# 22.1 Overview

Synchronous servo motors with single tooth winding

**Torques of motors with convection cooling**

| | |
|---|---|
| $M_N$ | 0.89 – 43.7 Nm |
| $M_0$ | 1 – 66.1 Nm |

**Torques of motors with forced ventilation**

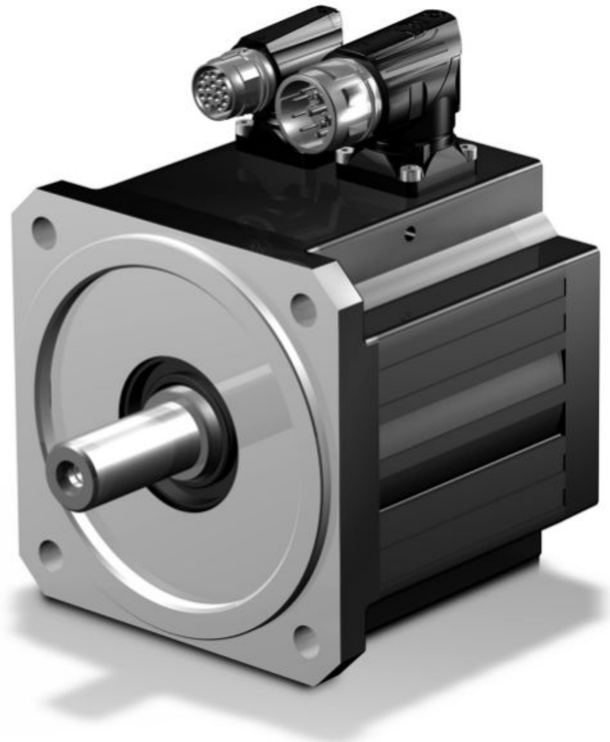
| | |
|---|---|
| $M_N$ | 2.9 – 77.2 Nm |
| $M_0$ | 3.5 – 94 Nm |

**Torques of motors with water cooling**

| | |
|---|---|
| $M_N$ | 2.6 – 72.1 Nm |
| $M_0$ | 3.4 – 90.1 Nm |

**Features**

| | |
|---|---|
| Highly dynamic (increased mass moment of inertia optionally available) | ✓ |
| Short length | ✓ |
| Super compact due to tooth winding technology with the highest possible copper fill factor | ✓ |
| Backlash-free holding brake (optional) | ✓ |
| Electronic nameplate for fast and reliable commissioning | ✓ |
| Convection cooling, forced ventilation (optional) or water cooling (optional) | ✓ |
| Optical, inductive EnDat absolute value encoder or resolver | ✓ |
| Multiturn absolute value encoders (optional) eliminate the need for referencing | ✓ |
| Rotating plug connectors with quick lock | ✓ |



EZ



# 22.2 Selection tables

The technical data specified in the selection tables applies for:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0° C to 40° C
- Operation on a STOBER drive controller
- DC link voltage $U_{ZK}$ = DC 540 V
- Paint black matte as per RAL 9005

In addition the technical data apply to an uninsulated design with the following thermal mounting conditions:

| Motor type | Steel mounting flange dimensions (thickness x width x height) | Convection surface Steel mounting flange |
|---|---|---|
| EZ3 – EZ5 | 23 x 210 x 275 mm | 0.16 $m^2$ |
| EZ7 – EZ8 | 28 x 300 x 400 mm | 0.3 $m^2$ |

Note the differing ambient conditions in section [ 22.7.3]

| Formula symbols | Unit | Explanation |
|---|---|---|
| $I_0$ | A | Standstill current: RMS value of the line-to-line current with standstill torque $M_0$ generated (Tolerance ±5 %) |
| $I_{max}$ | A | Maximum current: RMS value of the maximum permitted line-to-line current with maximum torque $M_{max}$ generated (tolerance ±5 %). |
| | | Exceeding $I_{max}$ may lead to irreversible damage (demagnetization) of the rotor. |
| $I_N$ | A | Nominal current: RMS value of the line-to-line current with nominal torque $M_N$ generated (tolerance ±5 %) |
| $J_{dyn}$ | $10^{-4}kgm^2$ | Mass moment of inertia of a motor in the dynamic version |
| $\Delta J$ | $kgm^2$ | Additive mass moment of inertia of a motor with increased mass moment of inertia |
| $K_{EM}$ | V/rpm | Voltage constant: peak value of the induced motor voltage at a speed of 1000 rpm and a winding temperature $\Delta\vartheta$ = 100 K (tolerance ±10 %) |
| $K_{M0}$ | Nm/A | Torque constant: ratio of the standstill torque and frictional torque to the standstill current; $K_{M0} = (M_0 + M_R) / I_0$ (tolerance ±10 %) |
| $K_{M,N}$ | Nm/A | Torque constant: ratio of the nominal torque $M_N$ to the nominal current $I_N$; $K_{M,N} = M_N / I_N$ (tolerance ±10 %) |
| $L_{U-V}$ | mH | Winding inductance of a motor between two phases (determined in the oscillating circuit) |
| $m_{dyn}$ | kg | Weight of a motor in the dynamic version |
| $\Delta m$ | kg | Additive weight of a motor with increased mass moment of inertia |
| $M_0$ | Nm | Standstill torque: the torque the motor is able to deliver long term at a speed of 10 rpm (tolerance ±5 %) |
| $M_{max}$ | Nm | Maximum torque: the maximum permitted torque the motor is able to deliver briefly (when accelerating or decelerating) (tolerance ±10 %) |
| $M_N$ | Nm | Nominal torque: the maximum torque of a motor in S1 mode at nominal speed $n_N$ (tolerance ±5 %) |
| | | You can calculate other torques as follows: $M_{N*} = K_{M0} \cdot I^* – M_R$. |
| $M_R$ | Nm | Frictional torque (of the bearings and sealings) of a motor at winding temperature $\Delta\vartheta$ = 100 K |



| Formula symbols | Unit | Explanation |
|---|---|---|
| $n_N$ | rpm | Nominal speed: the speed for which the nominal torque $M_N$ is specified |
| $P_N$ | kW | Nominal output: the output the motor is able to deliver long term in S1 mode at the nominal point (tolerance ±5 %) |
| $R_{U-V}$ | Ω | Winding resistance of a motor between two phases at a winding temperature of 20 °C |
| $T_{el}$ | ms | Electrical time constant: ratio of the winding inductance to the winding resistance of a motor: $T_{el} = L_{U-V} / R_{U-V}$ |
| $U_{ZK}$ | V | DC link voltage: characteristic value of a drive controller |



## 22.2.1 EZ motors with convection cooling

| Type | $K_{EM}$ [V/1000 rpm] | $n_N$ [rpm] | $M_N$ [Nm] | $I_N$ [A] | $K_{M,N}$ [Nm/A] | $P_N$ [kW] | $M_0$ [Nm] | $I_0$ [A] | $K_{M0}$ [Nm/A] | $M_R$ [Nm] | $M_{max}$ [Nm] | $I_{max}$ [A] | $R_{U-V}$ [Ω] | $L_{U-V}$ [mH] | $T_{el}$ [ms] | $J_{dyn}$ [$10^{-4}$ kgm²] | $m_{dyn}$ [kg] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EZ301U | 40 | 6000 | 0.89 | 1.93 | 0.46 | 0.56 | 0.95 | 2.02 | 0.49 | 0.04 | 2.80 | 12.7 | 11.70 | 39.80 | 3.40 | 0.19 | 1.50 |
| EZ301U | 40 | 3000 | 0.93 | 1.99 | 0.47 | 0.29 | 0.95 | 2.02 | 0.49 | 0.04 | 2.80 | 12.7 | 11.70 | 39.80 | 3.40 | 0.19 | 1.50 |
| EZ302U | 42 | 6000 | 1.50 | 3.18 | 0.47 | 0.94 | 1.68 | 3.48 | 0.49 | 0.04 | 5.00 | 17.8 | 4.50 | 18.70 | 4.16 | 0.29 | 2.10 |
| EZ302U | 86 | 3000 | 1.59 | 1.60 | 0.99 | 0.50 | 1.68 | 1.67 | 1.03 | 0.04 | 5.00 | 8.55 | 17.80 | 75.00 | 4.21 | 0.29 | 2.10 |
| EZ303U | 55 | 6000 | 1.96 | 3.17 | 0.62 | 1.2 | 2.25 | 3.55 | 0.65 | 0.04 | 7.00 | 16.9 | 4.90 | 21.10 | 4.31 | 0.40 | 2.60 |
| EZ303U | 109 | 3000 | 2.07 | 1.63 | 1.27 | 0.65 | 2.19 | 1.71 | 1.30 | 0.04 | 7.00 | 8.25 | 13.10 | 68.70 | 5.24 | 0.40 | 2.60 |
| EZ401U | 47 | 6000 | 2.30 | 4.56 | 0.50 | 1.4 | 2.80 | 5.36 | 0.53 | 0.04 | 8.50 | 33.0 | 1.94 | 11.52 | 5.94 | 0.93 | 4.00 |
| EZ401U | 96 | 3000 | 2.80 | 2.74 | 1.02 | 0.88 | 3.00 | 2.88 | 1.06 | 0.04 | 8.50 | 16.5 | 6.70 | 37.70 | 5.63 | 0.93 | 4.00 |
| EZ402U | 60 | 6000 | 3.50 | 5.65 | 0.62 | 2.2 | 4.90 | 7.43 | 0.66 | 0.04 | 16.0 | 43.5 | 1.20 | 8.88 | 7.40 | 1.63 | 5.10 |
| EZ402U | 94 | 3000 | 4.70 | 4.40 | 1.07 | 1.5 | 5.20 | 4.80 | 1.09 | 0.04 | 16.0 | 26.5 | 3.00 | 21.80 | 7.26 | 1.63 | 5.10 |
| EZ404U | 78 | 6000 | 5.80 | 7.18 | 0.81 | 3.6 | 8.40 | 9.78 | 0.86 | 0.04 | 29.0 | 51.0 | 0.89 | 7.07 | 7.94 | 2.98 | 7.20 |
| EZ404U | 116 | 3000 | 6.90 | 5.80 | 1.19 | 2.2 | 8.60 | 6.60 | 1.31 | 0.04 | 29.0 | 35.0 | 1.85 | 15.00 | 8.11 | 2.98 | 7.20 |
| EZ501U | 68 | 6000 | 3.40 | 4.77 | 0.71 | 2.1 | 4.40 | 5.80 | 0.77 | 0.06 | 16.0 | 31.0 | 2.10 | 12.10 | 5.76 | 2.90 | 5.00 |
| EZ501U | 97 | 3000 | 4.30 | 3.74 | 1.15 | 1.4 | 4.70 | 4.00 | 1.19 | 0.06 | 16.0 | 22.0 | 3.80 | 23.50 | 6.18 | 2.90 | 5.00 |
| EZ502U | 72 | 6000 | 5.20 | 7.35 | 0.71 | 3.3 | 7.80 | 9.80 | 0.80 | 0.06 | 31.0 | 59.0 | 0.76 | 5.60 | 7.37 | 5.20 | 6.50 |
| EZ502U | 121 | 3000 | 7.40 | 5.46 | 1.36 | 2.3 | 8.00 | 5.76 | 1.40 | 0.06 | 31.0 | 33.0 | 2.32 | 16.80 | 7.24 | 5.20 | 6.50 |
| EZ503U | 84 | 6000 | 6.20 | 7.64 | 0.81 | 3.9 | 10.6 | 11.6 | 0.92 | 0.06 | 43.0 | 63.5 | 0.62 | 5.00 | 8.06 | 7.58 | 8.00 |
| EZ503U | 119 | 3000 | 9.70 | 6.90 | 1.41 | 3.1 | 11.1 | 7.67 | 1.46 | 0.06 | 43.0 | 41.0 | 1.25 | 10.00 | 8.00 | 7.58 | 8.00 |
| EZ505U | 103 | 4500 | 9.50 | 8.94 | 1.06 | 4.5 | 15.3 | 13.4 | 1.15 | 0.06 | 67.0 | 73.0 | 0.50 | 4.47 | 8.94 | 12.2 | 10.9 |
| EZ505U | 141 | 3000 | 13.5 | 8.80 | 1.53 | 4.2 | 16.0 | 10.0 | 1.61 | 0.06 | 67.0 | 52.0 | 0.93 | 8.33 | 8.96 | 12.2 | 10.9 |
| EZ701U | 76 | 6000 | 5.20 | 6.68 | 0.78 | 3.3 | 7.90 | 9.38 | 0.87 | 0.24 | 20.0 | 31.0 | 0.87 | 8.13 | 9.34 | 8.50 | 8.30 |
| EZ701U | 95 | 3000 | 7.40 | 7.20 | 1.03 | 2.3 | 8.30 | 8.00 | 1.07 | 0.24 | 20.0 | 25.0 | 1.30 | 12.83 | 9.87 | 8.50 | 8.30 |
| EZ702U | 82 | 6000 | 7.20 | 8.96 | 0.80 | 4.5 | 14.3 | 16.5 | 0.88 | 0.24 | 41.0 | 60.5 | 0.34 | 3.90 | 11.47 | 13.7 | 10.8 |
| EZ702U | 133 | 3000 | 12.0 | 8.20 | 1.46 | 3.8 | 14.4 | 9.60 | 1.53 | 0.24 | 41.0 | 36.0 | 1.00 | 11.73 | 11.73 | 13.7 | 10.8 |
| EZ703U | 99 | 4500 | 12.1 | 11.5 | 1.05 | 5.7 | 20.0 | 17.8 | 1.14 | 0.24 | 65.0 | 78.0 | 0.36 | 4.42 | 12.28 | 21.6 | 12.8 |
| EZ703U | 122 | 3000 | 16.5 | 11.4 | 1.45 | 5.2 | 20.8 | 14.0 | 1.50 | 0.24 | 65.0 | 62.0 | 0.52 | 6.80 | 13.08 | 21.6 | 12.8 |
| EZ705U | 106 | 4500 | 16.4 | 14.8 | 1.11 | 7.7 | 30.0 | 25.2 | 1.20 | 0.24 | 104 | 114 | 0.22 | 2.76 | 12.55 | 34.0 | 18.3 |
| EZ705U | 140 | 3000 | 21.3 | 14.2 | 1.50 | 6.7 | 30.2 | 19.5 | 1.56 | 0.24 | 104 | 87.0 | 0.33 | 4.80 | 14.55 | 34.0 | 18.3 |
| EZ802U | 90 | 4500 | 10.5 | 11.2 | 0.94 | 5.0 | 34.5 | 33.3 | 1.05 | 0.30 | 100 | 135 | 0.13 | 1.90 | 14.60 | 58.0 | 26.6 |
| EZ802U | 136 | 3000 | 22.3 | 13.9 | 1.60 | 7.0 | 37.1 | 22.3 | 1.68 | 0.30 | 100 | 84.0 | 0.30 | 5.00 | 16.66 | 58.0 | 26.6 |
| EZ803U | 131 | 3000 | 26.6 | 17.7 | 1.50 | 8.4 | 48.2 | 31.1 | 1.56 | 0.30 | 145 | 124 | 0.18 | 2.79 | 15.50 | 83.5 | 32.7 |
| EZ805U | 142 | 2000 | 43.7 | 25.9 | 1.69 | 9.2 | 66.1 | 37.9 | 1.75 | 0.30 | 205 | 155 | 0.13 | 2.22 | 17.08 | 133 | 45.8 |

### Additional values in the version with increased mass moment of inertia

| Type | ΔJ [$10^{-4}$ kgm²] | Δm [kg] |
|---|---|---|
| EZ301 | – | – |
| EZ302 | – | – |
| EZ303 | – | – |
| EZ401 | 0.2 | 0.08 |
| EZ402 | 0.4 | 0.15 |
| EZ404 | 0.8 | 0.31 |
| EZ501 | – | – |
| EZ502 | 1.1 | 0.22 |
| EZ503 | 2.0 | 0.43 |
| EZ505 | 4.1 | 0.87 |
| EZ701 | – | – |
| EZ702 | 4.4 | 0.41 |
| EZ703 | 6.3 | 0.81 |
| EZ705 | 13.6 | 1.6 |
| EZ802 | 14.9 | 1.3 |
| EZ803 | 22.3 | 1.9 |
| EZ805 | 37.2 | 3.2 |



STÖBER

## 22.2.2 EZ motors with forced ventilation

| Type | $K_{EM}$ [V/1000 rpm] | $n_N$ [rpm] | $M_N$ [Nm] | $I_N$ [A] | $K_{M,N}$ [Nm/A] | $P_N$ [kW] | $M_0$ [Nm] | $I_0$ [A] | $K_{M0}$ [Nm/A] | $M_R$ [Nm] | $M_{max}$ [Nm] | $I_{max}$ [A] | $R_{U-V}$ [Ω] | $L_{U-V}$ [mH] | $T_{el}$ [ms] | $J_{dyn}$ [$10^{-4}$ kgm²] | $m_{dyn}$ [kg] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EZ401B | 47 | 6000 | 2.90 | 5.62 | 0.52 | 1.8 | 3.50 | 6.83 | 0.52 | 0.04 | 8.50 | 33.0 | 1.94 | 11.52 | 5.94 | 0.93 | 5.40 |
| EZ401B | 96 | 3000 | 3.40 | 3.40 | 1.00 | 1.1 | 3.70 | 3.60 | 1.04 | 0.04 | 8.50 | 16.5 | 6.70 | 37.70 | 5.63 | 0.93 | 5.40 |
| EZ402B | 60 | 6000 | 5.10 | 7.88 | 0.65 | 3.2 | 6.40 | 9.34 | 0.69 | 0.04 | 16.0 | 43.5 | 1.20 | 8.88 | 7.40 | 1.63 | 6.50 |
| EZ402B | 94 | 3000 | 5.90 | 5.50 | 1.07 | 1.9 | 6.30 | 5.80 | 1.09 | 0.04 | 16.0 | 26.5 | 3.00 | 21.80 | 7.26 | 1.63 | 6.50 |
| EZ404B | 78 | 6000 | 8.00 | 9.98 | 0.80 | 5.0 | 10.5 | 12.0 | 0.88 | 0.04 | 29.0 | 51.0 | 0.89 | 7.07 | 7.94 | 2.98 | 8.60 |
| EZ404B | 116 | 3000 | 10.2 | 8.20 | 1.24 | 3.2 | 11.2 | 8.70 | 1.29 | 0.04 | 29.0 | 35.0 | 1.85 | 15.00 | 8.11 | 2.98 | 8.60 |
| EZ501B | 68 | 6000 | 4.50 | 6.70 | 0.67 | 2.8 | 5.70 | 7.50 | 0.77 | 0.06 | 16.0 | 31.0 | 2.10 | 12.10 | 5.76 | 2.90 | 7.00 |
| EZ501B | 97 | 3000 | 5.40 | 4.70 | 1.15 | 1.7 | 5.80 | 5.00 | 1.17 | 0.06 | 16.0 | 22.0 | 3.80 | 23.50 | 6.18 | 2.90 | 7.00 |
| EZ502B | 72 | 6000 | 8.20 | 11.4 | 0.72 | 5.2 | 10.5 | 13.4 | 0.79 | 0.06 | 31.0 | 59.0 | 0.76 | 5.60 | 7.37 | 5.20 | 8.50 |
| EZ502B | 121 | 3000 | 10.3 | 7.80 | 1.32 | 3.2 | 11.2 | 8.16 | 1.38 | 0.06 | 31.0 | 33.0 | 2.32 | 16.80 | 7.24 | 5.20 | 8.50 |
| EZ503B | 84 | 6000 | 10.4 | 13.5 | 0.77 | 6.5 | 14.8 | 15.9 | 1.07 | 0.06 | 43.0 | 63.5 | 0.62 | 5.00 | 8.06 | 7.58 | 10.0 |
| EZ503B | 119 | 3000 | 14.4 | 10.9 | 1.32 | 4.5 | 15.9 | 11.8 | 1.35 | 0.06 | 43.0 | 41.0 | 1.25 | 10.00 | 8.00 | 7.58 | 10.0 |
| EZ505B | 103 | 4500 | 16.4 | 16.4 | 1.00 | 7.7 | 22.0 | 19.4 | 1.14 | 0.06 | 67.0 | 73.0 | 0.50 | 4.47 | 8.94 | 12.2 | 12.9 |
| EZ505B | 141 | 3000 | 20.2 | 13.7 | 1.47 | 6.4 | 23.4 | 14.7 | 1.60 | 0.06 | 67.0 | 52.0 | 0.93 | 8.33 | 8.96 | 12.2 | 12.9 |
| EZ701B | 76 | 6000 | 7.50 | 10.6 | 0.71 | 4.7 | 10.2 | 12.4 | 0.84 | 0.24 | 20.0 | 31.0 | 0.87 | 8.13 | 9.34 | 8.50 | 13.3 |
| EZ701B | 95 | 3000 | 9.70 | 9.50 | 1.02 | 3.1 | 10.5 | 10.0 | 1.07 | 0.24 | 20.0 | 25.0 | 1.30 | 12.83 | 9.87 | 8.50 | 13.3 |
| EZ702B | 82 | 6000 | 12.5 | 16.7 | 0.75 | 7.9 | 19.3 | 22.1 | 0.89 | 0.24 | 41.0 | 60.5 | 0.34 | 3.90 | 11.47 | 13.7 | 15.8 |
| EZ702B | 133 | 3000 | 16.6 | 11.8 | 1.41 | 5.2 | 19.3 | 12.9 | 1.51 | 0.24 | 41.0 | 36.0 | 1.00 | 11.73 | 11.73 | 13.7 | 15.8 |
| EZ703B | 99 | 4500 | 19.8 | 20.3 | 0.98 | 9.3 | 27.2 | 24.2 | 1.13 | 0.24 | 65.0 | 78.0 | 0.36 | 4.42 | 12.28 | 21.6 | 17.8 |
| EZ703B | 122 | 3000 | 24.0 | 18.2 | 1.32 | 7.5 | 28.0 | 20.0 | 1.41 | 0.24 | 65.0 | 62.0 | 0.52 | 6.80 | 13.08 | 21.6 | 17.8 |
| EZ705B | 106 | 4500 | 27.7 | 25.4 | 1.09 | 13 | 39.4 | 32.8 | 1.21 | 0.24 | 104 | 114 | 0.22 | 2.76 | 12.55 | 34.0 | 23.3 |
| EZ705B | 140 | 3000 | 33.8 | 22.9 | 1.48 | 11 | 41.8 | 26.5 | 1.59 | 0.24 | 104 | 87.0 | 0.33 | 4.80 | 14.55 | 34.0 | 23.3 |
| EZ802B | 90 | 4500 | 30.6 | 30.5 | 1.00 | 14 | 47.4 | 45.1 | 1.06 | 0.30 | 100 | 135 | 0.13 | 1.90 | 14.60 | 58.0 | 31.6 |
| EZ802B | 136 | 3000 | 34.3 | 26.5 | 1.29 | 11 | 47.9 | 28.9 | 1.67 | 0.30 | 100 | 84.0 | 0.30 | 5.00 | 16.66 | 58.0 | 31.6 |
| EZ803B | 131 | 3000 | 49.0 | 35.9 | 1.37 | 15 | 66.7 | 42.3 | 1.58 | 0.30 | 145 | 124 | 0.18 | 2.79 | 15.50 | 83.5 | 37.7 |
| EZ805B | 142 | 2000 | 77.2 | 45.2 | 1.71 | 16 | 94.0 | 53.9 | 1.75 | 0.30 | 205 | 155 | 0.13 | 2.22 | 17.08 | 133 | 51.8 |

