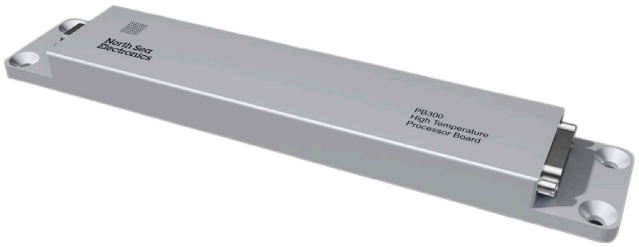
North Sea Electronics

NSE HT PB300 Processor Board

NSE-5003-03

Features

- Highly versatile processor board for downhole or other demanding applications
- 2 x Analog differential inputs with programmable gain
- CAN and RS485 interface
- 2 x Open Drain outputs
- 2Mbit HT FRAM
- 64Mbit HT Flash Memory (Optional)
- 3 axis accelerometer
- 18-32Vdc Input voltage range
- CNC Machined aluminum housing



Product Description

The NSE HT PB300 is a highly flexible, high temperature processor board. It is targeted at downhole wireline and drilling tools or other industrial applications where high temperature and severe shock and vibration may occur.

The NSE HT PB300 enables the user rapidly to progress the development of “smart tools” and cut cost by allowing the user to focus on algorithms and tool design. The board features the most common input and output (I/O) requirements and interfaces, such as analog bridge inputs (x2), open drain outputs (x2) for solenoid or relay switching, communication (CANbus and RS485) and several I/O pins. In addition, it has an onboard temperature sensor, accelerometer and a flash memory that gives the board a high level of flexibility.

The user can choose to develop its own firmware for the controller, or he can take advantage the extensive in-house experience in firmware development at NSE. If a customer chooses to write its own algorithms/firmware, NSE will provide drivers for all of the board’s hardware.

The NSE HT PB300 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 uses high temperature specified, military type “micro D” connectors.

