

Operation Manual | EN

AG1000

Planetary gear unit



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1 Foreword

1.1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.

It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement. No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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EP1590927, EP1789857, DE102004044764, DE102007017835

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1.2 Documentation issue status

Origin of the document

This documentation was originally written in German. All other languages are derived from the German original.

Product features

Only the product features specified in the current user documentation are valid. Further information given on the product pages of the Beckhoff homepage, in emails or in other publications is not authoritative.

| Version | Comment |
|---------|--|
| 1.4 | Chapter update: Installing the planetary gear unit 7.2 New chapter: Guidelines and Standards 2 ; For your safety 3 |
| 1.3 | Chapter update: Disposal 3.5 |
| 1.2 | Chapter update: 1.0 Foreword; 2.0 Safety |
| 1.1 | Chapter update: 8.1 |
| 1.0 | First edition |

1.3 Intended use

The gear unit is used for transforming torques and speeds. It is suitable for all industrial applications that are not covered by Article 2 of EC Directive 2002/95/EC (restriction of the use of certain hazardous substances in electrical and electronic equipment).

The gear unit must not be operated in potentially explosive atmospheres. In food processing applications, the gear unit may only be used beside or below the food area.

The gear unit is intended for mounting on Beckhoff stepper motors AS1000.

NOTE

Damage from improper use

Any use exceeding the maximum permissible speeds, torques and temperature is considered improper and is therefore not permitted.

2 Guidelines and Standards

In addition to the safety instructions mentioned in this manual, the general statutory and other rules and regulations for the prevention of accidents (e.g. personal protective equipment) and for environmental protection must be followed.

CAUTION

Personal injuries!

The gear units are **not** products under the terms of the EC Machinery Directive. Operation of the gear units in machines or systems is only permitted once the machine or system manufacturers has provided evidence of CE conformity of the complete machine or system.

3 For your safety

Read the section on safety and heed the notices to protect yourself against personal injury and material damages.

Liability limitations

All the components of the planetary gear units AG1000-+PMxx are supplied in certain hardware and software configurations appropriate for the conditions of the application. Unauthorized modifications to the hardware and/or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

In addition, the following actions are excluded from the liability of Beckhoff Automation GmbH & Co. KG:

- Failure to comply with this documentation
- Improper use
- Untrained personnel
- Use of unauthorized spare parts

3.1 Staff qualification

Only technical personnel with knowledge of control and automation technology may carry out any of the illustrated work steps on the Beckhoff software and hardware, in particular of the planetary gear units AG1000-+PMxx.

The technical personnel must have knowledge of drive technology and electrical systems and must also know how to work safely on electrical equipment and machines.

This also includes:

- production planning and
- securing of the working environment (e.g. securing the control cabinet against being switched on again).

The technical personnel must be familiar with the current and necessary standards and directives for the automation and drive environment.

3.2 Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

Symbols that warn of personal injury:

 **DANGER**

Serious risk of injury!

This is an extremely dangerous situation. Disregarding the safety notice will lead to serious permanent injuries or even death.

 **WARNING**

Risk of injury!

This is a dangerous situation. Disregarding the safety notice may lead to serious injuries.

 **CAUTION**

Personal injuries!

This is a dangerous situation. Disregarding the safety notice may lead to minor injuries.

Symbols that warn of damage to property or equipment:

NOTE

Warning of damage to property or the environment!

This notice indicates disturbances in the operational procedure that could damage the product or the environment.

Symbols indicating further information or tips:

 **Tip or pointer!**

This notice provides important information that will be of assistance in dealing with the product or software. There is no immediate danger to product, people or environment.

| | |
|---|---|
|  | <p>UL note!</p> <p>This symbol indicates important information regarding UL certification.</p> |
|---|---|

3.3 Instructions of the planetary gear unit AG1000-+PMxx

The safety instructions are designed to avert danger and must be followed during installation, commissioning, production, troubleshooting, maintenance and trial or test assemblies.

