Nanotec®
PLUG & DRIVE

Motion Control Solutions for Industrial and Robotic Applications

From integrated motors to CANopen masters with ROS interface, Nanotec offers innovative drive solutions for diverse industries

Integrated Motors - it´s Plug & Drive

- Brushless DC servo systems
- Programmable, step & direction, analog control
- Precise position, speed and torque control

All-In-One!

IMTS2016

ROBO Business
INVEST • INNOVATE • IMPLEMENT

ATX
AUTOMATION TECHNOLOGY
WEST

Integrated Brushless DC Servos

Integrated brushless DC servo motors from Nanotec are available in three sizes from Nema 17 to Nema 34 and different stack lengths. They feature:

- Precise position, velocity and torque control
- Integrated fully programmable controller
- Single-turn absolute encoder
- Controlled by fieldbus, step & direction, and analog I/O
- USB or CANopen, and CiA 402
- Digital and analog inputs, digital outputs

NEMA 17

NEMA 23/24

NEMA 34

PD2-C (High-Pole Servo/Stepper)
Operating voltage: 12–48 V
Rated torque: up to 0.5 Nm

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PD2-CB (Brushless DC Servo)
Operating voltage: 12–48 V
Rated power: 105 W
Rated torque: 0.25 Nm
Peak torque: 0.75 Nm
Rated speed: 4,000 rpm

PD4-C (High-Pole Servo/Stepper)
Operating voltage: 12–48 V
Rated torque: 1–3.5 Nm

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PD4-CB (Brushless DC Servo)
Operating voltage: 12–24 V
Rated power: 135 W
Rated torque: 0.37 Nm
Peak torque: 0.92 Nm
Rated speed: 3,500 rpm

PD6-C (High-Pole Servo/Stepper)
Operating voltage: 12–48 V
Rated torque: up to 8.8 Nm

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PD6-CB87S (Brushless DC Servo)
Operating voltage: 12–48 V
Rated power: 220 W
Rated torque: 0.7 Nm
Peak torque: 2.1 Nm
Rated speed: 3,000 rpm

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PD6-CB80M (Brushless DC Servo)
Flange size: 80 mm
Operating voltage: 12–48 V
Nominal output: 534 W
Rated torque: 1.7 Nm
Peak torque: 5 Nm
Rated speed: 3,000 rpm

Technology

The Linux-based Robot Operating System ROS is becoming more and more popular in service robotics applications. Therefore our engineers have chosen ROS for the semi-autonomous service robot we have developed to test our wheel drives in everyday use. However, two obstacles needed to be overcome – firstly the integration of CANopen devices is not yet standardized, and secondly, Linux is not real-time capable without modifications. For this reason we split the tasks: The motors and sensors are connected to Nanotec's newly developed CAN master EM5 (this way the motors will be controlled in real time). ROS will calculate the target positions of the wheels with the help of kinematics and a map, and send it to the EM5 via Ethernet. The master will then interpolate and control the path of the wheels in real time. In addition, the integrated touchscreen of the EM5 will allow the user to call up diagnostic data.

ROS and CANopen make a perfect team
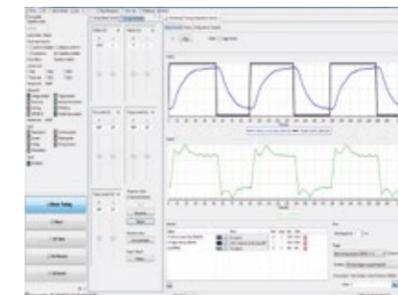
Plug & Drive Studio

A new software is now available for easy setup and programming of Nanotec's motor controllers: Plug & Drive Studio.

