

alpha gear drives



# TPM & TPMA High Torque

Rotary Servo actuators -  
Setting new standards in dynamics,  
precision and compactness

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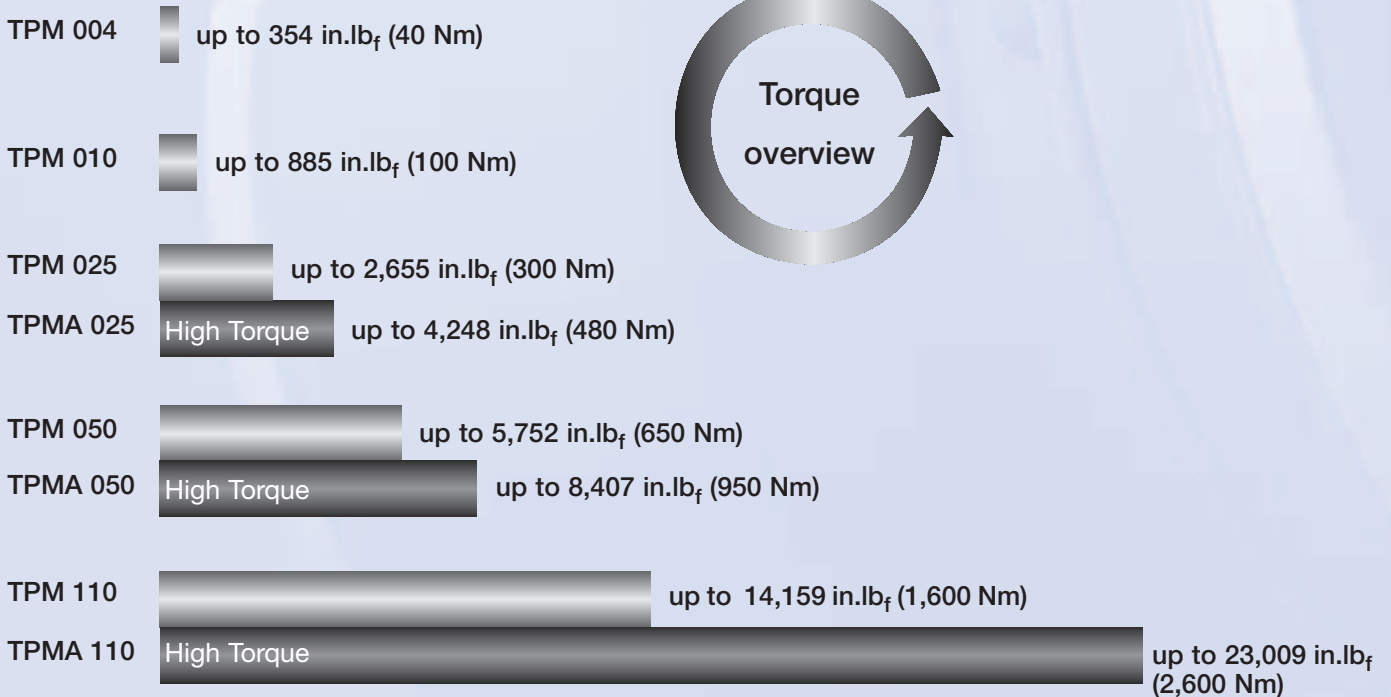
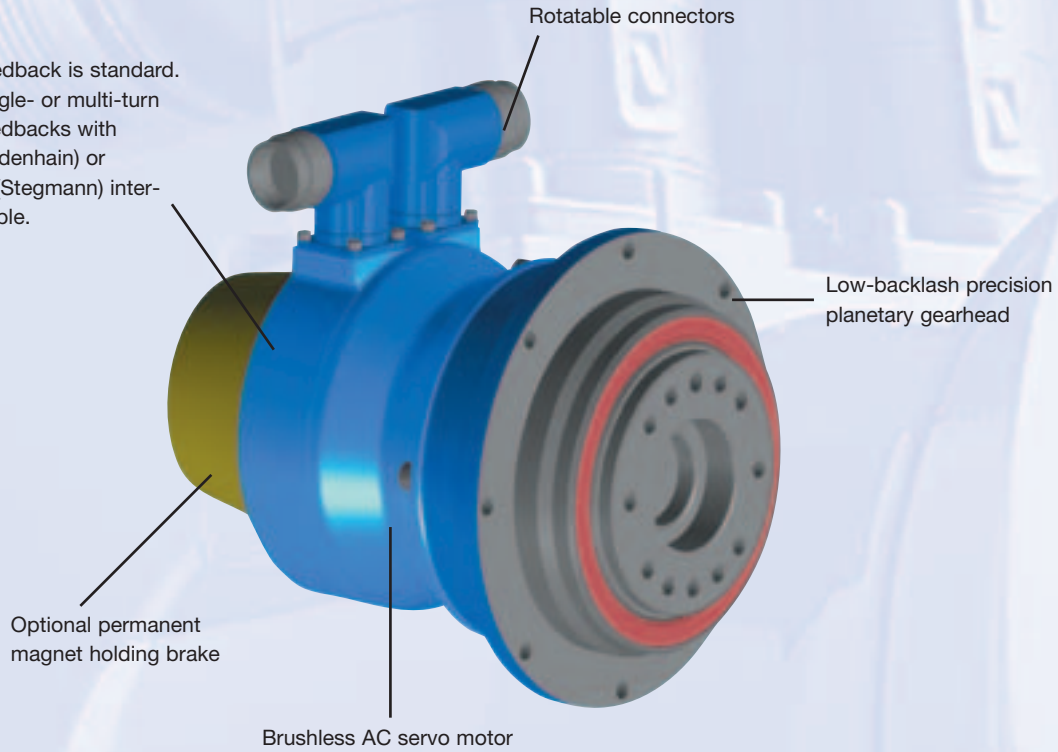
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# Product features

The TPM and TPMA are rotary servo actuators with a fully integrated **alpha** TP series high precision planetary gearhead, brushless AC servomotor, resolver or absolute feedback and optional holding brake. The TPM/TPMA operate with most servo controllers on the market to provide highly dynamic performance in an extremely compact package.

The two-stage TPM and three-stage TPMA set new standards for precision, compactness and dynamic performance for the drive technology market.

Resolver feedback is standard. Optional single- or multi-turn absolute feedbacks with EnDat® (Heidenhain) or Hiperface® (Stegmann) interfaces available.



# Product features

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## High dynamic performance

An integral brushless AC servomotor was designed to work with the **alpha** planetary gearheads to provide a high torque-to-inertia ratio, optimized for high dynamic performance. Connecting the motor to the gearhead without a coupling improves the stiffness of the unit while reducing the moment of inertia by approximately 40% compared to customary motor/gearhead units.

## High power density

A high pole count motor optimizes use of the magnetic material and yields the most power in the smallest package. In the new 3-stage TPMA version, the torque range has been considerably extended while maintaining the same compact design.

## Compact design/reduced weight

Integrating the servomotor and gearhead into one package sets new standards for reduced size and weight. It is approximately 62% shorter and weighs much less than a traditional motor/gearhead combination of comparable power. This is especially important for applications where mounting space is limited or where the motor itself is part of the moving load, e.g. robotics and gantries.

## High positioning accuracy/efficiency

Directly mounting the drive elements to the output flange reduces overall size and provides high torsional rigidity and short settling times. The pinion is integrated directly into the motor shaft, resulting in a much shorter motor-to-pinion distance. This design results in much higher positioning accuracy - <1 arc-minute of backlash - and higher dynamics, for shorter cycle times, increased machine throughput and reduced production costs for the customer application. In addition, the TPM/TPMA feature overall efficiency >85%.

## Direct mount/fewer components

The TPM/TPMA can be mounted from either the front or the rear of the mounting flange. The application load mounts directly to the driving flange, eliminating the need for a coupling. Dual tapered roller bearings in the output stage (from size 050) eliminate the need for additional support bearings in the customer application. In addition, two rotatable connectors allow for easy cable routing.

## Maintenance free

High quality synthetic lubricants provide lubrication for the service life of the product.

## Smooth motion and quiet operation

The TPM/TPMAs are characterized by low torque ripple for extremely smooth operation. They feature low noise levels of less than 65 dB(A).

## Simple integration

The TPM/TPMAs can be operated with most of the brushless servo controllers on the market. Preassembled cables and controller-specific start-up instructions simplify installation and start-up.

## Optional absolute feedback

An optional single- or multi-turn absolute encoder eliminates the necessity for homing on start-up.

# Applications



Yxlon



Six TPM drives on two swivel axes and one rotating axis control an X-ray testing system for cast parts. A move to a new position and an X-ray inspection occur within one second, repeating up to 300 times per part. The rapid positioning and testing procedure requires short settling times, which are achieved because of the low weight, high torsional rigidity and low inertia of the TPM drives.



Unicor

A winding unit without dancer roll forms the terminating unit of an extrusion machine for 2-5 mm wide plastic strips. Constant tension is required for smooth winding of the strips. The high torsional rigidity and excellent dynamics of the TPM drive enables rapid torque regulation, within a torque-adjustment range of 1:40.



SIG Robotics

Three TPM drives control the movement of the three axes of this fast pick and place robot, with up to 120 pick and place cycles per minute. The TPM was chosen for this application because of its high dynamic performance, low weight, small overall length and high reliability.



Gasti

Installed in a plant for dosing liquid products, three TPM drives control the piston dosing pump, a rotary valve and the container-lifting device. Because of its compact design, three TPM drives are incorporated into a 20 in x 20 in x 30 in space.



# TPM 004 - Technical data and characteristic curves

## Gearhead data

| Ratio  |  | i              |                                      | 21, 31, 61, 91   |
|--|--|----------------|--------------------------------------|--|
| Maximum acceleration torque <sup>1)</sup>                              | in.lbf (Nm)                                | $T_{2B}$       | i = 31<br>i = 21, 61, 91             | 360 (40)<br>280 (32)   |
| Emergency Stop torque <sup>2)</sup>                                    | in.lbf (Nm)                                | $T_{2Not}$     |                                      | 890(100)   |
| Nominal output torque  | in.lbf (Nm)                                | $T_{2N}$       | i = 31<br>i = 21, 61, 91             | 220 (25)<br>130 (15)   |
| Maximum input speed  | min <sup>-1</sup>                          | $n_{1Max}$     |                                      | 7,000  |
| Nominal input speed <sup>3)</sup>                                      | min <sup>-1</sup>                          | $n_{1N}$       |                                      | 6,000  |
| Torsional backlash   | arcmin                                     | $i_t$          | Standard<br>Reduced                  | ≤ 5<br>≤ 3   |
| Torsional rigidity   | in.lbf (Nm)/arcmin                         | $C_{t21}$      |                                      | 60 (6.8)   |
| Maximum axial force <sup>4)</sup>                                      | lbf (N)                                    | $F_{2AMax}$    |                                      | 370 (1,630)  |
| Maximum tilting torque   | in.lbf (Nm)                                | $M_{2TiltMax}$ |                                      | 810 (91)   |
| Tilting rigidity   | in.lbf (Nm)/arcmin                         | $C_{2K}$       |                                      | 750 (85)   |
| No-load running torque ( $n_1 = 3000 \text{ min}^{-1}$ ) <sup>5)</sup> | in.lbf (Nm)                                | $T_{012}$      | i = 31<br>i = 91                     | 13 (0.15)<br>7 (0.08)  |
| Moment of inertia reflected to the input                               | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Gear}$     | i = 21<br>i = 31<br>i = 61<br>i = 91 | $0.1 \cdot 10^{-4}$ (0.01)<br>$0.1 \cdot 10^{-4}$ (0.01)<br>$0.01 \cdot 10^{-4}$ (0.001)<br>$0.01 \cdot 10^{-4}$ (0.001) |

## Motor data

|   |  |            | i = 21, 31                 |                            | i = 61, 91                 |                            |
|---|--|------------|----------------------------|----------------------------|----------------------------|----------------------------|
| DC bus voltage                          | VDC  | $U_D$      | 320                        | 600                        | 320                        | 600                        |
| Peak torque <sup>6)</sup>               | in.lbf (Nm)                                | $M_{Max}$  | 15 (1.70)                  | 15 (1.70)                  | 7 (0.79)                   | 7 (0.79)                   |
| Continuous stall torque                 | in.lbf (Nm)                                | $M_0$      | 5 (0.58)                   | 5 (0.51)                   | 3 (0.31)                   | 2 (0.27)                   |
| Nominal torque                          | in.lbf (Nm)                                | $M_N$      | 4 (0.48)                   | 4 (0.41)                   | 2 (0.25)                   | 2 (0.21)                   |
| Peak current <sup>6)</sup>              | A  | $I_{Max}$  | 4.20                       | 2.50                       | 2.90                       | 1.70                       |
| Nominal current                         | A  | $I_N$      | 1.30                       | 0.70                       | 1.00                       | 0.50                       |
| No-load speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_0$      | 9,100                      | 9,500                      | 13,500                     | 13,500                     |
| Nominal speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_N$      | 7,625                      | 8,100                      | 11,100                     | 11,100                     |
| Maximum power                           | kW   | $P_{Max}$  | 0.92                       | 0.92                       | 0.58                       | 0.58                       |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$ | $1.4 \cdot 10^{-4}$ (0.16) | $1.4 \cdot 10^{-4}$ (0.16) | $0.8 \cdot 10^{-4}$ (0.09) | $0.8 \cdot 10^{-4}$ (0.09) |
| Moment of inertia w/ resolver w/ brake  | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$ | $2.0 \cdot 10^{-4}$ (0.22) | $2.0 \cdot 10^{-4}$ (0.22) | $1.3 \cdot 10^{-4}$ (0.15) | $1.3 \cdot 10^{-4}$ (0.15) |

## General data

|   |                      |   |
|---|----------------------|---|
| Protection class                              |                      | IP64  |
| Operating temperature range                   | F (°C)               | +14 to +194 (-10 to +90)  |
| Mounting position                             |                      | Any   |
| Lubrication                                   |                      | Synthetic oil, ISO VG 220                                       |
| Paint   |                      | RAL 5002 (Blue)   |
| Noise level ( $n_1 = 3000 \text{ min}^{-1}$ ) | dB(A)                | ≤ 65  |
| Weight without/with brake                     | lb <sub>m</sub> (kg) | 5.7/6.6 (2.6/3.0) at i = 21/31   5.3/6.0 (2.4/2.7) at i = 61/91 |
| Direction of rotation                         |                      | motor and gearhead in same direction                            |
| Insulation class                              |                      | F   |