The gear units of the AG1000 series are not designed for stand-alone operation and are always installed in a machine or system. After installation the additional documentation and safety instructions provided by the machine manufacturer must be read and followed.

CAUTION

Personal injuries

- Carefully read this manual before using the gear unit thoroughly, paying particular attention to the safety instructions. In the event of any uncertainties please notify your sales office immediately and refrain from working on the gear unit.
- Only trained, qualified personnel with good knowledge of drive technology may work on this gear unit.
- If a gear unit is installed in a machine it must not be commissioned until proof of compliance of the machine with the latest version of the EC Machinery Directive has been provided. This includes all relevant harmonized standards and regulations required for implementation of this Directive in national legislation.

WARNING

Serious risk of injury through hot surfaces!

- The surface temperature of the AG1000 gears, may exceed 120 °C, resulting in a risk of burns.
- Avoid touching the housing during or shortly after operation.
- Allow the gear unit to cool down for at least 15 minutes after switching off.
- Use a thermometer to check whether the surface has cooled down sufficiently.

WARNING

Objects flung out by rotating components can cause serious injuries.

- Remove any items and tools in the vicinity of the gear unit before starting up the unit.
- Remove/secure the feather key (if present), if the gear unit is operated without attachments on the output/drive side.

WARNING

Rotating components on the gear unit can pull in parts of the body and cause serious injury or death.

- When the gear unit is running, keep sufficient distance to rotating machine parts.
- During assembly and maintenance work, secure the machine against restarting and unintentional movements (such as uncontrolled lowering of lifting axes).

WARNING

A damaged gear unit can lead to accidents with risk of injury.

- Do not operate a gear unit that has been overloaded due to incorrect operation or a machine crash.
- Replace affected gear units, even if no external damage is visible.

NOTE

Loose or overloaded screw connections can damage the gear unit.

- Install and check all screw connections for which tightening torques are specified, using a calibrated torque wrench.

⚠ WARNING**Lubricants are flammable.**

- Do not use a water jet for extinguishing flames.
- Suitable extinguishing media are powder, foam, water spray or carbon dioxide.
- Follow the safety instructions of the lubricant manufacturer.

⚠ CAUTION**Solvents and lubricants can cause skin irritations.**

- Avoid direct skin contact.

NOTE**Solvents and lubricants can pollute soil and water.**

- Cleaning solvents and lubricants must be used and disposed of properly.

4 Handling

4.1 Transport

- No special mode of transport is prescribed for the gear unit.
- Only by qualified personnel.
- Only in the manufacturer's original packaging.
- Avoid hard shocks.
- If the packaging is damaged check the gear unit and any accessories for visible damage. Inform the transport company and, if necessary, the manufacturer.

WARNING

Suspended loads may fall and cause serious injury or death.

- Never stand under suspended loads.
- Secure the gear unit with suitable fastenings (e.g. straps) prior to transport.

NOTE

Hard impacts, e.g. due to falling or dropping, may damage the gear unit.

- Use only lifting gear and load handling devices with sufficient load-bearing capacity.
- Do not exceed the permitted lifting weight.
- Set the gear unit down slowly.

4.2 Packaging

- Recyclable cardboard with inserts
- Dispose of the packaging materials at designated disposal sites.
Observe the relevant national disposal regulations

4.3 Storage

- The gear units must not be stored outdoors. The storage space must be adequately ventilated and dry.
- The gear units may only be stored in the original recyclable manufacturer's packaging.
- The gear units may only be stored in a horizontal position.
- Storage temperature: -30 °C to +60 °C in the original packaging
- Storage time: 2 years max.

Possible damage to the gear unit seals

I If the gear units are stored at temperature ranges above 60 °C or subjected to direct sunlight or ultraviolet light, the gear unit seals may become damaged. Storage temperatures of up to 85 °C are permitted for a maximum of 2 weeks. However, please note that even short-term storage at such temperatures will result in premature ageing of the seals. Therefore, please check the seals before commissioning the gear unit.

