North Sea Electronics

NSE HT 60V Brushless DC Motor Controller 22mm

NSE-5001-07

Features

- Wide Input range of 18 – 60Vdc
- Up to 4A input current
- Up to 240W output
- High temperature – 177degC
- High efficiency design
- Hall and Resolver Interface
- Supports Sensorless Running
- 22.2mm diameter
- CNC Machined aluminum housing
- CAN Bus or RS485 Interface

Product Photo

Product Description

The NSE HT 60V Brushless DC Motor Controller 22mm is a high performance, high temperature motor controller designed for applications that requires an extremely small diameter, yet a full featured controller. It is targeted at downhole wireline, drilling tools, industrial and automotive applications.

The NSE HT 60V Brushless DC Motor Controller 22mm has an embedded firmware that allows sophisticated control of a wide variety of motors. An open protocol interface, combined with NSE or Customer software allow easy setup and configuration to most available Brushless DC motors. The controller can also be set up to have autonomous- and customer defined behavior.

The NSE HT 60V Brushless DC Motor Controller 22mm has all the sensors and algorithms required to run closed loop control of RPM, input power and output current (torque). The controller has integrated both resolver and hall encoder interface and a firmware setting decides which interface that is to be used. This feature, combined with its other easily configurable settings, increases the flexibility of the controller and allows the same controller to be used in a wide range of applications and tools.

In order to operate reliably at high temperature, the controller has high efficiency, reducing the dissipated power to a minimum. The logic and control section has low current consumption in order to further increase operational time in cases where the controller is run from battery.

The controller PCB layout is designed with ruggedness in mind. A CNC machined aluminum chassis provides maximum mechanical support to allow the board to operate in an environment where very high shock and vibration environment may occur. The board has rugged, high temperature connectors.

Revision History

REV	DATE	DESCRIPTION	PREP	APPR
A	02.06.2017	Initial Revision	RFY	GLK

1 Product Specification

1.1 Electrical Specifications

Parameter	Conditions / Comments	Min	Typ	Max	Unit
SUPPLY VOLTAGE					
Input Voltage Range	*Specified operational range*	18		60	*Vdc*
	Absolute maximum range	18		60	*Vdc*
Overvoltage trig voltage	*Exceeding this voltage will enable overvoltage protection*		65		*Vdc*
Current consumption	*Stand By @ 24Vdc Input*		T.B.A		*mA*
	Stand By @ 60Vdc Input		T.B.A		*mA*
DRIVE SECTION					
Commutation Mode			Trapezoid		
Speed Range	*4 pole motor*				
	Hall Encoder Feedback	0		12.000	*RPM*
	Resolver Feedback	0		10.000	*RPM*
	Sensorless	500		8.000	*RPM*
Input Current Range	*Maximum continuous input current over temperature range*	0		4	*A*
Input Current Sensor Range		0		8	*A*
Motor Current Sensor Range		0		+/-8	*A*
PWM Switching Frequency range		16		64	*kHz*
FEEDBACK INTERFACE					
Motor Position Feedback	*Firmware Selectable*	Hall /	Resolver /	Sensorless	
Hall Excitation Voltage		4	5	5.5	*Vdc*
Hall Excitation Current				20	*mA*
Resolver Excitation Voltage		3.5	4	5	*Vp-p*
Resolver Excitation Current				20	*mA rms*
Resolver Excitation Frequency	*Firmware Selectable*	4		20	*kHz*
Resolver Feedback Signal	*Minimum signal strength*	3			*Vp-p*
EXTERNAL TEMPERATURE SENSOR					
Sensor Type	*RTD - firmware selectable.*		PT100 / PT1000		
Temperature Range		-20		200	*°C*

MECHANICAL DIMENSIONS					
Chassis Diameter			22.2		*mm*
Chassis Length			285		*mm*
CANBUS INTERFACE*					
Baud Rate		83.3	125	250	*kbits/s*
RS485 INTERFACE*					
Baud Rate		38.4	38.4	250	*kbits/s*
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*

** Note - the unit can be ordered with either CAN bus or RS485 interface. Baudrate is configurable.*

1.2 Thermal properties

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

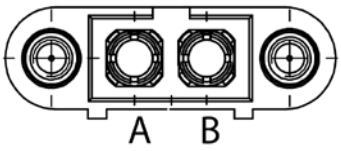
In a typical assembly, the **NSE UNIT** is mounted to a **MOUNTING PROFILE** that is located inside an **OUTER HOUSING**.

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.

