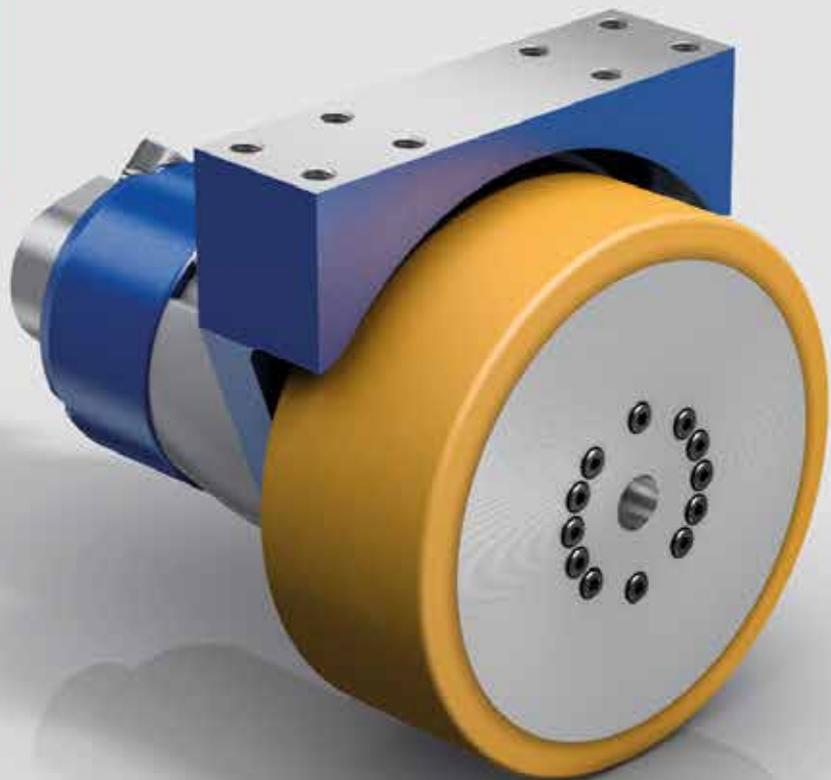


Operating Manual

TAS Drive actuator for automated guided vehicles



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Operating Manual - English

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Contents

1	About this manual	3			
1.1	Signal words	3			
1.2	Safety symbols	4			
1.3	Design of the safety instructions	4			
1.4	Information symbols	4			
2	Safety	5			
2.1	Dangers	5			
2.2	Personnel	5			
2.3	Intended use	5			
2.4	Reasonably foreseeable misuse	6			
2.5	Guarantee and liability	6			
2.6	General safety instructions	7			
2.7	Safety signs	8			
3	Description of the TAS drive actuator	9			
3.1	Identification plate	10			
3.2	Ordering code	11			
3.3	Performance statistics	11			
3.4	Weight	11			
4	Transport and storage	12			
4.1	Scope of delivery	12			
4.2	Packaging	12			
4.3	Transport	12			
4.4	Storage	12			
4.4.1	Short period of storage	12			
4.4.2	Long-term storage	13			
4.5	Running in after long-term storage	13			
4.6	Handling	13			
5	Assembly	14			
5.1	Preparations	14			
5.2	General information on the installation/mounting of the drive actuator	14			
5.2.1	Installation/mounting of the drive actuator in the Advanced Load or Performance package	15			
5.2.2	Installation/mounting of the drive actuator in the Compact or Advanced Speed package	15			
5.3	Removal and mounting of the pre-assembled drive wheel	15			
5.4	Mounting a third-party drive wheel	16			
5.5	Installing the electrical connections	16			
6	Startup and operation	17			
6.1	Safety instructions and operating conditions	17			
6.2	Data for electrical startup	17			
7	Maintenance and disposal	18			
7.1	Maintenance work	18			
7.1.1	Refreshment of service brake	18			
7.1.2	Visual inspection	19			
7.1.3	Checking the tightening torques	20			
7.1.4	Cleaning	20			
7.2	Maintenance schedule	21			
7.3	Information on the lubricant used	22			
7.4	Disposal	22			
8	Malfunctions	23			
9	Appendix	25			
9.1	Information for mounting with connection	25			
9.2	Information for mounting without connection	25			
9.3	Information on the attachment of the drive wheel	25			
9.4	Tightening torques for common thread sizes in general mechanical engineering	26			
9.5	Technical specifications	26			
9.5.1	Motor specifications TAS 24V	26			
9.5.2	Motor specifications TAS 48V	27			
9.5.3	Technical specifications of the motor feedback	28			
9.5.4	Technical specifications of the service brake	28			
9.5.5	Pin assignment 4 – TAS 004	30			
9.5.6	Pin assignment 4 – TAS 010	31			
9.5.7	Pin assignment S – TAS 025	32			
9.5.8	Pin assignment 1 – TAS 050	33			

1 About this manual

This operating manual contains necessary information for the safe operation of the drive actuator. If this manual is supplied with an amendment (e.g. for special applications), the information in the amendment is valid. Contradictory specifications in this manual are therefore void.

The user should contact **WITTENSTEIN cyber motor GmbH** with any questions about special applications. The owner must ensure that this operating manual is read and fully understood by all persons assigned to install, operate, or maintain the drive actuator.

Store the manual within reach of the drive actuator. Inform colleagues who work in the area around the machine of the safety instructions so that no one is hurt.

The original manual was created in German; all other language versions are translations of this manual.

1.1 Signal words

The following signal words are used to indicate possible hazards, prohibitions, and important information:

	⚠ DANGER
	This signal word indicates an imminent danger that will cause serious injuries or even death.
	⚠ WARNING
	This signal word indicates a potential hazard that could cause serious injuries and even death.
	⚠ CAUTION
	This signal word indicates a potential hazard that could cause minor or serious injuries.
	NOTICE
	This signal word indicates a potential hazard that could lead to property damage.
	A note without a signal word indicates application hints or especially important information for handling the drive actuator.

1.2 Safety symbols

The following safety symbols are used to indicate possible hazards, prohibitions, and important information:

		
General danger	Hot surface	Suspended loads
		
Entanglement	Electric voltage	Flammable
		
Electrostatically sensitive device	Environmental protection	Information

1.3 Design of the safety instructions

The safety instructions in this manual are designed according to the following pattern:

	⚠ CAUTION
	<p>Explanatory text describes the consequences of not complying with the instructions.</p> <ul style="list-style-type: none"> Instructional text describes directly which measures have to be taken.

1.4 Information symbols

The following information symbols are used:

- Indicates an action to be performed
- Ü Indicates the results of an action
- i Provides additional information on handling

2 Safety

This operating manual, especially the safety instructions, and the rules and regulations valid for the operating site, must be observed by all persons working with the drive actuator. In addition to the safety instructions in this manual, also observe any generally applicable environmental and accident prevention rules and regulations (e.g. personal safety equipment).

2.1 Dangers

The drive actuator has been constructed according to current technological standards and accepted safety regulations.

To avoid danger to the operator or damage to the machine, the drive actuator may only be used as intended (see Chapter 2.3 "Intended use") and in a technically flawless and safe state. Read the general safety instructions before beginning work (see Chapter 2.6 "General safety instructions").

2.2 Personnel

Only persons who have read and understood this operating manual may carry out work on the drive actuator.

2.3 Intended use

The drive actuator is designed to be installed in or connected to the following machines, incomplete machines or equipment:

- Movable machines, not intended for road use and only provided for professional (industrial) use.

