Features

- Up to 600Vdc input voltage
- Up to 5A continuous input current
- Up to 200kbps data rates
- High temperature – 177°C
- TTL Serial interface – data and status
- CANbus data interface
- Transparent data link
- Compact design & easy integration
- High noise redundancy
- Adaptive modulation
- Field-proven design

Product Description

The NSE Wireline Telemetry System is used for communication over wireline (e-line) 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.

Even if monoconductor is what is mainly used, 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 system is addressable that enables several downhole modems to communicate with one topside modem. The broad input voltage range allow the system to work from 0 to 600Vdc.

The **NSE HT DH Telemetry Long Range 51mm** is specifically designed for high power applications and long-range operation. The internal filter will provide high attenuation for noise from motor controllers, power converters or other noisy loads. The modem is also capable of supporting low-frequency operation to be able to achieve link on very long and highly attenuated cables.

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

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-5004-17 NSE HT DH Modem 51mm Long Range	**51mm (2")**	**300mm (11.81")**	**5/8A**	**Very High**	**YES**	**NO**
NSE-5004-02 NSE HT Downhole Telemetry 55mm	**55mm (2")**	**142mm (5.59")**	**8A**	**High**	**NO**	**NO**
NSE-5004-10 NSE HT Downhole Telemetry 38mm	**38mm (1 ½")**	**243mm (9.57")**	**4A**	**Medium**	**Optional**	**NO**
NSE-5004-11 NSE HT Downhole Telemetry 32mm ex. PSU	**32mm (1 ¼")**	**304mm (11.97")**	**2A**	**Medium**	**YES**	**NO**
NSE-5004-16 NSE HT Downhole Telemetry 32mm with PSU	**32mm (1 ¼")**	**304mm (11.97")**	**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 Nominal	*Continuous*	0		5	*Adc*
Wireline Current Overload	*Operation up to this current will be possible without damaging the modem but may result in reduced telemetry performance*			8	*Adc*
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*	15	45	*kHz*
Uplink data rate	*Payload data available to user*		200	*kbit/sec*
Downlink frequency range	*Centre frequency*	15	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		125.000		*bit/sec*
MECHANICAL DIMENSIONS				
Assembly Length	*Including Flanges*	300		*mm*
Assembly Width		45		*mm*
Assembly Height		31		*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 55mm 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 without 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 mean that it will work on a very broad range of cable. Contact NSE if you have questions about specific cable types or setup.

2.6   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

The attenuation of a cable must be within the telemetry limits for a band of at least 12kHz within the *f low* and *f high* frequencies. The cables to be evaluated should be measured using the setup shown below:

Measurement circuit for cable references
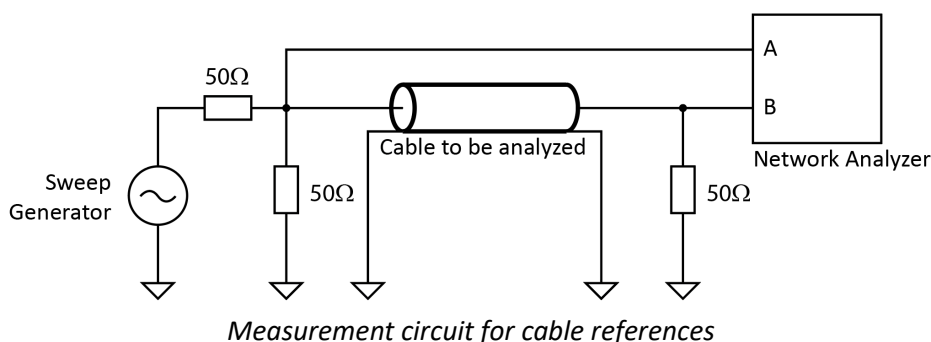
### 2.6.1   Telemetry attenuation limit plot

The plot shows the attenuation limit for the modem (horizontal thick red line). In addition, there are 3 reference cable plots shown. Each of these cables would within the limits of the DH modem.

