



TG drives

DRIVESPIN ROTARY ACTUATORS

Installation and service manual.

2/2017

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1. INTRODUCTION

1.1 Description

Installation and service manual of DriveSpin rotary actuators contains very important information and instructions for operation, maintenance and service. This manual is mainly for assembly and service workers.

Before starting work and using DriveSpin actuator is recommended to read these documents (if they are available):

- DriveSpin installation and service manual (this manual)
- Test report (part of DriveSpin actuator delivery)
- Digital servoamplifier installation and hardware manual
- Digital servoamplifier software manual
- Installation and use of expansion cards and modules guide
- Manual of other accessories

1.2 Application

DriveSpin rotary actuators are using mainly in industrial production and automatization. DriveSpin actuators can be used as drives of machine tools, industrial machines, robots and other precise applications with high requirements of positioning accuracy and drive dynamics. The main advantages of DriveSpin rotary actuator also include:

- backlash-free
- low inertia
- high ratio
- excellent kinematic accuracy
- high torque overload
- high dynamic performance
- high torsional and heeling rigidity
- high capacity of integrated radial-axial bearings
- long lifetime

If the assumed load should be above permissible values declared by manufacturer, or if the use of actuators is considered in other field than is specified, then is required to consult it with manufacturer of DriveSpin actuator.

DriveSpin rotary actuators are controlled strictly by digital servoamplifiers. Complete match of declared parameters is guaranteed only if all parts of a drive (digital servoamplifier, actuator, cables etc.) are supplied by manufacturer of DriveSpin actuator.

Drivespin rotary actuators **can not** operate in:

- potentially explosive areas
- environment with electrically conductive acids, alkaline solutions, oils, corrosive gases, vapour or environment with high dustiness
- directly on supply network routes
- on a device that does not meet the EC Machinery Directive, EMC Directive and Directive Low Voltage European Directives

DriveSpin rotary actuators could in some cases be a source of danger to persons and property, that's why all assembly and installation work including start up and service have to be done only by qualified personnel. Unprofessional manipulation or other actions that are not according to this manual causes a loss of warranty.

1.3 Safety instructions

Follow safety instructions that are provided in single chapters of this manual! Ill-treatment and tampering with device could cause injury or damage of the machine, so please follow the instructions below and in single chapters of manual or guide of every device!

Only qualified personnel are authorized to carry out the tasks, especially the installation, adjustment, maintenance, servicing or transportation of the equipment. By qualified personnel is meant expert, who has the necessary qualification for particular task.



In connection with certain use may DriveSpin actuator have increased surface temperature during the operation – be careful in contact with its surface because of danger of burn. Do not touch the actuator (especially his moving parts) during the operation or during its cooling period after shutdown.

Before unplugging any connector must be all circuits turned off – disconnected from power supply.



Damaged device must not be installed and putted into operation!

If the delivery of device is damaged, immediately complaint to the transport company.



Pay attention to information in each manual and follow the instructions!

- read these manuals or guides supplied as accessories of device
- pay attention to warning and safety signs on DriveSpin actuator
- abide by regulations and requirements of device
- follow the health and safety at work rules

Only qualified personnel are authorized to carry out these tasks!



- installation / assembly
- plugging in
- start up
- operation
- maintenance



Abide by principles of proper and safe storage!

If DriveSpin actuator will not be installed immediately, store it in a dry room with low level of dustiness, **always in original packaging!**



CAUTION!

During the operation and after, **there are some parts of actuator which are under voltage (electrically live parts), moving parts or hot surfaces on the actuator!**

Connection

Connection of actuator according to test report protocol, which is included with each delivery of actuator.



Please check position of pins on cable and connector (it has to be the same) before connecting. Connection of wrong cable into the connector or wrong orientation of cable can cause damage of connector.

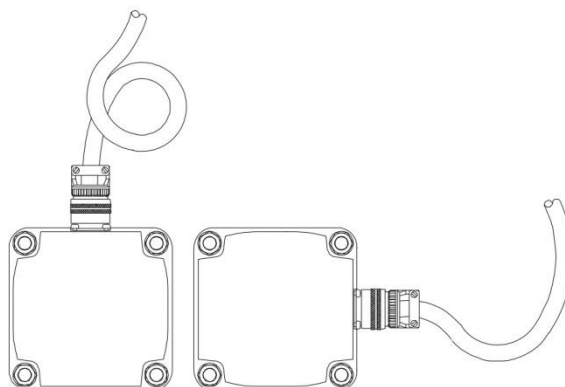
Never try to connect or disconnect device under voltage, it can cause serious damage of device and injury of operator personnel. Many digital servoamplifiers can keep residual voltage after disconnection from power supply, that is why is recommended to wait for a few minutes before start to work on device.

Parameter settings

Setting parameters for digital servoamplifier is carried out by qualified personnel only (service engineer from manufacturer or operator trained by manufacturer).

