



Servodrives | Servomotors

Digital AC-Servodrives

AC Servodrives with integrated safety functions

Main Characteristics Servo Drives

- Compact device for control cabinet installation
- With power supply unit for direct connection to 230 V or $3 \times 400/480$ V AC (wide-range inputs)
- Integrated safety system, wear-free, two-channel (category 1-4 according to EN 954-1); PL e acc. to ISO 13849-1 or SIL 3 acc. to IEC 61800-2 in preparation
- Digital servo drive with 2 processors
- High dynamics and control quality due to signal processor for the digital control of current and speed (controller cycle time 62.5 μ s)
- Position control (cycle time 1 ms, shorter cycle times on request) integrated
- Setting of the target positions via field bus (depending on the type) or positioning control with 500 blocks (option)
- Extensive technology functions, axis coupling (synchronization, electronic gearing, optionally flying shear) integrate
- Communication via field bus or RS 232C serial interface according to DRIVECOM Profile 22
- 8 digital inputs, 4 digital outputs
- 2 analog inputs, 2 analog outputs (option)
- Additional interfaces as an option (e. g. Modbus)
- Comfortable commissioning via PC
- Mains filter and shunt circuit integrated
- Easy wiring, as all connections can be plugged in at the front, at the top, or at the bottom
- UL certification in preparation

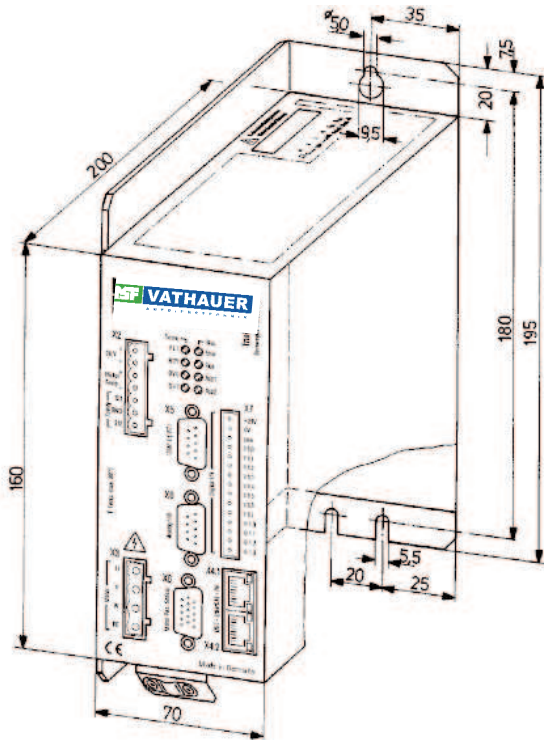
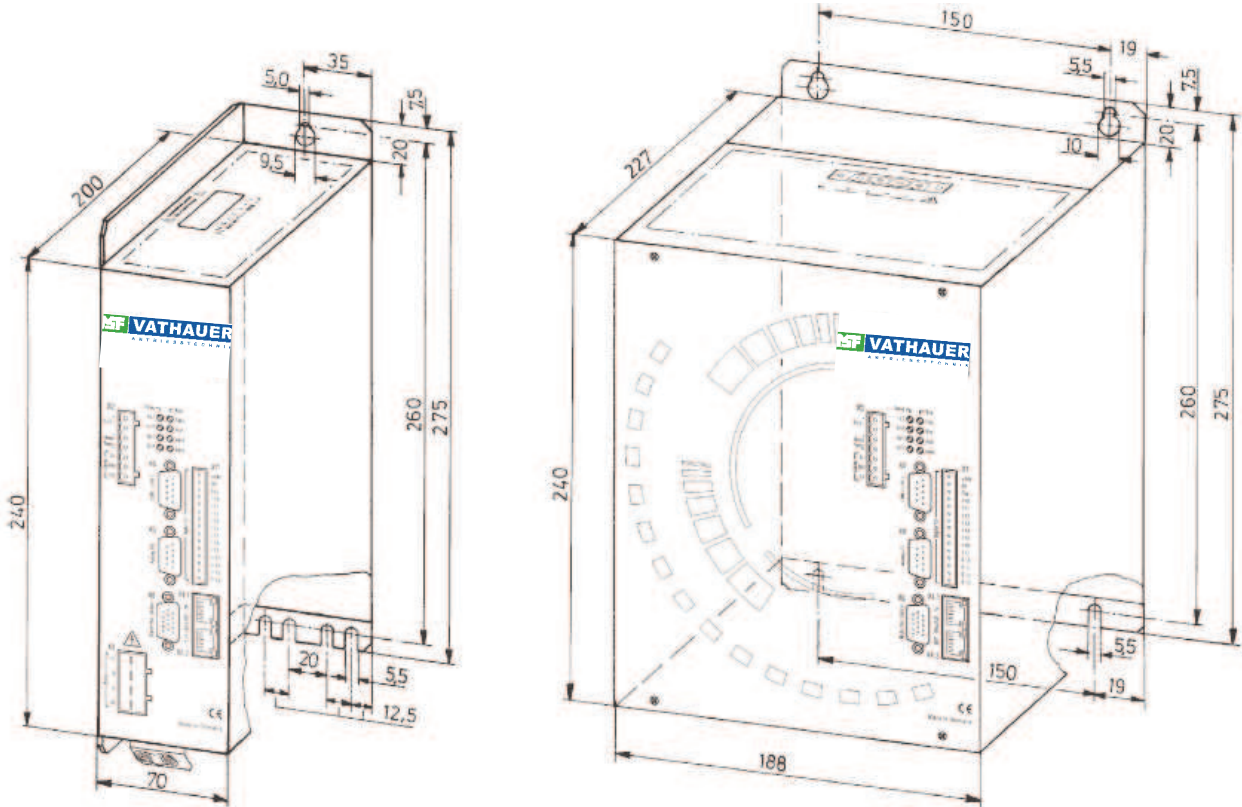
Main Characteristics Servo Motors