1) 1000 cycles per hour

2) Permissible 1000 times during the life span of the gearhead

4) Based on the flange center

3) At 68 °F ambient temperature

5) At 68 °F gearhead temperature

6) Limit motor values to maximum values of the gearhead





# TPM 010 - Technical data and characteristic curves

## Gearhead data

|   |  |                       |                                      |  |
|---|--|-----------------------|--------------------------------------|--|
| Ratio   |  | i                     |                                      | 21, 31, 61, 91   |
| Maximum acceleration torque <sup>1)</sup>                                       | in.lbf (Nm)                                | T <sub>2B</sub>       | i = 31<br>i = 21, 61, 91             | 890 (100)<br>710 (80)  |
| Emergency Stop torque <sup>2)</sup>   | in.lbf (Nm)                                | T <sub>2Not</sub>     |                                      | 2,210 (250)  |
| Nominal output torque   | in.lbf (Nm)                                | T <sub>2N</sub>       | i = 31<br>i = 21, 61, 91             | 440 (50)<br>310 (35)   |
| Maximum input speed   | min <sup>-1</sup>                          | n <sub>1Max</sub>     |                                      | 7,000  |
| Nominal input speed <sup>3)</sup>   | min <sup>-1</sup>                          | n <sub>1N</sub>       |                                      | 6,450  |
| Torsional backlash  | arcmin                                     | j <sub>t</sub>        | Standard<br>Reduced                  | ≤ 3<br>≤ 1   |
| Torsional rigidity  | in.lbf (Nm)/arcmin                         | C <sub>t21</sub>      |                                      | 190 (21)   |
| Maximum axial force <sup>4)</sup>   | lbf (N)                                    | F <sub>2AMax</sub>    |                                      | 480 (2,150)  |
| Maximum tilting torque  | in.lbf (Nm)                                | M <sub>2TiltMax</sub> |                                      | 2,080 (235)  |
| Tilting rigidity  | in.lbf (Nm)/arcmin                         | C <sub>2K</sub>       |                                      | 1,990 (225)  |
| No-load running torque (n <sub>1</sub> = 3000 min <sup>-1</sup> ) <sup>5)</sup> | in.lbf (Nm)                                | T <sub>012</sub>      | i = 31<br>i = 91                     | 3 (0.3)<br>2 (0.2)   |
| Moment of inertia reflected to the input  | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | J <sub>Gear</sub>     | i = 21<br>i = 31<br>i = 61<br>i = 91 | 0.35*10 <sup>-4</sup> (0.04)<br>0.27*10 <sup>-4</sup> (0.03)<br>0.09*10 <sup>-4</sup> (0.01)<br>0.09*10 <sup>-4</sup> (0.01) |

## Motor data

|   |  |                   | i = 21, 31                  |           | i = 61, 91                  |           |
|---|--|-------------------|-----------------------------|-----------|-----------------------------|-----------|
| DC bus voltage                          | VDC  | U <sub>D</sub>    | 320                         | 600       | 320                         | 600       |
| Peak torque <sup>6)</sup>               | in.lbf (Nm)                                | M <sub>max</sub>  | 32 (3.60)                   | 29 (3.30) | 15 (1.70)                   | 15 (1.70) |
| Continuous stall torque                 | in.lbf (Nm)                                | M <sub>0</sub>    | 10 (1.10)                   | 10 (1.10) | 5 (0.60)                    | 5 (0.60)  |
| Nominal torque                          | in.lbf (Nm)                                | M <sub>N</sub>    | 8 (0.94)                    | 7 (0.84)  | 5 (0.52)                    | 5 (0.51)  |
| Peak current <sup>6)</sup>              | A  | I <sub>Max</sub>  | 7.30                        | 5.00      | 4.50                        | 3.00      |
| Nominal current                         | A  | I <sub>N</sub>    | 1.50                        | 1.10      | 1.10                        | 0.70      |
| No-load speed <sup>6)</sup>             | min <sup>-1</sup>                          | n <sub>0</sub>    | 5,800                       | 7,800     | 7,000                       | 7,700     |
| Nominal speed <sup>6)</sup>             | min <sup>-1</sup>                          | n <sub>N</sub>    | 4,875                       | 6,775     | 5,900                       | 6,550     |
| Maximum power                           | kW   | P <sub>Max</sub>  | 1.22                        | 1.66      | 0.75                        | 0.85      |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | J <sub>Mot.</sub> | 3.3*10 <sup>-4</sup> (0.37) |           | 1.9*10 <sup>-4</sup> (0.21) |           |
| Moment of inertia w/ resolver w/ brake  | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | J <sub>Mot.</sub> | 3.9*10 <sup>-4</sup> (0.44) |           | 2.5*10 <sup>-4</sup> (0.28) |           |

## General data

|  |                      |  |
|--|----------------------|--|
| Protection class                                       |                      | IP64   |
| Operating temperature range                            | F (°C)               | +14 to +194 (-10 to +90)   |
| Mounting position                                      |                      | Any  |
| Lubrication  |                      | Synthetic oil, ISO VG 220  |
| Paint  |                      | RAL 5002 (Blue)  |
| Noise level (n <sub>1</sub> = 3000 min <sup>-1</sup> ) | dB(A)                | ≤ 65   |
| Weight without/with brake                              | lb <sub>m</sub> (kg) | 10.8/11.7 (4.9/5.3) at i = 21/31   9.7/10.8 (4.4/4.9) at i = 61/91 |
| Direction of rotation                                  |                      | motor and gearhead in same direction                               |
| Insulation class                                       |                      | F  |

1) 1000 cycles per hour

2) Permissible 1000 times during the life span of the gearhead

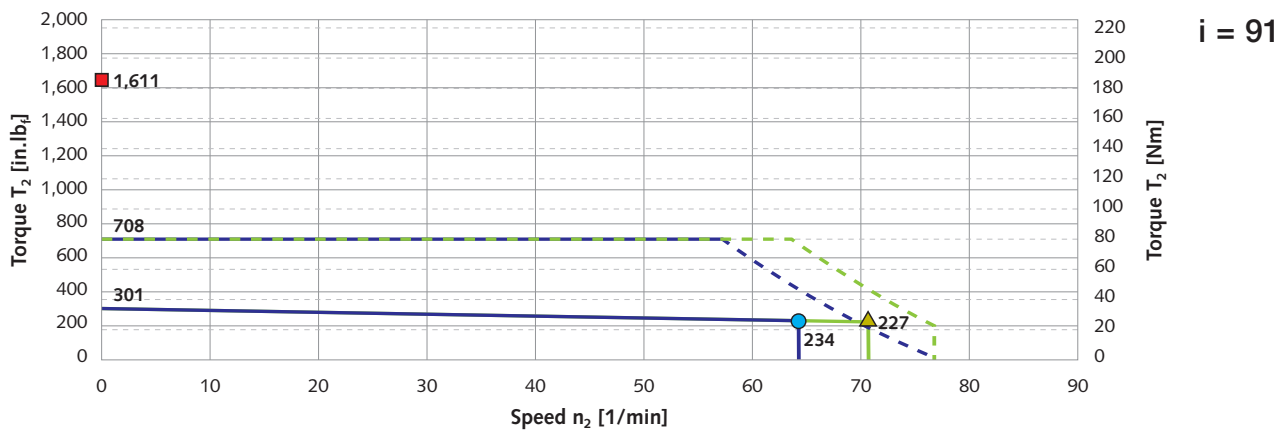
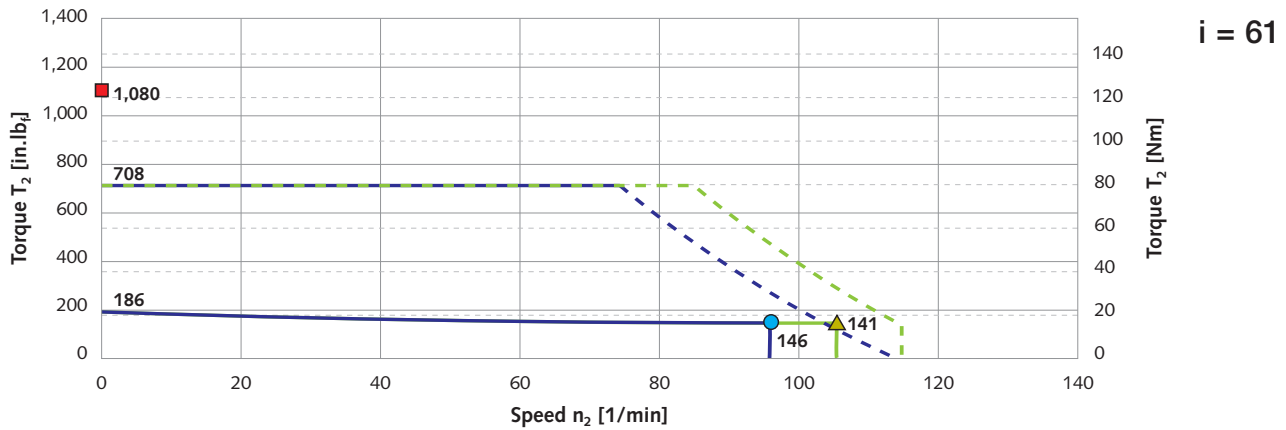
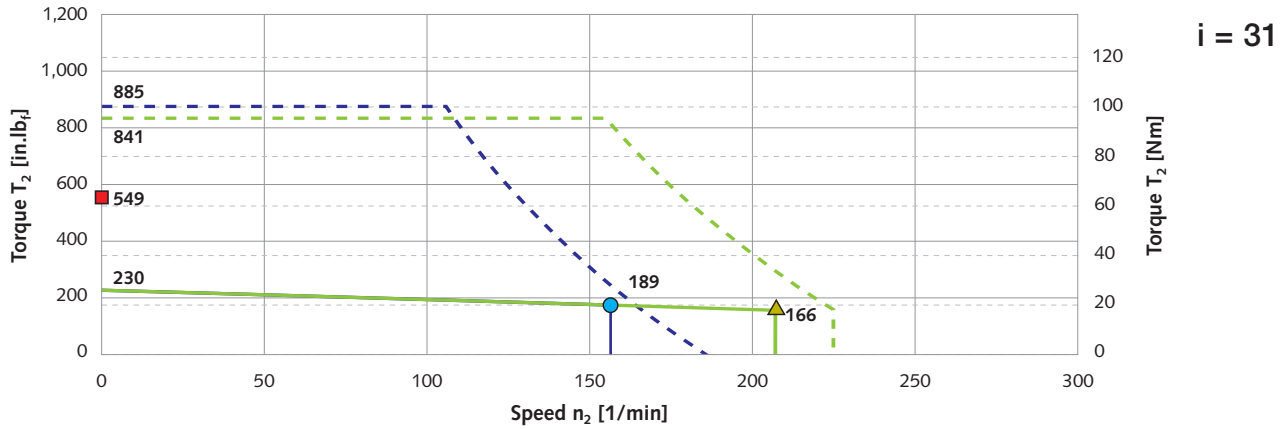
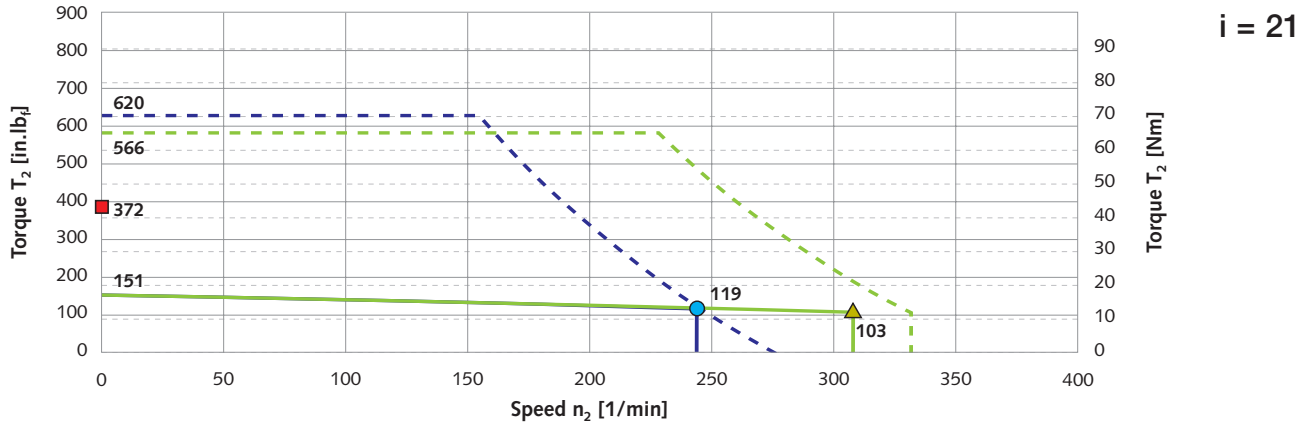
3) At 68 °F ambient temperature

4) Based on the flange center

5) At 68 °F gearhead temperature

6) Limit motor values to maximum values of the gearhead

The tolerances of T, I, n may be ± 10%. In circumstances the maximum allowable current has to be limited because of the maximum allowable torque of the mounted gearbox.



- |          |   |  |  |
|----------|---|--|--|
| 320V DC: | <span style="color: blue;">---</span> Max. output torque  | <span style="color: blue;">—</span> Nominal torque       | <span style="color: blue;">●</span> Nominal point  |
| 600V DC: | <span style="color: green;">---</span> Max. output torque | <span style="color: green;">—</span> Nominal torque      | <span style="color: green;">▲</span> Nominal point |
|          |   | <span style="color: red;">■</span> Holding torque: brake |  |



# TPM 025 - Technical data and characteristic curves

## Gearhead data

| Ratio  |  | i              |                                      | 21, 31, 61, 91   |
|--|--|----------------|--------------------------------------|--|
| Maximum acceleration torque <sup>1)</sup>                              | in.lbf (Nm)                                | $T_{2B}$       | i = 31<br>i = 21, 61, 91             | 2,660 (300)<br>2,210 (250)   |
| Emergency Stop torque <sup>2)</sup>                                    | in.lbf (Nm)                                | $T_{2Not}$     |                                      | 5,530 (625)  |
| Nominal output torque  | in.lbf (Nm)                                | $T_{2N}$       | i = 31<br>i = 21, 61, 91             | 1,500 (170)<br>890 (100)   |
| Maximum input speed  | min <sup>-1</sup>                          | $n_{1Max}$     |                                      | 6,000  |
| Nominal input speed <sup>3)</sup>                                      | min <sup>-1</sup>                          | $n_{1N}$       |                                      | 5,900  |
| Torsional backlash   | arcmin                                     | $j_t$          | Standard<br>Reduced                  | ≤ 3<br>≤ 1   |
| Torsional rigidity   | in.lbf (Nm)/arcmin                         | $C_{t21}$      |                                      | 500 (56)   |
| Maximum axial force <sup>4)</sup>                                      | lb <sub>f</sub> (N)                        | $F_{2AMax}$    |                                      | 930 (4,150)  |
| Maximum tilting torque   | in.lbf (Nm)                                | $M_{2TiltMax}$ |                                      | 3,660 (413)  |
| Tilting rigidity   | in.lbf (Nm)/arcmin                         | $C_{2K}$       |                                      | 4,870 (550)  |
| No-load running torque ( $n_1 = 3000 \text{ min}^{-1}$ ) <sup>5)</sup> | in.lbf (Nm)                                | $T_{012}$      | i = 31<br>i = 91                     | 5.0 (0.6)<br>3.0 (0.3)   |
| Moment of inertia reflected to the input                               | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Gear}$     | i = 21<br>i = 31<br>i = 61<br>i = 91 | $0.9 \cdot 10^{-4}$ (0.10)<br>$0.5 \cdot 10^{-4}$ (0.06)<br>$0.1 \cdot 10^{-4}$ (0.01)<br>$0.1 \cdot 10^{-4}$ (0.01) |

