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Perm Motor GmbH

Permanent-field, electronic commutated synchronous disk armature motors (axial flow motor)

PMS model series

Installation instructions



DANGER

The appropriate manuals must be studied in full prior to any installation, initial start-up and maintenance.

All instructions pertaining to the system and safety must be followed in full. Non-observance of the instructions may lead to injury to persons and/or material damage.

PERM MOTOR shall not be held liable for any damage caused through non-observance of instructions.

Independent tests and inspections are of particular importance for all applications in which a malfunction could result in injury to persons or material damage.

All examples and data, as well as all other information in this manual are there solely for the purpose of instruction and they may not be used for special application without the operator running independent tests and inspections beforehand.

PERM MOTOR does not guarantee, neither expressly nor tacitly, that the examples, data or other information in these instructions are free from error, comply with industrial standards or fulfil the requirements of any special application.

Prior to any installation of the system it must be switched to zero potential!

Use cable screening and mains supply connections that correspond with the *European Union EMC Directive*.

Check the function of installed protection and monitoring systems.



The following must be observed before an installation:

- Always disconnect the electrical mains supply before any interventions to the system.
- Check the function of all installed protection and monitoring systems

PERM MOTOR expressly rejects any implied guarantee pertaining to any marketability or suitability for a special purpose, including in the event that **PERM MOTOR** was notified of such a special purpose or the manual contains a reference to such a special purpose.

PERM MOTOR shall not be held liable for any indirect and direct damage nor for any incidental and consequential damage that results from application of any of the examples, data or miscellaneous information as given in this manual.



	<p>PERM MOTOR shall not provide any guarantee for the design and planning of the overall technical system. This is a matter of the operator, its planners and its specialist engineers. They are also responsible for checking whether the performances of our devices match the intended purpose. The operator is also responsible for a correct initial start-up of the overall system.</p>
	<p>The examples and data, as well as all other information in this manual are there solely for the purpose of instruction and they should not be used for special application without the operator running independent tests and inspections beforehand.</p>
	<p>Independent tests and inspections are of particular importance for all applications in which a malfunction could result in injury to persons or material damage.</p>

Table of contents

1	Safety information and relevant signal words and symbols.....	1
1.1	Safety measures for disk armature motors	2
1.2	Basic safety measures during initial start-up and normal operation	3
1.3	Safety measures for maintenance and servicing	4
1.4	Safety measures before starting up again	4
2	Application and function	5
2.1	Proper and intended use	5
2.2	Function description	5
2.3	General technical motor data.....	6
2.4	Senders and sensors.....	8
3	Technical drawings, connection diagrams	8
4	Installation	9
4.1	Installation of disk armature motor	9
4.2	Installation of lines and connections	10
5	Maintenance	11
6	Malfunctions.....	12
7	Download publications.....	13

1 Safety information and relevant signal words and symbols

This publication provides specific safety information on how to avoid any unavoidable remaining risks when operating a machine. This includes hazards for:

- People
- Product and machine
- Environment

The primary aim of the safety instructions is to prevent personal injury!

The signal words used in this publication are specifically designed to direct your attention to possible extent of any damage!



DANGER indicates a hazardous situation, the consequence of which could be fatal or severe injuries if it is not prevented.



WARNING indicates a hazardous situation, which could lead to fatal injury or severe injuries if it is not prevented.



CAUTION indicates a hazardous situation, which could lead to minor injuries if it is not prevented.



NOTE indicates possible material damage.



Safety information is not only denoted by a signal word but also by hazard warning triangles. Hazard warning triangles can contain different symbols to illustrate the danger. However, the symbol used is no substitute for the actual text of the safety information. The text must therefore always be read in full!



This symbol does not indicate safety information, but rather it provides important information to enhance the user's understanding of the functions. This information should be noted and acted on.

Some of the notes in this publication immediately preceding the Table of contents contain safety information. They must be read, understood and complied with before any operation or maintenance is carried out!

1.1 Safety measures for disk armature motors

This machine has been designed for reliable utilisation in accordance with the application, conditions and specifications as described in these instructions. Everyone who works on this machine must have read these instructions and the information. The employer or safety officer bear responsibility for ensuring that these instructions are known and adhered to.