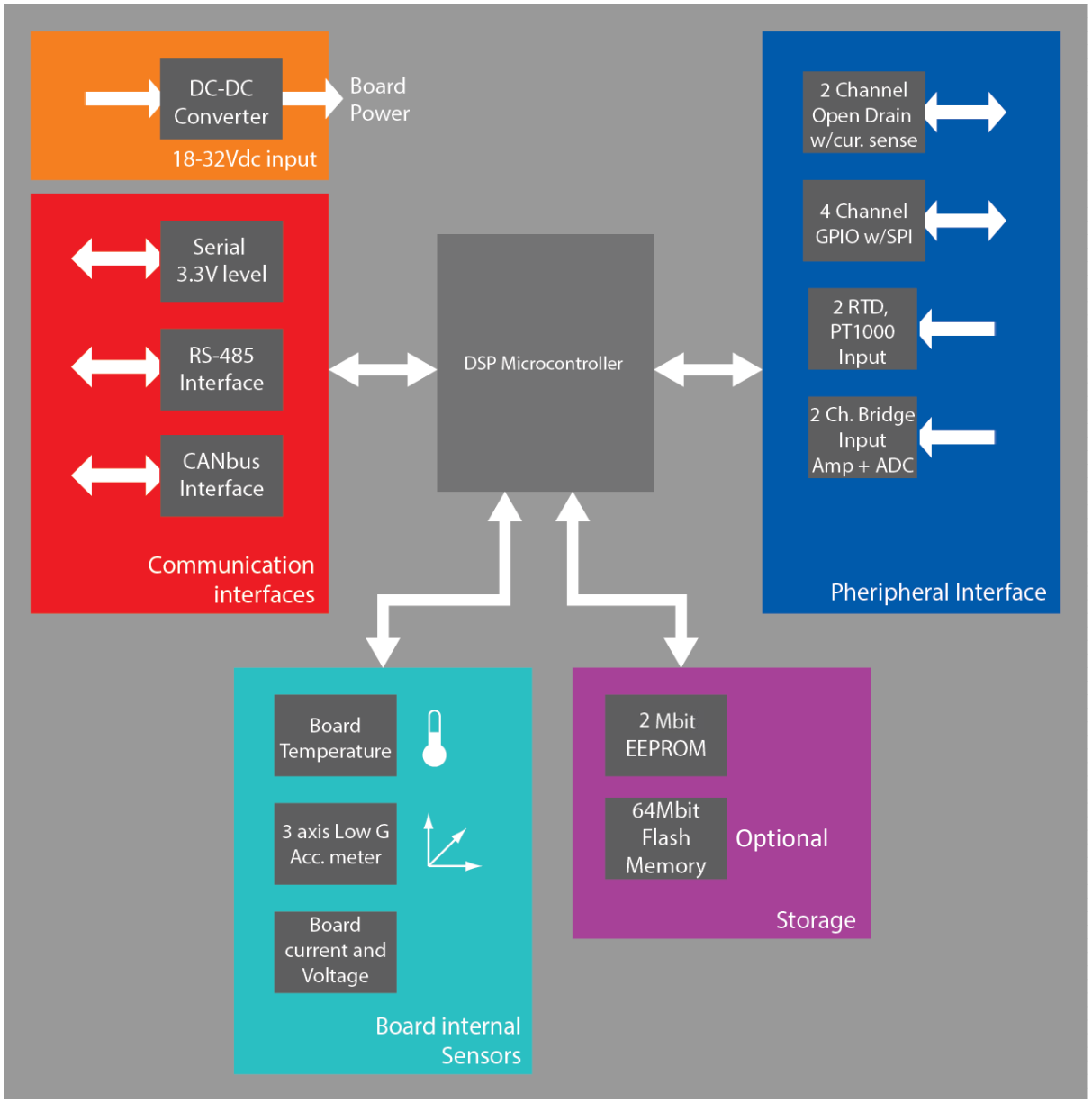
1 Board Overview

The NSE HT PB300 Processor Board features a DSP Microcontroller paired with an accurate high temperature oscillator. This is a proven solution from NSE and has been tested and verified in several designs that are in operation worldwide.

All peripherals are connected to the controller through dedicated IO pins, communication buses or SPI.

The combination of a proven design layout, good support, extensive documentation, and base driver firmware for all IO functions allow for rapid development of applications and algorithms.