4.4 Maintenance / Cleaning

4.4.1 Maintenance tasks

4.4.1.1 Visual inspection

- Check the entire gear unit for external damage.
- Check the entire gear unit for leaks.
 - In the installation position, check that no foreign media (e.g. oil) accumulate on the drive and output shaft.

4.4.2 Commissioning after maintenance

- Clean the gear unit externally.
- Attach all safety devices.
- Perform a test run before releasing the gear unit again for operation.

4.4.3 Notes on the lubricant used

i Lubricant used

All gear units are lubricated for life at the factory. The lubricant used is a grease.

4.4.4 Notes on the adhesive

i Inserted adhesive

The sun wheel of the gear unit is factory glued to the motor shaft of the AS1000 series. The employed Adhesives WEICONLOCK AN 306-48 (D) and WEICONLOCK AN 306-60 (D) are anaerobic Sealants. These include dangerous ingredients such as:

- acrylic acid (<3%)
- methacrylic acid (> 10%)
- 2-hydroxyethyl methacrylate (<20%)
- cumene hydroperoxide (1%) and
- methacrylic acid ester (<20%)

Further information on the adhesives is available directly from the manufacturer:

| Adhesive WEICONLOCK AN306-48 / 60 (D) |
|--|
| WEICON GmbH & Co. KG, Königsberger Str. 255 D-48045 Münster Tel.: +49 (0)251 / 93 22-0 www.weicon.com |

4.5 Disposal

i National regulations

Observe the relevant national disposal regulations.

Supplementary information on replacing the adapter plate and disassembly and disposal of the gear unit is available from our service department:

- The device should be disposed of by a certified disposal company. Addresses can be obtained from our service department.
- Metal parts can be sent for metal recycling.

In accordance with the WEEE 2012/96/EG Directives we take old devices and accessories back for professional disposal, provided the transport costs are taken over by the sender.

Send the devices with the note "For disposal" to:

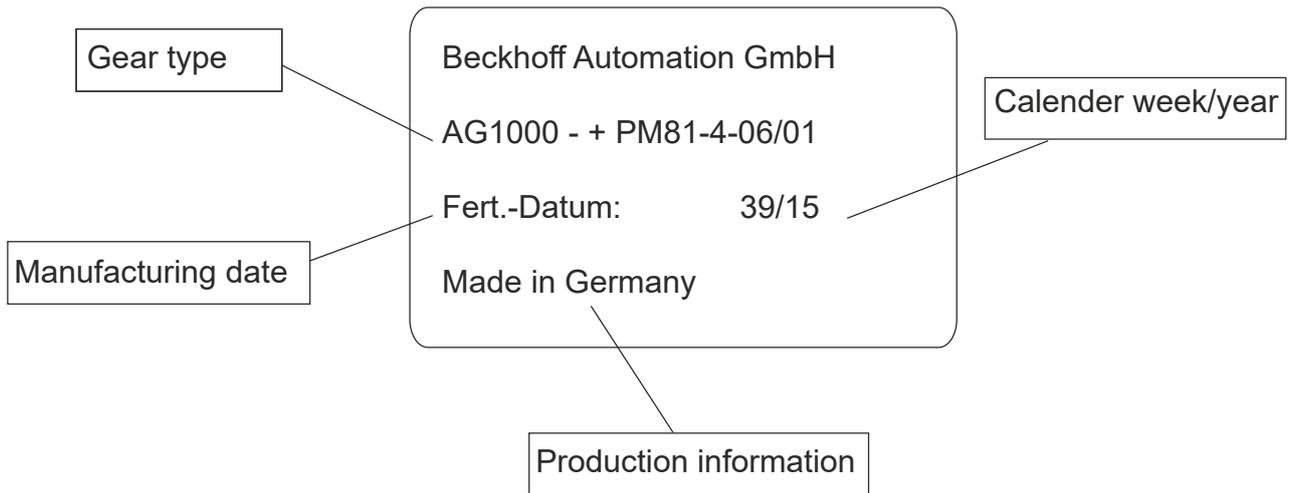
Beckhoff Automation GmbH & Co. KG
 Huelshorstweg 20
 D-33415 Verl

