Features

- *4 OFF – Open Drain Channels*

- *Magnetometer Interface (MAG610/614)*

- *1 x CAN bus interface*

- *4 x GPIO/0-5V Single Ended Analog Input*

- *3 x RTD Interface*

- *4 x Bridge (5V) Analog Inputs*

- *1 x 3-Axis Accelerometer 2g/4g/8g*

- *1 x Onboard Temperature Sensor*

- *1 x Onboard FRAM or Flash*

- *2 x UART Interface*

- *Input Voltage and Current Measurement*

- *High Shock and Vibration Resistance*

- *High Temperature Design*

Product Description

The NSE PB400HT is a highly versatile processor board for demanding high temperature applications. Its layout is targeted for downhole wireline and drilling tools or other industrial applications where high temperature may occur.

The processor board can communicate using CANbus and UART interface allowing for connection to a wide range of peripheral units. Analog inputs for bridge sensors (pressure sensors, strain sensors and accelerometers), RTD, single ended voltage measurement and magnetometer (typical MAG610/614) means that it can be used to monitor the most common sensors one would meet in its typical environment

The PB400 has Open Drain channels that facilitate switching of relays, solenoids or other control units. The Open Drain channels will also measure the current for each channel. It can also be configured for PWM control. Advanced monitoring and fault detection can easily be set up. There are also four general purpose pins that can either be configured as GPIO or single ended analog inputs.

The board has an embedded memory that allow for logging of key data. Default the PB400 is installed with a FRAM memory but an optional Flash memory can be installed if larger memory size is required.

The PB400 is delivered in an aluminum chassis and is designed to operate in a very high shock and vibration environment.

1   Electrical Specifications

1.1   Overview

Parameter	Conditions / Comments	Min	Typ	Max	Unit
MECHANICAL DIMENSIONS					
Length	*Chassis*		195		mm
Width			37		mm
Height			13		mm
TEMPERATURE RANGE					
Operating		-20		175	Deg C
Storage		0		40	Deg C
SUPPLY VOLTAGE					
Input Voltage		18		48	Vdc
Power Consumption			0.75		W
INTEGRATED SENSORS					
Temperature sensor range		-40		180	Deg C
Temperature sensor error				±3	Deg C
Accelerometer number of axes			3		X, Y, Z
Accelerometer range	*User Selectable 2g,4g,8g*	-8	±2	8	G
Accelerometer gain error	*over full temperature range*			±5	%FSE
Input voltage measurement				70	V
Input voltage measurement error				±2	V
Board current measurement		6		60	mA
Board current measurement	*excluding push-pull currents*			±5	mA
MAGNETOMETER INTERFACE					
Channels	*MAG610/MAG614*		3		(X,Y,Z)
Sampling Rate				77	Hz
ONBOARD MEMORY					
FRAM	*Default*		2		Mbit
Flash	*Optional*		64		Mbit
ANALOG INPUT					
RTD channels	*2-Wire PT100/PT1000*		3		
RTD Temperature range		-20		280	Deg C
Bridge input channels	*Differential input*		4		
Bridge input gain		1		128	
Bridge resistance		100			Ohms
Bridge excitation voltage			5		V
Excitation current limit		200			mA
Sampling rate				7	Hz
GPIO/0-5V ANALOG INPUT					
Number of channels			4		
Analog Range		0		5	V
Digital Range	*(100k pull-up to 3.3V)*	0		5	V
High voltage level input		2.6			V
Low voltage level input				0.7	V

OPEN DRAIN					
Channels			4		
Current rating	Sinking	0		1	A
Current measurement error				0.1	A
Open Drain input voltage		0		48	Vdc

COMMUNICATION					
UART channels			2		
UART baud rate		4.8	38.4	230.8	kbaud
UART Level	Configurable, 3.3V default	3.3	3.3	15	V
CAN bus channels			1		
CAN bus baud rate		83.333	125	500	kbps

