



Features

- Eurocard size (100x160mm)
- Up to 600Vdc input voltage
- Up to 2A input current
- Up to 200kbps data rates
- USB / RS485 / Eth. Interface
- Very compact design
- Easy integration into 3rd party systems
- High noise redundancy
- Adaptive modulation
- High shock and vibration resistance



Product Description

The NSE Wireline Telemetry System is used for communication via wireline or powerline. The system consists of two main components: 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 Topside Telemetry – Eurocard Board is designed to be used stand-alone or integrated into a backplane system. All IO can be accessed either by a DIN41612 connector or by the designated board connector.

NSE Wireline Telemetry Systems are deployed worldwide and cover all applications from power tools, such as tractor and stokers, to low power sensor 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 immun.	USB / RS485 ports	Ethernet Option
NSE-5004-01 NSE Topside Telemetry 19inch Rack	2U x 330mm (excl. con.)	1200V	8A	High	2 / 1	NO
NSE-5004-20 NSE Topside Telemetry – Portable Unit	314 x 113 x 71.5mm	600V	2A	Medium	3 / 0	YES
NSE-5004-21 NSE Topside Telemetry – Eurocard Board	100x 160mm Eurocard	600V	2A	Medium	3 / 1	YES

2 Product Specification

2.1 Electrical Specifications

Parameter	Conditions / Comments	Min	Typ	Max	Unit
SUPPLY VOLTAGE					
Input Voltage	<i>Operational</i>	9	24	36	Vdc
Input Power				30	W
WIRELINE / POWER INTERFACE					
Input High Voltage	<i>Continuous</i>			600	Vdc
Current	<i>Continuous</i>			2	Adc
COMMUNICATION INTERFACES					
USB Port 1	Virtual Serial Port – Communication	9.600		375.000	bps
USB Port 2	Virtual Serial Port – <i>Not assigned</i>	-		-	
USB Port 3	Virtual Serial Port – <i>Status</i>	9.600		375.000	bps
RS-422/485	Alternative communication port	9.600		375.000	bps
Ethernet*	Alternative communication port *Not implemented – Consult NSE for information	-		-	
INTEGRATED SENSORS					
Temperature sensor	<i>Measurement range</i>	-20		85	degC
ENVIRONMENTAL					
Operating temp. range	<i>Min and Max temperature of the ambient atmosphere</i>	-10		50	degC

TRANSMISSION PARAMETERS				
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	
CONNECTORS				
<i>Backplane</i>	<i>Harting - 96 pin</i>		DIN41612	
<i>Board Power</i>	<i>Molex</i>		105309-1302	
<i>Wireline/PSU</i>	<i>Harwin</i>		M80-5000000M1-04-331-00-000	
<i>Ethernet</i>	<i>Wuerth</i>		RJ-45	
<i>3xUSB</i>	<i>Harwin</i>		G125-MV10605L1P	
<i>RS-422</i>	<i>Harwin</i>		G125-FV10605L0P	
PHYSICAL SIZE				
<i>Length</i>	<i>PCB size excluding 96Pin edge connector</i>		160	<i>mm</i>
<i>Width</i>			100	<i>mm</i>
<i>Height</i>			24	<i>mm</i>

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 fibre) cables
- TEC Downhole Cables
- Various Subsea cables
- Twisted pair

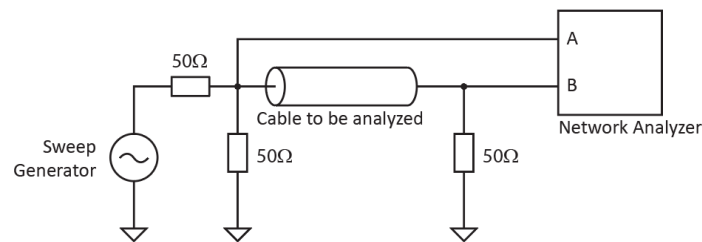
The versatility and adaptive algorithms of the telemetry mean that it will work on a very broad range of cable. Contact NSE if you have questions about specific cable types or setup.

