Use and Maintenance Manual

For motors and gear motors of the following series: AM-AC ACC PA PAC BC2000 BC2000-24MP MC MCC PC PCC XC BS MCBS ACF PAF MCF PCF XCF MCFBS AMSS PCFSS XCFSS SXCFSS AMSSE

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1. GENERAL SAFETY INFORMATION

This manual has been written by the manufacturer to provide authorised personnel with all information required to safely perform the transport, movement and handling, installation, testing and inspection, and repair of Mini Motor products.

This manual applies to the following product series: AM-AC ACC PA PAC BC2000 BC2000-24MP MC MCC PC PCC XC BS MCBS ACF PAF MCF PCF XCF MCFBS AMSS PCFSS XCFSS SXCFSS AMSSE (see Mini Motor technical catalogue). This manual also applies to the version with planetary gear stage (suffix “E” to product series code, e.g. ACE).

The motors in question are electrical machinery, and as such should be considered hazardous as they contain live parts and others which rotate.

Movement/handling, commissioning, use and any repairs required must be performed by QUALIFIED PERSONNEL, and only after complying with the following instructions:

- The qualified personnel must be familiar with the procedures for the installation, maintenance and use of the motor, and must have read this use and maintenance manual.
- The qualified personnel must know all technical data, specifications and electrical connections for the motor to install.

In order to minimise actions which could lead to damage to the product and injury to the operator and/or bystanders, the following instructions must be followed:

- Check that the system is not live before making the electrical connection to the motor.
- Check that the electrical cables have not been damaged during installation, that they are dressed properly away from moving parts, and that they are not subject to mechanical stresses.
- Close the cover of the terminal box before applying power to the motor.

The surfaces of the motor could reach or exceed a temperature of 100°C, therefore do not position parts near the motor which could degrade or catch fire at these temperatures.

- **Warning: Make the earth connection to the motor before any application**
- Do not approach rotating parts with any part of the body.
- Use appropriate personal protective equipment (PPE) when working in the vicinity of the end of the shaft (presence of sharp edges in the key seat).
- Before testing the machine, provide for adequate protection around rotating parts (joints etc.).
- Check the tightness of the screws of the electrical terminals before proceeding to test the motor.

The use of standard servomotors, gear units and gear motors is not allowed in the following:

- saline environments and those with high humidity levels;
- corrosive environments with explosion risk (ATEX);
- liquid or totally immersed environments, with the exception of the “SS” series.

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1.1 PRODUCT IDENTIFICATION

The product is fitted with a nameplate to allow rapid identification and to comply with applicable regulations.

An example nameplate for single-phase, three-phase and direct current motors/gear motors is given below.

For further details, see the technical catalogue which can be downloaded from the website www.minimotor.com .

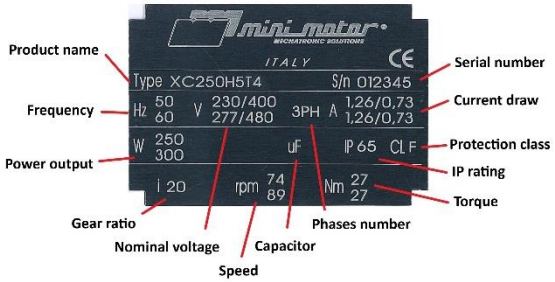


Figure 1 - Nameplate nomenclature for single-phase, three-phase and direct current motors/gear motors

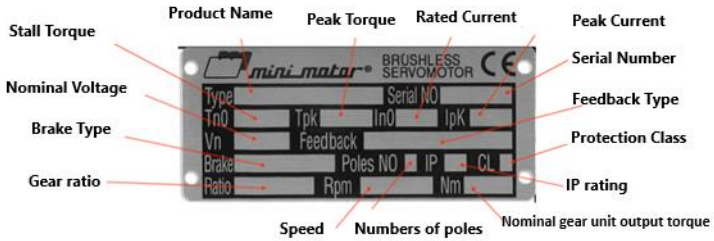


Figure 2 - Nameplate nomenclature for brushless motors/gear motors

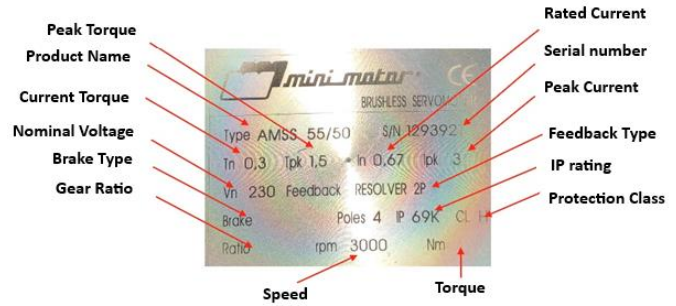


Figure 3 - Nameplate nomenclature for "SS" series motors/gear motors

Every Mini Motor product has a unique serial number stamped on its nameplate and inside the gearbox housing terminal compartment. Check that the two serial numbers match.