- Maintenance-free, since brushless
- High dynamics
- Wide speed control range
- IP 65 protection
- Insulation according to class F, DIN VDE 0530, withstanding tropical conditions
- High power-density due to rotor with rare earth permanent magnets
- Ball bearings with grease filling for 20,000 operating hours
- Integrated resolver for sinusoidal commutation, optionally optical position sensors (incremental or absolute, single- or multi-turn) for highest dynamics and accuracy
- Thermal protection by integrated PTC thermistor
- Connection of motor and position sensor via connectors
- Self-cooling
- Design with flange according to DIN 42 677, any mounting position
- Bearing plates and housings made of high-quality light-metal alloy
- Rotor dynamically balanced
- Standard shaft end without groove, special version possible, e. g. with keyway
- Special motors, e. g. short motors, hollow-shaft motors

Main Characteristics Gearboxes

- Single- or multi-stage planetary gears, low backlash on request, gear ratio 1 : 3 to 1 : 175
- Worm gear, ratio 1 : 6 to 1 : 208
- Output torques of up to 2400 Nm
- Special gearboxes, e. g. spur gear and bevel gearings, hollow-shaft gears

Dimension



Interfaces of the Servo Drives

LEDs are provided at the front panel. All connections can be plugged at the front panel, the top side and, for devices with higher power, at the bottom side. Combicon connectors are available for the easy connection of:

- power supply and external shunt resistor
- motor
- control supply voltage 24 V
- protective earth PE
- safety system

Depending on the application, the following can be connected additionally via the Combicon connectors:

- 8 digital inputs and 4 digital output
- motor temperature sensor (if not connected via the connector of the motor position sensor)

D sub connectors are provided at the front panel for the connection of:

- motor position sensor (resolver as standard, optionally optical motor position sensors, see type code on the last page of this data sheet)
- COM1 (RS 232C) for connecting a PC
- analog inputs and outputs (partly optional)

Input or output encoder signals (Input encoder signals is provided for axis coupling (synchronization, electronic gearing, flying shear), external position sensor, or pilot frequency mode; output encoder signals for encoder emulation).

Depending on the equipment, an optional additional interface can be installed at the top:

- additional incremental encoder output (option)
- additional input encoder signals (option)
- additional EnDat interface (option)
- additional CAN interface (option)
- additional Modbus interface (option)

If required, we also supply connection cables (ready-assembled, as well), connector sets, and other accessories.

