NEW PRODUCTS

- N5 motor controller with EtherCAT and CANopen
- NEMA 17 Plug & Drive integrated motors – also in IP
- BLDC flat motors and slotless BLDC motors

Powerful, modular drive solutions for BLDC and stepper motors
From our economical 50 W motor control boards for device construction to flexible, freely programmable, bus-compatible controllers all the way to powerful, compact Plug & Drive motors in closed and open loop for decentralized drive solutions Beyond MicroStepping

www.nanotec.com
The company

Since 1991 Nanotec Electronic GmbH & Co. has manufactured and supplied High Performance Stepping motors, BLDC, Stepper driven linear actuators, and Controls to OEM's worldwide. Nanotec Electronic has strived for 20 years to continuously improve the performance of our products. Nanotec responded to customer needs and expanded our product offering to meet their demanding applications.

20 years of industry leading innovation has culminated with the introduction of our Plug & Drive controls. Our Plug & Drive controls with Nanotec Stepping & BLDC motors deliver near servo performance. Plug & Drive controls, running closed loop, sinusoidally commutate our Stepping motors via an encoder to deliver performance Beyond MicroStepping. Plug & Drive delivers a high energy-efficient product in a compact package with the ability to precisely position stepper and BLDC motors. Our advanced software platform guarantees easy integration of our motors and control packages. Our strong focus on R&D guarantees Nanotec Electronic will continue innovate and deliver cost effective high performance products to meet customer demands in the future.

We are a German company, quality and long life, is extremely important to everyone at Nanotec. Our processes are strictly regulated through the entire manufacturing process to insure quality. We are certified to the latest ISO 9001:2008 standards by TÜV Management Service.

Our vision: quality, innovation, reliability – and flexibility

OEM's and equipment builders, requirements for motors and controls vary, from off the shelf standard products to exotic. If your application requires customization of motors and controls remember Nanotec. Thanks to our production in Germany, and our comprehensive range of components in stock, we are able to respond quickly to your exact requirements. Our engineers are willing to work with you through your design phase. Nanotec offers a wide variety of standard products and we offer custom shaping, connectors, brakes, encoders, gears or gearboxes. Let us know how we can assist you to make our products drop in with ease.

Low-cost products thanks to high-end production

Production of our drives is carried out by our subsidiary company Nanotec ChangZhou in China, and by a joint venture company also located there. Thanks to our 20 years of experience in motor production in Asia, we place the greatest emphasis on quality assurance. Since 2008, we test samples of mechanical components on a Zeiss 3D coordinate measuring machine. For the final inspection of motors, at many stages we use testing equipment developed in-house, e.g. for testing counter-electromotive force or the axial play of the motors. High quality factory equipment and in-depth staff training results in stable processes and high quality manufacturing.

Application example: Lülau Engineering relies on high-precision stepper motor technology for the skintrek® PT5 phototherapy device

The skintrek® PT5 medical UV radiation device is the most innovative technology currently available on the market for irradiating skin diseases. It became apparent during development how important simple component interchangeability is.

There are two phototherapy processes for providing UV radiation for skin diseases such as psoriasis, vitiligo and eczema: a normal one where the skin is irradiated with a floodlight and a digital one. In this latter case, the UV radiation is converted into a pixel matrix. The individual beams controlled independently from each other only expose areas of skin afflicted with the disease.

"During treatment it is important that as little healthy skin as possible is irradiated in order to minimize the risk of skin cancer," explains Graduate Engineer Friedrich Lülau, who is considered the grandfather of digital phototherapy. This put the goal of development for the new skintrek® PT5 UV radiation device in clear focus. No healthy skin should be irradiated, even if the patient moves. The exposure head has to be able to follow the slightest movements.

This four-dimensional mobility was realized using high-precision stepper motor technology. Seven Nanotec stepper motors plus control systems are in the device. Plug & Drive motors were primarily used; they integrate the motor, the control system and the encoder into their housing. Advantage: Low wiring effort. "You only need the power supply and interface cables; motor and encoder lines are integrated," says R&D Manager Dr. Matthias Kock.

