



**North Sea
Electronics**

Product Specification

Product:

42V Stepper Motor Controller

NSE 5001-03

REVISION HISTORY

REV	DATE	DESCRIPTION	PREP	CHECK	APPR	COMPANY
00	25.10.2012	Initial Release	EEN	GLK	RFY	NSE
01	30.10.2013	Minor revisions	BCM		RFY	NSE
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North Sea Electronics AS

Gravdalsveien 245, N-5164 Laksevåg, Norway

E-mail:

mail@nse.no

Comp. Reg. No.:

NO987774002MVA

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2 Purpose of Document

This document describes the key specifications and features of the NSE 5001-03 stepper motor controller. Full specification of the control interface, and further details on operation of the product are available separately.

3 Introduction

The NSE 5001-03 Stepper Motor Controller is designed for use in down-hole tools, and other harsh operating environments. The Motor Driver provides positioning and free-running control of a single, two-phase stepper motor, up to 42V and 1.2A. The Motor Driver uses a CAN interface for control and monitoring.

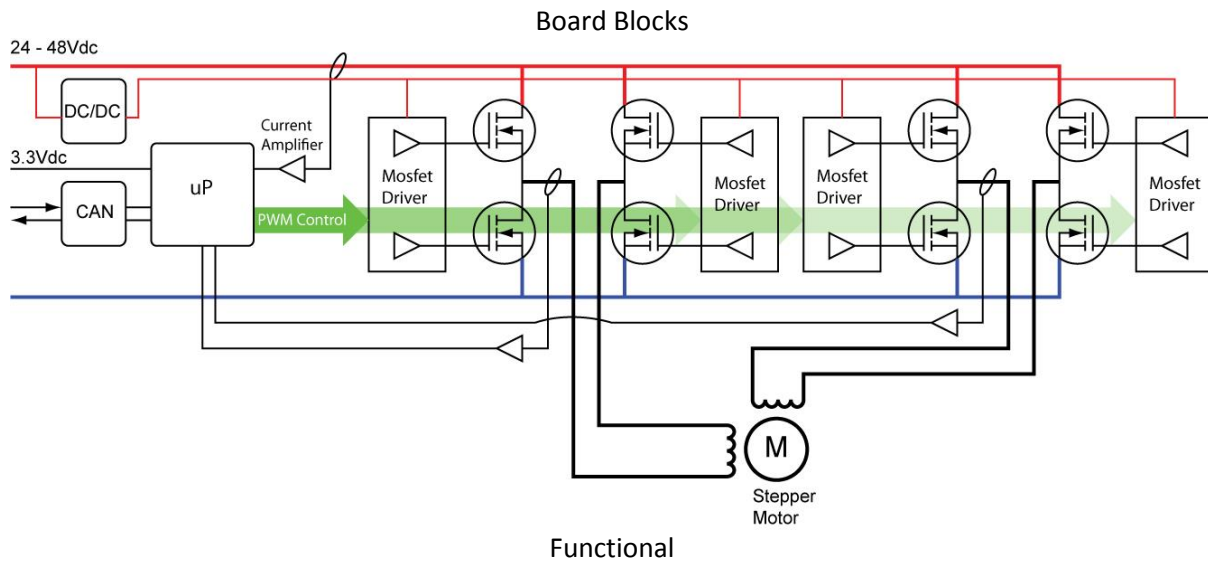
4 Abbreviations

NSE	North Sea Electronics AS
SRS	System Requirement Specification
BLDC	BrushLess Direct Current
PWM	Pulse Width Modulation
bps	Bit Per Second
RPM	Revolutions Per Minute
CRC	Cyclic Redundancy Check