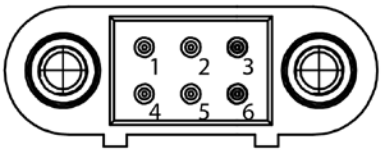
1.3 Connectors

1.3.1 Input Power

MCD Connector: Nicomatic CMM220 male HP30 2 pin
Mating connector: Nicomatic CMM220 female HP30 2 pin

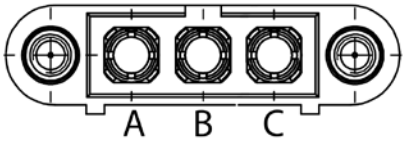
Pin	Signal name	Description / Function	Connector Pinout
A	GND	GROUND	
B	POWER+	POWER positive / Supply	

1.3.2 Input Communication

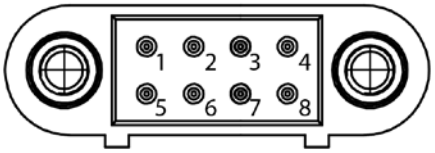
Pin	Signal name	Description / Function	Connector Pinout
1	CAN L	CAN Low	
2	CAN L	CAN Low	
3	GND	Ground	
4	CAN H	CAN High	
5	CAN H	CAN High	
6	GND	Ground	

1.3.3 Output Power

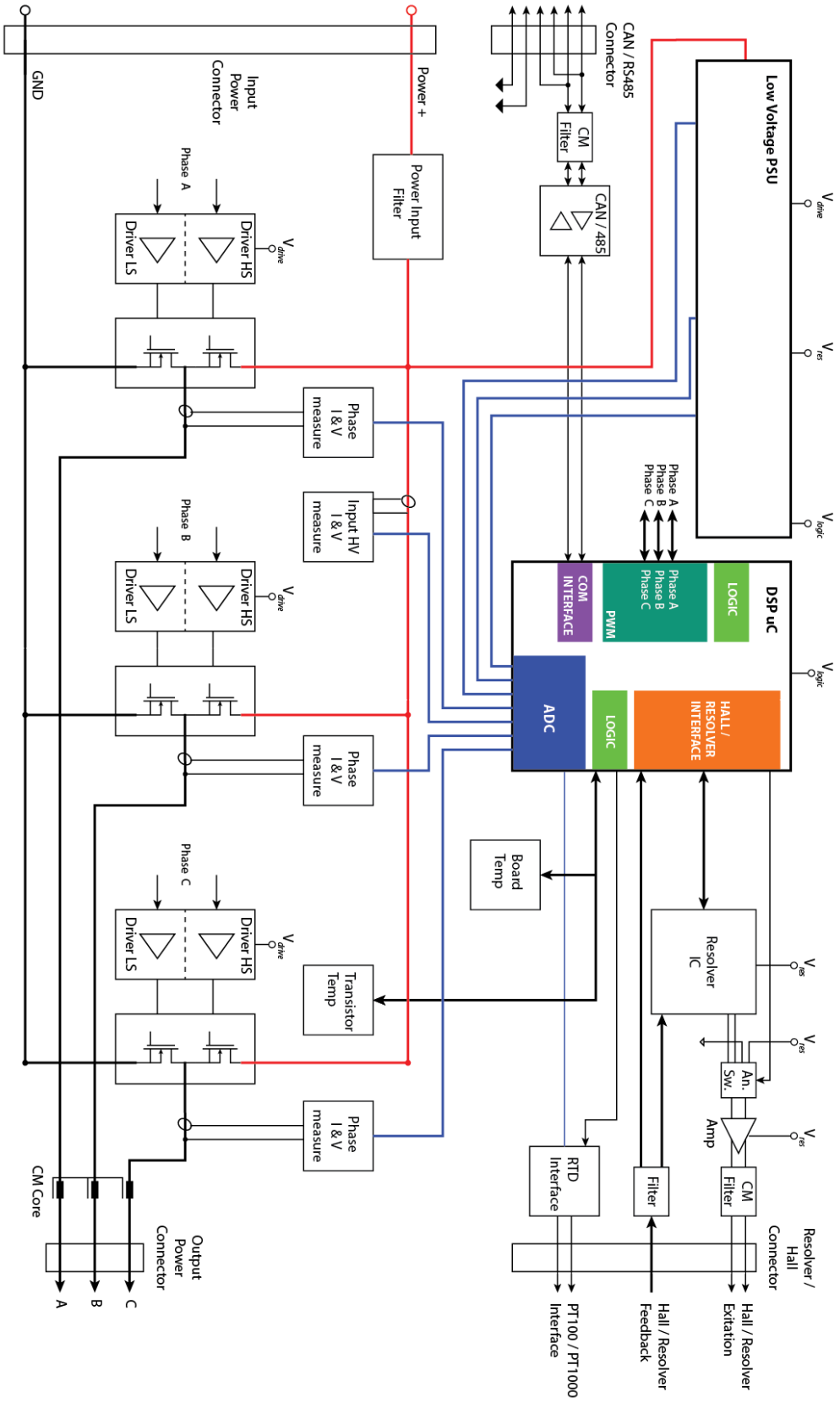
Motor Connector: Nicomatic CMM220 male HP30 3 pin
Mating connector: Nicomatic CMM220 female HP30 3 pin

