can be distributed over CANbus:</p> <ol style="list-style-type: none"> <li>1. Temperature Sensor</li> <li>2. Input Voltage Measurement</li> <li>3. Output Voltage Measurement</li> <li>4. Output Current Measurement</li> </ol>
<b>Over Voltage Protection</b>	<p>The over-voltage protection will activate if the input voltage goes above the threshold voltage of the over-voltage circuit. When the over voltage is activated, the circuit will cut off the power to the board and thereby shut it down.</p> <p>When the board has been shut down by the over-voltage circuit, the input voltage must decrease into the valid operational voltage range before the unit will attempt restart.</p> <p>After re-start the unit will resume normal operation.</p>
<b>Output Power Switch</b>	<p>The <b>NSE HT-DCDC-MP1</b> has an output switch that will disconnect the output in the case of the following event:</p> <ol style="list-style-type: none"> <li>1. Output over-current</li> <li>2. Output short circuit</li> <li>3. Input over voltage range</li> <li>4. Input under voltage range</li> </ol> <p>During startup the switch is off until the converter is within the valid input voltage range.</p>
<b>CAN Bus interface</b>	<p>The <b>NSE HT-DCDC-MP1</b> has a CANbus interface for communications with other systems.</p> <p>Typically, the DCDC converter will act like a slave on a CANbus network. It has a defined protocol for reading its internal registers.</p> <p>The CANbus is available as long as internal start-up is activated. Internal start-up will occur typically when approximately 30V is applied on the input.</p>
<b>Startup circuit</b>	<p>The <b>NSE HT-DCDC-MP1</b> has a dedicated start up circuit to allow proper powering and protection during startup of the unit. The unit will start up as long as it is within the specified voltage range.</p>
<b>Temperature sensing</b>	<p>There is one embedded temperature sensor on the PCB. The internal temperature of the unit can be read out through the CAN communication interface.</p>



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<b>Output Short Circuit Protection</b>	<p>The unit is protected against overload and short circuits with a current limiting feature and a short circuit detect.</p> <p>If the current rises above the current triggering limit, the converter will turn off its output switch in order to protect its circuitry.</p> <p>If a short circuit is detected (output voltage drop below the short circuit triggering level) the output switch will be turned off.</p> <p>In both cases (current protection and short circuit detection), the unit will try to restart and resume to normal operation when the short circuit or overload is removed.</p>
<b>Bootloader</b>	<p>The <b>NSE HT-DCDC-MP1</b> can be firmware upgraded through its CANbus interface using the NSE bootloader software. Bootloader is activated during startup when a low voltage, typically 50Vdc is applied on the input terminals.</p> <p>Consult NSE for further information.</p>

