North Sea Electronics

Features

- Up to 600Vdc input voltage

- Up to 2A input current

- Up to 200kbps data rates

- High temperature – 177°C

- TTL Serial interface – data and status

- CANbus interface - data

- Very compact design

- Easy integration into tools

- High noise redundancy

- Adaptive modulation

- High shock and vibration resistance

- Field proven design

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 modems are designed to communicate over wire- or powerlines. Even if monoconductor wireline is the main use, the versatility of the system has made it popular in other applications such as coiled tubing and subsea backup communication system.

NSE Wireline Telemetry Systems are deployed worldwide and cover all applications from power tools, such as tractor and strokers, 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 in order to optimize the signal to noise ratio.

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

1 Table of NSE HT Downhole modems

Product Number / Name	Required Internal Dia.	Chassis / Assembly Length	Max. Wireline Current	Noise immun.	Gateway Processor & CANBus	Internal PSU High Volt. -> Low Volt.
NSE-5004-02 NSE HT Downhole Telemetry 55mm	**55mm**	**142mm**	**8A**	**High**	**NO**	**NO**
NSE-5004-10 NSE HT Downhole Telemetry 38mm	**38mm**	**243mm**	**4A**	**Medium**	**Optional**	**NO**
NSE-5004-11 NSE HT Downhole Telemetry 32mm ex. PSU	**32mm**	**304mm**	**2A**	**Medium**	**YES**	**NO**
NSE-5004-16 NSE HT Downhole Telemetry 32mm with PSU	**32mm**	**304mm**	**2A**	**Medium**	**YES**	**YES**

2 Product Specification

2.1 Electrical Specifications

Parameter	Conditions / Comments	Min	Typ	Max	Unit
WIRELINE INTERFACE					
Input High Voltage	*Continuous*	0		600	*Vdc*
Input Transient Voltage	*Single transient < 1sec*			900	*V*
Wireline Current	*Continuous*	0		2	*Adc*
Wireline Filter Inductance		140		200	*uH*
Wireline Series Resistance				100	*mΩ*
LOW VOLTAGE SUPPLY					
Input supply voltage		18		30	*Vdc*
Input supply current	*Receive / Idle @ 24Vdc input*		30		*mA*
Input supply current	*Transmit @ 24Vdc - pulse*			150	*mA*

TRANSMISSION PARAMETERS				
Uplink frequency range	Centre frequency	20	45	kHz
Uplink data rate	Payload data available to user		200	kbit/sec
Downlink frequency range	Centre frequency	24	30	kHz
Downlink data rate	Payload data available to user		16	kbit/sec
Adaptive Filter Tuning	Continuous - to optimize SNR	YES		
Adaptive Modulation	Uplink – to optimize data rates	YES		
Automatic gain control	Uplink and downlink	YES		
Data redundancy check	8 bit	YES		
Automatic retransmission	Modems will retransmit if CRC fails	YES		
DATA INTERFACE				
UART Serial Data port	TTL Level, 3.3V	YES		
UART Serial Status port	TTL Level, 3.3V	YES		
UART Serial Data port bit rate	Consult NSE for full table	9.600	375.000	bit/sec
UART Serial Status port bit rate	Fixed data rate	125.000		bit/sec
Gateway processor installed		YES		
CANBus data interface		YES		
CANbus bit rate		50.000	250.000	bit/sec
MECHANICAL DIMENSIONS				
Assembly Length	Excluding connector	243		mm
Assembly Width		37		mm
Assembly Height		22.1		mm
INTERNAL SENSORS				
Temperature sensor range	Reading available on status port	-20	190	°C
ENVIRONMENTAL AND THERMAL				
Ambient temperature	Min and Max temperature on the surface of outer housing given that thermal resistance is within the specification	-20	177	°C
Thermal Resistance	Surface of OUTER HOUSING to NSE UNIT *Refer to the Section "Thermal properties" for further definition		0.5	°C/W
OPERATIONAL LIFETIME				
Expected Lifetime	< 125°C Ambient Temperature	2000		Hours
	125 - 150°C (4 x acc. factor)	500		Hours
	150- 177°C (8 x acc. factor)	250		Hours

2.2   Thermal properties

The NSE HT Downhole Telemetry 32mm 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.

2.3   Conformal Coating

This product is delivered with no conformal coating.

2.4   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.

2.5 Cable types supported

The NSE Downhole telemetry system was 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 means that it will work on a very broad range of cable. Contact NSE if you have questions about specific cable types or setup.