CONNECTORS			
H2	Harwin G125-MH12605M4P	26-Pin	
H3	Harwin G125-MH13405M4P	34-PIN	

1.2   Features

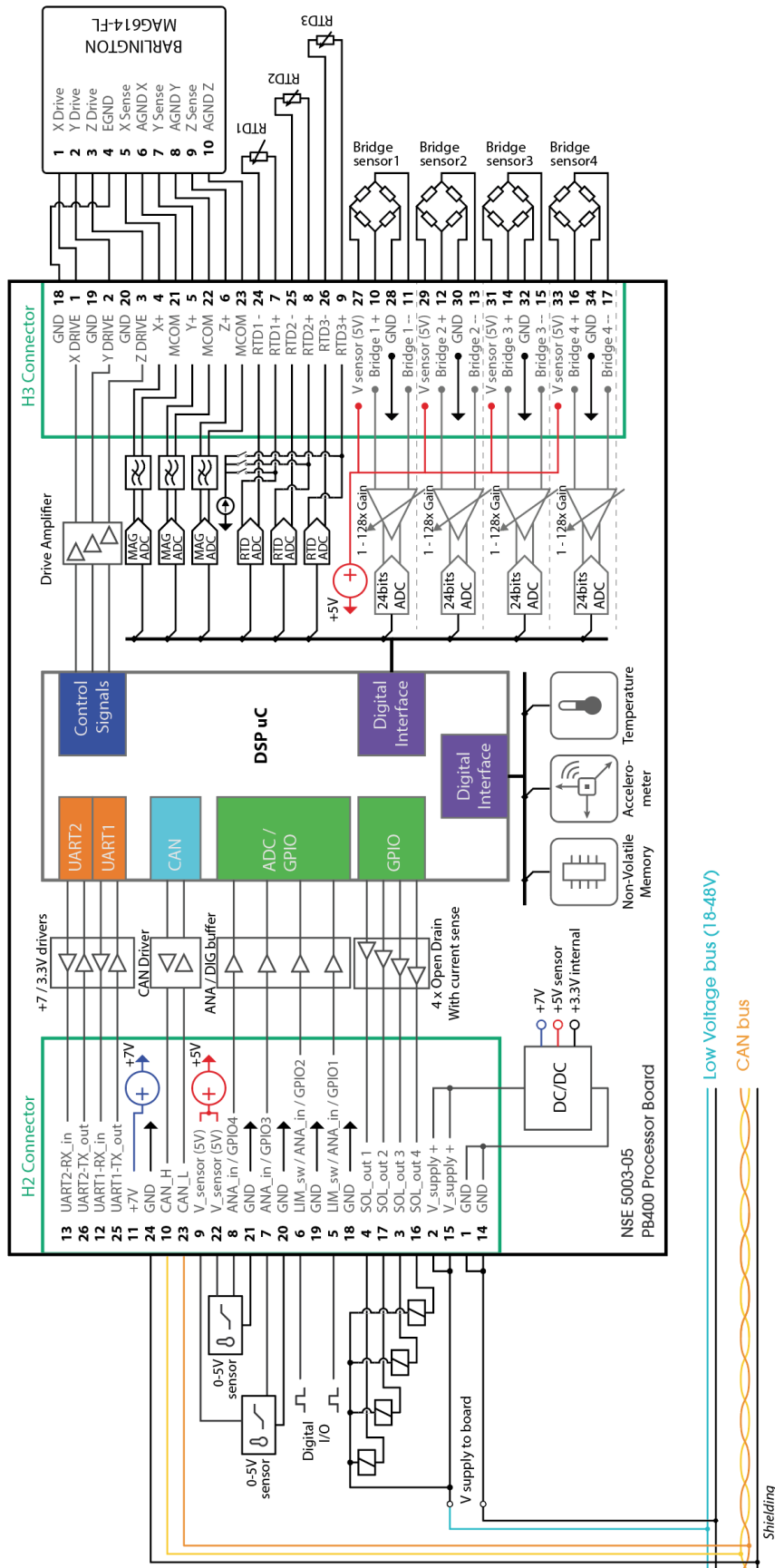| Feature	Description
CAN bus	The controller can be delivered with or without CAN bus termination resistor. The TVS protection and noise filter on the CAN bus allows for the controller to operate in an extreme environment.
UART	The two UART channels are default hardware configured to operate on 3.3V TTL level. The UART channels may be HW configured to operate on other voltage levels up to 15V upon request.
Input power	The PB400 controller is design to operate from 18-48V_{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 3 RTD sensors – either PT100 or PT1000. The choice of sensor is selectable through the communication interface.
Analog Input (Differential)	The board has 4 differential input channels for measurements of bridge sensors (typically). 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.