In particular the following points must be observed:

- The drive actuator must be controlled by a servo controller.
- The drive actuator must not be used in applications with special environmental conditions e.g. vacuum, potentially explosive atmospheres, in food production, clean room or areas with radioactive contamination.
- Observe also Chapter 7.3 "Information on the lubricant used".
- For risk-free operation, required safety devices have to be present, properly installed, and fully functional. They may not be removed, changed, bypassed, or rendered ineffective.

In case of an emergency shutdown, power failure and or damage to the electrical equipment, the drive actuator must be:

- switched off immediately,
- secured against uncontrolled re-activation,
- secured against uncontrolled after-running.
- The installed brake may only be utilized in emergency stop situations for braking the running drive actuator.

2.4 Reasonably foreseeable misuse

Any use that deviates from the approved technical data (e.g. speed, force, torque, temperature) is not use as intended and is therefore not permitted.

In particular the following applications are not permitted:

- Conveying persons.
- Operation of the drive actuator without properly installing it in or connecting it to other machines or other partly completed machinery or equipment.
- Operation of the drive actuator in a defective state.
- Operation of the drive actuator, without determining that the machine in which it is to be installed complies with the provisions of the Machinery Directive 2006/42/EC.
- Operation of the drive actuator in a potentially explosive environment.
- Assembly of the drive actuator without prior acknowledgment of the operating / assembly manual.
- Operation of the drive actuator without legible warning and information signs.
- Use of improper lubricants.
- Use of unsuitable servo controllers.
- Use in improper installation, operating, performance and ambient conditions.
- Attaching drives that are critical to safety to the drive actuator.
- Assembly of the drive actuator by insufficiently competent personnel.

2.5 Guarantee and liability

Any of the following will render void guarantee and liability claims for personal injury or material damage:

- Ignoring the information on transport and storage
- Improper use (misuse)
- Improper or neglected maintenance and repair
- Improper assembly/disassembly or improper operation (e.g. test run without secure attachment)
- Operation of the drive actuator with defective safety devices or equipment
- Operation of the drive actuator without lubricant
- Operation of a heavily soiled drive actuator
- Modifications or reconstructions that have been undertaken without written approval of **WITTENSTEIN cyber motor GmbH**.

2.6 General safety instructions

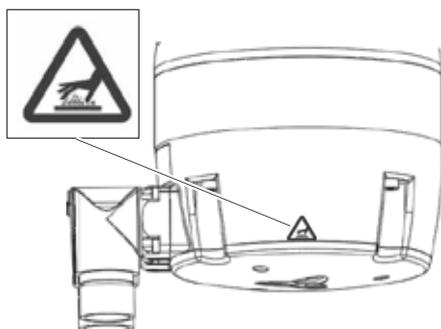
	<p style="text-align: center;">⚠ DANGER</p> <p>Faulty electrical connections or unapproved, current-carrying components can cause serious injuries and even death.</p> <ul style="list-style-type: none"> • Have all electrical connection work performed by qualified technicians only. • Immediately replace damaged cables or plugs.
	<p style="text-align: center;">⚠ WARNING</p> <p>During generator operation, voltage is induced. This can lead to lethal current surges.</p> <ul style="list-style-type: none"> • Ensure that no plugs and connections are exposed during generator operation.
	<p style="text-align: center;">⚠ WARNING</p> <p>Objects flung out by rotating components can cause serious injuries.</p> <ul style="list-style-type: none"> • Remove objects and tools from the drive actuator before putting it into operation.
	<p style="text-align: center;">⚠ WARNING</p> <p>Rotating components on the drive actuator can pull in parts of the body and cause serious injuries and even death.</p> <ul style="list-style-type: none"> • Keep a sufficient distance to rotating machine components while the drive actuator is running. • Secure the machine against restarting and unintentional movements during assembly and maintenance work (e.g. uncontrolled lowering of lifting axes).
	<p style="text-align: center;">⚠ CAUTION</p> <p>Hot drive actuator housing can cause serious burns.</p> <ul style="list-style-type: none"> • Touch the drive actuator housing only when wearing protective gloves or after the drive actuator has been idle for some time.
	<p style="text-align: center;">NOTICE</p> <p>Loose or overloaded screw connections can damage the drive actuator.</p> <ul style="list-style-type: none"> • Always use a calibrated torque wrench to tighten and check all screw connections for which a tightening torque has been specified.

	⚠ WARNING
	<p>Lubricants are flammable.</p> <ul style="list-style-type: none"> • Do not spray with water to extinguish. • Suitable extinguishing agents are powder, foam, water mist, and carbon dioxide. • Observe the safety instructions of the lubricant manufacturer.

	⚠ CAUTION
	<p>Solvents and lubricants can cause skin irritations.</p> <ul style="list-style-type: none"> • Avoid direct skin contact.

	<p>Solvents and lubricants can pollute soil and water.</p> <ul style="list-style-type: none"> • Use and dispose of cleaning solvents and lubricants properly.
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2.7 Safety signs



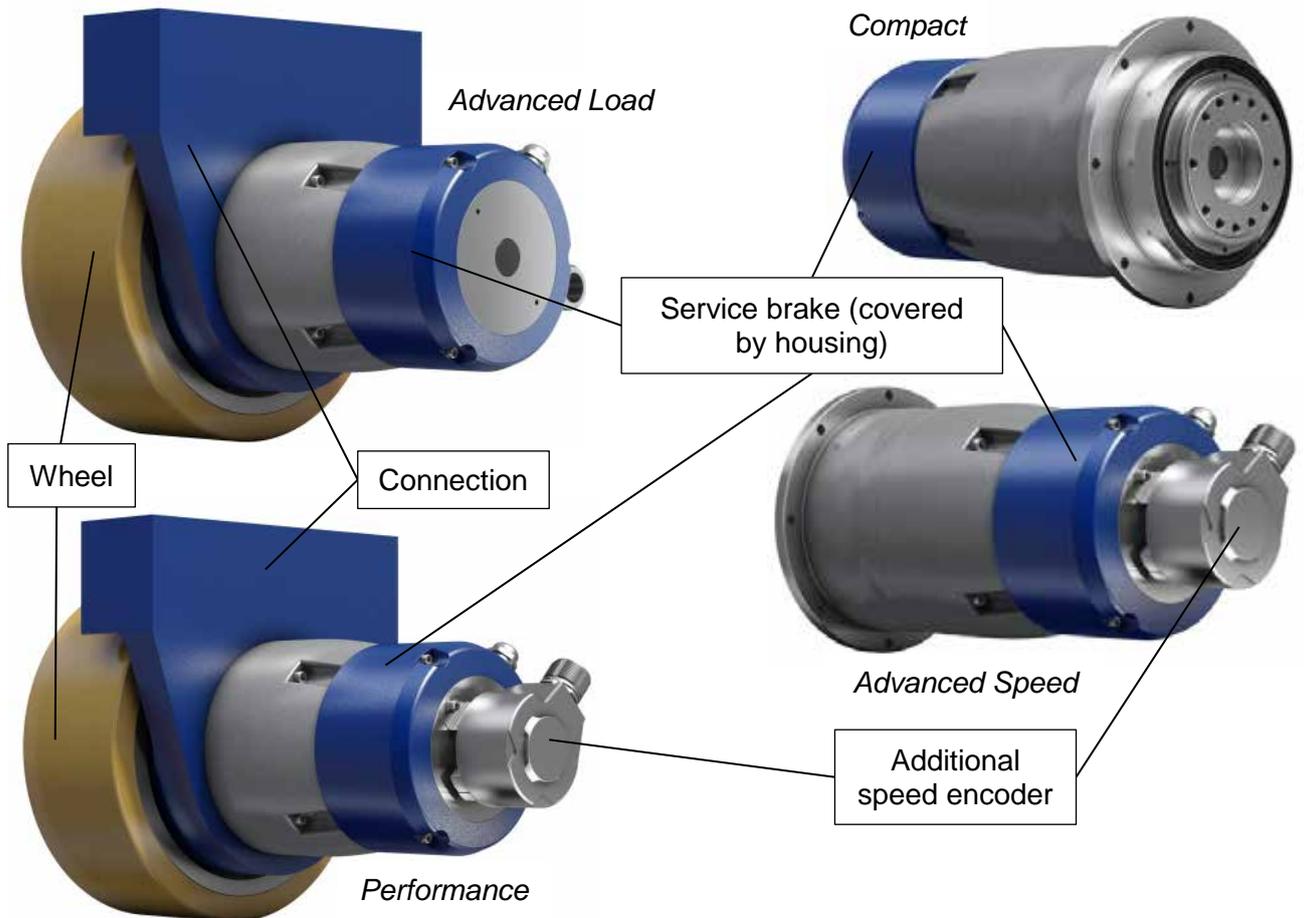
There is a safety sign on the drive actuator housing that warns against hot surfaces. This safety sign must not be removed.

