



## Features

- Very compact design
- Up to 600Vdc input voltage
- Up to 2A input current
- Up to 200kbps data rates
- 2 x USB / RS485 data interface
- Easy integration into 3<sup>rd</sup> party systems
- High noise redundancy
- Adaptive modulation
- High shock and vibration resistance
- AC or DC input power



## Product Description

The NSE Wireline Telemetry System is used for communication via wireline or powerline. The system consists of two main components: a topside unit and one or more downhole modems.

The NSE Wireline Telemetry System operates as a transparent link between the topside user interface/applications and the electronics located in the downhole tool. Serial commands sent from a computer to the topside modem are modulated and superimposed on the power cable. This signal is demodulated and converted back to conventional serial commands (TTL or CANBus) in the downhole modem.

The TS Telemetry Portable Unit is designed to be used stand-alone or integrated into a user system. The compact size of the unit makes mounting and placement of the unit very flexible. Two options for wireline and DC input connections are provided.

NSE Wireline Telemetry Systems are deployed worldwide and cover all applications from power tools, such as tractor and stokers, to low power sensors and data acquisition tools. The reliability of the link allows data transfer in very noisy conditions over difficult cables and the system will optimize data rates for the given setup.

The system requires very little user interaction. In most cases, the modems will autotune to the correct gain and frequency settings for a cable. During operation, the system is continuously adapting to the conditions on the line to optimize the signal to noise ratio.

The system is addressable so several downhole modems can communicate with one topside modem and has a broad input voltage range.

## 1 Table of NSE Topside Modems

Product Number / Name	Size	Max. Input DC Voltage	Max. Wireline Current	Noise immunity	USB / RS485 ports
<b>NSE-5004-01</b> NSE Topside Telemetry 19inch Rack	<b>2U x 330mm</b> <b>(excl. conn.)</b>	<b>1200V</b>	<b>8A</b>	<b>High</b>	<b>2 / 1</b>
<b>NSE-5004-20</b> NSE Topside Telemetry – Portable Unit	<b>314 x 113 x</b> <b>71.5mm</b>	<b>600V</b>	<b>2A</b>	<b>Medium</b>	<b>3 / 0</b>
<b>NSE-5004-21</b> NSE Topside Telemetry – Eurocard Board	<b>100x 160mm</b> <b>Eurocard</b>	<b>600V</b>	<b>2A</b>	<b>Medium</b>	<b>3 / 1</b>

## 2 Product Specification

### 2.1 Electrical Specifications

Parameter	Conditions / Comments	Min	Typ	Max	Unit
<b>SUPPLY VOLTAGE</b>					
<i>Input Voltage DC supply</i>	<i>Can be powered from either AC or DC.</i>	18	24	36	Vdc
<i>Input Voltage AC supply</i>	<i>Can be powered from either AC or DC.</i>	110		230	Vac
<i>Input Power</i>				30	W
<b>WIRELINE / POWER INTERFACE</b>					
<i>Input High Voltage</i>	<i>Continuous DC Voltage</i>			600	Vdc
<i>Current</i>	<i>Continuous DC Voltage</i>			2	Adc
<b>COMMUNICATION INTERFACES</b>					
<i>USB Port 1</i>	<i>Virtual Serial Port – Data 1</i>	9.600		375.000	bps
<i>USB Port 2</i>	<i>Virtual Serial Port – Data 2</i>	9.600		375.000	bps
<i>USB Port 3</i>	<i>Virtual Serial Port – Status</i>	9.600		375.000	bps
<i>RS-422/485</i>	<i>Not Mounted</i>	-		-	
		-		-	
<b>INTEGRATED SENSORS</b>					
<i>Temperature sensor</i>	<i>Measurement range</i>	-20		85	degC
<b>ENVIRONMENTAL</b>					
<i>Operating temp. range</i>	<i>Min and Max temperature of the ambient atmosphere</i>	-10		50	degC