**Additional values in the version with increased mass moment of inertia**

| Type | ΔJ [$10^{-4}$ kgm²] | Δm [kg] |
|---|---|---|
| EZ301 | – | – |
| EZ302 | – | – |
| EZ303 | – | – |
| EZ401 | 0.2 | 0.08 |
| EZ402 | 0.4 | 0.15 |
| EZ404 | 0.8 | 0.31 |
| EZ501 | – | – |
| EZ502 | 1.1 | 0.22 |
| EZ503 | 2.0 | 0.43 |
| EZ505 | 4.1 | 0.87 |
| EZ701 | – | – |
| EZ702 | 4.4 | 0.41 |
| EZ703 | 6.3 | 0.81 |
| EZ705 | 13.6 | 1.6 |
| EZ802 | 14.9 | 1.3 |
| EZ803 | 22.3 | 1.9 |
| EZ805 | 37.2 | 3.2 |

EZ



## 22.2.3 EZ motors with water cooling

| Type | $K_{EM}$ [V/1000 rpm] | $n_N$ [rpm] | $M_N$ [Nm] | $I_N$ [A] | $K_{M,N}$ [Nm/A] | $P_N$ [kW] | $M_0$ [Nm] | $I_0$ [A] | $K_{M0}$ [Nm/A] | $M_R$ [Nm] | $M_{max}$ [Nm] | $I_{max}$ [A] | $R_{U-V}$ [Ω] | $L_{U-V}$ [mH] | $T_{el}$ [ms] | $J_{dyn}$ [$10^{-4}$ kgm²] | $m_{dyn}$ [kg] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EZ401W | 47 | 6000 | 2.55 | 5.20 | 0.49 | 1.6 | 3.35 | 6.95 | 0.49 | 0.04 | 8.50 | 33.0 | 1.94 | 11.52 | 5.94 | 0.93 | 4.00 |
| EZ401W | 96 | 3000 | 3.30 | 3.70 | 0.89 | 1.0 | 3.55 | 3.90 | 0.92 | 0.04 | 8.50 | 16.5 | 6.70 | 37.70 | 5.63 | 0.93 | 4.00 |
| EZ402W | 60 | 6000 | 5.00 | 8.00 | 0.63 | 3.1 | 6.45 | 9.70 | 0.67 | 0.04 | 16.0 | 43.5 | 1.20 | 8.88 | 7.40 | 1.63 | 5.10 |
| EZ402W | 94 | 3000 | 5.85 | 5.50 | 1.06 | 1.8 | 6.35 | 6.00 | 1.07 | 0.04 | 16.0 | 26.5 | 3.00 | 21.80 | 7.26 | 1.63 | 5.10 |
| EZ404W | 78 | 6000 | 7.70 | 10.5 | 0.73 | 4.8 | 10.6 | 12.3 | 0.87 | 0.04 | 29.0 | 51.0 | 0.89 | 7.07 | 7.94 | 2.98 | 7.20 |
| EZ404W | 116 | 3000 | 10.4 | 8.30 | 1.25 | 3.3 | 11.3 | 8.90 | 1.27 | 0.04 | 29.0 | 35.0 | 1.85 | 15.00 | 8.11 | 2.98 | 7.20 |
| EZ501W | 68 | 6000 | 4.30 | 6.40 | 0.67 | 2.7 | 5.55 | 7.25 | 0.77 | 0.06 | 16.0 | 31.0 | 2.10 | 12.10 | 5.76 | 2.90 | 5.00 |
| EZ501W | 97 | 3000 | 5.40 | 4.75 | 1.14 | 1.7 | 5.65 | 4.85 | 1.18 | 0.06 | 16.0 | 22.0 | 3.80 | 23.50 | 6.18 | 2.90 | 5.00 |
| EZ502W | 72 | 6000 | 8.10 | 11.2 | 0.72 | 5.1 | 10.3 | 12.9 | 0.80 | 0.06 | 31.0 | 59.0 | 0.76 | 5.60 | 7.37 | 5.20 | 6.50 |
| EZ502W | 121 | 3000 | 10.2 | 7.70 | 1.32 | 3.2 | 11.0 | 7.85 | 1.41 | 0.06 | 31.0 | 33.0 | 2.32 | 16.80 | 7.24 | 5.20 | 6.50 |
| EZ503W | 84 | 6000 | 9.95 | 12.6 | 0.79 | 6.3 | 14.2 | 15.2 | 0.94 | 0.06 | 43.0 | 63.5 | 0.62 | 5.00 | 8.06 | 7.58 | 8.00 |
| EZ503W | 119 | 3000 | 13.5 | 10.2 | 1.32 | 4.2 | 15.2 | 11.3 | 1.35 | 0.06 | 43.0 | 41.0 | 1.25 | 10.00 | 8.00 | 7.58 | 8.00 |
| EZ505W | 103 | 4500 | 14.2 | 13.0 | 1.09 | 6.7 | 20.2 | 17.2 | 1.18 | 0.06 | 67.0 | 73.0 | 0.50 | 4.47 | 8.94 | 12.2 | 10.9 |
| EZ505W | 141 | 3000 | 17.9 | 11.4 | 1.57 | 5.6 | 21.5 | 13.1 | 1.65 | 0.06 | 67.0 | 52.0 | 0.93 | 8.33 | 8.96 | 12.2 | 10.9 |
| EZ701W | 76 | 6000 | 7.00 | 10.2 | 0.69 | 4.4 | 10.4 | 12.7 | 0.83 | 0.24 | 20.0 | 31.0 | 0.87 | 8.13 | 9.34 | 8.50 | 8.30 |
| EZ701W | 95 | 3000 | 10.2 | 9.95 | 1.03 | 3.2 | 10.4 | 10.0 | 1.06 | 0.24 | 20.0 | 25.0 | 1.30 | 12.83 | 9.87 | 8.50 | 8.30 |
| EZ702W | 82 | 6000 | 12.0 | 17.5 | 0.69 | 7.5 | 19.3 | 22.5 | 0.86 | 0.24 | 41.0 | 60.5 | 0.34 | 3.90 | 11.47 | 13.7 | 10.8 |
| EZ702W | 133 | 3000 | 17.1 | 12.2 | 1.40 | 5.4 | 19.3 | 13.1 | 1.47 | 0.24 | 41.0 | 36.0 | 1.00 | 11.73 | 11.73 | 13.7 | 10.8 |
| EZ703W | 99 | 4500 | 19.1 | 18.1 | 1.06 | 9.0 | 26.7 | 23.7 | 1.14 | 0.24 | 65.0 | 78.0 | 0.36 | 4.42 | 12.28 | 21.6 | 12.8 |
| EZ703W | 122 | 3000 | 22.5 | 17.0 | 1.32 | 7.1 | 27.5 | 19.6 | 1.42 | 0.24 | 65.0 | 62.0 | 0.52 | 6.80 | 13.08 | 21.6 | 12.8 |
| EZ705W | 106 | 4500 | 24.1 | 22.0 | 1.10 | 11 | 37.2 | 31.6 | 1.18 | 0.24 | 104 | 114 | 0.22 | 2.76 | 12.55 | 34.0 | 18.3 |
| EZ705W | 140 | 3000 | 30.3 | 20.5 | 1.48 | 9.5 | 39.4 | 25.4 | 1.56 | 0.24 | 104 | 87.0 | 0.33 | 4.80 | 14.55 | 34.0 | 18.3 |
| EZ802W | 90 | 4500 | 30.7 | 30.3 | 1.01 | 15 | 46.9 | 44.6 | 1.06 | 0.30 | 100 | 135 | 0.13 | 1.90 | 14.60 | 58.0 | 26.6 |
| EZ802W | 136 | 3000 | 32.2 | 26.6 | 1.21 | 10 | 48.9 | 29.6 | 1.66 | 0.30 | 100 | 84.0 | 0.30 | 5.00 | 16.66 | 58.0 | 26.6 |
| EZ803W | 131 | 3000 | 46.7 | 34.1 | 1.37 | 15 | 65.7 | 41.7 | 1.58 | 0.30 | 145 | 124 | 0.18 | 2.79 | 15.50 | 83.5 | 32.7 |
| EZ805W | 142 | 2000 | 72.1 | 42.1 | 1.71 | 15 | 90.1 | 51.9 | 1.74 | 0.30 | 205 | 155 | 0.13 | 2.22 | 17.08 | 133 | 46.8 |

### Additional values in the version with increased mass moment of inertia

| Type | ΔJ [$10^{-4}$ kgm²] | Δm [kg] |
|---|---|---|
| EZ301 | – | – |
| EZ302 | – | – |
| EZ303 | – | – |
| EZ401 | 0.2 | 0.08 |
| EZ402 | 0.4 | 0.15 |
| EZ404 | 0.8 | 0.31 |
| EZ501 | – | – |
| EZ502 | 1.1 | 0.22 |
| EZ503 | 2.0 | 0.43 |
| EZ505 | 4.1 | 0.87 |
| EZ701 | – | – |
| EZ702 | 4.4 | 0.41 |
| EZ703 | 6.3 | 0.81 |
| EZ705 | 13.6 | 1.6 |
| EZ802 | 14.9 | 1.3 |
| EZ803 | 22.3 | 1.9 |
| EZ805 | 37.2 | 3.2 |

## 22.3 Torque/speed characteristic curves

Torque/speed characteristic curves depend on the nominal speed and/or winding version of the motor and the DC link voltage of the drive controller that is used. The following torque/speed characteristic curves apply to the DC link voltage DC 540 V.

| Formula symbols | Unit | Explanation |
|---|---|---|
| ED | % | Duty cycle relative to 10 minutes |
| $M_{lim}$ | Nm | Torque limit without compensating for field weakening |
| $M_{limF}$ | Nm | Torque limit of the motor with forced ventilation |
| $M_{limFW}$ | Nm | Torque limit with compensation for field weakening (applies to operation on STOBER drive controllers only) |
| $M_{limK}$ | Nm | Torque limit of the motor with convection cooling |
| $M_{limW}$ | Nm | Torque limit of the motor with water cooling |
| $M_{max}$ | Nm | Maximum torque: the maximum permitted torque the motor is able to deliver briefly (when accelerating or decelerating) (tolerance ±10 %) |
| $n_N$ | rpm | Nominal speed: the speed for which the nominal torque $M_N$ is specified |
| $\Delta\vartheta$ | K | Temperature difference |

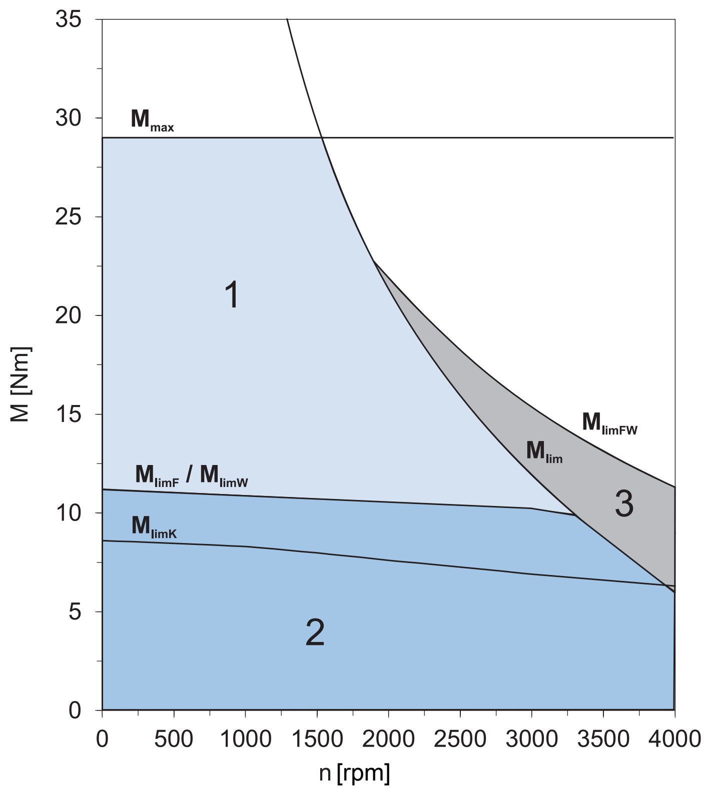
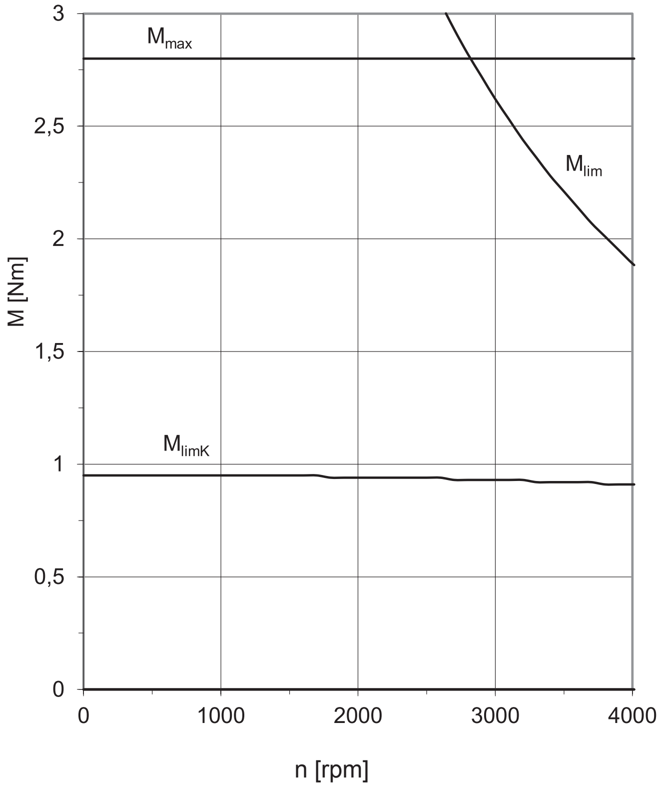



*Illustration 1:* Explanation of a torque/speed characteristic curve

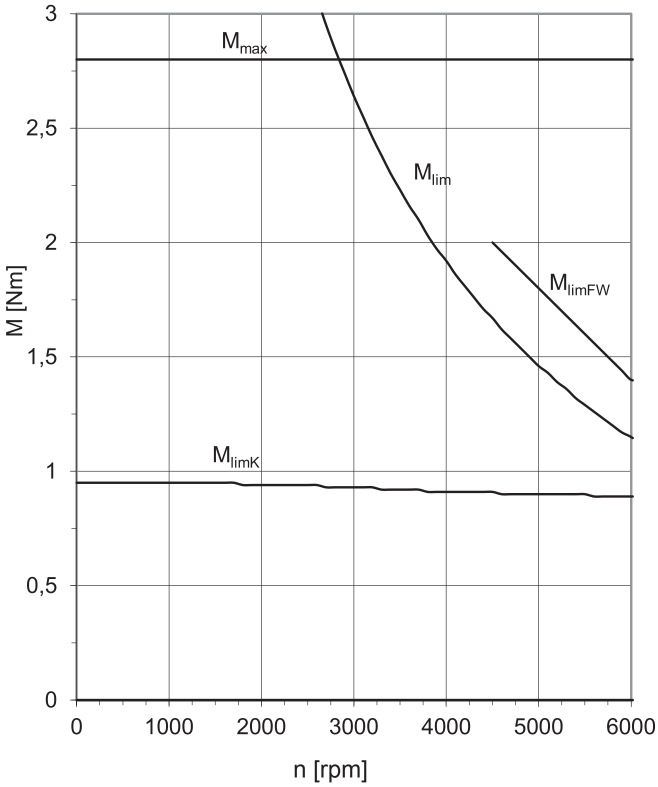
| | | | |
|---|---|---|---|
| 1 | Torque range for brief operation (duty cycle < 100%) with $\vartheta$ = 100 K | 2 | Torque range for continuous operation at a constant load (S1 mode, duty cycle = 100%) with $\vartheta$ = 100 K |
| 3 | Field weakening range (can only be used with operation on STOBER drive controllers) | | |



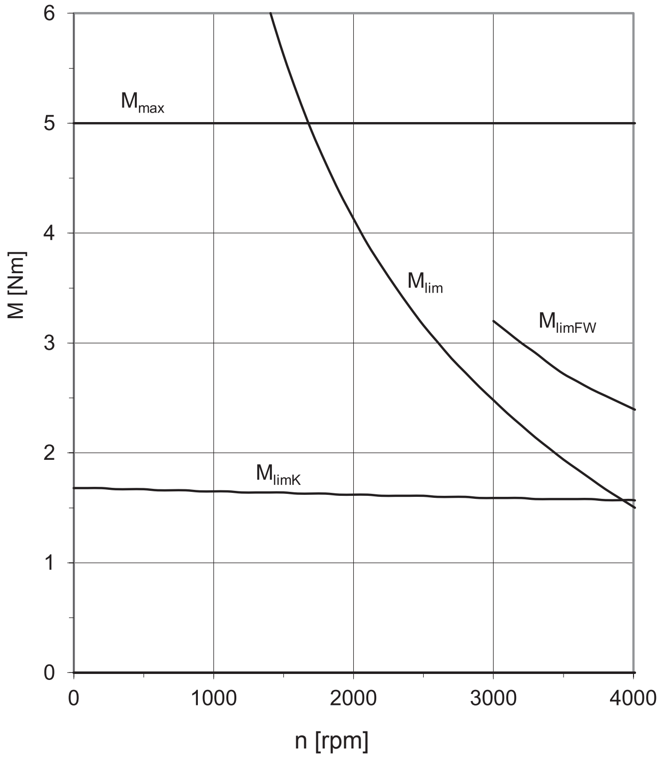
**EZ301** ($n_N$=3000 rpm)