3 Description of the TAS drive actuator

The TAS drive actuator is a combination of a low-backlash planetary gearhead, an AC synchronous servo motor, a service brake as well as additional, industry-specific components. The following is a description of the configurations depending on the package as well as all relevant components.

Package	Identification	Service brake	Wheel	Connection	Additional speed encoder
Compact	TAS_xxxC-x...	Yes	No	No	No
Advanced Load	TAS_xxxL-x...	Yes	Yes	Yes	No
Advanced Speed	TAS_xxxS-x...	Yes	No	No	Yes
Performance	TAS_xxxP-x...	Yes	Yes	Yes	Yes

Table 1



3.1 Identification plate

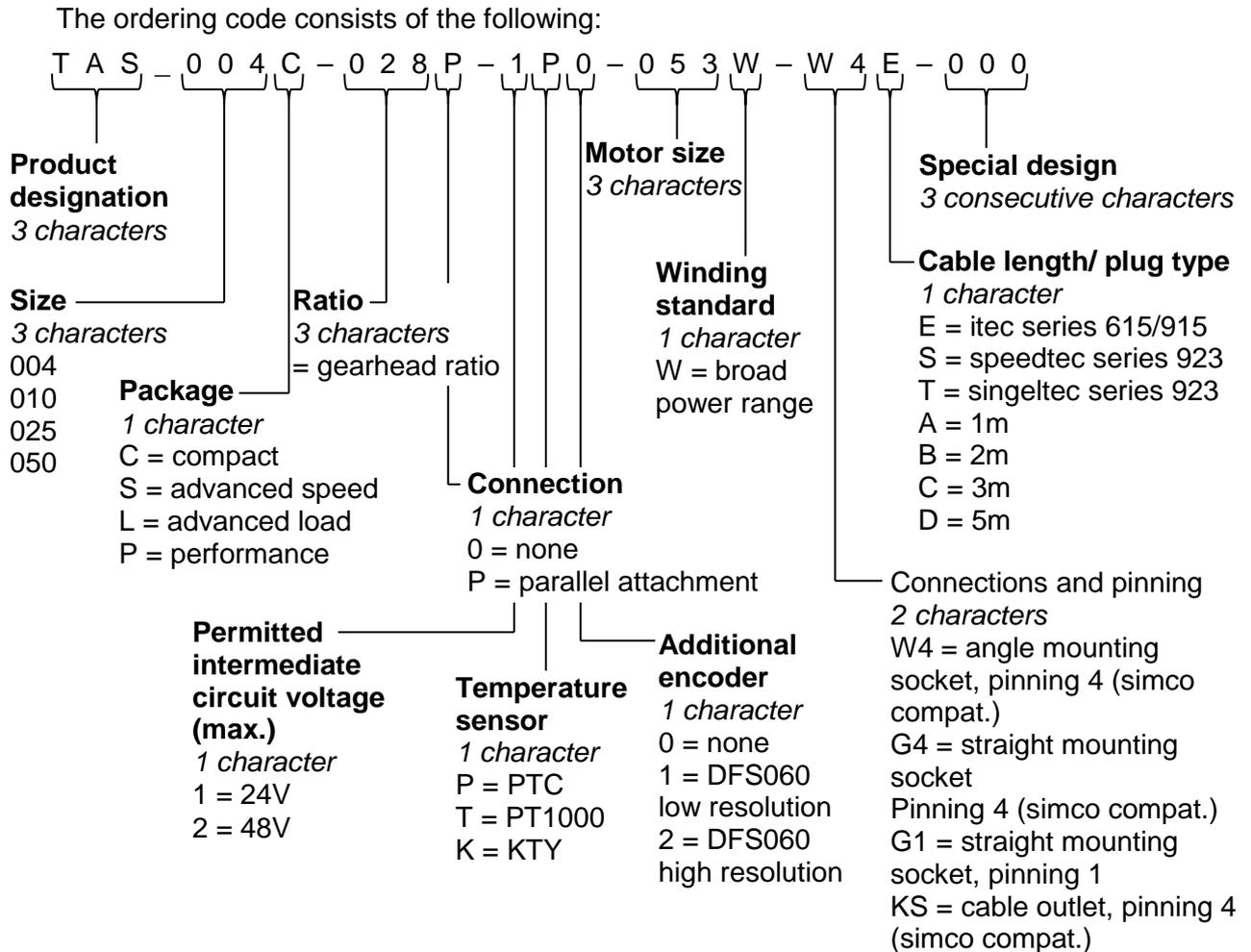
The identification plate is attached to the housing of the drive actuator. The identification plate shown contains sample values.

C		D		E		A		F		N		P		B		L					
				WITTENSTEIN cyber motor GmbH - Walter Wittenstein Str. 1 - D-97999 Igersheim																	
Typ: TAS 010P-031P-1K1-064W-W4S-000										AC: 40028256											
UD [V]: 24		M20 [Nm]: 22		M2B [Nm]: 85		M1max [Nm]: 3,1		n1max [rpm]: 5412		Class: F		Pos: xxx									
ID [Arms]: 20,0		Imax [Arms]: 60,0		Ubrake [V]: 24		Ratio: 31		n2max [rpm]: 175		Date: KW/JJ		IP: 65									
Lubrication: Oil OPTIG. SYNT. 800/220								Serial No.: xxxxxxx													
Drive: xxxxxxx				Material No.: xxxxxxx																	
Back EMF		Inverter Duty / PWM				Constant Torque (CT)															
G		Q		K		H		I		T		J		S		M		R		O	

	Designation		Designation
A	Ordering code (see 3.2 "Ordering code")	K	Lubrication
B	Material number / article code (MN/AC)	L	Mounting position
C	Intermediate voltage	M	Max. speed
D	Continuous stall torque at gear output	N	Max. speed of the motor
E	Max. acceleration torque at the gear output	O	Protection class
F	Max. acceleration torque of the motor	P	Insulation class
G	Continuous stall current of the motor	Q	Servo converter
H	Max. acceleration current of the motor	R	Production date
I	Brake voltage	S	Serial number
J	Gearhead ratio	T	Material number (customer)

Table 2

3.2 Ordering code



3.3 Performance statistics

For reliable operation, we recommend following the specifications in our technical data sheet. In addition, we are happy to provide support in achieving the targeted dimensioning of the overall drive train. Further information can be found in chapter 9.5 "Technical specifications".