<b>TRANSMISSION PARAMETERS</b>				
Uplink frequency range	<i>Centre frequency</i>	20	45	<i>kHz</i>
Uplink data rate	<i>Payload data available to user</i>		200	<i>kbit/sec</i>
Downlink freq. range	<i>Centre frequency</i>	24	30	<i>kHz</i>
Downlink data rate	<i>Payload data available to user</i>		16	<i>kbit/sec</i>
Adaptive Filter Tuning	<i>Continuous - to optimize SNR</i>		YES	
Adaptive Modulation	<i>Uplink – to optimize data rates</i>		YES	
Automatic gain control	<i>Uplink and downlink</i>		YES	
Data redundancy check	<i>8 bit</i>		YES	
Automatic retransmit	<i>Modems will retransmit if CRC fails</i>		YES	
<b>CONNECTORS</b>				
<i>AC Inlet Supply Power</i>	<i>AC supply to power the modem</i>	IEC Inlet with switch FN-9266		
<i>DC Inlet Supply Power</i>	<i>DC supply to power the modem</i>	4mm Banana		
<i>High Voltage DC OUT</i>	<i>HV DC Output to wireline / cable</i>	Lemo / Phoenix		
<i>High Voltage DC IN</i>	<i>HV DC Input from external PSU</i>	Lemo / Phoenix		
<i>3xUSB</i>		USB C		
<i>RS-422</i>		Not Mounted		
<b>PHYSICAL SIZE</b>				
<i>Length</i>	<i>Including flanges</i>	314,3		mm
<i>Width</i>		112,9		mm
<i>Height</i>		24		mm

## 2.2 Conformal Coating

This product is delivered with no conformal coating.

## 2.3 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.

## 2.4 Cable types supported

The NSE Telemetry system is developed to work on wireline cables, but has proven to provide reliable links on a variety of cable and setups such as:

- Wireline, Monoconductor cables
- Wireline, Hepta cables
- Coiled tubing with electrical lines
- Coiled tubing with hybrid (electro and fiber) cables
- TEC Downhole Cables
- Various Subsea cables
- Twisted pair

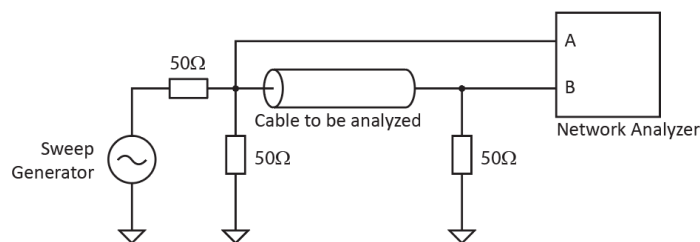
The versatility and adaptive algorithms of the telemetry mean that it will work on a very broad range of cable. Contact NSE if you have questions about specific cable types or setup.

## 2.5 Telemetry range

The maximum supported cable length of the modem depends on several factors:

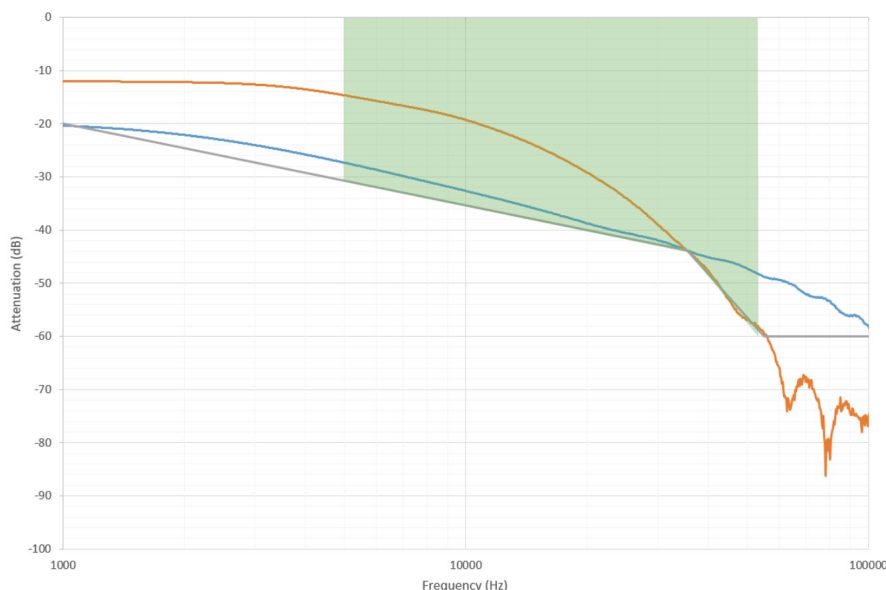
- Cable type and characteristics
- Connections from the topside modem to the cable head/winch
- Connections and grounding in the tool itself
- Ground loops and ground induced noise
- Sources of noise downhole such as - motor controller, power converters, and sensors
- Sources of noise topside such as - power supplies, electrical winches, hydraulic power packs, and generators