2.5 Telemetry range

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

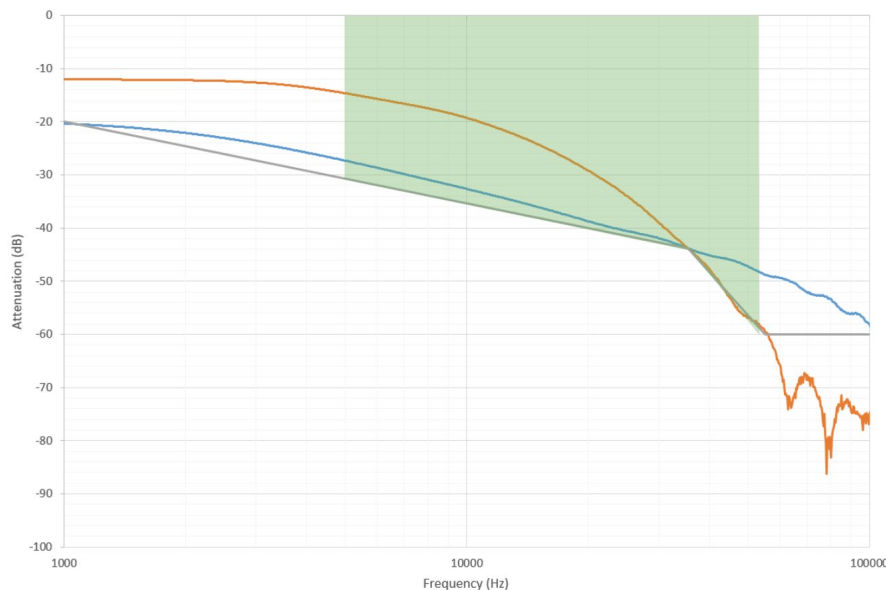
- Cable type and characteristics
- Connections from the topside modem to the cable head/winch
- Connections and grounding in the tool itself
- Ground loops and ground induced noise
- Sources of noise downhole such as - motor controller, power converters and sensors
- Sources of noise topside such as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