2.6 Gateway processor

The NSE HT Downhole Telemetry 32mm is provided with a gateway processor and a CANBus Interface. The gateway processor allows the modem to communicate directly on CANBus and if required, the gateway processor can be set up to perform user-specified tasks.

The Gateway processor can be enabled or disabled depending on if the user wants to use UART or CANBus to send and receive data with the modem.
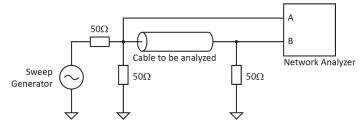
2.7   Telemetry range

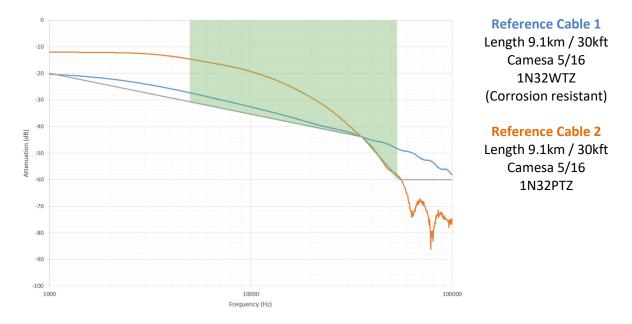The maximum supported cable length of the modem depend on several factors:

- 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

In order 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.

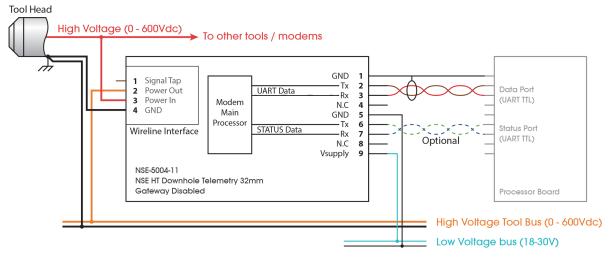

Measurement circuit for cable references

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.
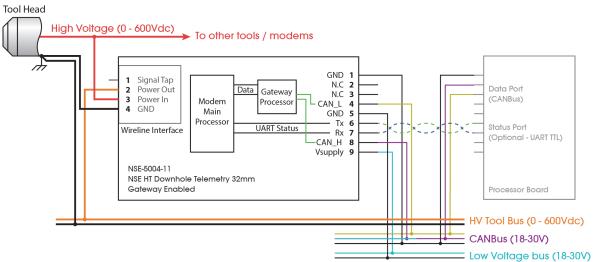

Reference Cable 1
Length 9.1km / 30kft
Camesa 5/16
1N32WTZ
(Corrosion resistant)

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

3   Connections

3.1   Overview – Gateway disabled

3.2   Overview – Gateway enabled

3.3   Input Connections

Pin	Signal name	Description / Function	Connector Pinout (Face View)
1	Signal Tap	Internally short circuited to Power In. Can be used to bypass the modem DH filter. Consult NSE for use.	
2	Power Out	HV Power out to the HV Tool bus / load of the system	
3	Power In	HV Power in to the DH Modem. This should come directly from the topside modem powerline output (through the cable / wireline).	
4	GND	Ground Connections. Should held the same potential as the GND pin on the signal connector.	

3.4 Output connector

Modem Connector: **M83513-A01CP**
Suggested mating connector: **NSE-Connector Kit – NSE…**

Pin	Signal name Gateway Disabled	Signal name Gateway Enabled	Description / Function	Connector Pinout (Face View)
1	GND	GND	Low voltage ground connection.	
2	SERIAL 1 TX	SERIAL 1 TX	Serial Data 1 Out from modem.	
3	SERIAL 1 RX	SERIAL 1 RX	Serial Data 1 In to modem.	
4	CAN_L	CAN_L	CANBus Low	
5	GND	GND	Low voltage ground connection.	
6	STATUS TX	STATUS TX	Status Data Out from modem.	
7	STATUS RX	STATUS RX	Status Data 2 In to modem.	
8	CAN_H	CAN_H	CANBus High	
9	V_Supply	V_Supply	Low voltage supply voltage.	

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	The data being sent and received on the data port is the exact 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. Note that topside and downhole modem can have different baudrates 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.
High Power Wireline Filter	The down hole modem has a high power wireline filter design to separate the communication signal from the power being fed to the tool. 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 on demanding loads such as motor controllers and power converters. If further filtering than the standard filter is required, NSE will help design and implement this.
Automatic Link Tuning	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 ensure optimum data rates and signal quality for a given cable. The feature can be disabled if the user wants to set the parameters themselves.
Adaptive filter tuning	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.
Adaptive modulation	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. 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.

