Gears

If mechanical power is required at a high torque and correspondingly reduced speed, a maxon precision gear is recommended. According to the gear ratio the output speed is reduced while the output torque is enhanced. For a more precise determination of the latter, efficiency must be taken into consideration.

Conversion
The conversion of speed and torque of the gear output (n_L, M_L) to the motor shaft (n_{mot}, M_{mot}) follows the following equations:

$$n_{mot} = i \cdot n_L$$

$$M_{mot} = \frac{M_L}{i \cdot \eta}$$

where:
i: reduction
η: Gearhead efficiency

Program

- **GPX/GP (Planetary gearhead)**
- **GS (Spur gearhead)**
- **KD (Koaxdrive)**
- **GPS (Screw drives)**

1	Output shaft
2	Mounting flange
3	Bearing of the output shaft
4	Axial security
5	Intermediate plate
6	Cogwheel
7	Planetary gearwheel
8	Sun gearwheel
9	Planet carrier
10	Internal gear

Selection of gears

For the selection of the gearhead, the maximum transmittable power – the product of speed and torque – is decisive. It should be noted that the transmittable power depends on the number of gear stages.
The load torque should be below the nominal torque (max. continuous torque) of the gearhead $M_{N,G}$.

$$M_{N,G} \geq M_L$$

For short-term loading, the short-term torque of the gearhead must also be considered. Where possible, the input speed of the gear $n_{max,G}$ should not be exceeded. This limits the maximum possible reduction i_{max} at a given operating speed. The following applies to the selection of the reduction i

$$i \leq i_{max} = \frac{n_{max,G}}{n_L}$$

If the gear is selected, the data conversed to the motor axis (n_{mot}, M_{mot}) are used to select the motor. The maxon modular system defines the proper motor-gear combinations.

Service life

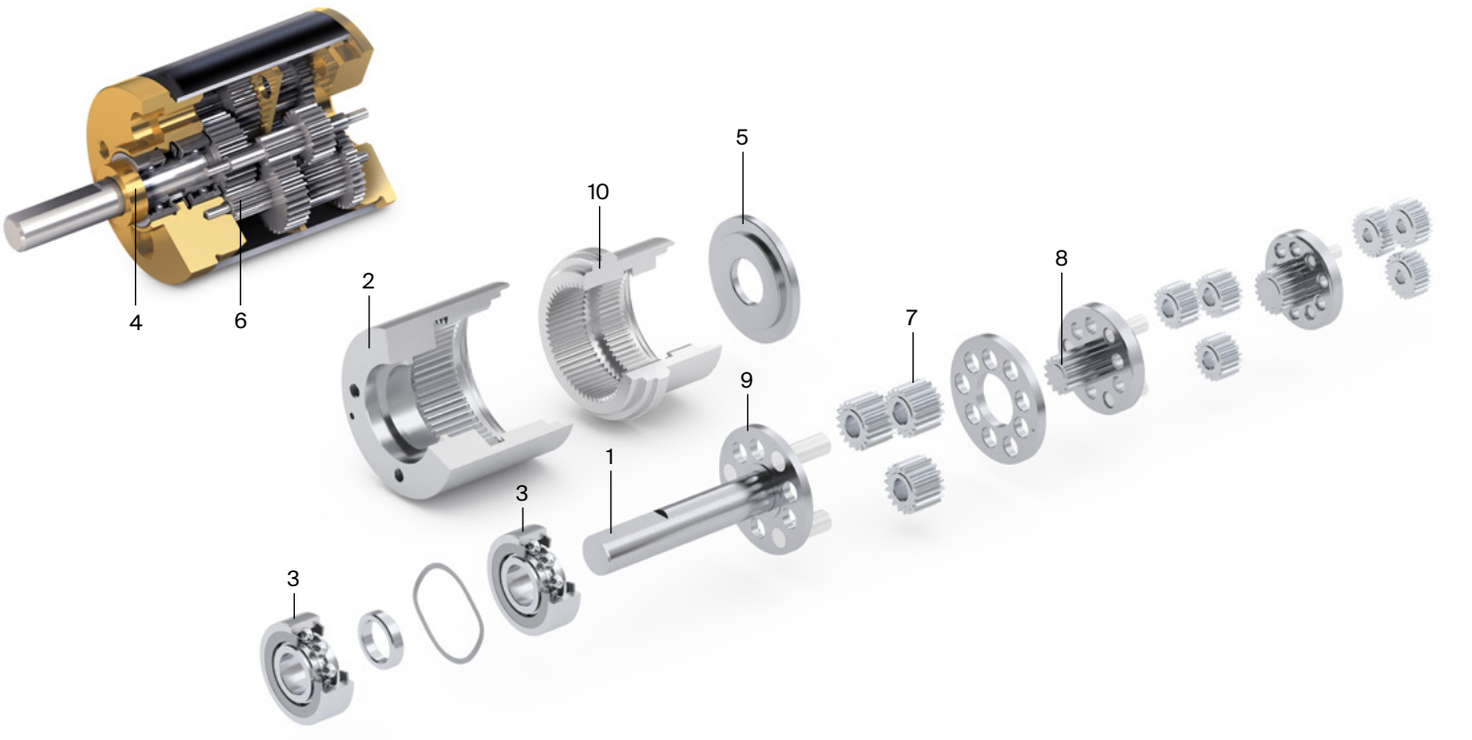
The gears usually achieve 1000 to 3000 operating hours in continuous operation at the maximum permissible load and recommended input speed. Service life is significantly extended if these limits are not pushed.
If the speed drops below this threshold, the gearhead may be loaded with higher torques without compromising the life span. On the other hand, higher speeds and thus higher reduction ratios can be chosen if the torque limits are not fully exploited.
Factors affecting life span include:
- Exceeding maximum torque can lead to excessive wear.
- Local temperature peaks in the area of tooth contact can destroy the lubricant.
- Massively exceeding the gear input speed reduces the service life.
- Radial and axial loads on the bearing.