Same-sized hole, twice the holding torque

A PD4-N5918 model with 3.54 Nm of holding torque was chosen for the X-axis as well. The height is configured using PD4-N5918 Plug & Drive motor is on the crossmember (X axis) where the exposure head is housed. A PD4-N6018 model with 3.54 Nm of holding torque is located in the crossbeam (Y2 axis) where the exposure head is housed. This drive made it apparent how quickly the actual performance requirement can differ from plans. In particular, the holding torque of the originally preferred PD4-N5918 variant was not enough during real-world testing. Instead of 1.5 Nm, 3 Nm were required. The result was almost twice the holding torque with just a 4 mm x 4 mm larger size and the same-sized hole, without the need for expensive redesigning. The motor functions as a swivel drive that can rotate the exposure crossbeam to 20° degrees on each side in order to cover the side areas of the body with precision.

Closed loop for smooth-running operation

There is a color filter between the light source and the light modulator. Depending on the skin disease being treated, the color filter disk puts a color spectrum into position for the exposure with the aid of ST2018 stepper motors controlled using a controller developed in-house. The exposure unit can move back and forth in the crossbeam (X axis) and its height can be adjusted (Z axis). In order to provide uniform drive architecture, a PD4-N5918 motor was chosen for the X axis as well. The height is controlled using two ST4118 stepper motors plus a SMC47 control system, combined with a linear slide, in closed loop mode.

The skintrek® PT5 has been on the market since the beginning of 2012. Looking back on 2 years of development time, Dr. Matthias Kock concludes, "It was the right choice. Cooperating with Nanotec was very productive and effective. The motors also exhibit very quiet running behavior in closed loop mode."

Photos: Lülau Engineering
New product lines with closed loop control system

N5 – fieldbus-compatible motor controller

The new N5 generation of motor controllers represents the platform for all future Nanotec motor controllers. Its advantage: High flexibility when selecting a motor with uniform motor controller architecture. The N5 motor controller supports closed loop field-oriented control, is programmable, is suitable for BLDC and stepper motors and provides many activation options. Moreover, N5 controllers can be used in fieldbus operations.

Technical data:
- 70 V/10 A (stepper motor) or 48 V/20 A (BLDC design)
- Input for encoders (differential, 24 V) and Hall sensors
- 6 digital inputs, 2 analog inputs (-10 to +10 V or 0-20 mA, switchable using software), 2 digital outputs
- Integrated activation for holding brake
- Ethernet connection for programming via NanoIP or activation via the reset interface
- Field bus interface: EtherCAT or CANopen
- NanoJ 2.0 for standalone applications

NanoIP – Simple, platform-independent programming

- A web server runs on each N5 motor controller; it can be used to access the browser-based NanoIP interface
- Comfortable access to the entire ObjectDictionary for programming the drive, convenient autotuning using an integrated scope for analyzing control behavior
- Separate interfaces, such as with reduced configuration options for machine operators, can be created easily by changing the NanoIP’s HTML source code and loaded into one of the control system’s subdirectories via NanoIP
- NanoJ programs can be installed and started on the control system. The speed of NanoJ was increased substantially on the N5; as a result, time-critical signals from inputs can be reacted to within 2 ms, for instance

PD4-C – Plug & Drive stepper motor with integrated encoder

Our new PD4-C family of Plug & Drive motors was developed especially for cost-sensitive applications where high performance and efficiency are required nonetheless. The motors of the PD4-C line are available as both stepper motors and BLDC motors and thus provide high flexibility when designing mixed drive environments.

Technical data:
- Stepper motor (up to 3 Nm) or BLDC design (135 W)
- Single-turn absolute encoder (12-bit resolution) for immediate operation in closed loop mode without a reference run
- Can be activated using cycle/direction or analog input (speed, position)
- Can be configured over USB
- NanoJ 2.0 for standalone applications

Slotless BLDC motors in 16 and 28 mm sizes

The expression „slotless” refers to the fact that the majority of BLDC motors have pole pieces or slots on the inside of the stator for the winding to be wound around. These pole pieces together with the windings are also referred to as an „iron core”. In contrast, a slotless or iron-less BLDC motor only has ring-shaped plates as the stator. A flat, glued or potted winding is installed on this plate. Slotless BLDC motors are ideal for high-speed applications.