5 Product overview

5.1 Scope of delivery AG1000

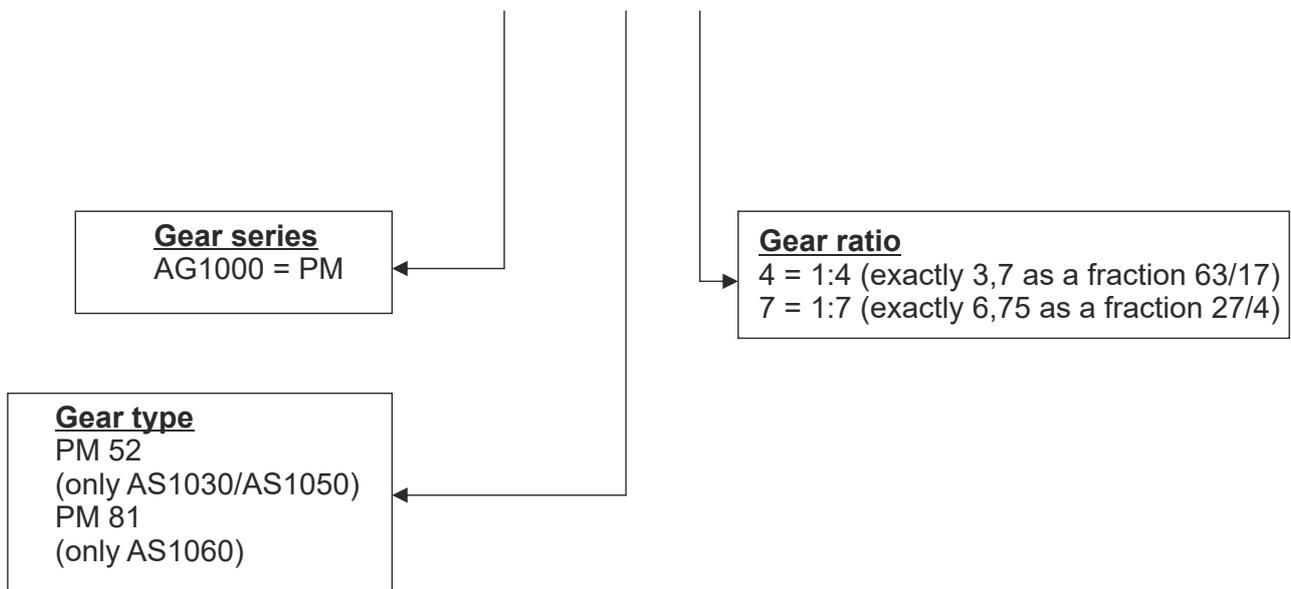
- Check the completeness of the delivery against the delivery note.
- Missing parts or damage should be reported immediately in writing to the carrier, the insurance company and / or Beckhoff Automation.

5.2 Type plate AG1000



5.3 Type key AG1000

AG1000-+PMxx.x

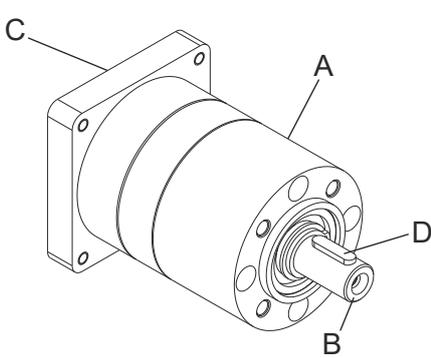


6 Technical description

6.1 Gear unit configuration

The devices of the AG1000-PMxxxx series are planetary gear units. They can be used in any installation position. The gears are lubricated lifetime and have an unbalance can Pinion. Furthermore, they are firmly connected to the output shaft. Input and output are coaxial. The shafts rotate in the same direction. The planetary gears are characterized by high efficiency. Also, the gearboxes of the series AG1000 high torque transmission with small installation space.

