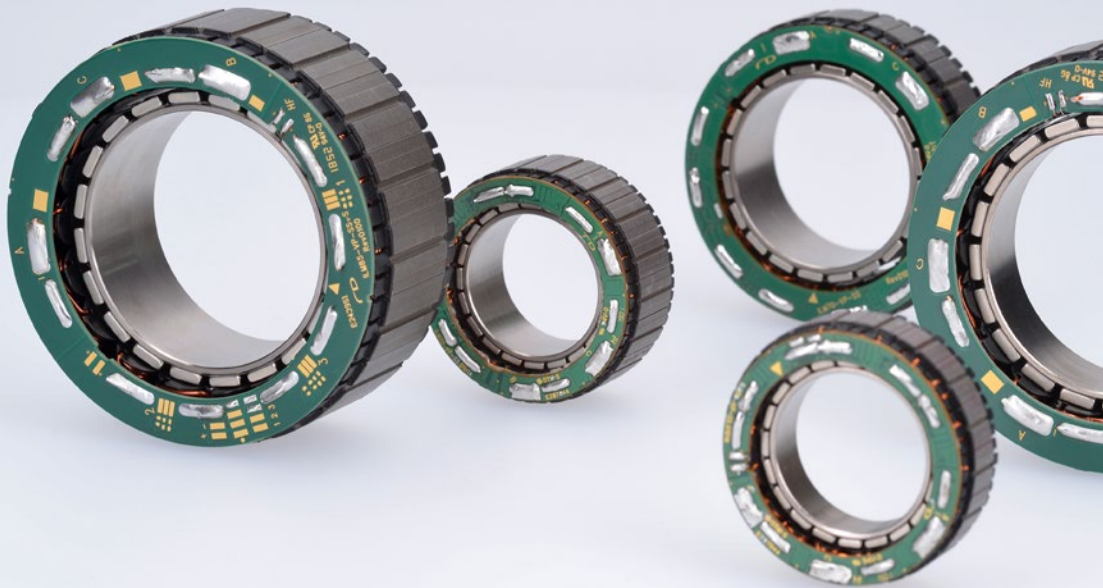




# Assembly Instructions ILM-E Servo Kits

Edition 10/2021 EN



We have checked the content of this document for conformity with the unit described in it. There may nevertheless still be differences, so we cannot guarantee complete accuracy and correctness.

However, the information in this document is reviewed regularly and any necessary corrections are included in subsequent editions.

All trademarks mentioned in this manual are the property of their respective owners (see section 1.12 on page 7).

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## Contents

<b>1 Introduction</b>	<b>4</b>
1.1 Notes on the assembly instructions	4
1.2 Description	4
1.3 Revision index	5
1.4 Supplementary documents	5
1.5 Explanation of the symbols used	5
1.6 Training	5
1.7 Declaration of incorporation	5
1.8 Serial number	5
1.9 Warranty	6
1.10 Transportation and storage	6
1.11 Environmentally-friendly disposal	7
1.12 Trademarks	7
<b>2 Safety</b>	<b>8</b>
2.1 Hazard classification	8
2.2 Target group	8
2.3 Intended use	9
2.4 Working environment and operation	9
2.5 Safety instructions for the ILM-E servo kit	10
2.6 Warning labels	11
<b>3 Technical data</b>	<b>12</b>
3.1 Data sheet	12
3.2 Connection diagram (star-serial configuration)	12
3.3 Installation dimensions	13
<b>4 Solder pads on the connection board</b>	<b>14</b>
<b>5 Assembly</b>	<b>15</b>
5.1 Stator	17
5.1.1 Tools and equipment required	17
5.1.2 Shrink-fitting	18
5.2 Rotor	20
5.2.1 Tools and equipment required	20
5.2.2 Bonding process	21
5.2.3 Inserting the rotor into the stator	22
<b>6 Declaration of incorporation</b>	<b>23</b>

## 1 INTRODUCTION

### 1.1 Notes on the assembly instructions



These instructions contain important information that should be followed when installing the ILM-E servo kits.

- ▶ Read all the instructions carefully before starting assembly to avoid possible risks and mistakes.
- ▶ These instructions are part of the product. Keep the instructions in a safe place for future reference.

### **WARNING**

- ▶ Follow ALL danger and warning instructions and notes on precautionary measures.
- ▶ Read section „2 Safety“ on page 8 carefully.

### 1.2 Description

RoboDrive's ILM-E series of stator-rotor installation kits provides solutions for structurally integrated drive engineering. An ILM-E (internal rotor motor – Evolution) servo kit consists of a stator and a rotor with permanent magnets for installation in machines and devices in the commercial environment.

The RoboDrive technology provides the highest power density at maximum torque and overload capability in a compact design.

The flexible concept offers solutions for a variety of demanding drive applications. Alternative nominal currents, increased rotational speeds and customised torque-speeds are available upon request.