To provide a reference for the telemetry we use 2 cable characteristics as the maximum limit for the range of the standard modem setup. Note that in most cases, the telemetry will operate fine on even longer cables than these references, but they serve as a guideline. Long-range modems will support cables setups with higher attenuation.



Measurement circuit for cable references

The graph below shows the attenuation plot of the reference cables with the overlay of a green area ranging between 5 to 55kHz. In this area, the attenuation of the cable should not be below the limit indicated. As can be seen, both the reference cables are within the green area for the frequency range of interest.

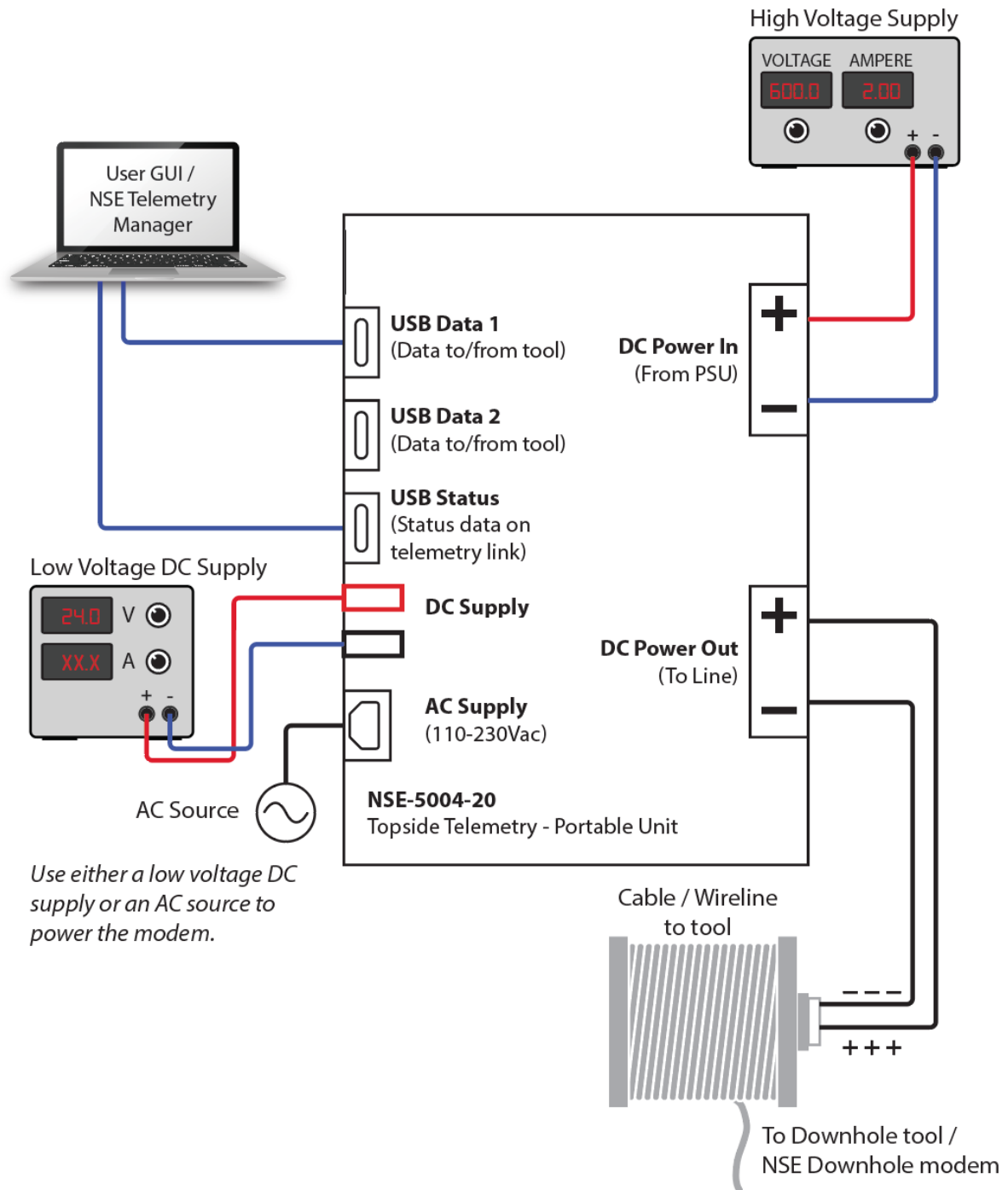