6.2 Overview of the gear components

|  | Gear components | |
|--|-----------------|---------------|
| | A | Gear housing |
| | B | Output shaft |
| | C | Adapter plate |

6.3 General technical data



The maximum permissible speeds and torques can be found in our catalog or on our website at <http://www.beckhoff.de>.

6.4 Transport, assembly and disassembly



Recommendations for trouble-free operation and long service life

- Ensure adequate convection of the gear unit.
- Ensure adequate heat dissipation from the gear unit via the output flange.
- The gear unit may heat up due to the motor and other external heat sources. Acquaint yourself with the motor temperature and external influences that may occur during operation.
- Note the protection class of the gear unit and the resulting constraints.

Preparing the installation

The drive and output sides are treated with a corrosion inhibitor to protect from corrosion. Ensure that the installation instructions are enclosed with the gear unit and remove the corrosion inhibitor, once you have read up on handling hazardous substances.

7 Mechanical installation

7.1 Important notes

⚠ CAUTION

Damage to persons and devices

Observe the general and special safety instructions.

The gear unit can be used in any gear unit.

NOTE

Assembly sequence

Always follow the assembly sequence described below in order to avoid damage.

The fastening screws are not included and must be provided by the customer. Pertinent information can be found in the individual assembly steps.

NOTE

Compressed air may damage gear unit seals.

Do not use compressed air for cleaning the gear unit.

NOTE

In rare cases, leaks ("sweating") may occur at the drive in gear units with grease lubrication (see type plate).

- To avoid "sweating", we recommend sealing the areas between
 - ⇒ adapter plate, drive housing and gear unit and
 - ⇒ adapter plate and motor
 - ⇒ with a surface seal adhesive (e.g. Loctite® 573 or 574).
- For further information please contact our customer service.
- Clean the following components with a clean, lint-free cloth and a grease-dissolving, non-aggressive cleaning agent:
 - all surfaces in contact with adjacent components
 - Centering
 - the motor shaft
 - the internal diameter of the socket
 - the spacer sleeve inside and outside
- In addition, check the contact surfaces for damage and foreign particles.

7.2 Installing the planetary gear unit

For installation of the planetary gear at the stepper motor please note the following:

- The planetary gear of the AG1000-xxxx series are supplied with a separate adapter shaft and integrated sun wheel.
- Slide the adapter shaft onto the stepper motor shaft up to the end stop and secure it with a heat resistant, industrial adhesive (e.g. WEICONLOCK AN306-60).
- Before applying the adhesive to the adapter shaft, clean the motor shaft with a suitable solvent.
- A cotter pin (not included) can be inserted through the mounting hole.
- Slide the gear unit onto the motor shaft. Screw the gear flange to the motor flange. Ensure the screws are tightened evenly to avoid tensions in the component.

7.2.1 Mounting the gear

Order of assembly:

- Clean the motor shaft and the sun wheel with isopropanol. Remove all dirt particles from the motor shaft or sun wheel. Carefully dry all the components.
- Wet the sun wheel and the motor shaft with the adhesive WEICONLOCK AN 306-60. Make sure that the adhesive is evenly distributed over the complete motor shaft.