The implementation of customer-specific solutions to achieve a compact and thermally-optimized design is supported by extensive documentation and RoboDrive development expertise.

ILM-E servo kits offer the following stand-out features:

- Installation kits for maximum freedom of design
- Hollow shaft capability
- Low voltage 12 V – 48 V
- Excellent copper fill factor offering high torque density and dynamic response

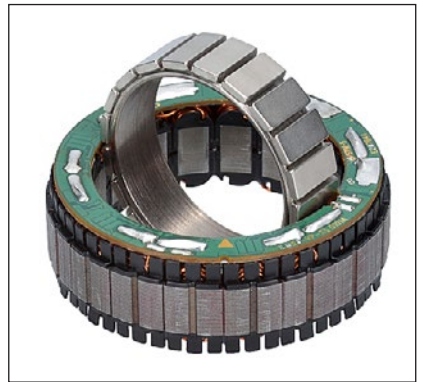


Fig. 1: ILM-E servo kit

- Concentrated windings for low losses
- Thermally-optimized actuator design thanks to structural integration
- Drive systems developed to optimize weight and installation space on the basis of load profile analyses
- High bandwidth and minimal harmonics for optimal control quality

### 1.3 Revision index

Manual	Edition	Language
ILM-E Servo Kit Assembly Instructions	10/2021, initial version	EN

Table 1: Revision index

### 1.4 Supplementary documents

Installation drawings and data sheets are available for different sizes on our website.

### 1.5 Explanation of the symbols used

- ▶ This symbol indicates an action to be taken.
- This symbol indicates a list.

### 1.6 Training

The manufacturer offers training courses on the general handling of the ILM-E servo kits. Please contact the [TQ-Drives division of TQ-Systems GmbH](#) as required.

### 1.7 Declaration of incorporation

The ILM-E servo kits are regarded as "partly-completed machinery" as defined in the Machinery Directive 2006/42/EC. The declaration of incorporation is an integral part of this installation manual (see section 6 on page 23).

### 1.8 Serial number

- The serial number is shown on the label attached to the stator.
- The serial number is shown on the label attached to the rotor.

#### NOTE

The label on the rotor must be removed without leaving any residues before the rotor is installed.

## 1.9 Warranty

TQ-Systems GmbH guarantees that, if used for the agreed purpose, the ILM-E servo kits fulfil the contractually defined specifications and functionality and correspond to the state of the art at the time of delivery.

The warranty is limited to material, manufacturing and processing defects.

The manufacturer's liability and warranty shall not apply in the following cases:

- Genuine parts were not replaced with genuine parts or parts approved by TQ-Systems GmbH.
- The assembly or set-up work was carried out without following these assembly instructions or was otherwise carried out incorrectly.
- Unauthorised repairs
- Incorrect operation
- Incorrect use
- Application of force
- Other modifications to the contractual product

### NOTE

The warranty period is 12 months and starts upon delivery to the customer.

Please contact the [TQ-Drives Division of TQ-Systems GmbH](#) for all claims under the warranty.

## 1.10 Transportation and storage

- The stator and rotor of the ILM-E servo kit are shipped in separate packing units.
- Always transport the ILM-E servo kits in the original packaging to avoid mechanical damage or damage due to static electricity.
- During transportation, avoid hard impacts or vibrations that could affect the ILM-E servo kits.

## 1.11 Environmentally-friendly disposal

### DANGER

#### Danger of death by powerful magnetic fields

The life of persons with passive or active implants such as pacemakers, defibrillators, insulin pumps etc. is put at risk if they stand in the vicinity of the ILM-E servo kit.

- ▶ Make sure that no persons who could possibly be affected by powerful magnetic fields are able to approach the ILM-E servo kit. They must maintain a safe distance of at least 2 m.
- ▶ Instruct persons in the vicinity of the potential risk.



The ILM-E servo kits must not be disposed of in the residual waste bin.

- ▶ In Germany, metal and plastic components should be disposed of at the local recycling centre. The national regulations in other EU states should also be followed.
- ▶ In Germany, electrical components should be disposed of in accordance with the Electrical and Electronic Equipment Act (ElektroG). In other EU states, the national implementation of the Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE) should be followed.
- ▶ The regulations and statutory requirements in your own country concerning disposal should also be followed.

## 1.12 Trademarks

- LOCTITE® is a trademark of Henkel.
- Kapton® is a trademark of DuPont.

## 2 SAFETY

These instructions contain notes that you must follow for your own personal safety and to avoid injury and damage to property. They are highlighted by warning triangles and are shown as follows according to the level of danger.

### 2.1 Hazard classification

#### **DANGER**

The signal word designates a hazard with a **high** degree of risk which, if it is not avoided, will result in death or severe injury.

#### **WARNING**

The signal word designates a hazard with a **medium** degree of risk which, if it is not avoided, will result in death or severe injury.

