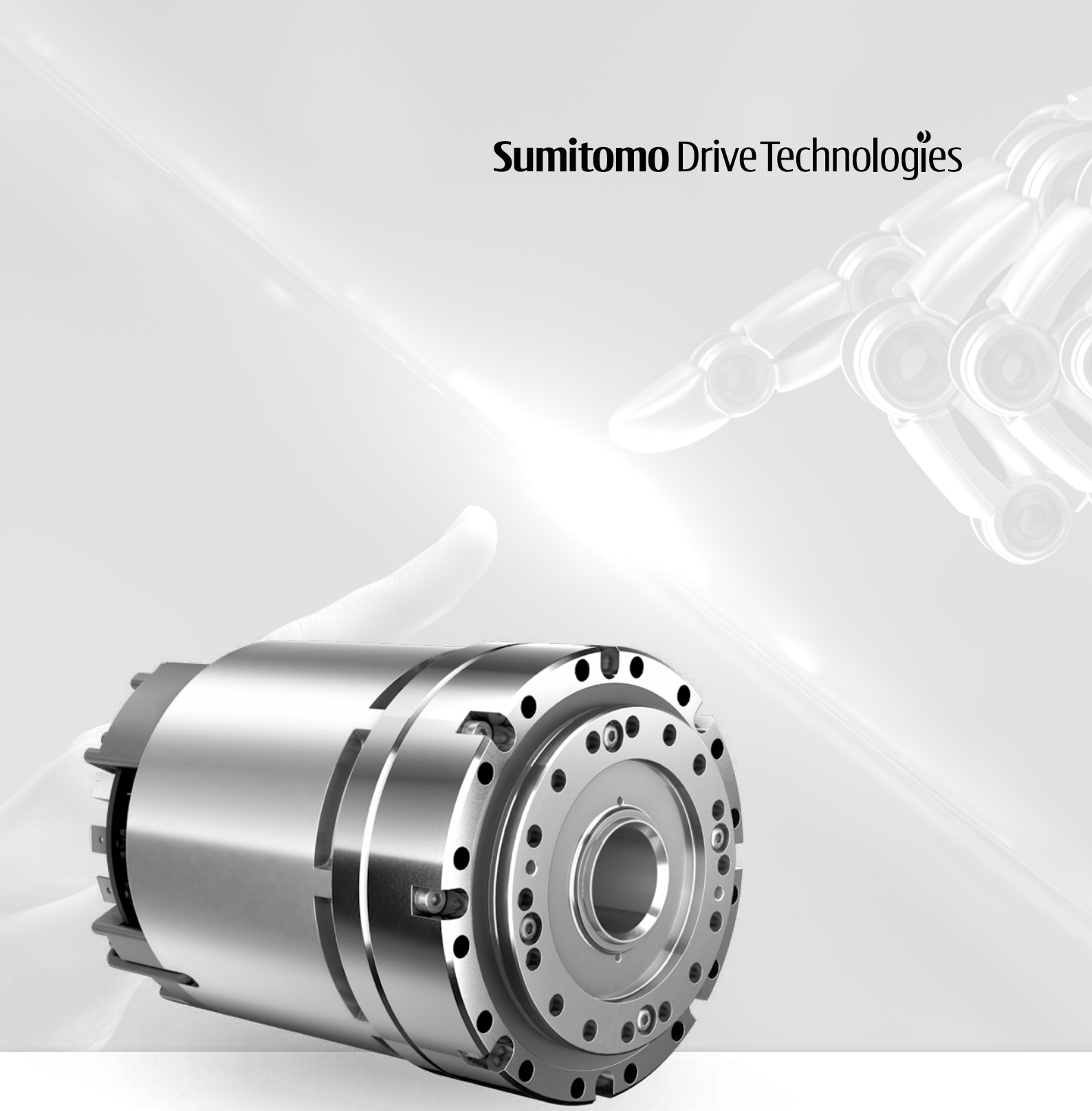
Sumitomo Drive Technologies



TUAKA ACTUATORS

Operating manual

Legal notice

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The original manual is printed in German. Manuals in other languages have been translated from German.

Further information and installation instructions

Table of contents

1. User instructions 6

1.1. Notes on the operating manual 6
1.1.1. Validity of the operating manual 6
1.1.2. Target group 6
1.2. Product identification and nameplate 7
1.3. Text markings and symbols 8
1.4. Images used 8
1.5. Abbreviations 8

2. Safety 9

2.1. Explanation of safety notices and warnings 9
2.2. Presentation and structure of warnings 9
2.3. Hazard classification of warnings 9
2.4. Personnel requirements and qualifications 10
2.4.1. Operator 10
2.4.2. Qualified staff 10
2.5. Personal safety equipment 10
2.6. Basic safety instructions 11
2.7. Danger areas 15
2.8. Safety devices 15
2.9. What to do in an emergency 15
2.10. Environmental protection 15

3. Product overview 16

3.1. Product description 16
3.1.1. Structure and function of TUAKA ACTIVE 17
3.1.2. Structure and function of TUAKA SERVO 18
3.1.3. Structure and function of TUAKA DRIVE 19
3.2. Designated use 20
3.3. Important machine information 20
3.3.1. Lifetime 20
3.3.2. Permissible operating environment 20
3.3.3. Dimensions and technical data of TUAKA ACTIVE 21
3.3.4. Dimensions and technical data of TUAKA SERVO 22
3.3.5. Dimensions and technical data of TUAKA DRIVE 24

4. Transport and storage 26

4.1. Transport 26
4.2. Storage 27
4.2.1. Storage space requirements 27
4.2.2. Short-term storage of up to three months 27

4.2.3. Long-term storage for more than three months 27
4.2.4. Long-term storage for more than two years 27

5. Assembly, installation and commissioning 28

5.1. Preparatory work 28
5.1.1. Necessary tools and auxiliary equipment 29
5.1.2. Preparatory tasks 29
5.2. Mechanical installation 29
5.2.1. Ensuring a suitable installation location 29
5.2.2. Specified screws and tightening torques 30
5.2.3. Fitting the actuator 32
5.2.4. Installing the mechanical cooling unit 33
5.2.5. Mechanical interfaces 33
5.3. Electrical installation 34
5.3.1. Connections on the TUAKA ACTIVE 35
5.3.2. Connections on the TUAKA SERVO 36
5.3.3. Connections on the TUAKA DRIVE 39
5.4. Connecting the communication interfaces 41
5.4.1. Connecting the communication interfaces – TUAKA ACTIVE 41
5.4.2. Connecting communication interfaces – TUAKA SERVO 41
5.4.3. Connecting communication interfaces – TUAKA DRIVE 41
5.5. Testing and checking the safety system 41
5.6. Brake configuration 42
5.6.1. Configuring the brake on the TUAKA ACTIVE and TUAKA SERVO 42
5.6.2. Configuring the brake on the TUAKA DRIVE 42
5.7. Checking the installation 43
5.8. Commissioning 43
5.8.1. Commissioning the TUAKA ACTIVE and TUAKA SERVO 43
5.8.2. Commissioning the TUAKA DRIVE 43

6. Manufacturer settings 45

6.1. Restoring the factory settings 45
6.2. Mechanical settings and synchronisation 45
6.3. Software and electrical settings 45
6.3.1. TUAKA ACTIVE and TUAKA SERVO settings 45
6.3.2. TUAKA DRIVE settings 45
6.4. Safety-related (setting) parameters 45
6.4.1. Quick stop 45
6.4.2. End position 45
6.4.3. Thermal protection parameters 46

7. Operation 47

7.1. Operating modes 47

7.2. Switching the machine on and off 48

7.3. Process or sequence of operations 48

7.4. Technical performance data 48

8. Inspection, maintenance and cleaning 49

8.1. Inspection 50

8.2. Maintenance 50

8.3. Cleaning 50

9. Troubleshooting, fault elimination and repair 51

10. Decommissioning, disassembly and disposal 53

10.1. Decommissioning 53

10.2. Disassembly 53

10.3. Disposal 54

11. Spare parts and customer service 55

11.1. Ordering spare parts 55

11.2. Customer service 55

12. Index 56

1 User instructions

1.1 Notes on the operating manual

1.1.1 Validity of the operating manual

This operating manual contains information and instructions about safe handling and faultless operation as well as maintenance of the following actuators:

- TUAKA ACTIVE
- TUAKA SERVO
- TUAKA DRIVE

Refer to the nameplate for the exact type.

1.1.2 Target group

This manual is intended for operators and qualified staff authorised by Sumitomo (SHI) Cyclo Drive Germany GmbH. Observing the instructions will help avoid hazards, reduce repair costs and downtime, and increase the reliability and lifetime of the actuator.

Every person responsible for the following tasks must read, understand and apply the instructions in the manual:

- Transport and storage
- Assembly, installation and commissioning
- Operation
- Repair, inspection and testing
- Cleaning and care
- Troubleshooting and fault elimination
- Decommissioning, disassembly and disposal

If you have any questions, please consult the Sumitomo (SHI) Cyclo Drive Germany GmbH customer service department. ➜ *Chap. 11.2 "Customer service" page 55*

1.2 Product identification and nameplate

A nameplate containing the following product identification information is attached to the housing:

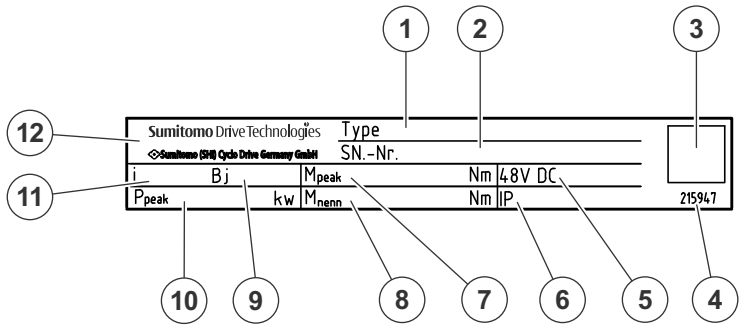

Figure 1.1 Nameplate

1	Type	7	Peak torque
2	Serial number	8	Rated torque
3	QR code	9	Year of manufacture
4	Nameplate number	10	Maximum power
5	Rated voltage	11	Ratio
6	Protection class	12	Manufacturer

1.3 Text markings and symbols

Different markings and symbols are used in the text in this manual. These are explained below.

Warning symbols are used in warnings and categorised according to the level of danger. Please note the instructions and explanations in the Safety section.
➜ *Chap. 2 "Safety" page 9*

Additional information and tips

Notes on environmentally-friendly use

▶ Text marking to prompt a necessary action or measure
  ▶ Text marking for a subordinate action or measure

1 Text marking to prompt necessary action steps in a specific order

△ Result of action steps

- Text marking for a list
  - Text marking for a subordinate list

`Uqhvyctg"vgzv`

➜ *"Reference to chapter, images or other documents"*

To provide a more readable format, Sumitomo (SHI) Cyclo Drive Germany GmbH is referred to as "Sumitomo" in the following text. Where legally relevant, the company name is written out in full.

1.4 Images used

This operating manual contains stylised line drawings. Some illustrations are provided as examples and some have had parts removed or have been simplified for better illustration and explanation for the benefit of the user.

▶ Please note the following:
- Disassembly is not always included in the respective description.
- The images do not display different equipment variants unless explicitly specified.
- The accompanying descriptive text always applies to the images.

1.5 Abbreviations

The following abbreviations are used in this operating manual (selection, in alphabetical order):

Designation/abbreviation	Meaning
-	-
approx.	approximately
etc.	et cetera; and so on
-	-
Chap.	Chapter
e.g.	for example

2 Safety

This operating manual contains instructions and information about safety and maintenance as well as safe and correct operation of the actuator. The following chapters also contain additional information, in particular warnings, which must also be observed.

▶ Follow all instructions to avoid personal injury, environmental damage and material damage.

2.1 Explanation of safety notices and warnings

Basic safety information includes instructions for safe use and for maintaining the safe condition of the actuator.

Action-related warnings warn of residual risks and indicate a dangerous action.

All safety information on components from suppliers can be found in the relevant manufacturer documents and supplier documentation.

▶ Follow all instructions to avoid personal injury, environmental damage and material damage.

2.2 Presentation and structure of warnings

Warnings are action-based and structured as follows:

⚠ SIGNAL WORD

Type and source of danger!