3.4 Weight

The weights of all sizes and packages are specified in the following table in [kg]. The actual weight may deviate by up to 10% due to variations in components.

Size \ Package	Compact	Advanced Speed	Advanced Load	Performance
TAS 004	2.9	10.1	3.1	10.3
TAS 010	5.7	13.9	5.9	14.1
TAS 025	10.4	19.0	10.6	19.2
TAS 050	24.0	39.3	24.2	39.5

Table 3

4 Transport and storage

4.1 Scope of delivery

- Check the completeness of the delivery against the delivery note.
- i Immediately notify the carrier, the insurance company, or **WITTENSTEIN cyber motor GmbH** in writing of any missing parts or damage.

4.2 Packaging

The drive actuator is delivered packed in foil and cardboard boxes.

- Dispose of the packaging materials at the recycling sites intended for this purpose. Observe the applicable national regulations concerning disposal.

4.3 Transport

	NOTICE
	<p>Hard knocks, for instance because of falling or hard dropping, can damage the drive actuator.</p> <ul style="list-style-type: none"> · Only use hoisting equipment and lifting accessories with sufficient capacity. · The maximum permissible load of a hoist may not be exceeded. · Lower the drive actuator slowly.

	⚠ WARNING
	<p>Suspended loads can fall and can cause serious injuries and even death.</p> <ul style="list-style-type: none"> · Do not stand under suspended loads.

4.4 Storage

Store the drive actuator in horizontal position and dry surroundings at a temperature of 0 °C to + 30 °C in the original packaging. Store the drive actuator for a maximum of 5 years. For storage logistics, we recommend the "first in - first out" method.

4.4.1 Short period of storage

A short period of storage is regarded as storing the actuator for a few minutes up to 12 months. During this period, store the motor in a horizontal position at a temperature of +5 °C to + 40 °C in the original packaging. The surroundings must be dry, free of dust and not subject to vibrations; it has a low air humidity and low temperature gradients, so that no condensation occurs on the actuator (see Chapter 6.1 "Safety Instructions and Operating Conditions"). The storage area must also not be subject to aggressive media, such as exhausts from vehicles or gases, mist, acidic aerosols, aerosols of acids, alkaline solutions or salts.

For storage logistics, we recommend the "first in - first out" method.

4.4.2 Long-term storage

Long-term storage includes periods from 1 year to 10 years.

The basic precondition for long-term storage is a closed, dry, dust-free storage room not subject to vibrations and not subject to aggressive media, such as exhausts from vehicles or gases, mist, acidic aerosols, aerosols of acids, alkaline solutions or salts.

The actuators must be stored in a horizontal position (horizontal axial direction).

The following conditions must be fulfilled:

1. Minimum air temperature of + 5 °C.
2. Maximum air temperature of + 25 °C.
3. Maximum relative humidity of 65%.
4. Maximum absolute air humidity of 10 g/m³.
5. Maximum temperature change speed of 0.1 °C/min.
6. Minimum air pressure of 70 kPa.
7. Maximum air pressure of 106 kPa.
8. No direct sunlight. Maximum total solar irradiance of 50 W/m².
9. No biological environmental influences.
10. No chemically active environmental influences.

Temperature and air humidity must be permanently monitored. This may be done by a data logger. The measurements must not be more than 1 hour apart. At least 2 measuring points must be selected: The highest point and the deepest point close to the exterior wall at which the actuator can be stored.

4.5 Running in after long-term storage

After long-term storage, running in of the actuator in accordance with the following defined requirement is mandatory. Otherwise the actuator may be damaged after a short period of operation. The actuator guarantee will also be void.

The following running-in procedure after long-term storage must be carried out on drive electronics with speed regulation while the actuator is not subject to load and the axial direction is horizontal. Ensure the actuator is adequately secured. Cooling is not required:

- | | | |
|-------------------------|--------------------|----------------|
| 1. Run clockwise | with 10% n_{max} | for 10 minutes |
| 2. Run counterclockwise | with 10% n_{max} | for 10 minutes |
| 3. Run clockwise | with 25% n_{max} | for 6 minutes |
| 4. Run counterclockwise | with 25% n_{max} | for 6 minutes |
| 5. Run clockwise | with 50% n_{max} | for 3 minutes |
| 6. Run counterclockwise | with 50% n_{max} | for 3 minutes |
| 7. Run clockwise | with n_{max} | for 3 minutes |
| 8. Run counterclockwise | with n_{max} | for 3 minutes |

If the running-in procedure after long-term storage is not carried out on the actuator, the ball bearings on both sides may be damaged during operation, which significantly reduces the life of the ball bearings and can lead to failure of the actuator.

If the running-in procedure after long-term storage is not carried out on the actuator, the actuator guarantee is void. (see Chapter 2.6 "Guarantee and liability")

4.6 Handling

Handling of the drive actuator must be done in such a way that no force is exerted on any additional speed encoder installed (see Chapter 3 "Description of the TAS drive actuator"). Thus for example it is not permitted to lift the drive actuator by the additional speed encoder. Non-conforming handling can negatively affect the correct function of the additional encoder and even lead to failure of the encoder.

5 Assembly

- Read the general safety instructions before beginning work (see Chapter 2.6 "General safety instructions").

5.1 Preparations

	NOTICE
	<p>Many electronic components are sensitive to electrostatic discharge (ESD). This particularly concerns integrated circuits (IC), semiconductors, resistors with a tolerance of less than one percent as well as transistors and other components such as encoders.</p> <ul style="list-style-type: none"> • Work only at ESD-compliant work sites. • Always wear a tested anti-static wrist band, a protective coat and suitable shoes or overshoes. • Never touch the components by their connectors or feed lines. • Never lift the drive actuator by the additional speed encoder. • Avoid the use of plastic tools and plastic component parts.

	NOTICE
	<p>Compressed air can damage the drive seals of the drive actuator.</p> <ul style="list-style-type: none"> • Do not use compressed air to clean the drive actuator.

- Clean/de-grease the connection flange of the drive actuator with a clean, lint-free cloth and a grease-dissolving, non-aggressive cleaning agent.
- Dry all fitting surfaces to neighboring components in order to achieve the proper friction values of the screw connections.
- Check the fitting surfaces additionally for damage and impurities.

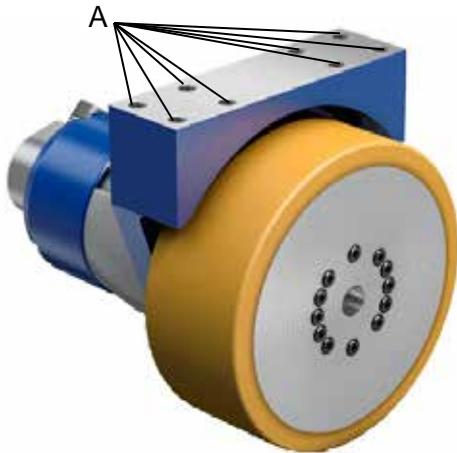
5.2 General information on the installation/mounting of the drive actuator

	<p>The drive actuator is intended to be mounted in a horizontal position. The quantity of lubricant has been determined for this mounting position. The mounting position and the lubricant that has been filled in are indicated on the identification plate (see Chapter 3.1 "Identification plate").</p> <ul style="list-style-type: none"> • Mount the drive actuator only in the specified mounting position and with the recommended screw dimensions and strengths.
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	<ul style="list-style-type: none"> • Observe the safety and processing instructions for the threadlocker to be used.
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5.2.1 Installation/mounting of the drive actuator in the Advanced Load or Performance package

This chapter relates to drive actuators whose packages contain the connection. (See in this regard Chapter 3 "Description of the TAS drive actuator")

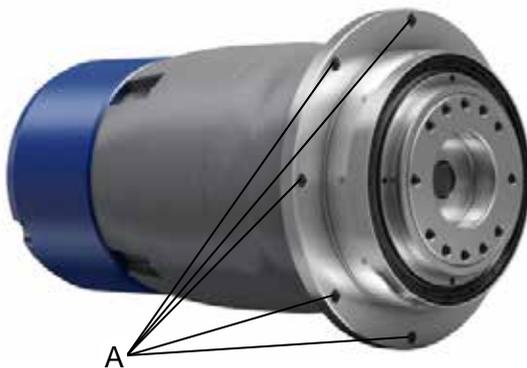


- Smear the fastening screws with a threadlocker (e.g. Loctite® 243).
- Fasten the drive actuator to the machine with the fastening screws through the threaded bores (A) in the connection on the vehicle frame.
- i Mount the drive actuator in such a way that the identification plate remains legible.