The dashed vertical lines show the lower and higher frequencies for where the attenuation of the cable should be considered.
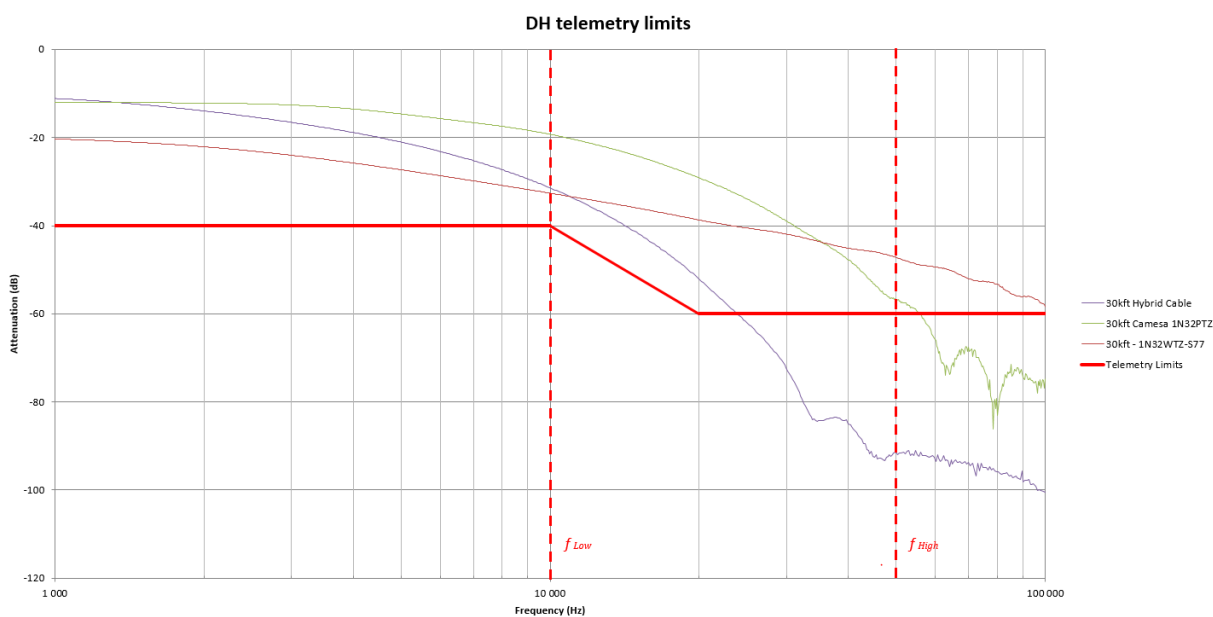
3 Connections