1.2 MOVEMENT/HANDLING AND STORAGE

All products are packaged to prevent damage during shipping and handling. It is nevertheless the user's responsibility to check the integrity of the product before installation.

Below are some precautions to follow for correct storage:

- Store the product in an environment with temperatures of between 0°C and +40°C, which should be covered, dry, clean and free from vibrations.
- Keep the product off the ground.
- Place the product on a flat, stable surface.
- For storage periods exceeding four months, protect the outer machined parts in steel and the output shaft with rust preventive oil or grease, and periodically check the condition ***(with the exception of products equipped with optional stainless-steel output shafts).***
- Perform a few turns of the slow shaft every four to five months.

1.3 IDENTIFICATION AND NOTES ON cURus AND cCSAus PRODUCTS

- **cURus UL recognized products for the US and Canada** can be identified from the product mark directly on the product nameplate. All information relating to acceptability conditions for the end user can be viewed at the following link. The Product IQ site requires user registration.
  https://iq.ulprospector.com/info/
  Searching for "MINI MOTOR" or the individual product purchased will give access to the above information.

Document Name	Company Name	UL CCN Description
NMMS2.E503911	Mini Motor S.p.A.	POWER CONVERSION EQUIPMENT - COMPONENT
NMMS8.E503911	Mini Motor S.p.A.	POWER CONVERSION EQUIPMENT CERTIFIED FOR CANADA - COMPONENT
PRGY2.E324263	Mini Motor S.p.A.	MOTORS FOR APPLIANCE APPLICATIONS - COMPONENT
PRGY8.E324263	Mini Motor S.p.A.	MOTORS FOR APPLIANCE APPLICATIONS CERTIFIED FOR CANADA - COMPONENT
PRHZ2.E504007	Mini Motor S.p.A.	SERVO AND STEPPER MOTORS - COMPONENT
PRHZ8.E504007	Mini Motor S.p.A.	SERVO AND STEPPER MOTORS CERTIFIED FOR CANADA - COMPONENT

- **cCSAus approved products** are equivalent to the previous ones, but approved by the CSA approval body. They are identified by the cCSAus logo directly on the product nameplate.
  Information for the end user can be found at the following address:
  https://www.csagroup.org/testing-certification/product-listing/

2 PRELIMINARY OPERATIONS

2.1 PRE-INSTALLATION PRODUCT INSPECTION

The following checks must be performed before installing the product:

- Check that the product corresponds to the purchase order.
- Check product integrity after opening the packaging.
- Check the data given on the nameplate.
- Check that the supply voltage complies with that specified on the nameplate.
- Check that there are no lubricant leaks.
- Check the tolerance of the couplings to the drive components. Apply tolerances on the order of g7 / f7.
- For products of construction type B3, check the flatness of the mounting surface.
- For products of construction type B5/B14, check that the mating tolerance is F7.
- Earthing of the product to the machine.

For gearmotors, it is possible during running in that the nameplate rpm and torque data will be below the nominal values given. Noise levels could be higher.

There may be a film of dewatering fluid on the products, which is required to protect the external parts from corrosion.

2.2 ELECTRICAL CONNECTION

Always earth the motor before connecting it to the power supply. The marked terminal is located inside the terminal box (use a cable of sufficient cross-sectional area).

In the case of **single-phase, three-phase and direct current motors/gear motors**, the diagram is located under the terminal compartment cover.

To connect the product to the supply, the four retaining screws must be removed and the cover removed as shown in the figure.

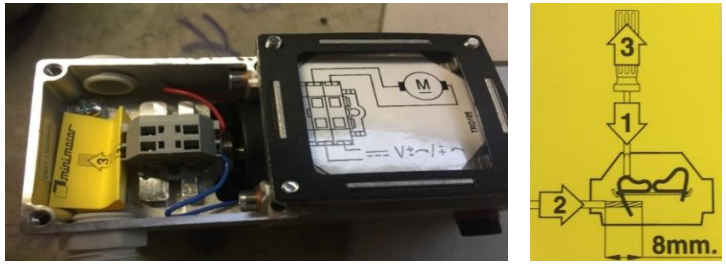


Figure 4 - Example of Connection Diagram

The type of terminals used allows ferrules and other types of wire terminals to be avoided, as they ensure excellent electrical contact even in the presence of strong vibration or high temperatures, while fully complying with applicable regulations. Connection only requires 8 mm to be stripped from the end of the cables, as specified on the yellow plate shown in *Figure 4*.