The controller can be accessed from a PC via a variety of field buses (CANopen, Ethernet or Modbus). For setup, the object directory holding the controller configuration can be read and written via a table. Pre-defined filters enable the user to only display the parts of CiA 402 objects that pertain to a certain task, such as setup or a certain operating mode (i.e. speed). Experienced users can configure the objects via an integrated command line. The entire communication can be recorded and played back later so that lengthy command sequences only need to be entered once during setup. To tune the controller parameters, an integrated oscilloscope displays up to eight objects simultaneously with a resolution of up to one millisecond. Furthermore, Plug & Drive Studio allows the user to program the controller in NanoJ V2 in an IDE with syntax highlighting and a debugger.

For 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 way, the controller settings and status values (I/O status, actual current, speed, position, etc.) can be read and written 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.

Brushless DC Servo Controllers

- For brushless DC and stepper motors
- Closed-loop (FOC) contol with encoder, sensorless or hall feedback
- Precise position, velocity, and torque control
- Quick to parameterize and easy to program with NanoJ V2
- Controlled by fieldbus, step & direction, and analog I/O
- No step losses

	N5	C5	C5-E
Operating voltage	12-72 V (low current) 12-48 V (high current)	12-48 V	12-48 V
Continuous current	10 A (low current) 18 A (high current)	6 A	6 A (low current) 10 A (high current)
Peak current	10 A (low current) 40 A (high current)	6 A	6 A (low current) 30 A (high current)
Encoder input	yes	no	yes
Brake output	yes	no	yes
Interfaces	EtherCAT, CANopen, Ethernet/IP	USB	USB, CANopen
Inputs/outputs	6 digital inputs 2 analog inputs 2 digital outputs	3 differential inputs 3 digital inputs 1 analog input 2 digital outputs	5 digital inputs 2 analog inputs 3 digital outputs

	CL3-E	NP5
Operating voltage	12-24 V	12-48 V
Continuous current	3 A	6 A
Peak current	3 A (low current) 6 A (high current)	10 A
Encoder input	yes	yes
Interfaces	USB, CANopen, Modbus (RS485, RS323)	2x SPI, 1x 12C, CANopen (external circuitry required)
Inputs/outputs	5 digital inputs 2 analog inputs 3 digital outputs	2 encoder inputs 7 general I/O 2 A/D converter 1 brake output

ClosedLoop   NanoJ V2   CANopen   Modbus   EtherNet/IP   EtherCAT

Technology

Triple your Speed with Nanotec´s Revolutionary Sensorless

Increase your production output by switching from open-loop to sensorless control. By using a Nanotec controller, you can almost triple the speed of your CNC machine, as the motors will accelerate much faster and without any resonances. This way you have the advantage of closed-loop servo control without investing into encoder feedback!

Stepper motor technology was long considered to be merely a cost-effective alternative to applications that do not demand the high performance delivered by servo motors. Machine designs in particular, had applications that were increasingly changed over to servo motors, whose ease of integration in small spaces counters their higher procurement costs.

This trend was reversed by the development of field-oriented, closed-loop controlled stepper motors. The core of closed-loop technology is the field-oriented control of stepper motors via encoder signals. This corresponds to the control of a brushless DC motor, turning a classic stepper into a high-pole servo. The resulting system continuously achieves twice or three times the torque at 20–50% of the nominal speed of a servo motor of the same size. In addition, this motor gets rid of the disadvantages of classic open-loop control, such as resonance or excessive heat generation.

However, these advantages of field-oriented control do not justify the higher price for the required encoder in classic stepper motor applications, such as small table-top CNC machines used for engraving, dosing, marking or milling. The positioning accuracy of the open-loop stepper motor is often sufficient, and developers simply require better running behavior and less heat generation to be able to benefit from the advantages of field-oriented control in these applications. Nanotec has developed a sensorless (i.e. encoder-free) control for stepper motors in which the current position and speed of the rotor are calculated by a "virtual encoder" in the controller.

An autosetup routine measures the connected motor and automatically determines the required parameters. The sensorless algorithm recognizes the accuracy with which the speed is currently being estimated. If the signal becomes too imprecise as the speed decreases, the system automatically switches to open-loop control and positioning continues in this mode. When restarted from a standstill, only a few degrees are needed to return to closed-loop mode. Thus, sensorless technology makes it possible to benefit from the advantages of field-oriented control in almost all traditional stepper motor applications.

