



Commissioning Guide and
Maintenance Instructions

Three-Phase Current
Servo Motors

TAM 00395

Edition 2/96

TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 1/19
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CONTENTS

1 Safety Information	2
1.1 General Dangers in the Case of Failure to Observe the Safety Information.....	2
1.2 Safety-Conscious Working.....	2
1.3 Various Safety Information for Operating and Maintenance Personnel.....	3
1.4 Indication of Special Dangers	4
1.5 No Unauthorized Additions or Modifications to the Drive	4
1.6 Appropriate Use	4
2 Technical Data	5
2.1 Motor Type, Product Number and Technical Data.....	5
3 Requirements of the Site	5
3.1 Transportation, Storage (see Appendix)	5
3.2 Mounting Space Required.....	5
3.3 Site	6
3.4 Ambient Conditions	6
3.5 Environmental Influences.....	6
4 Operation.....	7
4.1 Instructions for Initial Commissioning	7
4.2 Wiring Diagrams	8
4.3 Notes.....	8
5 Preventive Maintenance.....	10
5.1 Fan.....	10
5.2 DG 60 KT Incremental Encoder.....	12
5.3 Replacing the Brushless Tachometer Generator.....	13
5.4 Replacing the Drive End Shield, the Impeller and the Ball Bearing (Figure 7).....	15
5.5 Replacing the Brake.....	16
5.6 Replacing the Motor Housing with the Winding	17
6 List of Spare Parts.....	18
7 Decommissioning, Disassembly and Disposal.....	19

Changes as of					
Date	2/96				
Editor	Sonnauer				
Release					

TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 2/19
----------------------	--	---




1 Safety Information

1.1 General Dangers in the Case of Failure to Observe the Safety Information

The electric drive is designed to the state of the art and was checked for operating safety before delivery. Nevertheless, the machine can represent a danger when it is improperly operated by insufficiently trained personnel or employed for inappropriate use.

This means:

- Danger to life and limb
- Danger to the machine and other material property of the owner
- Danger to efficient operation of the machine

	– This symbol shows information about protecting the system.
	– This symbol shows general safety information for the protection of operating personnel.
	– This symbol shows safety information about sources of electrical danger.

1.2 Safety-Conscious Working

Any person occupied in the owner's company with setup, operation, corrective maintenance and repair of the electric drive must have read and understood the Commissioning Instructions, especially the section on **safety**.

It is advisable that the owner has that confirmed in writing by all such persons.

The drive must be connected and maintenance carried out by qualified and authorized specialists only.

The responsibilities for operation and maintenance of the drive must be clearly defined and observed in order to avoid indefinite responsibilities as far as safety is concerned.

For all work related to setup, operation, resetting, adjustment, maintenance and repair, the system must be shut down. Shutting down the system means that the drive is turned off with the main switch thus deenergizing all its components. The EMERGENCY STOP functions must also be checked.

<p>TAM 00395</p>	<p>Technical Instructions Commissioning Guide and Maintenance Instructions</p>	<p>BAUMÜLLER NÜRNBERG GmbH</p> <p>Page 3/19</p>
------------------------------------	---	---

1.3 Various Safety Information for Operating and Maintenance Personnel

Electric drives must be used only in systems corresponding to VDE specifications.

In operation, the power unit and the motor coils are live! Never touch these components during operation! Connect measuring instruments only when the motor is deenergized and disconnected from the mains.



Start working on the motor connections only after you have made sure that they carry neither potential nor voltage.



Be particularly careful when touching the drive shaft directly or indirectly. You must only do this when the drive is stationary and disconnected from the mains!



Refrain from any operation impairing machine safety.

The operator is obliged to immediately report modifications having occurred on the machine that might impair its safety.

Safety equipment must never be dismantled or disabled.



If safety devices are removed during commissioning, repair and maintenance work, disable the machine. Remount the safety equipment immediately after completion of commissioning, repair or maintenance work.



After any and all operator activity involving the machine, the owner must carry out acceptance testing and document it chronologically in the machine log (maintenance book etc.) (name of the person/firm carrying out acceptance testing, date of testing, signature and report number). If this is not carried out, the owner may be faced with consequences relating to liability legislation.

TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 4/19
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1.4 Indication of Special Dangers

Important! Before starting any maintenance work, lower the load.



Current: Check that the equipment is deenergized.
Main switch OFF!



Contact: Before starting work on the motor, check that the unit is switched off, idle and secured from being switched on again. Risk of injury!
Do not disconnect the motor connections during operation.
Danger to life! Do not touch the motor casing in rated operation.
Risk of burns!