- Higher speeds: Since there is no iron core, the inductance of the motor is very low and the current in the windings rises very quickly. This makes it appealing for high-speed applications.
- No detent torque/torque ripple: No detent torque occurs since the magnetic field is not strengthened at the pole pieces as with standard BLDCs. The motor turns with very good synchronization even at slow speeds.
- Higher efficiency: Iron loss is not an issue since the motors do not have an iron core; the motors have higher efficiency.
- Rated output:
  - DS16: 24 watts at 25,000 rpm
  - DS28: 75 watts at 14,000 rpm

BLDC flat motor

The new BLDC flat motors from Nanotec are the ideal solution for many applications due to their compact, flat design (45 mm diameter; length < 30 mm). For the 16-pin external rotor motors of the DF45 series, 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 compared to internal rotor motors comes from having the same output at the low torque ripple due to the rotor’s higher moment of inertia. The motors of the DF45 series can be produced according to customer-specific requirements for voltages from 12-48 V and a power of 25-80 watts.

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- Can be configured over USB
- NanoJ 2.0 for standalone applications

Ultra-flat stepper motors

In addition to the ST63, a second flat stepper motor is now also available in the form of the STF28, which was specially developed for feeder applications (feeding components as rolled goods) in the semiconductor industry.

The low height (<10 mm) of both motors, the ST63 and the STF28, is advantageous for many other applications in conjunction with the 1.8° step angle and the very high speeds that can be reached for a stepper motor, such as for a stirrer.
Closed loop-compatible stepper motors combine the advantages of stepper and servomotor technology. They run more quietly and have a lower resonance than stepper motors, provide position feedback and control, and avoid step-loss entirely. They represent an alternative to the stepper motor whenever energy efficiency, quiet operation and load tolerance are required. In contrast to servomotors, they offer the advantages of high torque at low speeds, short settling times, correct positioning with no oscillation and a lower price, often with a smaller size.

What is Closed Loop?

Sinusoidal commutation via encoder with field-oriented control is referred to as a closed loop process. Through the encoder, the rotor position is recorded and sinusoidal phase currents are generated in the motor coils. The vector control of the magnetic field ensures that the stator magnetic field is vertical to the rotor magnetic field and the field strength corresponds precisely to the required torque. The regulated current level in the coils provide even motor force and result in an especially quiet-running motor that can be accurately regulated.

True VS Pseudo Closed Loop

There are stepper motors that do add the closed loop flag and work with encoders, but offer no field-oriented, sinusoidal current control. They only check the step position, and cannot correct step losses during operation. True closed loop operation with field-oriented regulation compensates step losses during the run or prevents them from occurring by increasing the motor current.

Energy efficiency

In an open-loop system, the stepper motor is dimensioned such that it is certain to move the maximum required load. For this reason, normally a safety factor of 30% is calculated, which amounts to wasted energy in the application. When the load is reduced, the open-loop motor cannot react and wastes even more energy. Via the current control in the closed loop, the motor receives only as much energy as needed for the external load; the torque reserve, the greater is the resonance stimulation) and can bring the motor to a stop. In closed-loop mode, the motor receives only as much energy as needed for the external load; the torque reserve and its resonance stimulation do not exist, so there is practically no resonance behavior.

Service life

Efficient power regulation generates less heat in the motor, which stays significantly cooler. Reduced heating protects the motor bearings.

Overload

With a 20% safety reserve and a design for a continuous load of 30 kg, an additional load of only 5 kg exceeds the power reserve and the open-loop drive stops without an error message. By contrast, with the overload reserve the closed-loop stepper motor can handle the load increase easily.