New Brushless DC Motors and Gears

Nanotec offers a number of new three-phase brushless DC motors with high-energy permanent magnets that provide rapid acceleration and high speeds, paired with excellent efficiency. They are ideally suited for applications that demand very smooth running and a long service life.

	DF32	DF45	DB41	DB 43	DB80
Size	Ø 32 mm	Ø 43 mm	NEMA 17	NEMA 17	Flange size 80 x 80 mm
Operating voltage	24 V	24 V	24 V	24-48 V	48 V
Rated power	7.4 W	30-65 W	22–113 W	53–138 W	283-942 W
Peak torque	0.076 Nm	0.15-0.39 Nm	0.24-1.2 Nm	0.51–1.32 Nm	2.5-8.5 Nm
Rated torque	0.025 Nm	0.05-0.13 Nm	0.07–0.36 Nm	0.17–0.44 Nm	0.9-3 Nm
Rated speed	2,760 rpm	4,840-5,260 rpm	3,000 rpm	3,000 rpm	3,000 rpm

Nanotec has developed a number of new gears specially suited for medical, industrial, and robotic applications:

GPLK These gears are especially well suited for applications where the motor will be moved. They are made of plastic and therefore considerably lighter and much quieter than comparable gears made of metal.

GPLEP Planetary precision gears are equipped with reinforced output bearings and withstand high radial and axial loads.

GPLEF Flange planetary gears offer a reasonably priced high-efficiency alternative to cycloidal or harmonic gears with a standard ISO 9409 compliant mounting flange.

	GPLK42	GPLEP50	GPLEP70	GPLEP90	GPLEF64
Characteristics	low noise, low weight	high radial and axial loads			high stiffness
Motor flange size (mm/NEMA)	42/17	42/17	56/23	86/34	56/23
Nominal torque (Nm)	6	up to 15	up to 33	up to 97	up to 44
Max. load radial/axial (N)	up to 65/40	up to 800/100	up to 1,050/1350	up to 1,900/2,000	up to 550/1,200
Max. input speed (rpm)	5,000	18,000	13,000	13,000	13,000
Efficiency	min. 70 %	min. 95 %	min. 95 %	min. 95 %	min. 95 %

Standard or Custom Solutions

New: Robot Wheel Drives

Nanotec offers solutions for service robotics and transportation systems that meet a broad spectrum of load, speed, and braking requirements. These include small brushless DC motors for pipe inspection robots, Plug & Drive motors with an output of 50 W that drive a Mecanum platform via planetary gears, or drives for autonomous transportation systems with an output of several hundred watts per wheel.

All of our standard products can be combined according to our customers' requirements and supplemented by application-specific components. With our integrated motors and GPLEP planetary gears, we offer a standard solution for a variety of wheel drive requirements. Our product range is complemented by custom solutions, from actual wheels delivered with the gear motor to active safety brakes, bringing an AGV from full speed to a complete standstill in no time.

Turnkey For Your Application

From standard solutions to customer-specific designs, Nanotec will supply the perfect drive system for your application. Our motors, linear actuators, gears, brakes and encoders, are part of a modular system with over 4,000 possible combinations. The online configurator at www.nanotec.com will assist you in finding the right product.

In addition, you can order our motors with application-specific shafts and cable assemblies. We also develop completely new solutions based on your individual requirements. When designing a new product, we always keep economical production in mind, from first samples, through ramp up, and up to high volume series. Let us know how we can make it turnkey for your application!

About Us

Nanotec Electronic specializes in precise, high-performance drive solutions. We manufacture a broad range of integrated motors, brushless DC motors and stepper motors, as well as controllers and linear actuators for automation and robotic applications. Twenty-five years of engineering and production experience allow us to offer our customers valuable support in system design and selecting the best motion control solution for their application.

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

Nanotec
PLUG & DRIVE

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