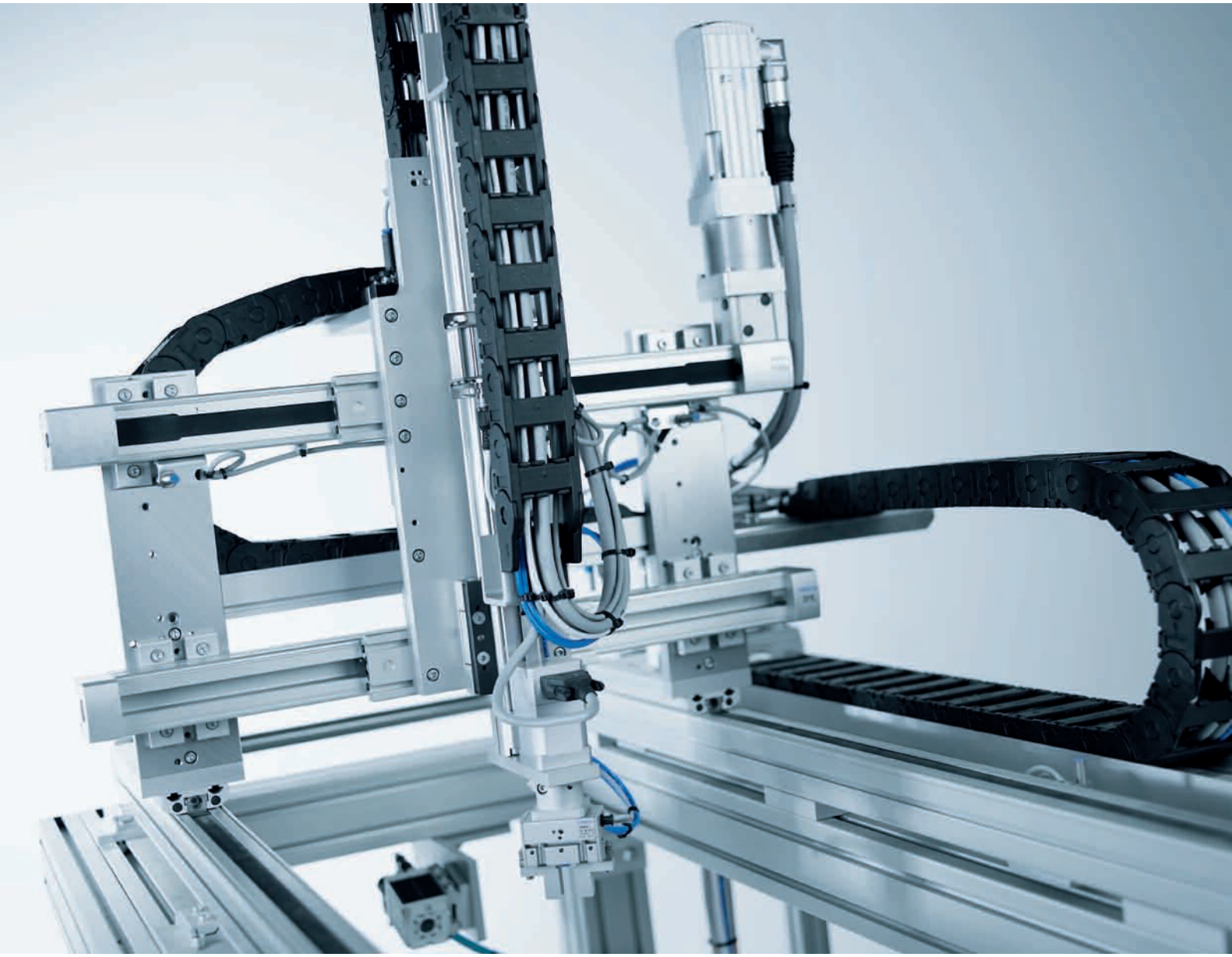
Glossary

The terminology of electrical drives



Automation with electrical drives requires specialist knowledge and has a language all of its own. Festo publish a 200 page dictionary of terminology which is available to all customers upon request.

Here we have taken a look at a few of the of the most commonly used terms.

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Glossary

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Absolute measuring system
With an absolute measuring system, there is always a fixed reference point and the position of the axis is measured relative to this. This is like a ruler, with which you know where the zero point is and can then read off, for example, 25.4 millimeters. Cf. “Incremental measuring system”.

Absolute positioning
Absolute positioning always uses a zero point as a fixed reference point and positioning is carried out relative to this, i.e. you travel from position 80 mm to position 95 mm. Cf. “Incremental positioning “.

AC
Abbreviation for “alternating current”. Indicates the sinusoidal voltage which is available through power sockets all over the world to power electrical devices.

Brushless and brush-type motors
Electric motors develop power through the attraction of two magnetic fields. One of these magnetic fields is able to rotate, which means that when this magnetic field is activated, the motor turns. The greatest power is obtained from an electric motor if the two magnetic fields act on each other at right angles. In order to achieve this, one magnetic field must be switched appropriately. This is done with carbon brushes in the case of brush-type motors and via the motor electronics in the case of brushless motors.

Closed-loop control
Closed-loop control means that a controlled variable is measured and an electronic controller reacts as appropriate to this measurement. A closed-loop controller automatically detects external influences and can react in such a way as to eliminate errors. Strictly speaking, closed-loop control is when the controlled variable is measured directly, as is the case, for example, with a displacement encoder on the carriage of a linear axis. We use the term “semi-closed-loop control” for cases where there is an additional mechanism between the measuring system and the controlled variable, for example in the case of a toothed-belt axis with a servo motor, where the measuring system is located on the motor and the toothed belt is between this and the carriage. The opposite of closed-loop control is open-loop control, where there is no feedback of the controlled variable.