1.5 No Unauthorized Additions or Modifications to the Drive

In the section on safety, it is indicated that for safety reasons unauthorized additions or modifications to the drive are not allowed. In case of doubt, please contact the manufacturer.



1.6 Appropriate Use

These machines are intended for commercial systems. They meet the standards of series DIN 0530/EN 60034. Use of this equipment in hazardous locations is prohibited unless expressly provided for (refer to additional information). If stricter requirements are specified, e.g. in non-commercial applications special guards to protect children, you must ensure that these requirements are complied with on the system side at set-up.

The machines are rated for ambient temperatures of + 5° C to + 40° C and site altitudes of ≤1000 m above sea level. Observe any information that differs from the data shown on the rating plate. On-site conditions at the place of use must correspond exactly with the information on the rating plate.

Electric motors are components for installation in machines in the sense of low-voltage guideline 89/392/EEC. You may not carry out commissioning until it has been determined that the end product conforms to this guideline (observe EN 60204-1).

DC machines comply with the requirements of low-voltage guideline 73/23/EEC.

TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 5/19
----------------------	--	---

When operating electric motors in accordance with their intended uses, the protection requirements must conform to EMC guideline 89/336/EEC. The person setting up the system is responsible for appropriate installation (e.g. physically separating signal lines and power cables, using shielded lines and cables.) In the case of systems with current converters, observe the manufacturer's EMC information.

2 Technical Data

2.1 Motor Type, Product Number and Technical Data

Refer to the rating plate on the motor.

3 Requirements of the Site

3.1 Transportation, Storage (see Appendix)

Check the motors on delivery. In the case of transport damage, inform Baumüller GmbH or the sales office responsible immediately (for addresses see back).



When storing motors for a relatively long period of time, damage can be avoided by taking the following precautions:

Store the motors only on dry premises at a constant temperature and without an aggressive atmosphere. Only store them out of doors in dust- and water-tight packaging material. Avoid permanent vibration acting on the motor. Protect the shaft and the connecting flange from corrosion.

3.2 Mounting Space Required

Mount the motors so that cooling air comes in and warm air is removed freely. This is ensured when the distance to neighbouring machine components is at least 10 cm.



TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 6/19
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3.3 Site

On-site, the effective vibration severity of 4.5 mm/s must not be exceeded over the entire speed range. Measurement according to DIN 45665.



3.4 Ambient Conditions

The power output stated in the list applies to continuous running duty (S1) at nominal speed and at a maximum ambient temperature of 40° C with the machines at a site altitude of 1000 m above sea level or less. In different conditions, the required list power P_L is the product of the factors explained below and the required power $P_L = P \times k_1 \times k_2$. If three-phase generators are to be operated at an ambient temperature of more than 40° C or at site altitudes of more than 1000 m above sea level, the required list power P_L is the product of factors k_1 , k_2 given in the table below and the required power P .

Ambient temperature	40° C	45° C	50° C	55° C	60° C
Correction factor k_1	1	1.05	1.1	1.16	1.24
Altitude above sea level	Up to 1000 m	Up to 2000 m	Up to 3000 m	Up to 4000 m	Up to 5000 m
Correction factor k_2	1	1.06	1.17	1.3	1.55

In the case of sites above 1000 m where the ambient temperature drops by approx. 10° C per 1000 m, power correction is not necessary.

At ambient temperatures above 40° C and with motors of enclosed design, contact the manufacturer for any design modifications that may be required.

3.5 Environmental Influences

You should generally prevent the motor from coming into contact with aggressive media.



TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 7/19
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4 Operation

All work may only be carried out by qualified specialists, with the low-voltage machine idle, deenergized and secured from being switched on again. This also applies to auxiliary circuits, e.g. the anti-condensation heater. Check that the equipment is deenergized!



Exceeding the tolerances in VDE 0530, Part 1/IEC 34-1 – +5% for the voltage, +2% for the frequency, as well as the ones for the curve shape and symmetry – increases heating and affects electromagnetic compatibility. Observe the information on the rating plate and the terminal diagram in the terminal box. The equipment must be coupled up such that a permanent, safe electrical connection is maintained (with no protruding wire ends); use the assigned cable tips. Make a safe PE connection. The smallest clearances between uninsulated live parts and ground may not be less than the following values:

8 mm where $U_N \leq 550 \text{ V}$, 10 mm where $U_N \leq 725 \text{ V}$, 14 mm where $U_N \leq 1000 \text{ V}$.