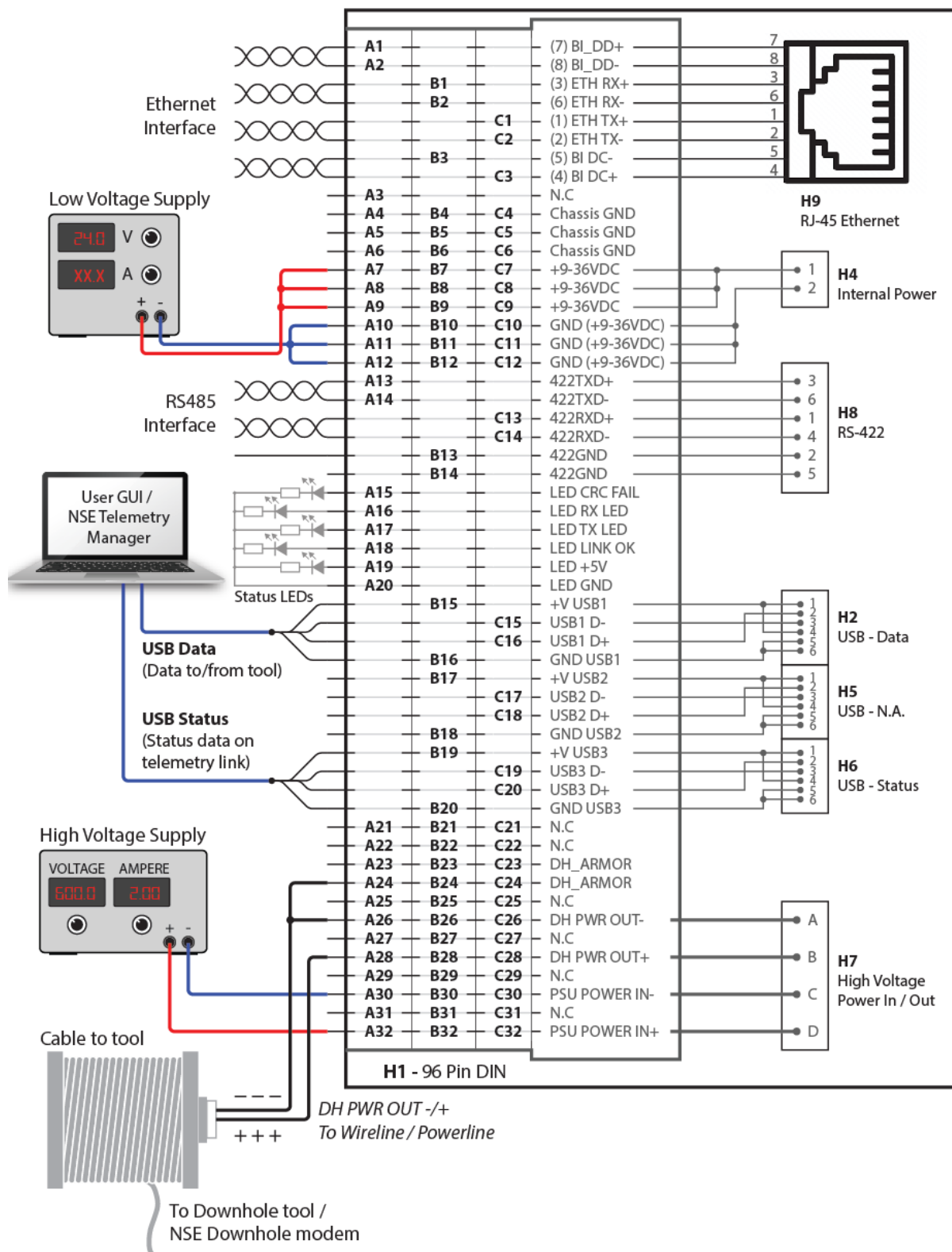


Reference Cable 1
 Length 9.1km / 30kft
 Camesa 5/16
 1N32WTZ
 (Corrosion resistant)

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

3 Connections

3.1 Overview



3.2 Connector Placement overview

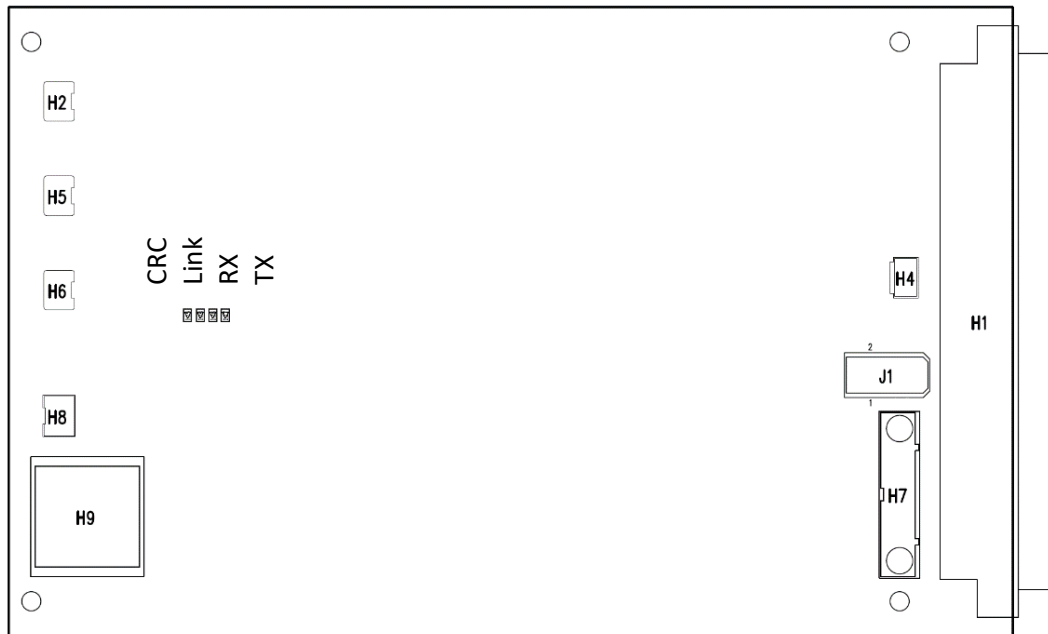


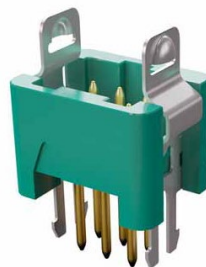
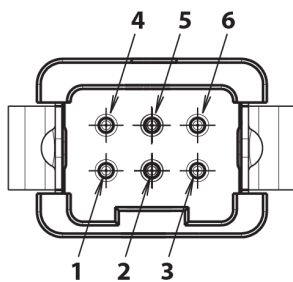
Figure 2 – Connector Placement Overview

3.3 H2 / H5 / H6 - USB 1 / USB 2 / USB3 Connector

The USB interface chip is FTDI FT232R USB to serial UART interface. The USB interfaces are galvanically isolated.

