Explanation of the pages 80–166

Dimensional drawings
Presentation of the views according to the projection method E (ISO).
All dimensions in [mm].

Mounting in plastic
Screwed connections on motors with plastic flanges require special attention.

M_A Max. tightening torque [Ncm]
A torque screw driver may be adjusted to this value.

L Active depth of screw connection [mm]
The relation of the depth of the screw connection to the thread diameter must be at least 2:1. The depth of the screw connection must be less than the usable length of the thread!

Motor Data
The values stated are based on a motor temperature of 25°C (so-called cold data).

Line 1 Nominal voltage U_N [Volt]
is the DC voltage on the motor connections on which all nominal data are based (lines 2–9). Lower and higher voltages are permissible, provided set limits are not exceeded.

Line 2 No load speed n_0 [rpm] ±10%
This is the speed at which the motor turns at nominal voltage and without load. It is approximately proportional to the applied voltage.

Line 3 No load current I_0 [mA] ±50%
This is the typical current that the unloaded motor draws when operating at nominal voltage. It depends on brush friction and friction in the bearings, and also increases with rising speed. No load friction depends heavily on temperature, particularly with precious metal commutation. In extended operation, no load friction decreases and increases at lower temperatures.

Line 4 Nominal speed n_N [rpm]
is the speed set for operation at nominal voltage and nominal torque at a motor temperature of 25°C.

Line 5 Nominal torque M_N [mNm]
is the torque generated for operation at nominal voltage and nominal current at a motor temperature of 25°C. It is at the limit of the motor's continuous operation range. Higher torques heat up the winding too much.

Line 6 Nominal current I_N [A]
is the current that, at 25°C ambient temperature, heats the winding up to the maximum permissible temperature (= max. permissible continuous current). I_N decreases as speed increases due to additional friction losses.

Line 7 Stall torque M_H [mNm]
is the torque produced by the motor when at standstill. Rising motor temperatures reduce stall torque.

Line 8 Stall current I_A [A]
is the quotient from nominal voltage and the motor's terminal resistance. Stall current is equivalent to starting current. With larger motors, I_A cannot often be reached due to the amplifier's current limits.

Line 9 Maximum efficiency η_{max} [%]
is the optimal relationship between input and output power at nominal voltage. It also doesn't always denote the optimal operating point.

Line 10 Terminal resistance R [Ω]
is the resistance at the terminals at 25°C and determines the stall current at a given voltage. For graphite brushes, it should be noted that resistance is load-dependent and the value only applies to large currents.

Line 11 Terminal inductance L [mH]
is the winding inductance when stationary and measured at 1 kHz, sinusoidal.

Line 12 Torque constant k_M [mNm/A]
This may also be referred to as "specific torque" and represents the quotient from generated torque and applicable current.

Line 13 Speed constant k_n [rpm/V]
shows the ideal no load speed per 1 volt of applied voltage. Friction losses not taken into account.

Line 14 Speed / torque gradient $\Delta n / \Delta M$ [rpm/mNm]
The speed / torque gradient is an indicator of the motor's performance. The smaller the value, the more powerful the motor and consequently the less motor speed varies with load variations. It is based on the quotient of ideal no load speed and ideal stall torque.

Line 15 Mechanical time constant τ_m [ms]
is the time required for the rotor to accelerate from standstill to 63% of its no load speed.

Line 16 Rotor inertia J_R [gcm^2]
is the mass moment of inertia of the rotor, based on the axis of rotation.

Line 17 Thermal resistance housing-ambient R_{th2} [K/W]
and
Line 18 Thermal resistance winding-housing R_{th1} [K/W]
Characteristic values of thermal contact resistance without additional heat sinking. Lines 17 and 18 combined define the maximum heating at a given power loss (load). Thermal resistance R_{th2} on motors with metal flanges can decrease by up to 80% if the motor is coupled directly to a good heat-conducting (e.g. metallic) mounting rather than a plastic panel.

Line 19 Thermal time constant winding τ_w [s]
and
Line 20 Thermal time constant motor τ_s [s]
These are the typical reaction times for a temperature change of winding and motor. It can be seen that the motor reacts much more sluggishly in thermal terms than the winding. The values are calculated from the product of thermal capacity and given heat resistances.

Line 21 Ambient temperature [°C]
Operating temperature range. This derives from the heat reliability of the materials used and viscosity of bearing lubrication.

Line 22 Max. winding temperature [°C]
Maximum permissible winding temperature.

Line 23 Maximum permissible speed n_{max} [rpm]
is the maximum recommended speed based on thermal and mechanical perspectives. A reduced service life can be expected at higher speeds.

Line 24 Axial play [mm]
For non-preloaded motors, this represents the tolerance limits of the factory-set bearing play. The latter is included in shaft length tolerances. Preloading cancels out axial play up to the given axial load.

Line 25 Radial play [mm]
Radial play is the bearing's radial movement. A spring is utilized to preload the motor's bearings, eliminating radial play up to a given axial load.

Line 26 / 27 Max. axial load [N]
Dynamically: axial load permissible in operation. If different values apply for traction and thrust, the smaller value is given.
Statically: maximum axial force applying to the shaft at standstill where no residual damage occurs.
Shaft supported: maximum axial force applying to the shaft at standstill if the force is not input at the other shaft end. This is not possible for motors with only one shaft end.

Line 28 Max. radial load [N]
The value is given for a typical clearance from the flange; this value falls the greater the clearance.

Line 29 Number of pole pairs
Number of north poles of the permanent magnet. The phase streams and commutation signals pass through per revolution p cycles. Servo-controllers require the correct details of the number of pole pairs.

Line 30 Number of commutator segments

Line 31 Weight of motor [g]