There may be no dirt or damp in the terminal box. Seal any unneeded cable entry holes and the terminal box itself dust- and water-tight. Secure the feather key for test operation without drive elements. In the case of low-voltage machines with brakes, check that the brake is working properly before carrying out commissioning.

Vibration levels of $v_{\text{eff}} \leq 3.5 \text{ mm/s}$ ($P_N \leq 15 \text{ kW}$) or $v_{\text{eff}} \leq 4.5 \text{ mm/s}$ ($P_N > 15 \text{ kW}$) in coupled operation are insignificant. If changes different from normal operation occur, e.g. increased temperatures, noises or vibrations, find out the cause and contact the manufacturer if necessary. Never disable guards, even in test operation. In case of doubt, switch off the low-voltage machine. If a lot of dirt accumulates, clean the airways regularly. Regrease bearing assemblies that have regreasing devices while the low-voltage machine is running. Observe the type of saponification. If grease exit holes are sealed with plugs (in the case of IP54 protection on the drive side; with IP23 protection on the driven and non-driven sides), remove the plugs before commissioning. Change permanently lubricated bearings after approximately 20,000 operating hours or 3-4 years at the latest.

4.1 Instructions for Initial Commissioning

Compare the available mains voltages to the values specified on the rating plate. Mount all guards before starting commissioning.



TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 8/19
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4.2 Wiring Diagrams

Connect the motor according to the supplied wiring diagrams.



4.3 Notes

The motor must only be mounted to the appropriate attachment points (pedestal, flange) in the installation position for which it is designed. When mounting, ensure that the motor is attached unwarped.



Checklist for Initial Commissioning

- Make a note of the motor type, the motor number and the version of the servo motor.
- Check the connections. The motor shaft can be turned evenly (release the brake first with brake motors).
- Measured at room temperature on U-V-W, the winding resistance corresponds to double the value of R_1 from the technical description. The tolerance of the measured value between the windings is less than 5% .
- Connect the brushless tachometer generator only.
- Drive the motor via the shaft at a constant speed while checking the tachometer voltage, U_1 , U_2 , U_3 , the position encoder signals k, l, m and the terminal voltages in accordance with Figure 1.