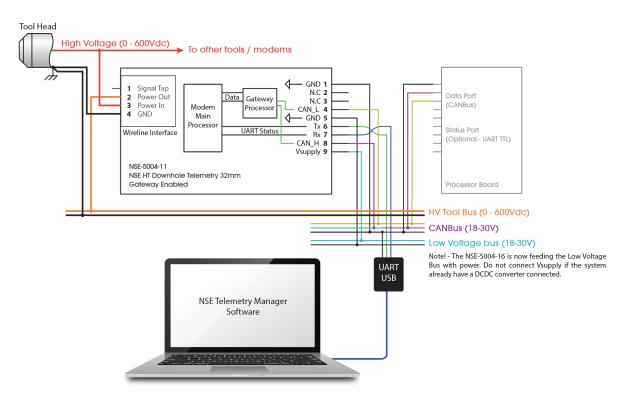| CRC and automatic retransmissions	All data being sent over the wireline are being CRC (Cyclic Redundancy Check) checked when received and if the modems detect a failed CRC it will request that the data are being retransmitted (up to 4 times). All CRC events, retransmissions and package loss (if resending 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.
Addressable	The down hole modems are addressable and several down hole modems can be connected in parallel. On topside modem one choose which modem to talk to by selecting a destination address.
Data buffering	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 a defined buffer space in order to temporarily store bytes that are not immediately sent. The status of the serial buffers can be monitored through the status port in order to optimize the data flow into the modems and to prevent overflowing the serial buffers. Flow control mechanism can also be enabled if required.

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.
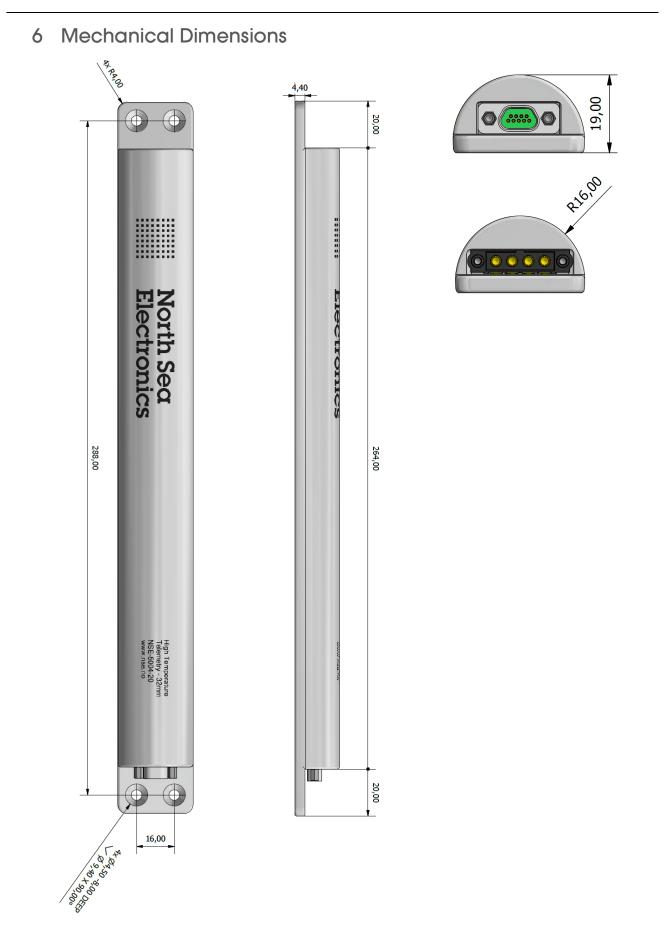
5 Graphical User Interface

The "NSE Telemetry Manager" software (graphical user interface) is a 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 and although the telemetry manager is typically connected to the topside modem, it can be useful to connect to the downhole modem as well, during setup and testing.

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 in order to ease support and faultfinding.

6 Mechanical Dimensions

7 Datasheet Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	21.09.2020	Initial release	RFY	GLK

8 Product Code

	Product code:	**NSE-5004**	**-11**
Category	NSE-5004	= NSE Telemetry	
Model	-11	= HT DH Telemetry 32mm	

8.1 Where to buy

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