3.1 Overview
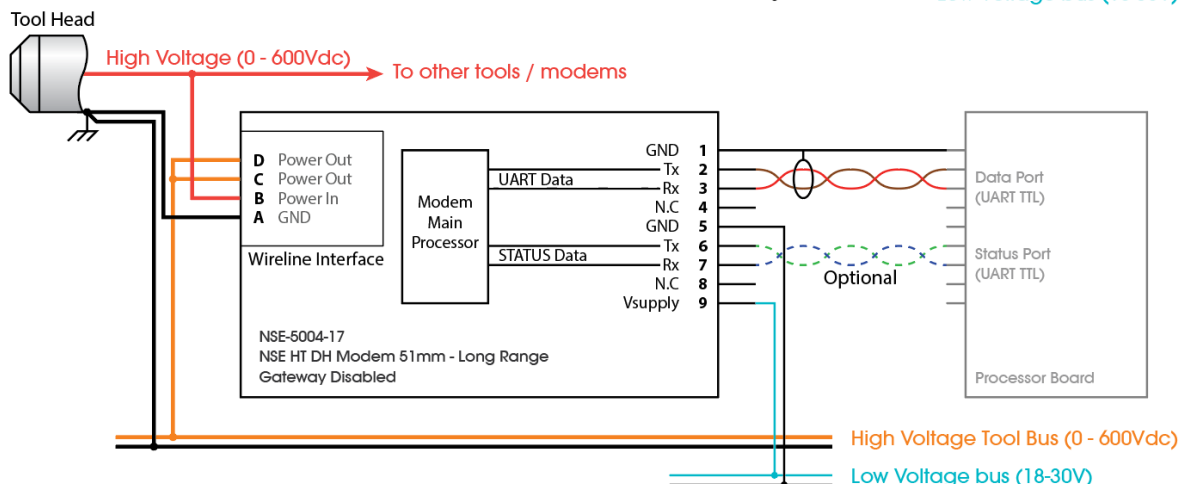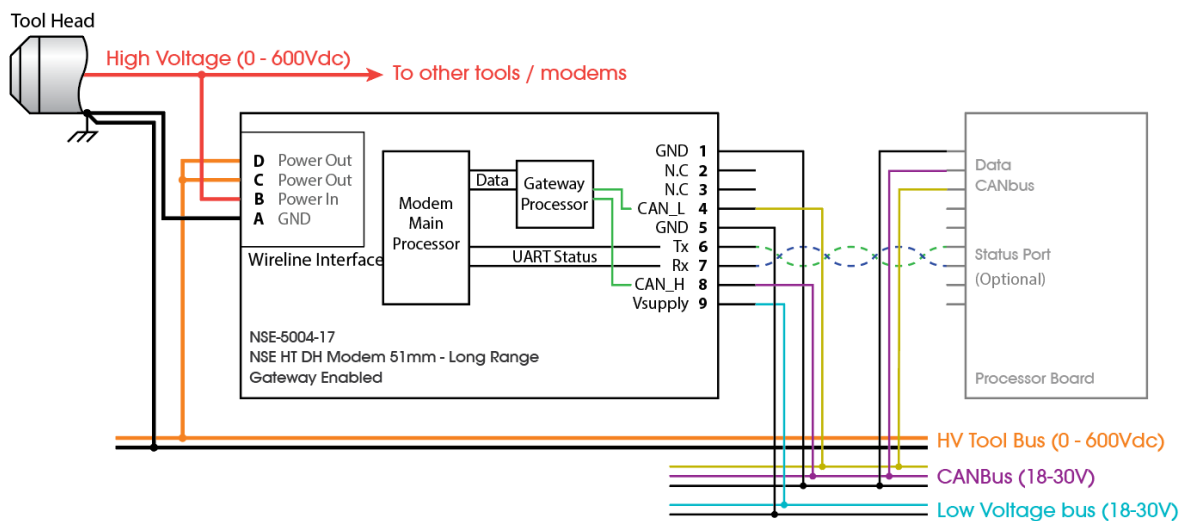
3.2 Input Connections

Pin	Signal name	Description / Function	Connector Pinout (Face View)
D	Power Out	HV Power out to the HV Tool bus / load of the system	
C	Power Out	HV Power out to the HV Tool bus / load of the system	
B	Power In	HV Power in to the DH Modem. This should come directly from the topside modem powerline output (through the cable / wireline).	
A	GND	Ground Connections. Should held the same potential as the GND pin on the signal connector.	

3.3   Output connector

Modem Connector: **High temp M83513-A01CP**
Suggested mating connector: **NSE-5004-02-CON**