Cable routing

If the cables are exposed to various oil or other liquid substances that may pollute the cables and connectors, which can be subsequently damaged, it is recommended to modify cable routing by loops near connectors. Place and type of loop depends on position of connectors, please see examples below:



Note: If connectors are placed on the bottom surface of actuator, loops are not required.

ATTENTION: Adhere to the recommended bending radius of cables (min. $7.5 \times \Phi D$).

Safety brake

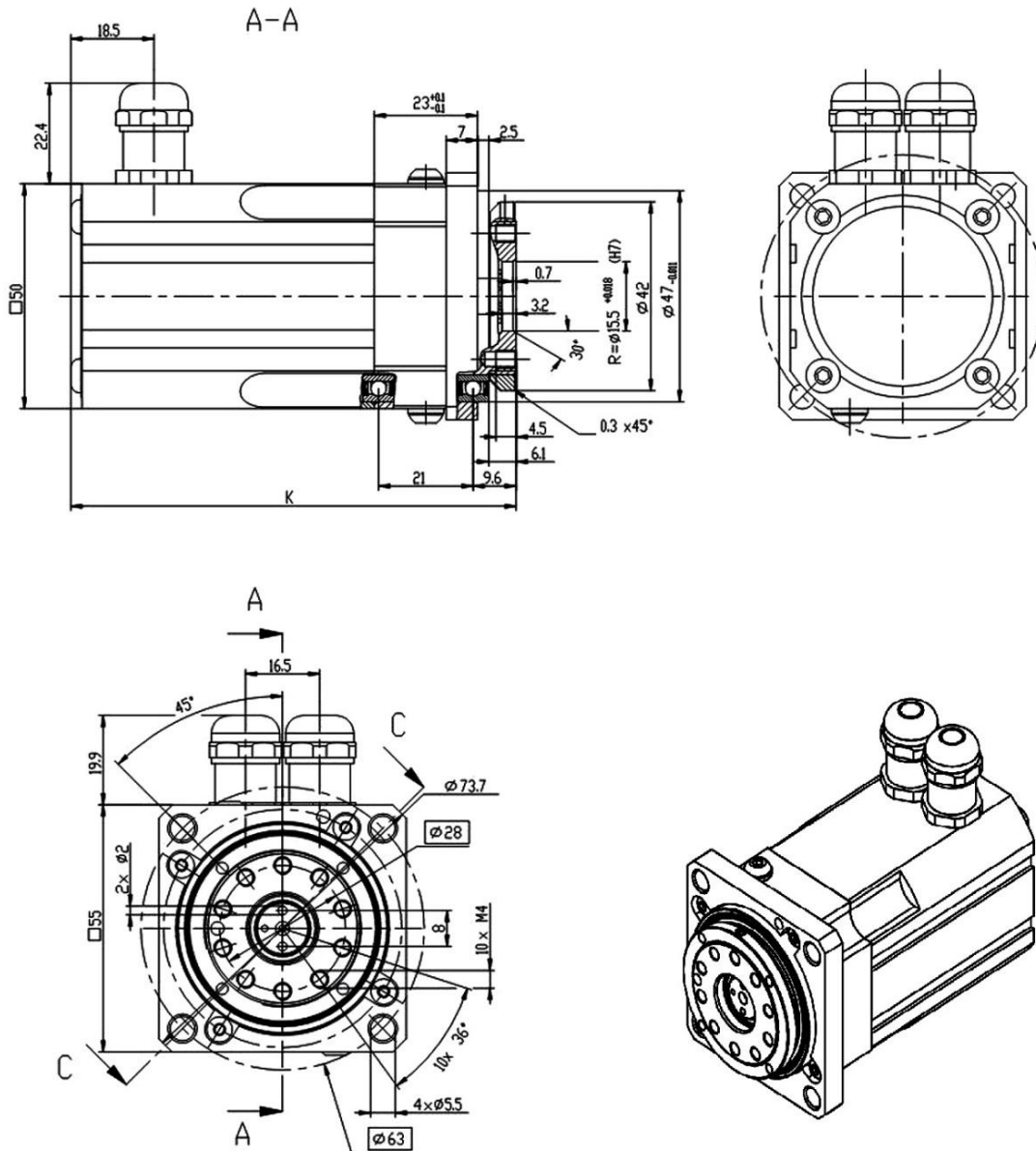
All actuators can be equipped with an electromagnetic brake, which is placed in motor of actuator. Brake is not designed for positioning, it is used to mechanical ensure of actuator standstill. Length of actuators with brake is higher – please see actuator drawings.



Never try to operate with braked actuator, it can cause a serious damage of actuator! Do not use brake for securing heavy load during working under them – always use another mechanism to ensure the load! Brake works as a spring-frictional mechanism, it doesn't have to provide reliable securing!