The specified screw sizes and tightening torques can be found in Chapter 9.1 "Information for mounting with connection".

5.2.2 Installation/mounting of the drive actuator in the Compact or Advanced Speed package

This chapter relates to drive actuators whose packages do not contain the connection. (See in this regard Chapter 3 "Description of the TAS drive actuator")



- Smear the fastening screws with a threadlocker (e.g. Loctite® 243).
- Fasten the drive actuator to the machine with the fastening screws through the through-holes (A) on the vehicle.
- i Mount the drive actuator in such a way that the identification plate remains legible.

The specified screw sizes and tightening torques can be found in Chapter 9.2 "Information for mounting without connection".

5.3 Removal and mounting of the pre-assembled drive wheel

	NOTICE
	<p>Distortions during mounting can damage the drive actuator.</p> <ul style="list-style-type: none"> • Mount or remove the drive actuator onto the output flange without forcing. • Never attempt to assemble by force or hammering! • Only use suitable tools and equipment for assembly and removal.

- i The prescribed screw sizes and tightening torques can be found in Chapter 9.3 "Information on the attachment of the drive wheel".

5.4 Mounting a third-party drive wheel

If it is intended to install a third-party drive wheel to the drive actuator in the Compact or Advanced Speed packages, or to replace the pre-assembled drive wheel with a third-party drive wheel in the Advanced Load and Performance packages, the following instructions must strictly be followed.

	NOTICE
	<p>Wheel geometries and contours affect the functionality and performance data of the drive actuator.</p> <ul style="list-style-type: none"> • Altered force and torque conditions may occur that affect the drive actuator. • Changing the wheel surface leads to different friction values. • The wheel material and geometries affect the permitted load of the wheel, which may affect the limitation of the overall drive.

i In the event of technical queries, contact the specified contacts.

5.5 Installing the electrical connections

	⚠ DANGER
	<p>Electrically live components may result in electric shocks if touched and can cause serious injuries and even death.</p> <ul style="list-style-type: none"> • Observe the five safety rules of electrical engineering before starting electrical installation work: <ul style="list-style-type: none"> - Switch off the voltage supply. - Secure it against being switched on again. - Ensure there is no voltage. - Ground and short-circuit. - Cover adjacent live parts. • Check whether there are protective caps on the plugs. If protective caps are missing, check the plugs for damage and soiling.

	⚠ DANGER
	<p>Electrical work performed in damp areas may result in electric shocks and can cause serious injuries and even death.</p> <ul style="list-style-type: none"> • Perform electrical installation work only in dry areas.

	<p>The cables of all drive actuators need to be laid out in such a way that a minimum bending radius of 10 x diameter is complied with. Torsional load of the cables should be avoided.</p>
---	--

6 Startup and operation

6.1 Safety instructions and operating conditions

- Read the general safety instructions before beginning work (see Chapter 2.6 "General safety instructions").
- i Wearing hearing protection in the vicinity of the drive actuator is recommended.

	NOTICE
	<p>Improper use can cause damage to the drive actuator.</p> <ul style="list-style-type: none"> · Ensure that <ul style="list-style-type: none"> - The ambient temperature does not drop below 0 °C or exceed +40 °C and - the operating surface temperature does not exceed +90 °C. · For other conditions of use, consult our Customer Service department. · Use the drive actuator only up to its maximum limit values, see Chapter 9.5 "Technical specifications". · Use the drive actuator only in a clean, dust-free and dry environment. · Operate the drive actuator only in the mounting position that is specified on the identification plate.

6.2 Data for electrical startup

The specified data is intended for the electrical startup.

	NOTICE
	<p>The servo controllers of the different manufacturers generally have proprietary data specifications.</p> <p>If the data is disregarded, the drive and/or the servo controller may be damaged.</p> <ul style="list-style-type: none"> · Observe the specified units precisely and check that they match the units of the servo controller. · If the units differ, make the necessary adjustment accordingly.

- i In some servo controllers, there are dependencies between individual parameters. We are happy to assist in finding the correct entries.
- i We provide adjusted and certified quick start guides for several servo controllers. In addition to parameters, these instructions also provide material numbers of pre-manufactured cable sets and an assignment of the drive actuators to the regulator product sizes.

7 Maintenance and disposal

- Read the general safety instructions before beginning work (see Chapter 2.6 "General safety instructions").

	⚠ WARNING
	<p>The permanent magnets of the rotor emit a strong magnetic field which becomes active during the disassembling of the drive actuator.</p> <ul style="list-style-type: none"> • Observe the general safety instructions (e.g. for pacemaker patients) for working in strong magnetic fields.

7.1 Maintenance work

	<p>The partial or complete disassembly of the drive actuator into its individual parts for maintenance or repair work is not permitted.</p> <ul style="list-style-type: none"> • In case of a malfunction or failure, contact the Customer Service department.
---	--

7.1.1 Refreshment of service brake

The brake torque of the service brake used is affected by various factors, such as oxidation, the flattening of friction surfaces or changes to the air gap. This behavior can cause fluctuation of up to $\pm 40\%$ in the brake torque.

To counteract these influences and reliably attain the specified brake torque, the brake should be applied regularly. If for example the drive cycle does not provide for a planned brake, and the brake will only be applied in the case of an emergency stop, regular application of the brake is not assured. In this case it is highly recommended that a so-called brake refreshment be carried out every four weeks.

The following cycle is recommended:

Recommended brake refreshment cycle		
Slipping speed	rpm	100
Duration for brake de-energized	s	0.5
Duration for brake energized	s	0.5
Number of cycles		5

Table 4

Startup of the brake

To make sure the brake is functioning, the brake must be inspected during startup.

- If the regulating device has a function for integrated testing of the brake torque during secure limited movement and secure limited speed, then use this function and observe the instructions from the regulating device's manufacturer.

If no such function is present, we recommend that the user proceed as follows:

- Limit the permitted range of movement and the maximum speed using the parameters in the regulating device so that no danger to persons or property can arise from movement of the axle.
- Calculate the required current of the motor I_{M4} required to achieve the holding torque with the torque constants, and limit the maximum current of the regulating device to this value.
- Apply current to the motor with the brake applied, gradually increasing the current to I_{M4} . During this, the motor must not move. Observe the permitted time for applying current of I_{M4} to the motor.
- If movement does occur, the user should ideally switch off the current supply automatically to avoid uncontrolled movement of the axle.
- If the brake torque M_4 is not reached, perform the brake refreshment cycle (see Table 4).
- Check the brake torque again after the refreshment cycle.

If the brake torque specified in the brake's technical data is reached, then the brake is ready for operation.

