Integrated Smart Motors

- Precise position, velocity and torque control
- Integrated motor controller
- Single-turn absolute encoder
- NEMA 17, NEMA 23, NEMA 34
- Operating voltage 12-48 V
- Fully programmable
- USB or CANopen slave
- High-pole servo (stepper motor)
- Low-pole servo (BLDC)

Servo Control Stepper Motor without Encoder

The new sensorless control for stepper motors determines a virtual encoder signal that enables servo operation of motors beginning at just a few rotations per second. This module is available both as a plug-in board or as a stand-alone controller.

- No step loss
- No resonances
- No overheating
For laboratory automation and applications with size restrictions, Nanotec now offers a servo motor with integrated motor controller and encoder and a flange size of 42 mm. In the stand-alone version with USB connection, the motors are controlled via clock-direction or by a set value specified in the analog input. In the CANopen version, they are controlled via a field bus according to CiA 402. Both versions support application programs that run in the motor controller.

**TECHNICAL DATA:**

PD2-C: High-pole DC servo system (stepper motor)
NEMA 17, 12-48 V, up to 0.5 Nm/70 oz-IN torque

PD2-C: Low-pole DC servo system (BLDC motor), up to 4000 RPM rated speed
NEMA 17 (PD2-CB42C): 12-48 V, 0.25 Nm/35 oz-IN (rated torque), 0.75 Nm/106 oz-IN (peak torque)
NEMA 17 (PD2-CB42M): 12-24 V, 0.125 Nm/18 oz-IN (rated torque), 0.38 Nm/54 oz-IN (peak torque)

PD6-CB: High-pole DC servo system (stepper motor)
NEMA 34, 12-48 V, up to 8.8 Nm/1246 oz-IN torque

PD6-C: Low-pole DC servo system (BLDC motor)
NEMA 34 (PD6-CB87S), 12-48V/0.7 Nm/99 oz-IN (rated torque), 2.1 Nm/297 oz-IN (peak torque)
Flange Size 80mm (PD6-CB80M), 12-48V/1.7 Nm/241 oz-IN (rated torque), 5 Nm/708 oz-IN (peak torque)

The PD6-C is the largest motor in Nanotec’s P&D series and displays exceptionally high power density in relation to its size. It is available in three versions: as a stepper motor with a flange size of 86 mm and a rated torque of 8.8 Nm, as a NEMA 34 BLDC motor with a nominal output of 220 W and as a BLDC motor with a flange size of 80 mm and a nominal output of 534 W. The PD6-C is particularly suitable for applications that require a high degree of efficiency, for example in service robotics or mechanical engineering.

**TECHNICAL DATA:**

PD6-CB: High-pole DC servo system (stepper motor)
NEMA 34, 12-48V/ up to 8.8 Nm/1246 oz-IN torque

PD6-C: Low-pole DC servo system (BLDC motor)
NEMA 34 (PD6-CB87S), 12-48V/0.7 Nm/99 oz-IN (rated torque), 2.1 Nm/297 oz-IN (peak torque)
Flange Size 80mm (PD6-CB80M), 12-48V/1.7 Nm/241 oz-IN (rated torque), 5 Nm/708 oz-IN (peak torque)
More Torque, More Accuracy
Cutting-edge technology for smoother motion

ONE STEP AHEAD WITH FIELD-ORIENTED CONTROL

Nanotec Plug & Drive motors implement field-oriented control closed loop or servo control. BLDC and stepper motors are vector controlled as a function of the load and differ only in terms of the working points resulting from the differing number of poles. This means that both the stepper motor and the BLDC perform like a servo. Up to now, field-oriented control required an encoder to acquire the necessary position and speed information. However, with the new sensorless control algorithm implemented in our controllers, you also get the advantages of closed-loop control for motors that don’t have an encoder.

SENSORLESS FIELD ORIENTED CONTROL - NO NEED TO PAY FOR AN ENCODER

Closed-loop control used to give stepper motors a competitive advantage in applications which required high torque at lower speeds so that geared servo systems were often replaced with much cheaper direct drive solutions. But in traditional cost-driven open-loop motor systems the benefits didn’t materialize as even cheap encoders are more expensive than most stepper motors, restricting their use in high-volume applications.