2. DRAWINGS

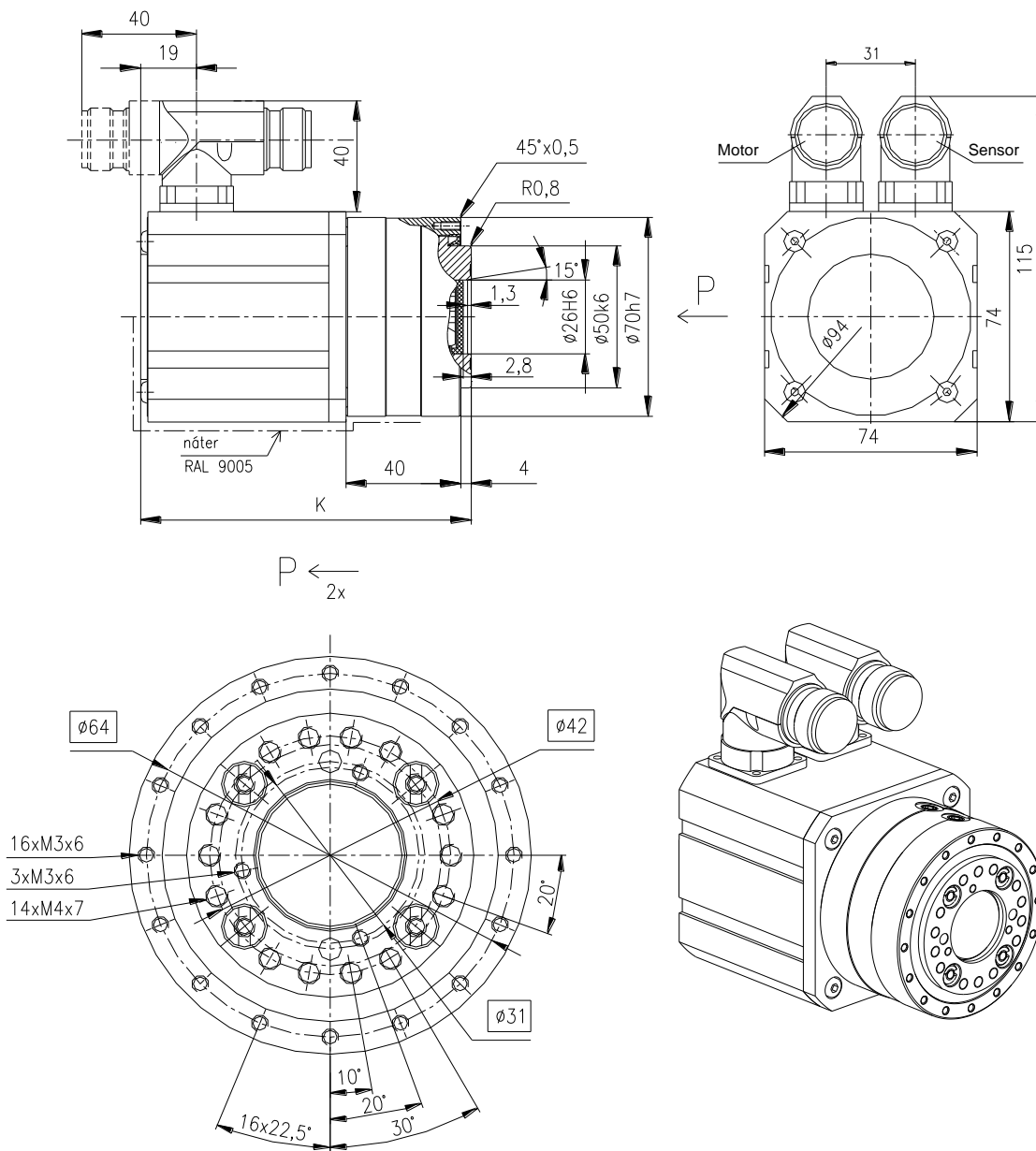
2.1 DS50



K dimension	without brake	with brake
Resolver	99 mm	136,6 mm
Hiperface	100,5 mm	139,1 mm
EnDat 1)	109,1 mm	135,1 mm

1) length of DS50 with y-tec connectors = 135,1mm, length of DS50 with cable bushings = 132,6mm