## Motor data

|   |  |            | i = 21, 31                  |             | i = 61, 91                 |           |
|---|--|------------|-----------------------------|-------------|----------------------------|-----------|
| DC bus voltage                          | VDC  | $U_D$      | 320                         | 600         | 320                        | 600       |
| Peak torque <sup>6)</sup>               | in.lbf (Nm)                                | $M_{max}$  | 104 (11.70)                 | 110 (12.40) | 38 (4.20)                  | 37 (4.20) |
| Continuous stall torque                 | in.lbf (Nm)                                | $M_0$      | 45 (5.00)                   | 45 (5.00)   | 15 (1.70)                  | 15 (1.70) |
| Nominal torque                          | in.lbf (Nm)                                | $M_N$      | 30 (3.30)                   | 30 (3.40)   | 12 (1.40)                  | 12 (1.30) |
| Peak current <sup>6)</sup>              | A  | $I_{Max}$  | 25.00                       | 10.60       | 10.80                      | 7.00      |
| Nominal current                         | A  | $I_N$      | 6.00                        | 3.40        | 3.10                       | 1.80      |
| No-load speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_0$      | 6,380                       | 6,000       | 7,300                      | 7,800     |
| Nominal speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_N$      | 5,200                       | 4,838       | 5,625                      | 6,200     |
| Maximum power                           | kW   | $P_{Max}$  | 4.04                        | 4.22        | 1.72                       | 1.85      |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$ | $21.2 \cdot 10^{-4}$ (2.39) |             | $7.6 \cdot 10^{-4}$ (0.86) |           |
| Moment of inertia w/ resolver w/ brake  | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$ | $21.8 \cdot 10^{-4}$ (2.46) |             | $8.3 \cdot 10^{-4}$ (0.49) |           |

## General data

|   |                                      |                                  |                                  |
|---|--------------------------------------|----------------------------------|----------------------------------|
| Protection class                              | IP64                                 |                                  |                                  |
| Operating temperature range                   | F (°C)                               | +14 to +194 (-10 to +90)         |                                  |
| Mounting position                             | Any                                  |                                  |                                  |
| Lubrication                                   | Synthetic oil, ISO VG 220            |                                  |                                  |
| Paint   | RAL 5002 (Blue)                      |                                  |                                  |
| Noise level ( $n_1 = 3000 \text{ min}^{-1}$ ) | dB(A)                                | ≤ 65                             |                                  |
| Weight without/with brake                     | lb <sub>m</sub> (kg)                 | 19.8/21.6 (9.0/9.8) at i = 21/31 | 16.8/18.5 (7.6/8.4) at i = 61/91 |
| Direction of rotation                         | motor and gearhead in same direction |                                  |                                  |
| Insulation class                              | F                                    |                                  |                                  |

1) 1000 cycles per hour

2) Permissible 1000 times during the life span of the gearhead

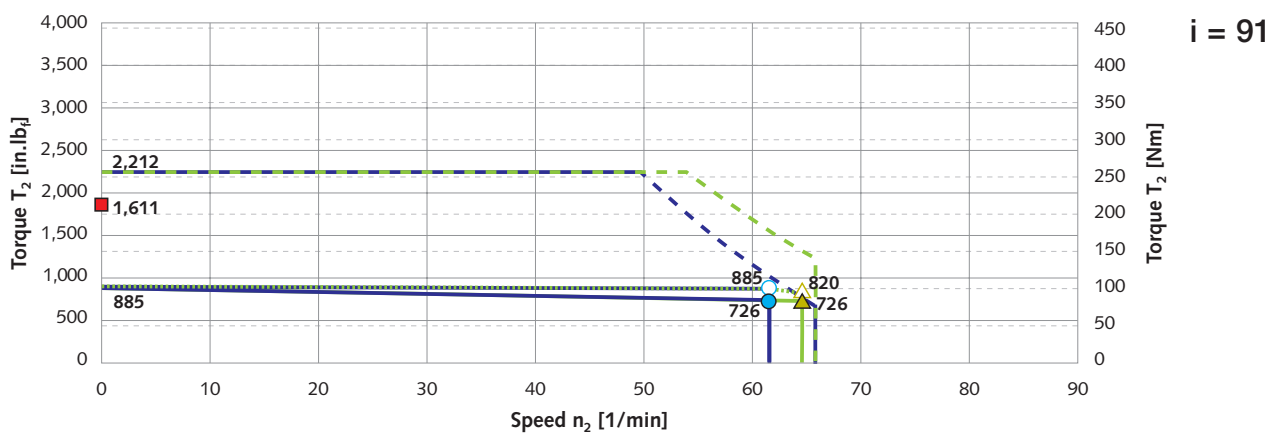
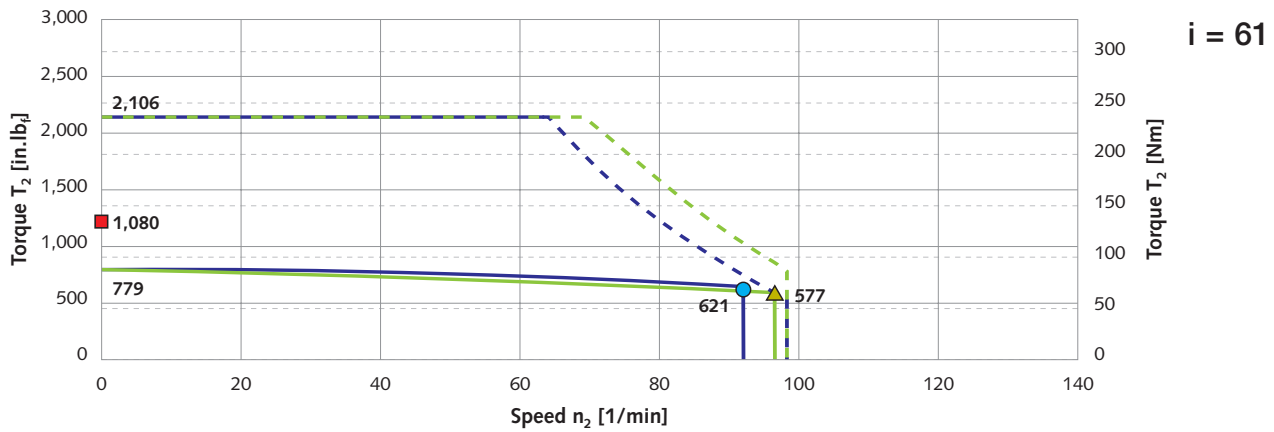
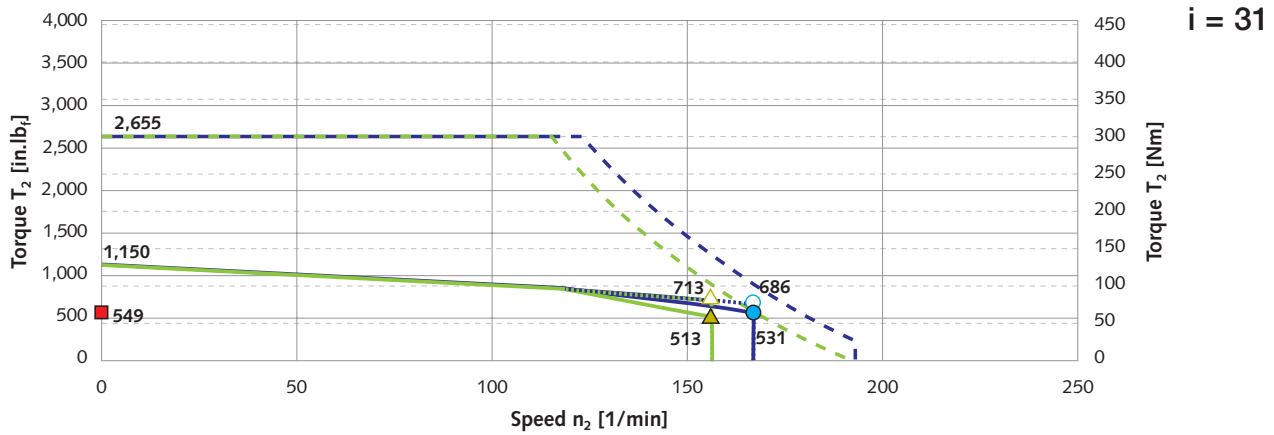
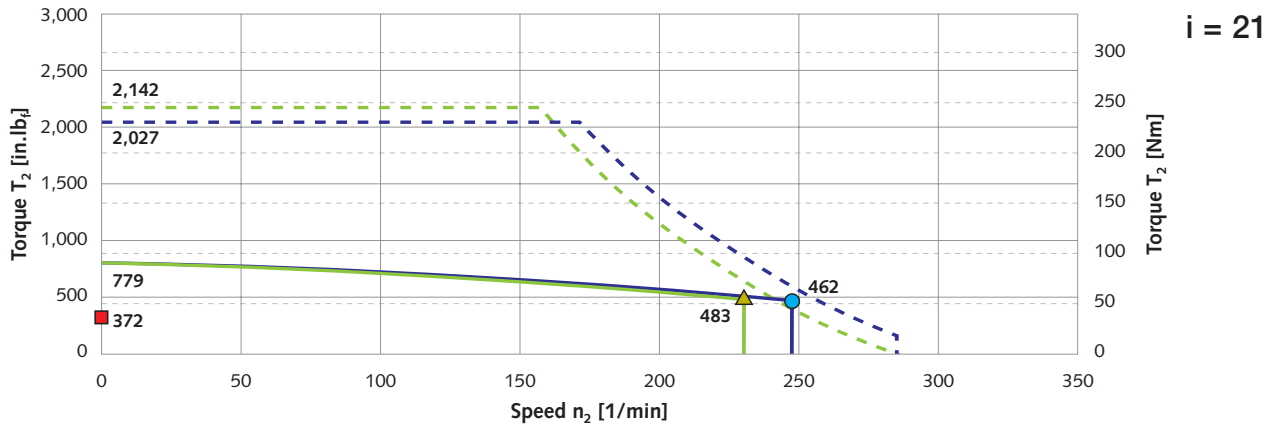
4) Based on the flange center

3) At 68 °F ambient temperature

5) At 68 °F gearhead temperature

6) Limit motor values to maximum values of the gearhead

The tolerances of T, I, n may be ± 10%. In circumstances the maximum allowable current has to be limited because of the maximum allowable torque of the mounted gearbox.



- |                      |                        |                      |                         |
|----------------------|------------------------|----------------------|-------------------------|
| 320V DC w/ resolver: | --- Max. output torque | ..... Nominal torque | ○ Nominal point         |
| 600V DC w/ resolver: | --- Max. output torque | ..... Nominal torque | △ Nominal point         |
| 320V DC w/ encoder:  | --- Max. output torque | --- Nominal torque   | ● Nominal point         |
| 600V DC w/ encoder:  | --- Max. output torque | --- Nominal torque   | ▲ Nominal point         |
|                      |                        |                      | ■ Holding torque: brake |



# TPM 050 - Technical data and characteristic curves

## Gearhead data

|  |  |                |                                      |  |
|--|--|----------------|--------------------------------------|--|
| Ratio  |  | i              |                                      | 21, 31, 61, 91   |
| Maximum acceleration torque <sup>1)</sup>                              | in.lbf (Nm)                                | $T_{2B}$       | i = 31<br>i = 21, 61, 91             | 5,750 (650)<br>4,430 (500)   |
| Emergency Stop torque <sup>2)</sup>                                    | in.lbf (Nm)                                | $T_{2Not}$     |                                      | 11,060 (1,250)   |
| Nominal output torque  | in.lbf (Nm)                                | $T_{2N}$       | i = 31<br>i = 21, 61, 91             | 3,270 (370)<br>1,950 (220)   |
| Maximum input speed  | min <sup>-1</sup>                          | $n_{1Max}$     |                                      | 5,000  |
| Nominal input speed <sup>3)</sup>                                      | min <sup>-1</sup>                          | $n_{1N}$       |                                      | 4,650  |
| Torsional backlash   | arcmin                                     | $j_t$          | Standard<br>Reduced                  | ≤ 3<br>≤ 1   |
| Torsional rigidity   | in.lbf (Nm)/arcmin                         | $C_{I21}$      |                                      | 1,040 (118)  |
| Maximum axial force <sup>4)</sup>                                      | lbf (N)                                    | $F_{2AMax}$    |                                      | 1,380 (6,130)  |
| Maximum tilting torque   | in.lbf (Nm)                                | $M_{2TiltMax}$ |                                      | 11,460 (1,295)   |
| Tilting rigidity   | in.lbf (Nm)/arcmin                         | $C_{2K}$       |                                      | 4,960 (560)  |
| No-load running torque ( $n_1 = 3000 \text{ min}^{-1}$ ) <sup>5)</sup> | in.lbf (Nm)                                | $T_{012}$      | i = 31<br>i = 91                     | 11.5 (1.3)<br>9.7 (1.1)  |
| Moment of inertia reflected to the input                               | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Gear}$     | i = 21<br>i = 31<br>i = 61<br>i = 91 | $3.3 \cdot 10^{-4}$ (0.37)<br>$2.3 \cdot 10^{-4}$ (0.26)<br>$0.5 \cdot 10^{-4}$ (0.06)<br>$0.4 \cdot 10^{-4}$ (0.05) |

## Motor data

|   |  |            | i = 21, 31                  |             | i = 61, 91                  |           |
|---|--|------------|-----------------------------|-------------|-----------------------------|-----------|
| DC bus voltage                          | VDC  | $U_D$      | 320                         | 600         | 320                         | 600       |
| Peak torque <sup>6)</sup>               | in.lbf (Nm)                                | $M_{Max}$  | 270 (30.50)                 | 288 (32.50) | 69 (7.80)                   | 69 (7.80) |
| Continuous stall torque                 | in.lbf (Nm)                                | $M_0$      | 120 (13.60)                 | 120 (13.60) | 32 (3.60)                   | 31 (3.50) |
| Nominal torque                          | in.lbf (Nm)                                | $M_N$      | 59 (6.60)                   | 43 (4.90)   | 25 (2.80)                   | 22 (2.50) |
| Peak current <sup>6)</sup>              | A  | $I_{Max}$  | 75.00                       | 54.00       | 19.60                       | 13.70     |
| Nominal current                         | A  | $I_N$      | 12.40                       | 5.60        | 4.20                        | 2.60      |
| No-load speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_0$      | 6,380                       | 7,180       | 5,000                       | 5,900     |
| Nominal speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_N$      | 5,375                       | 6,000       | 3,775                       | 4,562     |
| Maximum power                           | kW   | $P_{Max}$  | 11.18                       | 13.0        | 2.25                        | 2.53      |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$ | $80.5 \cdot 10^{-4}$ (9.09) |             | $20.2 \cdot 10^{-4}$ (2.28) |           |
| Moment of inertia w/ resolver w/ brake  | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) |            | $82.4 \cdot 10^{-4}$ (9.31) |             | $22.1 \cdot 10^{-4}$ (2.50) |           |