#### **CAUTION**

The signal word designates a hazard with a **low** degree of risk which, if it is not avoided, could result in minor or moderate injury.

#### **NOTE**

A note as used in these instructions contains important information about the product or about a part of the manual to which particular attention should be paid.

### 2.2 Target group

The activities described in this manual must only be carried out by technicians with the following qualifications:

- Training in the installation and commissioning of electrical devices (qualified electrician as defined in EN 50110-1: a person with technical training, knowledge and experience sufficient to allow them to recognise and avoid the risks that might be posed by electricity)
- Extensive knowledge in the fields of electrical engineering and drive technology
- Training in electrical and mechanical hazards and the local safety requirements
- Knowledge of the relevant standards and directives
- Knowledge and observance of this document and all the safety instructions

Any employee who does not have the relevant training must be given appropriate training and instruction. The instruction is to be given by authorised personnel with the appropriate training.



## 2.3 Intended use

The ILM-E servo kits must be used only for the applications listed in the technical descriptions, i.e. as a structurally-integrated drive. Any different or more extensive usage will be regarded as contrary to the intended use and will invalidate the warranty.

The ILM-E servo kits are regarded as "partly-completed machinery" as defined in the Machinery Directive 2006/42/EC and must not be brought into service until it has been determined that the machines in which the ILM-E servo kits are to be installed conform to the provisions of the Machinery Directive 2006/42/EC.

The ILM-E servo kits are not domestic appliances; as components they are intended exclusively for reuse for commercial or professional purposes as defined by IEC/EN 61000-3-2.

Intended use also includes compliance with this manual and the instructions it contains.

If the ILM-E servo kits are to be used safely and without interruption, they must have been correctly transported, stored, assembled and set up.

For any use contrary to the intended use, TQ-Systems GmbH shall accept no liability for any damage that may occur and offers no warranty that the product will work perfectly and correctly.

## 2.4 Working environment and operation

The ILM-E servo kits must only be operated under the conditions of use and within the performance limits specified in the documentation.

The ILM-E servo kits are not permitted to be used in the following areas:

- in potentially explosive areas
- in areas in which harmful substances as defined in EN 60721 may be encountered, such as oils, acids, gases, vapours or dusts
- underwater
- in areas exposed to radiation
- in a vacuum

## 2.5 Safety instructions for the ILM-E servo kit

### DANGER

#### Danger of death by powerful magnetic fields

The life of persons with passive or active implants such as pacemakers, defibrillators, insulin pumps etc. is put at risk if they stand in the vicinity of the ILM-E servo kit.

- ▶ Make sure that no persons who could possibly be affected by powerful magnetic fields are able to approach the ILM-E servo kit. They must maintain a safe distance of at least 2 m.
- ▶ Instruct persons in the vicinity of the potential risk.
- ▶ Attach warning instructions, stating POWERFUL MAGNETIC FIELDS at the installation area and storage location.

- The rotors of the ILM-E servo kit will attract other magnetic materials. The forces of attraction can be so great that the magnets of the servo kit splinter on impact and tiny fragments fly into the eyes.
  - ▶ Wear safety goggles to protect your eyes until you have finished installing the ILM-E servo kit.
- If the ILM-E servo kit is operated below the specified temperature, the magnets can become detached from the rotor and fly around due to thermal stressing of the adhesive.
  - ▶ Always operate the ILM-E servo kit within the specified temperature range.
- If the ILM-E servo kit operating voltage is too high, it will exceed the maximum permitted rotational speed. There is a risk of parts becoming detached and flying around.
  - ▶ Always operate the ILM-E servo kit within the specified voltage and speed ranges.
- The electromagnetic interference (EMI) emitted by the ILM-E servo kit is negligible in nominal operation. However it is not possible to entirely exclude the possibility that it will affect electrical devices.
- Fast acceleration of the ILM-E servo kit rotor can cause an inadequately secured ILM-E servo kit to move suddenly and be flung out of its original position.
- The drive train that is connected to the ILM-E servo kit must be designed for the maximum rotational speed of the ILM-E servo kit, otherwise the drive train may be damaged or crack.

- The ILM-E servo kit reaches high temperatures during operation. If there is a thermal bridge between the housing and the ILM-E servo kit installed in it, there is a risk of burns on the housing surface.
- Body parts (fingers, arms, hair, etc.) may be injured or torn off due to the rotation of exposed mechanical parts such as motor shafts. There is also the risk that items of clothing (ties, scarves, chains, rings, etc.) or objects (cables, etc.) may be wound onto the motor shaft and injure the wearer.
  - ▶ Never touch rotating components (motor shafts, clutches, etc.).
  - ▶ Do not wear belts, chains, ties or clothing with wide sleeves at the workplace.
  - ▶ Wear a hairnet if you have long hair.
  - ▶ Make sure that there are no exposed rotating parts.
- Rotating shafts can crack and parts (such as screws, etc.) can be flung about.
  - ▶ Secure rotating shafts with a protective cover.
- Install the ILM-E servo kit only in a dry environment.
- Protect the ILM-E servo kit against moisture and wet conditions.