Port	Connector reference	Function
USB1	H2	Data
USB2	H5	Not Assigned
USB3	H6	Status

Modem Connector: **Harwin G125-MV10605L1P**
 Mating connector: **Harwin G125-FC10605L0-0150L**



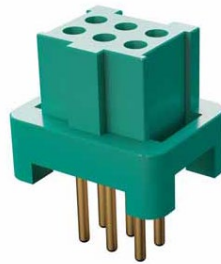
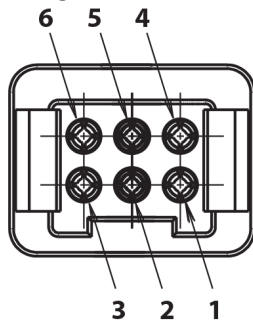
Illustration/Pin diagram shows the top view of the connector on the PCB (Looking down into the connector).

Pin	Signal	Description
1	+VUSB	+5V
2	D+	Data +
3	D-	Data -
4	+VUSB	+5V
5	GND (USB)	Ground
6	GND (USB)	Ground

3.4 H8 - RS-422 Connector

Port	Connector reference	Function
RS422	H8	Alternative data port. Has to be selected in telemetry manager to work as a data port instead of the H2 USB1 data port.

Modem Connector: **Harwin G125-FV10605L0P**
 Mating connector: **Harwin G125-MC10605L0-0150L**



Illustration/Pin diagram shows the top view of the connector on the PCB (Looking down into the connector).

Pin	Signal	Description
1	422RXD+	Receive Data +
2	GND (422)	Ground (RS422 reference)
3	422TXD+	Transmit Data +
4	422RXD-	Receive Data -
5	GND (422)	Ground
6	422TXD-	Transmit Data -

3.5 H9 - Ethernet Connector

Port	Connector reference	Function
Ethernet	H9	Currently, Ethernet is not implemented. Consult NSE for more information if required.

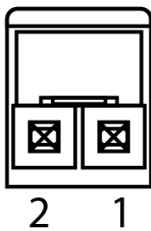
Modem Connector: **WUERTH 615008138321 – RJ45 - 10/100 Ethernet**

Pin	Signal	Description
1	TX+	Transmit Data +
2	TX-	Transmit Data -
3	RX+	Receive Data +
4	BI DC+	Bi-directional3+
5	BI DC-	Bi-directional3-
6	RX-	Receive Data -
7	BI DD+	Bi-directional4+
8	BI DD-	Bi-directional4-

3.6 H4 - Internal Power Connector information

Port	Connector reference	Function
Internal Power	H4	Used to power the modem with low voltage supply voltage (9-36Vdc)

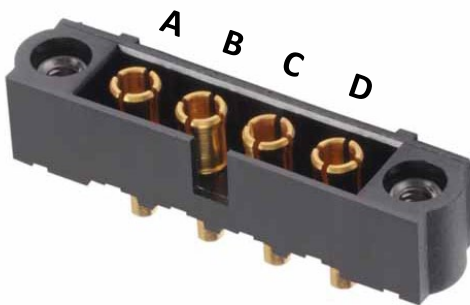
Modem Connector: **Molex 105309-1302**
 Mating connector: **Molex 105307-1202**



Illustration/Pin diagram shows the top view of the connector on the PCB (Looking down into the connector).

Pin	Signal	Description
1	+9-36V	Board Supply Voltage
2	GND (+9-36V)	Board supply Voltage Return

3.7 H7 – High Voltage DC IN / OUT



Illustration/Pin diagram shows the connector that is mounted on the PCB.

Port	Connector reference	Function
High voltage DC IN/OUT	H7	Interface to the downhole modem (OUT) and to a high voltage DC power supply (IN). Note that from the DH PWR OUT connections should go directly to the downhole modem(s) without anything connected in between except for the cable/wireline.

Modem connector: **Harwin M80-5000000M1-04-331-00-000**
 Mating connector: **Harwin M80-263F104-00-00 (connector house)**

Pin	Signal	Description
A	DH PWR OUT-	Return - High Voltage DC to Downhole tool
B	DH PWR OUT+	Positive - High Voltage DC to Downhole tool
C	PSU POWER IN-	Return - High Voltage DC from the power supply
D	PSU POWER IN+	Positive - High Voltage DC from the power supply

3.8 H1 - Backplane Connector

Port	Connector reference	Function
DIN96 Backplane	H1	Backplane connector. All connections.