## General data

|   |                      |   |
|---|----------------------|---|
| Protection class                                    |                      | IP64  |
| Operating temperature range F (°C)                  |                      | +14 to +194 (-10 to +90)  |
| Mounting position                                   |                      | Any   |
| Lubrication   |                      | Synthetic oil, ISO VG 220   |
| Paint   |                      | RAL 5002 (Blue)   |
| Noise level ( $n_1 = 3000 \text{ min}^{-1}$ ) dB(A) |                      | ≤ 65  |
| Weight without/with brake                           | lb <sub>m</sub> (kg) | 47.0/52.3 (21.3/23.7) at i = 21/31   33.3/35.7 (15.1/16.2) at i = 61/91 |
| Direction of rotation                               |                      | motor and gearhead in same direction                                    |
| Insulation class                                    |                      | F   |

1) 1000 cycles per hour

2) Permissible 1000 times during the life span of the gearhead

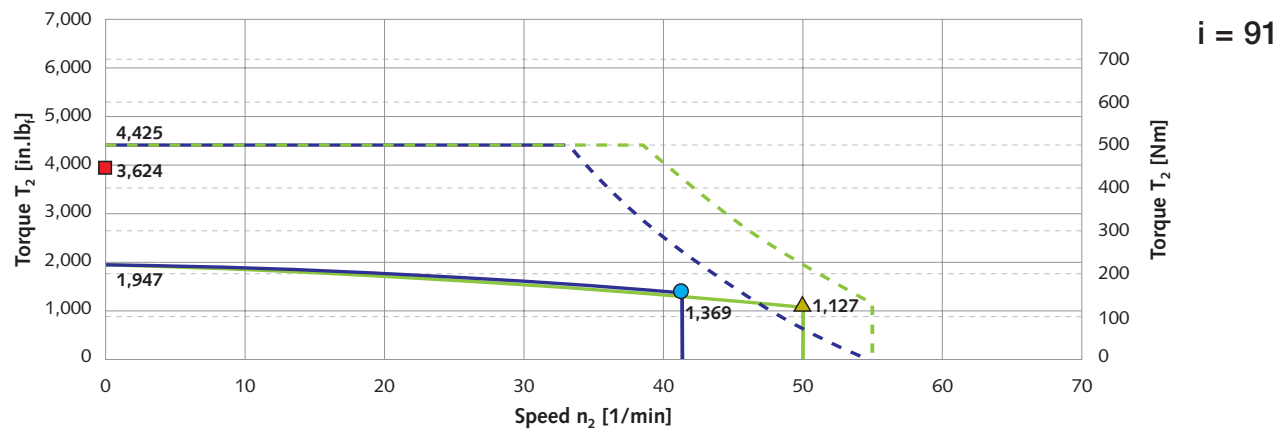
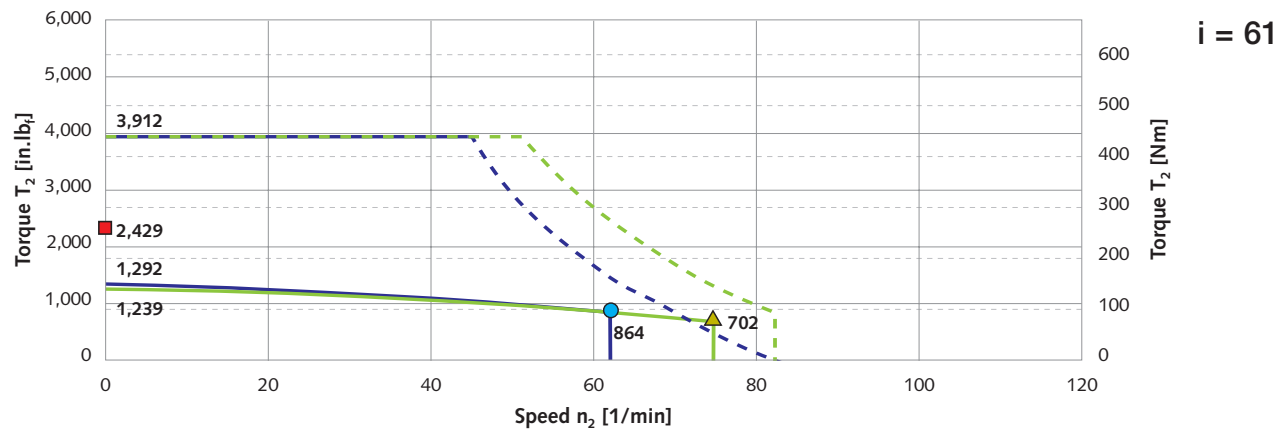
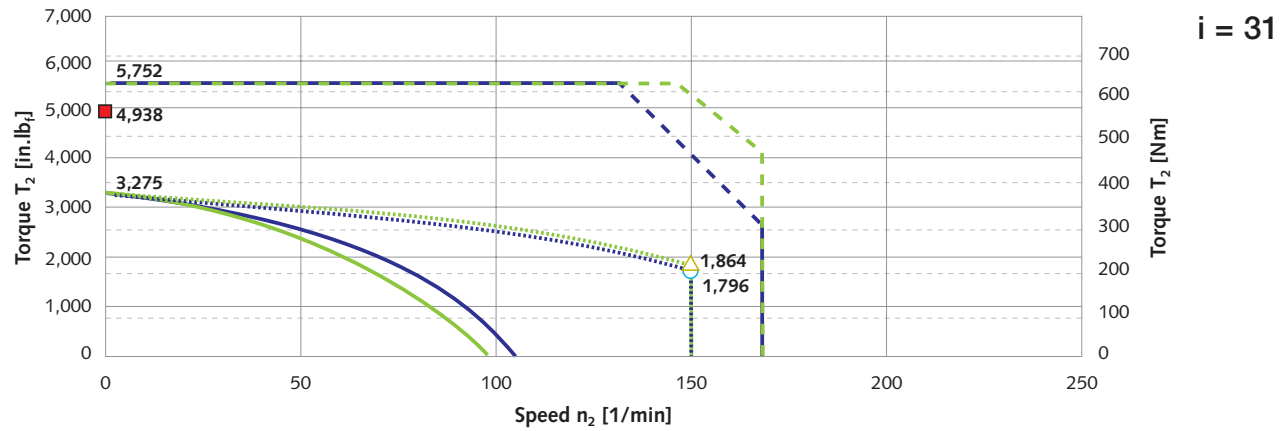
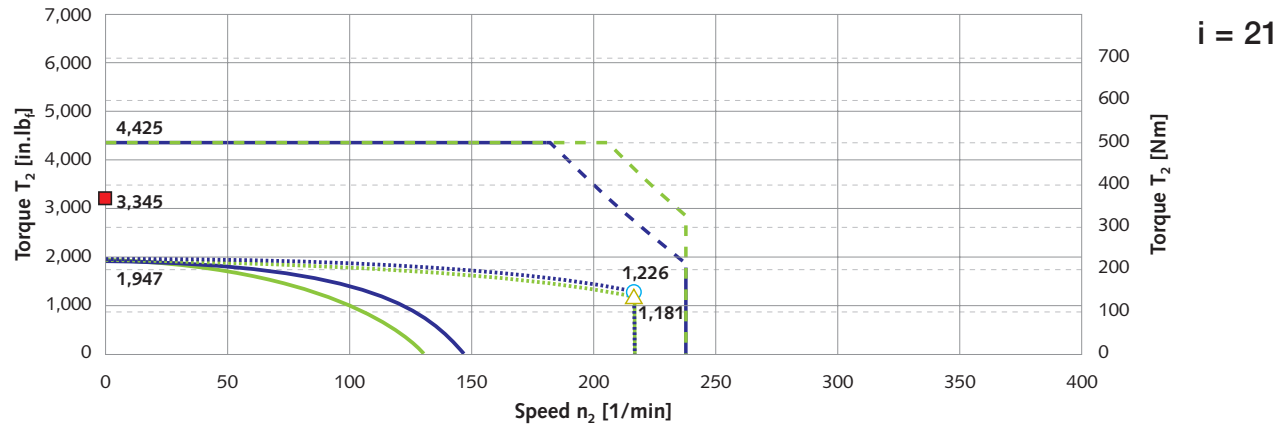
4) Based on the flange center

3) At 68 °F ambient temperature

5) At 68 °F gearhead temperature

6) Limit motor values to maximum values of the gearhead

The tolerances of T, I, n may be ± 10%. In circumstances the maximum allowable current has to be limited because of the maximum allowable torque of the mounted gearbox.



- |                      |                        |                         |                 |
|----------------------|------------------------|-------------------------|-----------------|
| 320V DC w/ resolver: | --- Max. output torque | ..... Nominal torque    | ○ Nominal point |
| 600V DC w/ resolver: | --- Max. output torque | ..... Nominal torque    | △ Nominal point |
| 320V DC w/ encoder:  | --- Max. output torque | --- Nominal torque      | ● Nominal point |
| 600V DC w/ encoder:  | --- Max. output torque | --- Nominal torque      | ▲ Nominal point |
|                      |                        | ■ Holding torque: brake |                 |





# TPM 110 - Technical data and characteristic curves

## Gearhead data

| Ratio  |  | i              |                                      | 21, 31, 61, 91   |
|--|--|----------------|--------------------------------------|--|
| Maximum acceleration torque <sup>1)</sup>                              | in.lbf (Nm)                                | $T_{2B}$       | i = 31<br>i = 21/61, 91              | 14,160 (1,600)<br>9,740/11,500 (1,100/1,300)   |
| Emergency Stop torque <sup>2)</sup>                                    | in.lbf (Nm)                                | $T_{2Not}$     |                                      | 24,340 (2,750)   |
| Nominal output torque  | in.lbf (Nm)                                | $T_{2N}$       | i = 31<br>i = 61, 91<br>i = 21       | 10,890 (1,230)<br>6,200 (700)<br>5,660 (640)   |
| Maximum input speed  | min <sup>-1</sup>                          | $n_{1Max}$     |                                      | 4,500  |
| Nominal input speed <sup>3)</sup>                                      | min <sup>-1</sup>                          | $n_{1N}$       |                                      | 3,500  |
| Torsional backlash   | arcmin                                     | $j_t$          | Standard<br>Reduced                  | ≤ 3<br>≤ 1   |
| Torsional rigidity   | in.lbf (Nm)/arcmin                         | $C_{t21}$      |                                      | 2,660 (300)  |
| Maximum axial force <sup>4)</sup>                                      | lbf (N)                                    | $F_{2AMax}$    |                                      | 2,260 (10,050)   |
| Maximum tilting torque   | in.lbf (Nm)                                | $M_{2TiltMax}$ |                                      | 27,120 (3,064)   |
| Tilting rigidity   | in.lbf (Nm)/arcmin                         | $C_{2K}$       |                                      | 12,850 (1,452)   |
| No-load running torque ( $n_1 = 3000 \text{ min}^{-1}$ ) <sup>5)</sup> | in.lbf (Nm)                                | $T_{012}$      | i = 31<br>i = 91                     | 24.8 (2.8)<br>17.7 (2.0)   |
| Moment of inertia reflected to the input                               | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Gear}$     | i = 21<br>i = 31<br>i = 61<br>i = 91 | $15.2 \cdot 10^{-4}$ (1.72)<br>$10.3 \cdot 10^{-4}$ (1.16)<br>$2.4 \cdot 10^{-4}$ (0.27)<br>$1.8 \cdot 10^{-4}$ (0.20) |

## Motor data

|   |  |            | i = 21, 31                    |             | i = 61, 91                    |             |
|---|--|------------|-------------------------------|-------------|-------------------------------|-------------|
| DC bus voltage                          | VDC  | $U_D$      | 320                           | 600         | 320                           | 600         |
| Peak torque <sup>6)</sup>               | in.lbf (Nm)                                | $M_{Max}$  | 350 (39.60)                   | 351 (39.70) | 270 (30.50)                   | 289 (32.60) |
| Continuous stall torque                 | in.lbf (Nm)                                | $M_0$      | 157 (17.70)                   | 158 (17.80) | 120 (13.60)                   | 120 (13.60) |
| Nominal torque                          | in.lbf (Nm)                                | $M_N$      | 113 (12.80)                   | 122 (13.80) | 58 (6.60)                     | 43 (4.90)   |
| Peak current <sup>6)</sup>              | A  | $I_{Max}$  | 58.00                         | 26.20       | 75.00                         | 54.00       |
| Nominal current                         | A  | $I_N$      | 13.50                         | 9.70        | 12.40                         | 5.60        |
| No-load speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_0$      | 3,700                         | 4,326       | 6,380                         | 7,180       |
| Nominal speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_N$      | 2,875                         | 3,300       | 5,375                         | 6,000       |
| Maximum power                           | kW   | $P_{Max}$  | 8.30                          | 11.30       | 11.18                         | 13.00       |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$ | $105.8 \cdot 10^{-4}$ (11.95) |             | $85.7 \cdot 10^{-4}$ (9.68)   |             |
| Moment of inertia w/ resolver w/ brake  | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$ | $121.2 \cdot 10^{-4}$ (13.70) |             | $101.2 \cdot 10^{-4}$ (11.43) |             |

## General data

|   |                                      |                                    |                                    |
|---|--------------------------------------|------------------------------------|------------------------------------|
| Protection class                                    | IP64                                 |                                    |                                    |
| Operating temperature range F (°C)                  | +14 to +194 (-10 to +90)             |                                    |                                    |
| Mounting position                                   | Any                                  |                                    |                                    |
| Lubrication   | Synthetic oil, ISO VG 220            |                                    |                                    |
| Paint   | RAL 5002 (Blue)                      |                                    |                                    |
| Noise level ( $n_1 = 3000 \text{ min}^{-1}$ ) dB(A) | ≤ 65                                 |                                    |                                    |
| Weight without/with brake                           | lb <sub>m</sub> (kg)                 | 81.8/87.3 (37.1/39.6) at i = 21/31 | 79.2/84.5 (35.9/38.3) at i = 61/91 |
| Direction of rotation                               | motor and gearhead in same direction |                                    |                                    |
| Insulation class                                    | F                                    |                                    |                                    |