## 2.6 Warning labels

- ▶ Attach warning labels that indicate the relevant risks to the machines in which the ILM-E servo kits are installed.
- ▶ Make sure that the warning labels are always clearly identifiable.
- ▶ Replace any damaged warning labels.
- ▶ Replace any warning labels that are missing.

### 3 TECHNICAL DATA

#### 3.1 Data sheet

You will find the technical data for the ILM-E servo kits in the data sheet provided in the ILM-E servo kits [download area](#).

#### 3.2 Connection diagram (star-serial configuration)

Connections A, B and C can be found on the ILM-E servo kit.

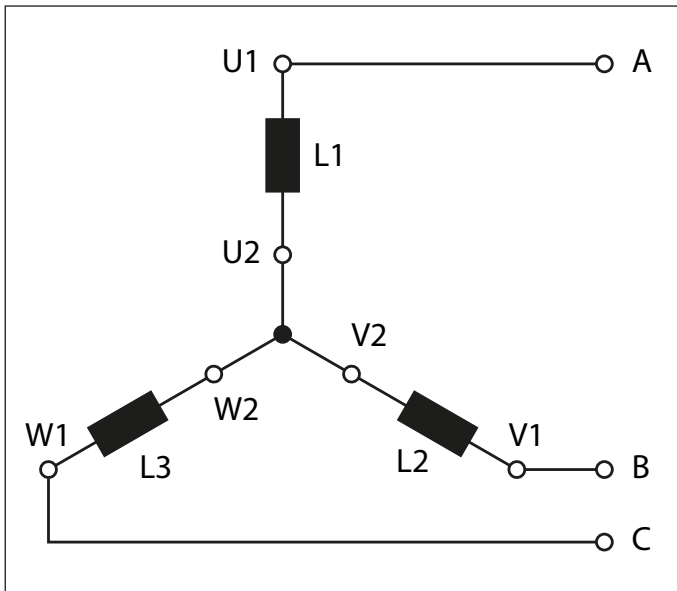


Fig. 2: Measuring points on the ILM-E servo kit (star-serial configuration)

Measured variable	Measured values
Nominal voltage $U_n^*$ [V]	
Nominal current $I_n^*$ [A]	
Terminal resistance $R_{TT}^*$ at 20 °C [mΩ]	See data sheet in the <a href="#">download area</a>
Terminal inductance $L_{TT}^*$ [μH]	

Table 2: Measuring points on the ILM-E servo kit (star-serial configuration)

### 3.3 Installation dimensions

The installation dimensions of the ILM-E servo kit are shown in the relevant drawing which can be found in the download area for the product concerned.

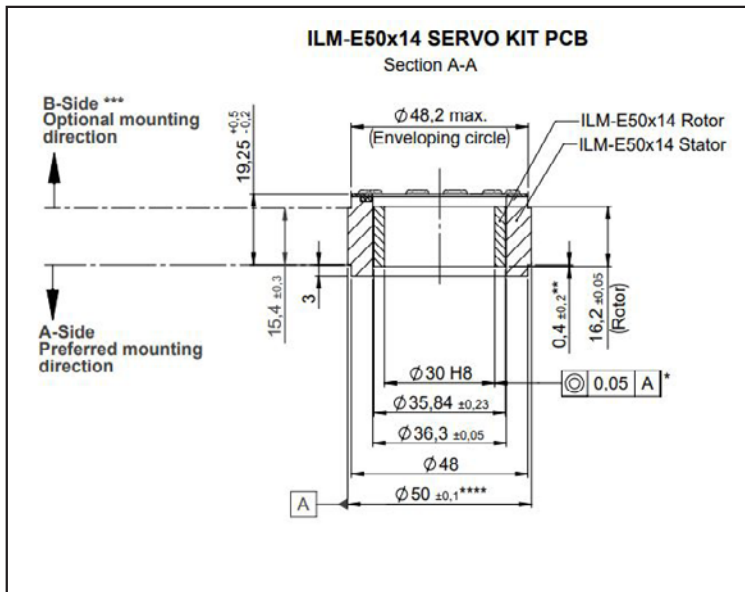


Fig. 3: Dimension designations

#### 4 SOLDER PADS ON THE CONNECTION BOARD

Fig. 4 shows the solder pads on the connection board by way of example. Detailed drawings for your specific ILM-E servo kit can be found on our website.