Description of the type and source of danger.

▶ Measures for averting the danger.

2.3 Hazard classification of warnings

Warnings are categorised according to the degree of danger. The danger levels with corresponding signal words and warning symbols are explained below.

⚠ DANGER

Immediate risk of death or serious injury.

⚠ WARNING

Possible risk of death or serious injury.

⚠ CAUTION

Possible minor injury.

NOTE

Damage to the device or environment.

2.4 Personnel requirements and qualifications

The manual draws a distinction between the following personnel:

- Operator
- Qualified staff

The listed groups of people must have read and understood the operating manual and must have reached the legal minimum age.

The actuators contain dangerous, live and rotating parts. All work must always be carried out by authorised and qualified personnel.

2.4.1 Operator

The operator is responsible for proper operation of the actuator and the overall system.

The operator must:

- have reached the legal minimum age,
- instruct qualified staff in how to handle the actuator.

2.4.2 Qualified staff

Qualified staff have received technical training and are authorised to handle the actuator.

Qualified staff must:

- have a recognised training certificate or appropriate specialist knowledge that is relevant for compliance with existing regulations, rules and guidelines, and
- have received instruction on how to use the actuator.

Work on the system's electrical equipment may only be carried out by qualified electricians in accordance with electrical engineering rules.

Only personnel with special knowledge and experience in the field of mechanics may work on mechanical components.

2.5 Personal safety equipment

The following personal protective equipment must be available and always used when carrying out the relevant activity, otherwise personnel may sustain serious injuries. The scope of the protective equipment is determined by national regulations.

- Protective gloves
- Protective glasses
- Safety shoes

2.6 Basic safety instructions

The basic safety instructions summarise all safety measures pertaining to the same subject and apply at all times to any activity related to the actuator. They also function as warnings in the appropriate places in this manual.

Mechanical hazards

The rotation of exposed mechanical parts, such as motor and hollow shafts, may result in injuries to limbs. In principle, it is possible to reach into the rotating gearbox at an open hollow shaft, causing serious injuries.

Contact with open input and output shafts can cause minor to severe skin abrasions.

Gloves can get caught on sharp edges and be pulled into mechanisms.

Loose clothing or objects can get entangled in the motor shaft, causing serious injury.

The sharp edges on actuators may cause cuts.

- ▶ The machine or system manufacturer must use suitable technical devices to protect rotating shafts and sharp edges with a protective cover.
- ▶ Never touch rotating components (motor shafts).
- ▶ Do not wear ties, chains or loose clothing in the workplace or in the immediate vicinity of the machine and actuator.
- ▶ People with long hair must wear a hair net.

Danger due to hot surfaces

The surface temperature of the actuators may reach 60-70°C during operation. Touching hot surfaces can cause skin burns.

The inverter and the exterior surfaces of the housing can reach temperatures of up to 100°C.

- ▶ Do not touch hot surfaces.
- ▶ Allow the actuator to cool down to the ambient temperature before touching.
- ▶ Wear personal safety equipment.
- ▶ When designing the installation position in the overall system, make sure that heat can dissipate adequately.

Electrical hazards

The actuator is supplied with electrical voltage. Touching live conductors and components can result in electric shocks, serious injury or even death.

- ▶ Avoid direct contact with live parts.
- ▶ Work must always be carried out by authorised, qualified staff.
- ▶ Before starting any work on the actuator, switch off the power supply to the overall system.
- ▶ Observe the five safety rules when working on electrical systems:
  - Disconnection (isolate all poles on a system from live parts)
  - Secure against switching on
  - Make sure that no components are live
  - Ground and short-circuit
  - Cover or block off live adjoining parts

Magnetic hazards

Persons with passive or active implants such as pacemakers, defibrillators, insulin pumps, etc., who remain in the immediate vicinity of the actuator are at risk of death.

- ▶ People who could potentially be affected by strong magnetic fields should be instructed to vacate the area.
- ▶ Instruct unauthorised persons to maintain a minimum safety distance of 2 metres.
- ▶ Inform people in the vicinity about the potential danger.
- ▶ Visibly display warning signs stating "Strong magnetic fields" in areas in which the actuator is installed or stored.

The encoder rings in the actuator are magnetised with a magnetic pattern that may be altered and damaged by different influences. Special precautions must be taken to permanently maintain the quality of the magnetic pattern.

- ▶ Remove all strong magnets in the vicinity of the encoder rings. (The stronger the magnet, the higher the risk of damage.)
- ▶ Always store the axles of actuators a sufficient distance away from one another.
- ▶ Keep strong magnets away from actuators and encoder rings, even for a short time. (The further away they are, the less influence they will have.)
- ▶ Remove all tools with magnetic properties from the assembly area, including magnetised screwdrivers.
- ▶ Make sure that the encoder rings and strong permanent magnets or electromagnets cannot come into contact with one another during installation.
- ▶ When storing, preparing and picking parts, make sure that the encoder rings are not transported or stored together with other magnets. (This includes permanent magnets for electric motors.)
- ▶ When working on actuators and encoder rings, remove all bags or clothing with magnetic fasteners.
- ▶ Avoid possible inductances caused by high-voltage lines near the encoder rings.
- ▶ Make sure that no metallic particles can enter the actuator.

Electromagnetic radiation can prevent proper control of the actuator and cause malfunctions.

- ▶ Avoid electromagnetic radiation in the area around the machine.

Electrostatic hazards

Electrostatic discharge (ESD) can damage the sensitive electronics of the actuators and the system.

- ▶ To protect the electronics, only perform work on the actuators at ESD-protected workstations as stipulated in DIN EN 61340-5-1.
- ▶ Do not use plastic bags, plastic containers or other non-antistatic or non-conductive materials within a radius of approximately one metre.
- ▶ Always perform a charge balance before touching a correspondingly marked assembly.
- ▶ Wear an ESD bracelet while handling the actuators.
- ▶ Wear ESD protective clothing such as wristbands, ESD gloves, and ESD shoes.
- ▶ Restrict movements. (Movement can cause static electricity to build up.)
- ▶ Handle the actuator with care and only hold it by the edges or frame.
- ▶ Do not touch soldering points, pins or exposed circuit boards.
- ▶ Do not leave the actuator in an area where others can touch and possibly damage it.
- ▶ While the device is still in the antistatic bag, touch an unpainted metal part of the system unit for two seconds or more. (This will discharge any static electricity from the packaging and your body.)
- ▶ Always store actuators in the ESD-protected transport packaging provided until they are needed again.
- ▶ To assemble, remove the actuator from the packaging and insert directly into the system without switching it off. (If the actuator needs to be switched off, always place it in an ESD protective bag or the ESD-protected transport packaging provided.)
- ▶ Do not place the actuator on the system cover or on a metal table.
- ▶ Please note that indoor humidity decreases and static charging increases in cold weather.

Hazards from lubricants

The lubricants are not pH-neutral and can cause allergic reactions.

- ▶ Avoid contact with lubricants.

Dangers due to uncontrolled actuator movements

The actuator can become damaged if it is placed down incorrectly or if it falls.

- ▶ After removing the actuator from the packaging, always set it down on the output flange.
- ▶ If the actuator sustains a fall, contact the manufacturer.

Setting the actuator down in an elevated location poses a risk of tipping over and falling, resulting in potential damage to the actuator and injury.

- ▶ Always secure the actuator against tipping over or falling.

The round actuator can roll away when positioned horizontally. Unless the actuator is installed, it is not stable when placed in an inclined position, resulting in potential damage to the actuator and injury.

- ▶ Take care to avoid unintentional movements and potential hazards.

During transport, assembly, disassembly and installation, there is a risk of the actuator falling and posing a hazard to persons standing in the danger zone. Furthermore, improper screw connections can cause the actuator to come loose and fall during operation. The actuator may sustain damage and cause serious injury to people in the danger zone as a result.

- ▶ For screw connections, observe the information in this operating manual.
- ▶ Observe the tightening torques.

Danger from increased vibrations

Increased vibration amplitudes can result in premature failure, depending on the application for which the actuator is used. In turn, this could result in serious damage to the machine and personal injury.

- ▶ Avoid increased vibration amplitudes on the machine.

Dangers from overloading

Overloading can result in complete failure of the actuator. In the worst case scenario, serious personal injury is possible, depending on the specific application.

- ▶ Observe the maximum permissible moments that can be transferred according to the product catalogue.

Danger of fire due to incorrect motor settings

Enabling `Hkgnf"Ygcmgpkpiu` in the motor settings can set the actuator on fire.

- ▶ Observe the manufacturer's specifications.
- ▶ Changes to the motor settings are carried out at your own risk.
- ▶ Continuously check the temperature and, if necessary, initiate countermeasures or restore the factory settings.
- ▶ If the motor begins to generate excessively loud noises when the controller is activated, the controller settings may be incorrect.
- ▶ If you are unable to adjust the controller yourself, contact the manufacturer.

Danger from increased noise levels

Operating the actuator increases noise levels, potentially resulting in serious hearing damage or complete hearing loss.

- ▶ Wear suitable hearing protection when using the actuator.

2.7 Danger areas

Remaining within the swivel range of moving robot arms and machine parts poses a risk of death.

- ▶ Install a protective grille or barriers around the overall system at a sufficient safety distance.
- ▶ Do not remain in the danger area unless the overall system has been switched off.
- ▶ Avoid remaining in danger areas unnecessarily.
- ▶ Observe the operating manual for the overall system.
- ▶ Observe the advanced safety functions of the actuator. ➜ *Chap. 3.1 "Product description" page 16*

2.8 Safety devices

Depending on the actuator type, safety functions are integrated into the actuator, which form a single unit together with the control for the overall system. Emergency stop buttons are located throughout the system.

- ▶ Observe the operating manual for the overall system.

2.9 What to do in an emergency

- ▶ Observe the relevant instructions for the overall system and operating site.

2.10 Environmental protection

The product meets all requirements for environmentally-friendly use. However, the following measures can further reduce the burden on the environment.

- ▶ Keep the environment in mind when handling operating materials.
- ▶ Prevent operating materials from leaking into natural environments and the direct surroundings.
- ▶ Dispose of operating materials and other chemicals in accordance with national regulations.

3 Product overview

3.1 Product description

TUAKA actuators are robust, compact motor-gearbox units that offer a high degree of precision. They can also be extended to include rotary encoders on the input side and the gearbox output side as well as a torque sensor, and can be equipped with a functional safety feature as an option. TUAKA actuators are specially designed for use in robotics applications.

TUAKA actuators offer:

- Two sizes, three configurations (ACTIVE, SERVO, DRIVE)
- Maximum acceleration torque of 157 Nm
- DRIVE – Standard safety functions: STO/SBC according to SIL 3 PL-e cat.3
- Increased torsional rigidity
- Lost motion < 1.0 arcmin
- Transmission error < 45 arcsec
- Maximum output speed of 123 rpm
- Supply voltage 48 V DC (operation possible from 24 to 55 V DC. Deviations in the supply voltage affect the specifications)

Basic options	Notes
Integrated safety brake	Holding brake with dynamic emergency stop capacity
Integrated torque sensor	16 bit (resolution)
Selection of encoders (SERVO variant only)	RLS: BiSS-C (SSI and SPI available, on request) Heidenhain: EnDat 2.2 SICK: Hiperface®
Second encoder at actuator output (DRIVE variant only)	Absolute multiturn (in combination with additional battery)
Advanced safety functions	SBT, SS1, SS2, SLS, SLP, SLT, Safe Velocity Process Data, Safe Position Process Data, Safe Torque Process Data, Safe digital IO and Safe Analogue Input

Accessories	Notes
Internal protection of the hollow shaft for cable installation	Tube made of static resin material for protecting wires
Housing protection according to IP class 66	Standard protection: IP20
Standard plug-in connector set	Standard wires without connectors (only wire end sleeves)
Additional heat sink	Designed according to installation space requirements and power consumption can be increased, if required
Optional external driver (SERVO variant only)	Wired with the axle and configured

3.1.1 Structure and function of TUAKA ACTIVE

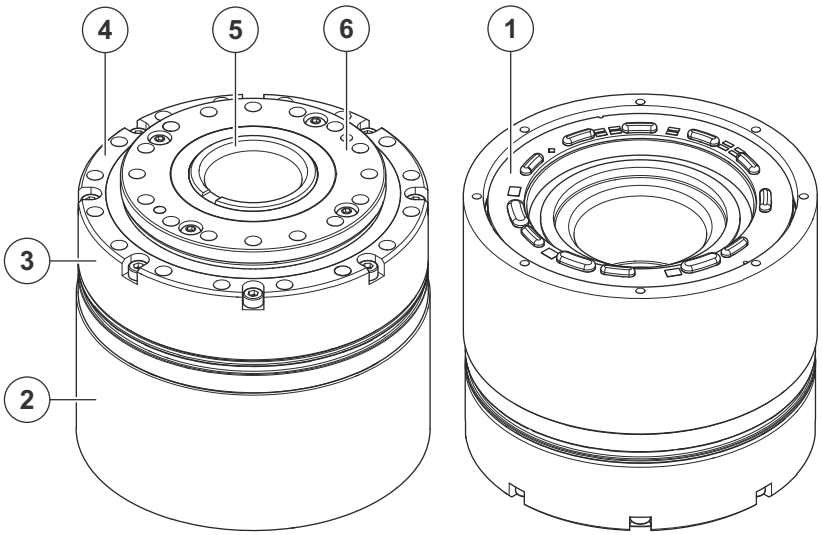

Figure 3.1 Main assemblies of the TUAKA ACTIVE (example illustration)

1	Connection board	4	Machine housing flange, input side
2	Motor	5	Input shaft
3	Gearbox	6	Output flange

The TUAKA ACTIVE is a fully integrated actuator consisting of a gearbox and motor. The TUAKA ACTIVE can be upgraded to the TUAKA SERVO with an additional encoder.