**Reference Cable 1**  
 Length 9.1km / 30kft  
 Camesa 5/16  
 1N32WTZ  
 (Corrosion resistant)

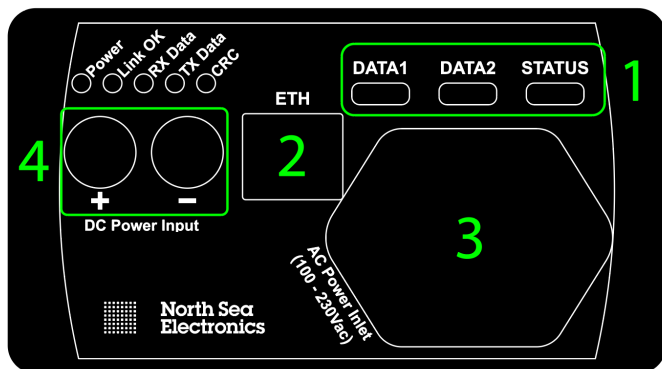
**Reference Cable 2**  
 Length 9.1km / 30kft  
 Camesa 5/16  
 1N32PTZ

### 3 Connections

#### 3.1 Overview



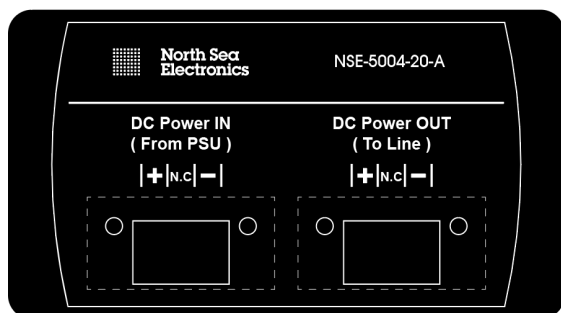
### 3.2 Front Panel Connectors



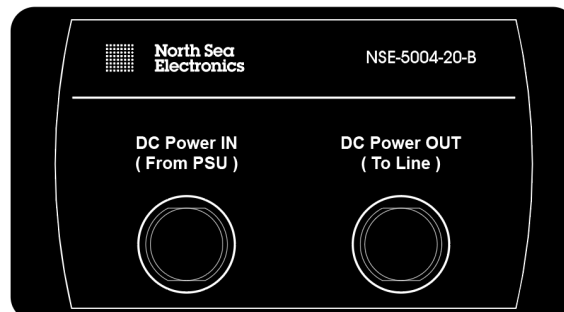
Connector(s)	Function	Type of connector
1	Data and status	3 x USB C
2	Ethernet	RJ45 – Note - this port is not in use.
3	AC Supply Inlet	IEC with switch
4	DC Supply Inlet	4mm Safety Banana

### 3.3 Rear Panel - DC Power IN and DC Power OUT connector

The Portable Unit can be supplied with two options on the DC Power IN and DC Power OUT connectors.