1) 1000 cycles per hour

2) Permissible 1000 times during the life span of the gearhead

4) Based on the flange center

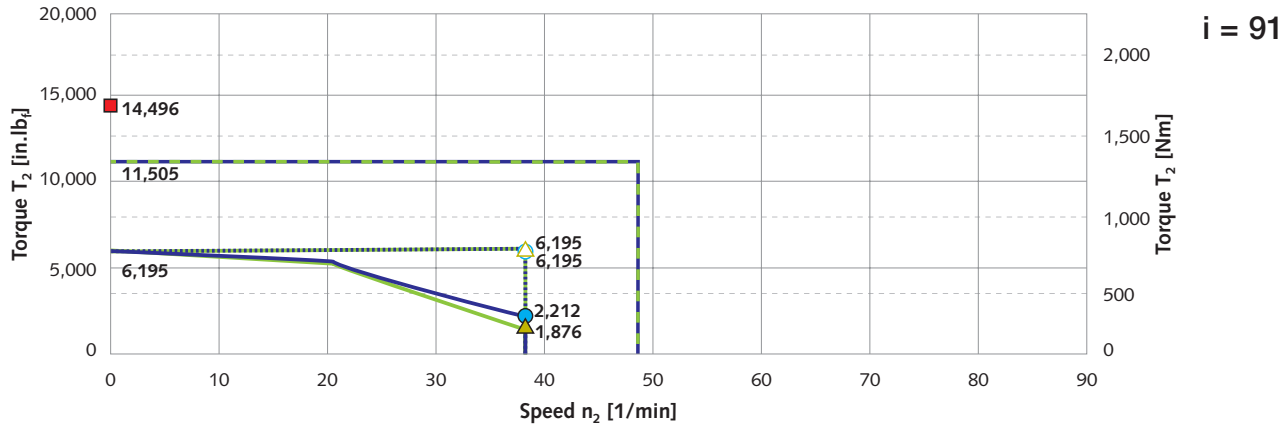
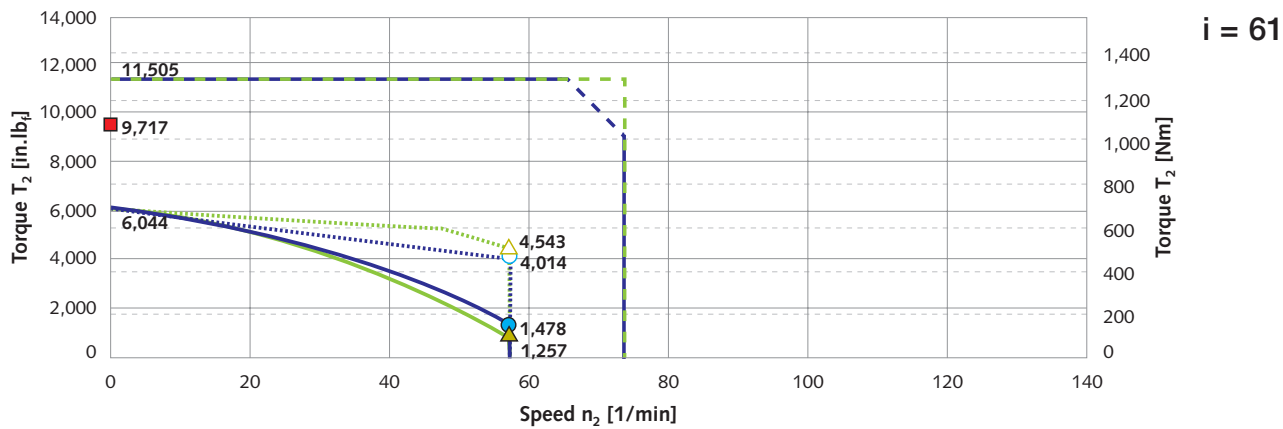
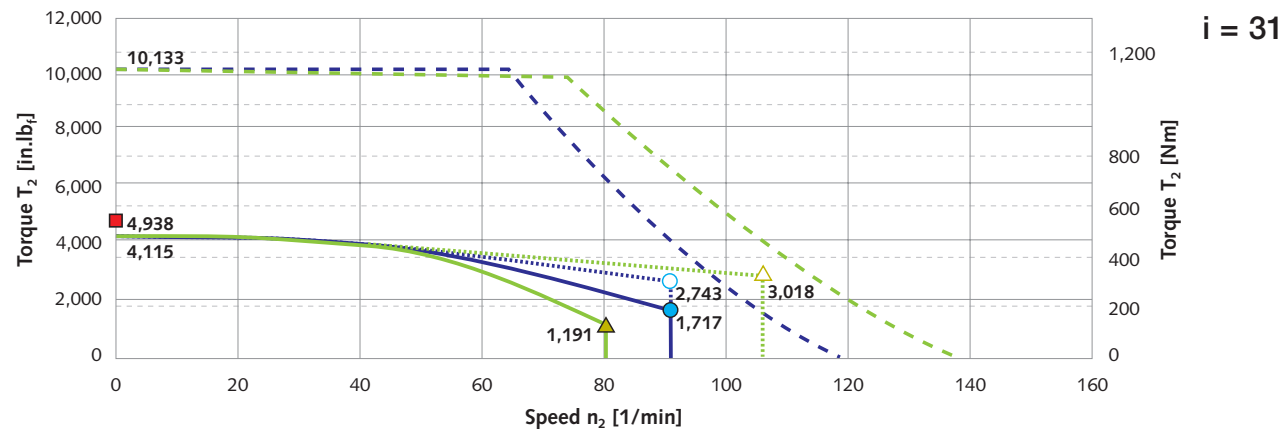
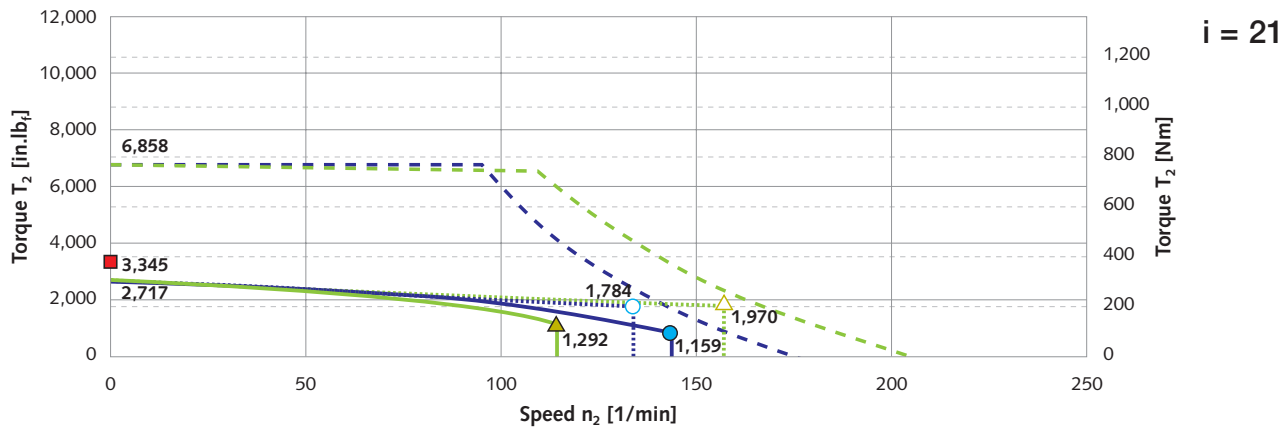
3) At 68 °F ambient temperature

5) At 68 °F gearhead temperature

6) Limit motor values to maximum values of the gearhead



The tolerances of T, I, n may be ± 10%. In circumstances the maximum allowable current has to be limited because of the maximum allowable torque of the mounted gearbox.



- |                      |                      |                      |                         |
|----------------------|----------------------|----------------------|-------------------------|
| 320V DC w/ resolver: | — Max. output torque | ····· Nominal torque | ○ Nominal point         |
| 600V DC w/ resolver: | — Max. output torque | ····· Nominal torque | △ Nominal point         |
| 320V DC w/ encoder:  | — Max. output torque | — Nominal torque     | ● Nominal point         |
| 600V DC w/ encoder:  | — Max. output torque | — Nominal torque     | ▲ Nominal point         |
|                      |                      |                      | ■ Holding torque: brake |



# TPMA 025 - Technical data and characteristic curves

## Gearhead data

| Ratio  |  | i              |                    | 110, 220   |
|--|--|----------------|--------------------|--|
| Maximum acceleration torque <sup>1)</sup>                              | in.lbf (Nm)                                | $T_{2B}$       |                    | 4,250 (480)  |
| Emergency Stop torque <sup>2)</sup>                                    | in.lbf (Nm)                                | $T_{2Not}$     |                    | 10,620 (1,200)   |
| Nominal output torque  | in.lbf (Nm)                                | $T_{2N}$       |                    | 2,300 (260)  |
| Maximum input speed  | min <sup>-1</sup>                          | $n_{1Max}$     |                    | 6,000  |
| Nominal input speed <sup>3)</sup>                                      | min <sup>-1</sup>                          | $n_{1N}$       |                    | 4,200  |
| Torsional backlash   | arcmin                                     | $j_t$          |                    | ≤ 1  |
| Torsional rigidity   | in.lbf (Nm)/arcmin                         | $C_{t21}$      |                    | 860 (97)   |
| Maximum axial force <sup>4)</sup>                                      | lbf (N)                                    | $F_{2AMax}$    |                    | 930 (4,150)  |
| Maximum tilting torque   | in.lbf (Nm)                                | $M_{2TiltMax}$ |                    | 3,660 (413)  |
| Tilting rigidity   | in.lbf (Nm)/arcmin                         | $C_{2K}$       |                    | 4,870 (550)  |
| No-load running torque ( $n_1 = 3000 \text{ min}^{-1}$ ) <sup>5)</sup> | in.lbf (Nm)                                | $T_{012}$      |                    | 3.5 (0.4)  |
| Moment of inertia reflected to the input                               | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Gear}$     | i = 110<br>i = 220 | 0.32*10 <sup>-4</sup> (0.036)<br>0.08*10 <sup>-4</sup> (0.009) |

## Motor data

|   |  | i = 110, 220 |                             |           |
|---|--|--------------|-----------------------------|-----------|
| DC bus voltage                          | VDC  | $U_D$        | 320                         | 600       |
| Peak torque <sup>6)</sup>               | in.lbf (Nm)                                | $M_{Max}$    | 37 (4.20)                   | 37 (4.20) |
| Continuous stall torque                 | in.lbf (Nm)                                | $M_0$        | 15 (1.70)                   | 15 (1.70) |
| Nominal torque                          | in.lbf (Nm)                                | $M_N$        | 12 (1.40)                   | 12 (1.30) |
| Peak current <sup>6)</sup>              | A  | $I_{Max}$    | 10.80                       | 7.00      |
| Nominal current                         | A  | $I_N$        | 3.10                        | 1.80      |
| No-load speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_0$        | 7,300                       | 7,800     |
| Nominal speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_N$        | 5,625                       | 6,200     |
| Maximum power                           | kW   | $P_{Max}$    | 1.72                        | 1.85      |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$   | 7.6*10 <sup>-4</sup> (0.86) |           |
| Moment of inertia w/ resolver w/ brake  | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$   | 8.4*10 <sup>-4</sup> (0.95) |           |

## General data

|   |                      |                                      |
|---|----------------------|--------------------------------------|
| Protection class                              |                      | IP64                                 |
| Operating temperature range                   | F (°C)               | +14 to +194 (-10 to +90)             |
| Mounting position                             |                      | Any                                  |
| Lubrication                                   |                      | Synthetic oil, ISO VG 220            |
| Paint   |                      | RAL 5002 (Blue)                      |
| Noise level ( $n_1 = 3000 \text{ min}^{-1}$ ) | dB(A)                | ≤ 65                                 |
| Weight without/with brake                     | lb <sub>m</sub> (kg) | 18.5/20.5 (8.4/9.3)                  |
| Direction of rotation                         |                      | motor and gearhead in same direction |
| Insulation class                              |                      | F                                    |

1) 1000 cycles per hour

2) Permissible 1000 times during the life span of the gearhead

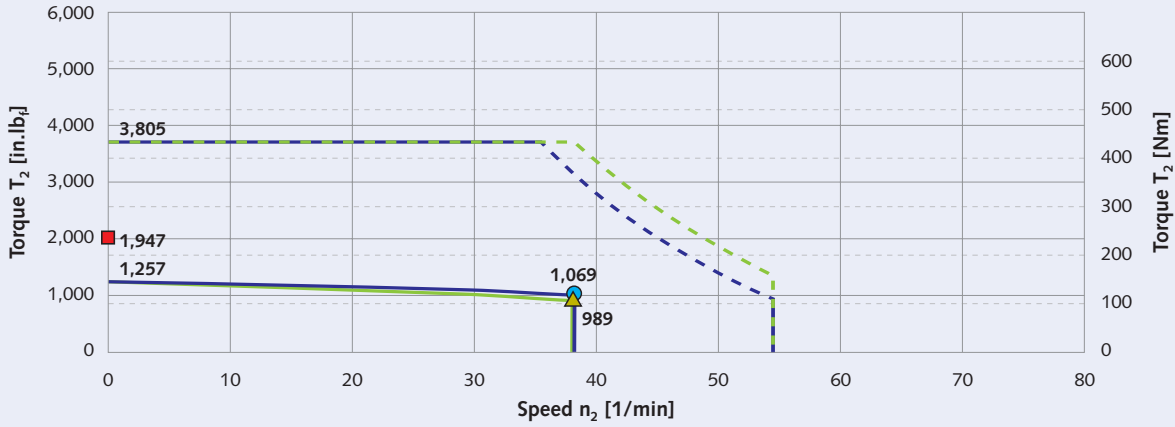
3) At 68 °F ambient temperature

4) Based on the flange center

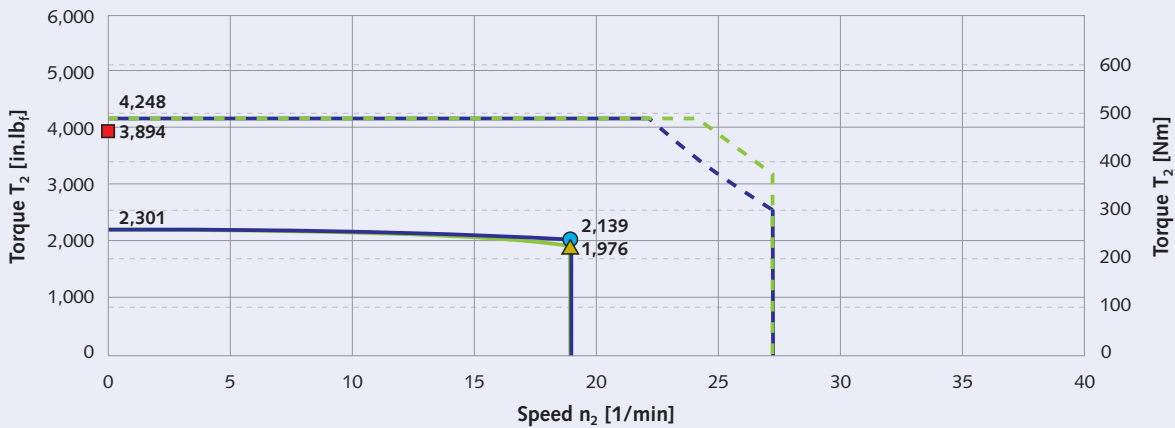
5) At 68 °F gearhead temperature

6) Limit motor values to maximum values of the gearhead

The tolerances of T, I, n may be  $\pm 10\%$ . In circumstances the maximum allowable current has to be limited because of the maximum allowable torque of the mounted gearbox.