➜ *Chap. 3.1.2 "Structure and function of TUAKA SERVO" page 18*

3.1.2 Structure and function of TUAKA SERVO

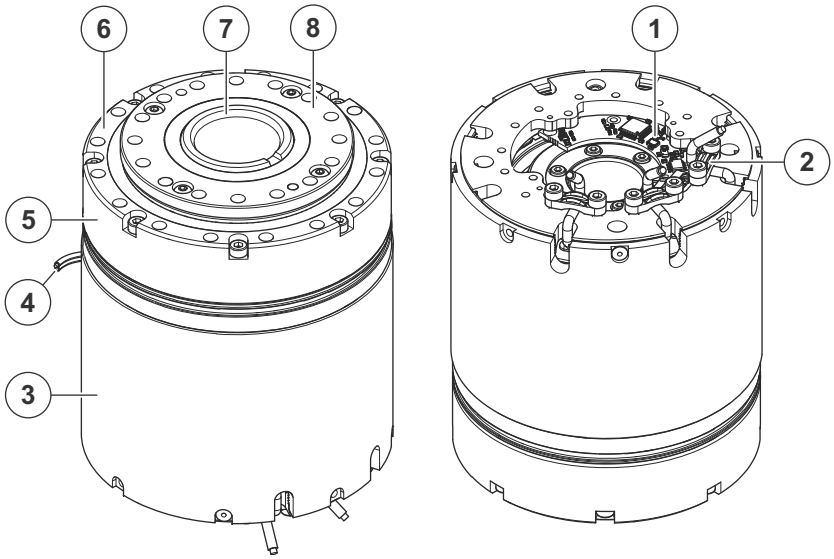

Figure 3.2 Main assemblies of the TUAKA SERVO (example illustration)

1	Encoder	5	Gearbox
2	Cable clamp	6	Machine housing flange, input side
3	Motor	7	Input shaft
4	Brake cable	8	Output flange

The TUAKA SERVO is a fully integrated actuator consisting of a gearbox, motor and encoder. The TUAKA SERVO completes the TUAKA ACTIVE actuator with the additional encoder.

The following encoders are available:

- RLS: BiSS-C (SSI and SPI available, on request)
- Heidenhain: EnDat 2.2
- SICK: Hiperface®

3.1.3 Structure and function of TUAKA DRIVE

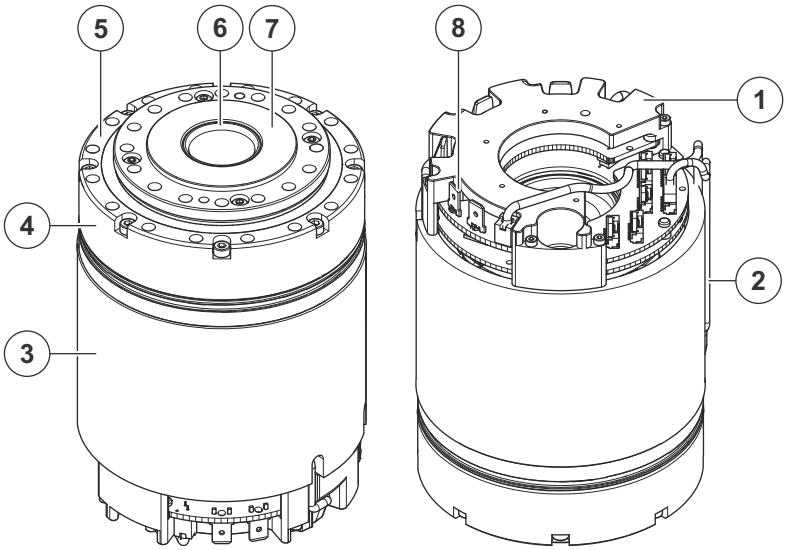

Figure 3.3 Main assemblies of the TUAKA DRIVE (example illustration)

1	Driver/controller (including encoder/connection board)	5	Machine housing flange, input side
2	Cable for brake or torque sensor (optional)	6	Input shaft
3	Motor	7	Output flange
4	Gearbox	8	Power supply

The TUAKA DRIVE is a fully integrated actuator that incorporates a powerful driver.

The TUAKA DRIVE actuator consists of:

- a gearbox,
- a motor,
- an encoder integrated on the motor shaft and
- a motion control with STO/SBC.

The following options are available with the same installation space:

- a speed sensor
- a second encoder on the output side
- advanced safety functions:
  - SBT
  - SS1
  - SS2
  - SLS
  - SLP
  - SLT
  - Safe Velocity Process Data
  - Safe Position Process Data
  - Safe Torque Process Data
  - Safe digital IO
  - Safe Analogue Input

3.2 Designated use

TUAKA actuators ACTIV, SERVO and DRIVE are designed and manufactured by Sumitomo for industrial and commercial systems in the field of robotics, precision machine tools, automation technology and medical applications.

The permitted speeds and performances specified in the technical data and on the nameplate must be observed. If the actuator loads deviate from the permitted values or the system is intended for applications other than industrial and commercial systems, the actuators may only be used after consulting the manufacturer.

As per EC Machinery Directive 2006/42/EC, the TUAKA actuators are components intended for installation in machines and systems. The system may not be operated in areas in which the EC Machine Directive 2006/42/EC applies until it has been ensured that the end product conforms to this EC Directive.

Safe, faultless operation of TUAKA actuators requires proper transport, storage and assembly as well as careful operation and maintenance under the permissible operating environments outlined in this operating manual.

Foreseeable misuse

Use of the actuators in areas other than those specified in the operating manual and ignoring the information in this operating manual constitutes misuse.

Furthermore, the use of TUAKA actuators in the following areas is not permitted:

- in potentially explosive atmospheres
- in areas containing the hazardous substances stipulated in EN 60721, such as oils, acids, gases, vapours, dust, etc.
- underwater
- under radiation
- in a vacuum

Sumitomo (SHI) Cyclo Drive Germany GmbH assumes no liability for misuse.

3.3 Important machine information

3.3.1 Lifetime

The rated lifetime of the actuator is 7,000 hours.

3.3.2 Permissible operating environment

Operating environment	Permitted value
Ambient temperature	+10°C to +50°C
Relative humidity	80% RH (no condensation)
Maximum installation height	1,000 m

If your requirements are different from the above, please contact the Sumitomo (SHI) Cyclo Drive Germany GmbH customer service department.
➜ *Chap. 11.2 "Customer service" page 55*

3.3.3 Dimensions and technical data of TUAKA ACTIVE

Dimensions

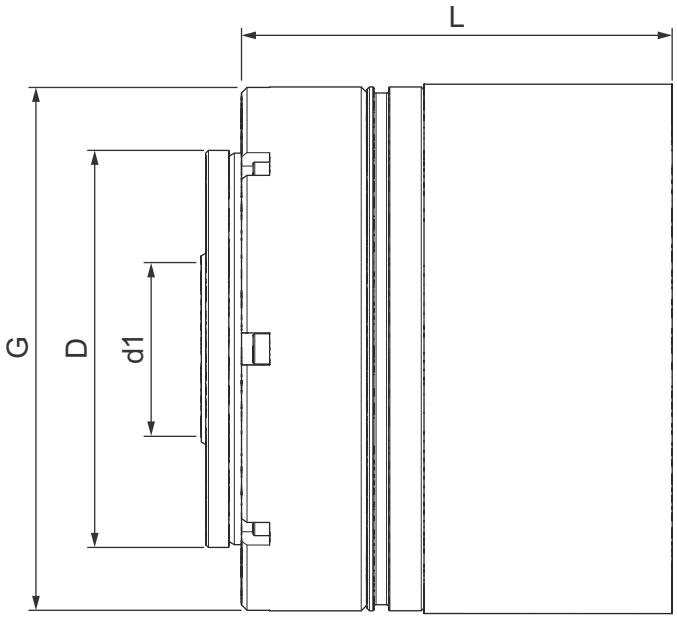

Figure 3.4 Dimensions of TUAKA ACTIVE

L	Length
D	Diameter of output, main diameter
d1	Diameter, hollow shaft diameter
G	Diameter, housing diameter

The dimensions relate to the TUAKA ACTIVE without any optional modules.

Size	Length L (mm)	Ø G (mm)	Ø D (mm)	Ø d1 (mm)	Weight (g)
103	89.2	74 h7	54 h7	26.5	1050
107	107.6	95 h7	72 h7	19.5	2400

Technical data

Mechanical backlash	not applicable
Lost Motion	< 1 arcmin
Sizes	2
Reduction ratio	50:1 / 80:1 / 100:1
Nominal output torque	21-67 Nm (if n1 = 2000 rpm)
Peak output torque	44-157 Nm
Max. output speed	Up to 123 rpm
Rated power consumption	107: up to 391 W 103: up to 388 W
Max. power consumption	107: up to 1453 W 103: up to 1259 W
Supply voltage	48 V DC (operation possible from 24 to 55 V DC)

3.3.4 Dimensions and technical data of TUAKA SERVO

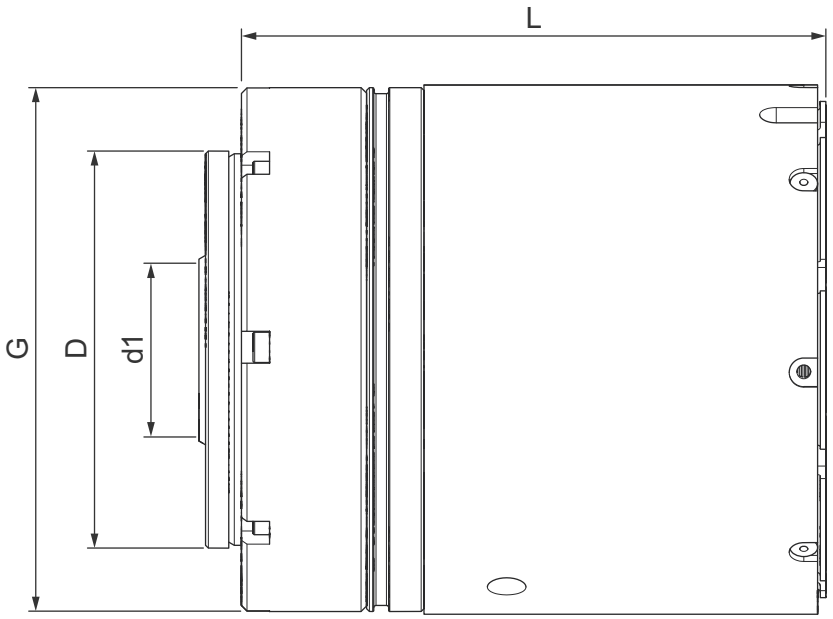

Figure 3.5 Dimensions of TUAKA SERVO

L	Length (depending on encoder)
D	Diameter of output, main diameter
d1	Diameter, hollow shaft diameter
G	Diameter, housing diameter

The dimensions relate to the TUAKA SERVO without any optional modules.