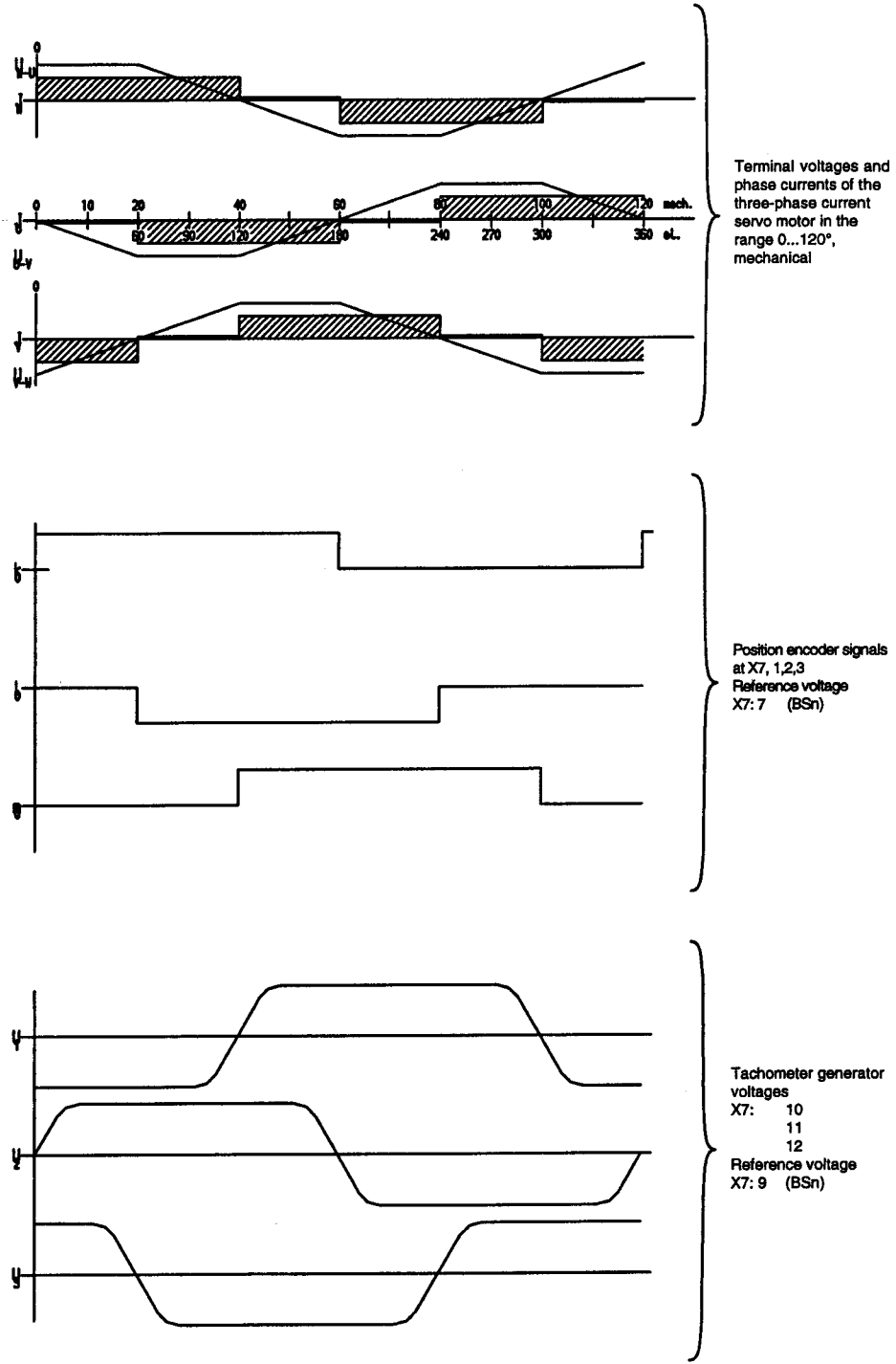


Figure 1

<p>TAM 00395</p>	<p>Technical Instructions Commissioning Guide and Maintenance Instructions</p>	<p>BAUMÜLLER NÜRNBERG GmbH</p> <p>Page 10/19</p>
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5 Preventive Maintenance

Important!

Before starting maintenance work, lower load.
 Before starting maintenance work, disconnect the machine from the mains.
 Retighten as specified all connections, e.g. screws, that were loosened during maintenance work.



5.1 Fan

If maintenance work has to be carried out on a force-ventilated motor, you must first dismount the fan hood. To do this, follow the steps described below:

Motors without an additional incremental encoder:

Release the M5 fastening screws (item 5).
 Pull off the fan cowl (item 6) towards the B side.
 Carry out the necessary maintenance work.
 Carry out remounting in reverse order.

Motors with an additional incremental encoder:

Pull the connections out of the flange box (item 3).
 In the case of old versions with Souriau flange boxes, use a Souriau ejector tool number 5106.021.09.16 to press the crimp contacts inwards.
 With versions with Interconnectron flange boxes, use an Interconnectron dismantling tool number B 038.
 Release the M5 fastening screws (item 5).
 Pull off the fan cowl (item 6) towards the B side.
 Carry out the necessary maintenance work.
 Insert the crimp contacts correctly into the flange box according to the number of the wire and snap them into place.
 Check the plug assignments again by the colours.
 Carry out remounting in reverse order.

<p>TAM 00395</p>	<p>Technical Instructions Commissioning Guide and Maintenance Instructions</p>	<p>BAUMÜLLER NÜRNBERG GmbH</p> <p>Page 11/19</p>
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1	Main terminal for main terminal box/main junction box	4	Connection for fan
2	Connection for brushless tachometer generator	5	M5 DIN 912 screw
3	Connection for incremental encoder	6	Fan cowl