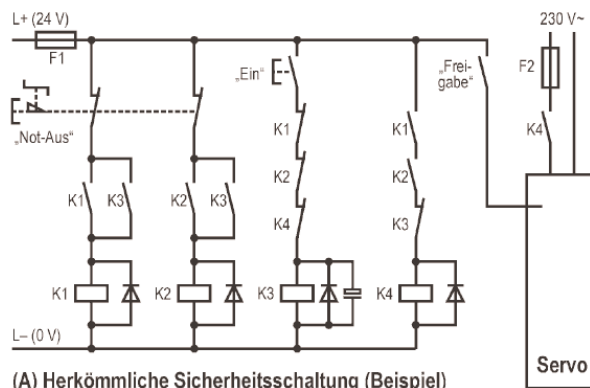
Servo Motors

The servo motors described here are permanentmagnet three-phase synchronous motors. The stator carries the 3-phase winding, the rotor is equipped with rare earth magnets at its surface. As the winding is located in the stator, the heat developing there can easily be dissipated via the surface.

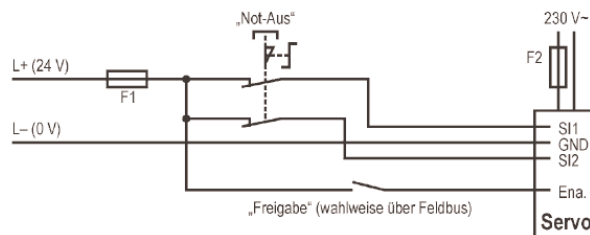
As standard, the motors are delivered for flange mounting. The standard position sensor of the motors is a resolver. For applications with particularly high requirements to the positioning accuracy, an optical motor position sensor can be used instead of a resolver (system accuracy $\pm 15'$) optionally:

- sincos (Hiperface) encoder¹ with 512 or 1024 sine periods (system accuracy $\pm 60''$ or $\pm 30''$ respectively)
- high-resolution incremental encoder with 512 or 2048 sine periods (system accuracy $\pm 60''$ or $\pm 20''$ respectively)²
- EnDat encoder¹ with 512 or 2048 sine periods (system accuracy $\pm 60''$ or $\pm 20''$ respectively)
- incremental encoder (square-wave signals) with 1024, 2048, or 4096 pulses (system accuracy $\pm 64''$, $\pm 32''$, or $\pm 16''$ respectively)

For further information on the motor position sensor, see the type code of the servo drive on the back of this data sheet as well as the data sheets for the servo motors. For protection against overheating, the motors are equipped with a temperature sensor which is evaluated in the servo drive.



(A) Herkömmliche Sicherheitsschaltung (Beispiel)



(B) Sicherheitsschaltung mit integrierter Sicherheitstechnik (Prinzip)

Monitoring functions

The servo drives are equipped with several monitoring functions which ensure trouble-free operation even in case of external faults. The drives are equipped with protective circuits against e. g.

- short circuit between motor phases
- earth leakage of one or several motor phases
- overtemperature of drive and motor
- mains overvoltage
- faults in the resolver voltages
- blocking of the motor
- mains voltage failure or shutoff
- different voltages at the safety inputs

These or other faults are stored. If the cause of the fault has been eliminated, the motor cannot run unless the fault memory has been reset from outside.

The following functions have been realized for the monitoring or protection of the machine:

- limit switch functions
- I²t current limiting

Functions of the Servo Drives

Operating modes

The servo drives can be used in a wide range of applications. For that, different operating modes such as torque mode, target position mode, or program mode can be selected via software. There are two large groups of operating modes:

- command mode and
- program mode (option)

Command mode

In command mode, individual movements can be specified via different interfaces. In this mode, the following axis operating modes are available as sub-modes:

- torque mode
- velocity mode
- target position mode,
- homing mode,
- electronic gearing,
- flying shear

In these axis operating modes, depending on the device, one of the following interfaces can be selected as setpoint source:

- EtherCAT or Ethernet interface
- Profibus interface
- CANopen® interface
- analog input (axis operating modes torque and velocity mode)
- input encoder signals (optional) (axis operating modes electronic gearing, flying shear)
- COM1 (RS 232C) serial interface
- Modbus (option) (RS 232 / RS 422 / RS 485)

The behavior of the drive in the different axis operating modes can be adapted to the application via machine data. Thus, e. g. acceleration and deceleration ramps can be set independent of each other (with trapezoidal or $\sin^2(t)$ ramps, if required).