5 Specifications

Parameter	Conditions / Comments	Min	Typ	Max	Unit
Supply voltage <i>Input Motor</i> <i>Input Voltage logic</i> <i>Current, motor</i> <i>Current logic</i>		18 3.2	3.3 90	42 3.5 1.5 110	Vdc Vdc A mA@3.3V
Stepper Driver <i>Drive mode</i> <i>Maximum speed</i> <i>Maximum motor speed</i> <i>Motor Current</i> <i>Acceleration</i>	(200step/rev motor)		Sinusoidal	10.000 3.000 1 10.000	Steps/sec RPM Arms Steps/sec ²
CAN port <i>Baud rate</i>			83.3 / 125		kbits/s
Environment <i>Op. Temperature Range</i> <i>Op. Pressure Range</i>		-20		150 10.000	°C psi
Physical board dimension: <i>Height</i> <i>Width</i> <i>Length</i> <i>Length</i> <i>Mount holes</i>	<i>Excluding Connector</i> <i>Including Connector</i>		11 28 120 125		mm mm mm mm
Connectors <i>Motor connection</i> <i>Input Connector</i>			Flying leads Glenair MIL-DTL-83513/10-B01NW		
Onboard sensors <i>Motor Temperature</i> <i>Temperature</i> <i>Voltage Sensor</i> <i>Current Sensors</i>			KTC thermocouple Ambient and Driver Input voltage Input, motor		

6 Block Diagram



7 Functionality

The Stepper Motor Driver is a current-controlled, sinusoidal driver for small, two-phase stepper motors, rated up to 42V and 1.2Arms. Sinusoidal motor currents are produced, using current feedback and hysteretic control. The output bridges use an adaptive control strategy of fast and slow decay modes to provide good performance while improving efficiency. The speed may be set between 1 and 10000 steps/second (giving a maximum of 3000rpm for a 200step/revolution motor). The motor phase current can be set from 0 to 1.2Arms. This interface may also be used for monitoring driver parameters including input voltage and current, ambient temperature, and transistor bridge temperature.

At higher speeds the resolution of the output currents is reduced, to reduce processing overhead, and "full step" equivalent operation is reached at 5000 steps/sec (1500rpm). Positioning control via the CAN interface is limited to full motor steps, while the positioning speed, acceleration, and deceleration can be set. Acceleration is limited to 10000steps/sec/sec.

Fault parameters may be set to required levels, or disabled, via the CAN interface.

7.1.1 Stepper Motor Control Parameters

Stepper Motor Control Parameters	Range
Motor speed	0 – 10.000 steps / sec
Motor Current	0 – 1.5A
Acceleration	0 – 10.000steps/sec ²
Motor Position	32bit signed position Absolute or relative

Fault condition levels	<i>Defined fault conditions</i>
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7.1.2 Stepper Motor Feedback Parameters

Stepper Motor Feedback Parameters	Range
Motor speed	0 – 10.000 steps/sec
Supply Current	0 – 1.2A
Motor Position	32bit signed integer step position, Absolute
Alarm State	Over-temperature (motor or driver) Over-current
Running / position State	Running or in position feedback (1 bit)

7.2 Integrated Sensors

7.2.1 Temperature sensors

Temperature on the board is continuously monitored, and may be obtained from the CAN interface. The temperature sensor measurements shall be within $\pm 3\%$ across the specified operating range (from 0°C to 177°C).

7.2.2 Voltage measurement

The board input voltage measurements shall be within $\pm 3\%$ across the specified operating range (from 0°C to 177°C).

7.2.3 Current measurement

The board input current is available on the CAN interface. Motor phase currents are also measured, and used in control, but are not available on the CAN interface in standard firmware. The board and motor current consumption measurements shall be within $\pm 5\%$ across the specified operating range (from 0°C to 177°C).