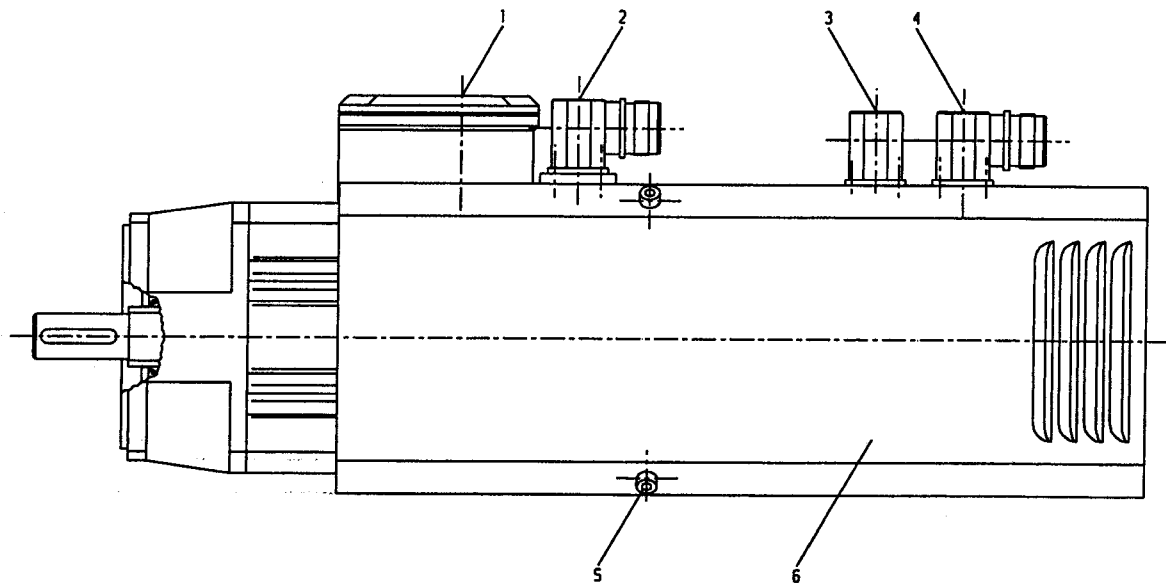


Figure 2

5.2 DG 60 KT Incremental Encoder

Release the fastening screws for the adapter flange.
 Remove the Allen screw (M6) and release the screw connection.
 Just loosen the adapter flange with the incremental encoder.
 Release the impeller of the incremental encoder with a 20-cm long M8 screw with the fly-wheel from the motor shaft (Figure 3) or press it off the brushless tachometer generator.
 Remove the adapter flange with the incremental encoder.
 If necessary, align the new incremental encoder by the zero pulse.
 First roughly zero the impeller using the marking.
 After this, release the three M4 clamping screws and turn the stator to align it to the rising edge of the zero pulse.

1	Connection for brushless tachometer generator	4	DG 60 KT incremental encoder
2	Connection for incremental encoder	5	M6 DIN 6912 screw
3	Adapter flange	6	M4 clamping screw with washer

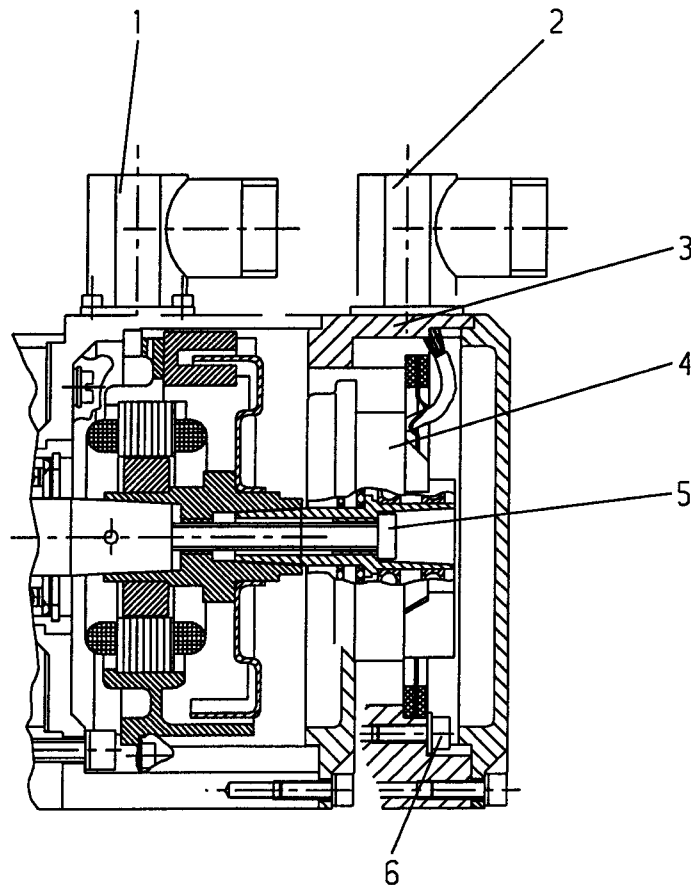


Figure 3

<p>TAM 00395</p>	<p>Technical Instructions Commissioning Guide and Maintenance Instructions</p>	<p>BAUMÜLLER NÜRNBERG GmbH</p> <p>Page 13/19</p>
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5.3 Replacing the Brushless Tachometer Generator

The impeller of the brushless tachometer generator comprises a ring magnet and position encoder disk both of which are mounted on a hollow shaft. The stator consists of the winding of the tachometer generator and the sensors for the position encoder signals.