To solve this, Nanotec looked at sensorless technology already present in BLDC motors. Over the years it developed from simple fan control at high speed to complex algorithms allowing sine control at a few hundred rpm. Behind this development was the innovative use of model based control that incorporates a mathematical model of the motor itself in the CPU, instead of simple hardware based Back-EMF measurement.

We developed a new, precise model covering both BLDC motors and stepper motors, thus raising the control quality to unprecedented levels:

- Stepper motors can be closed loop controlled without an encoder starting at 10-25 rpm (depending on the motor type) and reach their full torque at around 100-250 rpm. At this speed the virtual encoder information delivered by our motor model is as exact as the information delivered by a 1000 CPR encoder.
- You don’t need to configure the motor model. Just connect the motor, run the auto setup and the controller will know if it’s a stepper or a brushless DC and adjust the motor parameters accordingly.

So now you get the advantages of field-oriented control – cool-running, resonance-free, highly dynamic motors – without paying for an encoder!

APPLICATION-SPECIFIC PROGRAMMING WITH NANOJ

For the programming of our controllers, we developed NanoJ, a C++ based programming language in which the user program runs in a “sandbox”, which is executed in a fixed cycle of 1 ms. This method is used to read the controller settings and status values (I/O status, actual current, speed, position, etc.) after every 1-ms cycle. As a result, users can react to changes with just a few lines of code. They can also solve complex technical requirements, such as tracking a special acceleration ramp according to a mathematical function or changing the control parameters of a motor while it is running. Because field bus communication can be operated in parallel, time-critical tasks can be processed directly in the controller.
PROGRAMMABLE MOTOR CONTROLLERS FOR MORE FLEXIBILITY

The new N5 controller can be used with both BLDC and stepper motors. It supports Ethernet-based field buses such as Ethercat and Ethernet/IP as well as standard Ethernet and CANopen. All Nanotec controllers are fully programmable with NanoJ V2 with a C++ based script program.

TECHNICAL DATA:

12–70 V/10 A (stepper motor, rms rated current) or 12–48 V/18 A (BLDC, rms rated current)

6 digital inputs, 2 analog inputs, 2 transistor outputs

Designed as a housing-free board, the CL3-E controller offers a cost-effective solution for stepper and BLDC motors with a continuous output of up to 70 W. With a size of only 40x60 mm, this controller is ideally suited for laboratory automation and applications that require smooth and quiet performance. These range from open-loop stepper motors that autonomously respond to digital inputs to highly dynamic BLDC motors run in interpolated position mode via CANopen.

TECHNICAL DATA:

12-24 V/3 or 6 A (rms peak current)

5 digital inputs, 3 digital outputs, 2 analog outputs

The motor controller C5 was specifically designed for the open-loop control of stepper motors sized NEMA 17 to NEMA 34. It can be quickly and easily configured and programmed via USB and features innovative open-loop micro stepping with a pure sine wave. Step and direction can be set from full step to 1/4096 with the same ultimate performance. The C5 can run both BLDC and stepper motors in sensorless mode for applications that demand highly dynamic performance and smooth running.

TECHNICAL DATA:

12–48 V/6 A rms rated current

3 differential inputs for clock-direction, 3 digital inputs, 1 analog input, 2 digital outputs
High-Precision Motion Control

FOR DEMANDING CLOSED-LOOP SERVO APPLICATIONS

The C5-E controller is equipped with a CANopen field bus interface and an encoder input. It comes in two versions – either with a current range of 6 A and thus, an adequate current resolution even for small motors, or with a peak current of up to 30 A for BLDC motors at a supply voltage of up to 48 V.

TECHNICAL DATA:

- 12–48 V/10 A rated current/30 A rms peak current
- 5 digital inputs, 2 analog inputs, 3 digital outputs

STEPPER MOTOR WITH SUPERIOR EMC PERFORMANCE

The SC3518 series are 2-phase hybrid stepper motors with a very high torque and excellent EMC properties. The two outer pins of the integrated connector are attached to the motor housing. Together with the shielded cable, this creates a shield connection with excellent EMC performance. The motors are available with a shaft end for open-loop or sensorless control or with an integrated optical encoder NOE1 with up to 2000 increments/rotation.

TECHNICAL DATA:

- High-pole DC servo, NEMA 14 (35 mm)
- 1.8° step angle, 0.18 and 0.32 Nm torque

NEW PITCHES FOR LINEAR ACTUATORS

Linear drives from Nanotec enable fine adjustment of large forces while keeping energy requirements low. They offer highly reproducible resolutions in the micrometer range and reduce system costs on account of their simple and flexible motor design. Linear stepper motors can be used as a substitute for hydraulic and pneumatic cylinders and offer considerably higher flexibility.