Pin	Signal name	Description / Function	Connector Pinout (Face View)
1	GND	Low voltage ground connection.	
2	SERIAL 1 TX	Serial Data 1 Out from modem.	
3	SERIAL 1 RX	Serial Data 1 In to modem.	
4	CAN L	CAN Bus Low	
5	GND	Low voltage ground connection.	
6	SERIAL 2 TX	Status Data Out from modem / Serial Data 2 Out from modem.	
7	SERIAL 2 RX	Status Data 2 In to modem / Serial Data 2 In to modem.	
8	CAN H	CAN Bus High	
9	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 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 to ease support and faultfinding.
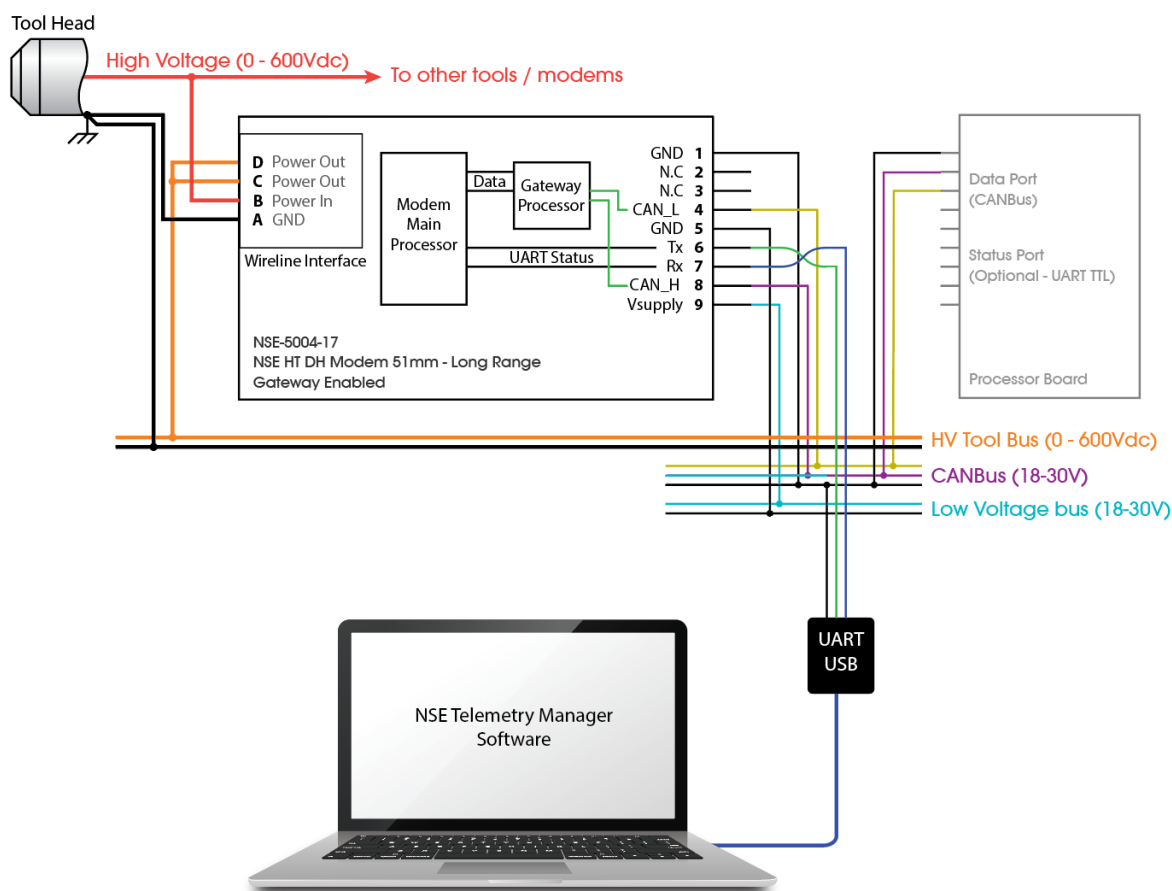
6   Mechanical Dimensions

7   Datasheet Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	11.03.2022	Initial release	RFY	GLK

8   Product code

		Product code:	**NSE-5004**	**-17**	**-Y-Y-Y**	**-X**
Category	NSE-5004	= NSE Telemetry				
Model	-17	= HT DH Modem 51mm Long Range				
Reserved Option codes						
Version	-A	= Standard version				

8.1   Where to buy

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