Size	Length L (mm)	Ø G (mm)	Ø D (mm)	Ø d1 (mm)	Weight (g)
103	max. 68.3	74 h7	54 h7	26.5	max. 1430 (depending on encoder)
107	max. 87.9	95 h7	72 h7	19.5	max. 2940 (depending on encoder)

Technical data

Mechanical backlash	not applicable
Lost Motion	< 1 arcmin
Sizes	2
Reduction ratio	50:1 / 80:1 / 100:1
Nominal output torque	21-67 Nm (if n1 = 2000 rpm)
Peak output torque	44-157 Nm
Max. output speed	Up to 123 rpm
Rated power consumption	107: up to 391 W 103: up to 388 W
Max. power consumption	107: up to 1453 W 103: up to 1259 W
Supply voltage	48 V DC (operation possible from 24 to 55 V DC)
Encoder communication	RLS: BiSS-C (SSI and SPI available, on request) Heidenhain: EnDat 2.2 SICK: Hiperface®
Encoder resolution	up to 20-bit

3.3.5 Dimensions and technical data of TUAKA DRIVE

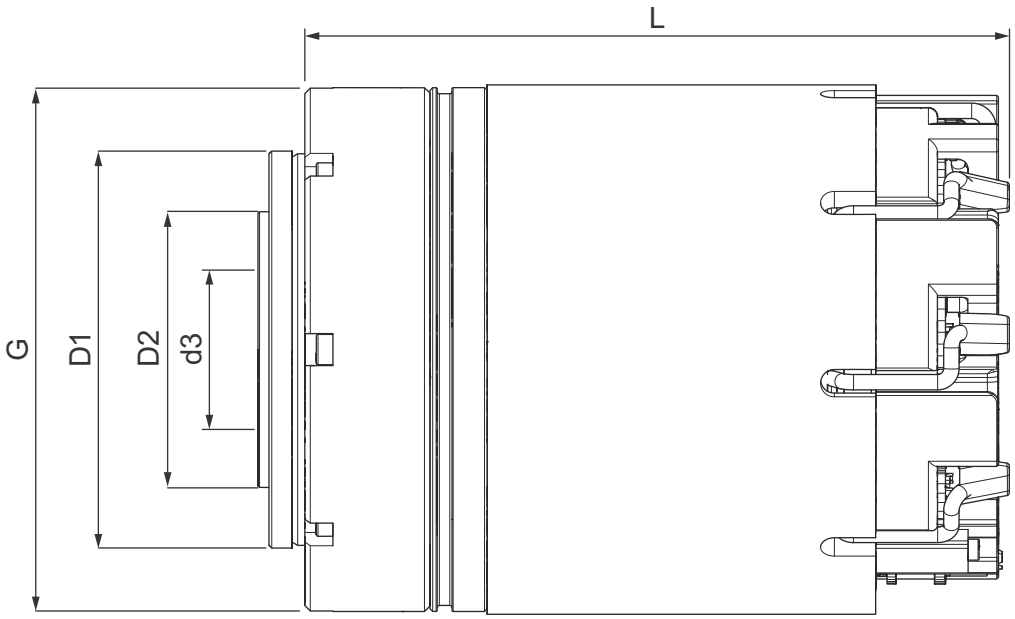

Figure 3.6 Dimensions of TUAKA DRIVE

L	Length	G	Diameter, housing diameter
D1	Diameter of output, main diameter		
D2	Diameter of output, centering		
d3	Hollow shaft diameter		

The dimensions relate to the TUAKA DRIVE without any optional modules.

Size	Length L (mm)	Ø G (mm)	Ø D1 (mm)	Ø D2 (mm)	Ø d3 (mm)	Weight (g)
103	89.2	74 h7	54 h7	40 h7	26.5 (23.0 dual encoder)	1615
107	107.6	95 h7	72 h7	50 h7	19.5 (17.0 dual encoder)	3095

Technical data

Lost Motion	< 1 arcmin
Sizes	3
Reduction ratio	50:1 / 80:1 / 100:1
Nominal output torque	21-67 Nm (if n1 = 2000 rpm)
Peak output torque	44-157 Nm
Max. output speed	Up to 123 rpm
Rated power consumption	107: up to 391 W 103: up to 388 W
Max. power consumption	107: up to 1453 W 103: up to 1259 W
Supply voltage	48 V DC (operation possible from 24 to 55 V DC)
Communication interface	EtherCAT, DS402, CoE, FoE, FSoE (max. cycle time of 4 kHz)
Encoder resolution	107: 20-bit (singleturn) or 18-bit (multiturn) 103: 19-bit (singleturn) or 18-bit (multiturn)
Standard safety functions	STO/SBC according to SIL 3 PL-e cat.3
Advanced safety functions	FSoE: SBT, SS1, SS2, SLS, SLP, SLT, safe process data (speed, position), 2x safe digital inputs, 1x safe digital output (OSSD), 1x safe analogue input (not in combination with integrated speed sensor)

4 Transport and storage

4.1 Transport

⚠ CAUTION

Risk of injury from falling!

The different actuators may fall and cause injury to limbs.

- ▶ Actuators that are still in their transport packaging and weigh more than 20 kg in total must always be transported using suitable lifting devices.

NOTE

Material damage due to improper transportation!

Using improper methods of transport may cause actuators to fall and sustain severe or irreparable damage. Damage from electrostatic discharge may also be possible.

- ▶ Always transport actuators in the ESD-protected transport packaging provided.
- ▶ Actuators that are still in their transport packaging and weigh more than 20 kg in total must always be transported using suitable lifting devices.

The actuators are always shipped individually in their cardboard packaging or on a collection pallet.

- ▶ The product must always be transported in its original packaging.
- ▶ Observe storage requirements during transportation.
  ➜ *Chap. 4.2 "Storage" page 27*
- ▶ Immediately after receiving the delivery, inspect for possible transport damage.
- ▶ In the event of possible transport damage, inform the transport company immediately.
- ▶ Do not commission a device that has been damaged in transit.

4.2 Storage

NOTE
Material damage due to improper storage! The actuators must be stored under specific storage conditions. Failing to store the device under the conditions specified may damage components on the actuator. ▶ Actuators that are still in their transport packaging and weigh more than 20 kg in total must always be transported using suitable lifting devices.

NOTE
Material damage caused by the input shaft spinning in the unpowered state! The unpowered rotation of an actuator input shaft will cause a multiturn error. ▶ Actuators that are still in their transport packaging and weigh more than 20 kg in total must always be transported using suitable lifting devices.

4.2.1 Storage space requirements

▶ Observe the following storage space requirements:
- closed, vibration-free, moderately ventilated
- no direct UV radiation
- low temperature fluctuations within the range of +5°C to +30°C
- Storage temperatures (without condensation): 0 to 60°C
- Humidity < 70%

4.2.2 Short-term storage of up to three months

▶ Provide sufficient corrosion protection for uncoated actuator parts. Use suitable packaging (e.g. VCI film).

4.2.3 Long-term storage for more than three months

▶ Provide sufficient corrosion protection for unpainted actuator parts and replace, if necessary. Use suitable packaging (e.g. VCI film).

Unpowered rotation of an actuator input shaft will cause a multiturn error.
➜ *Chap. 9 "Troubleshooting, fault elimination and repair" page 51*

4.2.4 Long-term storage for more than two years

▶ In the event of long-term storage for a period of more than two years prior to commissioning, have the manufacturer replace all the radial shaft sealing rings.

If you intend to store the product for two years or more, contact Sumitomo Service.
➜ *Chap. 11.2 "Customer service" page 55*

5 Assembly, installation and commissioning

⚠ WARNING

Risk of death and material damage resulting from insufficient qualification!

Assembly, installation and commissioning require specialist knowledge and must be performed in compliance with applicable regulations. Inadequate qualifications can result in serious or even life-threatening injuries or damage to the actuator or the overall system.

- ▶ Observe all applicable regulations.
- ▶ Only appoint suitably qualified staff to carry out work on the actuator.

Assembly, installation and commissioning are performed by authorised qualified staff of the overall system operator.

▶ Carry out assembly, installation and commissioning properly according to the following steps:

1. Preparatory work ➜ *Chap. 5.1 "Preparatory work" page 28*
2. Set-up/mechanical Installation ➜ *Chap. 5.2 "Mechanical installation" page 29*
3. Electrical installation ➜ *Chap. 5.3 "Electrical installation" page 34*
4. Installation of the communication interface ➜ *Chap. 5.3 "Electrical installation" page 34*
5. Checking and testing the safety systems
   ➜ *Chap. 5.5 "Testing and checking the safety system" page 41*
6. Checking the installation ➜ *Chap. 5.7 "Checking the installation" page 43*
7. Commissioning ➜ *Chap. 5.8 "Commissioning" page 43*

5.1 Preparatory work

NOTE

Material damage due to damaged components!

If the actuator and/or its surface get damaged during transport, this can result in material damage to the overall system.

- ▶ Check the supplied actuators for damage.
- ▶ In the event of damage, contact Sumitomo (SHI) Cyclo Drive Germany GmbH.

NOTE

Material damage due to improper cleaning!

Cleaning with mechanical equipment or aggressive cleaning agents can damage the surface of the actuator.

- ▶ The corrosion protection should never be mechanically removed (e.g. with an abrasive).
- ▶ Only alkaline cleaning agents may be used for cleaning.
- ▶ Do not allow cleaning agent to come into contact with the seals.

When handling cleaning agents, lubricants and corrosion protection agents, observe the personal and environmental safety regulations included in the relevant national safety provisions and safety data sheets.

Dispose of packaging materials in accordance with national disposal guidelines.

5.1.1 Necessary tools and auxiliary equipment

▶ Prepare the tools listed below for installation.

- Suitable wrench
- Measuring torque wrench

5.1.2 Preparatory tasks

1 Prepare tools and auxiliary equipment. ➜ *Chap. 5.2 "Mechanical installation" page 29*

2 Unpack the actuator.

3 Check the mating surfaces of the actuator mounting point for visible damage.

4 Clean and degrease the mating surfaces using a suitable cleaning agent and a lint-free cloth.

5 Check that the ambient conditions at the installation site match the information on the actuator nameplate.

△ Preparation of the actuator is complete.

5.2 Mechanical installation

⚠ WARNING

Risk of death and material damage resulting from impermissible torques!

Impermissible tightening torques applied at the screw connections can loosen the actuator and cause serious or even life-threatening injuries or damage to the actuator and the overall system.

▶ Select the number, size, screw quality and tightening torque of the mounting screws according to the specifications for the actuators and ambient conditions at the installation site.

▶ Tighten all screw connections with a calibrated torque wrench.

NOTE

Material damage caused by improper set-up and installation!

The actuator components are carefully checked and coordinated for maximum precision, and must not be disassembled under any circumstances. After disassembling and reassembling individual components, the actuator may malfunction and cause material damage. Disassembling the actuator will void the warranty.

▶ Protect the actuators from contamination and foreign objects.

▶ Only assemble the actuators when fully assembled in their original, delivery condition.

▶ Exchanging the individual components of different actuators is not permitted.

The actuators are mounted on one fixed and one moving connection. In addition, a mechanical cooling unit can be installed depending on the application and requirements.

5.2.1 Ensuring a suitable installation location

For mechanical installations, the following design measures must be implemented to ensure that the installation location is suitable.

▶ The fixed and moving connections must match the dimensions of the actuator at the mounting points and have a suitable hole pattern.

▶ The mounting points must consist of a flat surface and a centering seat.

▶ The connections must be designed for the weight of the actuator and dynamic loads.

▶ Actuators installed outdoors or under very unfavourable environmental conditions such as dirt, dust, or splashing water, should be protected with a cover.

▶ Ensure a sufficient air supply or cooling on the housing surface.

▶ The contact surfaces must be cleaned and degreased.

▶ Average roughness depth of the customer component according to ISO 4287: 10 µm to < 40 µm.

5.2.2 Specified screws and tightening torques

- ▶ Screw assembly data according to VDI 2230 EDITION 2015
- ▶ Prepare the prescribed screws and a torque wrench set to the tightening torque specified in the table below.
- ▶ Select screws made from a material capable of withstanding humidity to avoid excessive corrosion.
- ▶ Use a suitable measuring torque wrench.
- ▶ Use threadlocker.
- ▶ Tighten the screws crosswise in three steps:
  - tighten until the screw is resting on the surface,
  - tighten according to the tightening torque specified in the table,
  - tighten again to the tightening torque specified in the table to check and confirm.