Resonance behavior

Resonance frequencies occurring in the open loop depend on external loads (the greater the torque reserve, the greater the resonance stimulation), and can bring the motor to a stop. In closed-loop mode, the motor receives only as much energy as needed for the external load; the torque reserve and its resonance stimulation do not exist, so there is practically no resonance behavior.
### Beyond MicroStepping Closed Loop

Closed Loop Stepper Motors are an advanced development of classical stepper motor technology. They eliminate the limitations and drawbacks of classical stepper motors:

- Deliver near servo performance with Torque and position control
- No calculation or purchase of a safety reserve (normally up to 50%) required
- Greater efficiency on load fluctuation and no stoppage on overload
- Energy-efficient operation due to intelligent current regulation
- Practically resonance-free
- Longer service life of bearings due to less heat and vibration
- Reduced acceleration time because high torque is achieved even at high RPM
- Precise positioning due to monitoring and correction

**FOC of a two-phase hybrid stepper**

A dspDrive system basically implements vector control of a stepper motor (the position loop is not shown). It is analogous to vector control schemes for induction motors but needs no Clarke transformation ordinarily used to project the three-phase currents into two vectors. $I_d$ is the flux-generating part of the current vector, while $I_q$ is the torque-generating portion. The velocity controller changes the torque-generating current vector. The flux-generating current vector is only influenced by field weakening. The system always tries to maintain a 90° angle between the stator and rotor magnetic fields, and thus tries to keep $I_d$ at zero. The $I_d$ component only comes into play in the event of field weakening when the speed is over the constant torque range of the motor.

### Ideal application domains for Closed Loop Stepper Motors

- Multiple axis coordinated motion applications (serial, Ethernet, EtherCAT, CANopen)
- Positioning tasks with load fluctuation
- Winding
- Conveyor belt (start/stop, positioning)
- Dosing pumps, filling systems
- Semiconductor assembly
- Wafer production
- Textile machines, industrial sewing machines
- Robotics
- Inspection systems
- Applications that require quiet operation, short transient time and precise positioning

### SMCI - stepper motor controllers with Position and Torque control, closed loop capable delivering performance Beyond MicroStepping

<table>
<thead>
<tr>
<th>Model</th>
<th>SMCI12**</th>
<th>SMCP33</th>
<th>SMCI35</th>
<th>SMCI36</th>
<th>SMCI33</th>
<th>SMCI47-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>max. voltage/current (RMS)</td>
<td>24 V / 2.7 A</td>
<td>48 V / 4.2 A</td>
<td>48 V / 6 A</td>
<td>72 V / 9 A</td>
<td>48 V / 3 A</td>
<td>48 V / 10.5 A</td>
</tr>
<tr>
<td>Nominal current (RMS)</td>
<td>1.8 A</td>
<td>2 A / 4 A with/without heat sink</td>
<td>4 A</td>
<td>6 A</td>
<td>2 A</td>
<td>7 A</td>
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<tr>
<td>Interface</td>
<td>USB*, RS485 CANopen</td>
<td>USB*, RS232*, RS485</td>
<td>USB*, RS232 (3.3 V)</td>
<td>USB*, RS485, CANopen</td>
<td>USB, RS485, CANopen</td>
<td>USB*, RS485, CANopen</td>
</tr>
<tr>
<td>Motor type</td>
<td>Stepper motor</td>
<td>Stepper motor</td>
<td>Stepper motor</td>
<td>Stepper motor</td>
<td>BLDC motor</td>
<td>Stepper motor</td>
</tr>
</tbody>
</table>

* PD2-O4118* PD2-N4118 PD2-N-IP PD4-N5918 PD4-N5918/IP6 PD6-N8918

- Size 42 mm/ Nema 17 42 mm/ Nema 17 42 mm/ Nema 17 56 mm/ Nema 23 56 mm/ Nema 23 86 mm/ Nema 34
- max. voltage 24 V 48 V 48 V 48 V 48 V 48 V
- Interface RS485 CANopen RS485 CANopen RS485 CANopen RS485 CANopen RS485 CANopen RS485 CANopen
- Holding torque 0.2-0.5 Nm 0.5 Nm 0.5 Nm 0.5-3 Nm 0.5-3 Nm 3.2-9.3 Nm

* The PD2-O is not closed-loop capable

### Plug&Drive Integrated compact stepping motors deliver performance Beyond MicroStepping with Torque and Position control

**PD2-N-IP Beyond MicroStepping delivering near Servo performance**

Our high-performance Plug & Drive PD2-N motor is now available in an IP65 design. The Nema 17 stepper motor integrates the controller and a Magnetic Single-turn absolute 12-bit encoder into the housing. The advantage: Lower wiring effort, quick start up. Ideal for decentralized applications.