2.2 DS70*

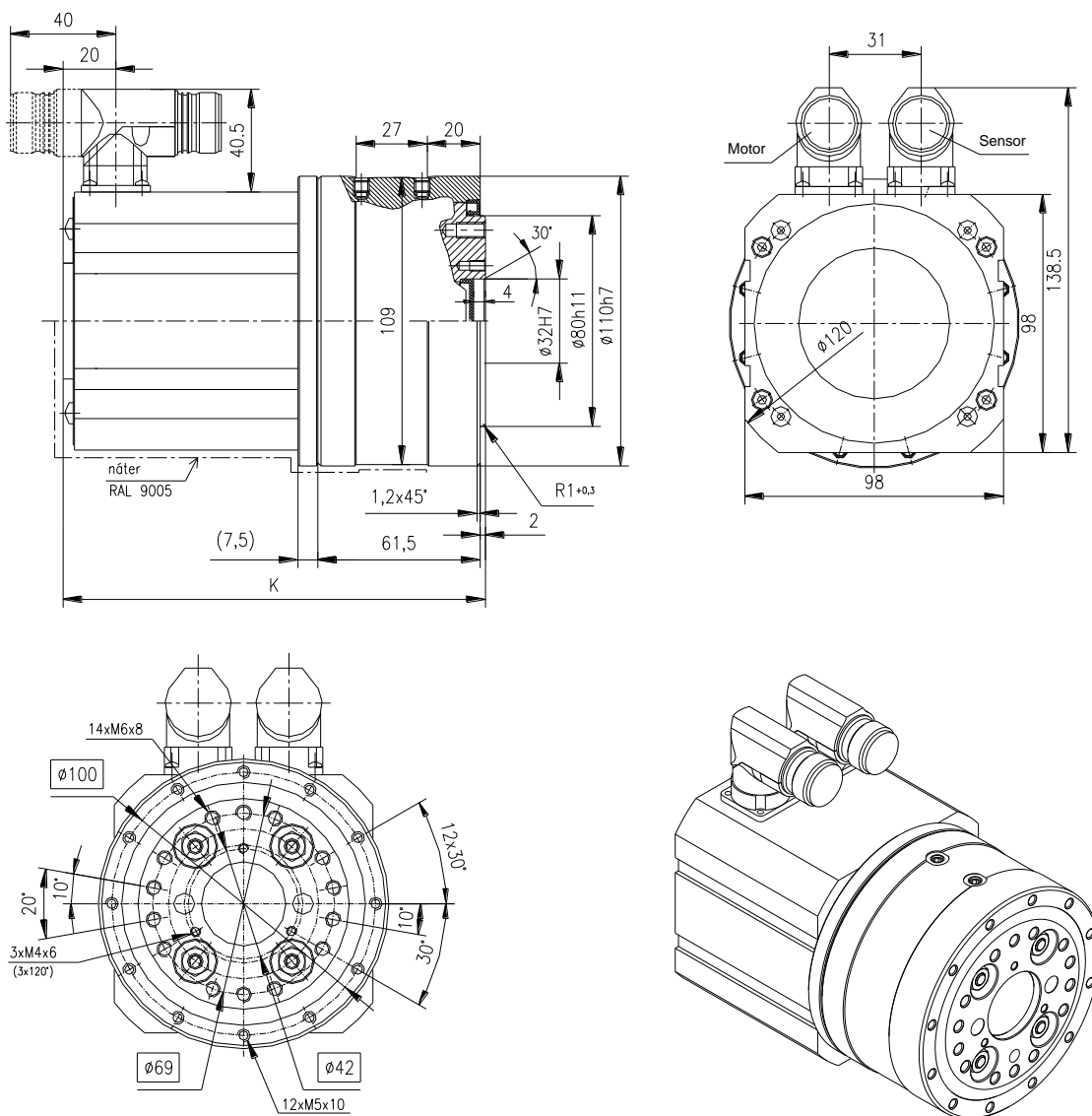


* gearbox output part can be different - see page 11

K dimension	without brake	with brake ⁵⁾
Resolver ¹⁾	115 mm	168 mm
EnDat ^{2) 4)}	145,5 mm	193 mm
Sin/cos ³⁾	145,5 mm	193 mm

- 1) Resolver RE15-1-A14 (2 poles) LTN
- 2) EnDat, EQN 1325 (8192 x 4096) Heidenhain
- 3) ERN 1387 (2048) Heidenhain
- 4) EQN 1313 (2048) Heidenhain
- 5) Electromagnetic brake 05.P1 , KEB

2.3 DS110



K dimension	without brake	with brake ⁵⁾
Resolver ¹⁾	161 mm	212,3 mm
EnDat ^{2) 4)}	202,4 mm	241,8 mm
Sin/cos ³⁾	202,4 mm	241,8 mm

- 1) Resolver RE15-1-A14 (2 poles) LTN
- 2) EnDat, EQN 1325 (8192 x 4096) Heidenhain
- 3) ERN 1387 (2048) Heidenhain
- 4) EQN 1313 (2048) Heidenhain
- 5) Electromagnetic brake 05.P1 , KEB

3. INSTALLATION AND OPERATION

3.1 Mechanical installation

Before mechanical installation of actuator is recommended to check:

- data on label of actuator and digital servoamplifier (especially output voltage – must be the same)
- mechanical condition of actuator (possible damage caused during the transport or storage)
- ambient temperature (if it is not in range of -10°C .. +40°C without condensation, please consult with manufacturer)
- presence of oils, acids, vapors, etc.

Preparatory work

It is important to clean output and fastening flange of actuator from impurities. The manufacturer recommends using of common solvents. Avert the contact between solvents and shaft seals, it could cause their damage. Solvents can not get into the gear!!!