Temperature/lubrication

maxon gears are lubricated for life. The lubricants used are especially effective in the recommended temperature range. At higher or lower operating temperatures we offer recommendations for special lubricants.

Spur gearhead

The gear consists of one or more stages. One stage represents the pairing of two cogwheels. The first cogwheel (pinion) is mounted directly on the motor shaft. The bearing of the output shaft is usually made of sintered material.
- Favorably priced
- For low torques
- Output torque up to 2 Nm
- Reduction ratios of 5:1 to 5752:1
- External – ∅12 – 45 mm
- Low noise level
- High efficiency



Planetary gearhead

Planetary gears are particularly suitable for the transfer of high torques. Large gearheads are normally fitted with ball bearings at gearhead output.
– For transferring high torques up to 180 Nm
– Reduction ratios of 4:1 to 6285:1
– External diameter 4–81 mm
– High performance in a small space
– High reduction ratio in a small space
– Concentric gear input and output

Plastic versions
Favorably priced and yet compact drives can be realized with plastic gears. The mechanical load is slightly smaller than that of metal designs, however, it is significantly higher than that of spur gears.

Ultra-performance gearhead
The UP (Ultra Performance) gearhead uses rolling bearings in all stages. This results in a very high efficiency and thus in a higher load capacity, as well as back-drivability even with high reductions.

Ceramic versions
By using ceramic components in gearheads, the wear characteristics of critical components can be significantly improved. The result when compared to purely metal gearheads is:
– Longer service life
– Higher continuous torques
– Higher intermittent torques
– Higher input speeds

High power gearhead
Especially high output torques in the output stage of planetary gearheads can be achieved through the following measures
– Use of ceramic components
– 4 instead of 3 planet gears in the output stage
– Additional motor-side support of the output stage
– Reinforcement of the output bearings

Heavy duty gearhead
The HD (heavy duty) gearheads are characterized by their robust construction. The use of stainless steel and optimized welding joints enable use under the most extreme conditions.

Reduced backlash gearhead
The reduction in backlash is achieved through a preloading of the planet gears in the output stage. Despite the wear that occurs during operation, the gearhead backlash remains constantly low, unlike for gearheads in which the backlash reduction is achieved by low-tolerance manufacturing and material pairing.

Sterilizable gearhead
Sterilizable gearheads are characterized by the use of stainless steel and special lubricants. The bearing of the output shaft and the connection to the motor are designed so that fluid leaking into the gearhead is inhibited.

Koaxdrive

Noise reduction
Noise is primarily generated in the input stage of the gearhead. The following measures can help to reduce noise:
– Smaller input speeds and thus smaller relative velocity of the tooth flanks
– Input stage with plastic gears
– Use of a Koaxdrive gearhead

The quiet “Koaxdrive” combines worm and planetary gearing. In the first stage, a separately mounted worm drives the three offset planetary wheels which then mesh in the specially toothed internal geared wheel. All further stages are designed as a normal planetary gear:
– low noise
– high reduction ratio in the first stage
– other properties as planetary gears