A: Impeller of the brushless tachometer generator

Remove the M6 Allen screw in the impeller of the brushless tachometer generator.
Using either the tools shown in Figure 3 or a 10-cm long M8 screw, press the cone off the motor shaft.
Remove the impeller.
If the ring magnet is defective, you must replace the complete tachometer generator impeller.
When you install a new tachometer generator impeller, the centring pin ensures that it is automatically positioned correctly.

B: Stator of the brushless tachometer generator

Release the M4 clamping screws.
Pull the connections out of the flange box.
In the case of old versions with Souriau flange boxes, use a Souriau ejector tool number 5106.021.09.16 to press the crimp contacts inwards.
With versions with Interconnectron flange boxes, use an Interconnectron dismantling tool number B 038.
Replace the tachometer generator stator.
Insert the crimp contacts correctly into the flange box (Figure 6) according to the number of the wire and snap them into place.
Check the plug assignments again by the colours.
Line up the notch on the tachometer generator stator with the marking and turn towards better commutation while the motor is running.
Balance the impeller.

C: Adjustment guide

Connect only the brushless tachometer generator on the servo unit.
Run the motor at a constant speed.
On the oscilloscope, record the synchronous generated voltage, e.g. U_{V-W} on terminals W-V and the position encoder signal 1 on X7:1 to X7:7 (Bsa). Keep turning the brushless tachometer generator's stator until the zero crossings of the two signals occur at the same time.

1	Brushless tachometer generator stator	5	M4x6 DIN 912 screw
2	Brushless tachometer generator impeller	6	Connection box for brushless tachometer generator
3	Fastening of brushless tachometer generator stator	7	M6 DIN 912 screw
4	Screen connection for brushless tachometer generator	8	