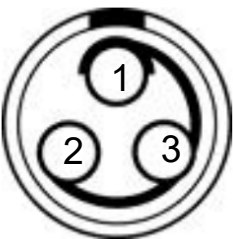
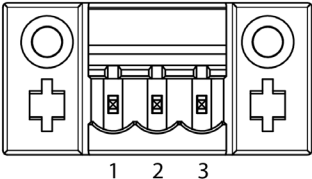
*Phoenix Option*



*Lemo Option*


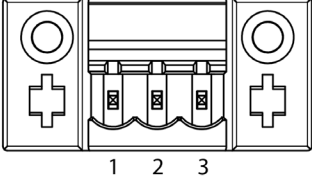
### 3.3.1 DC Power IN

	Phoenix terminal blocks Option (A)	Lemo Option (B)
Modem connector:	<b>DFK-MSTB 2,5/ 3-G-5,08 - 0707251</b>	<b>EGG.2B.303.CLL</b>
Suggested mating connector:	<b>MSTBP 2,5/ 3-ST-5,08 - 1769023</b>	<b>FGG.2B.303.CLAD72Z</b>

Pin	Signal name	Description	Connector Pinout – LEMO option (Face View)	Connector Pinout – Phoenix option (Face View)
1	DC + IN	High Voltage DC Positive INPUT		
2	N.C	Not Connected		
3	DC - IN	High Voltage DC Ground INPUT		

### 3.3.2 DC Power OUT

	Lemo Option (A)	Phoenix Option (B)
Modem connector:	<b>EGG.2B.303.CLL</b>	<b>DFK-MSTB 2,5/ 3-G-5,08 - 0707251</b>
Suggested mating connector:	<b>FGG.2B.303.CLAD72Z</b>	<b>MSTBP 2,5/ 3-ST-5,08 - 1769023</b>

Pin	Signal name	Description	Connector Pinout – LEMO option (Face View)	Connector Pinout – Phoenix option (Face View)
1	DC + OUT	High Voltage DC Positive OUTPUT		
2	N.C	Not Connected		
3	DC - OUT	High Voltage DC Ground OUTPUT		



### 3.4 LED Indicators

The board has 4 LED indicators to indicate activity.

Name	Colour	Description
<b>Power</b>	Green	Illuminates when power is applied to the modem
<b>Link OK</b>	Green	Illuminated when topside and downhole modem has power and contact with each other
<b>RX Data</b>	Green	Blinks when receiving data
<b>TX Data</b>	Green	Blinks when transmitting data
<b>CRC</b>	Red	Blinks when detecting a CRC Fault

## 4 Features

The NSE Telemetry is continuously being updated and updates are provided for free to our customers. Below is a list of the main (but not all) features of the telemetry system. Consult NSE for further questions or inquiries about the features and advantages of the NSE Telemetry system.

Feature	Description
<b>Transparent data port</b>	<p>The data being sent and received on the data port are the same bytes as you receive and send on the topside modem. No framing or encryption is necessary. The purpose of the modem is to be a transparent datalink from your topside user interface to the tool.</p> <p>Note that a topside and a downhole modem can have different baud rates and that the latency on the data can have some variation as the modem will buffer data and send it over the line in packages.</p>
<b>High Power Wireline Filter</b>	<p>The modem has a high power / high voltage wireline filter design to separate the communication signal from the DC power being fed to the modem.</p> <p>The high power filter will handle the currents (within specifications) and voltages normally being seen on a wireline and will help to improve the signal to noise ratio of the system.</p>
<b>Automatic Link Tuning</b>	<p>The first time the modems are powered up on a new cable, the topside and downhole modems will analyze the cable and work out the best settings for modulation, gains, and frequencies. No user interaction is required here, and this feature ensures optimum data rates and signal quality for a given cable.</p> <p>The feature can be disabled if the user wants to set the parameters themselves.</p>
<b>Adaptive filter tuning</b>	<p>Once the link has been established the modems will continuously work to adapt to the cable by updating the digital filter coefficients. The updates are being done several times per second and ensure that the link will maintain the highest possible signal to noise ratio even when conditions such as spooling out the cable, temperature and load, changes.</p>