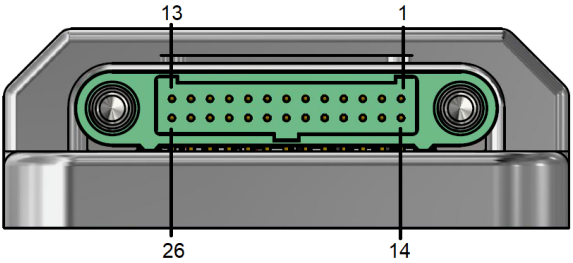|	The bridge excitation voltage is 5V, and the minimum bridge resistance that can be applied is 100Ω. The differential bridge input range is 4.9V when input gain is 1.
Excitation short circuit protection	The output excitation voltage for the analog bridges has a current limit feature to protect if there is a faulty sensor. The built-in protection will limit the current when the current exceeds ≈200mA and shut-down if the output excitation voltage is below 4.0 V.
Open Drain	There are four open drain channels on the PB400 can typically be used for relay or solenoid switching. The open drain channels can operate at the same voltage as the board supply voltage or another voltage source within the valid voltage range. Each channel can be separately PWM modulated and current can be measured for each channel.
GPIO/0-5V Analog input	The GPIO/0-5V analog pins can be SW configured to be either GPIO or single ended analog inputs with 0-5V range.
Memory	The PB400 has default installed a FRAM for logging and configuration purposes. The board can be delivered with a larger FLASH memory instead of the FRAM if desired.
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.
Magnetometer	The PB400 has an interface for use with external magnetometer. The board is designed for use with either Bartington MAG610 or MAG614 magnetometer. www.bartington.com

1.3   Accelerometer Orientation
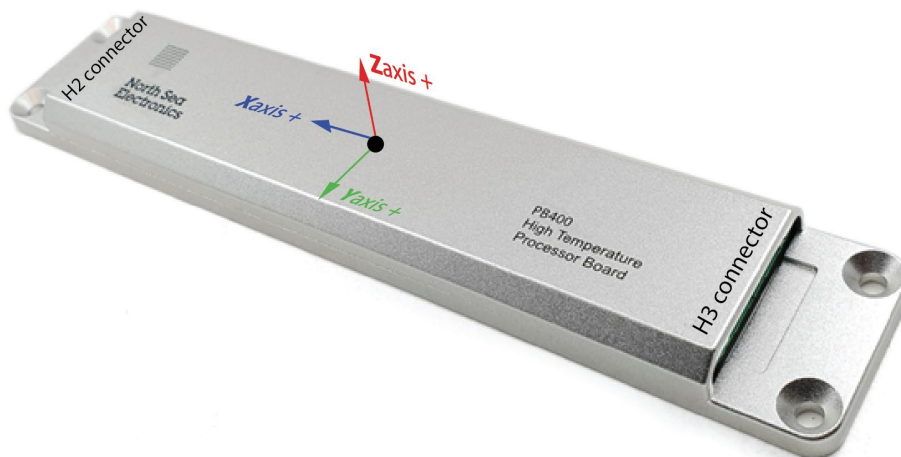
1.4   Block diagram
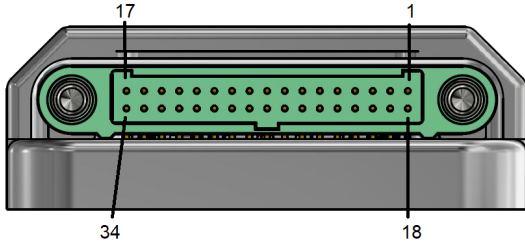
1.5   Connections

1.5.1   Connector H2

Connector H2 is a Harwin G125-MH12605M4P 26-pin connector.

Pin	Signal name	Description / Function	Connector Pinout (Face View)
1	GND	Ground	
2	+VIN	Board Input Voltage	
3	SOL3	Open Drain channel 3	
4	SOL1	Open Drain channel 1	
5	AINGPIO1	GPIO1/0-5VCH1	
6	AINGPIO2	GPIO1/0-5VCH2	
7	AINGPIO3	GPIO1/0-5VCH3	
8	AINGPIO4	GPIO1/0-5VCH4	
9	+VEXT	+5V Excitation Voltage	
10	CANH	CANH	
11	DNC	Do not connect	
12	UART1RX	RX UART1	
13	UART2RX	RX UART2	
14	GND	Ground	
15	+VIN	Board Input Voltage	
16	SOL4	Open Drain channel 4	
17	SOL2	Open Drain channel 2	
18	GND	Ground	
19	GND	Ground	
20	GND	Ground	
21	GND	Ground	
22	+VEXT	+5V Excitation Voltage	
23	CANL	CANL	
24	GND	Ground	
25	UART1TX	TX UART1	
26	UART2TX	TX UART2	

1.5.2 Connector H3

Connector H2 is a Harwin G125-MH13405M4P 34-pin connector.