Centering of actuator

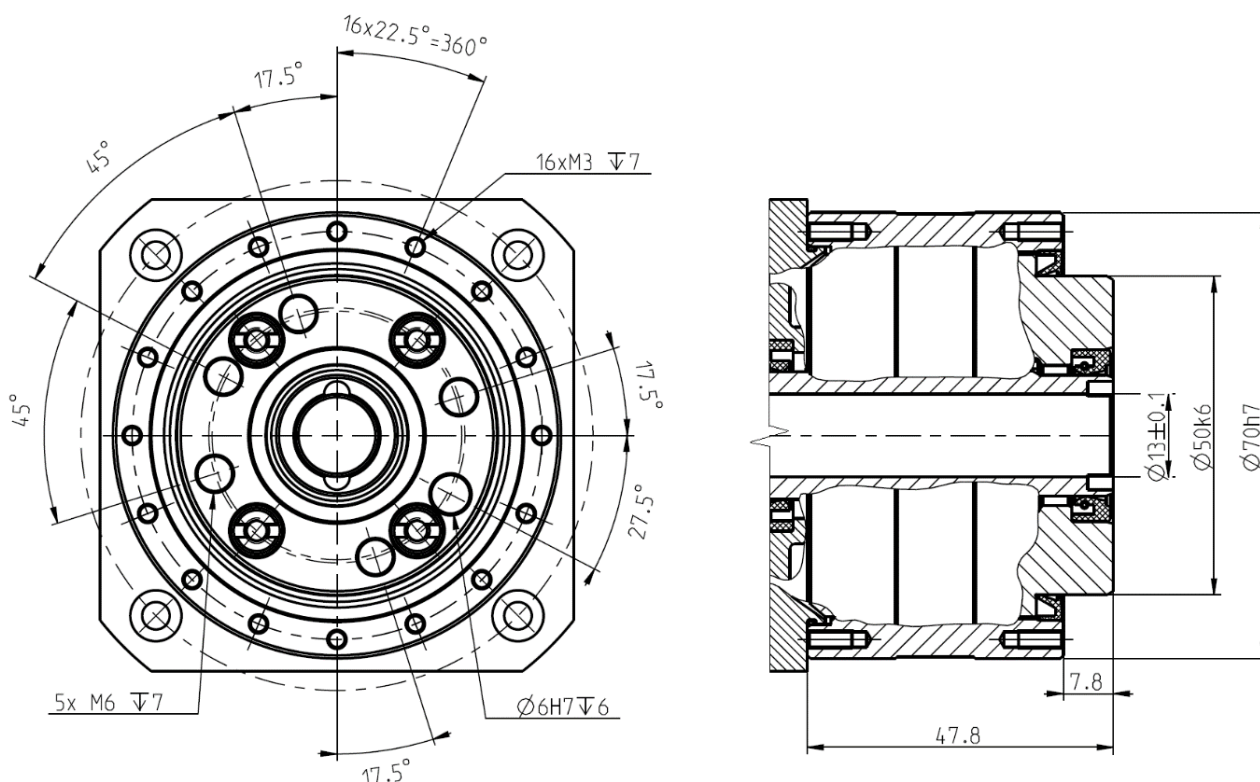
Actuator must be carefully centered, it is important to prevent nonpermissible load of output flange. In case of assembly of the actuator is recommended centering on the front flange outside diameter of cycloidal reducer which is tolerated (for DS70 and DS110 actuators) or on tolerated diameter of actuator front flange (for DS50 actuator). Both cases are illustrated on picture below:



In case of centering of rotating part which is mounted on actuator reducer is recommended to center this part on inner diameter of cycloidal reducer which is tolerated. On some types of DriveSpin rotary actuators is an inserted sealing in this diameter, which can be moved deeper into the body of reducer by simple tapping.



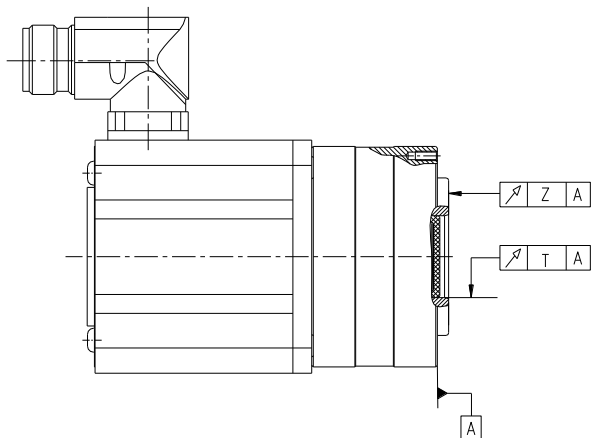
* Note - since 1st of January 2017 is sold a second type of DS70 with different output part of gearbox, main difference is in centering diameter which is $\varnothing 13 \pm 0,1 \text{mm}$ and also in position and size of the threads for load mounting, please see the dimensions below:



Keep permissible load values listed in the table of mechanical parameters of actuator.