Pin	Signal name	Description / Function	Connector Pinout
A	PHASE A	Motor Phase A	
B	PHASE B	Motor Phase B	
C	PHASE C	Motor Phase C	

1.3.4 Temperature and Resolver / Hall interface

Pin	Signal name	Description / Function	Connector Pinout
1	RTD+	RTD terminal 1 (PT100/1000)	
2	EX+	Resolver Excitation positive / 5V Hall sensor Supply	
3	FB1	Resolver Sine Pos. Feedback / Hall 1 Feedback	
4	FB2	Resolver Cos Pos. Feedback / Hall 2 Feedback	
5	RTD –	RTD terminal 2 (PT100/1000)	
6	EX-	Resolver Excitation negative / GND Hall Sensor Supply	
7	FB3	Resolver Sine Neg. Feedback / Hall 3 Feedback	
8	FB4	Resolver Cos Neg. Feedback	

2 Block Diagram



3 Functional Description

3.1 Communication interface

The controller can be delivered with either RS485 or CAN bus communication interface.

The unit has no CAN termination resistor. However, there is a common mode and noise filter on the communication interface.

3.2 Input power filter

The controller has a power filter in order to reduce radiated noise from the driver during operation. Note however that this filter will not remove all ripple currents and voltages, so depending on the application – further power line filtering may be required.

Consult NSE for more information on the power filter and noise characteristics.

3.3 Resolver or Hall interface

The controller has both resolver and hall interface integrated. The desired interface can be set through the communication interface. Refer to the connector pinout for connections.

In Resolver mode there are also several settings in regards to resolver pole numbers, frequency and offset. This feature allows the unit the unit be configured to most available resolvers.

Both the resolver and hall encoder interface features noise filter in order to remove motor noise and allow correct running of the motor.

3.4 Voltage and current sensing

The controller has embedded sensors for both input voltage and current, and phase currents. In addition it can sense the phase voltages and back EMF.

The voltages and currents are sampled by the on-board DSP and used in the firmware algorithms in order to control input power, motor phase currents (torque), RPM and alarm conditions.

3.5 Temperature sensing

There are two embedded temperature sensors (logic section and transistor temperature). These can both be read out through the CAN communication interface.

There is an external interface to an RTD sensor – either PT100 or PT1000. The choice of sensor is selectable through the communication interface. Typically this sensor is used to monitor motor temperatures.

The external temperature sensor is filtered in order to reduce motor noise interference to the reading.

3.6 Embedded firmware

The embedded firmware features all the necessary function to set up and run most available Brushless DC motors.

Initially the controller is set up to match the motors pole numbers and hall / resolver setup. Then the firmware features closed loop control algorithms and the possibility to tune the regulation parameters (PID-loop control) in order to achieve the desired response from the system.

In addition, it is the possibility of setting up sensor-less running of the motor and to tune the parameters of the startup and regulation in order to achieve smooth startup and running.

Setup of the controller is stored in a non-volatile memory that can also easily be down- and uploaded to a computer in order to save and restore defined configurations.

3.6.1 Closed loop regulation

The controller has the ability to run closed loop control of a motor:

- Speed – control the rpm to a desired setpoint
- Input Current – Control the input current (power consumption)
- Phase Current – Control the phase currents of a motor – this typically correlates with the motor torque
- Position – make the motor go to a certain position, using the internal position counter

All these parameters and control loops are run simultaneously – so that the controller can regulate the speed of a motor at a certain RPM and until the torque reaches a defined level in which the torque control loop will take over the regulation.

Consult NSE for more information on what can be achieved with our controllers in regards to both advanced and simple setups.

3.6.2 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.

4 Graphical User Interface

NSE provides for free with its controllers a Graphical User interface that can be used to set up and run the motors. The user interface used the standard protocol to communicate with the controller and allow the user to set up and run the system in a short time.

5 Mechanical Dimensions