Modem Connector: **Edge Connector 96 pin DIN41612 – Harting 09031967921**

Mating Connector: **DIN41612**

Pin assignments:

Pin	Description	Pin	Description	Pin	Description
A1	BI_DD+(7)	B1	ETH RX+(3)	C1	ETH TX+(1)
A2	BI_DD-(8)	B2	ETH RX-(6)	C2	ETH TX-(2)
A3	N.C	B3	BI_DC-(5)	C3	BI_DC+(4)
A4	Chassis GND	B4	Chassis GND	C4	Chassis GND
A5	Chassis GND	B5	Chassis GND	C5	Chassis GND
A6	Chassis GND	B6	Chassis GND	C6	Chassis GND
A7	+9-36V	B7	+9-36V	C7	+9-36V
A8	+9-36V	B8	+9-36V	C8	+9-36V
A9	+9-36V	B9	+9-36V	C9	+9-36V
A10	GND (+9-36V)	B10	GND (+9-36V)	C10	GND (+9-36V)
A11	GND (+9-36V)	B11	GND (+9-36V)	C11	GND (+9-36V)
A12	GND (+9-36V)	B12	GND (+9-36V)	C12	GND (+9-36V)
A13	422TXD+	B13	422GND	C13	422RXD+
A14	422TXD-	B14	422GND	C14	422RXD-
A15	LED CRC FAIL	B15	+VUSB1	C15	USB1 D-
A16	LED RX LED	B16	GND (USB)	C16	USB1 D+
A17	LED TX LED	B17	+VUSB2	C17	USB2 D-
A18	LED LINK OK	B18	GND (USB)	C18	USB2 D+
A19	LED +5V	B19	+VUSB3	C19	USB3 D-
A20	LED GND	B20	GND (USB)	C20	USB3 D+
A21	N.C	B21	N.C	C21	N.C
A22	N.C	B22	N.C	C22	N.C
A23	DH_ARMOR	B23	DH_ARMOR	C23	DH_ARMOR
A24	DH_ARMOR	B24	DH_ARMOR	C24	DH_ARMOR
A25	N.C	B25	N.C	C25	N.C
A26	DH PWR OUT-	B26	DH PWR OUT-	C26	DH PWR OUT-
A27	N.C	B27	N.C	C27	N.C
A28	DH PWR OUT+	B28	DH PWR OUT+	C28	DH PWR OUT+
A29	N.C	B29	N.C	C29	N.C
A30	PSU POWER IN-	B30	PSU POWER IN-	C30	PSU POWER IN-
A31	N.C	B31	N.C	C31	N.C
A32	PSU POWER IN+	B32	PSU POWER IN+	C32	PSU POWER IN+

3.9 LED Indicators

The board has 4 LED indicators to indicate activity.

Name	Colour	Description
Link	Green	Illuminated when topside and downhole modem has power and contact with each other
RX	Green	Blinks when receiving data
TX	Green	Blinks when transmitting data
CRC	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
Transparent data port	<p>The data being sent and received on the data port is 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 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>
High Power Wireline Filter	<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>
Automatic Link Tuning	<p>The first time the modems are powered up on a new cable, the topside and downhole modems will analyse 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>
Adaptive filter tuning	<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>Adaptive modulation</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>CRC and automatic retransmissions</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>Addressable</p>	<p>The downhole modems are addressable and several downhole modems can be connected in parallel. On the topside modem, one choose which modem to talk to by selecting a destination address.</p>
<p>Data buffering</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. The flow control mechanism can also be enabled if required.</p>