NOTE

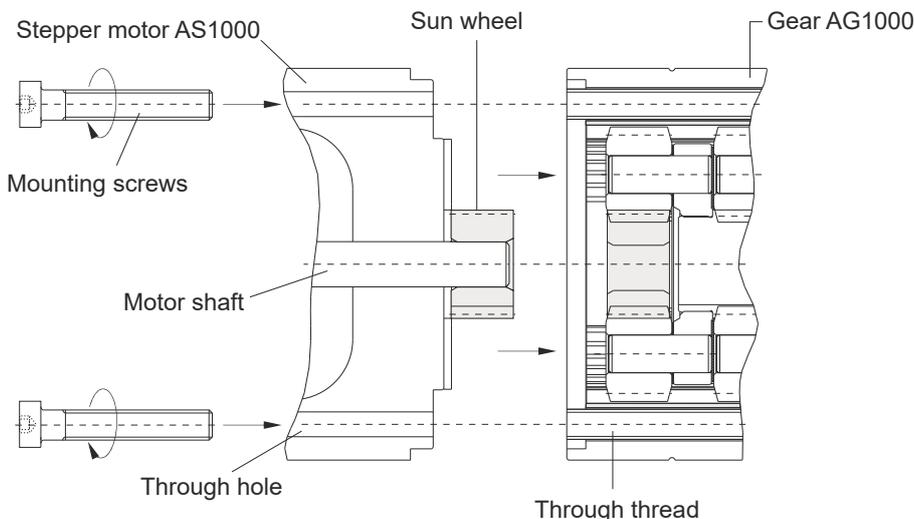
Damage to the gear unit!

When wetting the motor shaft, make sure that no adhesive runs into the interior of the component! There is a danger of components sticking and impairing the function of the gear unit!

● Hardening time of the adhesive!

I WEICONLOCK AN 306-60 is an anaerobic adhesive. It hardens immediately on contact with metal and the exclusion of oxygen. Note that the components can no longer be moved after gluing. The adhesive is completely hardened after 10 to 15 minutes.

- Now wet the threaded holes of the gear unit with a screw-locking compound. Make sure that all threads are completely wetted.
- Push the motor onto the gear unit and fix both components.
- Now fasten the gear unit to the motor with the four hex socket-head screws. Tighten the screws diagonally. Observe the specified tightening torque.



8 Technical data of the planetary gear units

Beckhoff offers planetary gears for stepper motors in order to increase the torque or to improve the mass inertia ratio. Stepper motors whose flanges have dimensions of 56 mm or above can be fitted with low-play planetary gears.

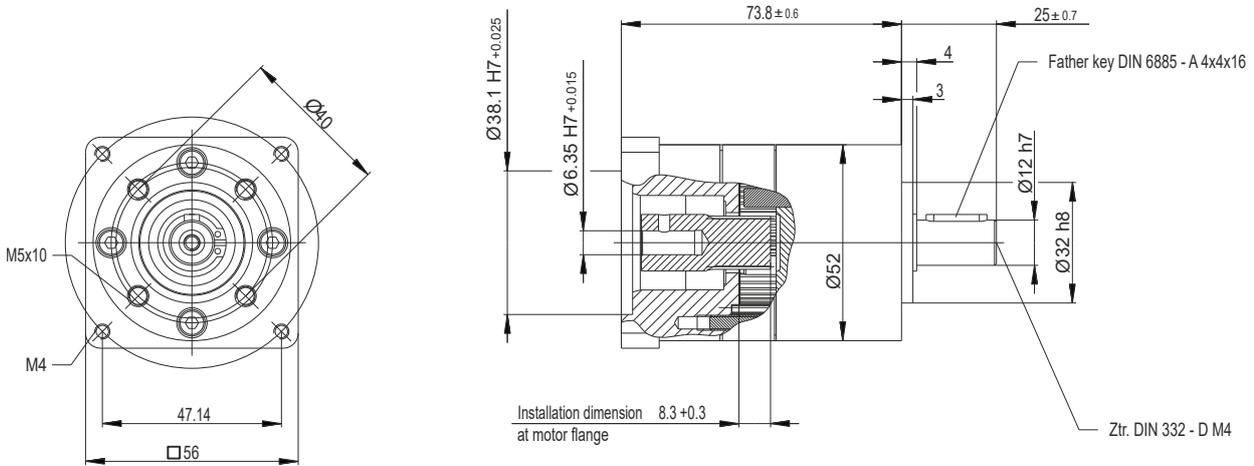
| | AG1000-+PM052.00x | AG1000-+PM081.00x |
|-----------------------|--------------------------|--------------------------|
| Rated torque | 4 Nm | 20 Nm |
| Acceleration torque | 6 Nm | 30 Nm |
| Gear play | ≤ 0,7° | ≤ 0,5° |
| Max. radial power | 200 N | 400 N |
| Max. axial power | 60 N | 80 N |
| Stepper motors | AS1030 and AS1050 | AS1060 |
| Fastening screws | 4 x M4 | 4 x M6 |
| Tightening torque | 2.8 Nm | 9 Nm |
| Operating temperature | -30 °C at + 120°C | |
| Protection class | DIN EN 60529 | |
| Operating factor | CB = 1,0 (3h/day) | |