⚠ DANGER

High voltage

Death or severe injury through electrical shock

- > All work on the motor to be performed by skilled personnel only
- > Always disconnect motor from mains when working on it
- > The cover for the connecting lines may only be opened for assembly or maintenance work
- > Route lines carefully and ensure that the insulation cannot be damaged or worn-through



⚠ DANGER

Electric motor shaft may start up unexpectedly

Risk of injury through getting trapped in drive shaft area

- > All work on the motor to be performed by skilled personnel only
- > Always disconnect motor from mains when working on it
- > When work has to be performed with the mains supply switched on, one should always be aware of drive shaft movement
- > Block off access to the drive shaft area as soon as the electrical voltage is switched on



⚠ WARNING

Heavy weight or motors

Risk of crushing or bone injuries caused by device falling down

- > Wear safety shoes when transporting the device
- > Attach mechanical protection devices against falling down
- > Use suitable hoisting gear



⚠ CAUTION

Motor gets hot

Risk of burn injuries

- > Always allow motor to cool down first before working on it
- > Wear suitable protective clothing

1.2 Basic safety measures during initial start-up and normal operation



The motor may only be installed and operated by qualified and authorised personnel!

Before switching the motor on for the first time:

- > Make sure that only authorised personnel enter the motor's operating area
- > Make sure that non-one can be injured or endangered when the motor starts up
- > Ensure that all motor and any other protection devices are active
- > Check that all undone screw fittings are now tight
- > Make sure that all connections have been properly executed
- > Make sure that the drive is undamaged and not blocked
- > Check that the motor rotates in the correct direction
- > Make sure that all protective screens have been properly installed
- > Make sure that there are no other hazard sources

Before each motor start-up

- > Check motor and system for visible signs of damage, and make sure that they are in perfect condition. Always notify the responsible department immediately about any defects
- > Ensure that all motor and any other protection devices are active
- > Remove all material and objectives surplus to requirements from the operating area of the motor or system

When the motor is operating

- > Check the motor is running properly:
 - No overload
 - Nor speed fluctuation
 - Strong noise development or suchlike

1.3 Safety measures for maintenance and servicing



Before starting maintenance or repair work:

- > Block access to motor operating area or the system for any unauthorised people!
Put up an information board that indicates that such work is underway
- > Switch off electrical supply and secure against being switched back on again
- > Allow any parts on the machine that have to be touched to cool down to room temperature and check whether the electrical voltage has been switched off
- > Check that all screw fittings are tight
- > Replace any damaged lines or cables immediately
- > Ensure switch cabinet is always closed, access is to be for authorised personnel only



- > Never use a water spray or high-pressure cleaner to clean switching cabinets and other electrical equipment housing. Risk of short circuits and corrosion
- > Ensure that all motor and any other protection devices are active

1.4 Safety measures before starting up again



- > Check that all undone screw fittings are now tight.
- > Ensure that all motor and any other protection devices are active
- > Make sure that the drive is undamaged and not blocked
- > Make sure that all connections have been properly executed
- > Check that the motor rotates in the correct direction
- > Make sure that all protective screens have been properly installed
- > Make sure that there are no other hazard sources

2 Application and function

2.1 Proper and intended use

The disk armature motors in the PMS model series are used solely for the drive or alternator function. They are intended for use in an industrial environment. When operated outdoors, additional protective measures against weather are also required. Signals are exchanged through electrical signals. Because transmission may be interfered with by external circumstances or influences, the user must provide additional safety devices to match the application case.

In individual cases, the following must be coordinated with the manufacturer PERM MOTOR:

- Each use which deviates from the above mentioned
- Modifications to the device
- Use in extreme, ambient conditions that deviate from the specification (dust, temperature, wetness)
- Use under powerful electrical or electromagnetic fields
- Use in aggressive atmospheres or vapours
- Use in potentially explosive areas

A written opinion from the manufacturer must always be procured in the event of any obscurities, queries or missing statement.

2.2 Function description

The disk armature motors in the PMS model series are permanent-field synchronous motors with a rotating output shaft. The motor control can be effected independently of the controller and the speed, i.e. it is not torque specific. Generally an absolute position sensor is required as motor feedback, e.g. a resolver, Sin/Cos sensor or an encoder. This then provides the indispensable motor controller a necessary relative position signal from the rotor to the stator. For operation the motor controller has to be connected to an external voltage supply.