If the brake torque specified in the brake's technical data is not reached, then:

- Repeat the grinding-in procedure.
 - i The grinding-in process may only be repeated twice during a testing procedure for the brake torque.

If after the third grinding-in process, the brake torque is still not reached, the brake is **not functional**:

- Do **not** start up the drive. Contact our sales department.
 - i Always provide the ordering code and serial number.

7.1.2 Visual inspection

- Check the entire drive actuator and all cables for exterior damage.
- The radial shaft seals are subject to wear. Check the drive actuator during every visual inspection for leaks (lubricant leaks).
 - i More general information on radial shaft seals can be found on our partner's website at <http://www.simrit.de>.
 - i Liquid foreign media in contact with the output sealing ring for extended periods of time can reach the interior of the drive actuator. It is therefore necessary to ensure that the drive actuator fitted in the vehicle is not standing or operated in liquids (e.g. deep water puddles or similar).
- Check whether the safety signs (see Chapter 2.7 "Safety signs") and the identification plate (see Chapter 3.1 "Identification plate") are mounted and legible.
- Inspect the drive wheel for cracks or ruptures in the surface material.
 - i **The drive wheel may be replaced as a spare part. Additional information can be obtained from our Customer Service department.**

7.1.3 Checking the tightening torques

- Check the tightening torque of the fastening screws on the frame connection and the drive wheel.
- i The specified tightening torques can be found in Chapter 9.1 "Information for mounting with connection", and in 9.3 "Information on the attachment of the drive wheel".
- If, while checking the tightening torque, a screw that can be further tightened is discovered, follow the instructions in "Remounting the screw".

Remounting the screw

- Loosen the screw.
- Remove the residue glue from the threaded bore and from the screw.
- De-grease the screw.
- Coat the screw with a threadlocker (e.g. Loctite® 243).
- Screw in the screw and tighten it with the prescribed tightening torque.

7.1.4 Cleaning



NOTICE

Compressed air can damage the drive seals of the drive actuator.

- Do not use compressed air to clean the drive actuator.

- Clean the drive actuator using a clean, lint-free cloth.
- If necessary, use a grease-dissolving, non-aggressive cleaning agent.

Startup after maintenance work

- Clean the outside of the drive actuator.
- Attach all safety devices.
- Do a trial run before releasing the drive actuator again for operation.

7.2 Maintenance schedule

Maintenance work	Scope of the work	At startup	Every 4 weeks	After 500 operating hours or 3 months	Yearly
Visual inspection and cleaning	Check the drive actuator for any damage, excessive soiling or other anomalies which were not present in the condition as delivered.	X		X	X
Checking the tightening torques	All screw connections between the drive actuator and the vehicle/frame/interfaces, as well as the drive wheel.	X		X	X
Visual inspection of the wheel	Investigate the drive wheel for impurities, cracks, ruptures, wear, deformation, swelling etc.	X		X	X
Brake refreshment with function check	Recommended refreshment cycle of the brake: <ul style="list-style-type: none"> - Slipping speed: 100 rpm - Duration for brake de-energized: 0.5s - Duration for brake energized: 0.5s - Number of cycles: 5 		X ¹	X	X
Brake function check	Opening and closing the brake e.g. by deactivating the controller	At least twice daily			
Inspection of the brake torque	Inspection of the brake torque by measuring the brake torque or inspecting the brake functionality	At least once a day			

Table 5

¹ Applies if the target drive cycle does not provide for this kind of braking

7.3 Information on the lubricant used

	A change of lubricant in drive actuators of this design is not necessary. The gearhead and the bearings are lubricated for life at the factory.
---	--

The manufacturer listed below will provide any further information on the lubricants:

Manufacturer: Castrol Industrie GmbH, Mönchengladbach

Tel.: + 49 2161 909-30

www.castrol.com

7.4 Disposal

Consult our Customer Service department for supplementary information on decommissioning, disassembly and disposal of the drive actuator.

- Dispose of the drive actuator at the recycling sites intended for this purpose.
- i Observe the applicable national regulations concerning disposal.

8 Malfuncions

	NOTICE
	<p>Changed operational behavior can be an indication of existing damage to the drive actuator, or cause damage to the drive actuator.</p> <ul style="list-style-type: none"> Do not put the drive actuator back into operation until the cause of the malfunction has been eliminated.

	<p>Rectifying of malfunctions may only be done by specially trained technicians.</p> <p>To facilitate troubleshooting and the optimization of controller settings, it is useful to record the current over a full cycle (a servo controller function) and make it available as a file.</p>
---	--

Fault	Possible cause	Solution
Increased operating temperature	Selected construction too weak for task, nominal operating exceeded.	Check the technical specifications.
	Motor is heating the gearhead.	Check the controller's settings.
	Ambient temperature too high.	Ensure adequate cooling.
Increased operating noises	Damaged bearings	Consult our Customer Service department.
	Damaged gear teeth	
Loss of lubricant	Lubricant quantity too high	Remove the drive wheel. Wipe off discharged lubricant and continue to watch the drive actuator. Lubricant discharge should stop after a short time.
	Seals not tight	Consult our Customer Service department.
	Motor protection has been triggered	Check for errors. Check whether the motor protection setting is correct.
Wrong direction of rotation	Wrong set value specification for the servo controller	Check servo controller/ converter. Check the set value specifications and the polarities.
Motor does not start	Feed line interrupted	Check the connections.
	Wiring of motor and / or encoder not correct	Check the wiring of the motor phases and the motor encoder.
	Blown fuse	Check for faults and replace the fuse.
	Incorrect controller parameters	Check that the motor parameters are suitable in terms of the drive actuator used.

Fault	Possible cause	Solution
	Motor protection has been triggered	Check for errors. Check whether the motor protection setting is correct.
Motor is droning and has a high power consumption	Drive is blocked	Check the drive.
	Error in the encoder line	Check the encoder line.
	Incorrect controller parameters	Check that the motor parameters are suitable in terms of the drive actuator used.
	Brake does not release	See error: "Brake does not release".
Brake does not release	Voltage drop along the feed line > 10%	Ensure that the supply voltage is correct. Check the cable cross-section.
	Incorrect brake connection	Check the connection for correct polarity and voltage.
	Short circuit in the coil or at body of brake coil	Consult our Customer Service department.
	Friction partners are adhering due to long downtimes and high temperatures	Consult our Customer Service department.
Acceleration times are not met	Load is too high	Check the construction plan.
	Power limiting active	Check the controller parameters.
Position error	Shielding of the encoder line insufficient	Inspect the shielding of the connection cables.
	Disturbing pulse from the brake, protective circuit of the brake missing or defective	Check the protective circuit (e.g. Varistor) of the brake on the converter.
	Mechanical coupling between the motor shaft and encoder defective	Consult our Customer Service department.

Table 6: Malfunctions

9 Appendix

9.1 Information for mounting with connection

Size	Threaded insert HELICOIL® Plus Free Running Thread x pitch	Quantity x Thread x Depth [] x [mm] x [mm]	Tightening torque [Nm] Property class 10.9
TAS 004	M12 x 1.75	4 x M12 x 18	108
TAS 010	M12 x 1.75	4 x M12 x 18	108
TAS 025	M12 x 1.75	8 x M12 x 24	108
TAS 050	M12 x 1.75	8 x M12 x 24	108

Table 7

- i Recommended screw strength: 10.9
- i It is recommended to use the entire thread length if possible, so as to create a secure screw connection.