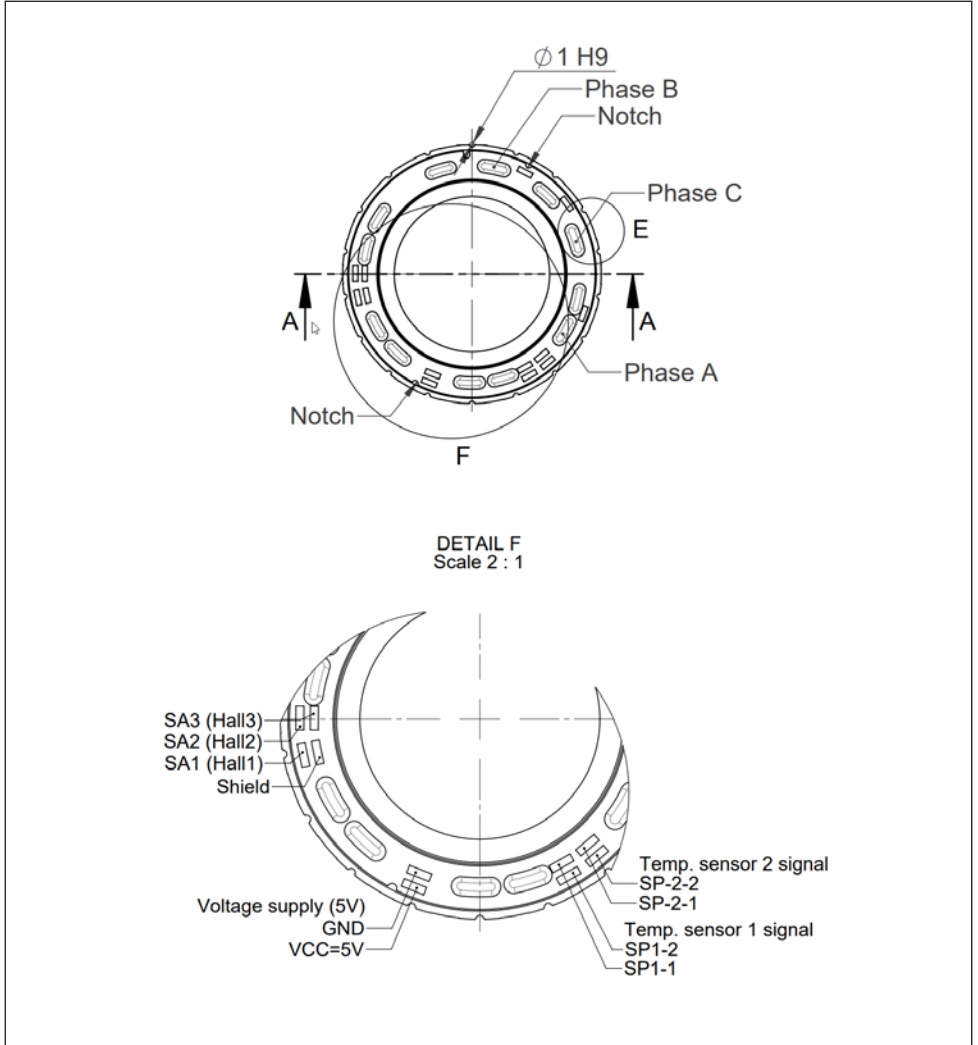


Fig. 4: Solder pads on the connection board

## 5 ASSEMBLY

The assembly processes listed below are merely suggestions, and their applicability and safety must be assessed by the responsible technician (see 2.2).

### **DANGER**

#### **Danger of death by powerful magnetic fields**

The life of persons with passive or active implants such as pacemakers, defibrillators, insulin pumps etc. is put at risk if they stand in the vicinity of the ILM-E servo kit.

- ▶ Make sure that no persons who could possibly be affected by powerful magnetic fields are able to approach the ILM-E servo kit. They must maintain a safe distance of at least 2 m.
- ▶ Instruct persons in the vicinity of the potential risk.
- ▶ Attach warning instructions stating POWERFUL MAGNETIC FIELDS to the packaging, at the installation area and at the storage location.

### **DANGER**

#### **Danger of death by electric shock.**

The ILM-E servo kit is supplied with electrical voltage for operation. Touching live conductors can result in death or severe injuries.

- ▶ Use the main switch to switch off all power to the complete system before starting installation or maintenance work.
- ▶ Observe the five safety rules (DIN VDE 0105-100) for working on electrical systems:
  - Disconnect from mains (all-pole disconnection of a system from live parts)
  - Secure against reconnection
  - Check that the system is voltage-free
  - Earth and short-circuit
  - Cover or block off access to adjacent live parts

 **DANGER****Danger of death by electric shock or arcing at the power connections of the ILM-E servo kit**

The contacts of the power connections carry potentially fatal voltages and high current strengths. Removing the cables to the power connections of the ILM-E servo kit during operation can cause arcing, resulting in serious or fatal injury.

Depending on the installed buffer capacity, the DC link of a connected inverter can continue to carry dangerous voltages for some time, even after the power supply to the entire system is switched off.

- ▶ Never detach electrical connections on the ILM-E servo kit or the inverter while they are live.
- ▶ Use a permitted meter to check that the power connections are voltage-free before you carry out installation work on the device.