Using unsuitable motor controllers

Risk of damage to the motor,

Risk of injury through heat or flying parts

- > Disk armature motors may only be operated with motor controllers that can handle and monitor the required voltage and output range

2.3 General technical motor data

Degree of protection	Degree of protection IP54 (other degrees of protection optionally available on request)
Cooling	Natural cooling for version without type auxiliary letters Surface cooling, type auxiliary letter "L" ; min. 5 ^m /s speed of cooling air Water cooling, type auxiliary letter "W"; max. 60 °C water temperature, max. 3 bar water pressure
Version	Heat insulating material class "F" max. permissible winding temperature 155 °C
Motor contactor	Temperature sensor KTY 84-130 embedded in winding head (other temperature sensors optionally available on request)
Ambient temperature	-10°C to +40°C
Heating	$\Delta\vartheta \leq 105k$
Installation position	Optional
Geodetic height	< 1000m above sea level
Motor feedback	Customer requirement (when ordering, quote type, or controller used)

• **Output definition**

The values listed for each motor for output or torque are valid for continuous operation (S1) at nominal speed under the previously-mentioned cooling conditions and ambient temperatures.

• **Winding insulation and heating**

All motors are designed in **insulating material class F** in accordance with **DIN 60034** for a permissible **winding temperature** of **105 K** at a **room temperature** of **up to 40 °C**.
The insulation is resistant to gases and vapours from combustible materials.

- **Permissible radial forces at end of shaft**

All bearings are designed for a service life of **approx. 20,000 operating hours**.

The permissible radial forces are listed in the product catalogue according to motor types.

The product catalogue is available from the manufacturer

All values are valid for horizontal installation of a motor only without any additional axial forces.

- **Axial load of motor**

The permissible axial forces are listed in the product catalogue according to motor types.

The product catalogue is available from the manufacturer

- **Remarks**

Rated torque M_N and rated capacity P_N are essentially dependent on two variables:

- the motor controller used
- the ability to dissipate heat resulting from engine friction through the housing and flange.

Housing and flange temperature in operation: max. 90 °C

Tolerances for output-specific technical data: ±10 %.

Already included in these tolerances are:

- Production tolerances
- Permanent magnet tolerances
- Temperature dependence of permanent magnets
- Influence of motor heating under load

2.4 Senders and sensors

- **Motor feedback**

Generally the motors are equipped with a motor feedback function. Apart from the relative position signal from the rotor to the stator this also provides the signal for the current speed.

- Resolver type “LTN RE-15-1-V67”
- 8 bit RLS encoder with analogue sin/cos output
- 12 bit RLS encoder with SSI output
- 3 digital Hall sensors U/V/W
- Others available on request

- **KTY temperature sensor**

The motors in the PMS model series are equipped as standard with a temperature sensor in the stator winding for evaluation in the motor controller. If required additional PTCs or heat monitors can be installed.

NOTICE

There is a risk of disk armature motor malfunctions through improper connection of KTY temperature sensor

- > Care must be taken when connecting the KTY to ensure that the temperature sensor is correctly evaluated
- > Avoid currents > 4 mA in the KTY circuit as excessively high intrinsic heating of the temperature sensor could damage its insulation and the motor windings

3 Technical drawings, connection diagrams

The technical drawings and pin assignments of the motors are subject to ongoing customer-specific modifications. They may therefore vary significantly.

Corresponding drawings and connections are available in the manufacturer's product catalogue or they can be downloaded from its internet site. Drawings can also be posted on request.

4 Installation



WARNING

Danger through improper installation

Risk of injury through heat or flying parts

- > Installation, maintenance and operation to be conducted by skilled personnel only.
- > Before installation make sure that the motor output matches the rating plate for the drive, the motor controller's output voltage and the mains voltage
- > Drive must be undamaged
- > All ambient conditions (Chapter 2.3) must be fulfilled

4.1 Installation of disk armature motor

Installation can be carried out at almost any position. This should however, where possible, be a position that has low vibration and one exposed to low ambient temperature only.