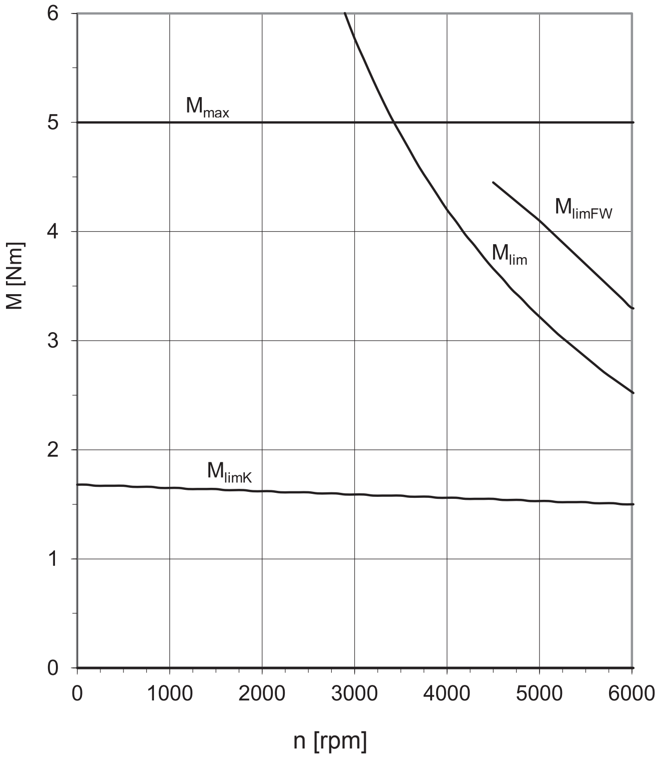

**EZ301** ($n_N$=6000 rpm)




**EZ302** ($n_N$=3000 rpm)



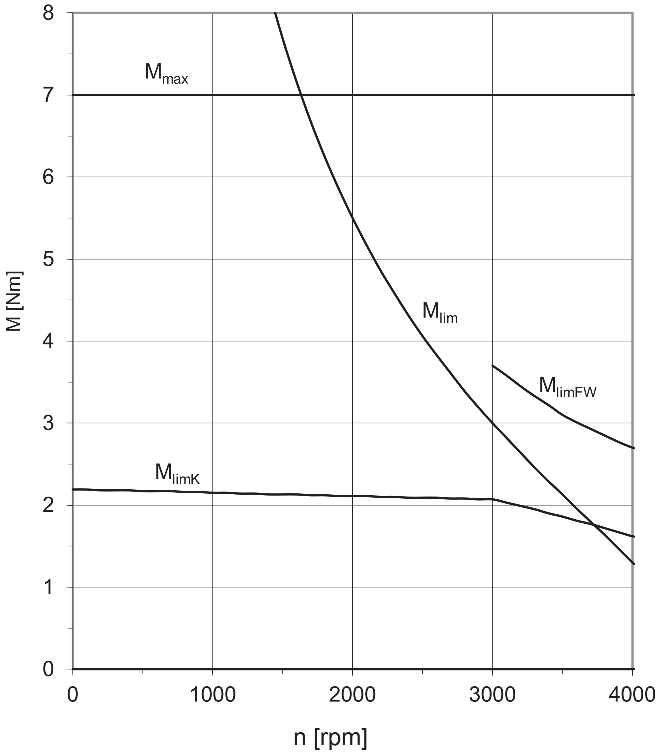

**EZ302** ($n_N$=6000 rpm)



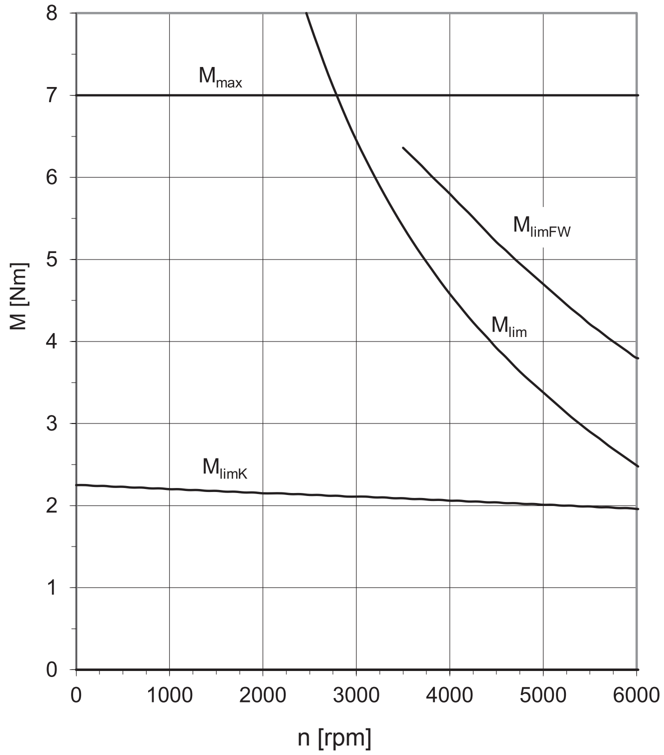


STÖBER

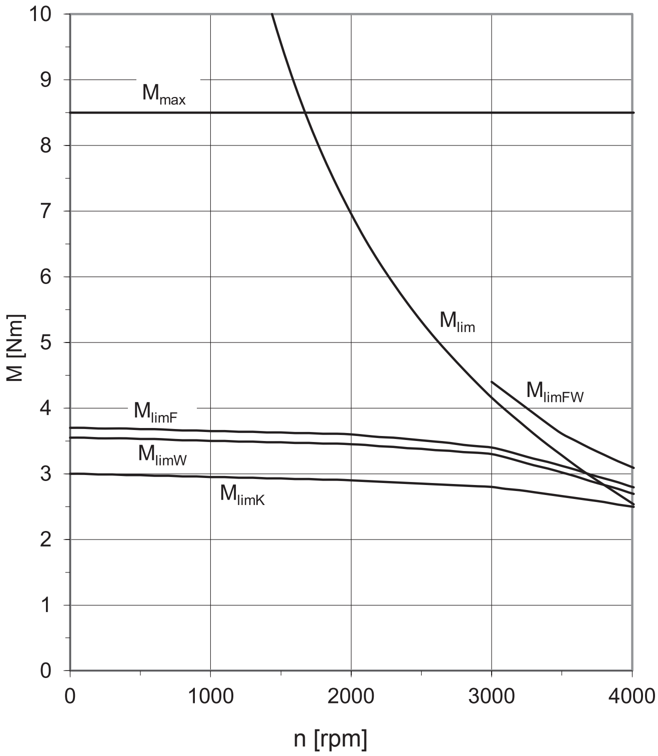
**EZ303** ($n_N$=3000 rpm)



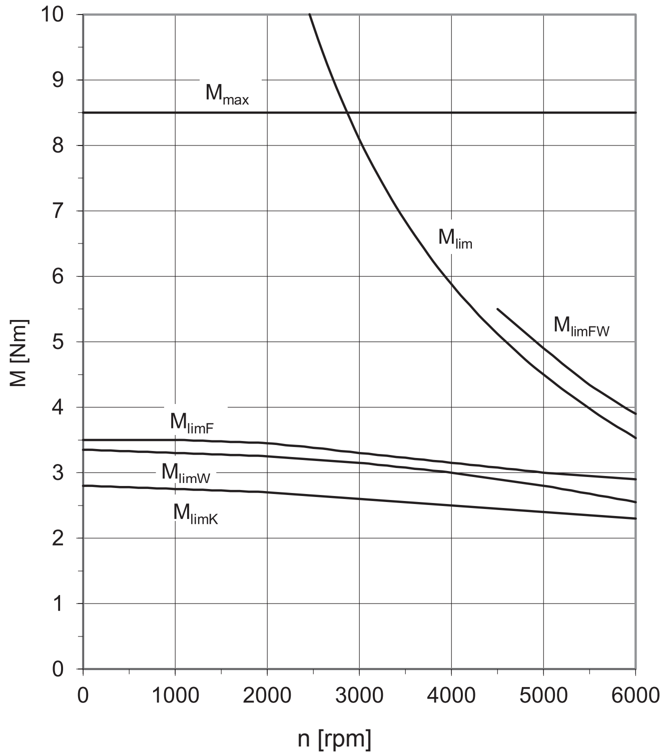

**EZ303** ($n_N$=6000 rpm)




**EZ401** ($n_N$=3000 rpm)

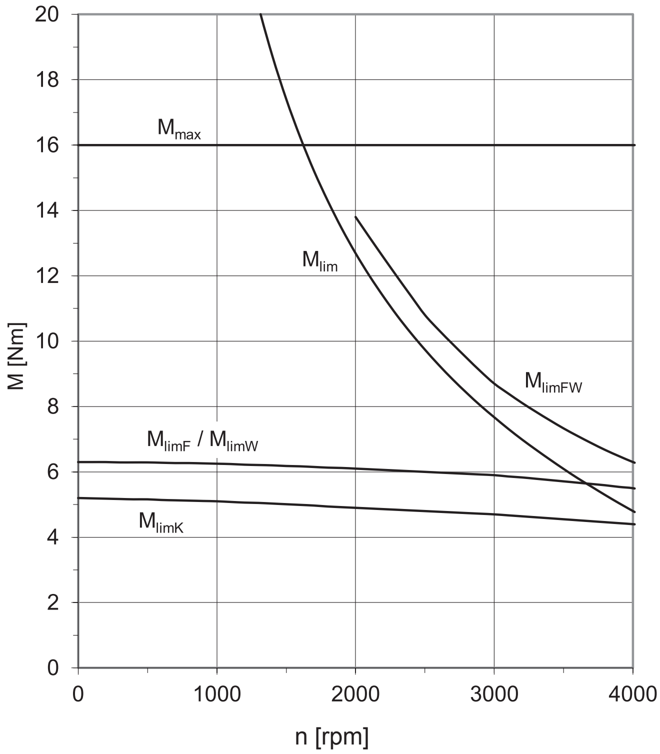



**EZ401** ($n_N$=6000 rpm)

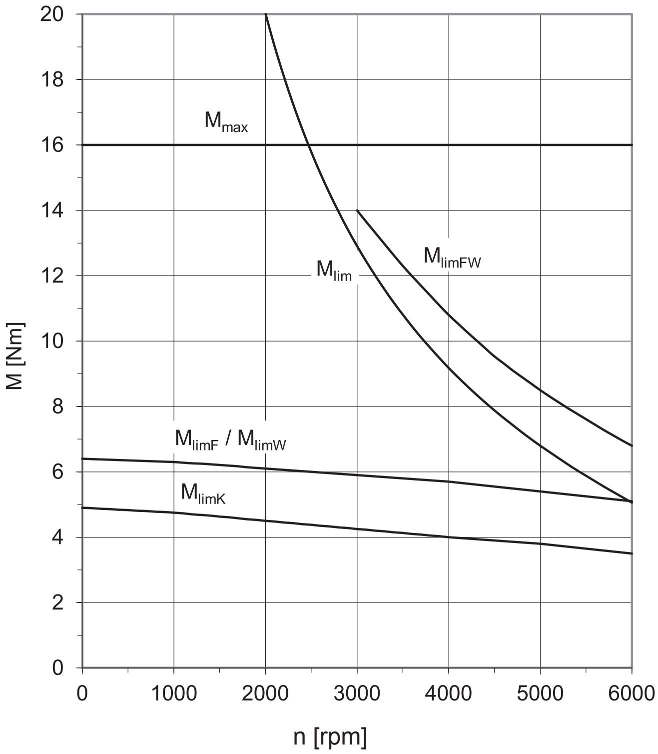



EZ

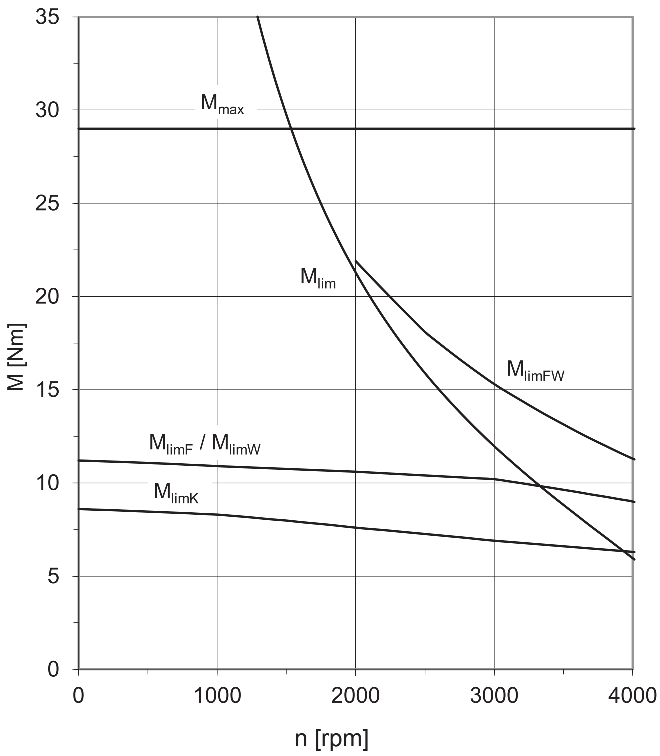
**EZ402** ($n_N$=3000 rpm)



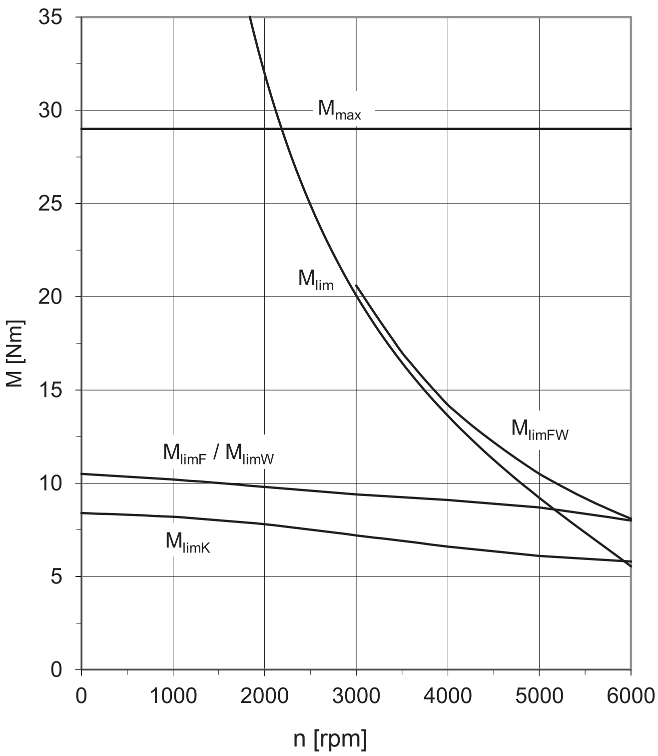

**EZ402** ($n_N$=6000 rpm)



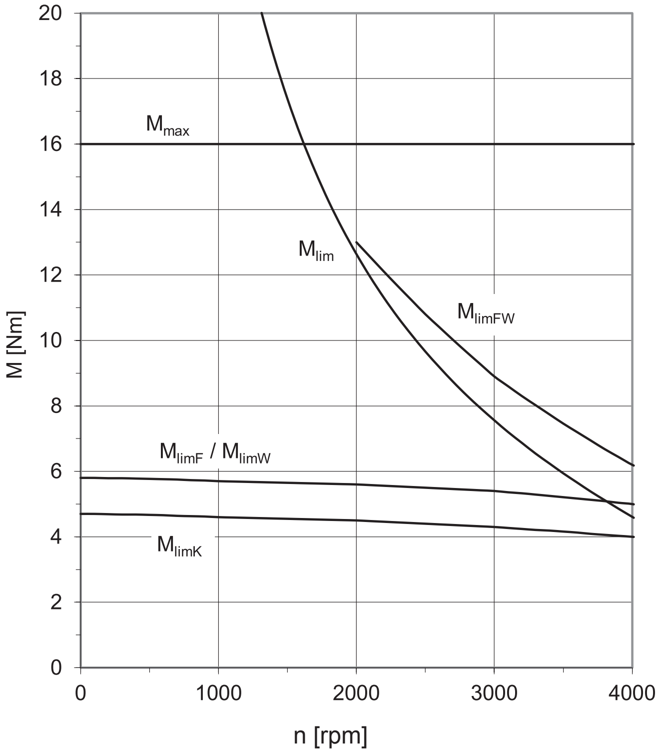

**EZ404** ($n_N$=3000 rpm)



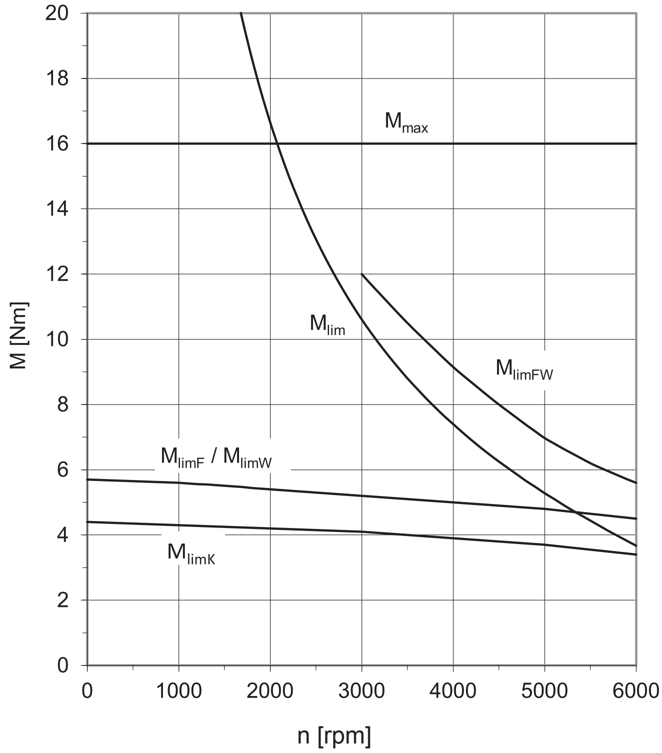

**EZ404** ($n_N$=6000 rpm)



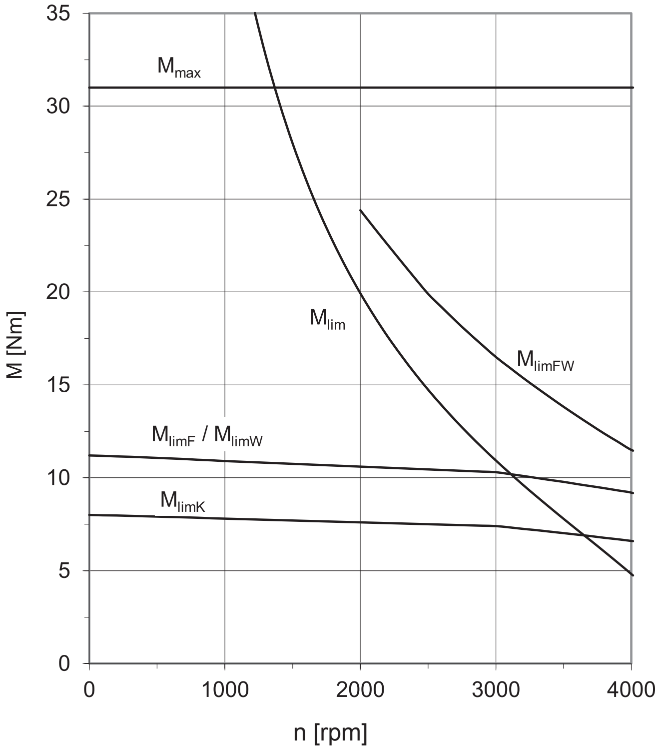
**EZ501** ($n_N$=3000 rpm)