The cable gland used (M16x1.5 with strain relief) allows a cable of between 4 mm and 10 mm diameter to be used.

Make a preliminary check of the type of diagram to use.

Precisely follow the instructions given on the diagram; modifying the connection diagram could compromise correct product operation.

In the case of products with thermal protection, this must always be connected to ensure correct product operation.

In the event that the nameplate with the wiring diagram is lost, wiring diagrams can be downloaded from www.minimotor.com .

In the case of special connection diagrams, contact Mini Motor directly.

For **brushless** servomotors, follow the diagrams available at www.minimotor.com when connecting the motors; the following cables must be used:

- For the signals: the connecting cable must be of screened shielded twisted-pair type.
- For the power: the connecting cable must have outer shielding.

Use separate conduit for the power cables and signal cables.

Contact Mini Motor directly for the wiring and connection diagrams.

2.3 Instructions for Alternating Current Products

If the motor is controlled via electromechanical contactors, it is essential to use a protection system against the voltage surges generated when the contacts of the individual contactors open.

Solution 1: RC Filter: Provides excellent protection against voltage surges, drastically reducing electromagnetic emissions. The sizing is independent of the supply voltage. This solution **CANNOT** be used if the motor is driven by frequency converters **(INVERTER)**.

Solution 2: Varistors: Provide good protection from voltage surges, and can also be used on inverter-driven products. The varistors must have a rated voltage of between 1.3 and 1.5 times the value of the supply voltage, and a dissipation energy of at least 50J.

For example: Supply voltage 400 Vac; minimum rated voltage of the varistor: 1.3 x 400 = 520 Vac; maximum rated voltage of the varistor: 1.5 x 400 = 600 Vac.

Both solutions must be connected in parallel to the motor phases downline of the contactor (between the contactor and the motor).

These measures will ensure correct product operation. Mini Motor shall not be held liable for malfunctions or burned out windings in the event that these measures are not applied.

2.4 Instructions for Permanent Magnet Direct Current Products

It is essential that the peak **inrush current** draw is no more than three times the rated current value.

Exceeding this value could cause demagnetisation of the stator and/or damage to the product.

Brushed gear motors are not designed for continuous use, as the continuous contact of the brushes would reduce the product lifespan.

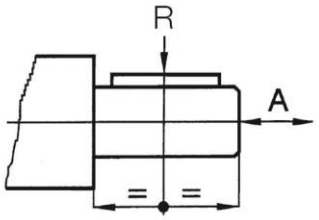
During normal product operation, it is necessary to limit the maximum power draw through calibration of the power supply equipment.

It is absolutely prohibited to supply the motors directly from batteries without the use of suitable current limitation systems (e.g.: AC/DC or DC/DC drives).

2.5 Intended Uses and Limitations

Each product has a potentially different use: ensure that the purchased product can be used in the intended environment. As a general rule, unless otherwise specified on the product itself, Mini Motor products must be:

- Handled, installed, used and maintained in accordance with this manual.
- Handled, installed, used and maintained by qualified and authorised staff.
- Used within a temperature range of 0°C to +40°C.
- Installed with adequate ventilation provided for.
- For construction type B3 (with feet), ensure that the mounting surface is flat.
- For construction type B5 (with flange), fastening must be performed with F7 mating tolerance.
- Use the threaded holes on the end of the shafts for assembly; avoid use of a hammer, as repeated impacts could irreparably damage the bearings.
- **DON'T** go above the radial and axial loads indicated on the following table, divided by product type:



Tipo / Type / Typ / Type / Tipo	AM	AC ACC	ACE ACCE	PA PAC	PAE PACE	BC2000 M BC2000 T BC2000 24MP	BCE2000 M BCE2000 T BCE2000 24MP	MC MCC *	MCE MCCE	PC PCC *	PCE PCCE	XC *
R (N)	55	420	450	1200	3000	180	300	500	450	1000	3000	1300
A (N)	40	210	400	600	1500	40	250	500	400	800	1500	900

IT (*) - Questo carico è stato calcolato sull'albero di uscita, fornibile opzionalmente.
Mini Motor consiglia per tutti i riduttori di non superare le seguenti velocità del motore:
• VITE SENZA FINE 3500 rpm
• COASSIALE 4000 rpm.