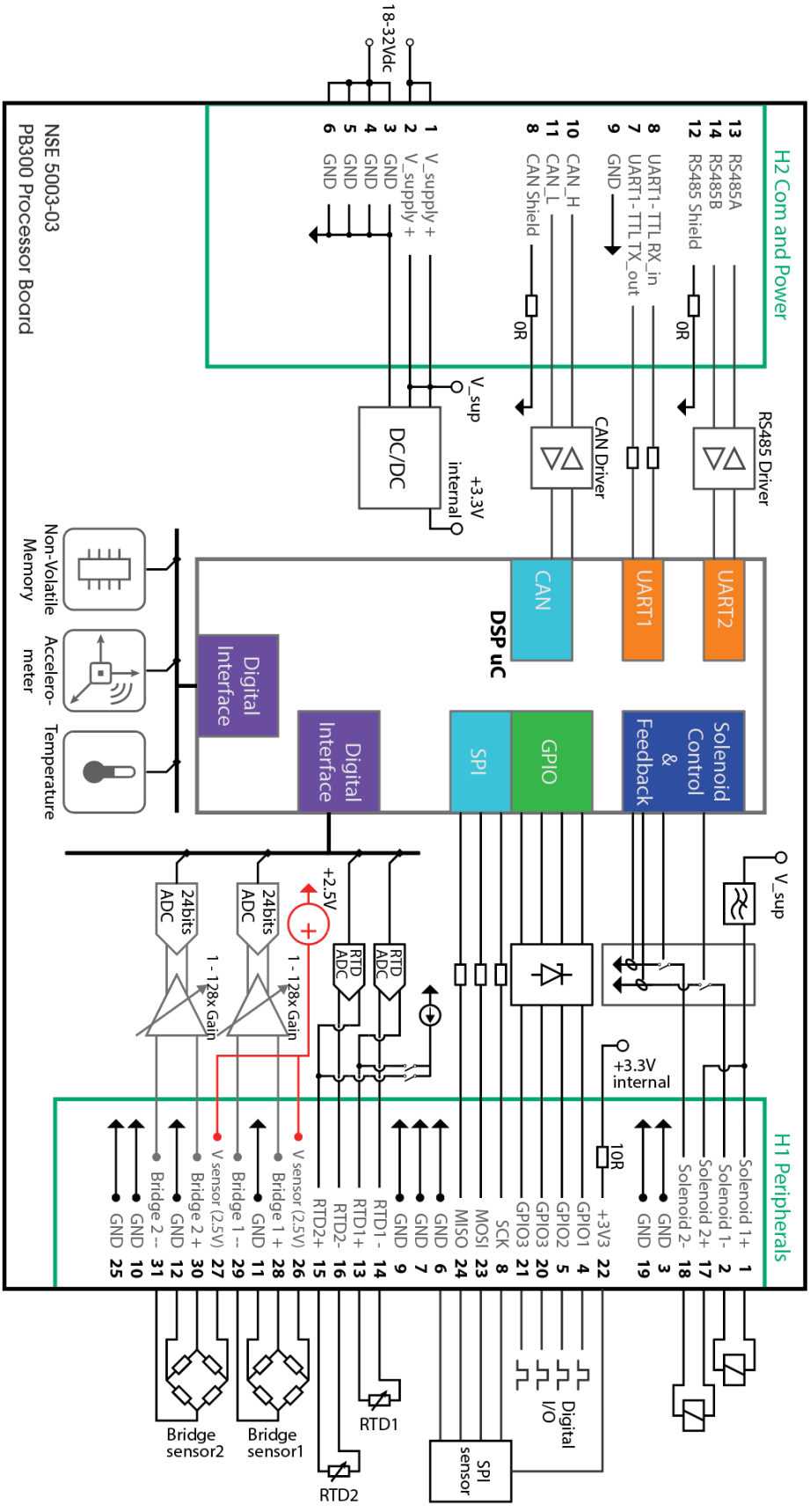
1.1 Board functions



1.2 Features

Feature	Description
CAN bus	The controller has a dedicated CAN interface for communication.
UART	One Uart channel is default configured to operate on 3.3V TTL level.
RS485	The controller has a dedicated RS485 interface.
Input power	The PB400 controller is design to operate from 18-32V_{DC}. The controller has a TVS protection and a fuse protecting the electronics from input over-voltage.
Voltage and current sensing	The controller has embedded sensors for both input voltage and current that can be read out through the communication interface.
Temperature sensing	The controller as an embedded temperature sensor that can be read out through the CAN communication interface. There is an external interface to 2 x RTD sensors. The choice of sensor type (PT100 or PT1000) is selectable through the communication interface.
Analog Input (Differential)	The board has 2 differential input channels for measurements of bridge sensors. The channels have a configurable gain of 1, 2, 4, 8, 16, 32, 64 and 128, and the ADC resolution is 24bits. The default gain is set to 128 in FW. The bridge excitation voltage is 2.5V, and the minimum bridge resistance that can be applied is 100Ω. The differential bridge input range is 2.4V when input gain is 1.
Excitation short circuit protection	The output excitation voltage for the analog bridges has a current limit feature to protect if there is a faulty sensor. The built-in protection will limit the current when the current exceeds the threshold current.
Open Drain	There are two open drain channels on the PB300 that can be used for relay or solenoid switching. The open drain channels can operate at the same voltage as the board supply and the board has a filtered supply voltage output to the solenoids. Each channel can be separately PWM modulated and current can be measured for each channel.
GPIO	The GPIO are pulled up to 3.3V (100k) and can be used as digital IO pins up to 3.3V. The pins are protected by TVS diodes
Memory	The PB300 has default installed a FRAM for logging and configuration purposes. The board can be delivered with a larger FLASH memory in addition if requested.
Accelerometer	Low-G accelerometer data measuring X, Y and Z axis will be acquired. The accelerometer is a MEMS accelerometer and measurement range is configurable to ±2g, ±4g, ±8g. The accelerometer is default configured to ±2g. Accelerometer data can be read out through the communication interface.