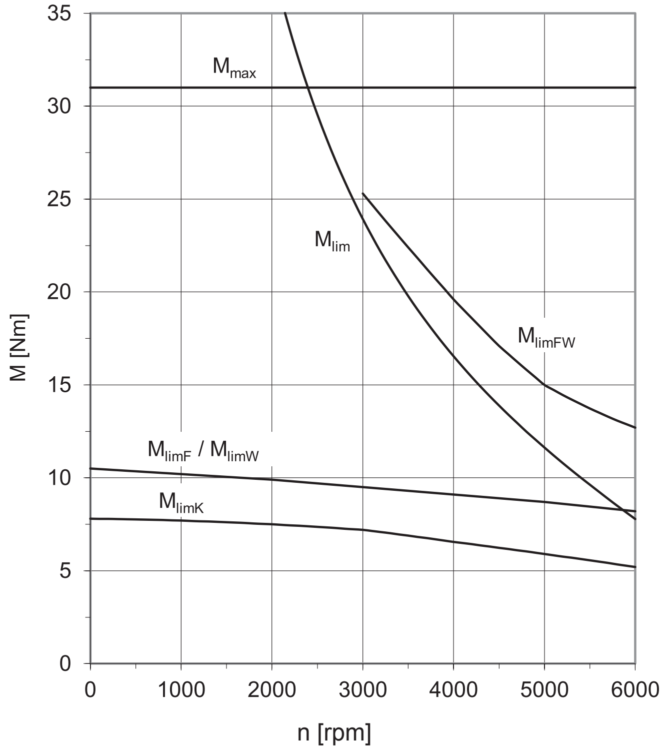

**EZ501** ($n_N$=6000 rpm)

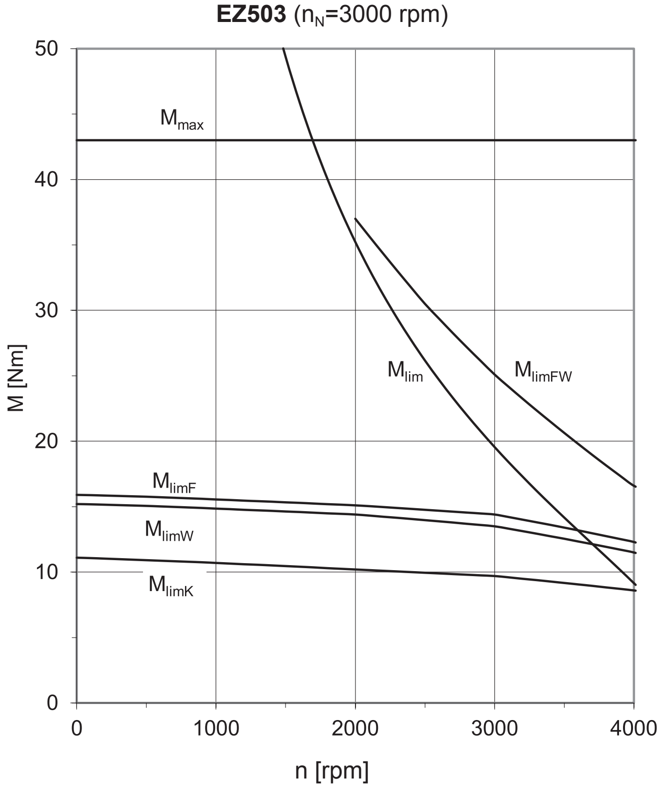


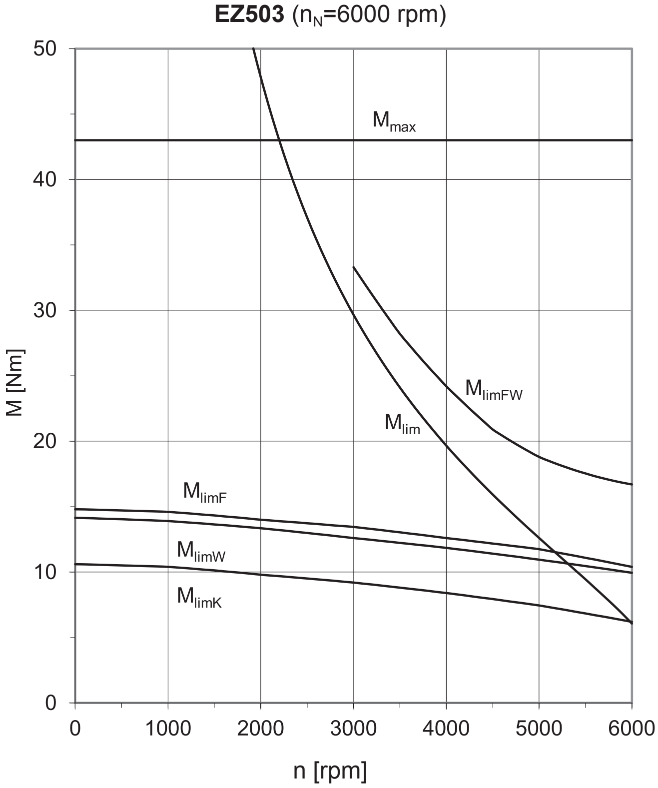

**EZ502** ($n_N$=3000 rpm)

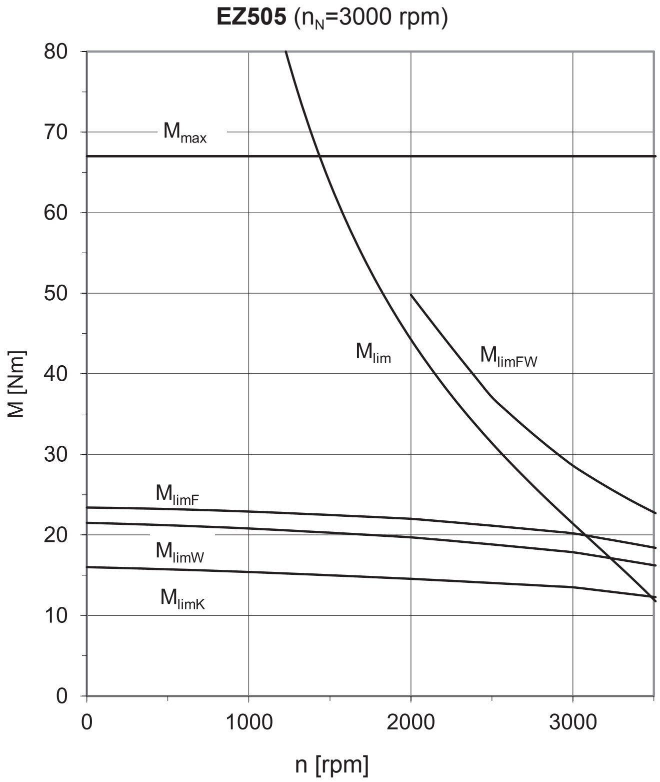


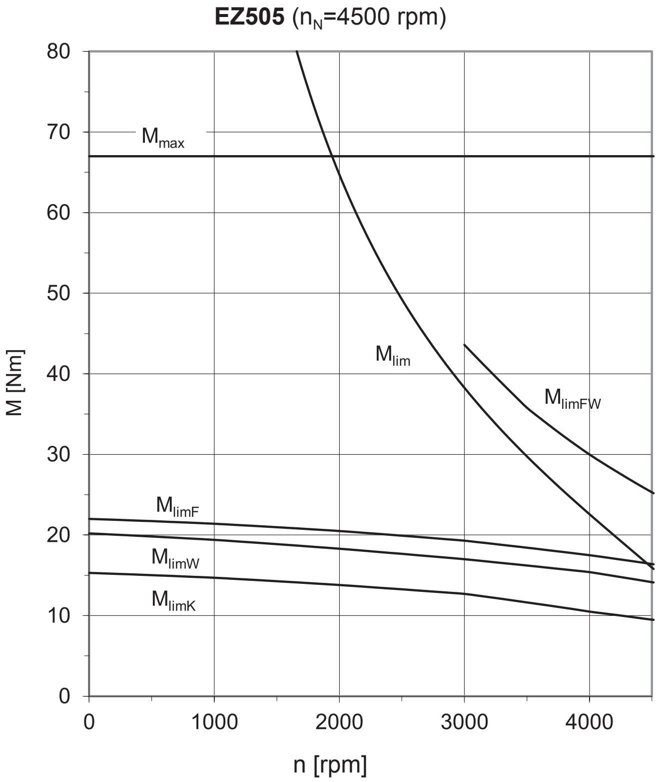

**EZ502** ($n_N$=6000 rpm)



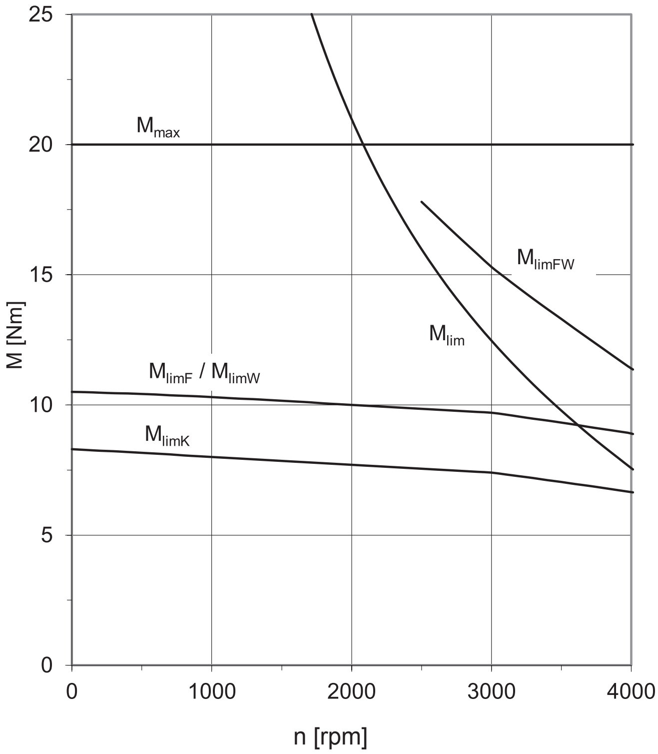

EZ503 (nN=3000 rpm)
Mmax
Mlim
MlimFW
MlimF
MlimW
MlimK
M [Nm]
n [rpm]
0
10
20
30
40
50
1000
2000
3000
4000


EZ503 (nN=6000 rpm)
Mmax
MlimFW
Mlim
MlimF
MlimW
MlimK
M [Nm]
n [rpm]
0
10
20
30
40
50
1000
2000
3000
4000
5000
6000

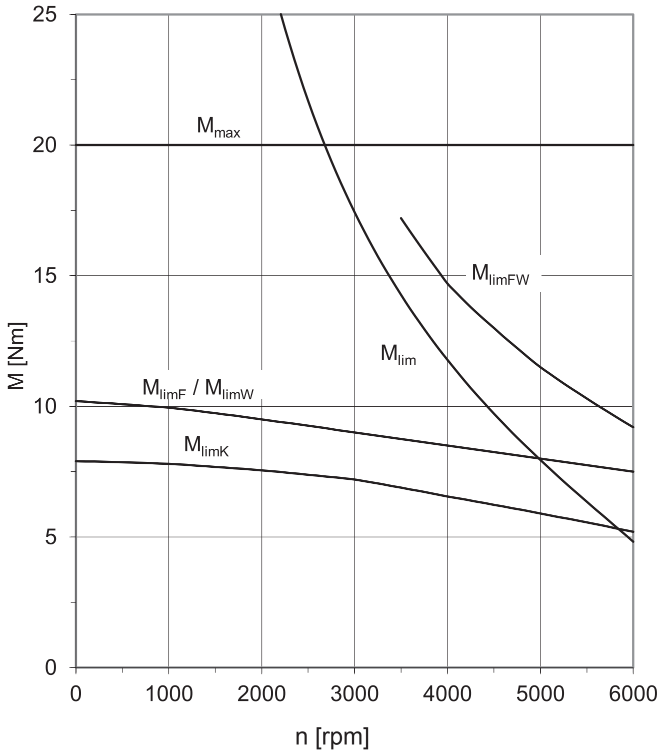

EZ505 (nN=3000 rpm)
Mmax
Mlim
MlimFW
MlimF
MlimW
MlimK
M [Nm]
n [rpm]
0
10
20
30
40
50
60
70
80
1000
2000
3000


EZ505 (nN=4500 rpm)
Mmax
Mlim
MlimFW
MlimF
MlimW
MlimK
M [Nm]
n [rpm]
0
10
20
30
40
50
60
70
80
1000
2000
3000
4000

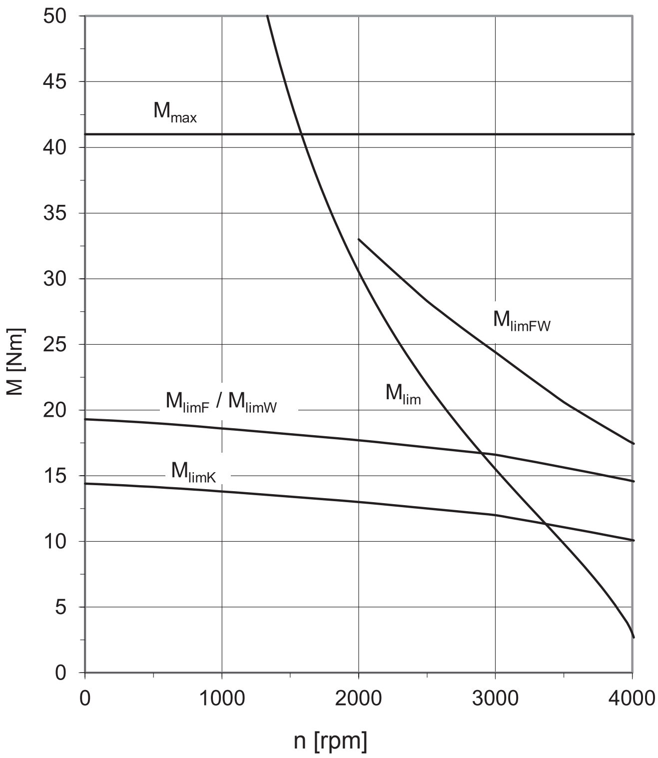
**EZ701** ($n_N$=3000 rpm)



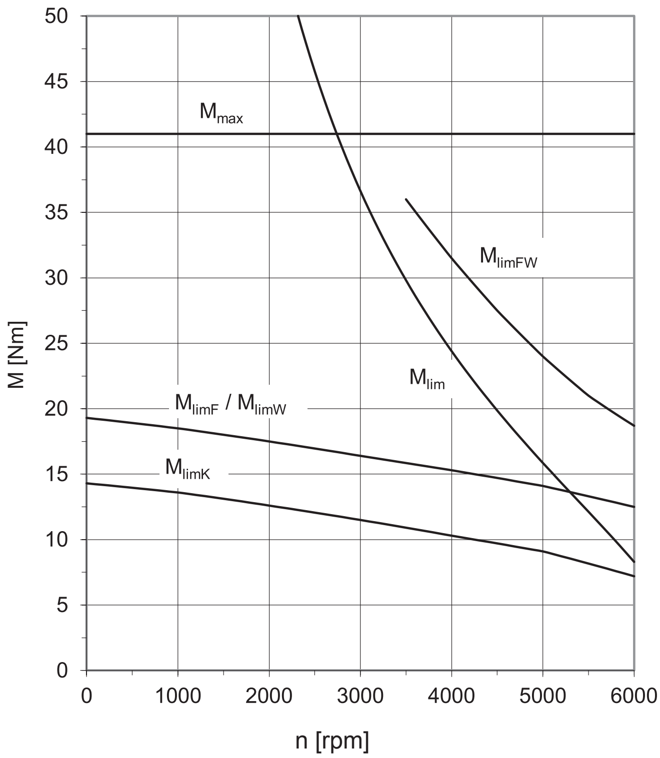

**EZ701** ($n_N$=6000 rpm)

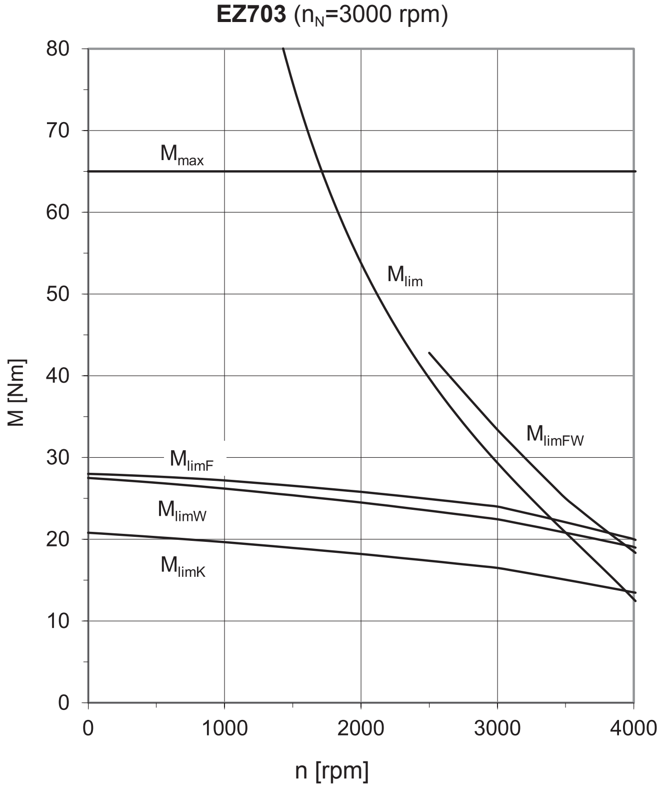


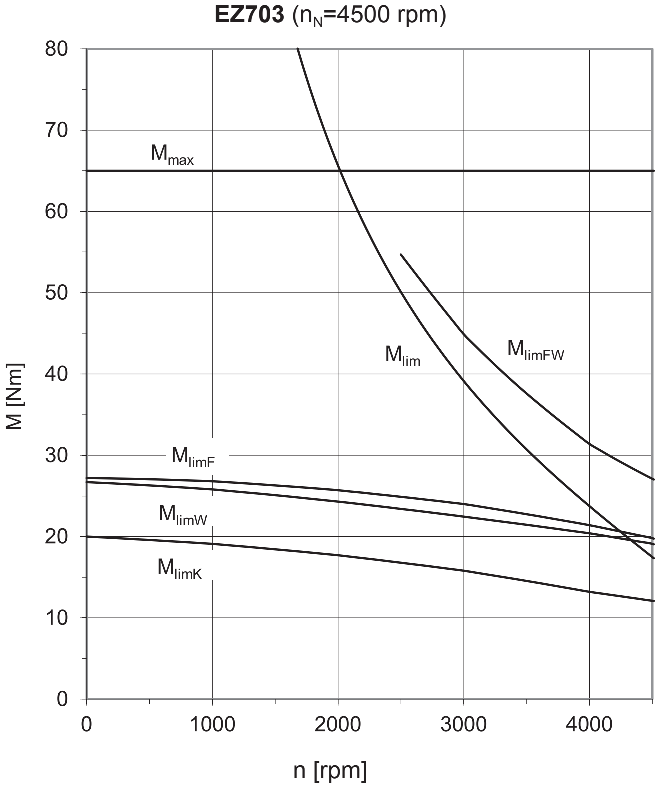

**EZ702** ($n_N$=3000 rpm)

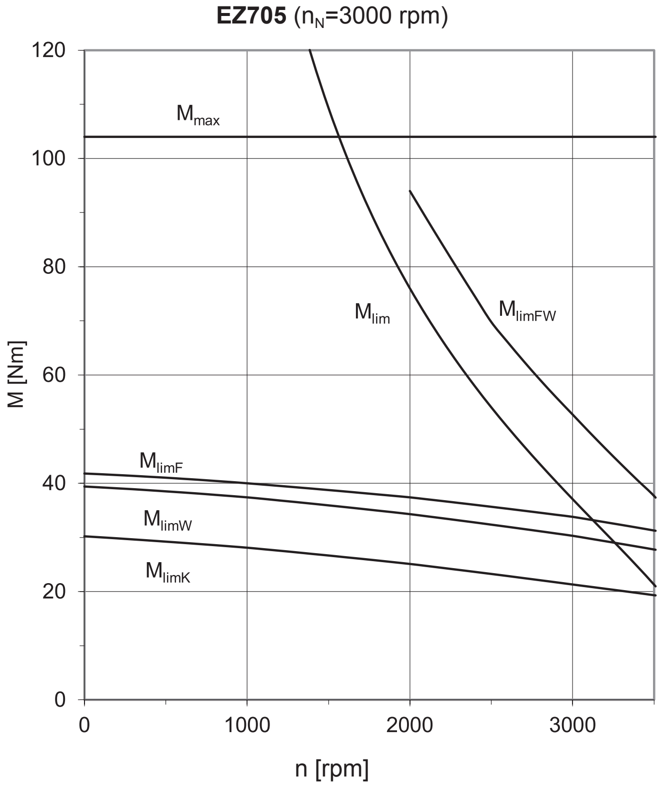


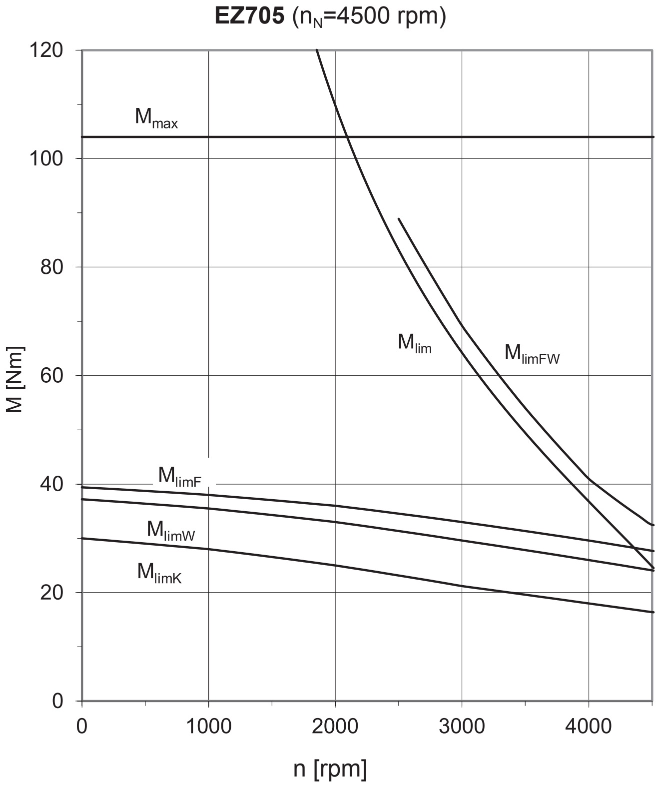

**EZ702** ($n_N$=6000 rpm)




**EZ703** ($n_N$=3000 rpm)
M [Nm]
n [rpm]
$M_{max}$
$M_{lim}$
$M_{limFW}$
$M_{limF}$
$M_{limW}$
$M_{limK}$
0
10
20
30
40
50
60
70
80
0
1000
2000
3000
4000

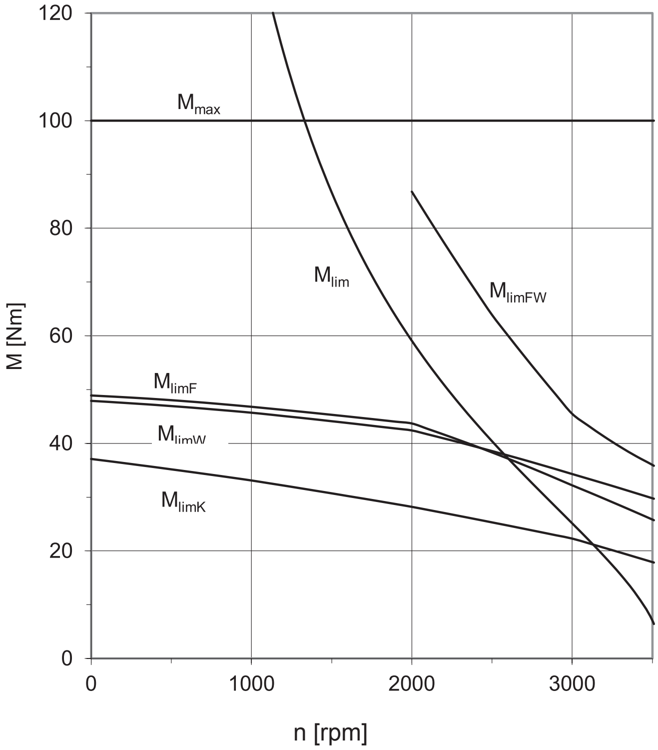

**EZ703** ($n_N$=4500 rpm)
M [Nm]
n [rpm]
$M_{max}$
$M_{lim}$
$M_{limFW}$
$M_{limF}$
$M_{limW}$
$M_{limK}$
0
10
20
30
40
50
60
70
80
0
1000
2000
3000
4000


**EZ705** ($n_N$=3000 rpm)
M [Nm]
n [rpm]
$M_{max}$
$M_{lim}$
$M_{limFW}$
$M_{limF}$
$M_{limW}$
$M_{limK}$
0
20
40
60
80
100
120
0
1000
2000
3000