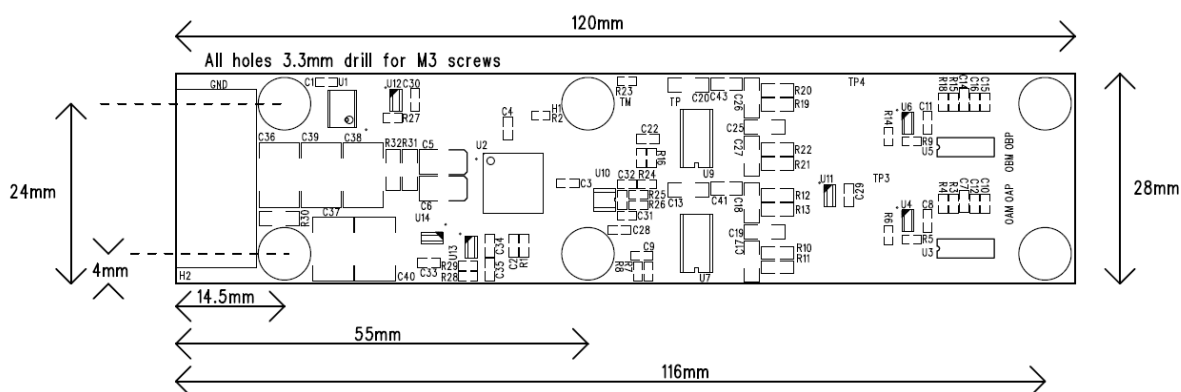
7.2.4 Motor Temperature

The motor driver has a KTC thermocouple amplifier onboard, intended for use with KTC elements embedded in the motor, but which can be used with any 2-wire k-type thermocouple. The TP (KTC temp+) and TM (KTC temp-) flying leads provide connection to the thermocouple.

7.2.5 CAN bus

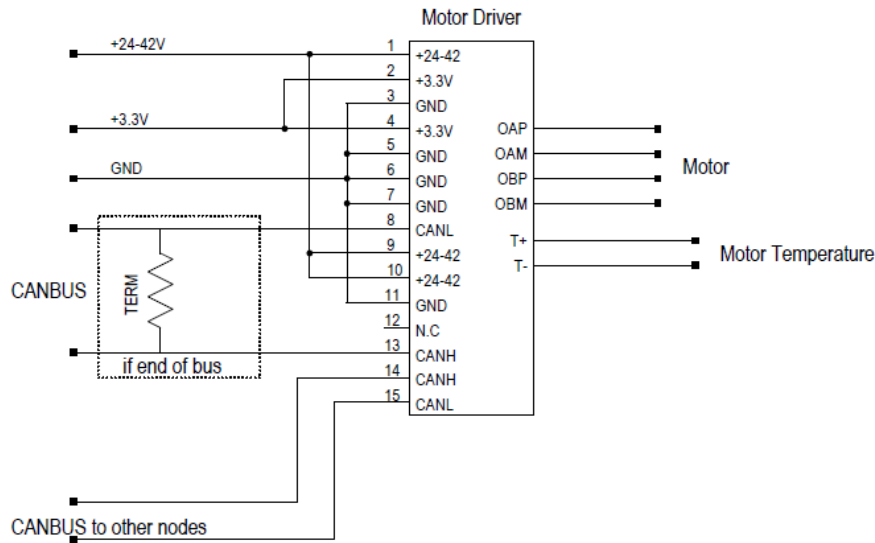
A proprietary protocol is implemented over CAN bus for data acquisition and control. If the stepper driver is located at the end of the bus, the CANBUS needs to be terminated with a 120Ω resistor as defined by the CANBUS standard.

8 Mechanical



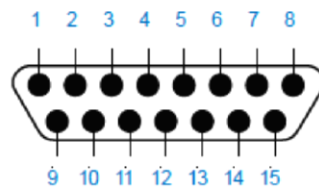
Board assembly height with stacked capacitor board is 11mm.

9 Pinout



The 15 pin connector is a Glenair MIL-DTL-83513/10-B01NW.

Pin Number	Signal name	Description
1	VMOTOR (max42V)	Motor Supply Voltage
2	3.3V	Logic 3.3V power input
3	GND	Ground
4	3.3V	Logic 3.3V power input
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	CANL	CAN low
9	VMOTOR (max42V)	Motor Supply Voltage
10	VMOTOR (max42V)	Motor Supply Voltage
11	GND	Ground
12		+20-30V MOSFET Driver Supply Voltage
13	CANH	CAN high
14	CANH	CAN high
15	CANL	CAN low



Connector Front view