1.3 Board block diagram



2 Board Specifications

	Min	Typ	Max	Unit
Physical size				
Length PCB		*167*		*mm (including connectors)*
Width PCB		*34*		*mm*
Length chassis		*200*		*mm*
Width chassis		*37*		*mm*
Height chassis		*14*		*mm*
Environmental				
Operating Temperature	0		177	*Deg C*
Storage Temperature	-40		60	*Deg C*
Power				
Voltage supply	18	28	32	*Vdc*
Supply Input Current		20		mA@28V
Integrated sensors				
Onboard temperature sensor range	0		190	*Deg C*
Temperature sensor error			±3	*Deg C*
Input voltage measurement range	15		36	*Volt*
Input voltage measurement error			± 3	*%*
Input Current measurement range	0		50	*mA – excluding solenoid output*
Input Current measurement error			± 5	*% of full scale output*
On board logic voltage		3.3		*Volt*
Logic voltage measurement error			± 3	*%*
Bridge excitation voltage		2.5		*Volt*
Bridge voltage measurement error			± 3	*%*
Accelerometer axis		3		*X,Y,Z (optional)*
Accelerometer range	-2		2	*g (optional)*
Accelerometer measurement error				*To be determined*
Accelerometer temperature range	0		150	*degC*
Onboard Memory				
Flash (Optional)		64		*Mbit*
EEPROM		2		*Mbit*
Analog input				
RTD channels		2		*2-Wire PT1000*
RTD Temperature range	0		360	*Deg C*
Wheatstone bridge input channels		2		*Differential input*
Bridge input gain	1		128	
Bridge resistance	100			*Ohms*
Bridge excitation voltage		2.5		*Volts*
ADC resolution			24	*Bits*
Sampling rate			7	*Samples per sec*

GPIO (TTL)			
GPIO pins		*4*	*3.3V Logic*
Onboard pull-up resistor value		*100k*	*ohm*
High voltage level input	*2.6*		*Volt*
Low voltage level input		*0.7*	*Volt*
SPI bus pins		*3*	*3.3V Logic*
SPI bus speed	*250*		*kb/s clock frequency*
Solenoid Output			
Channels		2	
Solenoid Output voltage		Board Input Voltage	
Current rating		0.5	A
Current measurement error		± 5	*% of full scale output*
Communication			
CAN bus channels		1	
CAN bus default baud rate		250	kbps
RS485 channels		1	
Serial TTL channels		1	
Connectors			
H2		M83513/13-B type	COM / Power (15-socket R/A)
H1		M83513/10-E type	Peripherals (31-pin R/A)

2.1 Thermal properties

The NSE High Temperature PB300 is designed to operate in a 177°C environment.

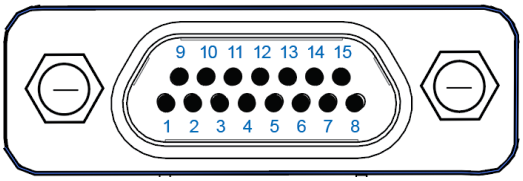
In a typical assembly, the **NSE UNIT** is mounted to a **MOUNTING PROFILE** that is located inside an **OUTER HOUSING**.

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.

2.2 Connectors

2.2.1 H2 communication and power

PB300 Connector: MKHT-262-015-443-220S – Equivalent to Micro D - M83513/13-B 15 pin.
Mating connector: M83513/03-BXX (Micro D 15 pin plug type – High temperature)

Pin	Signal name	Description / Function	Connector Pinout (Face View – looking in to the connector on the PCB)
1	+VIN	Supply voltage input	
2	+VIN	Supply voltage input	
3	GND	Ground	
4	GND	Ground	
5	GND	Ground	
6	GND	Ground	
7	TTL_TX	Serial TTL TX	
8	TTL_RX	Serial TTL RX	
9	GND	Ground	
10	CANH	CAN High - CAN bus	
11	CANL	CAN Low - CAN bus	
12	CAN Shield	GROUND through 1206 0Ω resistor	
13	RS485A	RS485A	
14	RS485B	RS485B	
15	RS485 Shield	GROUND through 1206 0Ω resistor	

2.3 H1 - Peripherals

PB300 Connector: MWDM2L-31PCBRPT Equivalent to Micro D - M83513/10-E Plug 31 contacts.
Mating connector: M83513/04-EXX (Micro D 31 contacts socket type – High temperature)

Signals on connector H1 are grouped on the connector for improved noise behavior.