Program mode

The program mode is available as an option. For that, a positioning control is integrated into the device running a part program which can communicate with other controls via various interfaces. This can be used to integrate the drive in the overall function of the machine. The part programs consist of single lines, also called blocks. The part program memory has a capacity of 500 blocks on which any number of part programs can be distributed. The block type determines the function of the individual block. Essential block types in the part program are:

- positioning
- feedforward
- machine functions (set outputs)
- going to home position
- jump to label
- jump on input (bit pattern)
- wait for input (bit pattern)
- program part repetition
- jump to/return from subroutine

The values for positions, speeds, etc. can either be defined directly in the block or via variables which can be changed at any time via the communication interfaces. Part programs can be written comfortably with the SPP Windows software.

Machine data

The parameters of the drive are set via so-called machine data. These data are stored in the servo drive in a way that they are protected against power failure. The machine data include e. g.:

- axis type (linear, round, continuous)
- motion profile type (linear, \sin^2) and slope
- factors for adapting position and speed values to physical units, e. g. μm , m/min
- control-loop parameters
- software limit switches
- in-position window
- behavior of control outputs

Most machine data can be changed during operation via the communication interfaces, e. g. for adapting ramps or controllers to different operating conditions.

Communication

Field bus (EtherCAT, Ethernet, Profibus DP, or CANopen®)

The servo drives are equipped with a field bus interface. All parameters of the servo drive can be transmitted via this interface:

- control and status information
- setpoints and actual values
- machine data
- part programs
- variables

The dynamically changing parameters (control and status information, rated and actual values) are transmitted cyclically via the process data channel. The other parameters are transmitted via the parameter channel.

EtherCAT or Ethernet interface

The servo drives are equipped with an EtherCAT interface. Optionally, these devices can be equipped with an Ethernet interface for TCP/IP communication.

Profibus DP interface

The servo drives are equipped with a Profibus DP interface. For sending and receiving, up to 16 bytes are available in the process data channel.

CANopen® interface

The servo drives are equipped with a CANopen® interface. The EDS file for these devices can be created with SPP Windows.

DRIVECOM profile 22 and CiA 402

Common parameters of a positioning drive were standardized by the DRIVECOM user group in profile 22 and by CAN in Automation (CiA®) in drive profile CiA 402. MSF was actively involved in the development of these standards, and the servo drives have been developed according to these profiles. The DRIVECOM profile 22 is used for all fieldbus interfaces. This guarantees a standardized parameter access independent of the bus system

Serial interface and Modbus

All parameters of the drive can be transmitted via the serial interface (RS 232C or Modbus RS 232 / RS 422 / RS 485, see below). For that, the DRIVECOM profile 22 parameters are used there, as well. Therefore, users working only with the serial interface at the beginning can make use of the knowledge acquired there in case of a future application of a fieldbus.

Analog interface

The servo drives are equipped with an analog interface. These devices are particularly suitable for multi-axis applications with higher-level controller (CNC) or as master and slave axis in synchronization applications (axis coupling).

Additional interfaces

In addition to the standard communication interfaces, all servo drives can be equipped with an additional interface (e. g. Modbus) for connecting other peripheral devices.

Commissioning and Software

The servo drives are delivered ready for operation. For commissioning, a PC can be connected via serial interface COM1. Alternatively, the PC can be connected via the fieldbus interface;

Command and commissioning software SPP Windows

For easy operation and commissioning of the servo drives using a PC: input and modification of machine data and part programs, control of the drives in all operating mode for commissioning purposes. Control-loop parameters can be set comfortably using oscilloscope functions. Options for archiving and documenting data complete the scope of functions.

Function blocks

For an easy integration of the servo drives into automation systems with Simatic S7 and compatible controllers as well as controllers programmed according to IEC 61131-3, e. g. Beckhoff TwinCAT, other controllers on request. The function blocks are based on PLCopen specification "Function blocks for motion control".

Supported functions:

- parameterization of the servo drives by the controller (e. g. after switch-on)
- triggering of movements (relative/absolute positioning, going to home position, speed setting ...)
- influencing the positioning control integrated in the drive (part program)
- input and output of binary signals (software inputs/ outputs)
- example programs for using the function library as a basis for the development of own programs

Drivers and DLL libraries

Drivers and DLL libraries are available for developing own application programs under Windows.

Example programs with documented source code can be used as a basis for the development of own programs.

Accessories

- Motor supply cables and encoder connection cables (also available as ready-assembled cables)
- Motor chokes (for long motor supply cables)
- Connector sets consisting of D sub male or female connectors, including screwable housings, and the Combicon connectors
- Field bus connection cables
- External shunt resistor (for special applications in which the internal shunt resistor is not sufficient)

Rated supply voltage	230 V AC $\pm 10\%$, 50 .. 60 Hz			
Rated DC-bus voltage	320 V DC			
Permissible supply voltage	85 .. 253 V AC (corresponds to 115 .. 340 V DC-bus voltage)			
Rated current (rms)	0.8 A	2 A	4 A	6 A
Pulse current (crest value)	3.4 A	8.5 A	17 A	25.5 A
Rated electrical power	0.3 kVA	0.75 kVA	1.5 kVA	2.1 kVA
Efficiency**	94.2%	96.0%	97.2%	97.6%
Switching frequency of power circuit	16 kHz			
Control supply voltage	24 V DC $\pm 20\%$, 0.4 A			
Safety system inputs	24 V DC $\pm 20\%$, 2 \times 0.1 A			
Width \times Height \times Depth***	70 mm \times 195 mm \times 200 mm			
Weight	1.6 kg			

Rated supply voltage	3 \times 400/480 V AC $\pm 10\%$, 50 .. 60 Hz				
Rated DC-bus voltage	560/680 V DC				
Permissible supply voltage	90 .. 528 V AC (corresponds to 125 .. 740 V DC-bus voltage)				
Rated current (rms)	2 A	4 A	8 A	16 A	32 A
Pulse current (crest value)	5.5 A	11 A	22 A	45 A	90 A
Rated electrical power	1.4 kVA	2.7 kVA	5.5 kVA	11 kVA	22 kVA
Efficiency**	96.7%	97.3%	97.8%	97.7%	97.9%
Switching frequency of power circuit	8 or 16 kHz (to be selected)				
Control supply voltage	24 V DC $\pm 20\%$, 0.5 A			24 V DC $\pm 20\%$, 1.1 A	
Safety system inputs	24 V DC $\pm 20\%$, 2 \times 0.1 A			24 V DC $\pm 20\%$, 2 \times 0.15 A	
Width \times Height \times Depth***	70 mm \times 275 mm \times 200 mm			190 mm \times 275 mm \times 227 mm	
Weight	2.8 kg			10.0 kg	

AC Servo Motors	MR 74	MR 75	MR 77	MR 6
Protection class	IP 65	IP 54 (without housing)	IP 54 (IP 65 optional)	IP 54 (IP 65 optional)
Flange dimension	37 .. 240 mm	55 .. 140 mm	40 .. 188 mm	37 .. 190 mm
Rated speed	2,000 .. 6,000 r.p.m.	3,000 r.p.m.	1,000 .. 8,000 r.p.m.	2,000 .. 7,000 r.p.m.
Rated torque	0.1 .. 70 Nm	0.4 .. 33 Nm	0.2 .. 43.5 Nm	0.05 .. 23 Nm
Stall torque	0.1 .. 115 Nm	0.5 .. 45 Nm	0.2 .. 53 Nm	0.1 .. 32 Nm
Shaft power	0.05 .. 15.7 kW	0.15 .. 10.5 kW	0.14 .. 7.5 kW	0.04 .. 7.2 kW
Data sheet	6674.260	6675.260	6677.260	6612.264

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