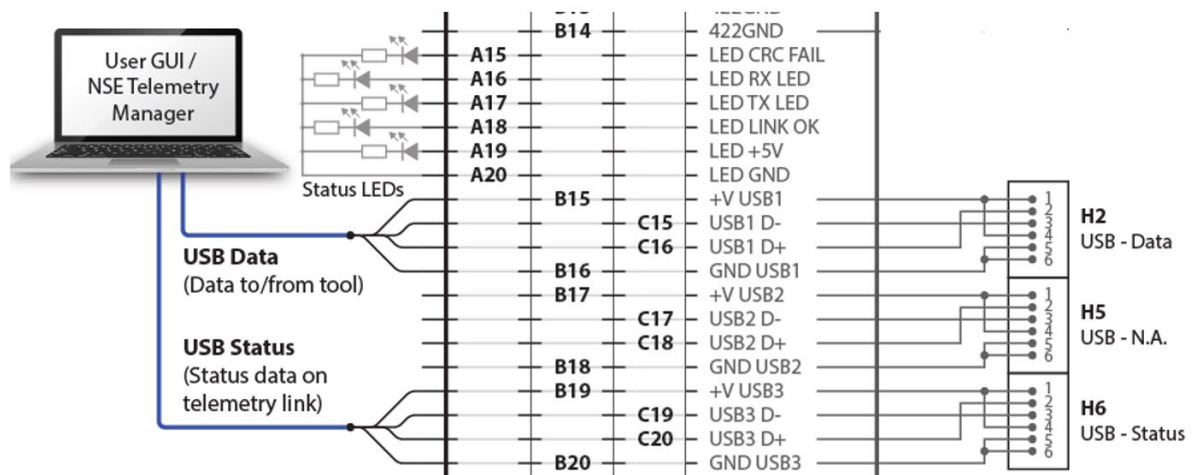
4.1 Bootloader

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

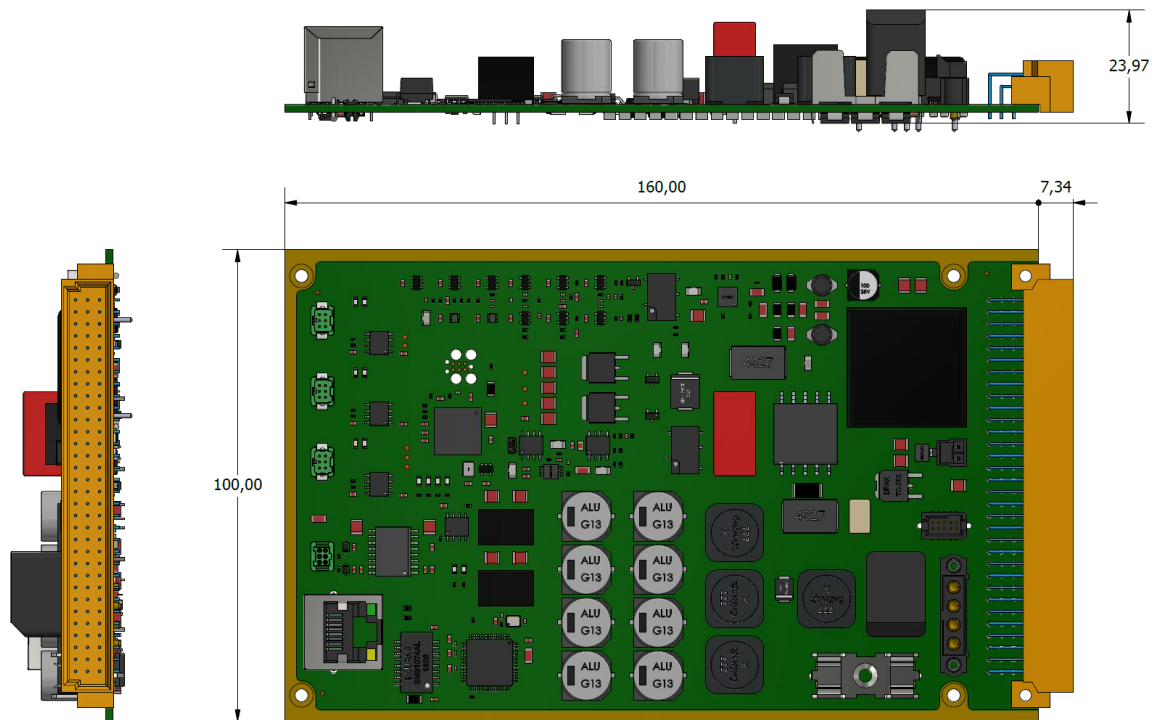
5 Graphical User Interface

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 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	23.09.2020	New doc# and updated content	RFY	

8 Product code

		Product code:	NSE-5004	-21
Category	NSE-5004	= NSE Telemetry		
Model	-21	= Topside Telemetry – Eurocard Board		

8.1 Where to buy

Email: sales@nse.no
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