Control circuit
The control circuit is normally used to provide a power supply for electronic devices, such as logic components, measuring systems, switches and displays. The control circuit should be routed separately from the load circuit.

Controller
A controller or programmable logic controller (PLC) is an electronic device which processes all its inputs within a defined period and sets its outputs accordingly.

DC
The abbreviation for “direct current”. This is the type of current supplied by batteries.

Direct drive
A direct drive is a special design of motor which can generate very high forces at low speeds. This gives very high acceleration and reduces cycle times. With a direct drive, the load to be moved is mounted directly on the motor without any transmission or other mechanical components. This technology is available in the form of rotary direct drives (torque motors) and linear direct drives (linear motors).

Electronic brake
An electronic brake function is produced by a motor controller which switches a motor to act like a generator and thus generate electricity and convert the mechanical energy of rotary motion into electrical energy. This energy conversion process slows the motor down but cannot be used to block the motor and stop it completely.

Emergency-stop circuit
The purpose of an emergency-stop circuit is to bring a machine into a safe state if a hazard is detected. This generally means first braking all motions to a standstill and then shutting off the power supply. The motor controllers CMMS, SFC and SEC has an input which can be used to obtain the fastest possible braking. The power supply is shut off within the customer’s system.

Encoder
An encoder is an optical or magnetic measuring system which outputs a certain number of pulses after a defined motion. With electric motors, the encoders used usually output 1000 to 4000 pulses per revolution.

Field bus
Field buses offer serial interfaces to provide communication between the various types of electronic devices within a system. They are standardized with regard to technical data, software and reaction time, thus allowing electronic devices made by different manufacturers to be combined in any desired way. The field bus systems offered for motor controllers are CAN, Profibus, and DeviceNet.

Frequency converter
A frequency converter is an electronic device which is used to provide an adjustment facility for the speed of a three-phase motor. With this device, speed can be controlled but it is not possible to approach positions. This requires the addition of a master controller and a measuring system.

Holding brake
The brakes used in handling systems are

Glossary

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usually holding brakes, i.e. they can hold an axis at a standstill. It is usually possible for a holding brake to bring a motion axis to a standstill a number of times in the case of a power supply failure.

Incremental measuring system
With an incremental measuring system, there is no fixed zero point. It is first necessary to execute a reference travel motion to define a zero point before it is possible to approach an absolute position. Cf. “Absolute measuring system”.

Incremental positioning
With incremental positioning, travel is relative to the current position, e.g. you specify that an axis should travel on a further 10 mm. Cf. “Absolute positioning”.

Load circuit
A load circuit is used to provide large currents for motors. These are fed to the power stages of the electronic controllers, which then supply the motors. In many cases, only the load circuit is switched off in the case of an emergency stop, leaving the control circuit switched on. In this way, the position of an axis is known at all times. This can be done with the motor controllers CMMS, SFC and SEC.

Linear motor
See “Direct drive”.

Motor controller
A motor controller is a frequency converter fitted with an additional controller. This allows a selective approach to various positions. We offer the motor controllers CMMS, SFC and SEC.

Open-loop control
We speak of open-loop control when an electronic controller feeds a signal to a motor and does not receive a feedback signal to say whether the position in question has been reached. All stepper motors without encoders operate in this way, which offers an adequate degree of safety as long as the peak torque of motor is not reached.

PNP and NPN logic
In Europe, logic inputs and outputs are wired using PNP logic, i.e. switching is from + via the load to –. With NPN logic, switching is from – via the load to +. The reason for this is partly historical but also safety-related. With NPN logic, there is a large number of terminals connected directly to the + conductor. If there is a short circuit from one of these terminals to a housing or –, no output will then work. If the same thing happens with PNP logic, the output transistor concerned will be destroyed but all the other inputs and outputs will continue to work.

Real-time capability
Real-time capability indicates that the reaction times of an electronic device or field bus lie within a certain period. In order to state this capability clearly, it is necessary to know the required reaction time. A modern controller processes all its inputs and outputs within 10 to 20 ms and thus has a reaction time within this period.

Resolver
A resolver is an inductive measuring system. Its functional principle is like that of a generator, i.e. a sinusoidal voltage is generated with a frequency which is directly dependent on the speed. The resolver electronics can use this frequency to determine the speed, acceleration and position.

Servo motor
“Servo” indicates closed-loop control. A servo motor has a built-in measuring system, so that the motor position is known accurately at all times. This allows external forces to be detected and compensated for and makes it possible to achieve very high accuracy.

Stepper motor
A stepper motor is a specially designed motor which advances in individual steps. Due to this stepwise advance, operation is relatively loud, but the motor does not vibrate when at a standstill. Normal stepper motors are not fitted with measuring systems. The motor is open-loop-controlled and not closed-loopcontrolled, with the result that it is relatively inaccurate.

Three-phase current
Three-phase current is a special form of alternating current which is transmitted via three conductors plus a neutral conductor (return conductor). It is used to drive particularly powerful electric motors and machines.

Torque motor
See “Direct drive”. We should not use this term, since it is also sued for the main drives of machines. For our applications, the term “rotary direct drive” is more suitable.