$i = 110$



$i = 220$

- 320V DC:    - - - Max. output torque    — Nominal torque    ● Nominal point
- 600V DC:    - - - Max. output torque    — Nominal torque    ▲ Nominal point
- Holding torque: brake





# TPMA 050 - Technical data and characteristic curves

## Gearhead data

| Ratio  |  | i              |                    | 110, 220   |
|--|--|----------------|--------------------|--|
| Maximum acceleration torque <sup>1)</sup>                              | in.lbf (Nm)                                | $T_{2B}$       |                    | 8,410 (950)  |
| Emergency Stop torque <sup>2)</sup>                                    | in.lbf (Nm)                                | $T_{2Not}$     |                    | 21,020 (2,375)   |
| Nominal output torque  | in.lbf (Nm)                                | $T_{2N}$       |                    | 5,980 (675)  |
| Maximum input speed  | min <sup>-1</sup>                          | $n_{1Max}$     |                    | 5,000  |
| Nominal input speed <sup>3)</sup>                                      | min <sup>-1</sup>                          | $n_{1N}$       |                    | 2,600  |
| Torsional backlash   | arcmin                                     | $j_t$          |                    | ≤ 1  |
| Torsional rigidity   | in.lbf (Nm)/arcmin                         | $C_{t21}$      |                    | 1,650 (186)  |
| Maximum axial force <sup>4)</sup>                                      | lbf (N)                                    | $F_{2AMax}$    |                    | 1,380 (6,130)  |
| Maximum tilting torque   | in.lbf (Nm)                                | $M_{2TiltMax}$ |                    | 11,460 (1,295)   |
| Tilting rigidity   | in.lbf (Nm)/arcmin                         | $C_{2K}$       |                    | 4,960 (560)  |
| No-load running torque ( $n_1 = 3000 \text{ min}^{-1}$ ) <sup>5)</sup> | in.lbf (Nm)                                | $T_{012}$      |                    | 7.1 (0.8)  |
| Moment of inertia reflected to the input                               | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Gear}$     | i = 110<br>i = 220 | 1.34*10 <sup>-4</sup> (0.151)<br>0.34*10 <sup>-4</sup> (0.038) |

## Motor data

|   |  | i = 110, 220 |                              |
|---|--|--------------|------------------------------|
| DC bus voltage                          | VDC  | $U_D$        | 320<br>600                   |
| Peak torque <sup>6)</sup>               | in.lbf (Nm)                                | $M_{Max}$    | 69 (7.80)<br>69 (7.80)       |
| Continuous stall torque                 | in.lbf (Nm)                                | $M_0$        | 32 (3.60)<br>31 (3.50)       |
| Nominal torque                          | in.lbf (Nm)                                | $M_N$        | 25 (2.80)<br>22 (2.50)       |
| Peak current <sup>6)</sup>              | A  | $I_{Max}$    | 19.60<br>13.70               |
| Nominal current                         | A  | $I_N$        | 4.20<br>2.60                 |
| No-load speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_0$        | 5,000<br>5,900               |
| Nominal speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_N$        | 3,775<br>4,562               |
| Maximum power                           | kW   | $P_{Max}$    | 2.25<br>2.53                 |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$   | 20.2*10 <sup>-4</sup> (2.28) |
| Moment of inertia w/ resolver w/ brake  | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$   | 22.2*10 <sup>-4</sup> (2.51) |

## General data

|   |                      |                                      |
|---|----------------------|--------------------------------------|
| Protection class                              |                      | IP64                                 |
| Operating temperature range                   | F (°C)               | +14 to +194 (-10 to +90)             |
| Mounting position                             |                      | Any                                  |
| Lubrication                                   |                      | Synthetic oil, ISO VG 220            |
| Paint   |                      | RAL 5002 (Blue)                      |
| Noise level ( $n_1 = 3000 \text{ min}^{-1}$ ) | dB(A)                | ≤ 70                                 |
| Weight without/with brake                     | lb <sub>m</sub> (kg) | 38.8/41.5 (17.6/18.8)                |
| Direction of rotation                         |                      | motor and gearhead in same direction |
| Insulation class                              |                      | F                                    |

1) 1000 cycles per hour

2) Permissible 1000 times during the life span of the gearhead

3) At 68 °F ambient temperature

4) Based on the flange center

5) At 68 °F gearhead temperature

6) Limit motor values to maximum values of the gearhead





# TPMA 110 - Technical data and characteristic curves

## Gearhead data

| Ratio  |  | i              |                    | 110, 220   |
|--|--|----------------|--------------------|--|
| Maximum acceleration torque <sup>1)</sup>                              | in.lbf (Nm)                                | $T_{2B}$       |                    | 23,010 (2,600)   |
| Emergency Stop torque <sup>2)</sup>                                    | in.lbf (Nm)                                | $T_{2Not}$     |                    | 57,520 (6,500)   |
| Nominal output torque  | in.lbf (Nm)                                | $T_{2N}$       |                    | 13,890 (1,570)   |
| Maximum input speed  | min <sup>-1</sup>                          | $n_{1Max}$     |                    | 4,500  |
| Nominal input speed <sup>3)</sup>                                      | min <sup>-1</sup>                          | $n_{1N}$       |                    | 3,300  |
| Torsional backlash   | arcmin                                     | $j_t$          |                    | ≤ 1  |
| Torsional rigidity   | in.lbf (Nm)/arcmin                         | $C_{t21}$      |                    | 4,870 (550)  |
| Maximum axial force <sup>4)</sup>                                      | lbf (N)                                    | $F_{2AMax}$    |                    | 2,260 (10,050)   |
| Maximum tilting torque   | in.lbf (Nm)                                | $M_{2TiltMax}$ |                    | 27,120 (3,064)   |
| Tilting rigidity   | in.lbf (Nm)/arcmin                         | $C_{2K}$       |                    | 12,850 (1,452)   |
| No-load running torque ( $n_1 = 3000 \text{ min}^{-1}$ ) <sup>5)</sup> | in.lbf (Nm)                                | $T_{012}$      |                    | 15.0 (1.70)  |
| Moment of inertia reflected to the input                               | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Gear}$     | i = 110<br>i = 220 | 5.72*10 <sup>-4</sup> (0.646)<br>1.41*10 <sup>-4</sup> (0.159) |

## Motor data

|   |  | i = 110, 220 |                                |
|---|--|--------------|--------------------------------|
| DC bus voltage                          | VDC  | $U_D$        | 320 600                        |
| Peak torque <sup>6)</sup>               | in.lbf (Nm)                                | $M_{Max}$    | 270 (30.50) 289 (32.60)        |
| Continuous stall torque                 | in.lbf (Nm)                                | $M_0$        | 120 (13.60) 120 (13.60)        |
| Nominal torque                          | in.lbf (Nm)                                | $M_N$        | 58 (6.60) 43 (4.90)            |
| Peak current <sup>6)</sup>              | A  | $I_{Max}$    | 75.00 54.00                    |
| Nominal current                         | A  | $I_N$        | 12.40 5.60                     |
| No-load speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_0$        | 6,380 7,180                    |
| Nominal speed <sup>6)</sup>             | min <sup>-1</sup>                          | $n_N$        | 5,375 6,000                    |
| Maximum power                           | kW   | $P_{Max}$    | 11.18 13.00                    |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$   | 85.7*10 <sup>-4</sup> (9.68)   |
| Moment of inertia w/ resolver w/o brake | in.lbf.s <sup>2</sup> (kgcm <sup>2</sup> ) | $J_{Mot.}$   | 101.2*10 <sup>-4</sup> (11.44) |

## General data

|   |                      |                                      |
|---|----------------------|--------------------------------------|
| Protection class                              |                      | IP64                                 |
| Operating temperature range                   | F(°C)                | +14 to +194 (-10 to +90)             |
| Mounting position                             |                      | Any                                  |
| Lubrication                                   |                      | Synthetic oil, ISO VG 220            |
| Paint   |                      | RAL 5002 (Blue)                      |
| Noise level ( $n_1 = 3000 \text{ min}^{-1}$ ) | dB(A)                | ≤ 70                                 |
| Weight without/with brake                     | lb <sub>m</sub> (kg) | 96.1/101.4 (43.6/46.0)               |
| Direction of rotation                         |                      | motor and gearhead in same direction |
| Insulation class                              |                      | F                                    |

1) 1000 cycles per hour

2) Permissible 1000 times during the life span of the gearhead

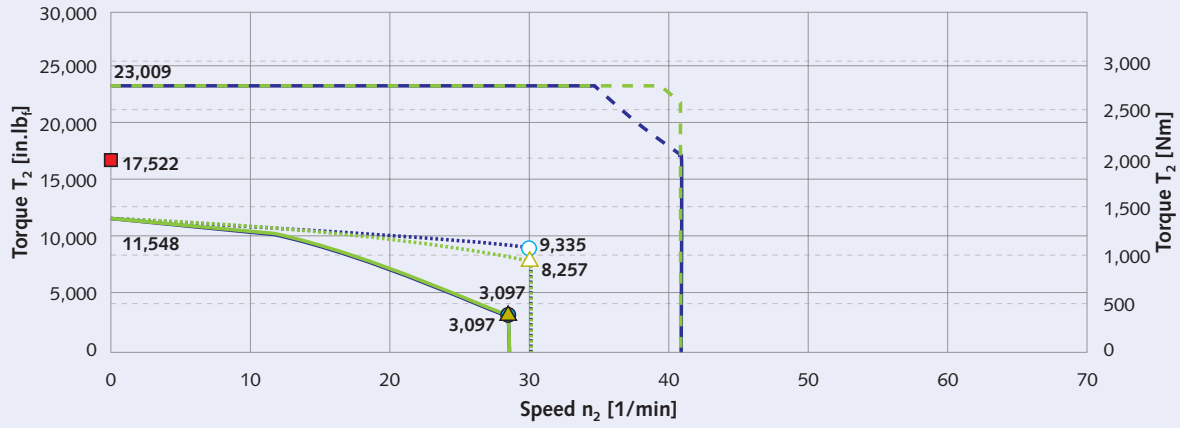
4) Based on the flange center

3) At 68 °F ambient temperature

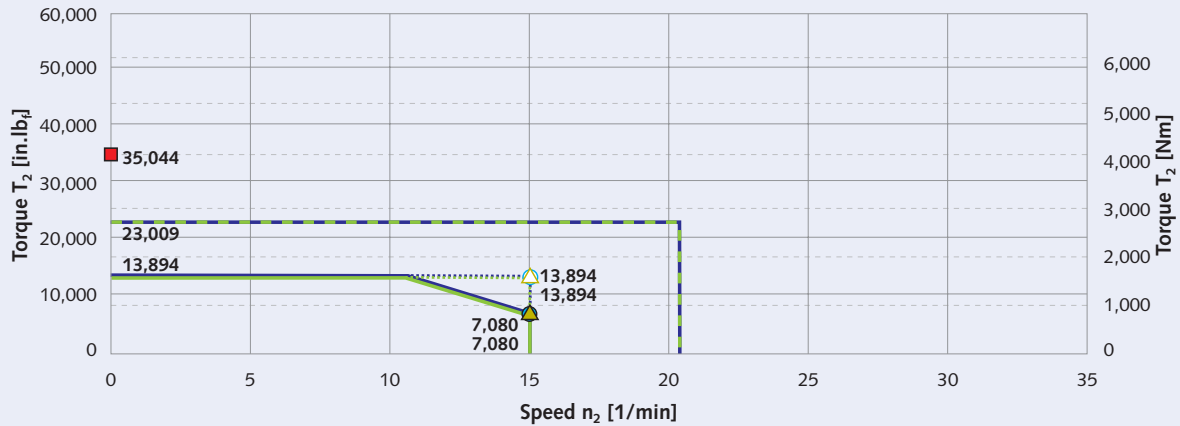
5) At 68 °F gearhead temperature

6) Limit motor values to maximum values of the gearhead

The tolerances of T, I, n may be ± 10%. In circumstances the maximum allowable current has to be limited because of the maximum allowable torque of the mounted gearbox.



i = 110

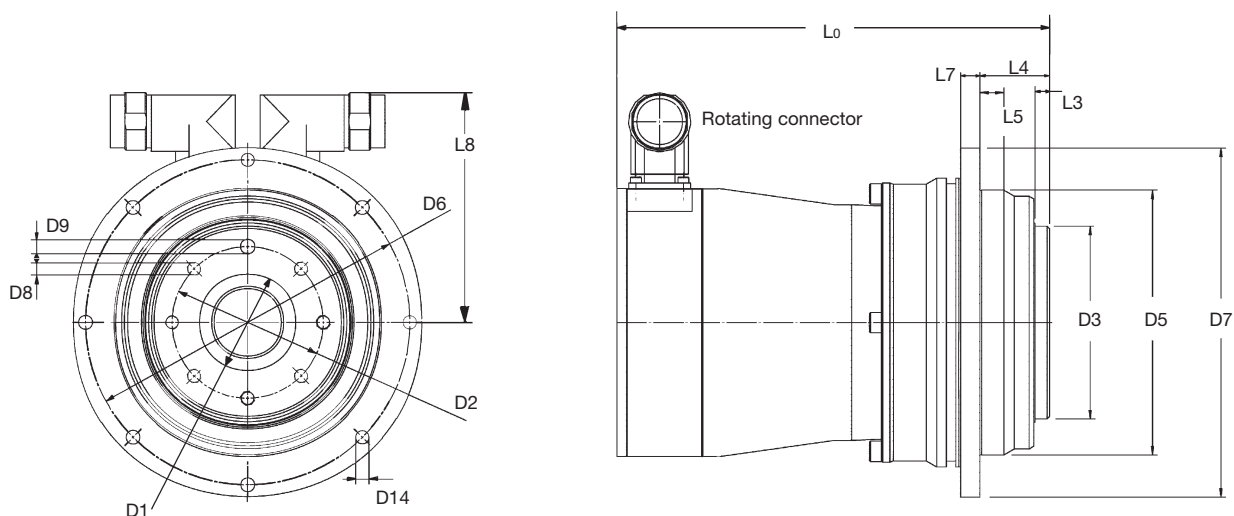


i = 220

- |                      |                          |                      |                         |
|----------------------|--------------------------|----------------------|-------------------------|
| 320V DC w/ resolver: | - - - Max. output torque | ..... Nominal torque | ○ Nominal point         |
| 600V DC w/ resolver: | - - - Max. output torque | ..... Nominal torque | △ Nominal point         |
| 320V DC w/ encoder:  | - - - Max. output torque | ..... Nominal torque | ● Nominal point         |
| 600V DC w/ encoder:  | - - - Max. output torque | ..... Nominal torque | ▲ Nominal point         |
|                      |                          |                      | ■ Holding torque: brake |