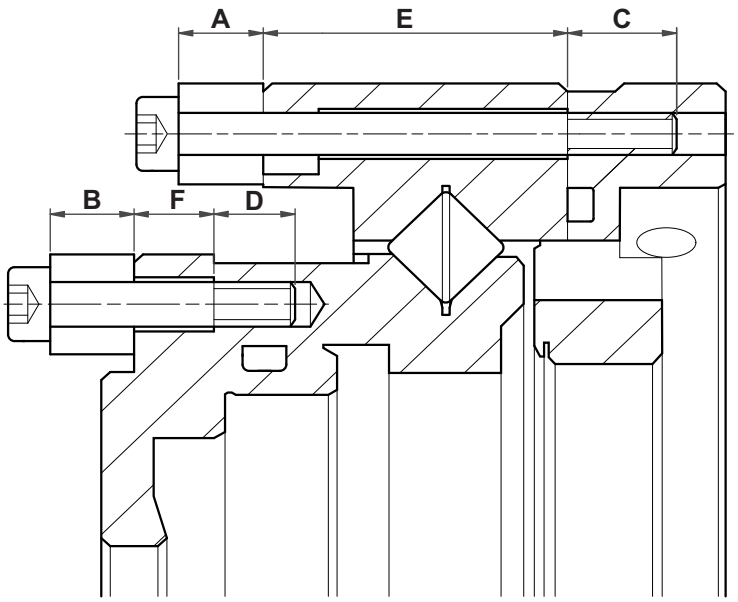

Figure 5.1 Tightening torques (sectional drawing)

A	Terminal width of customer flange	D	Insertion depth of screws at pitch circle 2
B	Terminal width of customer load	E	Terminal width of gearbox at pitch circle 1
C	Insertion depth of screws at pitch circle 1	F	Terminal width of gearbox at pitch circle 2

TUAKA 103

Customer flange at pitch circle 1 Ø 68 mm:

Load: Torsional moment 71 Nm

Customer flange material	AlCuMg1	AlCuMg1	C45	C45
Terminal width A	5 mm	27 mm	5 mm	27 mm
Cylinder screw	M3x30	M3x50	M3x30	M3x50
Thread length	18 mm	18 mm	18 mm	18 mm
Insertion depth C (max. 9 mm)	6.5 mm	4.5 mm	6.5 mm	4.5 mm
Strength category	12.9	12.9	12.9	12.9
Through hole	3.2 mm	3.2 mm	3.4 mm	3.4 mm
Tightening torque	1.7 Nm	1.7 Nm	2.0 Nm	2.0 Nm

Customer load at pitch circle 2 Ø 48 mm:

Load: Torsional moment 71 Nm

Customer flange material	AlCuMg1	AlCuMg1	C45
Terminal width B	5 mm	41 mm	26.5 mm
Cylinder screw	M3x14	M3x50	M3x35
Thread length	14 mm	18 mm	18 mm
Insertion depth D (max. 5 mm)	4.3 mm	4.3 mm	3.8 mm
Strength category	12.9	12.9	12.9
Through hole	3.2 mm	3.2 mm	3.4 mm
Tightening torque	2.0 Nm	2.0 Nm	2.0 Nm

TUAKA 107

Customer flange at pitch circle 1 Ø 87.5 mm:

Load: Torsional moment 157 Nm

Customer flange material	AlCuMg1	AlCuMg1	C45	C45
Terminal width A	5 mm	50 mm	5 mm	50 mm
Cylinder screw	M4x35	M4x80	M4x35	M4x80
Thread length	20 mm	20 mm	20 mm	20 mm
Insertion depth C (max. 10 mm)	7.3 mm	7.3 mm	7.3 mm	7.3 mm
Strength category	12.9	12.9	12.9	12.9
Through hole	4.3 mm	4.3 mm	4.5 mm	4.5 mm
Tightening torque	3.8 Nm	3.8 Nm	4.3 Nm	4.3 Nm

Customer flange at pitch circle 2 Ø 63.0 mm:

Load: Torsional moment 157 Nm

Customer flange material	AlCuMg1	AlCuMg1	C45
Terminal width B	6 mm	41 mm	25.5 mm
Cylinder screw	M4x16	M4x60	M4x35
Thread length	16 mm	20 mm	20 mm
Insertion depth D (max. 6.5 mm)	5.8 mm	5.8 mm	5.3 mm
Strength category	12.9	12.9	12.9
Through hole	4.3 mm	4.3 mm	4.5 mm
Tightening torque	4.4 Nm	3.8 Nm	4.3 Nm

If the installation conditions prevent the specified boundary conditions from being met, contact Sumitomo (SHI) Cyclo Drive Germany GmbH customer service department.
➜ *Chap. 11.2 "Customer service" page 55*

5.2.3 Fitting the actuator

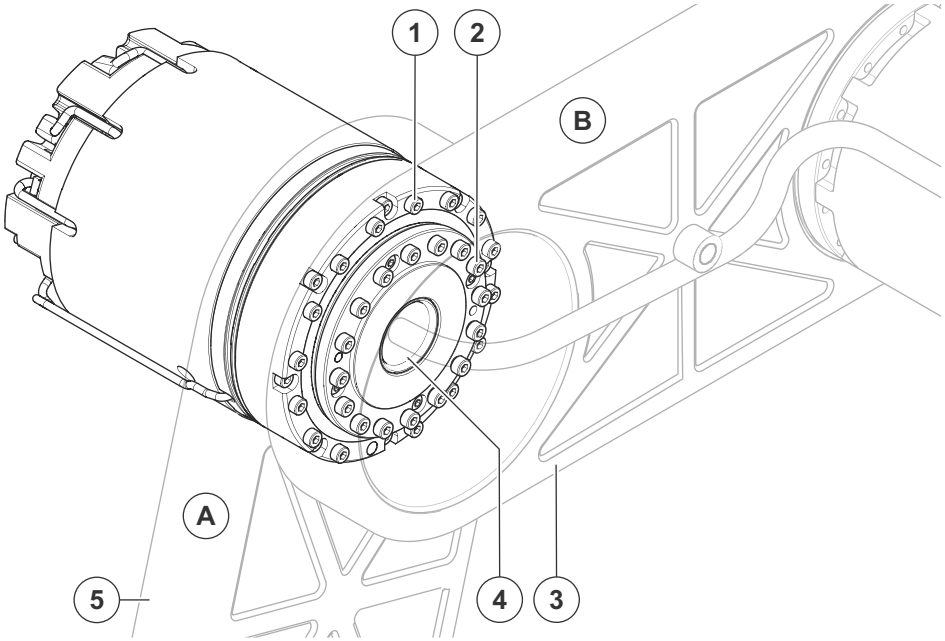

Figure 5.2 Screw connection on housing parts A and B (example illustration)

1	Actuator screw connection on housing section A	4	Actuator shaft
2	Output flange screw connection	5	Housing section A
3	Housing section B		

1 Prepare the prescribed screws and a measuring torque wrench set to the tightening torque specified in the table below.
➜ *Chap. 5.2.2 "Specified screws and tightening torques" page 30*

2 Carefully place the actuator onto fixed housing section A.

3 Secure the actuator in position by screwing the prescribed screws through the holes on housing part A until they are resting on the surface.

▶ Insert the screws crosswise.

▶ and tighten to the specified torques.

4 Carefully place moving housing section B on the drive flange of the actuator.

5 Secure housing section B in position by screwing the prescribed screws through the holes on the drive flange until they are resting on the surface.

▶ Insert the screws crosswise.

▶ and tighten to the specified torques.

△ Assembly of the actuator is complete.

△ The mechanical installation is complete.

5.2.4 Installing the mechanical cooling unit

NOTE
Material damage resulting from overheating! Inadequate cooling can irreparably damage the actuator. ▶ Ensure proper cooling.

An additional heat sink can be used to ensure that the actuators are cooled sufficiently.
The installation of heat sinks is not the responsibility of Sumitomo (SHI)
Cyclo Drive Germany GmbH.

The actuator has several thermal measurement points for ensuring that it is used correctly within the specified temperature range. The use of thermal protection parameters is recommended. ➜ *Chap. 6.4.3 "Thermal protection parameters" page 46*

5.2.5 Mechanical interfaces

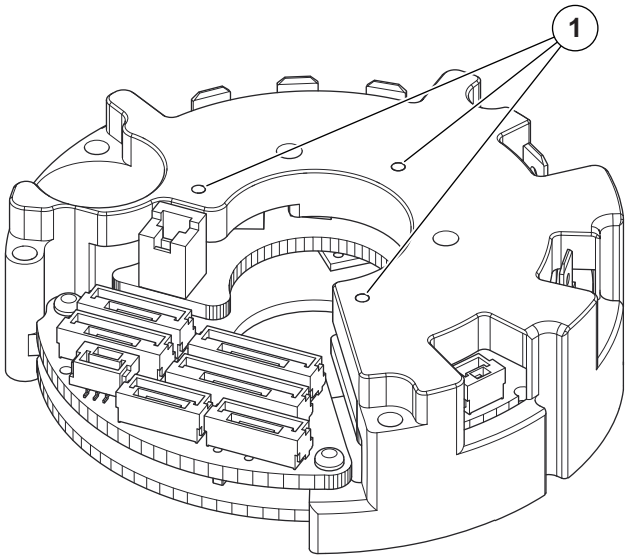

Figure 5.3 Threaded holes on the TUAKA DRIVE (example illustration)

1	Threaded holes

Screws may only be screwed to a limited extent into the marked threaded holes on the DRIVE variant. **A screw connection is not permitted on the SMM variant.**

▶ If a screw connection is needed, contact the manufacturer.

5.3 Electrical installation

⚠ WARNING

Electric shock from live components!

Unsecured voltages on live components can result in life-threatening electric shocks.

- ▶ Only use a protected safety extra-low voltage with electrically safe isolation.
- ▶ Before starting the electrical installation, disconnect the system correctly according to regulations.

NOTE

Material damage due to reverse polarity!

An incorrectly connected power cable can irreparably damage the actuator.

- ▶ Make sure that the power cables are connected correctly.
- ▶ Only use connecting cables designed for the ambient conditions, current strengths, voltages present, EMC and mechanical requirements.
- ▶ Connect the protective conductor to the PE.
- ▶ Only connect and disconnect plug-in connectors when dry or de-energised.

NOTE

Material damage caused by electrostatic discharge (ESD)!

Electrostatic discharge (ESD) can damage the electronics of the actuators.

- ▶ In order to protect the electronics, work on the actuators must always be carried out at ESD-protected workstations.

NOTE

Material damage caused by electromagnetic compatibility (EMC)!

Unwanted electrical or electromagnetic effects can cause malfunctions in the actuator or other components, resulting in material damage.

- ▶ Make sure that cables are routed in compliance with EMC rules.
- ▶ Route signal cables and power cables separately.

The electrical installation is carried out on the actuators. The connected actuators are connected to the overall system.

Use cables with a maximum length of 3 metres (the analogue-in cable must be no longer than 3 metres).

In general, only shielded cables should be used. The DC power supply must always be shielded.

Cables longer than 3 meters can be used for safe digital I/O, but they must be shielded.

The EtherCAT shield in the housing must not be connected to the drive.

Use an EtherCAT connector fitted to the housing or a cable shorter than 3 metres.