Pin	Signal name	Description / Function	Connector Pinout (Face View)
1	XDRV	Magnetometer X+ Excitation	
2	YDRV	Magnetometer Y+ Excitation	
3	ZDRV	Magnetometer Z+ Excitation	
4	X+	Magnetometer Signal X+	
5	Y+	Magnetometer Signal Y+	
6	Z+	Magnetometer Signal Z+	
7	RTD1+	RTD 1 +	
8	RTD2+	RTD 2 +	
9	RTD3+	RTD 3 +	
10	BRIDGE1+	Bridge 1 +	
11	BRIDGE1-	Bridge 1 -	
12	BRIDGE2+	Bridge 2 +	
13	BRIDGE2+	Bridge 2 -	
14	BRIDGE3+	Bridge 3 +	
15	BRIDGE3-	Bridge 3 -	
16	BRIDGE4+	Bridge 4 +	
17	BRIDGE4-	Bridge 4 -	
18	GND	Magnetometer X- Excitation	
19	GND	Magnetometer Y- Excitation	
20	GND	Magnetometer Z- Excitation	
21	MCOM	Magnetometer signal common	
22	MCOM	Magnetometer signal common	
23	MCOM	Magnetometer signal common	
24	RTD1-	RTD 1 Return	
25	RTD2-	RTD 2 Return	
26	RTD3-	RTD 3 Return	
27	+VEXT	+5V Excitation Voltage	
28	GND	Ground	
29	+VEXT	+5V Excitation Voltage	
30	GND	Ground	
31	+VEXT	+5V Excitation Voltage	
32	GND	Ground	
33	+VEXT	+5V Excitation Voltage	
34	GND	Ground	

2   Firmware

The PB400 comes with a base NSE firmware included. The base firmware includes setting and reading of all onboard readings, inputs, and outputs.
Firmware for communicating with peripherals (protocols) for extended devices is not included.

2.1   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.

3   Mechanical

3.1   Thermal properties

The NSE PB400HT is designed to operate in a 175°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.
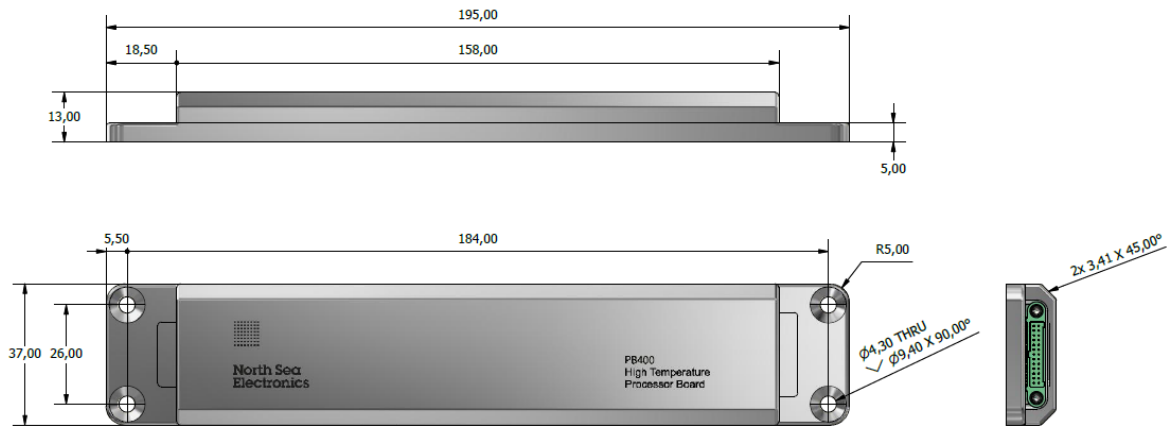

3.2   Conformal Coating

This product is delivered with no conformal coating.

3.3   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.

3.4   Dimensions

4   Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	15.07.2021	Initial release	RFY	GLK

5   Ordering

5.1   Order code

	Order code:	NSE-5003	-05	-A	-A
Category	NSE-5003	= NSE Processor Boards			
Model	-05	= PB400HT			
Chassis	-A -B	= with chassis = without chassis			
Firmware	-A -B-Z	= Standard FW = Customer specific			

5.2   Where to buy

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