- With closed loop field-oriented control
- Can be programmed as a sequential control
- 6 digital inputs (5 - 24 V), 1 analog input
- 2 x M12 terminal connector
- Single-turn absolute encoder (12-bit resolution) for immediate operation in closed loop mode without a reference run
- RS485 and CANopen versions
Simple commissioning and parameterization with NanoPro and NanoCAN

Via USB or the serial interface (or via a CAN converter from the manufacturers Beckhoff or Peak for CANopen), all controls and Plug & Drive motors can be quickly and easily parameterized and tested using the two free software tools NanoPro and NanoCAN (using the example of NanoPro below):

Start preset set 1 (relative positioning) with standard parameters (relative positioning, speed, ramp, etc.) in order to test whether motor is connected properly.

Optimize motor operation for the application, e.g. speed mode with different start/target speeds, ramps and motor currents, open and closed loop.

Select the relevant operation mode for the application (e.g. absolute positioning, speed control via analog input, torque, etc.) and save the parameters to the controller.

The connected control system is identified automatically and default values can be loaded for different motors. All motor-related parameters such as max. current level, current reduction, step mode, etc. are easily configurable here.

Machine settings make the parameters more transparent for the operator, thereby simplifying commissioning. Thus, the travel and speed for a linear axis can be configured in mm and m/s and the user does not have to deal with converting to steps and Hz.

Switching states (pos./neg. signal edge) can be defined for the controller’s digital inputs and the debouncing time for contact switches can be tested. The function of the inputs, such as release, reference switch, start, quick step and set selection can also be set here. Even the voltage thresholds for the analog input can be configured here just like filtering and a dead zone for preventing jerking around the neutral position for joystick applications.

A closed loop assistant determines the necessary motor and encoder parameters for the closed loop. The load angle values are determined by an automatic calibration run.

The control can be optimized further by autotuning and the option to adjust PID parameters manually.

Easy switching between open and closed loop operation to compare operating behavior, performance, positioning times, etc.

Multi-axis applications with CoDeSys and CANopen Interpolated Mode

Using Interpolated Mode in compliance with the CANopen CiA402 standard, it is possible to activate Nanotec stepper motor controllers or Plug & Drive motors directly using path control systems with a CANopen interface. Thus, a finished driver is available for 3S-Smart Software Solutions GmbH’s software PLC CoDeSys V3 SoftMotion in order to easily integrate the controller.

Spraying sealing material on the cover is a necessary for producing our motors with a higher protection class. The applied sealant contour has to be easy to modify in production due to the large number of variations based on motor size or customer-specific design. In order to automate this process, we rely on our own Plug & Drive motors with CoDeSys: Two Plug & Drive PD4-N5918 motors move the dosing head over toothed belt axes on the path specified by SoftSPS.

Integrating Nanotec control systems into CoDeSys

The provided library for Nanotec CANopen drives is installed first after software PLC is installed, on an industrial computer in our case. The two motors can then be added as devices easily using the EDS (electronic datasheet) file for the Plug & Drive motors and they can be configured over the CAN bus.
Closed Loop Starter-Kit

You can get to your optimal automation solution faster with our closed loop starter kit. The ideal speed can be determined or tested without much effort, whether operating in closed loop or open loop.

We have bundled a complete package for you that can use to determine the ideal output configuration quickly and easily in just a few steps:

- Step 1: Connect the motor to the test board
- Step 2: Connect the power supply
- Step 3: Connect the computer; install the software
- Step 4: Configure the motor
- Step 5: Test the settings
- Step 6: Connect the applications

Fast time-to-market is becoming more and more important. You can use the closed loop starter kit to reduce the evaluation phase.