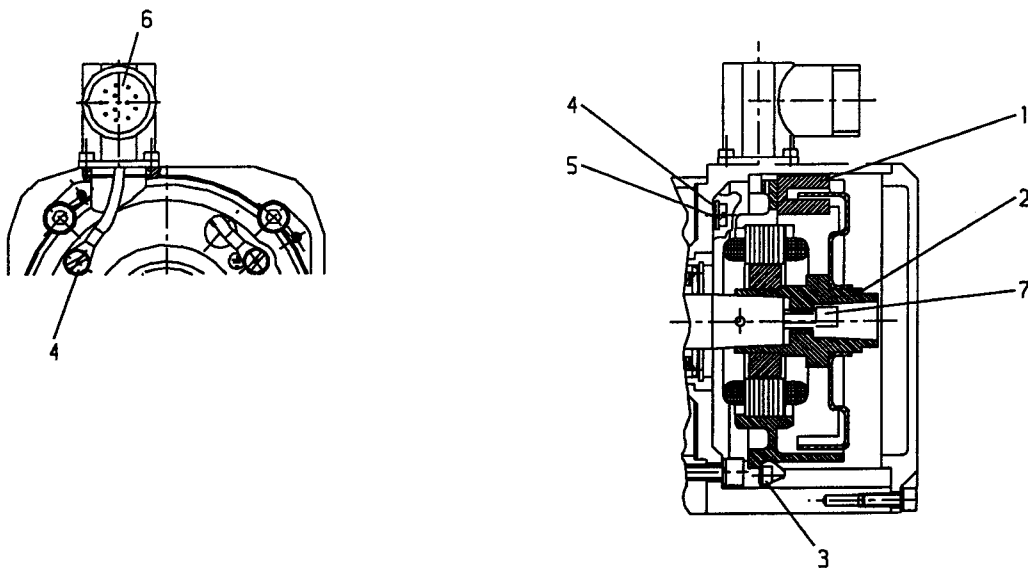


Figure 4

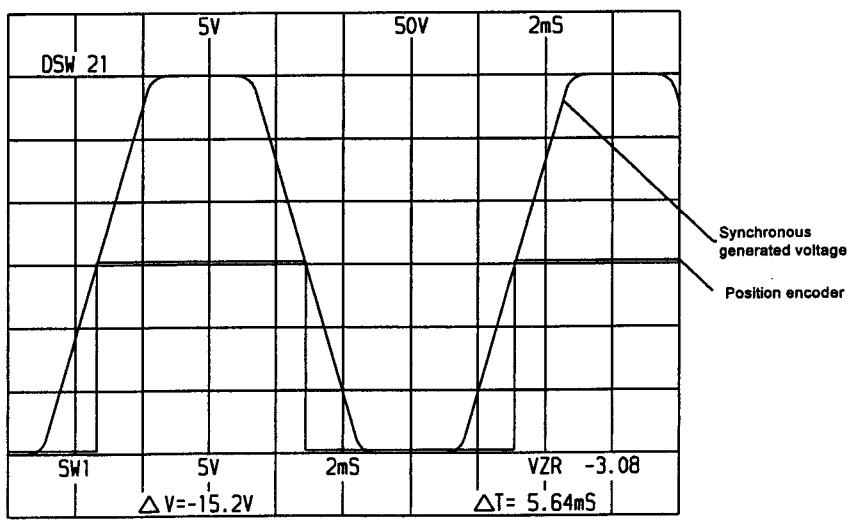


Figure 5

TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 15/19
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5.4 Replacing the Drive End Shield, the Impeller and the Ball Bearing (Figure 7)

Dismount the non-drive end shield, the incremental encoder and the tachometer generator impeller as described in 5.1/5.2.

Remove the fastening screws on the drive end shield.

Pull the drive end shield and the impeller out of the stator housing towards the A side. Due to the magnetic pulling force, you will need to use a certain amount of force to do this; the larger the motor, the more force that will be needed.

Loosen the screws of the bearing cover and remove the drive end shield from the impeller.

Use a retractor to pull the ball bearing and the inner raceway off the impeller.

Replace the defective part.

Carry out remounting in reverse order.

Balance the impeller.

List, sorted by motor sizes, of replacement ball bearings to use

Motor type and size	Ball bearing A-S	Ball bearing B-S
DS 36	6001 2ZR C3	6001 2ZR C3
DS 45	6004 2ZR C3	6003 2ZR C3
DS 56	6204 2ZR C3	6203 2ZR C3
DS 56 Short motors	6004 2ZR C3	6203 2ZR C3
DS 71	6205 2ZR C3	6203 2ZR C3
DS 71 Short motors	6205 2ZR C3	6203 2ZR C3
DS 100	6207 2ZR C3	6205 2ZR C3
DS 100 Short motors	6206 2ZR C3	6206 2ZR C3

All the bearings are lifetime-lubricated ball bearings.

The ball bearings are filled with lithium-saponified grease.

When replacing bearings ensure that the surroundings are clean and that you handle the bearings carefully. Handling the components incorrectly can adversely affect the bearings' useful lives or even result in damage.

<p>TAM 00395</p>	<p>Technical Instructions Commissioning Guide and Maintenance Instructions</p>	<p>BAUMÜLLER NÜRNBERG GmbH</p> <p>Page 16/19</p>
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5.5 Replacing the Brake

Dismount the non-drive end shield, the incremental encoder and the tachometer generator impeller as described in 5.1/5.2.

Release the terminals of the brake (the red and blue wires) in the main terminal box or the main junction box.

Remove the fastening screws of the drive end shield.

Pull the drive end shield and the impeller out of the stator housing towards the A side. Due to the magnetic pulling force, you will need to use a certain amount of force to do this; the larger the motor, the more force that will be needed.

Release the brake's fastening screws and remove the drive end shield from the impeller.

Use a retractor to pull the brake complete with the ball bearing and the inner raceway off the impeller.

When you carry out remounting, you must use a new ball bearing, a new inner raceway and a complete new brake.

Connect 24V DC to the positive lead (red cable).

Heat the brake disk and push it on the impeller. Ensure that the brake disk is in contact with the shaft shoulder.

Balance the impeller.

Heat a new ball bearing and mount it on the impeller.

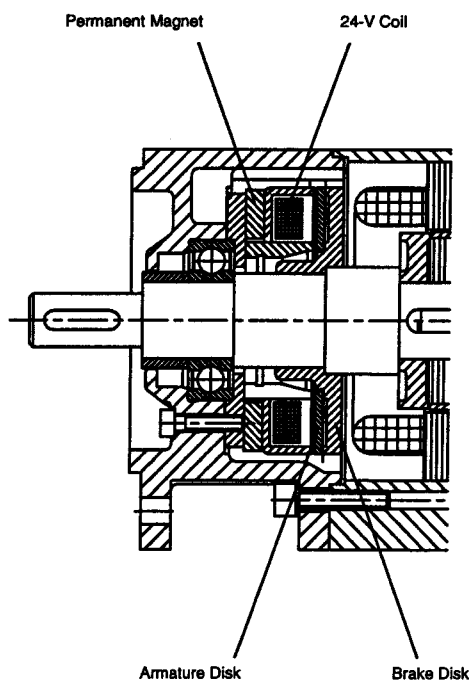
Also heat an inner raceway and push it on the impeller.