Avoid any impacts or shocks to the surface of the actuator, especially to the output flange, it may cause damage of device!!!

Values of front and peripheral runout of output flange



Actuator type	T [mm]	Z [mm]
DS 50	0.006	0.015
DS 70	0.007	0.02
DS110	0.008	0.025

T = radial runout of the mean diameter of output flange to the axis face (base A) and to the input face during roation of flange

Z = axial runout of the mean diameter of output flange to the axis face (base A) during rotation of flange

Tightening torques and permissible transmission torque

For ensuring reliable transmission of external load of actuator please use screws class T1 - 10.9 or 12.9 according to ISO 898.

Screw size	Tightening torque [Nm]	Mounting force [N]	Class of screw material - specifications
M3	1,9	3 100	ISO 898 T1 - 10.9 or 12.9
M4	4,3	5 300	
M5	8,4	8 800	
M6	14	12 400	

3.2 Electrical installation

Before starting electrical work on the device is highly recommended to read the relevant manuals and technical documentation (mainly actuator and digital servoamplifier). Moreover it should be checked undamage and correct functioning of equipment. After long storage it should be measured the insulation resistance of actuator.

Actuator can not be connected directly to the power supply. To connect the actuator is necessary to use the original cables and digital servoamplifier from the supplier. Disconnection actuator from the power supply is enabled by servoamplifier (please see manual of specific servoamplifier).

Connection instructions

During setting the route of cables please take account of their prevention of possible damage during the operation, especially before:

- mechanical damage caused by moving parts
- heat damage caused by overheated surface
- other possible destructive effects of the environment

Thermal protection of actuator

Thermal protection of DriveSpin actuator is provided by temperature sensor - thermistor, which is integrated in the winding of the servomotor. In addition to the temperature sensing is possible also monitoring of current.

3.3 Start-up

Starting work and using DriveSpin actuator must be in accordance with terms and conditions described in Chapter 1.

Before starting work is also necessary to check:

- actuator can not be damaged or blocked
- after long storage – please see Chapter 3.2
- all cables and connectors
- direction of actuator speed must be correct
- all safety covers must be functional and properly fixed
- there can not be any elements or sources of potential danger

The next step is to set the maximum speed of servomotor in the servoamplifier setup as same or lower as the maximum input speed of the actuator (please see technical parameters of actuator). For instructions how to do these steps please see manual of specific digital servoamplifier. For further information please contact the supplier.

During operation of actuator should be without overheating, without unwanted speed fluctuations and with low level of noise. If the operation problems occur, please follow instructions in Chapter 3.4.

During operation of actuator please ensure following requirements:

- control and protection devices can not be out of service (it is valid also during a test run)
- ambient temperature should be in range of -10 .. +40°C, no condensation (other please consult with manufacturer)
- surface of actuator has to be connected to the PE bus in electrical switchboard equipment, electrical safety of device depends on the least resistance of ground connection
- never disconnect cables during operation - danger of injury and property damage
- never disconnect cables on the side of actuator or servoamplifier with constant AC power - it could cause an electrical discharge with people injury or damage of actuator
- cables, parts of actuator and parts of digital servoamplifier may be under residual voltage, even if actuator was disconnected a while ago
- after disconnecting servoamplifier from power supply please wait at least five minutes before touching or disconnecting circuit and „live“ parts of circuit (contacts, screws, etc.)

3.4 Troubleshooting

PROBLEM	POSSIBLE CAUSE	SOLUTION
Actuator does not start (does not work).	Cables are not connected.	Check the integrity of cable connection.
	A blown fuse.	Replace the fuse.
	Protection of actuator.	Check the correct protection setting or set values in the servoamplifier.
Opposite direction of actuator speed.	Actuator is not connected correctly.	Check the values in the servoamplifier or circuit diagram.
Actuator hums and has high current consumption.	Actuator is blocked.	Check the actuator.
	Brake does not release.	Check the integrity of el. brake circuit, power supply 24V.
	Feedback error.	Check the cable and connector of feedback sensor.
Actuator is getting excessively hot (temperature over 65 °C).	Actuator is overloaded.	Measure the load, use more powerful actuator or reduce load, check the duty cycle.
	Ambient temperature is too high.	Keep the specified temperature range.
	Exceeding the specified operating mode (S1 .. S10, EN 60034), for example: too large effective torque	Type of operation of actuator is necessary to adjust for required operating conditions.
Noisy actuator operation.	Bearing damage.	Necessary replace of bearings, contact the supplier.
	Actuator damage.	Contact the supplier.

4. MAINTENANCE

During maintenance and servicing please follow safety instructions in this manual:

Intervals

The intervals between service inspections depends on many factors. The required inspection intervals need to be set individually depending on the total workload of the actuator. Along with the actuator must be regularly checked also electrical panel including digital servoamplifiers and cables. In case of damage of cable insulation, DriveSpin actuator must be shutted down (there is a danger of electrical shock) and all damaged cables must be replaced.