 **WARNING****Danger of eye injuries caused by splintering magnetic parts**

The rotors of the ILM-E servo kit will attract other magnetic materials. The forces of attraction can be so great that the magnets of the servo kit splinter on impact and tiny fragments fly into the eyes.

- ▶ Wear safety goggles to protect your eyes until you have finished installing the ILM-E servo kit.
- ▶ Keep the rotors of the ILM-E servo kit away from other magnetic materials.



## 5.1 Stator

### 5.1.1 Tools and equipment required

- Non-magnetic tool
- Cleaning agents
- Antistatic coat
- ESD grounding wrist strap
- Safety goggles
- Protective gloves
- Assembly sleeve
  - Drawing available as a download
  - Dimensions according to the outer diameter of the stator, as shown in the drawings
- Dowel pin
  - Adhesive for securing the dowel pin
  - Other dimensions corresponding to those in the drawing on the website

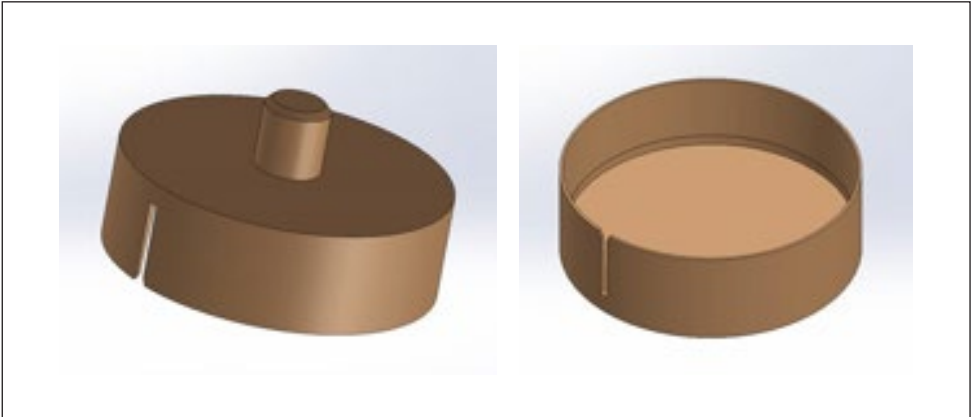


Fig. 5: Assembly sleeve

### 5.1.2 Shrink-fitting

#### WARNING

##### Danger of burns on hot surfaces

Contact with the housing at the temperatures required for shrink-fitting can cause severe burns.

► Wear appropriate heat protection for your hands throughout the entire process.

- Clean and degrease the housing and stator with isopropyl alcohol.
- Apply a small amount of adhesive in the groove identified for the dowel pin in the design guidelines and insert the dowel pin into the groove.

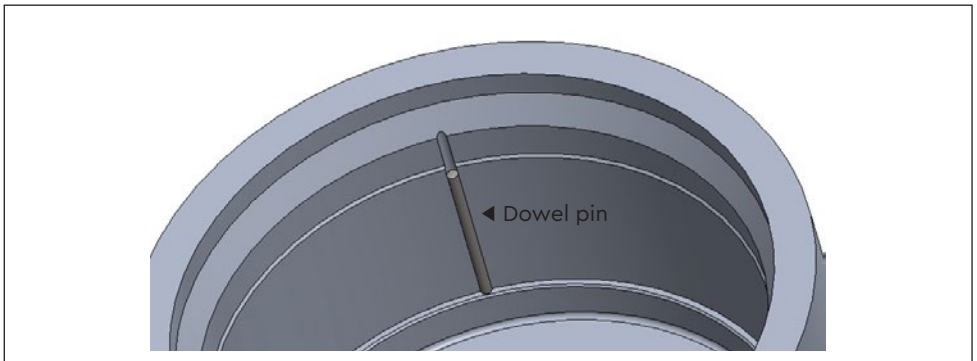


Fig. 6: Housing with dowel pin

- Heat the stator housing to 100 °C for roughly 45 minutes.

#### NOTE

Select a temperature that is appropriate for your selected materials and ambient temperatures.

- Remove the housing from the oven and align the stator in the housing as shown in the design guidelines.

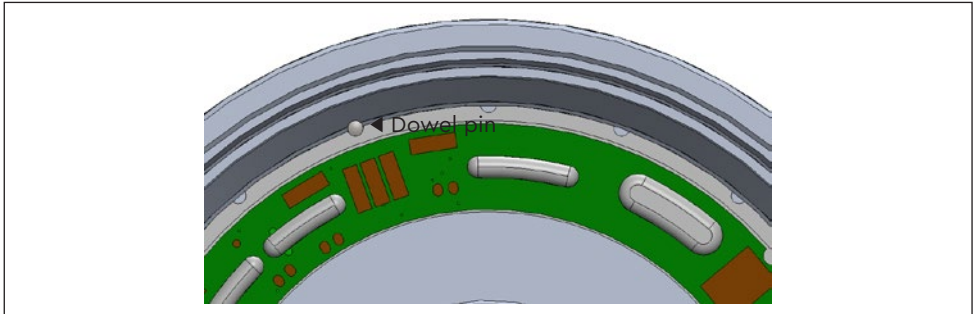


Fig. 7: Stator alignment

- Use the press-in tool to carefully press the stator into the housing until the pole cap/base of the stator touches the bottom surface of the housing.