Carefully run the two leads through the cable ducts in the stator housing and wire them in the terminal box or the main junction box.

Keep to the connection scheme!

Now remount the bearing shield.

Before recommissioning the drive, carry out a functional inspection to detect possible faults and remedy them if necessary.



TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 17/19
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5.6 Replacing the Motor Housing with the Winding

Dismount the incremental encoder; see section 5.1

Dismount the brushless tachometer generator; see section 5.2

Remove the impeller with the drive end shield as described in section 2.3.

In the case of motors with an integrated brake, dismount it as described in section 2.4.

Remove the housing fastening screws on the non-drive end shield.

Replace the motor housing (if necessary, compare the values of the winding resistors with the values in the table).

Remount the drive in reverse order.

Check that the rotor is free of play in both the axial and radial directions.

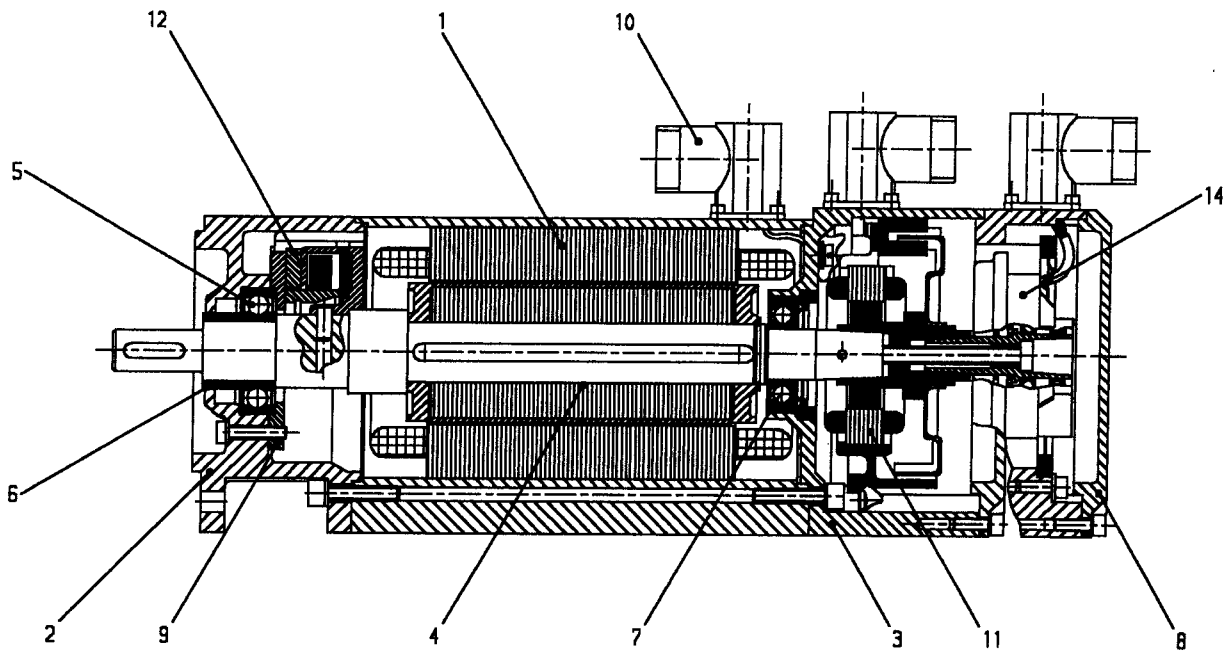
Check that the impeller can rotate freely.

With brake motors, check that the brake functions.

Connect the motor and check commutation as described in 2.2.

6 List of Spare Parts

1	Housing with winding	8	Fastening cover
2	Drive end shield	9	Bearing cover
3	Non-drive end shield	10	Terminal box/Main plug connector
4	Motor shaft with impeller package	11	Brushless tachometer generator with plug
5	Ball bearing A side	12	Holding brake
6	Sleeve		
7	Ball bearing B side	14	Pulse encoder with plug



TAM 00395	Technical Instructions Commissioning Guide and Maintenance Instructions	BAUMÜLLER NÜRNBERG GmbH Page 19/19
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7. Decommissioning, Disassembly and Disposal

At decommissioning of the motors the following also applies:

Before starting any work, lower the load.
Disconnect the motor from the mains.



The motor contains materials like steel, copper, insulation materials and lubricants. You must disassemble the motor appropriately and dispose of the material separately.

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