5.3.1 Connections on the TUAKA ACTIVE

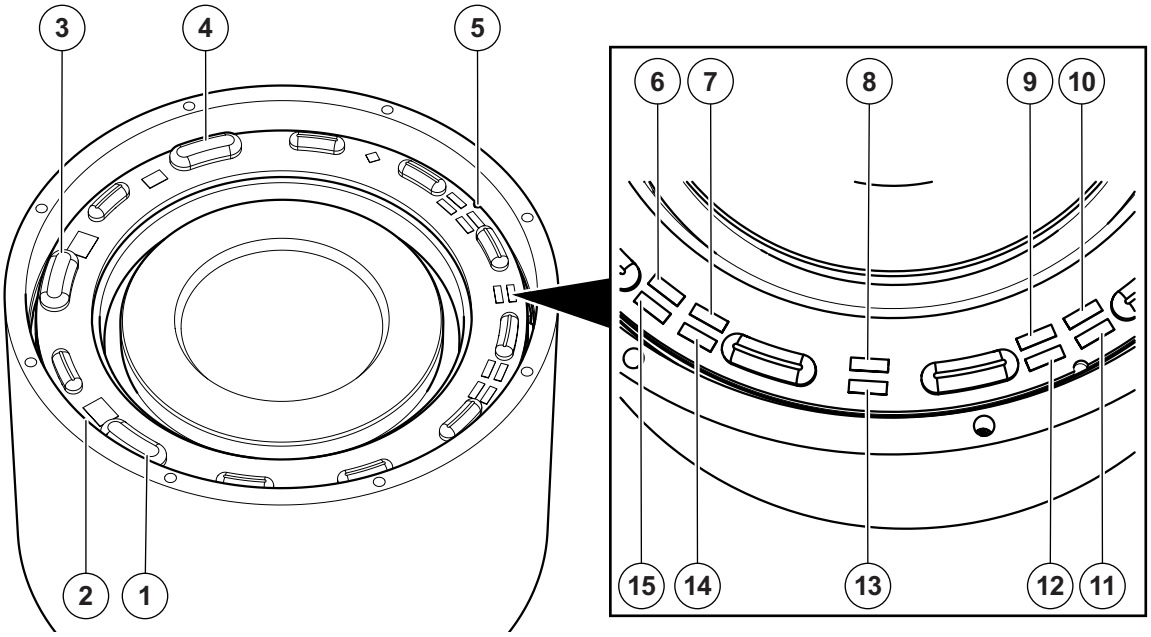

Figure 5.4 Overview of soldering pads on the TUAKA ACTIVE connection board (example illustration)

1	Phase A	9	Temperature sensor 1 signal SP1-1
2	Notch	10	Temperature sensor 2 signal SP2-1
3	Phase C	11	Temperature sensor 2 signal SP2-2
4	Phase B	12	Temperature sensor 1 signal SP1-2
5	Notch	13	5 V power supply
6	Hall sensor signal 3	14	Hall sensor signal 1
7	Shield	15	Hall sensor signal 2
8	GND		

- ▶ Solder the connections to the corresponding soldering pads on the connection board.
- ▶ Always perform soldering work at ESD-protected workplaces in accordance with DIN EN 61340-5-1.
- ▶ Select cable diameters that match the soldering pads. If the cables are bent excessively, soldering pads can tear off.

5.3.2 Connections on the TUAKA SERVO

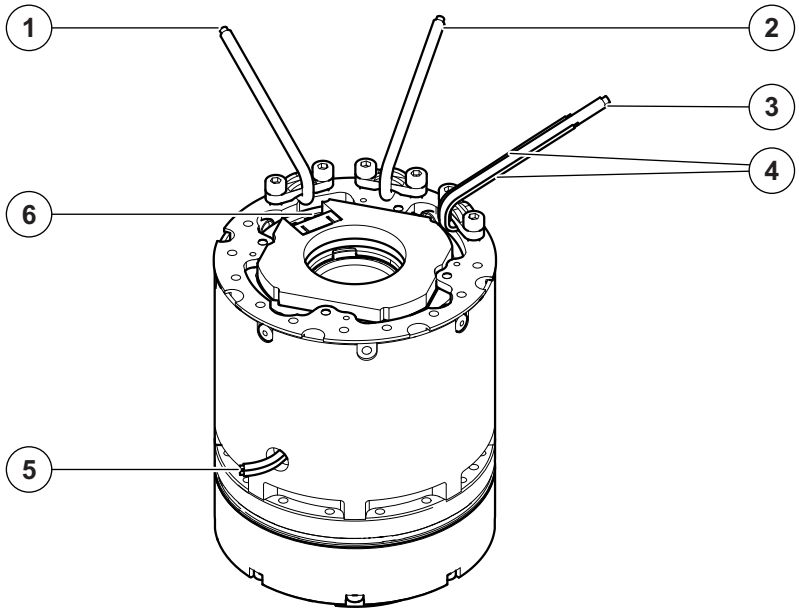

Figure 5.5 Connections on the TUAKA SERVO (example illustration)

1	Phase A	4	Temperature cable
2	Phase B	5	Brake cable
3	Phase C	6	Board connection

▶ Attach the board connections according to the designation below.

▶ Note the pin assignment.

Pin assignment for Heidenhain encoder KCI 1319 – singleturn

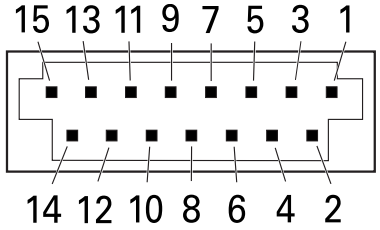

Figure 5.6 Pin assignment for Heidenhain encoder KCI 1319 – view of mating side

Pin	Signal	Description
1	-	not used
2	-	not used
3	-	not used
4	-	not used
5	T+	Temperature
6	T-	Temperature
7	Data	Serial data transmission
8	Data	Serial data transmission
9	Clock	Serial data transmission
10	Clock	Serial data transmission
11	Sensor Up	Supply voltage
12	Sensor 0 V	Supply voltage
13	Up	Supply voltage

Pin	Signal	Description
14	0 V	Supply voltage
15	-	not used

Sensor: The sensor cable is connected to the relevant power supply in the measuring device.

- ▶ Note the earthing requirements stipulated in the manufacturer's specifications.
- ▶ Leave unused pins or wires unassigned.

Pin assignment for Heidenhain encoder KBI 1335 – multiturn (including functional safety)

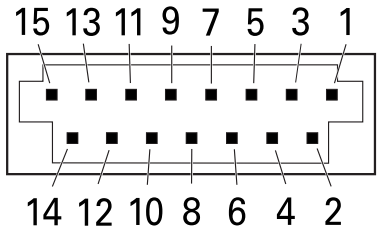

Figure 5.7 Pin assignment for Heidenhain encoder KBI 1335 – view of mating side

Pin	Signal	Description
1	-	not used
2	-	not used
3	-	not used
4	-	not used
5	T+	Temperature
6	T-	Temperature
7	Data	Serial data transmission
8	Data	Serial data transmission
9	Clock	Serial data transmission
10	Clock	Serial data transmission
11	U_{BAT}	External buffer battery (reverse polarity can damage the measuring device)
12	0 V_{BAT}	Supply voltage; connected inside the measuring device
13	Up	Supply voltage
14	0 V	Supply voltage; connected inside the measuring device
15	-	not used

- ▶ Leave unused pins or wires unassigned.

Pin assignment for RLS encoder – AksIM-2

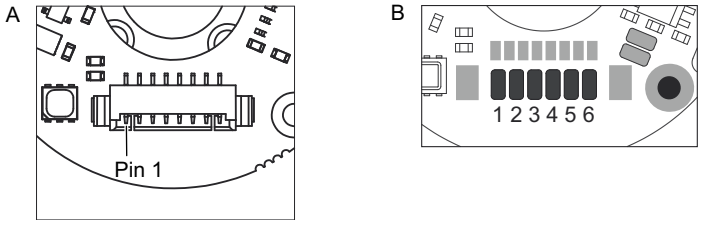

Figure 5.8 Pin assignment for RLS encoder – AksIM-2 – view from above

A	8-pin plug connection	B	Soldering points

Pin	Soldering point	BISS C
1	1	
2	2	
3	-	
4	-	
5	3	MA+
6	4	MA-
7	5	SLO+
8	6	SLO-

- ▶ Leave unused pins or wires unassigned.
- ▶ Solder the wires to the encoder according to IPC-A-610 Class 2 or 3 (or similar).

Pin assignment for SICK encoder

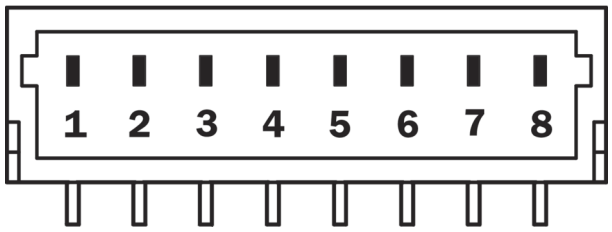

Figure 5.9 Pin assignment for SICK encoder – view of mating side

Pin	Signal	Description
1	U_S	Supply voltage
2	+ SIN	Process data channel
3	REFSIN	Process data channel
4	+ COS	Process data channel
5	REFCOS	Process data channel
6	GND	Ground connection
7	Data +	Parameter channel RS 485
8	Data -	Parameter channel RS 485

The GND connection (0 V) for the supply voltage has no connection to the housing.

5.3.3 Connections on the TUAKA DRIVE

⚠ WARNING

Risk of death and material damage resulting from incorrect attachment of connections!

Attaching the connectors incorrectly can trigger uncontrolled actuator movements and cause serious or even life-threatening injuries or damage to the actuator and the overall system.

▶ Always attach all connections to the board according to the designation.

TUAKA DRIVE is delivered with the phases and temperature sensor already connected.

103

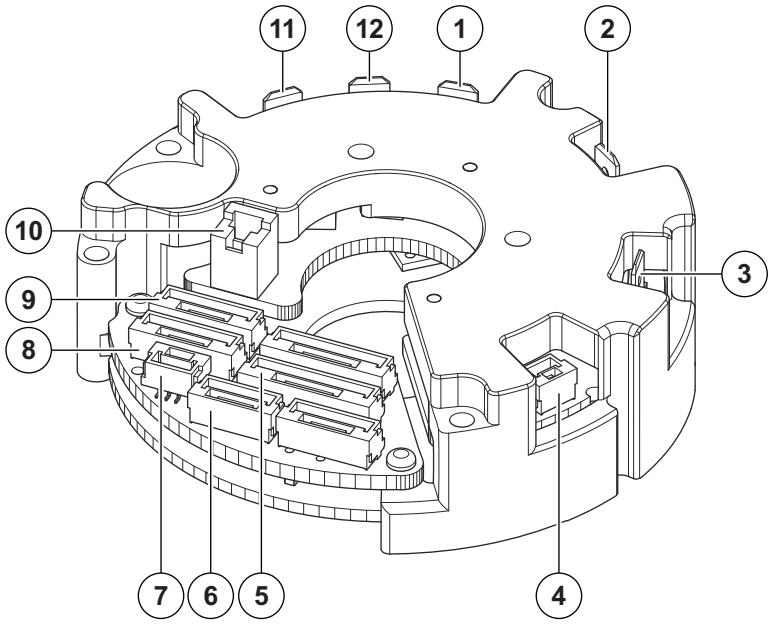

Figure 5.10 Connections on the TUAKA DRIVE (example illustration)

1	Phase C	7	Vacant, do not use
2	Phase B	8	EtherCat/STO-SBC OUT
3	Phase A	9	EtherCat/STO-SBC IN
4	Temperature sensor	10	Brake
5	Digital I/O	11	GND
6	Analogue IN/torque sensor	12	24 - 55 V power supply

▶ Attach all remaining connections to the board according to the designation.

▶ Greyed out connections must not be disconnected.

107

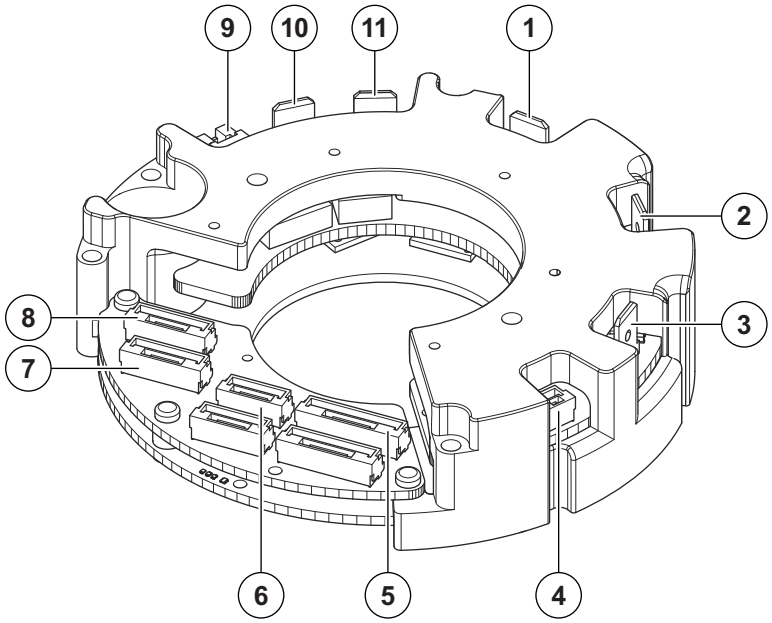

Figure 5.11 Connections on the TUAKA DRIVE (example illustration)

1	Phase C	7	EtherCat/STO-SBC OUT
2	Phase B	8	EtherCat/STO-SBC IN
3	Phase A	9	Brake
4	Temperature sensor	10	GND
5	Digital I/O	11	24 - 55 V power supply
6	Analogue IN/torque sensor		

- ▶ Attach all connections to the board according to the designation.
- ▶ Greyed out connections must not be disconnected.
- ▶ Note the connection overview.
  ➜ *Chap. Figure 5.11 "Connections on the TUAKA DRIVE (example illustration)" page 40*

5.4 Connecting the communication interfaces

Refer to the operating instructions of the master controller (not included in delivery) for information on operation.