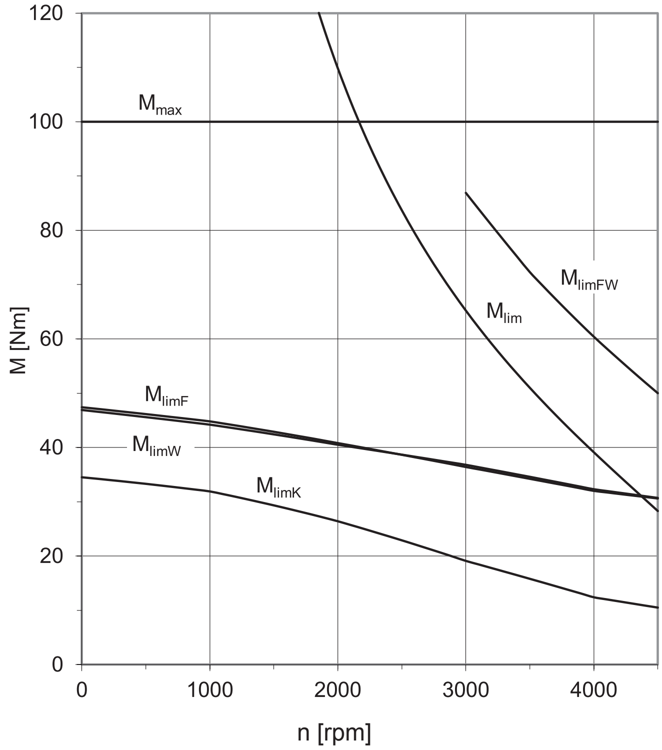

**EZ705** ($n_N$=4500 rpm)
M [Nm]
n [rpm]
$M_{max}$
$M_{lim}$
$M_{limFW}$
$M_{limF}$
$M_{limW}$
$M_{limK}$
0
20
40
60
80
100
120
0
1000
2000
3000
4000



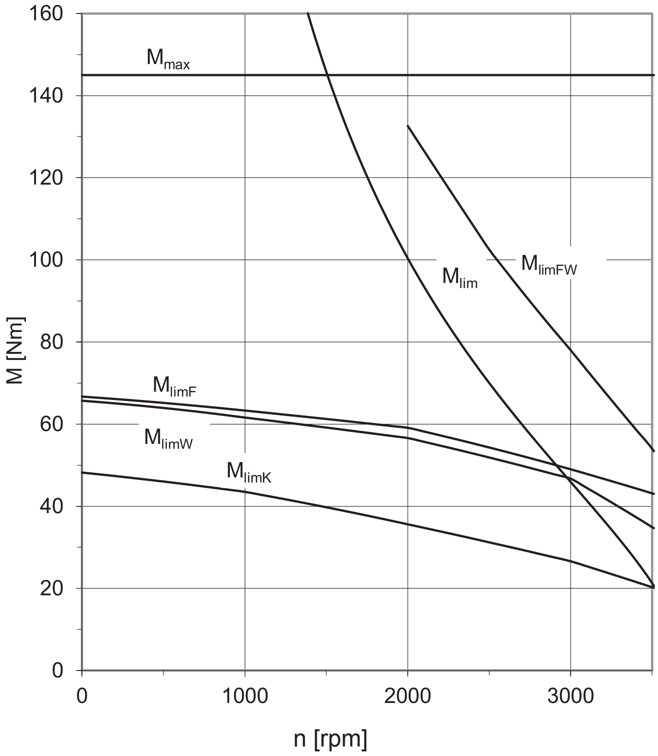
**EZ802** ($n_N$=3000 rpm)



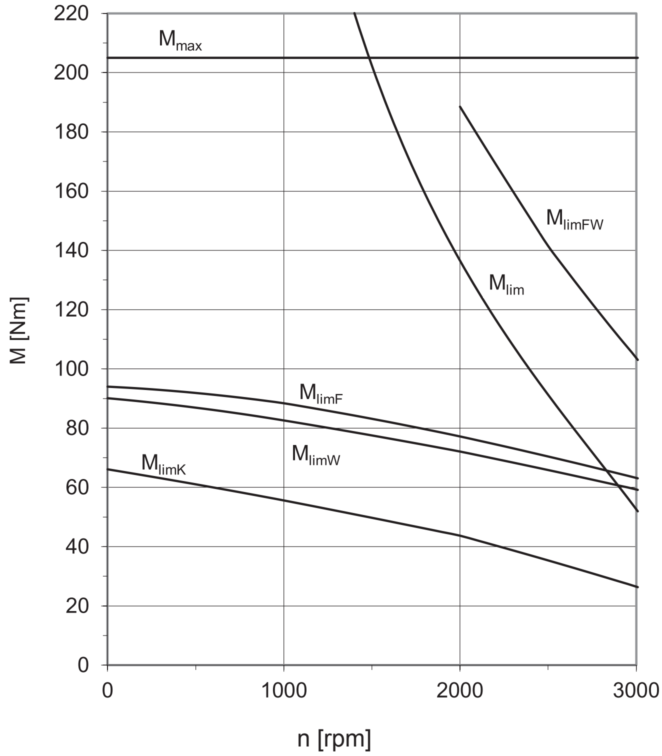

**EZ802** ($n_N$=4500 rpm)




**EZ803** ($n_N$=3000 rpm)




**EZ805** ($n_N$=2000 rpm)



# 22.4 Dimensional drawings

In this chapter you can find the dimensions of the motors.

Dimensions may exceed the requirements of ISO 2768-mK due to casting tolerances or the sum of additional tolerances.

We reserve the right to make modifications to the dimensions due to technical advances.

You can download CAD model of our standard drives from http://cad.stoeber.de.

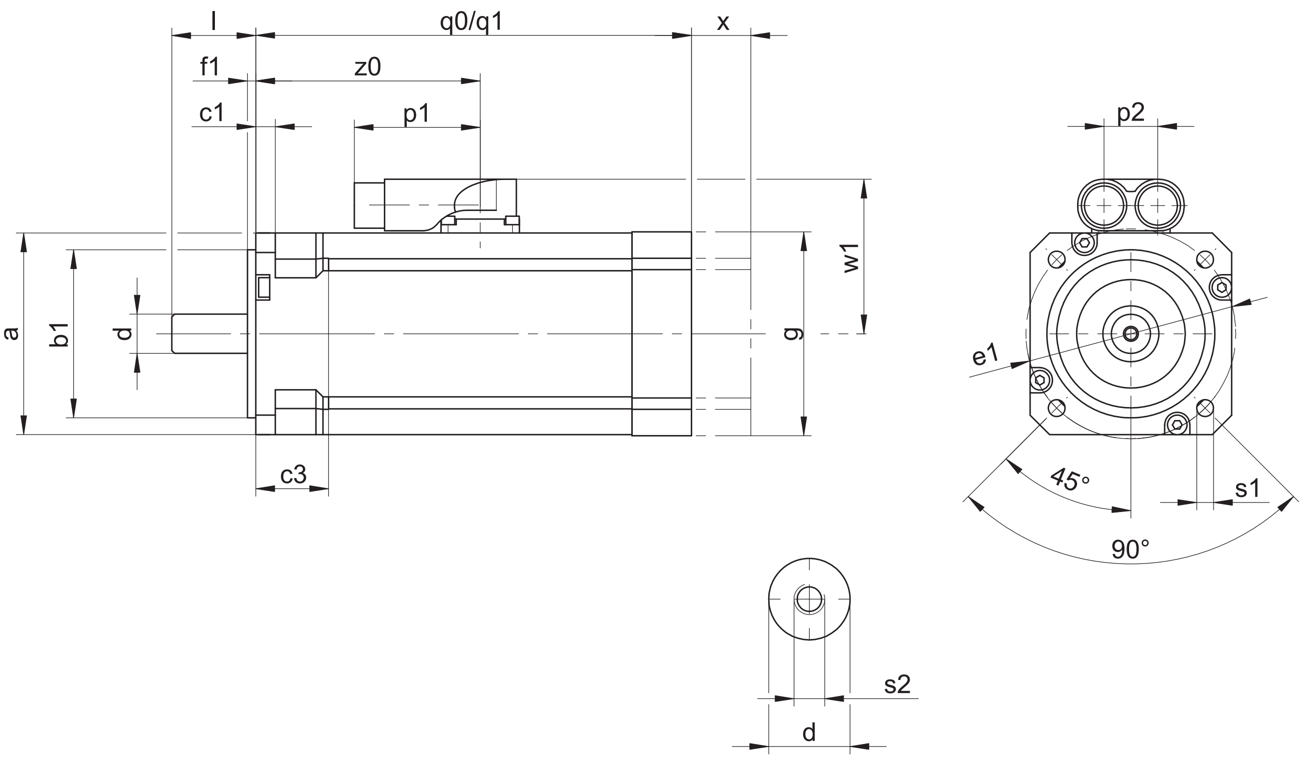
**Tolerances**

| Solid shaft | Tolerance |
|---|---|
| Shaft end fit ∅ ≤ 50 mm | DIN 748-1, ISO k6 |
| Shaft end fit ∅ > 50 mm | DIN 748-1, ISO m6 |

**Centering holes in solid shafts according to DIN 332-2, shape DR**

| **Thread size** | M4 | M5 | M6 | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|---|
| **Thread depth** | 10 | 12.5 | 16 | 19 | 22 | 28 | 36 | 42 | 50 |

## 22.4.1 EZ3 motors

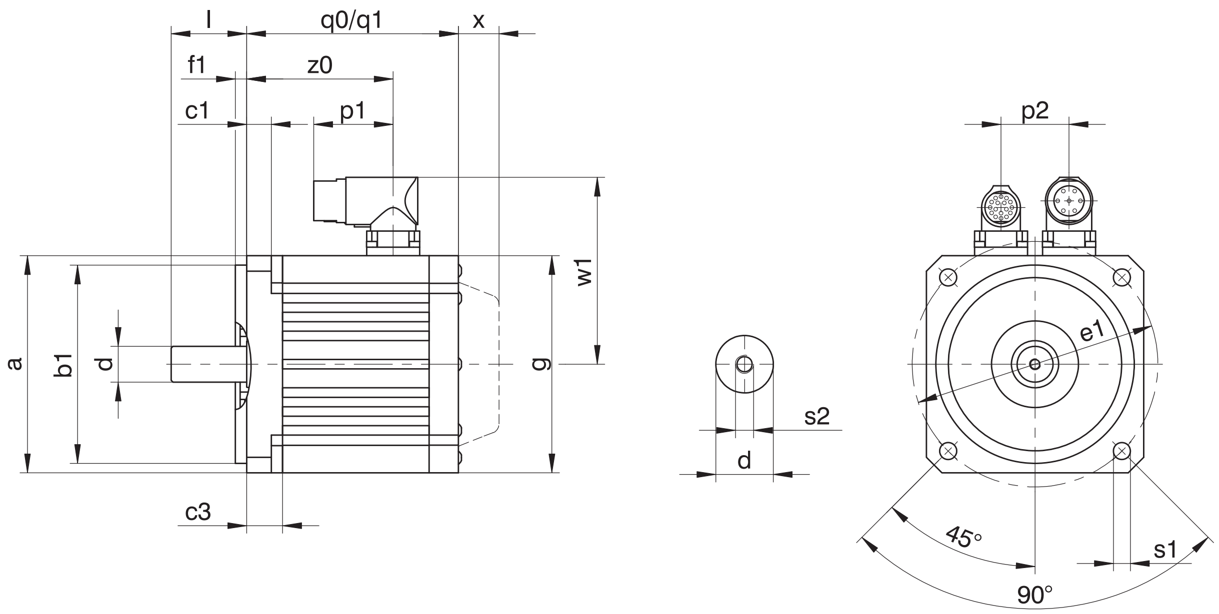



| | | | |
|---|---|---|---|
| q0 | Applies to motors without holding brake. | q1 | Applies to motors with holding brake. |
| x | Applies to encoders based on optical measuring principle. | | |

| Type | □a | ∅b1 | c1 | c3 | ∅d | ∅e1 | f1 | □g | l | p1 | p2 | q0 | q1 | ∅s1 | s2 | w1 | x | z0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EZ301U | 72 | $60_{j6}$ | 7 | 26 | $14_{k6}$ | 75 | 3 | 72 | 30 | 45 | 19 | 116 | 156 | 6 | M5 | 55.5 | 21 | 80.5 |
| EZ302U | 72 | $60_{j6}$ | 7 | 26 | $14_{k6}$ | 75 | 3 | 72 | 30 | 45 | 19 | 138 | 178 | 6 | M5 | 55.5 | 21 | 102.5 |
| EZ303U | 72 | $60_{j6}$ | 7 | 26 | $14_{k6}$ | 75 | 3 | 72 | 30 | 45 | 19 | 160 | 200 | 6 | M5 | 55.5 | 21 | 124.5 |



## 22.4.2 EZ4 – EZ8 motors with convection cooling

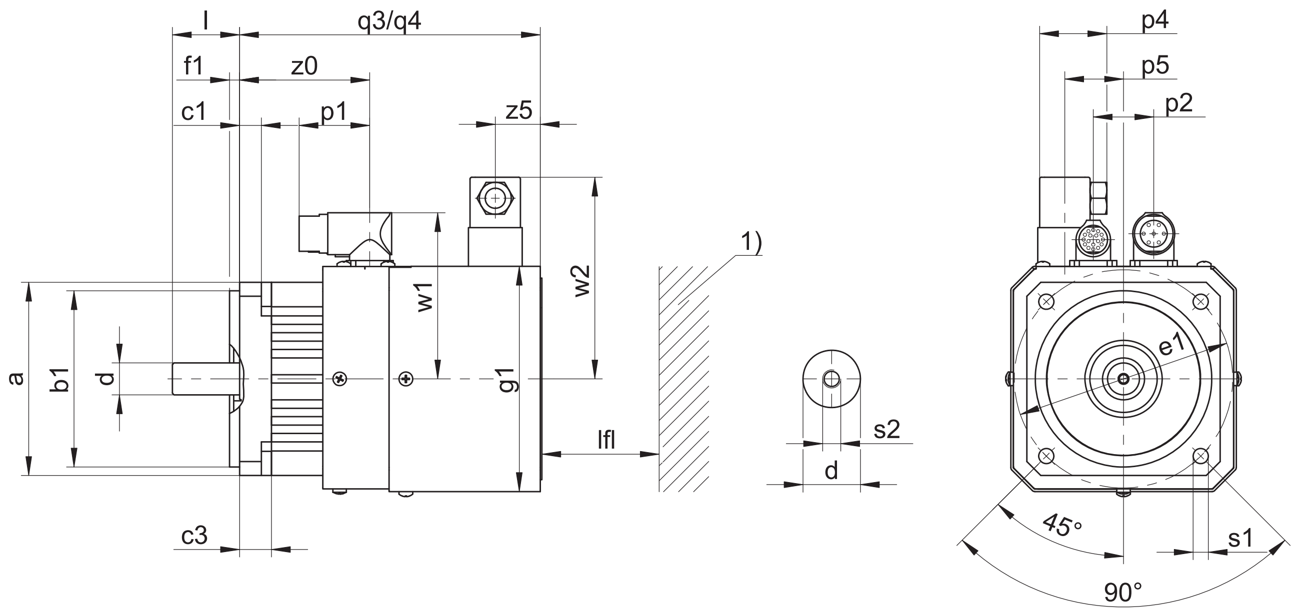



| | | | |
|---|---|---|---|
| q0 | Applies to motors without holding brake. | q1 | Applies to motors with holding brake. |
| x | Applies to encoders based on optical measuring principle. | | |

| Type | □a | ∅b1 | c1 | c3 | ∅d | ∅e1 | f1 | □g | l | p1 | p2 | q0 | q1 | ∅s1 | s2 | w1 | x | z0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EZ401U | 98 | $95_{j6}$ | 9.5 | 20.5 | $14_{k6}$ | 115 | 3.5 | 98 | 30 | 40 | 32 | 118.5 | 167.0 | 9 | M5 | 91.0 | 22 | 76.5 |
| EZ402U | 98 | $95_{j6}$ | 9.5 | 20.5 | $19_{k6}$ | 115 | 3.5 | 98 | 40 | 40 | 32 | 143.5 | 192.0 | 9 | M6 | 91.0 | 22 | 101.5 |
| EZ404U | 98 | $95_{j6}$ | 9.5 | 20.5 | $19_{k6}$ | 115 | 3.5 | 98 | 40 | 40 | 32 | 193.5 | 242.0 | 9 | M6 | 91.0 | 22 | 151.5 |
| EZ501U | 115 | $110_{j6}$ | 10.0 | 16.0 | $19_{k6}$ | 130 | 3.5 | 115 | 40 | 40 | 36 | 109.0 | 163.5 | 9 | M6 | 100.0 | 22 | 74.5 |
| EZ502U | 115 | $110_{j6}$ | 10.0 | 16.0 | $19_{k6}$ | 130 | 3.5 | 115 | 40 | 40 | 36 | 134.0 | 188.5 | 9 | M6 | 100.0 | 22 | 99.5 |
| EZ503U | 115 | $110_{j6}$ | 10.0 | 16.0 | $24_{k6}$ | 130 | 3.5 | 115 | 50 | 40 | 36 | 159.0 | 213.5 | 9 | M8 | 100.0 | 22 | 124.5 |
| EZ505U | 115 | $110_{j6}$ | 10.0 | 16.0 | $24_{k6}$ | 130 | 3.5 | 115 | 50 | 40 | 36 | 209.0 | 263.5 | 9 | M8 | 100.0 | 22 | 174.5 |
| EZ701U | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 145 | 50 | 40 | 42 | 121.0 | 180.0 | 11 | M8 | 115.0 | 22 | 83.0 |
| EZ702U | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 145 | 50 | 40 | 42 | 146.0 | 205.0 | 11 | M8 | 115.0 | 22 | 108.0 |
| EZ703U | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 145 | 50 | 40 | 42 | 171.0 | 230.0 | 11 | M8 | 115.0 | 22 | 133.0 |
| EZ705U | 145 | $130_{j6}$ | 10.0 | 19.0 | $32_{k6}$ | 165 | 3.5 | 145 | 58 | 71 | 42 | 226.0 | 285.0 | 11 | M12 | 134.0 | 22 | 184.0 |
| EZ802U | 190 | $180_{j6}$ | 15.0 | 25.0 | $32_{k6}$ | 215 | 3.5 | 190 | 58 | 71 | 60 | 222.0 | 299.0 | 13.5 | M12 | 156.5 | 22 | 168.0 |
| EZ803U | 190 | $180_{j6}$ | 15.0 | 25.0 | $38_{k6}$ | 215 | 3.5 | 190 | 80 | 71 | 60 | 263.0 | 340.0 | 13.5 | M12 | 156.5 | 22 | 209.0 |
| EZ805U | 190 | $180_{j6}$ | 15.0 | 25.0 | $38_{k6}$ | 215 | 3.5 | 190 | 80 | 71 | 60 | 345.0 | 422.0 | 13.5 | M12 | 156.5 | 22 | 277.0 |



### 22.4.3 EZ4 – EZ8 motors with forced ventilation

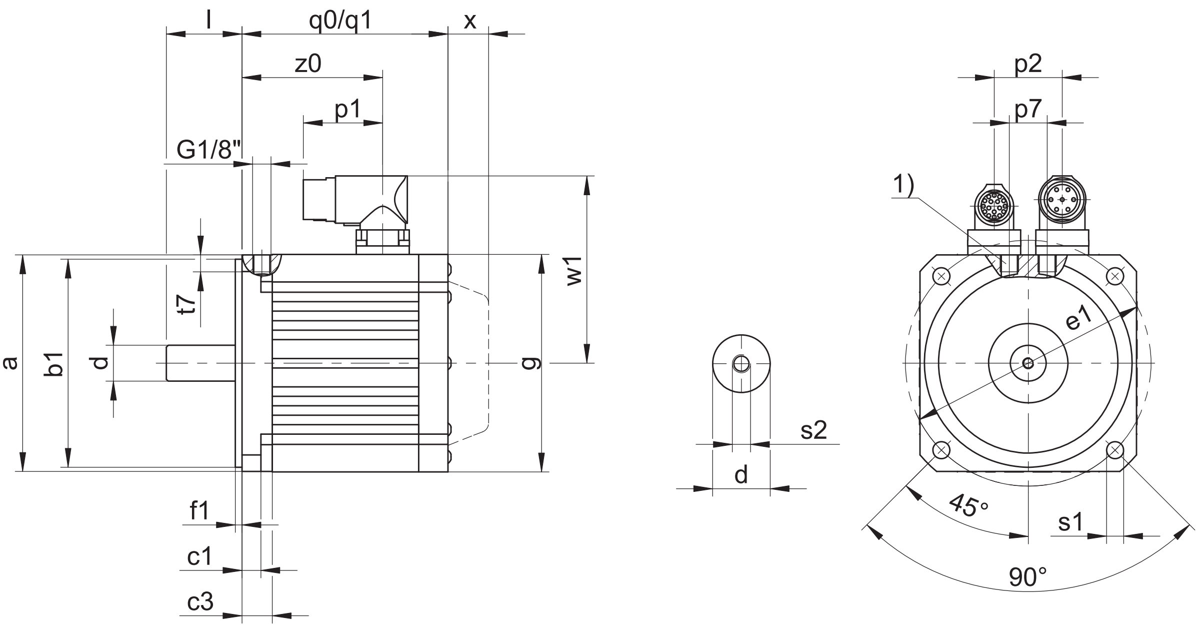



| | | | |
|---|---|---|---|
| q3 | Applies to motors without holding brake. | q4 | Applies to motors with holding brake. |
| 1) | Machine wall | | |

| Type | □a | Øb1 | c1 | c3 | Ød | Øe1 | f1 | □g1 | l | $lfl_{min}$ | p1 | p2 | p4 | p5 | q3 | q4 | Øs1 | s2 | w1 | w2 | z0 | z5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EZ401B | 98 | $95_{j6}$ | 9.5 | 20.5 | $14_{k6}$ | 115 | 3.5 | 118 | 30 | 20 | 40 | 32 | 37.5 | 0 | 175 | 224 | 9.0 | M5 | 91.0 | 111 | 76.5 | 25 |
| EZ402B | 98 | $95_{j6}$ | 9.5 | 20.5 | $19_{k6}$ | 115 | 3.5 | 118 | 40 | 20 | 40 | 32 | 37.5 | 0 | 200 | 249 | 9.0 | M6 | 91.0 | 111 | 101.5 | 25 |
| EZ404B | 98 | $95_{j6}$ | 9.5 | 20.5 | $19_{k6}$ | 115 | 3.5 | 118 | 40 | 20 | 40 | 32 | 37.5 | 0 | 250 | 299 | 9.0 | M6 | 91.0 | 111 | 151.5 | 25 |
| EZ501B | 115 | $110_{j6}$ | 10.0 | 16.0 | $19_{k6}$ | 130 | 3.5 | 135 | 40 | 20 | 40 | 36 | 37.5 | 0 | 179 | 234 | 9.0 | M6 | 100.0 | 120 | 74.5 | 25 |
| EZ502B | 115 | $110_{j6}$ | 10.0 | 16.0 | $19_{k6}$ | 130 | 3.5 | 135 | 40 | 20 | 40 | 36 | 37.5 | 0 | 204 | 259 | 9.0 | M6 | 100.0 | 120 | 99.5 | 25 |
| EZ503B | 115 | $110_{j6}$ | 10.0 | 16.0 | $24_{k6}$ | 130 | 3.5 | 135 | 50 | 20 | 40 | 36 | 37.5 | 0 | 229 | 284 | 9.0 | M8 | 100.0 | 120 | 124.5 | 25 |
| EZ505B | 115 | $110_{j6}$ | 10.0 | 16.0 | $24_{k6}$ | 130 | 3.5 | 135 | 50 | 20 | 40 | 36 | 37.5 | 0 | 279 | 334 | 9.0 | M8 | 100.0 | 120 | 174.5 | 25 |
| EZ701B | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 165 | 50 | 30 | 40 | 42 | 37.5 | 0 | 213 | 272 | 11.0 | M8 | 115.0 | 134 | 83.0 | 40 |
| EZ702B | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 165 | 50 | 30 | 40 | 42 | 37.5 | 0 | 238 | 297 | 11.0 | M8 | 115.0 | 134 | 108.0 | 40 |
| EZ703B | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 165 | 50 | 30 | 40 | 42 | 37.5 | 0 | 263 | 322 | 11.0 | M8 | 115.0 | 134 | 133.0 | 40 |
| EZ705B | 145 | $130_{j6}$ | 10.0 | 19.0 | $32_{k6}$ | 165 | 3.5 | 165 | 58 | 30 | 71 | 42 | 37.5 | 0 | 318 | 377 | 11.0 | M12 | 134.0 | 134 | 184.0 | 40 |
| EZ802B | 190 | $180_{j6}$ | 15.0 | 25.0 | $32_{k6}$ | 215 | 3.5 | 215 | 58 | 30 | 71 | 60 | 37.5 | 62 | 322 | 399 | 13.5 | M12 | 156.5 | 160 | 168.0 | 40 |
| EZ803B | 190 | $180_{j6}$ | 15.0 | 25.0 | $38_{k6}$ | 215 | 3.5 | 215 | 80 | 30 | 71 | 60 | 37.5 | 62 | 363 | 440 | 13.5 | M12 | 156.5 | 160 | 209.0 | 40 |
| EZ805B | 190 | $180_{j6}$ | 15.0 | 25.0 | $38_{k6}$ | 215 | 3.5 | 215 | 80 | 30 | 71 | 60 | 37.5 | 62 | 445 | 522 | 13.5 | M12 | 178.0 | 160 | 277.0 | 40 |