The starter kit is available in two variations:

- Starter kit 1-1: Plug & Drive PD4-N818 motor with test board and connecting cable set, detailed operating manual
- Starter kit 2-2: AS842 IP-protected BLDC motor, AS5918 IP-protected stepper motor, SMCI36 control system, connecting cable, detailed operating manual

Testing closed loop applications (examples in the starter kit)

Winding and laying

New application options for stepper motors open up due to the closed loop, particularly in winding applications. The torque control in conjunction with the high synchronization, even at the low speeds often necessary in these instances, allows indirect control of the pulling force via the motor’s torque in many applications, i.e. without a tension load cell or dancet. Alternatively, if a tension load cell is used for more precise control, then its signal can be processed by the Plug & Drive motor directly.

The example application substitutes a linear actuator for the laying drive often necessary in winding applications. Fast reversing is necessary at the reversal points in order to ensure that the motor may slide. The example application substitutes a linear actuator for the laying drive often necessary in winding applications. Fast reversing is necessary at the reversal points in order to ensure that the mate-

L35 linear actuator

The compact L35 linear actuator extends our wide range of models to linear actuators by adding a design with a size of 35 mm.

- 140 N max. force
- 0.01 mm resolution
- Just 34 mm overall length
- Available with an optional encoder

Linear actuators for harsh environmental conditions

For OEM applications (over 100 pieces), we can provide our linear actuators and linear actuator drives in the IP65 type of protection as well. The output for the push rod can be designed for IP as well for the variant with an linear slide lock.

- L41, L59 series with optional integrated encoder
- Linear drive with optional PDA-N control system
- Linear slide lock with optional Hall sensor as a limit switch

L20 linear actuator with linear slide

We have an almost unique selling point on the market in the form of our L20 models in 20 mm and NEMA 8 sizes. Based on a stepper motor, the linear actuator is ideal for the implementation of compact linear slides and precision linear axes. The spindle is prevented from rotating thanks to the integrated linear slide.

- PEEK nut for long service life
- 40 N force
- 0.005 mm resolution/step
- 25 mm stroke
- Can replace all standard stepper motors with a size of 20 mm/NEMA 8

Linear actuators and linear actuator drives - size of 20 - 56 mm

Nanotec linear drives are simple and flexibly designed, accurate and durable. They are designed for high, reproducible resolution (< 1 µm) and for quick feeding (> 300 mm/sec.). All of our linear actuators can replace standard motors and allow the design of uniform construction platforms. They are low-friction and low-wear due to the PEEK nuts being used. Some versions are self-locking and can be operated without a brake. Depending on the application, linear drives can be selected with or without a linear slide (integrated anti-rotation lock) and linear actuator drives.

<table>
<thead>
<tr>
<th>Series</th>
<th>L(S)2018</th>
<th>L(S)2818</th>
<th>L35</th>
<th>L(S)4118</th>
<th>L(S)5918</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>20 mm/Nema 8</td>
<td>28 mm/Nema 11</td>
<td>35 mm/Nema 14</td>
<td>42 mm/Nema 17</td>
<td>56 mm/Nema 23</td>
</tr>
<tr>
<td>Max. force</td>
<td>40 N</td>
<td>80 N</td>
<td>140 N</td>
<td>400 N</td>
<td>1000 N</td>
</tr>
<tr>
<td>Pitch of screw</td>
<td>1 mm</td>
<td>5 mm</td>
<td>2 mm</td>
<td>1, 2, 5 mm</td>
<td>2 mm</td>
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<tr>
<td>Resolution</td>
<td>0.005 mm</td>
<td>0.025 mm</td>
<td>0.01 mm</td>
<td>0.005-0.025 mm</td>
<td>0.01 mm</td>
</tr>
<tr>
<td>Encoder option</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</table>
### Stepper motors for harsh environmental conditions - IP65 rated

<table>
<thead>
<tr>
<th>Model</th>
<th>AS2818</th>
<th>AS4118</th>
<th>AS5918</th>
<th>AP8918</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>28 mm/Nema 11</td>
<td>42 mm/Nema 17</td>
<td>56 mm/Nema 23</td>
<td>86 mm/Nema 34</td>
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<tr>
<td>Holding torque</td>
<td>0.07-0.12 Nm</td>
<td>0.5 Nm</td>
<td>0.85-1.98 Nm</td>
<td>5.94-9.33 Nm</td>
</tr>
<tr>
<td>Encoder option</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Brake option</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
</tr>
</tbody>
</table>