# TPM 004-TPM 110 - Drawings



All dimensions in inch (mm)

| TPM   | 004            |       | 010            |       | 025            |       | 050                         |       | 110            |       |
|-------|----------------|-------|----------------|-------|----------------|-------|-----------------------------|-------|----------------|-------|
|       | 21/31          | 61/91 | 21/31          | 61/91 | 21/31          | 61/91 | 21/31                       | 61/91 | 21/31          | 61/91 |
| Ratio |                |       |                |       |                |       |                             |       |                |       |
| D1 H7 | 0.7874 (20)    |       | 1.2402 (31.5)  |       | 1.5748 (40)    |       | 1.9685 (50)                 |       | 3.1496 (80)    |       |
| D2    | 1.2402 (31.5)  |       | 1.9685 (50)    |       | 2.4803 (63)    |       | 3.1496 (80)                 |       | 4.9213 (125)   |       |
| D3 h7 | 1.5748 (40)    |       | 2.4803 (63)    |       | 3.1496 (80)    |       | 3.9370 (100)                |       | 6.2992 (160)   |       |
| D5 h7 | 2.5197 (64)    |       | 3.5433 (90)    |       | 4.3307 (110)   |       | 5.5118 (140)                |       | 7.8740 (200)   |       |
| D6    | 3.1102 (79)    |       | 4.2913 (109)   |       | 5.3150 (135)   |       | 6.6142 (168)                |       | 9.1732 (233)   |       |
| D7    | 3.3852 (86)    |       | 4.6457 (118)   |       | 5.7087 (145)   |       | 7.0472 (179)                |       | 9.7244 (247)   |       |
| D8    | 7xM5           |       | 7xM6           |       | 11xM6          |       | 11xM8                       |       | 11xM10         |       |
| D9    | 1x0.1969 (5)   |       | 1x0.2362 (6)   |       | 1x0.2362 (6)   |       | 1x0.3150 (8)                |       | 1x0.3937 (10)  |       |
| D14   | 8x0.1772 (4.5) |       | 8x0.2165 (5.5) |       | 8x0.2165 (5.5) |       | 12x0.2598 (6.6)             |       | 12x0.3543 (9)  |       |
| L3    | 0.1181 (3)     |       | 0.2362 (6)     |       | 0.2362 (6)     |       | 0.2362 (6)                  |       | 0.3150 (8)     |       |
| L4    | 0.7677 (19.5)  |       | 1.1811 (30)    |       | 1.1417 (29)    |       | 1.4961 (38)                 |       | 1.9685 (50)    |       |
| L5    | 0.2756 (7)     |       | 0.3937 (10)    |       | 0.3937 (10)    |       | 0.5748 (14.6)               |       | 0.5906 (15)    |       |
| L7    | 0.1575 (4)     |       | 0.2756 (7)     |       | 0.3150 (8)     |       | 0.3937 (10)                 |       | 0.4724 (12)    |       |
| L8    | 3.0551 (77.6)  |       | 3.2126 (81.6)  |       | 3.7598 (95.5)  |       | 4.5276 (115)/4.9410 (125.5) |       | 4.9410 (125.5) |       |

Length  $L_0$  without Brake

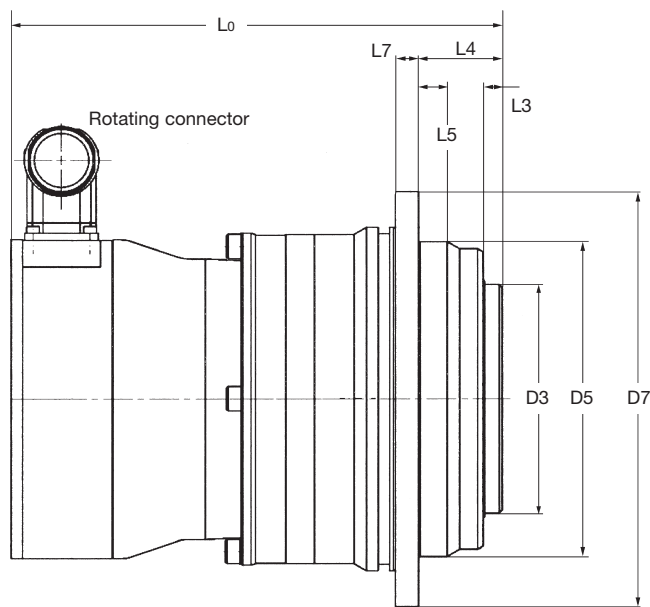
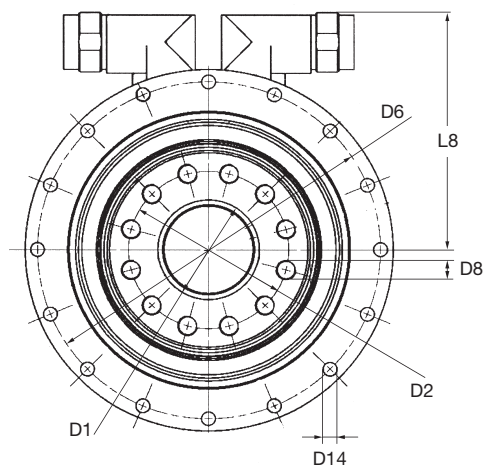
|           |              |              |                |              |                |              |               |                |               |               |
|-----------|--------------|--------------|----------------|--------------|----------------|--------------|---------------|----------------|---------------|---------------|
| Resolver  | 5.0393 (128) | 4.4488 (113) | 6.1024 (155)   | 5.5118 (140) | 7.0866 (180)   | 5.9449 (151) | 10.1968 (259) | 7.3228 (186)   | 11.2205 (285) | 10.6299 (270) |
| EnDat     | 6.1811 (157) | 5.5905 (142) | 8.1260 (206.4) | 7.5197 (191) | 8.9370 (227)   | 7.7165 (196) | 11.8110 (300) | 8.9173 (226.5) | 12.8346 (326) | 12.2441 (311) |
| Hiperface | 6.1811 (157) | 5.5905 (142) | 7.2441 (184)   | 6.6929 (170) | 8.7598 (222.5) | 7.5590 (192) | 10.7874 (274) | 8.9173 (226.6) | 11.8110 (300) | 11.2205 (285) |

Length  $L_0$  with Brake

|           |              |              |                |                |               |                |               |                 |               |               |
|-----------|--------------|--------------|----------------|----------------|---------------|----------------|---------------|-----------------|---------------|---------------|
| Resolver  | 6.5748 (167) | 5.9842 (152) | 7.2441 (184)   | 6.6732 (169.5) | 7.9527 (202)  | 6.8110 (173)   | 11.8110 (300) | 8.3071 (211)    | 12.9134 (328) | 12.2441 (311) |
| EnDat     | 7.7559 (197) | 7.1653 (182) | 9.5433 (242.4) | 9.0157 (229)   | 10.5512 (268) | 9.3504 (237.5) | 14.3307 (364) | 10.7677 (273.5) | 15.3543 (390) | 14.7638 (375) |
| Hiperface | 7.8740 (200) | 7.2835 (185) | 8.6417 (219.5) | 8.0670 (204.9) | 9.8819 (251)  | 8.7008 (221)   | 13.6220 (346) | 10.0984 (256.5) | 14.6456 (372) | 14.0551 (357) |



# TPMA 025-TPMA 110 - Drawings



All dimensions in inch (mm)

| TPM                        | 025             | 050             | 110             |
|----------------------------|-----------------|-----------------|-----------------|
| Ratio                      | 110/220         | 110/220         | 110/220         |
| D1 H7                      | 1.5748 (40)     | 1.9685 (50)     | 3.1496 (80)     |
| D2                         | 2.4803 (63)     | 3.1496 (80)     | 4.9213 (125)    |
| D3 h7                      | 3.1496 (80)     | 3.9370 (100)    | 6.2992 (160)    |
| D5 h7                      | 4.3307 (110)    | 5.5118 (140)    | 7.8740 (200)    |
| D6                         | 5.3150 (135)    | 6.6142 (168)    | 9.1732 (233)    |
| D7                         | 5.7087 (145)    | 7.0472 (179)    | 9.7244 (247)    |
| D8                         | 12xM8           | 12xM10          | 12xM12          |
| D14                        | 16x0.2165 (5.5) | 24x0.2598 (6.6) | 24x0.3543 (9)   |
| L3                         | 0.2362 (6)      | 0.2362 (6)      | 0.3150 (8)      |
| L4                         | 1.1417 (29)     | 1.4961 (38)     | 1.9685 (50)     |
| L5                         | 0.3937 (10)     | 0.5748 (14.6)   | 0.5906 (15)     |
| L7                         | 0.3150 (8)      | 0.3937 (10)     | 0.4724 (12)     |
| L8                         | 3.7598 (95.5)   | 4.5276 (115)    | 4.9409 (125.5)  |
| Length $L_0$ without Brake |                 |                 |                 |
| Resolver                   | 6.7323 (171)    | 8.7008 (221)    | 12.4212 (315.5) |
| EnDat                      | 8.5433 (217)    | 10.3543 (263)   | 14.0354 (356.5) |
| Hiperface                  | 8.3858 (213)    | 10.3543 (263)   | 13.0118 (330.5) |
| Length $L_0$ with Brake    |                 |                 |                 |
| Resolver                   | 7.5984 (193)    | 9.7244 (247)    | 14.0354 (356.5) |
| EnDat                      | 10.1811 (258.6) | 12.2047 (310)   | 16.5551 (420.5) |
| Hiperface                  | 9.5118 (241.6)  | 11.4960 (292)   | 15.8464 (402.5) |



## Electrically-released holding brake

A compact permanent-magnet brake is available for holding the rotor when the power is off. It is characterized by backlash-free operation, drag-free when disengaged, unlimited ON time and constant torque at high operating temperatures.

| Data                            |                       | TPM 004                 | TPM 010,<br>TPM(A) 025  | TPM(A) 050<br>(i=61/91/110/220) | TPM(A) 110,<br>TPM 050<br>(i=21/31) |
|---------------------------------|-----------------------|-------------------------|-------------------------|---------------------------------|-------------------------------------|
| Holding torque at 68°F (20°C)   | in.lbf                | 8.85                    | 17.70                   | 39.82                           | 159.29                              |
|                                 | (Nm)                  | (1)                     | (2)                     | (4.5)                           | (18)                                |
| Holding torque at 212°F (100°C) | in.lbf                | 7.1                     | 15.93                   | 35.40                           | 132.74                              |
|                                 | (Nm)                  | (0.8)                   | (1.8)                   | (4.0)                           | (15)                                |
| Dynamic torque                  | in.lbf                | 7.08                    | 15.04                   | 33.63                           | 132.74                              |
|                                 | (Nm)                  | (0.8)                   | (1.7)                   | (3.8)                           | (15)                                |
| Moment of inertia               | in.lbf·s <sup>2</sup> | 0.1859*10 <sup>-4</sup> | 0.6018*10 <sup>-4</sup> | 1.5930*10 <sup>-4</sup>         | 0.1469                              |
|                                 | (kgcm <sup>2</sup> )  | (0.021)                 | (0.068)                 | (0.18)                          | (1.66)                              |
| Weight                          | lb <sub>m</sub>       | 0.2426                  | 0.3308                  | 0.6615                          | 1.9845                              |
|                                 | (kg)                  | (0.11)                  | (0.15)                  | (0.30)                          | (0.9)                               |
| Release/set time                | ms                    | 12/8                    | 25/6                    | 35/7                            | 50/10                               |
| Coil resistance at 68°F (20°C)  | Ω                     | 53-62                   | 48-56                   | 44-52                           | 22-26                               |
| Supply voltage                  | VDC                   | 24 +6% -10%             |                         |                                 |                                     |
| Current                         | A                     | 0.45                    | 0.50                    | 0.55                            | 1.1                                 |

## Temperature sensors

The following temperature sensors are available with various servo controllers. They measure temperature directly at the motor coil.

- PTC - Positive temperature coefficient thermistor
- KTY - Linear temperature coefficient thermistor
- NTC - Negative temperature coefficient thermistor

## Feedback systems

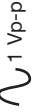
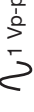


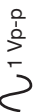
Various feedback systems are available for position encoding.

A single turn brushless resolver feedback is standard for TPM. This robust feedback device is suitable for many applications with normal demands for smooth running and precision.

For higher technical demands, optical encoders are available from Heidenhain and Stegmann. Using the EnDat® and Hiperface® interfaces, position values as well as information regarding startup and drive data can be stored to and retrieved from the TPM.

See page 30 for the respective pin assignments.

# Comparison of TPM feedback devices

| Parameter                                | Unit   | HEIDENHAIN  |   |  | STEGMANN  |   | Resolver<br>(2 Pole)  |
|--|--|---|---|--|---|---|---|
|  |  | ERN1185/ERN1387   | ECN1113/ECN1313   | EQN1125/EQN1325  | SRS50/66K   | SRM50/66K   |   |
| Feedback type                            |  | Incremental   | Abs. Singleturn   | Abs. Multiturn   | Abs. Singleturn   | Abs. Multiturn  | Abs. Singleturn   |
| Operating voltage                        | V  | 5   | 5   | 5  | 7 ... 12  | 7 ... 12  | 7 (10 KHz)  |
| Data interface                           |  | -   | EnDat   | EnDat  | Hiperface   | Hiperface   | -   |
| Electronic type plate                    |  | -   | ✓   | ✓  | ✓   | ✓   | -   |
| Form of the incremental signals          |  |  |  |  |  |  | -   |
| Number of sin/cos periods per revolution |  | 2048/2048   | 512/2048  | 512/2048   | 1024  | 1024  | 1   |
| Reference track available                |  | ✓   | -   | -  | -   | -   | -   |
| Absolute position when main power is on  |  | ✓ (within 1 revolution)   | ✓ (within 1 revolution)   | ✓  | ✓ (within 1 revolution)   | ✓   | ✓ (within 1 revolution)   |
| Absolute resolution                      | Pos./rev                                     | 1 Sin/Cos period  | 8192  | 8192   | 32768   | 32768   | 1 Sin/Cos period  |
| Multiturn function                       |  | -   | -   | ✓  | -   | ✓   | -   |
| Multiturn measuring range                |  | -   | -   | 4096   | -   | 4096  | -   |
| Maximum operating temperature            | °C   | 120   | 115   | 115  | 115   | 115   | 150   |
| Minimum operating temperature            | °C   | -30   | -30   | -30  | -20   | -20   | -55   |
| Moment of inertia                        | in.lb.s <sup>2</sup><br>(kgcm <sup>2</sup> ) | 0.035*10 <sup>-4</sup> /<br>0.23*10 <sup>-4</sup><br>(0.004/0.026)                  | 0.035*10 <sup>-4</sup> /<br>0.23*10 <sup>-4</sup><br>(0.004/0.026)                  | 0.035*10 <sup>-4</sup> /<br>0.23*10 <sup>-4</sup><br>(0.004/0.026)                 | 0.0885*10 <sup>-4</sup><br>(0.01)   | 0.0885*10 <sup>-4</sup><br>(0.01)   | TPM004<br>0.0177*10 <sup>-4</sup><br>(0.002)<br>TPM(A) 010-050<br>0.2655*10 <sup>-4</sup><br>(0.03)<br>TPM(A) 110<br>2.0709*10 <sup>-4</sup><br>(0.234) |
| Shock after EN60068-2-6                  |  | < 100g/6ms  | < 100g/6ms  | < 100g/10ms  | < 100g/10ms   | < 100g/10ms   | < 100g/11ms   |
| Vibration (55-2000Hz) after EN60068-2-27 |  | < 10g   | < 20g / 10g   | < 20g / 10g  | < 20g (10-2000Hz)   | < 20g (10-2000Hz)   | < 20g (10-500Hz)  |



# Accessories

## Cables

Matching signal and power cables for the tested servo controllers listed on page 29 are available.