<p><b>Adaptive modulation</b></p>	<p>The adaptive modulation will increase the modulation rate in steps (hence the available data rates) when the signal to noise ratio is better than defined thresholds. In this way, the user will always have the best possible data rate for the actual condition (cable and noise) at the same time as the modem will ensure to lower the data rates if noise levels increase.</p> <p>It is possible to set the modems to a “safe” mode where the system will optimize frequency and modulation for noisy conditions rather than “performance” mode where the modem will optimize for the highest possible data rates.</p>
<p><b>CRC and automatic retransmissions</b></p>	<p>All data being sent over the wireline are being CRC (Cyclic Redundancy Check) checked when received and if the modems detect a failed CRC it will request that the data are being retransmitted (up to 4 times).</p> <p>All CRC events, retransmissions, and package loss (if resending a package 4 times fail, the package is dropped) are being tracked and the count of these events can be read out over the status port.</p>
<p><b>Addressable</b></p>	<p>The downhole modems are addressable and several downhole modems can be connected in parallel. On a topside modem, one chooses which modem to talk to by selecting a destination address.</p>
<p><b>Data buffering</b></p>	<p>When data is being fed to the modems on the serial port, the data are being buffered until they are transmitted over the wireline. Both the topside modems and the downhole modems have defined buffer space to temporarily store bytes that are not immediately sent.</p> <p>The status of the serial buffers can be monitored through the status port to optimize the data flow into the modems and to prevent overflowing the serial buffers. A flow control mechanism can also be enabled if required.</p>

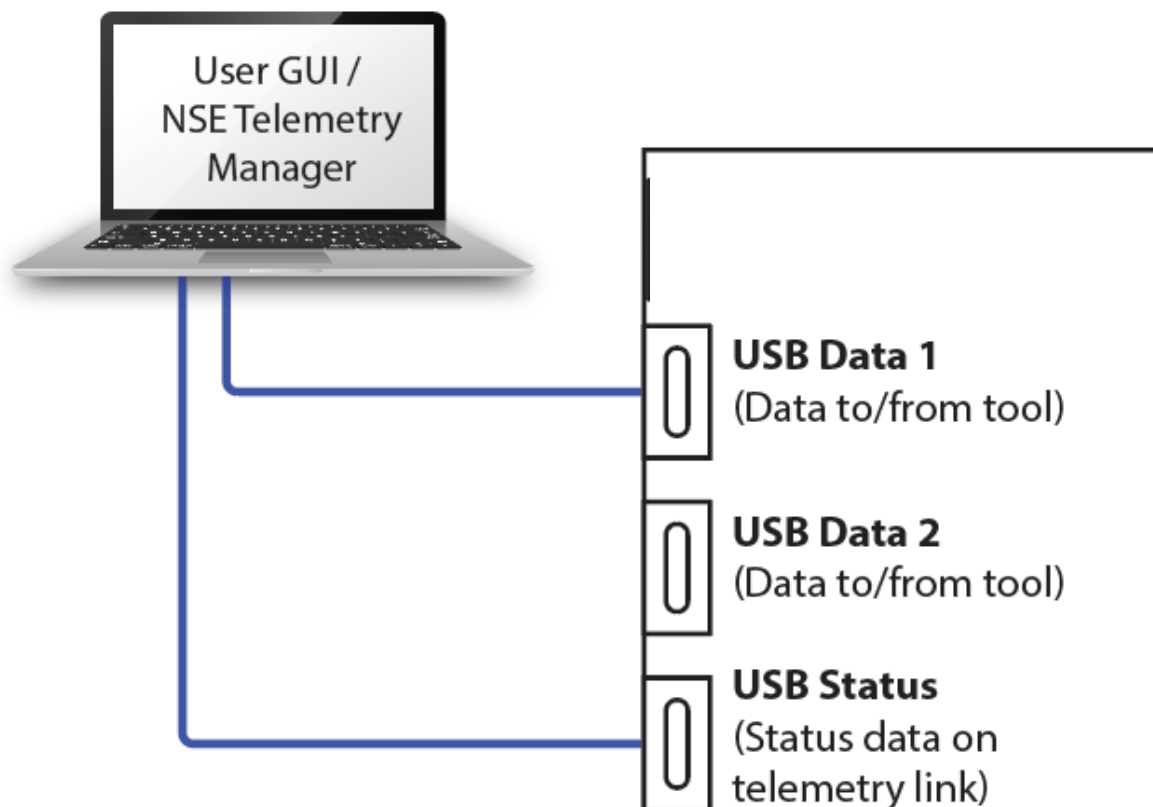
#### 4.1 Bootloader

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, and the bootloader allows the customer to upgrade a controller if desired.