Cleaning

The heavily soiled surfaces, splinters or dust may adversely affect the functionality of the overall life of the actuator, in extreme cases can lead to their destruction. It is recommended by manufacturer to get rid of these impurities in regular intervals (according to the conditions, up to 2 or 3x in a year). The main reason is to prevent the actuator before possible damage and to secure a sufficiently large active areas for heat dissipation. Insufficient heat dissipation as well as excessive overloading of the actuator (and the excessive heating) considerably reduces its life.

Lubrication

Front part of actuator – cycloidal reducer - is filled with grease (type of grease is indicated bellow). Replacement and addition of grease is not necessary for the normal operation of the actuator, however high load, high temperature, high speed reduce lifetime of lubricant. Grease change intervals please consult with the manufacturer in this case.

Transport and storage

Actuators should be transported in closed transport vehicles or containers secured against movement or overturning. Method of transport must conform to mutual agreement between customer and the supplier. Actuators should be conserved and stored wrapped in indoor areas. DriveSpin actuator must be protected from the direct effects of the weather, corrosive fumes, dust or mechanical shocks.

Transport and storage conditions:

- store in a dry place with low dust
- if it is necessary, use suitable, sufficiently rated handling equipment
- storage climatic category 1K4 according to EN50178
- storage temperature -25 .. +55°C
- relative humidity 5% až 95%, no condensation
- store only in the original package from the manufacturer
- protect the product against any violent shocks and vibrations
- storage period please consult with manufacturer

5. TECHNICAL SPECIFICATIONS

5.1 DS50

Operating data			DS 50	
Gear ratio	i	-	63	
Nominal torque	M_{2N}	Nm	18	
Short-term torque	M_{2max}	Nm	36	
Nominal speed (input)	n_N	rpm	2000	
Maximum speed (input) ⁸⁾	n_{max}	rpm	5000	
Roll stiffness ^{1) 6)}	M_t	Nm/arcmin	4	
Torsional stiffness ^{1) 7)}	k_t	Nm/arcmin	2,5	
Maximum backlash ⁹⁾	LM	arcmin	1,5	
Maximum roll torque ^{2) 3)}	M_{cmax}	Nm	14	
Maximum radial force ²⁾	F_R	kN	$0,044/(a2+0,0305)$ ⁵⁾	
Maximum axial force ^{2) 4)}	F_{amax}	kN	1,9	
DC link voltage	U_{DC}	V DC	24	320
Nominal motor torque	M_N	Nm	0,24	0,24
Nominal motor speed	n_N	rpm	4000	4500
Nominal motor power	P	W	100	113
Nominal motor current	I_N	A	7,8	0,68
Stall motor torque	M_o	Nm	0,26	0,26
Stall motor current	I_o	A	7,9	0,7
Maximum motor torque	M_{max}	Nm	1	1
Maximum motor current	I_{max}	A	33	2,9
Torque constant	K_M	Nm/A	0,03	0,37
Voltage constant	K_E	V/1000min ⁻¹	2	21
Motor poles	2p	-	6	6
Resistance 2 ph.	R_{2PH}	Ω	0,29	36,8
Inductance 2 ph.	L_{2PH}	mH	0,5	62
Frequency	f	Hz	0 ÷ 200	0 ÷ 225
Mass without brake	m	kg	0,95	
Mass with brake	m_{BR}	kg	1,2	
Brake torque	M_{BR}	Nm	0,4	
IP	IP 64 as standard (up to IP 67 as optional)			

5.2 DS70

Operating data			DS 70		
Gear ratio	i	-	57, 75	57, 75	57, 75
Nominal torque	M_{2N}	Nm	50	50	50
Short-term torque	M_{2max}	Nm	100	100	100
Nominal speed (input)	n_N	rpm	2000	2000	2000
Maximum speed (input) ⁸⁾	n_{max}	rpm	5000	5000	5000
Roll stiffness ^{1) 6)}	M_t	Nm/arcmin	35	35	35
Torsional stiffness ^{1) 7)}	k_t	Nm/arcmin	7	7	7
Maximum backlash ⁹⁾	LM	arcmin	1,5	1,5	1,5
Maximum roll torque ^{2) 3)}	M_{cmax}	Nm	142	142	142
Maximum radial force ²⁾	F_R	kN	2,8	2,8	2,8
Maximum axial force ^{2) 4)}	F_{amax}	kN	4,1	4,1	4,1
DC link voltage	U_{DC}	V DC	36	320	560
Nominal motor torque	M_N	Nm	0,86	0,76	0,76
Nominal motor speed	n_N	rpm	3000	4500	4500
Nominal motor power	P	W	270	358	358
Nominal motor current	I_N	A	13,2	1,87	1,04
Stall motor torque	M_o	Nm	0,95	0,95	0,95
Stall motor current	I_o	A	13,7	2,1	1,18
Maximum motor torque	M_{max}	Nm	2,4	2,4	2,4
Maximum motor current	I_{max}	A	50	7,8	4,4
Torque constant	K_M	Nm/A	0,07	0,45	0,8
Voltage constant	K_E	V/1000min ⁻¹	4,2	27	48,5
Motor poles	2p	-	10	10	10
Resistance 2 ph.	R_{2PH}	Ω	0,12	4,9	15,6
Inductance 2 ph.	L_{2PH}	mH	0,35	14,7	46,7
Frequency	f	Hz	0 ÷ 250	0 ÷ 375	0 ÷ 375
Mass without brake	m	kg	2,35 (Resolver) 2,8 (EnDat or Hiperface)		
Mass with brake	m_{BR}	kg	2,95 (Resolver) 3,4 (EnDat or Hiperface)		
Brake torque	M_{BR}	Nm	4,5	4,5	4,5
IP	IP 64 as standard (up to IP 67 as optional)				