- T3.5x8 for Nema 8 motors (L20 & LS20)
- T5x2 for Nema (L28 & LS28)
- T5x10 for Nema 11, 14 and 17 (L28 & LS28, L35 & LS35, L41 & LS41)
- T10x6 for Nema 23 (L59 & LS59)
**RELIABLE AND EFFICIENT FLAT MOTORS**

The DF45 series of BLDC flat motors are 16-pole external rotor motors with a standard diameter of 45 mm and a length of 27 mm. The new members of the series come in the sizes S and M with lengths of 18 mm and 21.6 mm. The permanent magnets are located on the rotor bell revolving around the internal stator with the windings. In addition to the shorter design, the advantage of this construction is in having the same output with a lower torque ripple due the rotor’s higher inertia. The DF45 motors are available in two versions either with cable or an integrated connector.

**TECHNICAL DATA:**

- 12-48 V, 25-80 W
- 45 mm diameter, in three different lengths from 18-27 mm

**POWERFUL NEMA 23 MOTOR**

The DB59 series of BLDC motors have an output of 220 W at a diameter of 56 mm (NEMA 23). This places them among the most powerful BLDC motors of this size. In addition to their high efficiency, they are very smooth running. The DB59 is available with or without Hall sensors. A magnetic encoder with a resolution of 0.09° can be added as an option for even more precise speed and position control.

**TECHNICAL DATA:**

- 24 V rated voltage, 84-220 W
- 23-60 Ncm/32.57-84.97 oz-IN torque

**BLDC MOTOR WITH HIGH POWER DENSITY**

With the DB80, Nanotec presents an EC motor which exhibits exceptionally high power density in relation to its size. Featuring a rated speed of 3000 rpm and a rated voltage of 48 V, this 8-pin motor is particularly suitable for applications that a require a high degree of efficiency; for example in service robotics or automated guided vehicle systems. The DB80 has a flange size of 80x80 mm and is available with Hall sensors or encoder. Four lengths cover a performance range from 280 to 940 W. Additional high-performance planetary gear systems can be mounted for high torques.

**TECHNICAL DATA:**

- 48 V rated voltage, 280-940 W
- 0.9-3 Nm/127.5-424.8 oz-IN torque
TAILORED PRODUCTS FOR DIVERSE INDUSTRIES

STEPPER MOTORS
- 10 mm to Nema 42
- Up to 25 Nm

BLDC MOTORS
- 22 mm to Nema 34
- 4 to 660 W
- Slotless and slotted
- Internal and external rotor

HYBRID LINEAR ACTUATORS
- Nema 8 to 23
- Captive with linear slide
- Non-captive lead screw
- External lead screw with nut

MODULAR MOTOR CONFIGURATION SYSTEM – OVER 4000 COMBINATIONS ...

When drive systems with high precision, reliability and extensive functionality are required to fit in small spaces, Nanotec supplies the necessary technology – either as standard solutions or individualized designs. Our stepper and BLDC motors, linear actuators and linear positioning drives together with a variety of gears and encoders, are part of a modular system with over 4000 possible combinations.

Check out our online configurator at www.nanotec.com to find the perfect motor combination for your application.

... OR A MOTOR DEVELOPED SPECIFICALLY FOR YOU?

In addition to motors with customer-specific alterations to shafts and cable assemblies, we also develop completely new drive solutions according to our customers’ requirements. Our team of experts will help you design drives which are tailored precisely to your needs: from the motor size and performance data, through to special environmental conditions, such as high temperatures, right up to customized electronics with adapted software. As our customer, you will profit from our many years of expertise in developing state-of-the-art drive solutions and manufacturing in our own production facilities – no matter whether you order one motor or large quantities for series production.
Nanotec Electronic, founded in 1991 near Munich, Germany, specializes in precise, high-performance drive solutions. We manufacture smart servo motors, servo and stepper controllers/drives, stepper and BLDC motors, encoders and linear actuators. Our engineering team can help you with system design and develop an economical high-pole servo system specifically for your application.

For additional information, technical assistance, and off-the-shelf delivery please contact our US office at (781) 219-3343 or info@us.nanotec.com.