Please supply the following data when you order:

- Complete TPM description
- Desired length of cable, available in lengths of 5, 10, 15, 20, 25, 30, 40 and 50 meters
- Exact type description of servo controller to be used

The cables have excellent quality:

- Suitable for cable tracks, because of highly flexible wires in accordance with DIN VDE 0295, class 6
- Oil and fire proof
- Free of halogen, silicon and CFC

## Mechanical characteristics:

|                                    |   |
|------------------------------------|---|
| Maximum tensile strength           | Static 7258 lb <sub>f</sub> /sq in (50 N/mm <sup>2</sup> ) Conductor diameter<br>Dynamic 2903 lb <sub>f</sub> /sq in (20 N/mm <sup>2</sup> ) Conductor diameter |
| Maximum permissible torsion        | ± 1,181 °/in (30 °/m)   |
| Permissible operating temperature  | Static: -58 °F to +176 °F (-50 to +80 °C)<br>Flexed: -4 °F to +158 °F (-20 to +70 °C)   |
| Minimum permissible bending radius | 10 x D (outer diameter of cable)<br>*)  |
| Number of bending cycles           | 5 million (at bending radius 10 x D)  |
| Maximum permissible acceleration   | 197 in/sec <sup>2</sup> (5 m/sec <sup>2</sup> )   |
| Maximum permissible speed          | 7087 in/min (180 m/min)   |

| *)  | D                                      | Conductor diameter  |
|---|--|---|
| Power cable TPM 004 - TPM(A) 050 (i=61, 91, 110, 220)<br>TPM 050 (i=21, 31), TPM(A) 110 | 0.48 in (12.2 mm)<br>0.59 in (15.1 mm) | 4 x 0.0023 sq in (1.5 mm <sup>2</sup> ) + 2 x 0.0012 sq in (0.75 mm <sup>2</sup> )<br>4 x 0.0039 sq in (2.5 mm <sup>2</sup> ) + 2 x 0.0015 sq in (1 mm <sup>2</sup> ) |
| Signal cable  | 0.39 in (10 mm)                        |   |



# Servo controllers

The TPM/TPMA AC servo actuators can be operated with a wide variety of servo controllers. The subsequent table lists all tested controllers with information on the correct option choices, feedbacks, temperature sensor and DC bus voltage.

For a number of these, a written startup manual is available. It contains all relevant parameter settings of the respective manufacturer to ensure that the startup can be performed in the shortest possible time.

| Manufacturer                                     | Series/type               | Feedback device |             |                 |                     | Temperature sensor |     |            | DC bus voltage  |         |
|--|---------------------------|-----------------|-------------|-----------------|---------------------|--------------------|-----|------------|-----------------|---------|
|  |                           | Resolver        | Incremental | EnDat interface | Hiperface interface | PTC                | NTC | KTY 84-130 | 320V DC         | 600V DC |
| AMK <sup>2)</sup>                                | AMKASYN KU <sup>3)</sup>  | ✗               | -           | ✗               | ✗                   | ✗                  | -   | -          | ✗               | ✗       |
| Bosch Rexroth <sup>2)</sup>                      | Servo Dyn D               | ✗               | -           | ✗               | -                   | -                  | ✗   | -          | -               | ✗       |
| Bosch Rexroth (Indramat) <sup>1)</sup>           | Ecodrive 03 <sup>4)</sup> | ✗               | -           | ✗               | -                   | ✗                  | -   | -          | ✗               | ✗       |
|  | Ecodrive 03, 16A          | ✗               | -           | -               | -                   | ✗                  | -   | -          | ✗               | ✗       |
|  | DIAX 04                   | ✗               | -           | ✗               | -                   | ✗                  | -   | -          | ✗               | ✗       |
| B & R <sup>1)</sup>                              | AcoPos                    | ✗               | -           | ✗               | -                   | ✗                  | -   | ✗          | ✗ <sup>6)</sup> | ✗       |
| CT   | UniDrive <sup>1)</sup>    | ✗               | -           | -               | ✗                   | ✗                  | -   | -          | ✗ <sup>5)</sup> | ✗       |
|  | UniDrive SP <sup>2)</sup> | ✗               | -           | ✗               | ✗                   | ✗                  | -   | -          | ✗ <sup>5)</sup> | ✗       |
| Danaher motion (Atlas Copco)                     | DMC 2                     | ✗               | -           | -               | -                   | ✗                  | -   | -          | ✗               | ✗       |
| Danaher motion <sup>1)</sup> (Seidel Kollmorgen) | Servostar 600/400         | ✗               | -           | ✗               | ✗                   | ✗                  | -   | -          | ✗               | ✗       |
| ELAU <sup>2)</sup>                               | PACDrive MC-4             | -               | -           | -               | ✗                   | ✗                  | -   | -          | ✗               | ✗       |
| ESR Pollmeier                                    | Trio-/MidiDrive A         | ✗               | -           | -               | -                   | ✗                  | -   | -          | ✗               | ✗       |
|  | Trio-/MidiDrive C         | ✗               | -           | ✗               | -                   | ✗                  | -   | -          | ✗               | ✗       |
|  | Trio-/MidiDrive D         | ✗               | -           | ✗               | ✗                   | ✗                  | -   | -          | ✗               | ✗       |
| Jetter   | Jetmove 6xx               | ✗               | -           | ✗               | ✗                   | ✗                  | -   | -          | ✗               | ✗       |
| KEB <sup>1)</sup>                                | Combivert S4              | ✗               | ✗           | -               | -                   | ✗                  | -   | -          | ✗               | ✗       |
| Lenze <sup>1)</sup>                              | Global Drive 93xx         | ✗               | -           | -               | ✗                   | ✗                  | -   | ✗          | -               | ✗       |
| Nord <sup>2)</sup>                               | SK 1000 E                 | ✗               | -           | -               | -                   | -                  | -   | ✗          | -               | ✗       |
| Parker Hannifin <sup>2)</sup> (Hauser)           | Compax                    | ✗               | -           | -               | ✗                   | ✗                  | -   | ✗          | ✗               | ✗       |
| S.B.C. <sup>2)</sup>                             | HPD                       | ✗               | -           | -               | -                   | ✗                  | -   | -          | ✗               | ✗       |
|  | LVD                       | ✗               | -           | -               | -                   | ✗                  | -   | -          | ✗               | -       |
| Siemens <sup>1)</sup>                            | SimoDrive 611U            | ✗               | ✗           | ✗               | -                   | -                  | -   | ✗          | -               | ✗       |
|  | SimoDrive 611D/840D       | -               | ✗           | ✗               | -                   | -                  | -   | ✗          | -               | ✗       |
|  | Master Drive MC           | ✗               | ✗           | ✗               | -                   | ✗                  | -   | ✗          | -               | ✗       |

Information on additional controllers can be supplied on request.

✗ = possible

- = not available

1) = Startup manual available

2) = Startup manual in preparation

3) = Version with EnDat interface needs Encoder with 512 SinCos

4) = Use of TPM 004, 010 please contact **alpha geardrives**

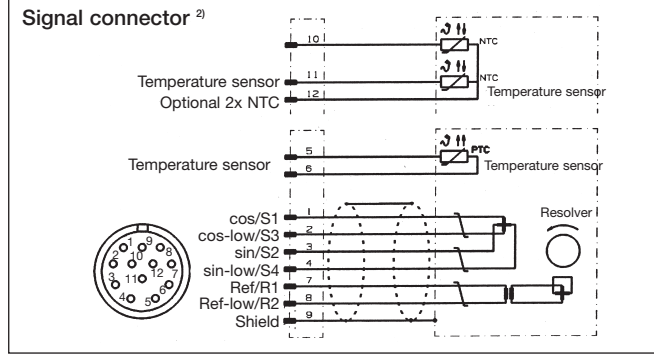
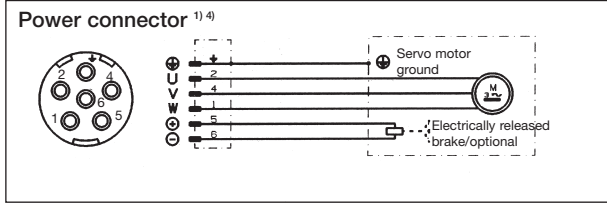
5) = Low voltage model

6) = Low voltage model, supported TPM type on request

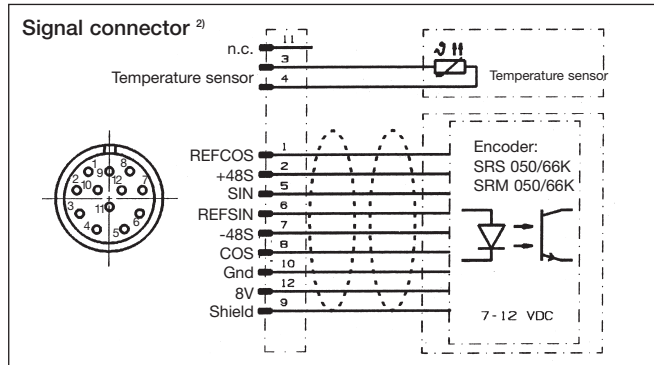
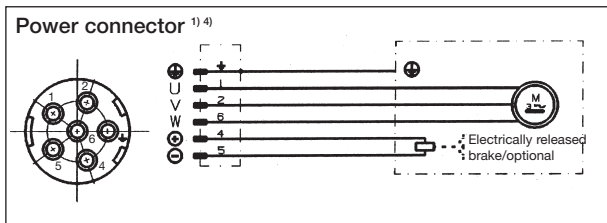
Operating manuals and installation guides are available at [www.alphagear.com](http://www.alphagear.com).

# Plug connections

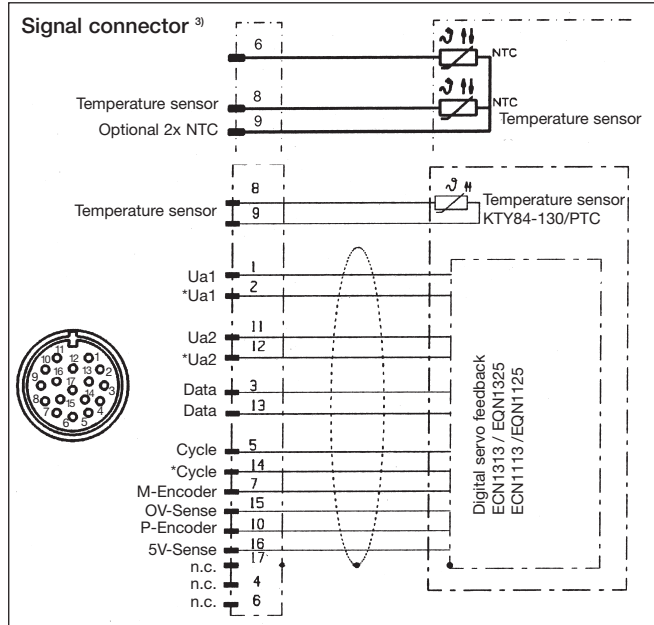
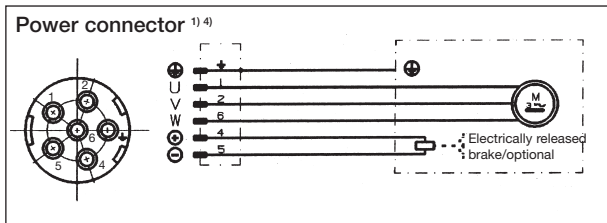
## Resolver, Singleturn



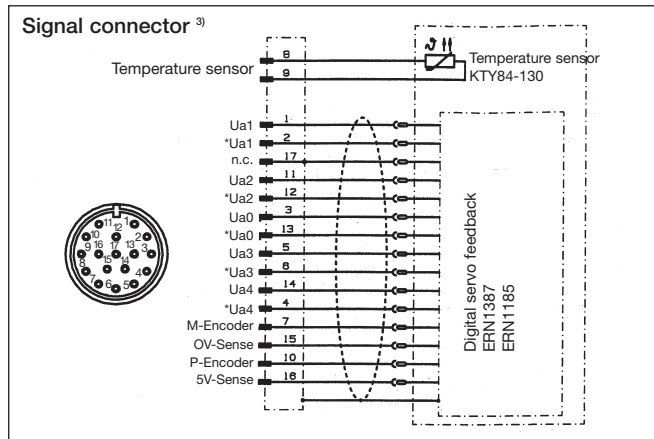
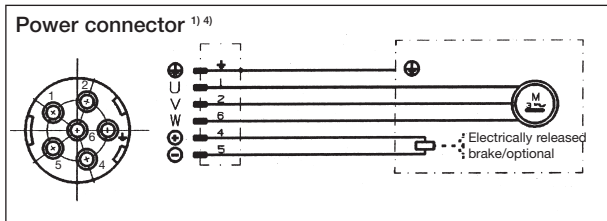
## Stegmann encoder, Single- and Multiturn Hiperface®



## Heidenhain encoder, Single- and Multiturn EnDat®



## Heidenhain encoder, incremental



- 1) = series B, 6 poles, pin contact Ø 2mm
- 2) = series A, 12 poles, P type, pin contact Ø 1mm, housing code 0°
- 3) = series A, 17 poles, E type, pin contact Ø 1mm, housing code 0°
- 4) = connection of ground wire to housing according to VDE 0627

# Ordering codes

TPM 025 - 021M - 600K - BP1

## Size

TPM 004 / 010 / 025 / 050 / 110  
TPMA 025 / 050 / 110

## Ratio

21 / 31 / 61 / 91 (TPM)  
110 / 220 (TPMA)

## Motor encoder

R = Resolver  
S = Singleturn absolute encoder EnDat<sup>®</sup>  
M = Multiturn absolute encoder EnDat<sup>®</sup>  
N = Singleturn absolute encoder Hiperface<sup>®</sup>  
K = Multiturn absolute encoder Hiperface<sup>®</sup>  
I = Incremental encoder

## Backlash

1 = Standard < 3 (5) arcmin  
0 = Reduced < 1 (3) arcmin  
(values in brackets: TPM 004)

## Brakes

BP = Permanent magnet brake  
OH = Without brake

## Temperature sensor

P = PTC  
N = NTC  
K = KTY 84-130

## DC bus voltage

320 = 320V DC at controller input  
voltage 1x230V/3x230V AC  
600 = 600V DC at controller input  
voltage 3x400V AC

## Additional options without codes

- Straight plug connections
- Painted in RAL 9005 (black)
- Synthetic oil, ISO PG68
- Explosionproof model (on request)
- Grease Lubrication



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