### 22.4.4 EZ4 – EZ8 motors with water cooling

**EZ4**
**EZ7**
**EZ8**




**EZ5**


| | |
|---|---|
| 1) | The supply or return line of the cooling system can be connected to both connections for water cooling. The flange with the connections for water cooling can be rotated 180°. |
| q0 | Applies to motors without holding brake. |
| q1 | Applies to motors with holding brake. |
| x | Applies to encoders based on optical measuring principle. |

| Type | □a | Øb1 | c1 | c3 | Ød | Øe1 | f1 | □g | l | p1 | p2 | p7 | q0 | q1 | Øs1 | s2 | t7 | w1 | x | z0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EZ401W | 98 | $95_{j6}$ | 9.5 | 20.5 | $14_{k6}$ | 115 | 3.5 | 98 | 30 | 40 | 32 | 20 | 118.5 | 167.0 | 9 | M5 | 9 | 91.0 | 22 | 76.5 |
| EZ402W | 98 | $95_{j6}$ | 9.5 | 20.5 | $19_{k6}$ | 115 | 3.5 | 98 | 40 | 40 | 32 | 20 | 143.5 | 192.0 | 9 | M6 | 9 | 91.0 | 22 | 101.5 |
| EZ404W | 98 | $95_{j6}$ | 9.5 | 20.5 | $19_{k6}$ | 115 | 3.5 | 98 | 40 | 40 | 32 | 20 | 193.5 | 242.0 | 9 | M6 | 9 | 91.0 | 22 | 151.5 |
| EZ501W | 115 | $110_{j6}$ | 10.0 | 16.0 | $19_{k6}$ | 130 | 3.5 | 115 | 40 | 40 | 36 | 20 | 109.0 | 163.5 | 9 | M6 | 8 | 100.0 | 22 | 74.5 |
| EZ502W | 115 | $110_{j6}$ | 10.0 | 16.0 | $19_{k6}$ | 130 | 3.5 | 115 | 40 | 40 | 36 | 20 | 134.0 | 188.5 | 9 | M6 | 8 | 100.0 | 22 | 99.5 |
| EZ503W | 115 | $110_{j6}$ | 10.0 | 16.0 | $24_{k6}$ | 130 | 3.5 | 115 | 50 | 40 | 36 | 20 | 159.0 | 213.5 | 9 | M8 | 8 | 100.0 | 22 | 124.5 |
| EZ505W | 115 | $110_{j6}$ | 10.0 | 16.0 | $24_{k6}$ | 130 | 3.5 | 115 | 50 | 40 | 36 | 20 | 209.0 | 263.5 | 9 | M8 | 8 | 100.0 | 22 | 174.5 |
| EZ701W | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 145 | 50 | 40 | 42 | 20 | 121.0 | 180.0 | 11 | M8 | 9 | 115.0 | 22 | 83.0 |
| EZ702W | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 145 | 50 | 40 | 42 | 20 | 146.0 | 205.0 | 11 | M8 | 9 | 115.0 | 22 | 108.0 |
| EZ703W | 145 | $130_{j6}$ | 10.0 | 19.0 | $24_{k6}$ | 165 | 3.5 | 145 | 50 | 40 | 42 | 20 | 171.0 | 230.0 | 11 | M8 | 9 | 115.0 | 22 | 133.0 |
| EZ705W | 145 | $130_{j6}$ | 10.0 | 19.0 | $32_{k6}$ | 165 | 3.5 | 145 | 58 | 71 | 42 | 20 | 226.0 | 285.0 | 11 | M12 | 9 | 134.0 | 22 | 184.0 |
| EZ802W | 190 | $180_{j6}$ | 15.0 | 25.0 | $32_{k6}$ | 215 | 3.5 | 190 | 58 | 71 | 60 | 25 | 222.0 | 299.0 | 13.5 | M12 | 12 | 156.5 | 22 | 168.0 |
| EZ803W | 190 | $180_{j6}$ | 15.0 | 25.0 | $38_{k6}$ | 215 | 3.5 | 190 | 80 | 71 | 60 | 25 | 263.0 | 340.0 | 13.5 | M12 | 12 | 156.5 | 22 | 209.0 |
| EZ805W | 190 | $180_{j6}$ | 15.0 | 25.0 | $38_{k6}$ | 215 | 3.5 | 190 | 80 | 71 | 60 | 25 | 345.0 | 422.0 | 13.5 | M12 | 12 | 156.5 | 22 | 291.0 |



# 22.5 Type designation

**Sample code**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EZ | 4 | 0 | 1 | U | D | AD | M4 | O | 096 |

**Explanation**

| Code | Designation | Design |
|---|---|---|
| **EZ** | Type | Synchronous servo motor |
| **4** | Size | 4 (example) |
| **0** | Generation | 0 |
| **1** | Length | 1 (example) |
| **U**<br>B<br>W | Cooling[1] | Convection cooling<br>Forced ventilation<br>Water cooling |
| **D**<br>M | Mass moment of inertia | Dynamic performance<br>With increased mass moment of inertia[2] |
| **AD** | Drive controller | SD6 (example) |
| **M4** | Encoder | EQI 1131 FMA EnDat 2.2 (example) |
| **O**<br>P | Brake | Without holding brake<br>Permanent magnet holding brake |
| **096** | Electromagnetic constant (EMC) $K_{EM}$ | 96 V/1000 rpm (example) |

**Instructions**

- You can find information about available encoders in section [▸ 22.6.4].
- In section [▸ 22.6.4.5], you can find information about connecting synchronous servo motors to other STOBER drive controllers.
- In section [▸ 27], you can find information about connecting STOBER synchronous servo motors to drive controllers of third-party manufacturers.

# 22.6 Product description

## 22.6.1 General features

| Feature | Description |
|---|---|
| Design | IM B5, IM V1, IM V3 in accordance with EN 60034-7/A1 |
| Protection class | IP56 / IP66 (option) |
| Thermal class | 155 (F) as per EN 60034-1 (155 °C, heating $\Delta\vartheta$ = 100 K) |
| Surface[3] | Black matte as per RAL 9005 |
| Cooling | IC 410 convection cooling<br>(IC 416 convection cooling with forced ventilation or optionally water cooling in the A-side flange) |
| Bearing | Ball bearing with lifetime lubrication and non-contact sealing |
| Sealing | Radial shaft seal rings made of FKM (A side) |
| Shaft end | Shaft without feather key, diameter quality k6 |
| Concentricity | Normal tolerance class in accordance with IEC 60072-1 |

[1] Only convection cooling available for EZ3 motors
[2] Not available for EZ3, EZ501 and EZ701 motors.
[3] Repainting will change the thermal properties and therefore the performance limits of the motor.

| Feature | Description |
|---|---|
| Coaxiality | Normal tolerance class in accordance with IEC 60072-1 |
| Axial runout | Normal tolerance class in accordance with IEC 60072-1 |
| Vibration intensity | A as per EN 60034-14/A1 |
| Noise level | Limit values as per EN 60034-9/A1 |

## 22.6.2 Electrical features

General electrical features of the motor are described in this section. For details see the selection tables section.

| Feature | Description |
|---|---|
| DC-link-voltage | DC 540 V (max. 620 V) on STOBER drive controllers |
| Winding | Three-phase, single-tooth design |
| Circuit | Star, center not led out |
| Protection class | I (protective grounding) as per EN 61140/A1 |
| Number of pole pairs | 5 (EZ3)<br>7 (EZ4/EZ5/EZ7)<br>8 (EZ8) |

## 22.6.3 Ambient conditions

Standard ambient conditions for transport, storage and operation of the motor are described in this section. Information about differing ambient conditions can be found in section [22.7.3].

| Feature | Description |
|---|---|
| Transport/storage surrounding temperature[4] | -30 °C to +85 °C |
| Surrounding operating temperature | −15 °C to +40 °C (without water cooling)<br>+10 °C to +40 °C (with water cooling) |
| Installation altitude | ≤ 1000 m above sea level |
| Shock load | ≤ 50 m/s² (5 g), 6 ms as per EN 60068-2-27 |

**Instructions**

- STOBER synchronous servo motors are not suitable for use in potentially explosive atmospheres according to ATEX-Richtlinie2014/34/EU.
- Brace the motor connection cables close to the motor so that vibrations of the cable do not place unpermitted loads on the motor plug connector.
- Note that the braking torques of the holding brake (optional) may be reduced due to shock loading.
- Also take into consideration the shock load of the motor with output units (such as gear units and pumps) to which the motor is connected.

## 22.6.4 Encoder

STOBER synchronous servo motors are available in versions with different encoder types. The following sections include information for choosing the optimal encoder for your application.

### 22.6.4.1 Encoder measuring principle selection tool

The following table provides you with a selection tool for an encoder measuring principle that is optimally suited for your application.

[4] If you will be storing or transporting the system in which a motor with water cooling is installed below +3 °C, drain the water completely out of the cooling circuit in advance.

EZ



| Feature | Absolute value encoder | | Resolver |
|---|---|---|---|
| Measuring principle | Optical | Inductive | Electromagnetic |
| Temperature resistance | ★★☆ | ★★★ | ★★★ |
| Vibration strength and shock resistance | ★★☆ | ★★★ | ★★★ |
| System accuracy | ★★★ | ★★☆ | ★☆☆ |
| Version with fault elimination for mechanical mounting FMA (option with EnDat interface) | ✓ | ✓ | – |
| The multiturn version (optional) eliminate the need for referencing | ✓ | ✓ | – |
| - Electronic nameplate ensures easy commissioning | ✓ | ✓ | – |
| Key: ★☆☆ = satisfactory, ★★☆ = good, ★★★ = very good | | | |

### 22.6.4.2 Selection tool for EnDat interface

The following table provides you with a selection tool for the EnDat interface of absolute value encoders.

| Feature | EnDat 2.1 | EnDat 2.2 |
|---|---|---|
| Short cycle times | ★★☆ | ★★★ |
| Additional information transferred with the position value | – | ✓ |
| Expanded power supply range | ★★☆ | ★★★ |
| Key: ★★☆ = good, ★★★ = very good | | |

### 22.6.4.3 EnDat encoder

In this chapter you can find detailed technical data of the encoder types that can be selected with EnDat interface.

**Encoder with EnDat 2.2 interface**

| Encoder type | Type code | Measuring principle | Recordable revolutions | Resolution | Position values per revolution |
|---|---|---|---|---|---|
| EQI 1131 FMA | M4 | Inductive | 4096 | 19 bits | 524288 |
| EQI 1131 | Q6 | Inductive | 4096 | 19 bits | 524288 |
| EBI 1135 | B0 | Inductive | 65536 | 18 bits | 262144 |
| EQN 1135 FMA | M3 | Optical | 4096 | 23 bits | 8388608 |
| EQN 1135 | Q5 | Optical | 4096 | 23 bits | 8388608 |
| ECN 1123 FMA | M1 | Optical | – | 23 bits | 8388608 |
| ECN 1123 | C7 | Optical | – | 23 bits | 8388608 |
| ECI 1118-G2 | C5 | Inductive | – | 18 bits | 262144 |

**Encoder with EnDat 2.1 interface**

| Encoder type | Type code | Measuring principle | Recordable revolutions | Resolution | Position values per revolution | Periods per revolution |
|---|---|---|---|---|---|---|
| EQN 1125 FMA | M2 | Optical | 4096 | 13 bits | 8192 | Sin/cos 512 |
| EQN 1125 | Q4 | Optical | 4096 | 13 bits | 8192 | Sin/cos 512 |
| ECN 1113 FMA | M0 | Optical | – | 13 bits | 8192 | Sin/cos 512 |
| ECN 1113 | C6 | Optical | – | 13 bits | 8192 | Sin/cos 512 |

**Instructions**

- The type code of the encoder is a part of the type designation of the motor.
- FMA = Version with fault elimination for mechanical mounting.
- The encoder EBI 1135 requires an external buffer battery so that the absolute position information will be retained after the power supply is turned off.
- Several revolutions of the motor shaft can only be recorded with multiturn encoders.

### 22.6.4.4 Resolver

In this chapter you can find detailed technical data of the resolver that can be installed as an encoder in a STOBER synchronous servo motor.

| Feature | Description |
|---|---|
| Input voltage $U_{1eff}$ | 7 V ± 5 % |
| Input frequency $f_1$ | 10 kHz |
| Output voltage $U_{2,S1-S3}$ | $K_{tr} \cdot U_{R1-R2} \cdot \cos\theta$ |
| Output voltage $U_{2,S2-S4}$ | $K_{tr} \cdot U_{R1-R2} \cdot \sin\theta$ |
| Transformation ratio $K_{tr}$ | 0.5 ± 5 % |
| Electrical fault | ±10 arcmin |

### 22.6.4.5 Possible combinations with drive controllers

The following table shows combination options of STOBER drive controllers with selectable encoder types.

| **Drive controller** | | **SDS 5000** | **MDS 5000** | **SDS 5000 sin/cos MDS 5000 sin/cos** | **SD6** | **SD6 sin/cos** |
|---|---|---|---|---|---|---|
| **Drive controller type code** | | AA | AB | AC | AD | AE |
| **ID connection plan** | | 442305 | 442306 | 442307 | 442450 | 442451 |
| **Encoder** | **Encoder type code** | | | | | |
| EQI 1131 FMA | M4 | ✓ | – | – | ✓ | – |
| EQI 1131 | Q6 | ✓ | ✓ | – | ✓ | – |
| EBI 1135 | B0 | ✓ | ✓ | – | ✓ | – |
| EQN 1135 FMA | M3 | ✓ | – | – | ✓ | – |
| EQN 1135 | Q5 | ✓ | ✓ | – | ✓ | – |
| ECN 1123 FMA | M1 | ✓ | – | – | ✓ | – |
| ECN 1123 | C7 | ✓ | ✓ | – | ✓ | – |
| ECI 1118-G2 | C5 | ✓ | ✓ | – | ✓ | – |
| EQN 1125 FMA | M2 | ✓ | ✓ | ✓ | ✓ | ✓ |
| EQN 1125 | Q4 | ✓ | ✓ | ✓ | ✓ | ✓ |
| ECN 1113 FMA | M0 | ✓ | ✓ | ✓ | ✓ | ✓ |
| ECN 1113 | C6 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Resolver | R0 | ✓ | ✓ | – | – | ✓ |

**Instructions**

- The type code of the drive controller and the encoder are a part of the type designation of the motor (see type designation chapter).
- In section [▸ 27], you can find information about connecting STOBER synchronous servo motors to drive controllers of third-party manufacturers.

EZ



## 22.6.5 Temperature sensor

In this chapter you can find technical data of the temperature sensors that are installed in STOBER synchronous servo motors for the realization of the thermal winding protection. To prevent damage to the motor, always monitor the temperature sensor with appropriate devices that will turn off the motor if the maximum permitted winding temperature is exceeded.

Some encoders have their own internal analysis electronics with warning and off limits that may overlap with the corresponding values set in the drive controller for the temperature sensor. In some cases this may result in an encoder with internal temperature monitoring forcing the motor to shut down even before the motor has reached its nominal data.

You can find information about the electrical connection of the temperature sensor in the connection technology chapter.

### 22.6.5.1 PTC thermistor

The PTC thermistor is installed as a standard temperature sensor in STOBER synchronous servo motors. The PTC thermistor is a drilling thermistor as per DIN 44082, so that the temperature of each winding phase can be monitored.

The resistance values in the following table and characteristic curve refer to a single thermistor as per DIN 44081. These values must be multiplied by 3 for a drilling thermistor in accordance with DIN 44082.

| Feature | Description |
|---|---|
| Nominal response temperature $\vartheta_{NAT}$ | 145 °C ± 5 K |
| Resistance R −20 °C up to $\vartheta_{NAT}$ − 20 K | ≤ 250 Ω |
| Resistance R with $\vartheta_{NAT}$ − 5 K | ≤ 550 Ω |
| Resistance R with $\vartheta_{NAT}$ + 5 K | ≥ 1330 Ω |
| Resistance R with $\vartheta_{NAT}$ + 15 K | ≥ 4000 Ω |
| Operating voltage | ≤ DC 7,5 V |
| Thermal response time | < 5 s |
| Thermal class | 155 (F) as per EN 60034-1 (155 °C, heating $\Delta\vartheta$ = 100 K) |

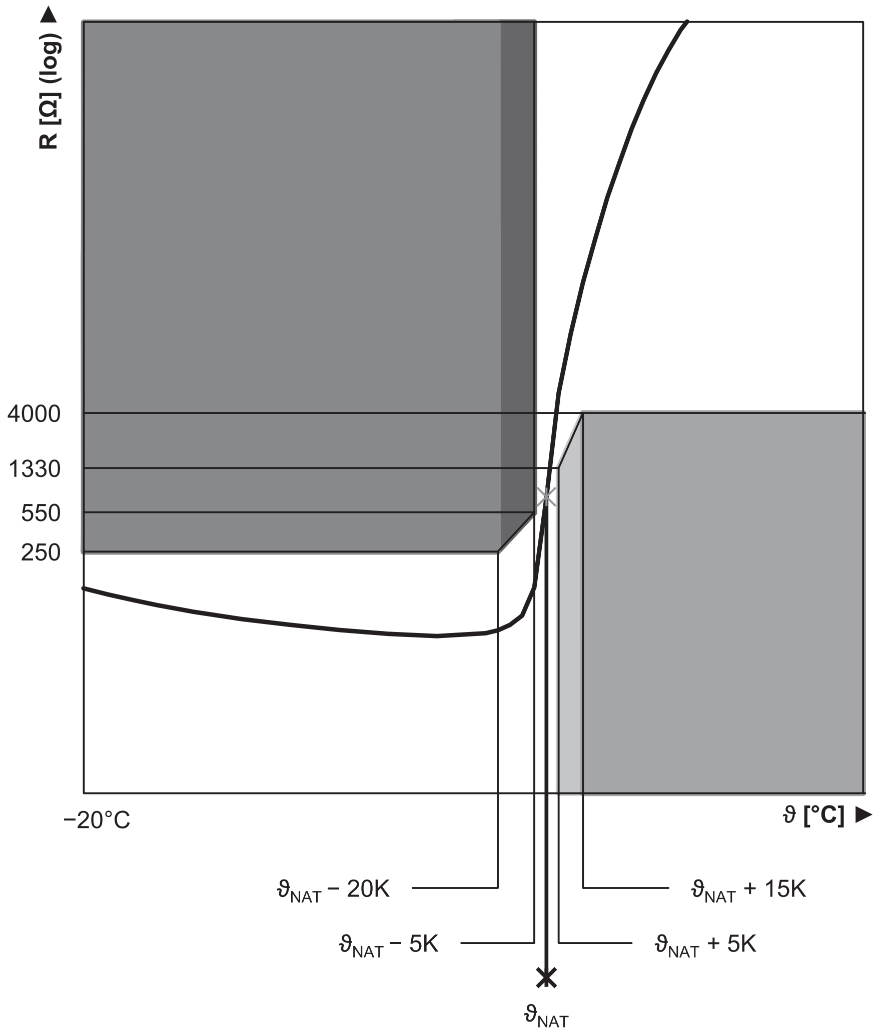



*Illustration 2:* Characteristic curve of PTC thermistor (single thermistor)

## 22.6.6 Cooling

A synchronous servo motor in the standard version is cooled by convection cooling (IC 410 in accordance with EN 60034-6). The air flowing around the motor is heated by the radiated motor heat and rises. The motor can optionally be cooled by an forced-cooling fan or with water.

