

# DC-Micromotors

## Precious Metal Commutation

5,9 mNm  
8 W

### Series 2233 ... S

| Values at 22°C and nominal voltage                        | 2233 T                  | 4,5 S                                       | 006 S | 012 S | 018 S                                       | 024 S | 030 S |                                 |                   |
|-----------------------------------------------------------|-------------------------|---------------------------------------------|-------|-------|---------------------------------------------|-------|-------|---------------------------------|-------------------|
| 1 Nominal voltage                                         | $U_N$                   | 4,5                                         | 6     | 12    | 18                                          | 24    | 30    | V                               |                   |
| 2 Terminal resistance                                     | $R$                     | 1,2                                         | 2,7   | 9,6   | 25                                          | 52    | 97    | $\Omega$                        |                   |
| 3 Efficiency, max.                                        | $\eta_{max}$            | 86                                          | 85    | 85    | 83                                          | 83    | 81    | %                               |                   |
| 4 No-load speed                                           | $n_0$                   | 8 500                                       | 7 700 | 8 200 | 9 000                                       | 8 400 | 8 700 | min <sup>-1</sup>               |                   |
| 5 No-load current, typ. (with shaft $\varnothing$ 1,5 mm) | $I_0$                   | 0,02                                        | 0,014 | 0,007 | 0,005                                       | 0,004 | 0,003 | A                               |                   |
| 6 Stall torque                                            | $M_H$                   | 20,2                                        | 16    | 17,3  | 13,4                                        | 12,4  | 9,9   | mNm                             |                   |
| 7 Friction torque                                         | $M_R$                   | 0,1                                         | 0,1   | 0,1   | 0,1                                         | 0,1   | 0,1   | mNm                             |                   |
| 8 Speed constant                                          | $k_n$                   | 1 895                                       | 1 296 | 684   | 508                                         | 354   | 293   | min <sup>-1</sup> /V            |                   |
| 9 Back-EMF constant                                       | $k_E$                   | 0,528                                       | 0,772 | 1,46  | 1,97                                        | 2,82  | 3,41  | mV/min <sup>-1</sup>            |                   |
| 10 Torque constant                                        | $k_M$                   | 5,04                                        | 7,37  | 14    | 18,8                                        | 27    | 32,6  | mNm/A                           |                   |
| 11 Current constant                                       | $k_I$                   | 0,198                                       | 0,136 | 0,072 | 0,053                                       | 0,037 | 0,031 | A/mNm                           |                   |
| 12 Slope of n-M curve                                     | $\Delta n / \Delta M$   | 421                                         | 483   | 472   | 676                                         | 678   | 877   | min <sup>-1</sup> /mNm          |                   |
| 13 Rotor inductance                                       | $L$                     | 60                                          | 120   | 440   | 800                                         | 1 600 | 2 400 | $\mu$ H                         |                   |
| 14 Mechanical time constant                               | $\tau_m$                | 11,5                                        | 10    | 11    | 17                                          | 11    | 12,9  | ms                              |                   |
| 15 Rotor inertia                                          | $J$                     | 2,6                                         | 2     | 2,2   | 2,5                                         | 1,6   | 1,4   | gcm <sup>2</sup>                |                   |
| 16 Angular acceleration                                   | $\alpha_{max}$          | 77                                          | 80    | 78    | 54                                          | 78    | 71    | $\cdot 10^3$ rad/s <sup>2</sup> |                   |
| 17 Thermal resistance                                     | $R_{th1} / R_{th2}$     | 4 / 27                                      |       |       |                                             |       |       | K/W                             |                   |
| 18 Thermal time constant                                  | $\tau_{w1} / \tau_{w2}$ | 4 / 660                                     |       |       |                                             |       |       | s                               |                   |
| 19 Operating temperature range:                           |                         |                                             |       |       |                                             |       |       |                                 |                   |
| – motor                                                   |                         | -30 ... +85 (optional version -55 ... +125) |       |       |                                             |       |       |                                 | °C                |
| – winding, max. permissible                               |                         | +125                                        |       |       |                                             |       |       |                                 | °C                |
| 20 Shaft bearings                                         |                         | sintered bearings (standard)                |       |       | ball bearings, preloaded (optional version) |       |       |                                 |                   |
| 21 Shaft load max.:                                       |                         | 1,5                                         |       |       | 2                                           |       |       |                                 | mm                |
| – with shaft diameter                                     |                         | 1,2                                         |       |       | 8                                           |       |       |                                 | N                 |
| – radial at 3 000 min <sup>-1</sup> (3 mm from bearing)   |                         | 0,2                                         |       |       | 0,8                                         |       |       |                                 | N                 |
| – axial at 3 000 min <sup>-1</sup>                        |                         | 20                                          |       |       | 10                                          |       |       |                                 | N                 |
| – axial at standstill                                     |                         |                                             |       |       |                                             |       |       |                                 |                   |
| 22 Shaft play:                                            |                         |                                             |       |       |                                             |       |       |                                 |                   |
| – radial                                                  | $\leq$                  | 0,03                                        |       |       | 0,015                                       |       |       |                                 | mm                |
| – axial                                                   | $\leq$                  | 0,2                                         |       |       | 0                                           |       |       |                                 | mm                |
| 23 Housing material                                       |                         | steel, zinc galvanized and passivated       |       |       |                                             |       |       |                                 |                   |
| 24 Mass                                                   |                         | 61                                          |       |       |                                             |       |       |                                 | g                 |
| 25 Direction of rotation                                  |                         | clockwise, viewed from the front face       |       |       |                                             |       |       |                                 |                   |
| 26 Speed up to                                            | $n_{max}$               | 10 000                                      |       |       |                                             |       |       |                                 | min <sup>-1</sup> |
| 27 Number of pole pairs                                   |                         | 1                                           |       |       |                                             |       |       |                                 |                   |
| 28 Magnet material                                        |                         | AlNiCo                                      |       |       |                                             |       |       |                                 |                   |