9.2 Information for mounting without connection

Size	Hole circle Ø [mm]	Through-hole quantity x diameter [] x [mm]	Screw size/ property class	Tightening torque [Nm]
TAS 004	79	8 x 4.5	M4 / 10.9	3.9
TAS 010	109	8 x 5.5	M5 / 10.9	7.6
TAS 025	135	8 x 5.5	M5 / 10.9	7.6
TAS 050	168	12 x 6.6	M6 /10.9	13.2

Table 8

9.3 Information on the attachment of the drive wheel

When changing the drive wheel, we recommend observing the following specifications:

Size	Index bore Ø x depth [mm] x [mm]	Hole circle Ø [mm]	Quantity x Thread x Depth [] x [mm] x [mm]	Tightening torque [Nm] Property class 10.9
TAS 004	---	31.5	8 x M5 x 7	7.69
TAS 010	6H7 x 7	50	7 x M6 x 10	13.2
TAS 025	6H7 x 7	63	11 x M6 x 12	13.2
TAS 050	8H7 x 10	80	11 x M8 x 15	31.9

Table 9

9.4 Tightening torques for common thread sizes in general mechanical engineering

The specified tightening torques for headless screws and nuts are calculated values and are based on the following conditions:

- Calculation in accordance with VDI 2230 (February 2003 version)
- Friction value for thread and contact surfaces $\mu=0.10$
- Utilization of the yield stress 90 %

Property class Screw / Nut	Tightening torque [Nm] with thread												
	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24
8.8 / 8	1.15	2.64	5.24	8.99	21.7	42.7	73.5	118	180	258	363	493	625
10.9 / 10	1.68	3.88	7.69	13.2	31.9	62.7	108	173	265	368	516	702	890
12.9 / 12	1.97	4.55	9.00	15.4	37.3	73.4	126	203	310	431	604	821	1042

Table 10: Tightening torques

9.5 Technical specifications

9.5.1 Motor specifications TAS 24V

Ordering code TAS_xxxx-xxxx-1xx-XXXX-xxx (XXXX = stator; 1 = 24V)					
	Unit	Stator 053W	Stator 064W	Stator 094W	Stator 130W
Intermediate voltage U_{DC}	V _{DC}	24	24	24	24
Torque constant K_t	Nm/A _{eff}	0.062	0.052	0.067	0.093
Voltage constant K_e	Vs	0.05	0.042	0.054	0.075
Ambient temperature θ_u	°C	40	40	40	40
Max. winding temperature θ_{max}	°C	140	140	140	140
Heat transfer resistance R_{th}	K/W	1.45	1.32	0.60	0.58
Thermal time constants τ_{th}	min	3.78	3.11	5.76	7.96
Max. power P_{max}	kW	0.34	1.09	2.18	5.15
Maximum torque M_{max}	Nm	1.97	3.06	5.58	24.8
Maximum current I_{max}	A _{eff}	31.5	60	84.0	312.0
Continuous stall torque M_0	Nm	0.66	1.04	1.88	9.70
Continuous stall current I_0	A _{eff}	10.5	20	28.0	104.0
No-load speed n_0	rpm	4490	5410	4190	3010
Connection resistance R_{tt}	Ohm	0.25	0.063	0.011	0.005
Connection inductance L_{tt}	mH	0.265	0.1	0.03	0.03
Electrical time constant τ_e	ms	1.1	1.5	2.5	6.8
Pole pair number p		4	4	6	6

Table 11

9.5.2 Motor specifications TAS 48V

Ordering code TAS_XXXX-XXXX-2xx-XXXX-xxx (XXXX = stator; 2 = 48V)					
	Unit	Stator 053W	Stator 064W	Stator 094W	Stator 130W
Intermediate voltage U_{DC}	V _{DC}	48	48	48	48
Torque constant K_t	Nm/A _{eff}	0.062	0.083	0.10	0.093
Voltage constant K_e	V _s	0.050	0.067	0.082	0.075
Ambient temperature θ_u	°C	40	40	40	40
Max. winding temperature θ_{max}	°C	140	140	140	140
Heat transfer resistance R_{th}	K/W	1.45	1.32	0.60	0.58
Thermal time constants τ_{th}	min	3.78	5.04	8.59	7.96
Max. power P_{max}	kW	1.08	1.32	3.93	10.6
Maximum torque M_{max}	Nm	1.97	3.06	8.00	24.8
Maximum current I_{max}	A _{eff}	31.5	43.8	84.0	312.0
Continuous stall torque M_0	Nm	0.65	1.21	2.82	9.70
Continuous stall current I_0	A _{eff}	10.5	14.6	28.0	104.0
No-load speed n_0	rpm	8990	6770	5580	6020
Connection resistance R_{tt}	Ohm	0.25	0.16	0.025	0.005
Connection inductance L_{tt}	mH	0.26	0.24	0.06	0.03
Electrical time constant τ_e	ms	1.1	1.5	2.5	6.8
Pole pair number p		4	4	6	6

Table 12

9.5.3 Technical specifications of the motor feedback

As motor feedback on commutation, a resolver is used in the drive actuator with the following technical data:

Drive actuator	TAS 004; TAS 010; TAS 025	TAS 050
Size	Size 15	Size 21
Type	TS2620N21E11	V23401-T1705-D501
Input voltage	$7V_{\text{eff}}$, 10kHz	$7V_{\text{eff}}$, 5kHz
Transmission ratio	$0.5 \pm 5\%$	$0.5 \pm 5\%$
Fault	$\pm 10'$	$\pm 10'$
Zero voltage	20mV_{eff}	25mV_{eff}
Phase shift	0°	0°
Impedance ZR0	$70+j100 \Omega$	$130+j310 \Omega$
Impedance ZS0	$180+j300 \Omega$	$105+j160 \Omega$
Impedance ZSS	$175+j257 \Omega$	$110+j220 \Omega$
Max. operating temperature	155°C	155°C

Table 13

9.5.4 Technical specifications of the service brake

The brakes fitted in the drive actuators are electromagnetically activated two-disc spring brakes. The brake force is produced by the springs and raised by electromagnetic force. In a de-energized state, the two friction surfaces are pressed onto countersurfaces by springs, producing a brake torque. By placing voltage on the excitation winding, the magnetic rotor is moved by the resulting force. This movement is directed against the pressure force of the springs. In this way, the friction and counter-surfaces are released from each other, leading to cancellation of the brake torque.

Observe the instructions given in Chapter 7.1.1 "Refreshment of service brake" for fault free operation.

TAS 004	i 16 – i 35	i 50
Type	KEB Combistop M 0008110	KEB Combistop M 0008110
Brake voltage	24 V	24 V
Performance of the coil at 20°C	11-15W	11-15W
Nominal torque of the brake after running-in	2Nm	1Nm
Max. permitted friction work during one-off activation	2000J	2000J
Delay during linking	$\leq 12\text{ms}$	$\leq 18\text{ms}$
Rise time of the brake torque	$\leq 13\text{ms}$	$\leq 18\text{ms}$
Total linking time	$\leq 25\text{ms}$	$\leq 36\text{ms}$
Separation time	$\leq 35\text{ms}$	$\leq 40\text{ms}$

TAS 010	i 16 – i 31	i 61
Type	KEB Combistop M 0008110	KEB Combistop M 0008110
Brake voltage	24 V	24 V
Performance of the coil at 20° C	11-15W	11-15W
Nominal torque of the brake after running-in	2Nm	1Nm
Max. permitted friction work during one-off activation	2000J	2000J
Delay during linking	≤12ms	≤18ms
Rise time of the brake torque	≤13ms	≤18ms
Total linking time	≤25ms	≤36ms
Separation time	≤35ms	≤40ms