### 22.6.6.1 Forced ventilation

STOBER synchronous servo motors can optionally be cooled with a forced-cooling fan to increase the performance data for the same size. Retrofitting with a forced-cooling fan is also possible to optimize the drive at a later date. When retrofitting, check whether the core cross-section of the power cable of the motor must be increased. Also take into account the dimensions of the forced-cooling fan.

The performance data of the motors with forced ventilation can be found in section [▹ 22.2.2], the dimensional drawings in section [▹ 22.4.3].

| Formula symbols | Unit | Explanation |
|---|---|---|
| $I_{N,F}$ | A | Nominal current of the forced-cooling fan |
| $L_{pA}$ | dBA | Noise level of the forced-cooling fan in the optimum operating range |
| $m_F$ | kg | Weight of the forced-cooling fan |
| $P_{N,F}$ | W | Nominal output of the forced-cooling fan |

EZ

| Formula symbols | Unit | Explanation |
|---|---|---|
| $q_{vF}$ | m³/h | Delivery capacity of the forced-cooling fan in open air |
| $U_{N,F}$ | V | Nominal voltage of the forced-cooling fan |

**Technical Data**

| Motor | Forced-cooling fan | $U_{N,F}$ [V] | $I_{N,F}$ [V] | $P_{N,F}$ [W] | $q_{v,F}$ [m³/h] | $L_{p(A)}$ [dBA] | $m_F$ [kg] | Protection class |
|---|---|---|---|---|---|---|---|---|
| EZ4_B | FL4 | 230 V ± 5 %, 50/60 Hz | 0.07 | 10 | 59 | 41 | 1.4 | IP44 |
| EZ5_B | FL5 | | 0.10 | 14 | 160 | 45 | 1.9 | IP54 |
| EZ7_B | FL7 | | 0.10 | 14 | 160 | 45 | 2.9 | IP54 |
| EZ8_B | FL8 | | 0.20 | 26 | 420 | 54 | 5.0 | IP55 |

**Connection assignment for forced-cooling fan plug connectors**

| Connection diagram | Pin | Connection |
|---|---|---|
|  | 1 | L1 (phase) |
| | 2 | N (neutral conductor) |
| | 3 | |
| | ⏚ | PE (protective ground) |

### 22.6.6.2 Water cooling

STOBER synchronous servo motors can optionally be cooled with water to increase the performance data for the same size. Water cooling represents an alternative to forced ventilation if it is not possible due to the surrounding area or space considerations. Water cooling cannot be retrofitted. It must be specified in the purchase order. Water cooling can not be combined with forced ventilation.

The performance data of the motors with water cooling can be found in section [▸ 22.2.3], the dimensional drawings in section [▸ 22.4.4].

**Cooling circuit specification**

| Feature | Description |
|---|---|
| Coolant | Water |
| Temperature at inlet | +5 °C to +40 °C (max. 5 K below the surrounding temperature) |
| Cooling circuit | Closed, with recooling unit |
| Cleanliness | Clear, with no suspended matter or dirt, use particle filter ≤ 100 µm if necessary |
| pH value | 6.5 – 7.5 |
| Hardness | 1.43 – 2.5 mmol/l |
| Salinity | NaCl < 100 ppm, demineralized |
| Anticorrosive | Maximum percentage 25 %, neutral relative to AlCuMgPb F38, GG-220HB |
| Operating pressure | ≤ 3.5 bar (provide a pressure relief valve in the supply line if necessary) |
| Flow rate | Optimum 6 l/min, minimum 4.5 l/min (EZ4/EZ5) |
| | Optimum 7.5 l/min, minimum 5 l/min (EZ7/EZ8) |

**Instructions**

- The nominal data for synchronous servo motors with water cooling refers to water as a coolant. If another coolant is used, the nominal data must be determined again.
- For detailed information about the cooling system or coolants and coolant additives, please contact the manufacturer of your cooling system.
- Coolant with fresh water from the public supply grid with coolants, lubricants or cutting agents from the machining process is not permitted.
- If the temperature of the coolant is lower than the surrounding temperature, interrupt the supply of coolant when the motor is stopped for extended times to prevent condensation water from forming.
- If you will be storing or transporting the system in which a motor is installed below +3 °C, drain the water completely out of the cooling circuit in advance.
- Further information on water cooling can be found in the operating manual for the motor.

## 22.6.7 Holding brake

STOBER synchronous servo motors can by equipped with a backlash-free permanent magnet holding brake to keep the motor shaft still when stopped. The holding brake engages automatically if the voltage drops.

Nominal voltage of permanent magnet holding brake: DC 24 V ± 5 %, smoothed. Take into account the voltage losses in the connection lines of the holding brake.

**Observe the following for the configuration:**

- The holding brake can be used for braking from full speed (following a power failure or when setting up the machine). Activate other braking processes during operation via corresponding brake functions of the drive controller to prevent prematurely wear on the holding brake.
- Note that when braking from full speed the braking torque $M_{Bdyn}$ may initially be up to 50 % less. This causes the braking effect to be introduced later and braking distances will be longer.
- Regularly perform a brake test to ensure the functional safety of the brakes. For further details see the documentation of the motor and the drive controller.
- Connect a varistor of type S14 K35 (or comparable) in parallel to the brake coil to protect your machine from switching surges. (Not necessary for connecting the holding brake to STOBER drive controller with BRS/BRM brake module).
- The holding brake of the synchronous servo motor does not provide adequate safety for person in the hazardous area around gravity-loaded vertical axes. Therefore take additional measures to minimize risk, e.g. by providing a mechanical substructure for maintenance work.
- Take into consideration voltage losses in the connection cables that connect the voltage source to the holding brake connections.
- The braking torque of the brake can be reduced by shock loading. Information about shock loading can be found in the ambient conditions section.

| Formula symbols | Unit | Explanation |
|---|---|---|
| $I_{N,B}$ | A | Nominal current of the brake at 20 °C |
| $\Delta J_B$ | $10^{-4}$kgm$^2$ | Additive mass moment of inertia of a motor with holding brake |
| $J_{Bstop}$ | $10^{-4}$kgm$^2$ | Reference mass moment of inertia with braking from full speed: $J_{Bstop} = J_{dyn} \times 2$ |
| $J_{dyn}$ | $10^{-4}$kgm$^2$ | Mass moment of inertia of a motor in the dynamic version |
| $J_{tot}$ | $10^{-4}$kgm$^2$ | Total mass moment of inertia (relative to the motor shaft) |
| $\Delta m_B$ | kg | Additive weight of a motor with holding brake |
| $M_{Bdyn}$ | Nm | Dynamic braking torque at 100 °C (Tolerance +40 %, −20 %) |

| Formula symbols | Unit | Explanation |
|---|---|---|
| $M_{Bstat}$ | Nm | Static braking torque at 100 °C (Tolerance +40 %, −20 %) |
| $M_L$ | Nm | Load torque |
| $N_{Bstop}$ | – | Permitted number of braking processes from full speed (n = 3000 rpm) with $J_{Bstop}$ ($M_L$ = 0). The following applies if the values of n and $J_{Bstop}$ differ: $N_{Bstop} = W_{B,Rlim} / W_{B,R/B}$. |
| n | rpm | Speed |
| $t_1$ | ms | Linking time: time from when the current is turned off until the nominal braking torque is reached |
| $t_2$ | ms | Disengagement time: time from when the current is turned on until the torque begins to drop |
| $t_{11}$ | ms | Response delay: time from when the current is turned off until the torque increases |
| $t_{dec}$ | ms | Stop time |
| $U_{N,B}$ | V | Nominal voltage of brake (DC 24 V ±5 % (smoothed)) |
| $W_{B,R/B}$ | J | Friction work per braking |
| $W_{B,Rlim}$ | J | Friction work until wear limit is reached |
| $W_{B,Rmax/h}$ | J | Maximum permitted friction work per hour per individual braking |
| $x_{B,N}$ | mm | Nominal air gap of brake |

**Calculation of friction work per braking process**

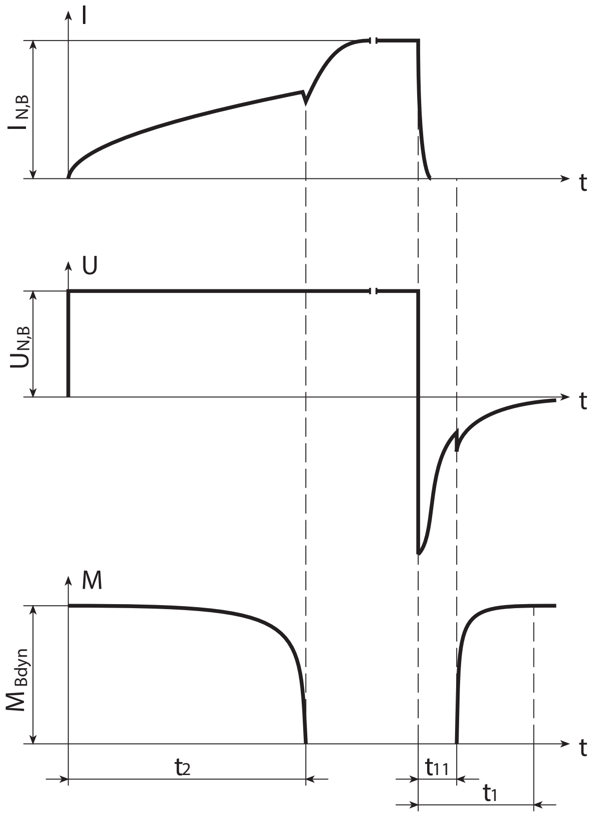
$$W_{B,R/B} = \frac{J_{tot} \cdot n^2}{182.4} \cdot \frac{M_{Bdyn}}{M_{Bdyn} \pm M_L}$$

The sign of $M_L$ is positive if the movement runs vertically up or horizontally and negative if the movement runs vertically down.

**Calculation of the stop time**

$$t_{dec} = 2.66 \cdot t_1 + \frac{n \cdot J_{tot}}{9.55 \cdot M_{Bdyn}}$$

**Switching characteristics**




**Technical Data**

| | $M_{Bstat}$ [Nm] | $M_{Bdyn}$ [Nm] | $I_{N,B}$ [A] | $W_{B,Rmax/h}$ [kJ] | $N_{B,stop}$ | $J_{B,stop}$ [$10^{-4}$kgm²] | $W_{B,Rlim}$ [kJ] | $t_2$ [ms] | $t_{11}$ [ms] | $t_1$ [ms] | $x_{B,N}$ [mm] | $\Delta J_B$ [$10^{-4}$kgm²] | $\Delta m_B$ [kg] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EZ301 | 2.5 | 2.3 | 0.51 | 6.0 | 48000 | 0.752 | 180 | 25 | 3.0 | 20 | 0.2 | 0.186 | 0.55 |
| EZ302 | 4.0 | 3.8 | 0.75 | 8.5 | 38000 | 0.952 | 180 | 44 | 4.0 | 26 | 0.3 | 0.186 | 0.55 |
| EZ303 | 4.0 | 3.8 | 0.75 | 8.5 | 30000 | 1.17 | 180 | 44 | 4.0 | 26 | 0.3 | 0.186 | 0.55 |
| EZ401 | 4.0 | 3.8 | 0.75 | 8.5 | 16000 | 2.24 | 180 | 44 | 4.0 | 26 | 0.3 | 0.192 | 0.76 |
| EZ402 | 8.0 | 7.0 | 0.75 | 8.5 | 13500 | 4.39 | 300 | 40 | 2.0 | 20 | 0.3 | 0.566 | 0.97 |
| EZ404 | 8.0 | 7.0 | 0.75 | 8.5 | 8500 | 7.09 | 300 | 40 | 2.0 | 20 | 0.3 | 0.566 | 0.97 |
| EZ501 | 8.0 | 7.0 | 0.75 | 8.5 | 8700 | 6.94 | 300 | 40 | 2.0 | 20 | 0.3 | 0.571 | 1.19 |
| EZ502 | 8.0 | 7.0 | 0.75 | 8.5 | 5200 | 11.5 | 300 | 40 | 2.0 | 20 | 0.3 | 0.571 | 1.19 |
| EZ503 | 15 | 12 | 1.0 | 11.0 | 5900 | 18.6 | 550 | 60 | 5.0 | 30 | 0.3 | 1.721 | 1.62 |
| EZ505 | 15 | 12 | 1.0 | 11.0 | 4000 | 27.8 | 550 | 60 | 5.0 | 30 | 0.3 | 1.721 | 1.62 |
| EZ701 | 15 | 12 | 1.0 | 11.0 | 5400 | 20.5 | 550 | 60 | 5.0 | 30 | 0.3 | 1.743 | 1.94 |
| EZ702 | 15 | 12 | 1.0 | 11.0 | 3600 | 30.9 | 550 | 60 | 5.0 | 30 | 0.3 | 1.743 | 1.94 |
| EZ703 | 32 | 28 | 1.1 | 25.0 | 5200 | 54.6 | 1400 | 100 | 5.0 | 25 | 0.4 | 5.680 | 2.81 |
| EZ705 | 32 | 28 | 1.1 | 25.0 | 3500 | 79.4 | 1400 | 100 | 5.0 | 25 | 0.4 | 5.680 | 2.81 |
| EZ802 | 65 | 35 | 1.7 | 45.0 | 6000 | 149 | 2250 | 200 | 10 | 50 | 0.4 | 16.460 | 5.40 |
| EZ803 | 65 | 35 | 1.7 | 45.0 | 4500 | 200 | 2250 | 200 | 10 | 50 | 0.4 | 16.460 | 5.40 |
| EZ805 | 115 | 70 | 2.1 | 65.0 | 7000 | 376 | 6500 | 190 | 12 | 65 | 0.5 | 55.460 | 8.40 |



## 22.6.8 Connection method

The following sections describe the connection technology of STOBER synchronous servo motors in the standard version of STOBER drive controllers. You can find further information relating to the drive controller type that was specified in your order in the connection plan that is delivered with every synchronous servo motor.

In section [▷ 27], you can find information about connecting STOBER synchronous servo motors to drive controllers of third-party manufacturers.



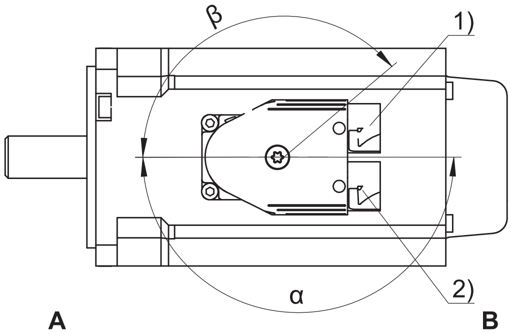
#### 22.6.8.1 Plug connector

STOBER synchronous servo motors are equipped with twistable quick lock plug connectors in the standard version (external plug connector size con.58). For details see this section.

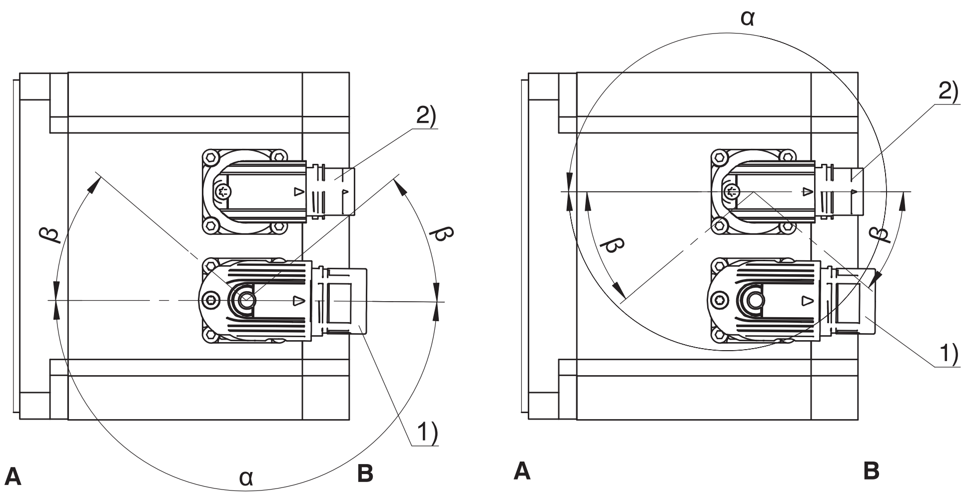
In motors with forced ventilation or water cooling, prevent collisions between the motor connection cables and the plug connector of the forced-cooling fan or the connecting lines of the cooling system. In the event of a collision, turn the motor plug connectors appropriately. For details on the position of the forced-cooling fan plug connector or the connections for water cooling, see the dimensional drawings section.

The illustrations represent the position of the plug connectors when delivered.

**Turning ranges of plug connectors (EZ3 motors)**




**Turning ranges of plug connectors (EZ4 – EZ8 motors)**




| | | | |
|---|---|---|---|
| 1 | Power plug connector | 2 | Encoder plug connector |
| A | Attachment or output side of the motor | B | Rear of the motor |

**Power plug connector features**

| Motor type | Size | Connection | Turning range | |
|---|---|---|---|---|
| | | | α | β |
| EZ3 | con.15 | Quick lock | 180° | 120° |
| EZ4, EZ5, EZ701, EZ703 | con.23 | Quick lock | 180° | 40° |
| EZ705, EZ802, EZ803, EZ805U | con.40 | Quick lock | 180° | 40° |
| EZ805B, EZ805W | con.58 | Screw thread[5] | 0° | 0° |

[5] Specify the alignment to side A or B in the purchase order.

**Encoder plug connector features**

| Motor type | Size | Connection | Turning range | |
|---|---|---|---|---|
| | | | α | β |
| EZ3 | con.15 | Quick lock | 180° | 120° |
| EZ4, EZ5, EZ7, EZ802, EZ803, EZ805U | con.17 | Quick lock | 180° | 20° |
| EZ805B, EZ805W | con.17 | Quick lock | 180° | 0° |

**Instructions**

- The number after "con." indicates approximately the external thread diameter of the plug connector in mm (for example con.23 designates a plug connector with an external thread diameter of about 23 mm).
- In turning range β the power and encoder plug connectors can only be turned if they will not collide with each other by doing so.
- For the EZ3 motor, the power and encoder plug connectors are mechanically connected and can only be turned together.

## 22.6.8.2 Connection of the motor housing to the protective ground system

Connect the motor housing to the protective ground system to protect persons and to prevent the false triggering of fault current protection devices.

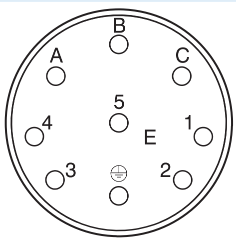
All attachment parts required for the connection of the protective ground to the motor housing are delivered with the motor. The grounding screw of the motor is identified with the symbol ⏚ as per IEC 60417-DB. The minimum cross-section of the protective ground is specified in the following table.

| Cross-section of the copper protective grounding in the power cable (A) | Cross-section of the copper protective ground for motor housing ($A_E$) |
|---|---|
| A < 10 mm² | $A_E$ = A |
| A ≥ 10 mm² | $A_E$ ≥ 10 mm² |

## 22.6.8.3 Connection assignment of the power plug connector

The size and connection plan of the power plug connector depend on the size of the motor. The colors of the connection strands inside the motor and specified according to IEC 60757.

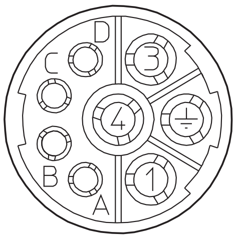
**Plug connector size con.15**

| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
|  | A | 1U1 (phase U) | BK |
| | B | 1V1 (phase V) | BU |
| | C | 1W1 (phase W) | RD |
| | 1 | 1TP1/1K1 (temperature sensor) | |
| | 2 | 1TP2/1K2 (temperature sensor) | |
| | 3 | 1BD1 (brake +) | RD |
| | 4 | 1BD2 (brake −) | BK |
| | ⏚ | PE (protective ground) | GNYE |

EZ

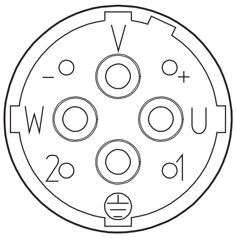


**Plug connector size con.23 (1)**




| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
| | 1 | 1U1 (phase U) | BK |
| | 3 | 1V1 (phase V) | BU |
| | 4 | 1W1 (phase W) | RD |
| | A | 1BD1 (brake +) | RD |
| | B | 1BD2 (brake −) | BK |
| | C | 1TP1/1K1 (temperature sensor) | |
| | D | 1TP2/1K2 (temperature sensor) | |
| | ⏚ | PE (protective ground) | GNYE |

**Plug connector size con.40 (1.5)/con.58 (3)**

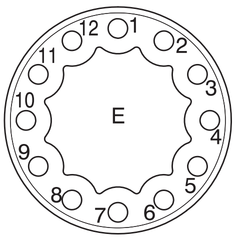



| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
| | U | 1U1 (phase U) | BK |
| | V | 1V1 (phase V) | BU |
| | W | 1W1 (phase W) | RD |
| | + | 1BD1 (brake +) | RD |
| | − | 1BD2 (brake −) | BK |
| | 1 | 1TP1/1K1 (temperature sensor) | |
| | 2 | 1TP2/1K2 (temperature sensor) | |
| | ⏚ | PE (protective ground) | GNYE |

## 22.6.8.4 Connection assignment of encoder plug connector

The size and connection assignment of the encoder plug connector depend on the type of the installed encoder and the size of the motor.