5.4.1 Connecting the communication interfaces – TUAKA ACTIVE

Only motor cables are connected to the TUAKA Active.
There are no communication interfaces.

5.4.2 Connecting communication interfaces – TUAKA SERVO

1 Establishing connections to the TUAKA SERVO.
➜ *Chap. 5.3.2 "Connections on the TUAKA SERVO" page 36*

2 Establishing communication with the servo controller.

△ The communication interfaces are connected to the TUAKA SERVO actuator.

5.4.3 Connecting communication interfaces – TUAKA DRIVE

If you plan to connect additional actuators in series, the EtherCat signal must be looped through the driver with the EtherCat IN and then EtherCat OUT connections, and then routed to the next actuator.

1 Connect the communication lines to the control of the overall system.

2 *You can use Synapticon's instructions for installation and set-up or initial operation.*
➜ *„"https://doc.synapticon.com/oblac_drives/oblac_drives_commissioning/index.html"*

△ The communication interfaces are connected to the TUAKA DRIVE actuator.

5.5 Testing and checking the safety system

1 During initial commissioning, operate the actuator without any load.

TUAKA ACTIVE/ TUAKA SERVO:	▶ Use a suitable controller (and master, if necessary) for the commissioning test. (not included in the delivery)
TUAKA DRIVE:	▶ OBLAC software is recommended for the commissioning test. ➜ *"https://doc.synapticon.com/oblac_drives/oblac_drives_commissioning/index.html"*

2 Before switching on the actuator, check for compliance with all safety regulations.

3 Check that the safety systems are functioning properly.

4 Test the safety systems and keep a record of the results.

△ Testing and checking of the security systems is complete.

The following additional documentation is available for the DRIVE variant:
➜ *"https://doc.synapticon.com/resources/system_integration/Synapticon_System_integration_guidelines.pdf"*

5.6 Brake configuration

⚠ WARNING

Risk of death and material damage resulting from a damaged brake cable!

Damage to the actuator brake cable can result in brake failure and serious or even life-threatening injuries or damage to the actuator or the overall system.

- ▶ Protect the brake cable from damage.
- ▶ Inspect the brake cable regularly for damage.

5.6.1 Configuring the brake on the TUAKA ACTIVE and TUAKA SERVO

	Symbol	Unit	103	107
Rated current	I_r	A	0.42	0.56
Power	p	W	2.9	3.9
Static torque	T_stat	Nm	1.15	3.3
Factory engage voltage	U_eng	V	9.5	10.3
Disengage voltage	U_dis	V	1	1
Armature engage time	t_eng	ms	40	40
Armature disengage time	t_dis	ms	20	20
Insulation class	-	-	F	F

5.6.2 Configuring the brake on the TUAKA DRIVE

The brake on the TUAKA DRIVE is already configured.

5.7 Checking the installation

1. Check the machine/robot for the following points:
   - correct installation and alignment
     ➜ *Chap. 5.2.2 "Specified screws and tightening torques" page 30*
   - tight fit of all fastening elements and earthing connections
   - proper connection and functionality of auxiliary and additional equipment
   - secure connection and, if necessary, insulation of communication lines, cable assembly and power connections
2. Where possible, the actuator should be switched on and off without any load.
3. Once the actuator is running smoothly and without unusual noises, apply load to the motor with the machine.
   ▶ In the event of a malfunction, stop the drive immediately and contact Sumitomo.
4. Measure the surface temperature after 10, 20, 30, 60 and 180 minutes.
   ▶ The maximum permitted difference from the ambient temperature must be checked.
   ▶ If the value specified for the relevant actuator type is exceeded, stop the drive immediately and contact Sumitomo.

△ The checks of the installation are complete.

5.8 Commissioning

NOTE
Material damage due to exceeding the device limits! Exceeding the device limits can irreparably damage the actuator. ▶ Prior to commissioning, compare the application requirements with the actuator data and make sure that they are within the specifications.

5.8.1 Commissioning the TUAKA ACTIVE and TUAKA SERVO

▶ During commissioning, observe the currents consumed when the motor is loaded by its working machine. (Any potential overloading and network asymmetries can be identified immediately.)

△ Commissioning of the TUAKA ACTIVE and TUAKA SERVO is complete.

5.8.2 Commissioning the TUAKA DRIVE

The supply voltage should preferably be 48 V DC. Other voltages are permitted, but produce different performance values. The maximum continuous voltage of 55 V DC or peak voltage of 60 V DC must not be exceeded.

The cycle time for TUAKA DRIVE is preset to 1 kHz. The fastest cycle time is 4 kHz (cycle time of the servo controller).

▶ When adjusting the cycle time, the FIR filter (command smoothing of the communication signal) must be adapted accordingly. No FIR filter is required at 4 kHz. The filter can be adapted either via the master controller or using the OBLAC software from Synapticon.
➜ *"https://doc.synapticon.com/software/50/motion_control/advanced_control_options/fir/index.html"*

If the maximum output of the power supply (e.g. maximum current at a certain voltage) varies from the driver specifications, the following applies:

▶ Set the performance limits in the actual driver. (To protect the drive from undersupply.) See also the documentation from Synapticon:
➜ *"https://doc.synapticon.com/software/50/actuator_config/power_limit/index.html"*

▶ If necessary, set upper and lower limits for the voltage and current in the driver.
➜ *"https://doc.synapticon.com/software/50/protection/index.html"*

▶ During commissioning, observe the currents consumed when the motor is loaded by its working machine. (Any potential overloading and network asymmetries can be identified immediately.)

1 Refer to Synapticon's instructions for commissioning.
➜ *"https://doc.synapticon.com/hardware/circulo/index.html"*

2 Fine tune the torque sensor. (If a torque sensor is present, it is delivered fully calibrated.)

▶ Adjust the torque sensor value to the theoretical value.
- If the values differ, an adjustment can be made by changing the offset.
- The offset can also be used to compensate for a constant bending moment.

The internal sensor electronics are designed for the maximum torque of the gearbox. Compensating for an excessive bending moment combined with a high applied torque can cause saturation of the driver's analogue input.

▶ The torque sensor value can be filtered using a moving average filter (0-100 pts.) and a low-pass filter (recommended cut-off frequency > 850 Hz).

If the torque sensor value is filtered excessively, the accuracy decreases and the response time of the sensor signal increases.

△ Commissioning of the TUAKA DRIVE is complete.

6 Manufacturer settings

6.1 Restoring the factory settings

The factory settings can be restored from the OBLAC interface.

1 Open the overview of the corresponding actuator in the OBLAC interface.

2 Press the `tgugv"hcevqt{"ugvvkpiu"`button.

△ The factory settings have been restored.

In addition, a configuration file containing all the preset parameters as well as the individual settings and calibrations is provided for each actuator.

6.2 Mechanical settings and synchronisation

TUAKA is provided according to the ordered hardware configuration (see also previous chapters).

6.3 Software and electrical settings

6.3.1 TUAKA ACTIVE and TUAKA SERVO settings

There are no software settings available for TUAKA ACTIVE and TUAKA SERVO.

6.3.2 TUAKA DRIVE settings

The current software settings are only provided by the manufacturer on request.

It is only possible to check the configurations of the gearbox, engine and brake in expert mode.

Information about settings from Synapticon:
➜ *"https://doc.synapticon.com/circulo/sw5.0/actuator_config/actuator_config.html"*

▶ In the event of a commutation deviation, please follow Synapticon's instructions.
➜ https://www.synapticon.com/documentation/circulo/sw5.0/actuator_config/commutation_offset_detection.html

6.4 Safety-related (setting) parameters

6.4.1 Quick stop

EtherCAT master requires a quick stop command from the drive. The quick stop deceleration time brings the drive to a standstill or can be used to deactivate the drive immediately.

The object to use is 0x605A:0 Quick stop option code. The deceleration must be configured in object 0x6085:0 Quick stop deceleration [default unit mRPM].

6.4.2 End position

Limits can be configured for the actuator's end position. These limits are only effective in Profile position and Profile velocity modes.

They can be configured with the following objects:

- Min position limit: 0x607D:01
- Max position limit 0x607D:02

The status of the STO/SBC can be monitored via the Safety statusword object:

STO status: 0x6621:1

SBC status: 0x6621:2

6.4.3 Thermal protection parameters

The temperature limits and i2t parameters are already preconfigured in DRIVE.

We recommend keeping the i2t configuration, apart for the Enabled option code. This code can be selected to either limit the current to the motor's rated value when i2t is activated and to allow the motor to cool down, or to trigger an error and stop the drive.

i2t can be configured using object 0x200A.

The actuator's temperature is monitored via the External Scaled Measurement object 0x2038:1 and is already preconfigured.

It also has a preconfigured upper threshold of X value. The inverter issues a warning when it reaches 90% of this value and an error when it reaches 100%.

7 Operation

⚠ WARNING

Risk of death and material damage resulting from brake failure!

Excessive braking can cause a thermal overload of the brake and therefore lead to brake failure, which can result in serious or even life-threatening injuries, or damage to the actuator or overall system.

▶ Avoid excessive braking.

NOTE

Material damage resulting from overheating!

The various actuators can overheat due to excessive operation, which may damage the grease layer and actuator.

▶ Avoid overloading the motor.

7.1 Operating modes

The user specifies the operating mode on the overall system (master controller).

The DRIVE controller supports three different control algorithms:

- a torque controller,
- a speed controller and
- a cascade position controller (position and speed cascade).

The DRIVE controller can also be controlled in two different operating modes: either a profile mode, where the trajectories are generated on the DRIVE controller, or a cyclic mode, where the trajectories are generated periodically on the master (the next setpoint value, such as torque, velocity or position, is calculated in each cycle) and also transmitted periodically to the DRIVE controller.

Axles that are not fitted with absolute encoders can use homing mode to restore the position to a previously defined location.

The mode can be changed by setting the object 0x6060.

The different operating modes are described below.

Operating mode	Description
Cyclic mode	In Cyclic mode, the trajectory must be calculated periodically by the master (the next setpoint value, such as torque, velocity or position, is calculated in each cycle). This setpoint value is also transmitted periodically to the DRIVE controller after each calculation step.
Cyclic synchronous torque control (CST)	In CST mode, the master transmits the required torques to the drive.
Cyclic synchronous velocity control (CSV):	In CSV mode, the master transmits the required speeds to the drive.
Cyclic synchronous position control (CSP)	In CSP mode, the master transmits the required positions to the drive.
Profile mode	In Profile mode, the trajectory is calculated on the DRIVE controller. The master specifies the boundary conditions of the trajectory once, and initiates the movement of the actuator by transmitting a start signal to the slave.
Profile position mode	In Profile position mode, the trajectory to a target point is generated on the drive.
Profile velocity mode	In Profile velocity mode, the motor rotates at a target speed.
Profile torque mode	In Profile torque mode, the drive transmits a target torque to the motor.

Operating mode	Description
Homing mode	Homing mode can be used to centre an axle in its current position or to move the axle to an encoder index pulse.
Diagnostics mode	Diagnostics mode is used to execute diagnostic OS commands.

For more details and information on operating modes:
➜ *"https://doc.synapticon.com/circulo/sw5.1/motion_control/operation_modes/operation_modes.html"*

The controller can only switch modes through the Drive State Machine.