x = ratio 4 (3.7 exactly or 63/17 as a fraction), ratio 7 (6.75 exactly or 27/4 as a fraction)

Gear rim and planet wheels in steel design, straight-toothed. Lubricant Klübersynth GE14-151

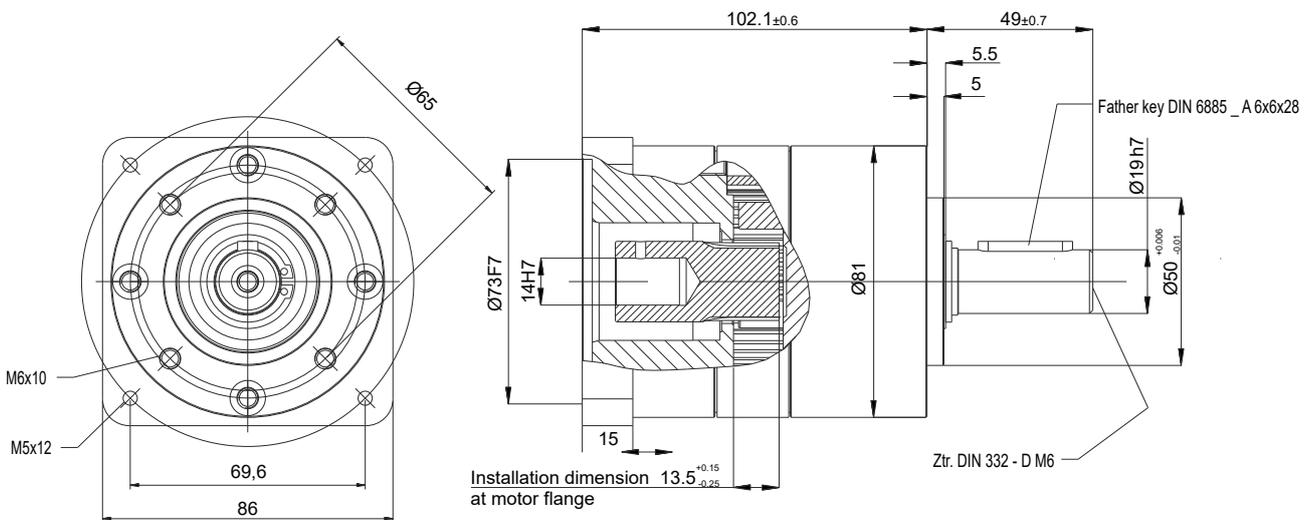
8.1 PM052

8.1.1 Dimensional drawing PM052



8.2 PM081

8.2.1 Dimensional drawing PM081



9 Commissioning

9.1 Important notes

⚠ CAUTION

Damage to persons and devices

- Read up on the general and special safety instructions before starting the work.

NOTE

Improper operation may result in damage to the gear unit.

- Please ensure that
 - ⇒ the **ambient temperature** is not below -30 °C and not above +60 °C, and
 - ⇒ the **operating temperature** does not exceed +90 °C.
- Avoid icing, which can damage the seals.
- For other operating conditions please contact our customer service.
- Do not exceed the operational limit values for the gear unit
- Only use the gear unit in a clean, dust-free and dry environment.