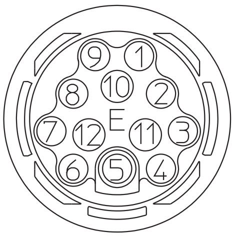
**Encoder EnDat 2.1/2.2 digital, plug connector size con.15**



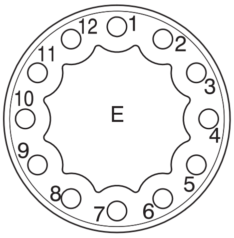

| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
| | 1 | Clock + | VT |
| | 2 | Up sense | BN GN |
| | 3 | | |
| | 4 | | |
| | 5 | Data − | PK |
| | 6 | Data + | GY |
| | 7 | | |
| | 8 | Clock − | YE |
| | 9 | | |
| | 10 | 0 V GND | WH GN |
| | 11 | | |
| | 12 | Up + | BN GN |
| | Pin 2 is connected with pin 12 in the built-in socket | | |



**Encoder EnDat 2.1/2.2 digital, plug connector size con.17**

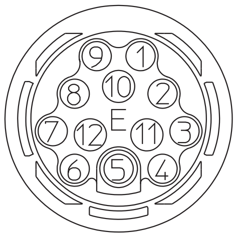
| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
|   | 1 | Clock + | VT |
| | 2 | Up sense | BN GN |
| | 3 | | |
| | 4 | | |
| | 5 | Data − | PK |
| | 6 | Data + | GY |
| | 7 | | |
| | 8 | Clock − | YE |
| | 9 | | |
| | 10 | 0 V GND | WH GN |
| | 11 | | |
| | 12 | Up + | BN GN |
| | Pin 2 is connected with pin 12 in the built-in socket | | |

**Encoder EnDat 2.2 digital with battery buffering, plug connector size con.15**

| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
|   | 1 | Clock + | VT |
| | 2 | UBatt + | BU |
| | 3 | UBatt − | WH |
| | 4 | | |
| | 5 | Data − | PK |
| | 6 | Data + | GY |
| | 7 | | |
| | 8 | Clock − | YE |
| | 9 | | |
| | 10 | 0 V GND | WH GN |
| | 11 | | |
| | 12 | Up + | BN GN |
| | UBatt+ = DC 3.6 V for encoder type EBI in combination with the AES option of STOBER-drive controllers | | |

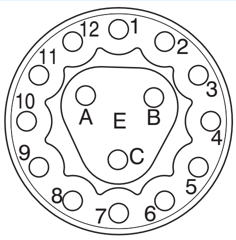
STÖBER

**Encoder EnDat 2.2 digital with battery buffering, plug connector size con.17**



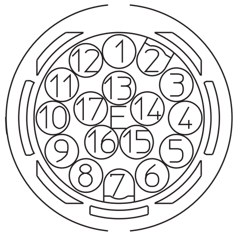

| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
| | 1 | Clock + | VT |
| | 2 | UBatt + | BU |
| | 3 | UBatt − | WH |
| | 4 | | |
| | 5 | Data − | PK |
| | 6 | Data + | GY |
| | 7 | | |
| | 8 | Clock − | YE |
| | 9 | | |
| | 10 | 0 V GND | WH GN |
| | 11 | | |
| | 12 | Up + | BN GN |
| | UBatt+ = DC 3.6 V for encoder type EBI in combination with the AES option of STOBER-drive controllers | | |

**Encoder EnDat 2.1 with sin/cos incremental signals, plug connector size con.15**

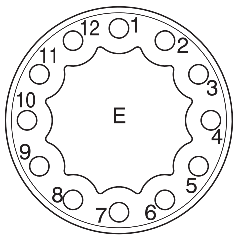



| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
| | 1 | Up sense | BU |
| | 2 | 0 V sense | WH |
| | 3 | Up + | BN GN |
| | 4 | Clock + | VT |
| | 5 | Clock − | YE |
| | 6 | 0 V GND | WH GN |
| | 7 | B + (sin +) | BU BK |
| | 8 | B − (sin −) | RD BK |
| | 9 | Data + | GY |
| | 10 | A + (cos +) | GN BK |
| | 11 | A − (cos −) | YE BK |
| | 12 | Data − | PK |
| | A | | |
| | B | | |
| | C | | |

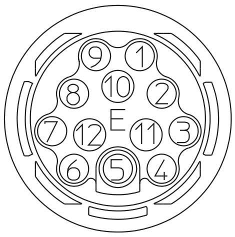
**Encoder EnDat 2.1 with sin/cos incremental signals, plug connector size con.17**

| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
|  | 1 | Up sense | BU |
| | 2 | | |
| | 3 | | |
| | 4 | 0 V sense | WH |
| | 5 | | |
| | 6 | | |
| | 7 | Up + | BN GN |
| | 8 | Clock + | VT |
| | 9 | Clock − | YE |
| | 10 | 0 V GND | WH GN |
| | 11 | | |
| | 12 | B + (sin +) | BU BK |
| | 13 | B − (sin −) | RD BK |
| | 14 | Data + | GY |
| | 15 | A + (cos +) | GN BK |
| | 16 | A − (cos −) | YE BK |
| | 17 | Data − | PK |

**Resolver, plug connector size con.15**

| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
|  | 1 | S3 cos + | BK |
| | 2 | S1 cos − | RD |
| | 3 | S4 sin + | BU |
| | 4 | S2 sin − | YE |
| | 5 | | |
| | 6 | | |
| | 7 | R2 Ref + | YE WH |
| | 8 | R1 ref − | RD WH |
| | 9 | | |
| | 10 | | |
| | 11 | | |
| | 12 | | |

**Resolver, plug connector size con.17**

| Connection diagram | Pin | Connection | Color |
|---|---|---|---|
|  | 1 | S3 cos + | BK |
| | 2 | S1 cos − | RD |
| | 3 | S4 sin + | BU |
| | 4 | S2 sin − | YE |
| | 5 | | |
| | 6 | | |
| | 7 | R2 Ref + | YE WH |
| | 8 | R1 ref − | RD WH |
| | 9 | | |
| | 10 | | |
| | 11 | | |
| | 12 | | |

## 22.7 Projecting

You can project your drives with our SERVOsoft design software. SERVOsoft is available at no cost from your consultant in one of our sales centers. Note the limit conditions in this section for a safe design of your drives.

### 22.7.1 Calculation of the operating point

In this chapter you can find information that is necessary for the calculation of the operating point.

The formula symbols for values actually present in the application are identified by a *.

| Formula symbols | Unit | Explanation |
|---|---|---|
| ED | % | Duty cycle relative to 10 minutes |
| $M_{op}$ | Nm | Torque of motor in the operating point from the motor characteristics for $n_{1m*}$ |
| $M_{1*}$ – $M_{6*}$ | Nm | Existing motor torque in the relevant time segment (1 to 6) |
| $M_{eff*}$ | Nm | Existing effective torque of the motor |
| $M_{limF}$ | Nm | Torque limit of the motor with forced ventilation |
| $M_{limK}$ | Nm | Torque limit of the motor with convection cooling |
| $M_{limW}$ | Nm | Torque limit of the motor with water cooling |
| $M_{max}$ | Nm | Maximum torque: the maximum permitted torque the motor is able to deliver briefly (when accelerating or decelerating) (tolerance ±10 %) |
| $M_{max*}$ | Nm | Existing maximum torque |
| $M_{n*}$ | Nm | Existing torque of the motor in the n-th time segment |
| $M_N$ | Nm | Nominal torque of the motor |
| $n_{m*}$ | rpm | Existing average motor speed |
| $n_{m,1*}$ – $n_{m,6*}$ | rpm | Existing average speed of the motor in the respective time segment (1 to 6) |
| $n_{m,n*}$ | rpm | Existing average speed of the motor in the n-th time segment |
| $n_N$ | rpm | Nominal speed: the speed for which the nominal torque $M_N$ is specified |

| Formula symbols | Unit | Explanation |
|---|---|---|
| $t$ | s | Time |
| $t_{1*} – t_{6*}$ | s | Duration of the relevant time segment (1 to 6) |
| $t_{n*}$ | s | Duration of the n-th time segment |

Check the following conditions for operating points other than the nominal point specified in the selection tables $M_N$:

$n_{m*} \leq n_N$

$M_{eff*} \leq M_{limK}$ or $M_{eff*} \leq M_{limF}$ or $M_{eff*} \leq M_{limW}$

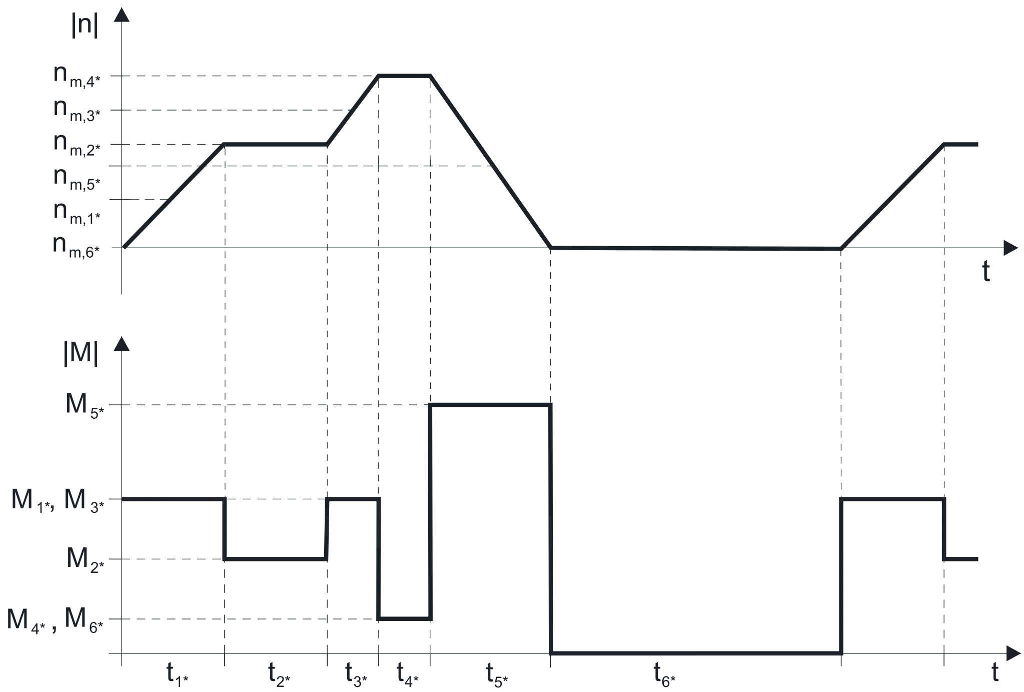
$M_{max*} < M_{max}$

The values for $M_N$, $n_N$, $M_{max}$ can be found in the selection tables.

The values for $M_{limK}$ or $M_{limF}$ or $M_{limW}$ can be found in the torque/speed characteristic curves.

### Example of cycle sequence

The following calculations refer to a representation of the power consumed on the motor shaft based on the following example:




### Calculation of the existing average input speed

$$n_{m*} = \frac{|n_{m,1*}| \cdot t_{1*} + \ldots + |n_{m,n*}| \cdot t_{n*}}{t_{1*} + \ldots + t_{n*}}$$

If $t_{1*}$ + ... + $t_{5*} \geq 10$ min, determine $n_{m*}$ without pause $t_{6*}$.

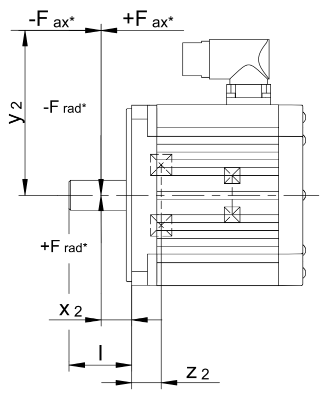
### Calculation of the existing effective torque

$$M_{eff*} = \sqrt{\frac{t_{1*} \cdot M_{1*}^2 + \ldots + t_{n*} \cdot M_{n*}^2}{t_{1*} + \ldots + t_{n*}}}$$

EZ

## 22.7.2 Permissible shaft loads

| Formula symbols | Unit | Explanation |
|---|---|---|
| $F_{ax^*}$ | N | Existing axial force on the output |
| $F_{ax100}$ | N | Permitted axial force on the output for $n_{m^*} \leq 100$ rpm |
| $F_{ax}$ | N | Permitted axial force on the output |
| $F_{rad^*}$ | N | Existing radial force on the output |
| $F_{rad100}$ | N | Permitted radial force on the output for $n_{m^*} \leq 100$ rpm |
| $F_{rad}$ | N | Permitted radial force on the output |
| l | mm | Length of the output shaft |
| $M_{k^*}$ | Nm | Existing breakdown torque on the output |
| $M_{k100}$ | Nm | Permitted breakdown torque on the output for $n_{m^*} \leq 100$ rpm |
| $M_k$ | Nm | Permitted breakdown torque on the output |
| $n_{m^*}$ | rpm | Existing average motor speed |
| $x_2$ | mm | Distance from shaft shoulder to the point of application of force |
| $y_2$ | mm | Distance from shaft axes to the point of application of axial force |
| $z_2$ | mm | Distance from shaft shoulder to the center of the output bearing |




**Permissible shaft loads**

| | $z_2$ [mm] | $F_{ax100}$ [N] | $F_{rad100}$ [N] | $M_{k100}$ [Nm] |
|---|---|---|---|---|
| EZ301 | 24,0 | 350 | 1000 | 39 |
| EZ302 | 24,0 | 350 | 1000 | 39 |
| EZ303 | 24,0 | 350 | 1000 | 39 |
| EZ401 | 19,5 | 550 | 1800 | 62 |
| EZ402 | 19,5 | 550 | 1800 | 71 |
| EZ404 | 19,5 | 550 | 1800 | 71 |
| EZ501 | 19,5 | 750 | 2000 | 79 |
| EZ502 | 19,5 | 750 | 2400 | 95 |
| EZ503 | 19,5 | 750 | 2400 | 107 |
| EZ505 | 19,5 | 750 | 2400 | 107 |
| EZ701 | 24,5 | 1300 | 3500 | 173 |
| EZ702 | 24,5 | 1300 | 4200 | 208 |
| EZ703 | 24,5 | 1300 | 4200 | 208 |



| | $z_2$ [mm] | $F_{ax100}$ [N] | $F_{rad100}$ [N] | $M_{k100}$ [Nm] |
|---|---|---|---|---|
| EZ705 | 24,5 | 1300 | 4200 | 225 |
| EZ802 | 28,5 | 1750 | 5600 | 384 |
| EZ803 | 28,5 | 1750 | 5600 | 384 |
| EZ805 | 28,5 | 1750 | 5600 | 384 |

The values specified in the tables apply to permitted shaft loads:

- For shaft dimensions according to the catalog
- If force is applied at the center of the output shaft: $x_2 = l / 2$ (shaft dimensions can be found in section [▸ 22.4]).
- Output speed $n_{m^*} \leq 100$ rpm ($F_{ax} = F_{ax100}$; $F_{rad} = F_{rad100}$; $M_k = M_{k100}$)

The following applies for output speeds $n_{m^*} > 100$ rpm:

$$F_{ax} = \frac{F_{ax100}}{\sqrt[3]{\frac{n_{m^*}}{100\ \text{rpm}}}} \qquad F_{rad} = \frac{F_{rad100}}{\sqrt[3]{\frac{n_{m^*}}{100\ \text{rpm}}}} \qquad M_k = \frac{M_{k100}}{\sqrt[3]{\frac{n_{m^*}}{100\ \text{rpm}}}}$$

The following formula applies to other points of application of force:

$$M_{k^*} = \frac{2 \cdot F_{ax^*} \cdot y_2 + F_{rad^*} \cdot (x_2 + z_2)}{1000} \leq M_{k100}$$

$$F_{rad^*} \leq F_{rad100}$$

$$F_{ax^*} \leq F_{ax100}$$

In applications with multiple axial and/or radial forces, the forces must be added vectorially.

## 22.7.3 Derating

If you use the motor under ambient conditions that differ from the standard ambient conditions, the nominal torque $M_N$ of the motor reduces. In this chapter you can find information about the calculation of the reduced nominal torque.

| Formula symbols | Unit | Explanation |
|---|---|---|
| H | m | Installation altitude above sea level |
| $K_H$ | – | Derating factor for installation altitude |
| $K_\vartheta$ | – | Derating factor for surrounding temperature |
| $M_N$ | Nm | Nominal torque of the motor |
| $M_{N^*}$ | Nm | Reduced nominal torque of the motor |
| $\vartheta_{amb}$ | °C | Surrounding temperature |

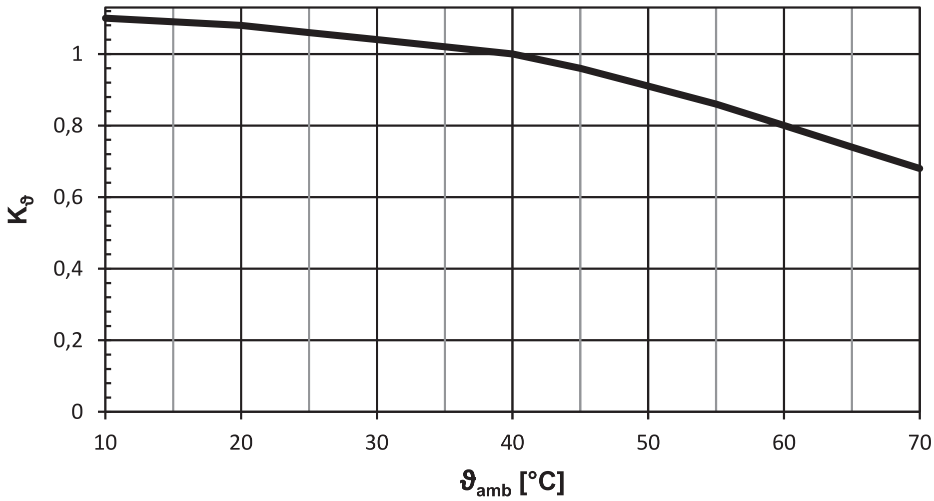



*Illustration 3:* Derating depending on the surrounding temperature

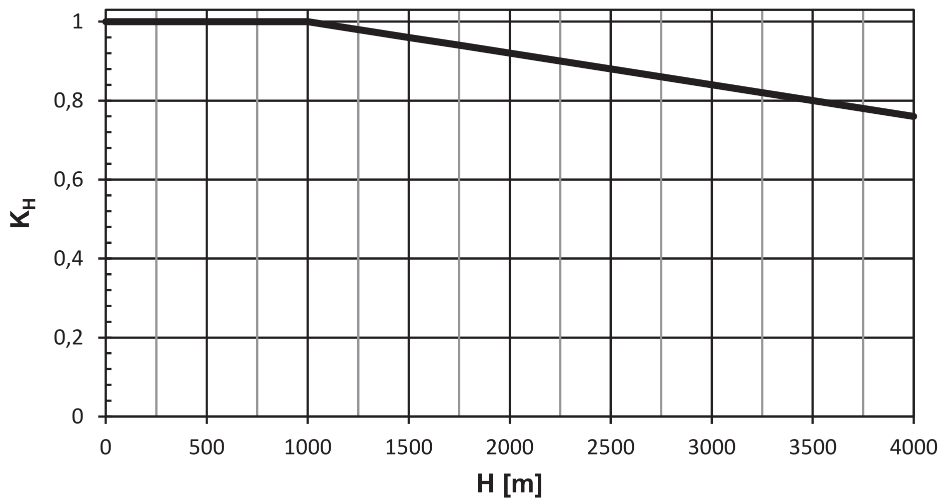



*Illustration 4:* Derating depending on the installation height

**Calculation**

If surrounding temperature $\vartheta_{amb}$ > 40 °C:

$M_{N*} = M_N \cdot K_\vartheta$

If installation altitude H > 1000 m above sea level:

$M_{N*} = M_N \cdot K_H$

If the surrounding temperature $\vartheta_{amb}$ > 40 °C and installation altitude H > 1000 m above sea level:

$M_{N*} = M_N \cdot K_H \cdot K_\vartheta$



# 22.8 Further information

## 22.8.1 Directives and Standards

STOBER synchronous servo motors meet the requirements of the following directives and standards:

- Niederspannungsrichtlinie 2014/35/EU
- EMV-Richtlinie 2014/30/EU
- EN 60204-1:2006-06
- EN 60034-1:2010-10
- EN 60034-5/A1:2007-01
- EN 60034-6:1993-11
- EN 60034-9/A1:2007-04
- EN 60034-14/A1:2007-06

## 22.8.2 Identifiers and test symbols

STOBER synchronous servo motors have the following identifiers and test symbols:

CE mark: the product meets the requirements of EU directives.

cURus test symbol "Recognized Component Class 155(F)"; registered under UL number E182088 (N) with Underwriters Laboratories USA (optional).

## 22.8.3 More documentation

More documentation concerning the product can be found online at:

http://www.stoeber.de/de/stoeber_global/service/downloads/downloadcenter.html

Enter the ID of the documentation in the Search... field.

| Documentation | ID |
|---|---|
| Operating manual synchronous servo motors EZ | 442585 |