➜ *"https://www.synapticon.com/documentation/circulo/sw5.1/canopen_over_ecat.html"*

7.2 Switching the machine on and off

Actuators cannot be operated without a master. The machine can only be switched on and off via the power supply.

7.3 Process or sequence of operations

See instructions and function of CANopen over EtherCAT (CoE).

- Synapticon:
  ➜ *"https://www.synapticon.com/documentation/circulo/sw5.1/canopen_over_ecat.html"*
- Alternative EtherCat homepage:
  ➜ *"https://www.ethercat.org/en/technology.html"*

7.4 Technical performance data

Performance data	Actuator type	100	80	50
peak output torque	ECY 107	157 Nm	137 Nm	98 Nm
	ECY 103	54 Nm	43 Nm	34 Nm
rated output torque	ECY 107	67 Nm	63 Nm	39 Nm
	ECY 103	24 Nm	22 Nm	16 Nm
max. rotation output speed	ECY 107	28 rpm	35 rpm	56 rpm
	ECY 103	62 rpm	77 rpm	23 rpm

8 Inspection, maintenance and cleaning

⚠ DANGER

Risk of death from moving robot arms and machine parts!

When the system is switched on, robot arms and machine parts in the area around the system can move at any time and cause serious or even life-threatening injuries to personnel in the immediate vicinity.

- ▶ Only enter the area around the overall system when switched off.
- ▶ Take appropriate measures to secure the overall system against reactivation and against operation by unauthorised persons.

⚠ WARNING

Electric shock from live components!

Unsecured voltages on live components can result in life-threatening electric shocks.

- ▶ Only use a protected safety extra-low voltage with electrically safe isolation.
- ▶ Before starting the electrical installation, disconnect the system correctly according to regulations.

⚠ WARNING

Risk of death and material damage resulting from insufficient qualification!

Assembly, installation and commissioning require specialist knowledge and must be performed in compliance with applicable regulations. Inadequate qualifications can result in serious or even life-threatening injuries or damage to the actuator or the overall system.

- ▶ Observe all applicable regulations.
- ▶ Only appoint suitably qualified staff to carry out work on the actuator.

Inspection, maintenance and cleaning are intended to maintain the functionality of the actuator and prevent premature wear.

Carry out the following steps before starting maintenance work.

1 Observe the operating manual and instructions for the overall system.

2 Use the control system of the overall system to bring the drive to a controlled standstill.

3 Switch off the power and control voltage.

4 Switch off the main switch of the overall system.

5 Take appropriate measures to secure the overall system against reactivation and against operation by unauthorised persons.

6 Wait for the electrical systems to discharge.

7 Detach all electrical connections.

8 Prior to disassembly, secure the actuator to prevent it from falling or moving.

△ The actuator has been prepared for inspection, maintenance and cleaning.

8.1 Inspection

▶ In order to ensure the proper operating condition of the actuator, carry out the defined inspections at the specified intervals.

Inspection work	Intervals
Clean the housing and cooling elements of the actuators if they are dirty.	weekly
Check the actuator for damage.	monthly
Check the connection cable for damage and replace if faulty.	monthly
Check that the protective conductor connection is in good condition and firmly seated, and replace if faulty.	monthly
Check the mechanical fasteners.	semi-annually

▶ If the actuator is faulty, decommission the system immediately and replace the actuator.

▶ If the cable sheath has even the smallest defect, decommission the system immediately and replace the actuator.

▶ Do not make any temporary repairs.

△ The inspection is complete.

8.2 Maintenance

No maintenance work is required on the actuator.

▶ Do not perform any maintenance work.

8.3 Cleaning

NOTE

Damage caused by static charging!

When cleaning the actuator, electrostatic charging may occur due to a lack of earthing, which may damage the control electronics and sensors as a result.

▶ Only clean the actuator with proper earthing.

Excessive dirt, dust or chips can negatively affect the function of the actuators and even cause them to fail in extreme cases. In order to ensure that the heat radiation surface is large enough, regular inspections and cleaning are necessary.

▶ If necessary, clean the housing and cooling elements of the actuators.

  ▶ Use a clean, dry, lint-free cleaning cloth or brush.

  ▶ Only use antistatic cleaning cloths and brushes.

△ Cleaning is complete.

9 Troubleshooting, fault elimination and repair

⚠ WARNING

Risk of death and material damage resulting from insufficient qualification!

Troubleshooting and fault elimination must be performed in compliance with the applicable regulations for the overall system and in accordance with the operating manual.
Inadequate qualifications can result in serious or even life-threatening injuries and damage to the TUAKA product or the overall system.

- ▶ Observe all applicable local regulations.
- ▶ Observe the operating manual.
- ▶ Only allow suitably qualified staff to carry out troubleshooting and fault elimination tasks.

The following table is intended to assist with troubleshooting and fault elimination.

- ▶ If a fault cannot be rectified, contact Sumitomo customer service.
  ➜ *Chap. 11.2 "Customer service" page 55*

Fault	Cause	Remedy
Damage to the cable connections	Transportation or frequent insertion and removal of the cable connections used can cause damage to the cable or the plug-in connectors (crimp).	▶ Check cable for breaks and replace, if necessary. ▶ Check connectors on cables and replace crimp, if necessary. ▶ Do not mix up the power connections (phase and GND) on the DRIVE.
STO connection not OK	If the STO is not connected and a 24 V supply is not available, the Circulo switches to a safe state and cannot rotate.	▶ Check and ensure the integrity of the STO connection.
Overheating	The temperature of the actuator on the gearbox housing must not exceed 60°C, otherwise the gearbox will be damaged (see also gearbox data sheet).	▶ Check the temperature and if necessary, ensure that the cooling unit is operational.
Gearbox damage	Modifying the default settings in the DRIVE controller (e.g. gear ratio, motor data, etc.) may damage the actuator. Any modifications you make are at your own risk.	▶ The default settings should remain unchanged. ▶ If any of the settings have been modified or deleted, inform the manufacturer immediately so that the product can be restored to an operational state.
Driver damage	Operating voltage out of specification.	▶ Operating voltage must be within the specifications (min. 14 V DC, nominal 24 to 55 V DC).
High noise levels	Controller with a cycle time > 1 ms.	▶ Set the cycle time to < 1 ms.
Product does not run smoothly	Driver not tuned correctly.	▶ Retune the driver.
PhOvUvOt error	Voltage too high during generator operation.	▶ Install braking chopper.
Multiturn error	Unpowered movement or loss of information.	▶ Relearn position information.

In the DRIVE variant, the Error Report Object provides further information about the error or warning indicated by error code object 0x603F.

For further details and information about Error Report Objects:

➜ *"https://doc.synapticon.com/circulo/sw5.0/errors_warnings/error_report_object.html"*

10 Decommissioning, disassembly and disposal

10.1 Decommissioning

⚠ WARNING

Risk of death from uncontrolled movements!

The overall system can move in all directions at any time during operation. As a result, there is the possibility of life-threatening injuries.

- ▶ Switch off the overall system before starting work on the actuators.
- ▶ Always switch off and secure the overall system before entering the area around it.
- ▶ Only authorised qualified staff are permitted to decommission the actuators.

Decommissioning may only be carried out by authorised qualified staff in conjunction with the overall system.

Carry out the following steps before starting the decommissioning process.

1. Observe the operating manual and instructions for the overall system.
2. Use the control system of the overall system to bring the drive to a controlled standstill.
3. Switch off the power and control voltage.
4. Switch off the main switch of the overall system.
5. Take appropriate measures to secure the overall system against reactivation and against operation by unauthorised persons.
6. Wait for the electrical systems to discharge.
7. Detach all electrical connections.

△ Decommissioning of the actuator is complete.

10.2 Disassembly

⚠ CAUTION

Risk of burns from hot surfaces!

The surface temperature of the actuators can exceed 60-70°C during operation. Touching hot surfaces can cause skin burns.

- ▶ Do not touch hot surfaces.
- ▶ Allow the actuator to cool to ambient temperature.
- ▶ Wear personal safety equipment.

NOTE

Material damage resulting from lack of expertise!

Disassembling the actuators without appropriate specialist knowledge can cause irreparable damage.

- ▶ Only authorised qualified staff are permitted to disassemble the actuators.

1. Carry out decommissioning. ➜ *Chap. 10.1 "Decommissioning" page 53*
2. Prior to disassembly, secure the actuator against falling or uncontrolled movements.
3. Detach all electrical connections and communication lines from the actuator.
4. Unscrew the actuator from the overall system.

△ Disassembly of the actuator is complete.

▶ No other disassembly work is required.

10.3 Disposal

⚠ WARNING

Risk of injury and illness from chemicals!

Lubricants coming into contact with the skin, eyes or lungs can cause injury and illness.

- ▶ When handling lubricants, observe the personal and environmental safety regulations included in the safety data sheets accompanying the products.
- ▶ Wear personal safety equipment.

NOTE

Environmental damage caused by improper disposal!

Improper disposal can cause lasting damage to the environment.

- ▶ Ensure proper and environmentally-friendly disposal.
- ▶ Appoint a specialist company to dispose of the product correctly.
- ▶ Observe national guidelines and local regulations for disposal.
- ▶ If materials are not suitable for recycling, dispose of them correctly.
- ▶ If you have any questions, please contact the customer service department of Sumitomo (SHI) Cyclo Drive Germany GmbH.

The actuators contain different raw materials that can be disposed of separately and recycled sustainably.

At the end of its service life, the actuator must be disposed of correctly. The materials used must be disposed of separately.

1 Decommission the overall system.

- ▶ Follow the instructions of the operator of the overall system.

2 Disconnect the overall system and actuators as prescribed and secure them against reactivation.

3 Collect any used oil and lubricants.

4 Collect all metal actuator parts.

5 Collect all electrical parts.

6 Collect any materials that are not suitable for recycling.

7 Dispose of all components and operating materials separately and as intended.

△ Disposal of the actuator is complete.

11 Spare parts and customer service

11.1 Ordering spare parts

NOTE
Material damage resulting from lack of expertise! The use of non-approved spare parts may compromise safety. Original spare parts are required to ensure proper operation and an adequate level of safety. The use of other parts can invalidate liability for any subsequent consequences. ▶ Always use original spare parts or spare parts approved by Sumitomo (SHI) Cyclo Drive Germany GmbH.

Spare parts must be ordered from the customer service department.

➜ *Chap. 11.2 "Customer service" page 55*

▶ Please have the following information ready when ordering spare parts:

- Name and position of the spare part
- Serial number ➜ *Chap. 1.2 "Product identification and nameplate" page 7*

11.2 Customer service

You can contact the customer service department using the following contact details:

Tel.: + 49 8136 66-0

Email: SCG.service@shi-g.com

12 Index

A
Abbreviations 8
Assembly 28
Auxiliary equipment 29
B
Basic safety instructions 11
C
Checking the installation 43
Cleaning 49, 50
Commissioning 28, 43
D
Danger areas 15
Decommissioning 53, 55
Designated use 20
Dimensions and technical data
TUAKA ACTIVE 21
TUAKA DRIVE 24
TUAKA SERVO 22
Disassembly 53
Disposal 54
E
Emergencies 15
Environmental protection 15
F
Fault elimination 51
Fitting the actuator 32
Foreseeable misuse 20
I
Images used 8
Inspection 49, 50
Installation 28
Installation location 29
L
Lifetime 20
M
Maintenance 49, 50
Manufacturer settings 45
Mechanical cooling unit 33
Mechanical installation 29
N
Nameplate 7
Notes on the operating manual 6
O
Operating environment 20
Operating modes 47
Operation 47
Ordering 55
P
Performance data 48
Personnel requirements 10
Process or sequence of operations 48
Product description 16
Product identification 7
Product overview 16
Q
Qualification 10
R
Recycling 54
Repair 51
S
Safety 9
Safety devices 15
Safety equipment 10
Safety instructions
Description 9
Storage 27
Structure and function
TUAKA ACTIVE 17
TUAKA DRIVE 19
TUAKA SERVO 18
Symbols 8
T
Target group 6
Testing and checking the safety system 41
Text markings 8
Tightening torques 30
Tools 29
Transport 26
Troubleshooting 51
U
User instructions 6
V
Validity of the operating manual 6
W
Warnings
Description 9
Hazard classification 9
Presentation and structure 9

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