Table 14

TAS 025	i 16 – i 31	i 61 – i 91
Type	KEB Combistop 023811N	KEB Combistop 023811N
Brake voltage	24 V	24 V
Performance of the coil at 20° C	25W	25W
Nominal torque of the brake after running-in	5Nm	2.5Nm
Max. permitted friction work during one-off activation	4600J	4600J
Delay during linking	≤15ms	≤21ms
Rise time of the brake torque	≤15ms	≤23ms
Total linking time	≤30ms	≤44ms
Separation time	≤60ms	≤36ms

Table 15

TAS 050	i 16 – i 31	i 61 – i 91
Type	KEB Combistop 033811N	KEB Combistop 033811N
Brake voltage	24 V	24 V
Performance of the coil at 20° C	30W	30W
Nominal torque of the brake after running-in	10Nm	5Nm
Max. permitted friction work during one-off activation	6100J	6100J
Delay during linking	≤23ms	≤27ms
Rise time of the brake torque	≤22ms	≤28ms
Total linking time	≤45ms	≤55ms
Separation time	≤83ms	≤72ms

Table 16

9.5.5 Pin assignment 4 – TAS 004

Identification of pin assignment 4: "TAS_004x-xxxx-xxx-xxxx-x4x"

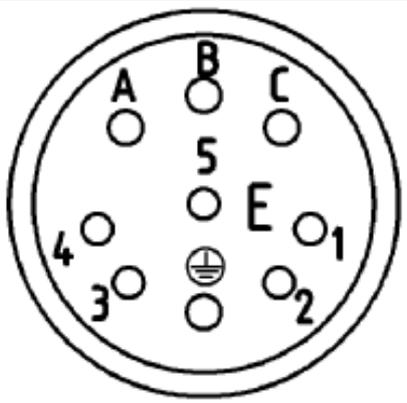
<i>Power</i>	Intercontec mounting socket, series 915, 9-pin, group 1 contact pin Ø 1mm	
View of plug side of drive actuator	Pin	Function
	A	U
	B	V
	C	W
	1	Temp +
	2	Temp -
	3	n.c.
	4	n.c.
	5	n.c.
	⏚	PE grounding conductor

Table 17

- i The shielded cables, black and white, may be insulated and, if necessary, shortened.

<i>Service brake</i>	Cable plug M12 4-pin	
View of plug side of drive actuator	Pin	Function
	1	+
	2	-
	3	n.c.
	4	n.c.

Table 18

- i With this type of brake the cables may be connected in any way desired. The polarity is not relevant for the connection of the cable.

<i>Signal</i>	Intercontec mounting socket, series 615, 12-pin, group 1 contact pin Ø 1mm	
View of plug side of drive actuator	Pin	Function
	1	cos/S1
	2	cos-low/S3
	3	sin/S2
	4	sin-low/s4
	5	Ref/R1
	6	Ref-low/R2
	7	n.c.
	8	n.c.
	9	Screen
	10	n.c.
	11	n.c.
	12	n.c.

Table 19

9.5.6 Pin assignment 4 – TAS 010

Identification of pin assignment 4: "TAS_010x-xxxx-xxx-xxxx-x4x"

<i>Power</i>	Intercontec mounting socket, series 923, 9-pin, group 1 contact pin 4 x Ø 2mm + 5 x Ø 1mm	
View of plug side of drive actuator	Pin	Function
	A	U
	B	V
	C	W
	D (⏚)	PE grounding conductor
	E	Temp +
	F	n.c.
	G	n.c.
	H	Temp -
	L	n.c.

Table 20

- i The shielded cables, black and white, may be insulated and, if necessary, shortened.

<i>Service brake</i>	Cable plug M12 4-pin	
View of plug side of drive actuator	Pin	Function
	1	+
	2	-
	3	n.c.
	4	n.c.

Table 21

- i With this type of brake the cables may be connected in any way desired. The polarity is not relevant for the connection of the cable.

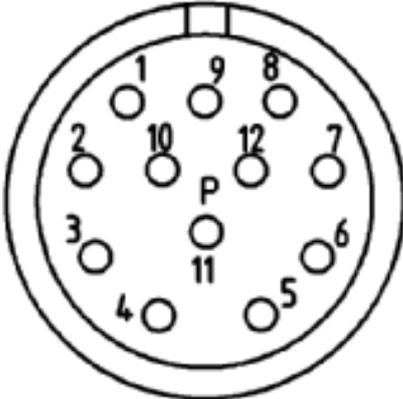
<i>Signal</i>	Intercontec mounting socket, series 623, 12-pin, group 1 contact pin Ø 1mm	
View of plug side of drive actuator	Pin	Function
	1	cos/S1
	2	cos-low/S3
	3	sin/S2
	4	sin-low/S4
	5	n.c.
	6	n.c.
	7	Ref/R1
	8	Ref-low/R2
	9	Screen
	10	n.c.
	11	n.c.
	12	n.c.

Table 22

9.5.7 Pin assignment S – TAS 025

Identification of the pin assignment S: "TAS_025x-xxxx-xxx-xxxx-xSx"

<i>Power</i>	Open cable ends
Wire color/labelling	Function
1/ U/ L1	U
2/ V/ L2	V
3/ W/ L3	W
Green/Yellow	PE grounding conductor

Table 23

- i The shielded cables, black and white, may be insulated and, if necessary, shortened.

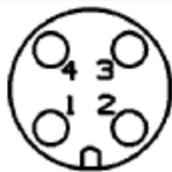
<i>Service brake</i>	Cable plug M12 4-pin	
View of plug side of drive actuator	Pin	Function
	1	+
	2	-
	3	n.c.
	4	n.c.

Table 24

- i With this type of brake the cables may be connected in any way desired. The polarity is not relevant for the connection of the cable.

<i>Signal</i>	Open cable ends
Wire color/labelling	Function
Brown	Temp +
White	Temp -
Gray	cos/S1
Pink	cos-low/S3
Blue	sin/S2
Red	sin-low/S4
Green	Ref/R1
Yellow	Ref-low/R2

Table 25

9.5.8 Pin assignment 1 – TAS 050

Identification of pin assignment 1: "TAS_050x-xxxx-xxx-xxxx-x1x"

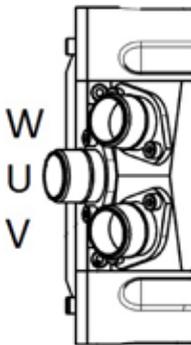
<i>Power</i>	3 x Intercontec mounting socket, series 923, 1-pin contact pin Ø 8mm	
Top view	Mounting socket	Function
	W	W
	U	U
	V	V

Table 26

- i The shielded cables, black and white, may be insulated and, if necessary, shortened.

<i>Service brake</i>	Cable plug M12 4-pin	
View of plug side of drive actuator	Pin	Function
	1	+
	2	-
	3	n.c.
	4	n.c.

Table 27

- i With this type of brake the cables may be connected in any way desired. The polarity is not relevant for the connection of the cable.

<i>Signal</i>	Intercontec mounting socket, series 623, 12-pin, group 1 contact pin Ø 1mm	
View of plug side of drive actuator	Pin	Function
	1	cos/S1
	2	cos-low/S3
	3	sin/S2
	4	sin-low/S4
	5	Temp +
	6	Temp -
	7	Ref/R1
	8	Ref-low/R2
	9	Screen
	10	n.c.
	11	n.c.
	12	n.c.

Table 28

Revision history

Revision	Date	Comment	Chapter
01	15.03.17	New version	All
02	06.07.17	Layout, translation	All
03	23.05.19	Layout, translation ja	All



cyber motor

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