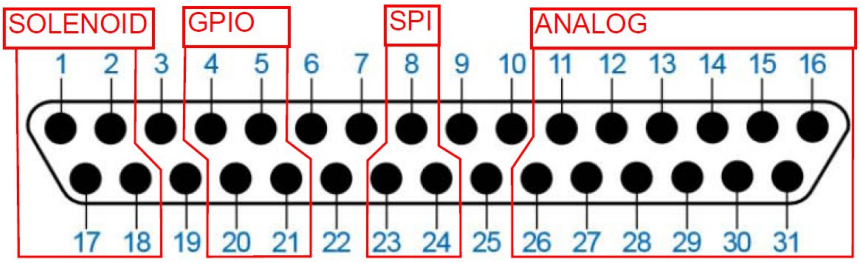
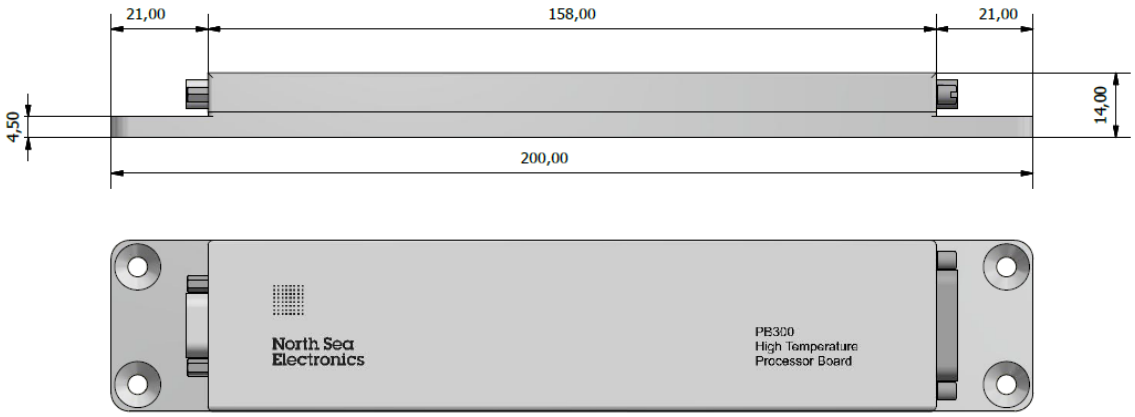


Figure 1 - Connector H2 signal placement. Face View – looking in to the connector on the PCB

Pin Number	Signal name	Description
1	Solenoid 1+	Solenoid 1 Supply
2	Solenoid 1-	Solenoid 1 Return
3	GND	GROUND
4	GPIO1	General Purpose I/O CH1
5	GPIO2	General Purpose I/O CH2
6	GND	GROUND
7	GND	GROUND
8	SCK	Optional SPI clock
9	GND	GROUND
10	GND	GROUND
11	GND	GROUND
12	GND	GROUND
13	RTD1+	RTD channel 1+
14	RTD1-	RTD channel 1-
15	RTD2+	RTD channel 2+
16	RTD2-	RTD channel 2-
17	Solenoid 2+	Solenoid 2 Supply
18	Solenoid 2-	Solenoid 2 Return
19	GND	GROUND
20	GPIO3	General Purpose I/O CH3
21	GPIO4	General Purpose I/O CH4
22	+3V3	+3V3 logic voltage
23	MOSI	Optional SPI Master Output
24	MISO	Optional SPI Master Input
25	GND	GROUND
26	+2.5V	Bridge Excitation Voltage – 2.5V
27	+2.5V	Bridge Excitation Voltage – 2.5V
28	Bridge1+	Differential Input Channel 1+
29	Bridge1-	Differential Input Channel 1-
30	Bridge2+	Differential Input Channel 2+
31	Bridge2-	Differential Input Channel 2-

3 Mechanical Dimensions



Consult NSE for 3D step model of chassis.
Width is 37mm

4 Datasheet Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	05.09.2017	Initial Revision	RFY	GLK
B	04.06.2018	Updated	RFY	GLK
C	24.02.2021	Updated with new memory sizes	RFY	GLK
D	21.06.2022	Updated block diagram, function description and connector pinouts	RFY	GLK

5 Ordering

5.1 Order code

		Order code:	**NSE-5003**	**-03**	**-B**
Category	NSE-5003	= NSE HT Processor Boards			
Model	-03	= PB300 Processor Board			
Variant	-A	= 2Mbit EEPROM (FRAM) Memory (Standard)			
	-C	= 64k-bit SPI Serial HT EEPROM (Optional)			
	-D	= 2Mbit FRAM and 64Mbit Flash Memory (Optional)			

5.2 Where to buy

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