**AS4118 and AS5918 now with optional brake and 24V encoder**

The AS4118 and AS5918 series are now available in a version with a 24 V encoder with a brake and 24 V encoder alongside the 5 V encoder version. The integrated holding brake can ensure the motor’s position even when de-energized, which is especially important for Z-axes and safety-critical applications.

### Brushless DC Servo Motor with IP65: ASB42
- 3-phase BLDC motor with a size of 42 mm/Nema 17 and IP65 type of protection for harsh environments
- Incremental, magnetic encoder for precise activation
- No additional Hall sensors required resulting in higher reliability
- Reference signal synchronous to Hall phase for even more precise positioning
- 1024 pulses per revolution
- 0.09° resolution (using quadrature)
- Speed of 6000 rpm, peak torque: 75 Ncm

### Brushless DC Servo Motor with IP65: ASB87
- 3-phase BLDC motor size of 87 mm/Nema 34 and IP65 type of protection for harsh environments
- Incremental, magnetic encoder for precise activation
- No additional Hall sensors required resulting in higher reliability
- Reference signal synchronous to Hall phase for even more precise positioning
- 1024 pulses per revolution
- 0.09° resolution (using quadrature)
- Speed of 3000 rpm, rated output of 250 W, peak torque: 2 Nm

### Valve drive for liquid chromatography

Due to the limited installation dimensions in the new customer application, only a maximum edge length of 28 mm for the motor was possible. Despite this, a torque of 0.55 Nm had to be reached, which until that point had been achieved only with a motor with an edge length of 40 mm. As a result, a planetary gear with a gear reduction ratio of 19:1 became necessary. The NOE1 encoder was installed on the gearbox’ output shaft in order to be able to position with 100% accuracy despite backlash from the gearbox. Using quadrature evaluation, a resolution of 0.045° can be reproducibly achieved this way.

### Linear actuator with integrated limit switches

Customer-specific solutions, even in short runs, are one of our strengths. You can find an example of a design adapted to a specific customer’s needs on the left. For the application, the motor sits in the middle of two symmetrical push rods. Therefore, the spindle was put on the rear side, also with a thread, where the push rod is mounted. We attached two Hall sensors as limit switches on the top side of the linear slide lock. They are triggered by a magnet traveling along on the spindle.

### 2-axis control system

The pictured motherboard for two SMCP33 plug-in PCBs was developed to a customer’s specifications from our standard evaluation board. In addition to motor activation, multiple switch outputs with various voltages and outputs were integrated in order to switch or supply accessories in the customer unit.
Nanotec products are available both directly from us and via a worldwide network of sales partners. A current list of our sales partners can be found at http://en.nanotec.com/nanotec_kontakt.html

Our complete range of products can be found on the Internet at: www.nanotec.com

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Europe:
Nanotec Electronic GmbH & Co. KG
Kapellenstraße 6
D-85622 Feldkirchen/Munich, Germany
Phone for Sales: +49 (0) 89 900 686-0
Phone for Support: +49 (0) 89 900 686-48
Fax: +49 (0) 89 900 686-50
E-mail for Sales: info@nanotec.de
E-mail for Support: support@nanotec.de

USA:
Nanotec Electronic, U.S., Inc.
98 Sheridan Avenue
Medford, MA 02155 U.S.
Phone for Sales: +1 781 219 33 43
Fax: +1 781 498 13 44
E-mail: info@us.nanotec.com

Asia:
Nanotec Electronics (ChangZhou) Co., Ltd.
Building 1-18 QingJiang Road, New District
ChangZhou City, JiangSu Province
PR. China 213222
Phone for Sales: +86 519 830 211 77
Fax: +86 519 830 211 17
E-mail for Sales: info@cn.nanotec.com
E-mail for Support: support@cn.nanotec.com

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