**NOTE**

Make sure that the alignment/positioning of the stator does not change when it is pressed in. Be careful not to press on the PCB while pressing the stator in.

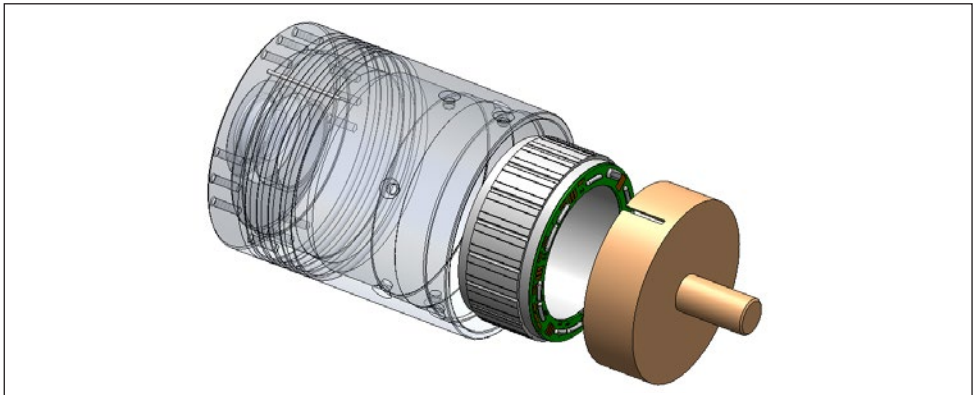


Fig. 8: Pressing-in process

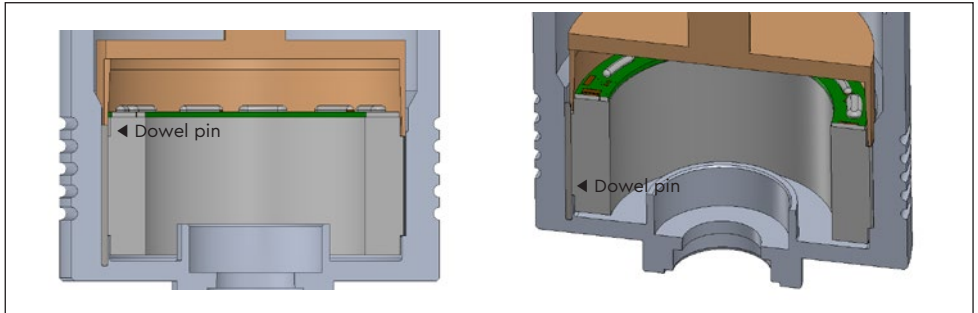


Fig. 9: Final stator position

- Allow the housing to cool to room temperature.
- Once the housing has cooled to room temperature, check that the stator is seated firmly and without gaps in the housing.

## 5.2 Rotor

### **WARNING**

#### **Danger of eye injury and skin irritation by adhesives**

The adhesives used for bonding can cause severe eye injuries and skin irritations.

- ▶ Wear safety goggles to protect your eyes and wear safety gloves until you have finished installing the ILM-E servo kit.
- ▶ Read and follow the safety data sheets provided with the adhesive.

### 5.2.1 Tools and equipment required

- Non-magnetic tool
- Bonding adhesive for rotor (e.g. LOCTITE 648)
- Kapton tape
- Cleaning agents
- Lint-free cloths
- Antistatic coat
- ESD grounding wrist strap
- Safety goggles
- Protective gloves

### 5.2.2 Bonding process

- ▶ Clean and degrease the bonding surfaces on the shaft (item 1 in Fig. 10) and rotor (item 1 in Fig. 11) following the adhesive manufacturer's instructions.
- ▶ Heat the rotor for 5 minutes at 60 °C in the curing oven.
- ▶ Following the manufacturer's instructions, apply a thin ring of adhesive (item 2 in Fig. 10) to the bonding surface on the shaft (item 1 in Fig. 10).
- ▶ Following the manufacturer's instructions, apply a thin ring of adhesive (item 2 in Fig. 11) to the inner surface in the vicinity of the indexing hole (item 3 in Fig. 11) on the rotor.
- ▶ Align the rotor so that the indexing hole (item 2 in Fig. 12) points towards the shaft (see Fig. 12).
- ▶ Push the rotor (item 1 in Fig. 12) onto the shaft (item 3 in Fig. 12) and gently push it as far as it will go.