⚠ DANGER

Serious risk of injury!

- Only specialist personnel with extensive knowledge in the areas of electrical engineering / drive technology are allowed to install and commission the equipment.
- Check that all live connection points are protected against accidental contact.
- The surface temperature of the motor can exceed 100 °C in operation. Check (measure) the temperature of the motor. Wait until the motor has cooled down below 40 °C before touching it.
- Make sure that, even if the drive starts to move unintentionally, no danger can result for personnel or machinery.

NOTE

Overloading of the gear!

With motor / gear combinations can in case of failure (mechanical blockage of the power train) due to high ratio, the gear will be overloaded.

To prevent this, make sure that the motor rated torque and the motor peak torque is limited in the servo drive.

Example:

- Motor rated torque / motor peak torque: 1 Nm / 5 Nm
- Gear rated torque / gear peak torque: 15 Nm / 24 Nm
- Gear ratio: $i = 10$
- The motor rated torque is not limited. The motor peak torque is limited to 2,4 Nm.

9.2 Guide for commissioning the gear units

The procedure for commissioning is described as an example.

A different method may be appropriate or necessary, depending on the application of the equipment.

- Check the assembly and alignment of the motor and the gear unit.
- Check the drive components such as clutch, gear unit, belt pulley and gear unit for correct seating and setting (observe the permissible radial and axial forces).
- Check the wiring and connections at the motor, stepper motor terminal and gear unit. Check that the earthing is correct.
- Test the function of the holding brake, if used. (Apply $24V_{DC}$, the brake must release).
- Check whether the rotor of the motor revolves freely (release the brake, if necessary). Listen out for grinding noises from the motor and the gear unit.
- Check that all the required measures against accidental contact with live and moving parts have been carried out.
- Carry out any further checks which are specifically required for your system.
- Now commission the drive according to the commissioning instructions for the stepper motor terminal.
- During the installation and commissioning look out for chips or similar contaminants that may penetrate into the gear unit. Keep the work area clean and protect the gear unit from foreign objects. Penetration of dirt reduces the service life of the gear unit.

9.3 Troubleshooting

NOTE

Changed operating behavior

A change in operating behavior may indicate existing damage of the gear unit or result in damage to the gear unit.

- Do not recommission the gear unit until the fault has been rectified.

⚠ CAUTION

Personal injuries

Troubleshooting may only be performed by trained personnel.

| Error | Possible cause | Remedy |
|---------------------------------|--|---|
| Increased operating temperature | The gear unit is not suitable for the purpose. | Check the technical data. |
| | Motor heats up the gear unit. | Check the wiring of the motor. |
| | | Ensure adequate cooling. Change the motor. |
| | The gearbox is on the load side not properly mounted on a sufficiently large flange to dissipate the heat. | Ensure adequate heat dissipation. |
| Increased operating noises | Distorted motor mounting | Contact our service department. |
| | Bearing damage | |
| | Gear tooth damage | |
| | Toothed belt tension too high | |
| Lubricant loss | Lubricant quantity too high | Wipe off the leaking lubricant and continue to monitor the gear unit. Lubricant discharge should stop after a short time. |
| | Leaks | Contact our service department. |

10 Decommissioning

⚠ CAUTION

Damage to persons and devices

- Read up on the general and special safety instructions before starting the work.

11 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

Beckhoff's branch offices and representatives

Please contact your Beckhoff branch office or representative for [local support and service](#) on Beckhoff products!

The addresses of Beckhoff's branch offices and representatives round the world can be found on her internet pages:

<http://www.beckhoff.com>

You will also find further [documentation](#) for Beckhoff components there.

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Beckhoff Support

Support offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

- support
- design, programming and commissioning of complex automation systems
- and extensive training program for Beckhoff system components

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Beckhoff Service

The Beckhoff Service Center supports you in all matters of after-sales service:

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- repair service
- spare parts service
- hotline service

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