## 4 Mechanical Dimensions

### 4.1 NSE-5002-15 & 17 models

*This chassis version is only available for NSE-5002-15 and NSE-5002-17 models.*

#### 4.1.1 A - Chassis version – Rectangular $\varnothing 42\text{mm}$

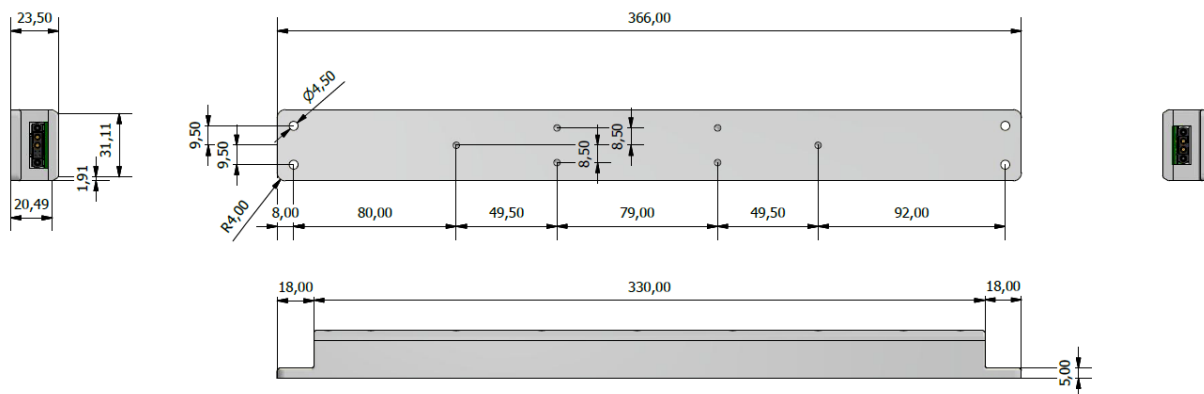


Figure 1 Mechanical dimensions

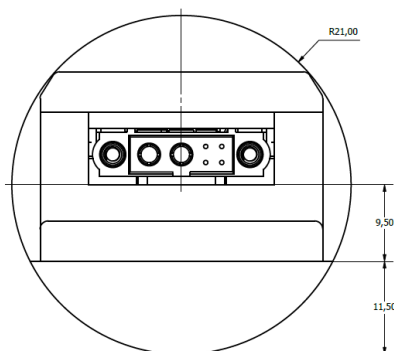
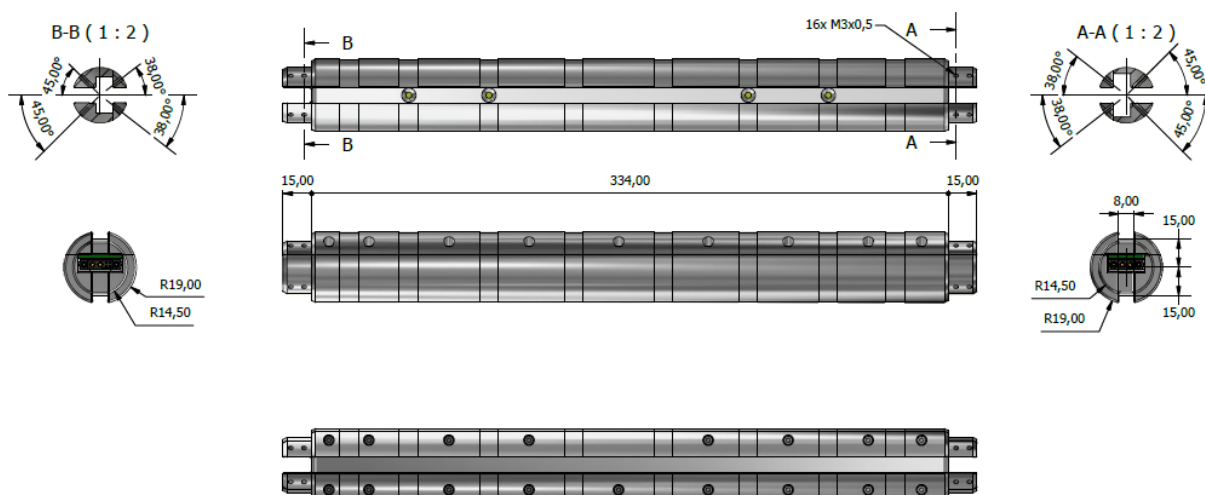


Figure 2 Unit inside ID=42mm

#### 4.1.2 B – Chassis version - Circular housing $\varnothing 38\text{mm}$



## 4.2 NSE-5002-22 & 23 models

*This chassis version is only available for NSE-5002-22 and NSE-5002-23 models.*

### 4.2.1 Chassis version A – Curved $\varnothing 35.5\text{mm}$

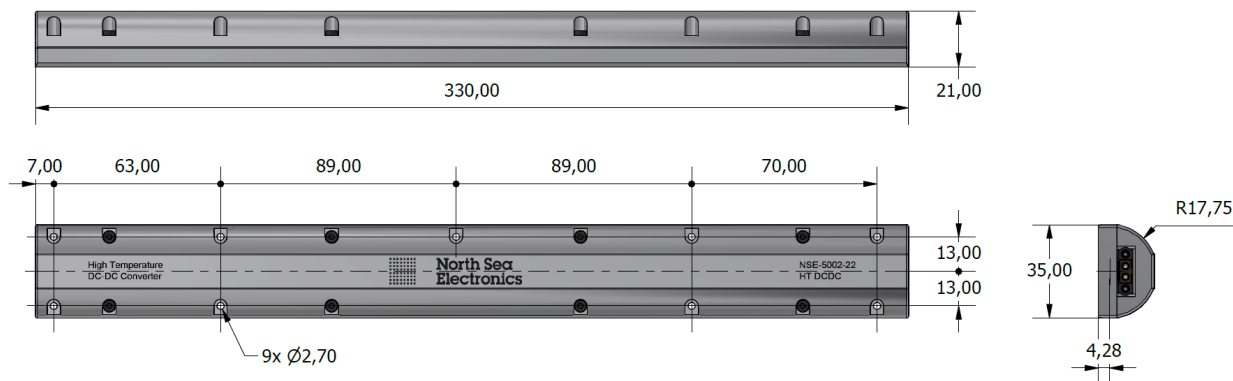


Figure 3 Mechanical dimensions

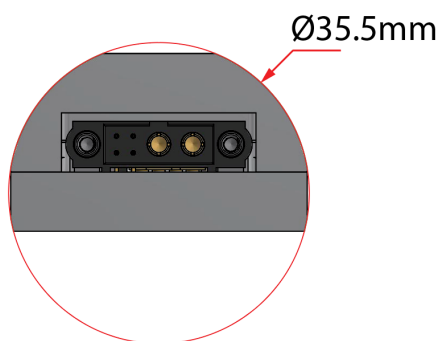


Figure 4 Unit inside ID=35.5mm

## 5 Ordering

### 5.1 Order code

Category		NSE-5002-	-XX	-XXV	-X	-X	-X
<b>Model</b>	- 15	= 40-60Vdc – 4.2A out					
	- 17	= 20-40Vdc – 4.2A out					
	- 22	= 40-60Vdc – 3.3 - 5A out					
	- 23	= 20-40Vdc – 3.3 - 5A out					
<b>Output</b>	XX	= 20-60V - Desired output voltage (Factory set)					
<b>Chassis</b>	-A	= 15 & 17 models: Rectangular Ø42mm = 22 & 23 models: Half Cylinder Ø35.5mm					
	-B	= 15 & 17 models: Circular Ø38mm					
	-C	= Reserved					
	-D	= Model 15: Cust#30224 - specific chassis					
<b>Startup Voltage</b>	-A	= 50V					
	-B	= 100V (standard)					
<b>Options</b>	-A	= No Canbus Termination					
	-B	= Canbus Termination					

**Connector set:** NSE-5002-03-CON

### 5.2 Where to buy

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

## 6 Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	01.12.2022	Initial revision	RFY	TKK
B	03.03.2023	Corrected typos	GLK	GLK
C	15.03.2023	Corrected chassis options	AJA	GLK
D	09.05.2023	Updated specifications	TKK	GLK
E	11.05.2023	Updated specifications	TKK	GLK
F	08.06.2023	Added storage temperature and chassis option „D“, fixed typo on CANbus option.	GLK	GLK
G	01.09.2023	Connector set – fixed typo	GLK	GLK