#### NOTE

- Do not press on the surfaces of the rotor magnets as this could damage them.
- Only press on the inner ring (item 1 in Fig. 13) of the rotor when you push it onto the shaft. The pressure points (item 2 in Fig. 13) should be opposite one another.

- ▶ Quickly remove any excess adhesive with a dry cloth. Do not use solvents on the shaft or magnets.
- ▶ Carry out the curing process following the adhesive manufacturer's instructions.

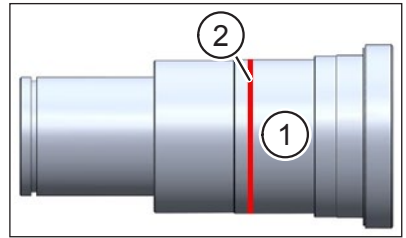


Fig. 10: Adhesive ring on the shaft

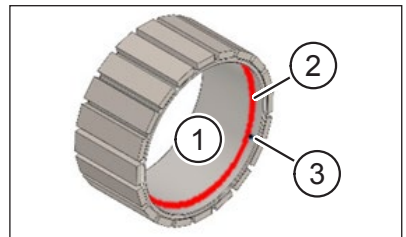


Fig. 11: Adhesive ring on the rotor

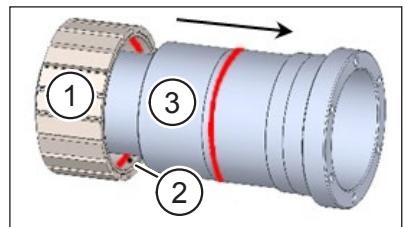


Fig. 12: Pushing the rotor onto the shaft

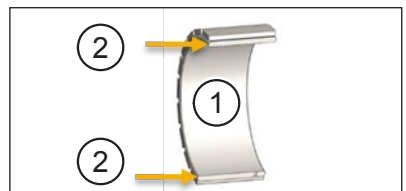


Fig. 13: Pressure points on the inner ring

### 5.2.3 Inserting the rotor into the stator

#### WARNING

##### **Danger of crushing, catching or cutting injuries to the hands.**

For example, the rotor can move suddenly under the effect of magnetic forces. This can result in severe injuries.

- ▶ To prevent sudden movements of the rotor during installation, use a mechanical means to lock the rotor in place.
- ▶ When inserting the rotor into the stator, use a mechanical centring guide to prevent the rotor moving suddenly towards the stator due to magnetic attraction.
- ▶ Wear safety goggles to protect your eyes and wear safety gloves until you have finished installing the ILM-E servo kit.

#### NOTE

- ▶ Make sure that the rotor is not tilted as it is inserted, otherwise parts of the magnets on the rotor can splinter off or the inner surface of the stator and other parts can be damaged.
  - ▶ When inserting the rotor into the stator, be aware of the powerful magnetic forces that can pull the rotor suddenly into the stator. The centring aid must therefore be held in place with appropriate force.
- ▶ Use a mechanical centring guide to insert the rotor into the stator.

## 6 DECLARATION OF INCORPORATION

### Declaration of Incorporation according to Annex IIB, 2006/42/EC



**We**

Company name:	TQ Systems GmbH
Postal code, city:	82229 Seefeld, Germany
Postal address:	Mühlstr. 2, Gut Delling

**hereby declare**, that a declaration of incorporation has been issued, in sole responsibility, for the following partly completed machinery:

Product category:	<b>Partly completed machinery</b>
Product name:	Servo kit internal rotor motor (ILM-E)
Model name / Type name:	ILM-E38x12, ILM-E50x8, ILM-E50x14, ILM-E70x10, ILM-E70x18, ILM-E85x13, ILM-E85x23, ILM-E85x30

This partly completed machinery meets the following health and safety protection requirements in accordance with Annex I of EC Machinery Directive 2006/42/EC:

1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.3, 1.3.7, 1.5.1, 1.5.2, 1.5.4, 1.7.1, 1.7.2

**The following further EU directives were applied:**

- Low voltage directive 2014/35/EU
- RoHS 2011/65/EU

The relevant technical documentation has been compiled in accordance with Annex VII, Part B of EC Machinery Directive 2006/42/EC. We undertake, in response to a reasoned request, to supply it in electronic form to the market surveillance authorities within a reasonable period.

**The following person is authorised** to compile the technical documentation in accordance with Annex II, Part 1, B. no. 2, 2006/42/EC:

Name, first name:	Ralf Schmidt
Address:	Mühlstr. 2, Gut Delling, 82229 Seefeld, Germany
Position in the company of the manufacturer:	BVA DRV EW IN, Development Manager DRIVES

**When installing in a machine or when finishing a machine that works on its own, the specifications provided in the assembly instructions must be adhered to.**

**This product may not be brought into service until the machine or system in which it is to be installed or of which it represents a component, conforms to the provisions of all the relevant directives.**



i.V. Christian Stangl  
TQ-Drives Division Manager