- Be sure that the coupling are coaxial. We suggest using an **elastic coupling** to reduce loads generated by misalignment.
- In the coupling between hollow shaft and male input shaft, always use damping grease, to avoid corrosion from vibrations.

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For THREE-PHASE motors/gear motors, whenever there is the possibility of the output shaft jamming and/or persistent overload conditions, it is advisable to use magneto-thermal protection (MCBs).

Single-phase motors/gear motors contain a thermal cut-out device inside the winding which protects the motor by automatically cutting the power supply when the winding temperature reaches 130°C ± 5%.

DC powered motors/gear motors require the use of dedicated current limitation systems, and where necessary a thermal pellet fastened to the radiator which will cut the power supply whenever there is a possibility of the output shaft jamming.

Brushless servomotors have a PTC temperature sensor inside the motor which is responsible for reporting motor overheating to the converter control circuits. The PTC sensor is connected to the converter via the resolver cable.

Ensure that the resolver cable has been correctly connected and the converter setting has been performed correctly.

Mini Motor shall not be held liable for burned out windings, premature wear of bearings and deterioration of lubricant oil due to the causes outlined above. Premature wear of seal rings is not covered by warranty, as they are exposed to weather and unknown environmental conditions.

2.6 General Warranty Conditions

Mini Motor's warranty covers only manufacturing defects and is valid for one year from product shipment, unless agreed otherwise. Mini Motor will replace or repair defective parts under this warranty, but bears no liability for direct or indirect damages of any nature. The warranty shall lapse in the event that the provisions listed in the use and maintenance manual have not been followed, and/or repairs or modifications have been made without the company's written authorisation.

3 Installation and Periodic Inspections

Before placing the motor into service, check that the torque output is lower than that specified on the nameplate.

The activities to be performed before installation are listed below, along with the periodic inspection intervals:

Activity	
Check for any lubricant leaks.	Before installation
Check the coupling tolerances for matching of the product to the mating component. Check the individual model ordered in the Minimotor catalogue (www.minimotor.com).	Before installation
For products of construction type B3, check the flatness of the mounting surface.	Before installation
For products of construction type B5/B14, check that the mating tolerance is F7.	Before installation

Periodic Inspections (2000 hour intervals, and in any case at least once a year)
Check for any lubricant leaks
Clean fan cover
Check brake
Check the brushes and replace if necessary (for permanent magnet DC products)

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3.1 Brake Inspection and Regulation

Permanent magnet brakes are single-disc devices in which the force of the permanent magnet is used to produce a braking torque (safety system with mechanical locking of the rotor with no current present).

To remove the braking force, the permanent magnetic field is cancelled out by an opposing electromagnetic field.

Ensure that the motor, gear motor or servomotor is free (not braked) before power is applied.

For **self-braking motors/gear motors** (products with the letters **KA** or **KB** in the product code), whenever the braking action should be reduced due to wear, the gap must be restored as follows:

1) Power the brake (causing it to release);
2) Slacken off the fan retaining screws on the motor shaft;
3) Move the fan away from the brake, **without removing it**, using a suitable extractor;
4) Obtain a 0.20 mm spacer;
5) Position the spacer between the surface of the brake and the fan;
6) Move the fan up to the brake surface so that it takes on the spacer measurement;
7) Tighten the fan retaining screws to a torque of 1.0 Nm using a torque driver, and pull out the spacer.

Brushless servomotors (BSK and BSEK series) do not require maintenance of the brake. Contact Mini Motor directly with any problems.

4 Troubleshooting

A series of potential issues are listed below. Follow the advice given before taking any action.

Fault	Possible Cause	Solution
Leaking lubricant	Excessive vibration of gear motor	Check installation
	Worn seal rings	Contact Mini Motor
High temperature	Electrical connection not made correctly	Check connection
		Contact Mini Motor
	Insufficient ventilation	Remove any foreign bodies
	Load applied to product greater than nominal nameplate value	Check applied load
		Contact Mini Motor
	Faulty capacitor (single-phase motors/gear motors only)	Replace capacitor
		Contact Mini Motor
Excessive noise	Incorrect brake gap (only KA and KB braked versions)	Restore gap (Sec. 3.1)
		Contact Mini Motor
	Worn bearings	Contact Mini Motor
	Worn shaft/worm screw coupling (VSF gear motors only)	Contact Mini Motor
	Foreign bodies in ventilation zone	Check fan and fan cover condition
Product does not operate	Incorrect electrical connection	Check connection
		Contact Mini Motor
	Jam	Check value of load and method of application
	Open circuit/fault on capacitor	Replace capacitor
		Contact Mini Motor