For installation use qualitatively high-grade fastening material only. This applies, in particular, to the fastening screws

NOTICE

Setting up motor

- > The motor may only be set up or installed on in an unchanged design on a level, vibration-free and torsionally stiff substructure.
- > Motor and machine must be carefully aligned to ensure that the drive shaft is not overloaded (note permissible transverse and axial forces!)
- > Avoid any bumps and impacts on the shaft end!
- > When using an external ventilator ensure cooling air has unimpeded access. Make sure that other units do not suck in warm extracted air.
- > Parts with a half feather key groove, which was retrofitted to the shaft, must be balanced with a half feather key groove (motor shafts are balanced ex-factory with a half feather key groove).

Preparatory work

- > The ends of the motor shafts must be cleaned thoroughly of any corrosion-preventive agent, contamination or such like (use off-the-shelf solvents). Solvents must not be used on bearings or sealing rings, as otherwise material may be damaged!

Mounting and shaft load

There is a risk of excessive surface pressure on the feather key. As a consequence the motor may become defective.

- > For reliable torque transfer the entire bearing length of the feather key must be utilised.

Risk of damage to disk armature motor through improper installation!
When pulling clutches, belt pulleys and suchlike onto the motor shaft additional excessive axial forces may be generated! These, in turn, will reduce the service life considerably. PERM MOTOR shall not be held liable for any such instances!

- > Therefore, when attaching accessories to the motor shaft, always ensure that the internal thread at the shaft end is used as an installation aid.

Transport / storage

Inspect the delivery immediately after receipt for any transport damage. Notify the transport company of any such damage promptly. Initial start-up may then need to be prevented.

If required, use suitable, sufficiently-rated means of transport. If necessary, remove any transport fastenings before initial start-up.

4.2 Installation of lines and connections

Lines routed to and from the electric motor must be free of pulling forces and any risk of crushing. The smallest possible bending radius must never be dropped below. The lines must be attached such that in the event of any relative movement by the machine as it runs does not generate any pulling forces. To avoid any faults through losses, the maximum permitted cable length must not be exceeded. The prescribed minimum line cross-section must be adhered to, as otherwise there is a risk of fire through overheating.

When routing the lines, one must also take care to ensure that they do not present any risk of tripping over and the lines are securely fastened.

The permissible values of the previously-mentioned variables are listed in the product catalogue according to types of motor. The product catalogue is available from the manufacturer

Connector plugs are generally designed according to customer specification. Information on assignment and version is to be requested from PERM MOTOR directly.

NOTICE

Evaluation of temperature sensor

The integrated temperature sensor must be evaluated by the motor controller, and in the event of any overheating of the motor respond in a suitable manner, e.g.

- > reduction of motor torque when a temperature limit is exceeded.
- > switch off of motor when a temperature limit is exceeded.

5 Maintenance

To guarantee a reliable operating principle over the entire service life, the electric motor must be overhauled at the latest after **20000 operating hours** or after a period of **10 years**. Both wear parts here are replaced while a recalibration and a new adjustment are also conducted. In the event of increased radial or axial bearing loads this interval can be significantly reduced. The customer itself is bound to ensure that the permissible operating values are not exceeded. PERM MOTOR shall not be held liable.

6 Malfunctions

Fault	Possible cause	Remedy
Motor fails to start	Motor supply line interrupted	Check connection
	Motor contactor activated	Check motor contactor is correctly configured, rectify fault
Wrong running direction	Motor wrongly connected	Check motor controller; check set-point value
Motor makes humming noise and draws excess current	Drive blocked	Check drive
	Motor feedback malfunction	Check motor feedback, if necessary configure through motor controller
Motor heats up too much	Overload	Test output, if necessary reduce load or use larger motor
	Ambient temperature too high	Note permissible temperature range
	Insufficient cooling	Check cooling supply, free up cooling channels, retrofit external ventilator
	Duty-type rating S1 to S9 in accordance with DIN 57530 exceeded, e.g. through excessive switching frequency	Match motor's duty-type rating to required operating conditions or use a larger motor
	Temperature sensor not connected or evaluation in controller incorrect	Connect temperature sensor, check controller configuration and correct if necessary.
	Temperature sensor defective	Have temperature sensor replaced
Motor running noise	Bearing damage	Consult with motor manufacturer (PERM MOTOR)

7 Download publications

Publications can be downloaded in PDF format from our internet site:

www.perm-motor.de

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