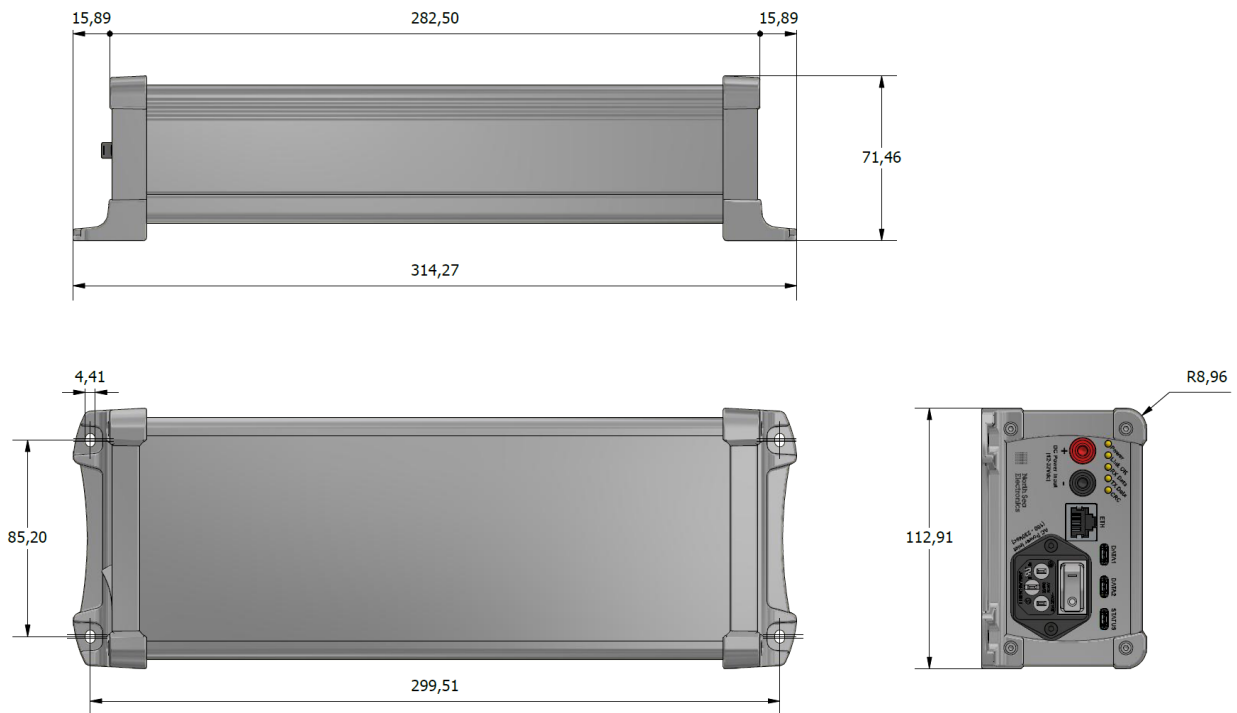
## 5 Graphical User Interface

The “NSE Telemetry Manager” software (graphical user interface) is free of charge software that can be used to set up and monitor the telemetry system. The software uses the **status port** (USB Status) to communicate with the modem.

The “NSE Telemetry Manager” will display all relevant data from the telemetry and can trend- and download all parameters. Data from a test can be uploaded directly to NSE servers to ease support and faultfinding.



## 6 Mechanical Dimensions



## 7 Datasheet Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	28.09.2020	Initial release	RFY	GLK
B	29.04.2022	Updated product photo	RFY	GLK
C	10.01.2025	Removed references to Ethernet. Updated DC input	RFY	GLK

## 8 Product code

		Product code:	NSE-5004	-20	-X
<b>Category</b>	NSE-5004	= NSE Telemetry			
<b>Model</b>	-20	= Topside Telemetry – Portable Unit			
<b>Version</b>	-A	= Phoenix Terminal Block (DC Power Connections)			
	-B	= Lemo connectors (DC Power Connections)			

### 8.1 Where to buy

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