### Rated values for continuous operation

|                                  |       |       |       |       |       |       |       |                   |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------------------|
| 29 Rated torque                  | $M_N$ | 3,4   | 5     | 5,9   | 4,9   | 4,9   | 4,3   | mNm               |
| 30 Rated current (thermal limit) | $I_N$ | 0,7   | 0,7   | 0,43  | 0,27  | 0,19  | 0,14  | A                 |
| 31 Rated speed                   | $n_N$ | 6 930 | 4 800 | 4 600 | 4 830 | 4 170 | 3 860 | min <sup>-1</sup> |

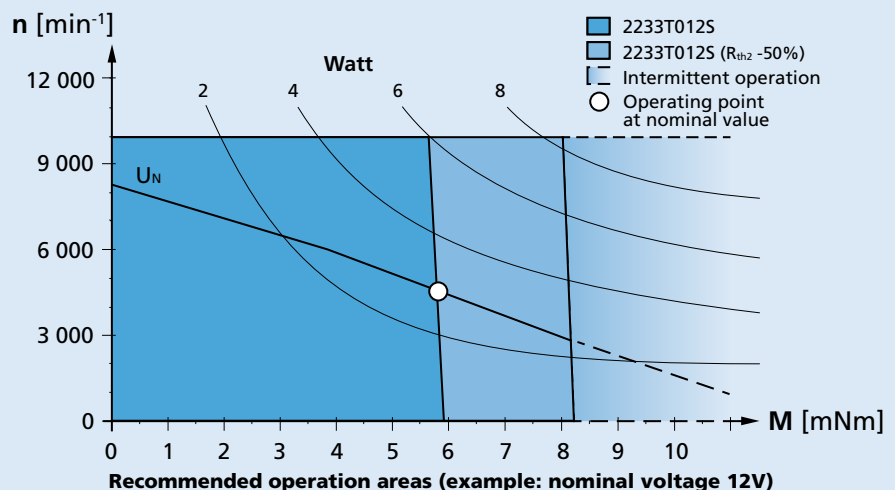
**Note:** Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The  $R_{th2}$  value has been reduced by 0%.

#### Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

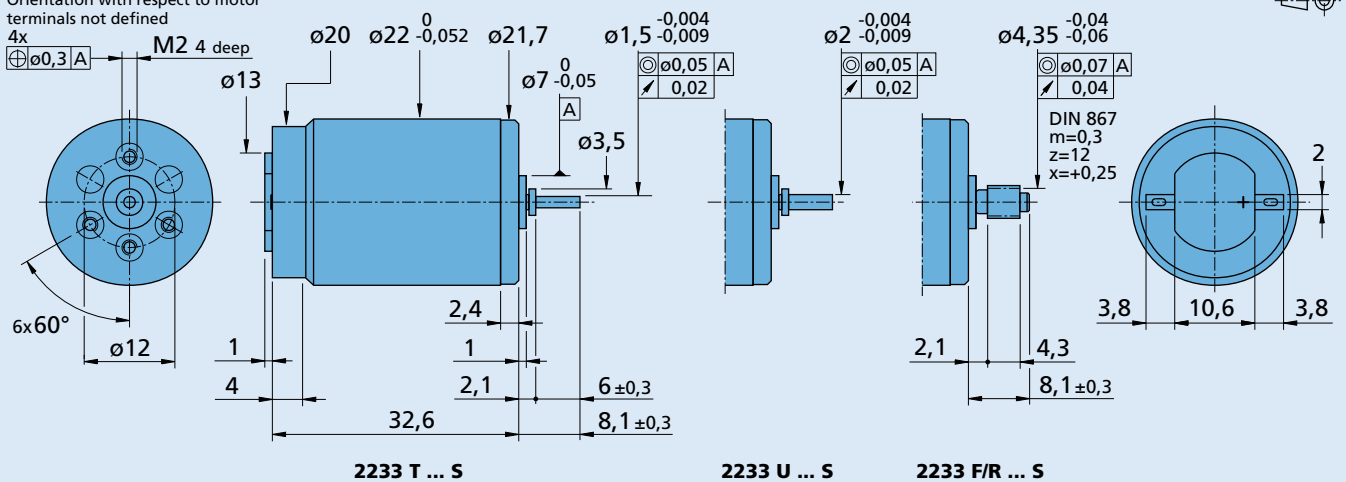
The diagram shows the motor in a completely insulated as well as thermally coupled condition ( $R_{th2}$  50% reduced).

The nominal voltage ( $U_N$ ) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



### Dimensional drawing

Orientation with respect to motor terminals not defined



### Options

Example product designation: **2233T012S-277**

| Option | Type         | Description                                                                                       |
|--------|--------------|---------------------------------------------------------------------------------------------------|
| L      | Twin Leads   | For motors with twin leads (PVC), length 150 mm, red (+) / black (-)                              |
| 4924   | Twin Leads   | For motors with twin leads (PVC), length 300 mm, red (+) / black (-)                              |
| X4924  | Twin Leads   | For motors with twin leads (PVC), length 600 mm, red (+) / black (-)                              |
| 4925   | Twin Leads   | For motors with twin leads (PVC), length 150 mm, red (+) / black (-), with connector AMP 179228-2 |
| X4925  | Twin Leads   | For motors with twin leads (PVC), length 300 mm, red (+) / black (-), with connector AMP 179228-2 |
| Y4925  | Twin Leads   | For motors with twin leads (PVC), length 600 mm, red (+) / black (-), with connector AMP 179228-2 |
| F      | Single Leads | For motors with single leads (PTFE), length 150 mm, red (+) / black (-)                           |
| 277    | Bearings     | 2 preloaded ball bearings                                                                         |

### Product combination

| Precision Gearheads / Lead Screws            | Encoders               | Drive Electronics                                                    | Cables / Accessories                                                                   |
|----------------------------------------------|------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 22E<br>22EKV<br>22/2<br>22/5<br>22/7<br>23/1 | HEDS 5500<br>HEDL 5540 | SC 1801<br>SC 2402<br>SC 2804<br>MCDC 3002<br>MCDC 3003<br>MCDC 3006 | To view our large range of accessory parts, please refer to the "Accessories" chapter. |