5.3 DS110

Operating data			DS 110		
Gear ratio	i	-	67, 89, 119	67, 89, 119	67, 89, 119
Nominal torque	M_{2N}	Nm	122	122	122
Short-term torque	M_{2max}	Nm	244	244	244
Nominal speed (input)	n_N	rpm	2000	2000	2000
Maximum speed (input) ⁸⁾	n_{max}	rpm	4500	4500	4500
Roll stiffness ^{1) 6)}	M_t	Nm/arcmin	150	150	150
Torsional stiffness ^{1) 7)}	k_t	Nm/arcmin	22	22	22
Maximum backlash ⁹⁾	LM	arcmin	1	1	1
Maximum roll torque ^{2) 3)}	M_{cmax}	Nm	740	740	740
Maximum radial force ²⁾	F_R	kN	9,3	9,3	9,3
Maximum axial force ^{2) 4)}	F_{amax}	kN	13,1	13,1	13,1
DC link voltage	U_{DC}	V DC	36	320	560
Nominal motor torque	M_N	Nm	3,8	3,2	3,2
Nominal motor speed	n_N	rpm	1000	3000	3000
Nominal motor power	P	W	397	1005	1005
Nominal motor current	I_N	A	20,5	5	2,8
Stall motor torque	M_o	Nm	4,1	4,1	4,1
Stall motor current	I_o	A	21,3	6	3,4
Maximum motor torque	M_{max}	Nm	11,1	11,1	11,1
Maximum motor current	I_{max}	A	85	24,1	13,6
Torque constant	K_M	Nm/A	0,2	0,67	1,19
Voltage constant	K_E	V/1000min ⁻¹	11,5	40,5	72
Motor poles	2p	-	10	10	10
Resistance 2 ph.	R_{2PH}	Ω	0,1	1,24	4
Inductance 2 ph.	L_{2PH}	mH	0,8	10,6	34
Frequency	f	Hz	0 ÷ 84	0 ÷ 375	0 ÷ 375
Mass without brake	m	kg	7,23 (Resolver) 7,89 (EnDat or Hiperface)		
Mass with brake	m_{BR}	kg	8,16 (Resolver) 8,82 (EnDat or Hiperface)		
Brake torque	M_{BR}	Nm	4,5	4,5	4,5
IP	IP 64 as standard (up to IP 67 as optional)				

5.4 Explanatory notes

- 1) Central statistical value.
For further information please contact the supplier.
- 2) Value is valid for 15 rpm.
- 3) Trunnion torque was measured with $F_a=0$.
For further information please contact the supplier.
- 4) Measured axial force for $M_{c\ max} = 0$.
For further information please contact the supplier.
- 5) a_2 = distance of radial force tech. origin from the front of output flange.
- 6) This parameter depends on the version of cycloidal reducer.
- 7) This parameter depends on the version of cycloidal reducer, gear ratio and maximum backlash.
- 8) It is permissible only short-term use of $n_{\ max}$ in duty cycle.
For further information please contact the supplier.
- 9) The average angular transmission error is $\pm 36\text{arcsec}$.^{1) 7)}
For further information please contact the supplier.

Important notes:

- Values in table are valid for nominal lifetime $L_{10} = 6000$ [hours].
- DriveSpin actuators are designed for S3..S8 operation modes. Other modes must be consulted with manufacturer.
- Mounting position is optional.
- Cycloidal reducers are filled with Grease Castrol Optitem TT1 grease.
- Maximum operating speed of the cycle please consult with manufacturer.

6. CONTACT DETAILS

Company name	TG Drives, s.r.o.
Legal form	limited liability company
Office address	Olomoucká 1290/79, CZ - 627 00 Brno
Invoicing address	Olomoucká 1290/79, CZ - 627 00 Brno
IČO	60738821
DIČ	CZ60738821
Phone	+420548141811
Fax	+420548141890
E-mail	info@tgdrives.cz
Web	www.tgdrives.com

NOTES: