

Operating manual for drives

ebmpapst

The engineer's choice



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Use

The safety regulations must be noted and followed when using the motors. Read through this operating manual carefully, before you start working on the drives. Please note and follow the hazard signs and warnings to avoid personal risk and malfunctions.

This operating manual is to be treated as part of the drives.

If the drives are sold or passed on the operating manual must be handed over with it. Copies can be made of safety regulations, assembly and installation instructions and passed on for the purpose of informing about potential hazards and their prevention.

ebm-papst is always interested in further developing and improving the products.

This may lead to possible deviations of the products to this operating manual.

Subject to change without notice.

The respective current version of this operating manual can be found in the download area of the Info Center on our website: www.ebmpapst.com

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1.1 Foreword

All the safety instructions listed under [Chapter 2](#) must be followed at all times during the installation and operation of the drives; outside of Germany the relevant laws, directives, guidelines and regulations of the respective country also apply.

Read through this operating manual carefully before starting any work on the drives.

Note and follow the following warnings in order to avoid personal risk or product malfunctions.

This operating manual is to be thought of and handled as part of the drives and must be handed over with the drives if it is sold or passed on.

The safety instructions can be copied and passed on to provide information about potential hazards and their prevention.

Depending on the version or revision status of the products, differences may exist compared to this operating manual. The user must check this before using the manual and take into account any such differences.

1.2 Target group

This operating manual is solely directed at qualified and trained skilled personnel with knowledge of electronics and mechanics.

1.3 Notation used in this document

In this operating manual the significance of texts is denoted by different presentation forms.

Descriptive text is presented without preceding symbol.

- Text with a preceding dot (•) indicates a list which is introduced by a heading.
 - Text with a preceding dash (–) is on a lower level below the list with a dot.

[Underlined blue text](#) denotes a cross-reference, which can be clicked in the PDF document.

The part of the document named in the text is then displayed.

1.4 Terms Used

Drive

The term drive includes the drive motor, the gearing and all components included in the scope of delivery.

Components

Components for gear motors include transmitters and brakes as well as electronic assemblies.

1.5 Warnings and notes

Warnings and notices are always positioned before the instruction, implementation of which can result in a hazard or property damage.

The following warnings are used in this document:



DANGER

- ▶ Hazardous situation imminent and will lead to severe injury or death if the procedures are not followed. Strictly follow the procedure.

WARNING

- ▶ Hazardous situation can arise and lead to severe injury or death if the procedures are not followed. Exercise extreme caution while working.

CAUTION

- ▶ Hazardous situation can arise and lead to minor or slight injuries or property damage if the procedures are not followed.



NOTICE

Hazardous situation could possibly arise and lead to property damage if not avoided.

2.1 General safety instructions

- Before starting work, disconnect the drives or the design application using suitable devices provided and secure it against being switched back on again.
- Before opening the units or entering the danger zone, safely bring all drives to a standstill and secure them against being switched back on again.
- Do not make any changes, add attachments or make modifications to the drives without ebm-papst's approval.
- If the motor is subjected to unapproved loads, check it for damage and if necessary repair or replace it.
- Do not commission or start up the design application until it has been fully checked for compliance with all relevant legal requirements, directives and guidelines and the safety provisions relevant for its intended use (e.g. accident prevention regulations and technical standards).
- Re-assess any safety risks caused by the drive after it has been installed in the customer's application.

2.2 Documentation

In addition to this operating manual, the "Kickstart" PC software is required for making settings and parameterization (configuration) of the ECI-K4 motors and VDC-K4 motors. The operation is described in the "ebm-papst Kickstart" software handbook and can be downloaded from our homepage: www.ebmpapst.com

2.3 Standards, guidelines and directives

- The product does not fall under the Low Voltage Directive 2006/95/EC, as the nominal operating voltage is not within the voltage range from 75 V DC and 1500 V DC.
- The Machinery Directive MD is applicable, as the product is “partly completed machinery” in accordance with Article 2, paragraph g), MD 2006/42/EC. A “CE” marking does not have to be provided on the rating plate. A Declaration of Incorporation must have been drawn up in accordance with Annex II, Part 1, Section B, MD 2006/42/EC.
- The drives do not contain substances prohibited according to the RoHS Directive 2011/65/EU and under § 5 of the German Electrical and Electronic Equipment Law ("Elektro- und Elektronikgerätegesetz").
- The Electromagnetic Compatibility Directive 2014/30/EU (EMC Directive).

2.4 Personnel qualifications

- Only qualified electricians may install the drives and carry out the trial run and work on the electrical system.
- The drives may only be transported, unpacked, operated and serviced by instructed and authorised skilled personnel.

2.5 Personal safety

- Provide adequate safeguards / contact protection.
- Wear suitable clothing.
- Do not wear loose clothing or jewellery.
- Keep hair, clothing and gloves away from rotating components.
- Wear personal protective equipment (hearing protection, thermal protection gloves).

2.6 Electrical / electromagnetic safety

- Check the electrical equipment of the drives regularly.
- Only use cables and connectors approved by ebm-papst.
- Remove defective cables and loose connections immediately.
- Take suitable measures to avoid impermissible electromagnetic interference emissions.
- Take suitable measures against high-frequency EMC radiation.
- Ensure EMC capability in the terminal device / installation state.
- Use control devices to control the electromagnetic radiation.

2.7 Mechanical safety

- Only carry out work when the system / machine is at a standstill.
- Provide adequate cooling of the drive.
- Remove protective devices and guards on the drives and design application only for the purpose of carrying out repair and assembly work.

2.8 Intended use

The drives with rotating movement are intended for industrial plants and systems, for installation in machines as defined in the Machinery Directive 2006/42/EC or for installation in equipment by competent companies or establishments, taking into account the applicable guidelines, directives and standards.

In accordance with the intended use of the machine/equipment in which the drive is installed, other product-specific and product-unrelated guidelines and standards are also applicable, the observance of which is the responsibility of the machine/equipment manufacturer.

Initial operation is prohibited until compliance of the end product with these guidelines and/or other guidelines and standards applicable for the end product is established. ebm-papst is responsible for establishing the compliance of the end products with the respective guidelines or standards. Observance of the proper operating data is imperative. In case of doubt, do not commence operation of the drive. In case of queries, please contact ebm-papst.

2.8.1 Type-related exclusion

Due to their type or design, the drives must not be used in the following areas of use; this could result in hazards and equipment damage:

- In case of special fail-safe requirements.
- In aircraft and space vehicles.
- In rail and motor vehicles.
- In boats and ships.
- In potentially explosive atmospheres (EX protection area).
- For operation near flammable materials or components.
- For use as a safety component or for carrying out safety-relevant functions.

If the drive is used under operating conditions other than those described in [Chapter 5](#), prior consultation with the manufacturer is required.

Operation is prohibited in the case of improper use.

2.9 Maintenance/repair

- The control electronics/drives are maintenance-free for the period of the planned life.
- In observance of the operating conditions specified by ebm-papst, lubrication of the bearings and gearing components will last for the lifetime of the equipment.
- Repairs on the product may only be made by qualified personnel or ebm-papst.

2.10 Conversions and Modifications

Only operate the drive when it is in original and fault-free condition. Upgrades, modifications or conversions of the drives are prohibited. Always agree any desired modifications with ebm-papst.

Any conversions or modifications not expressly approved by us will invalidate any liability held by us. This also applies to damage caused by the use of non-original components or by operation outside of the agreed parameters.

2.11 Cleaning

- Damage or malfunction if the unit is cleaned by cleaning with a water spray or high-pressure (jet) cleaner.
- Use of acids, alkalis and solvent-based cleaning agents.
- Use of pointed and sharp-edged objects.

2.12 Transport / storage

- Transport drives in their original packaging only.
- Secure the transport goods.
- Do not exceed the vibration values, temperature and climate ranges during the whole transport ([see Chapter 5](#)).
- Store drives, dry and protected in their original packaging, in a clean environment.
- Do not store the drive for longer than 24 months at -25 °C to +70 °C.
 - Please note that, in accordance with our General Terms and Conditions of Sale and Delivery, we assure a warranty of 12 months after delivery. We therefore recommend that the storage period be kept to a minimum.

2.13 Disposal

On disposing of the product, note and follow all legal and local regulations and requirements applicable in your country.

The drives and components are installed as components in machines and equipment.

As individual components in the industrial field, they do not come under the purview of the law on electrical and electronic equipment. If the drives are installed in end products that come under the purview of this law, the manufacturer of the end product is responsible for observance of the legal regulations.

2.14 Liability and warranty

Complaints must be reported to ebm-papst immediately after finding the defect, error or fault. ebm-papst GmbH & Co. KG does not accept any liability or provide any warranty whatsoever for incidents due to

- Failure to follow this operating manual.
- Incorrect handling and use of the drives.
- Improper handling.
- Incorrect storage.
- Unsecured transport.
- Use of accessories and spare parts of other manufacturers without the express and written approval of ebm-papst.
- Changes to the drives without the express and written approval of ebm-papst.
- Opening/replacing the components in a service case by personnel not authorised by ebm-papst.

3 Identification and Labelling.

3.1 Scope of Delivery

The drives are assembled individually, in accordance with the construction kit system.

Please refer to the scope of delivery for the relevant accompanying documents (e.g. delivery note).

- Check the content of the delivery immediately for conformity of the scope of delivery with the documents accompanying the goods. ebm-papst provides no guarantee in the event of fault notification at a later date.

In the case of

- identifiable damage from transportation
- Identifiable defects
- Incompleteness

submit a complaint immediately to ebm-papst.

3.2 Labelling

In addition to the external visibly identifiable features (e.g. drive shaft geometry, extension components), ebm-papst drives are labelled by the content of the rating plates on the gearing.

| Labelling | |
|---------------------------------------|---------------------------------------|
| Spur Gearhead (Example) | Planetary Gearhead (Example) |
| FL 85.3 Gearing type.Number of stages | NP 63.2 Gearing type.Number of stages |
| i = 54:1 Gear reduction | i = 26:1 Gear reduction |
| 36P Auditor number | 36P Auditor number |
| 40/16 Week/year of production | 40/16 Week/year of production |

The exact product design is clearly described by the order number. This is specified in the order papers.

3 Identification and Labelling.

3.3 Purchase Order Numbers

3.3.1 PO number system: preferred types

With our preferred types, we offer you a selection of motors and gear motors which are provided ready for dispatch within 48 hours. The preferred types can be purchased with a maximum order volume of 20 products per order.

| "Preferred type" indicator | Motor / Gear motor | Motor type indicator | Motor size | Package length | Voltage | Electronic variants | Gears | Gear sizes | Number of stages | Reduction | Generator | Brake |
|----------------------------|--------------------|----------------------|----------------------------|----------------------------------|--|---------------------|---|----------------------|------------------|--------------------|----------------------------|----------------|
| V | M G | ECI BCI VDC | 42 49 52 63 80 | 10 20 30 40 50 60 | A = 12 V B = 24 V D = 48 V E = 60 V | K1 K4 | 0 = Optimax P = Performax® PP = Performax®Plus NP = NoiselessPlus E = EtaCrown® EP = EtaCrown®Plus | 42 52 63 75 | 1 2 3 | 5 9 20 30 | G1 G2 G3 G4 G5 | B1 B2 B3 |

Example:

VG.ECI4240BK1.PP42.1.5 (ECI-42.40, 24 V K1 with Performax®Plus 42 (single-stage) reduction 5:1)

VM.ECI8060DK1.G1B1 (ECI-80.60, 48 V K1 with generator 1 and brake 1)

3 Identification and Labelling.

3.3.2 PO number system: Standard program construction kits

Generate the product tailored to you online using the standard program construction kits. We offer you a unique product configurator on our Internet portal, using which you can put together all our solutions according to your specific needs.

| Gear size | Number of stages | Types of EC motor | Motor size | Package length | Number of poles in capacitor motor | Gears | Consecutive numbering |
|-----------|------------------|---|------------|----------------|------------------------------------|---|-----------------------|
| 32 | | | 24 | 10 | | | |
| 42 | | | 28 | 14 | | | |
| 50 | | | 30 | 15 | | | |
| 52 | 1 | | 35 | 20 | | | |
| 63 | 2 | C = VDC Motor D = DPM Motor E = ECI/ECM Motor | 40 | 25 | | C = Compactline E = EtaCrown® EP = EtaCrown®Plus F = Flatline H = Performax® HRL L = NoiselessPlus O = Optimax P = Performax® PP = Performax®Plus | xx |
| 75 | 3 | | 42 | 30 | | | |
| 78 | 4 | | 43 | 38 | 2 | | |
| 85 | 5 | | 48 | 40 | 4 | | |
| 90 | | | 49 | 45 | | | |
| 91 | | | 52 | 50 | | | |
| 92 | | | 54 | 55 | | | |
| | | | 63 | 60 | | | |
| | | | 71 | 77 | | | |
| | | | 80 | 80 | | | |

Example:

42.2.E4240.P04 (Performax® 42, 2-stage, ECI-42.40, reduction 30:1)
92.3.4030.4.C12 (Compactline 92, 3-stage, KM4030, 4 pole, reduction 142:1)

3 Identification and Labelling.

3.3.3 PO number system: NEMA connection for spur wheel and planetary gears

Gears with NEMA connection give you the possibility to add these to any motors with NEMA geometry

| Size | Number of stages | NEMA | Size | Gears | Consecutive numbering |
|------|------------------|------|------|---|-----------------------|
| 42 | | | | | |
| 52 | | | | | |
| 63 | 1 | | | | |
| 78 | 2 | N | 17 | C = Compactline F = Flatline P = Performax® | xx |
| 85 | 3 | | 23 | | |
| 90 | 4 | | 34 | | |
| 91 | 5 | | | | |
| 92 | | | | | |

Example:

42.1.N17.P01 (Performax® 42, 1-stage, NEMA 17 connection, reduction 5:1)
85.3.N23.F03 (Flatline 85, 3-stage, NEMA 23 connection, reduction 40, 3:1)

3.3.4 Customer-specific motor solutions

The above safety information also applies to customer-specific motors.

Example:

426.92231 (Compactline 92.2 VDC-3-54.14)
 493.92021 (Performax® 52.1 BCI-63.55)

4.1 Assembly

Before assembly, carry out an identity check on the drive.



Electrical voltage and power

DANGER

Electrical voltage

Regularly check the product's electrical equipment.

- ▶ Even with low supply voltage, the voltage can increase through energetic recovery. Motors which brake or taper off work in a similar way to a generator and hereby emit electrical power. Life-threatening voltages can be produced as a result.
- ▶ Remove loose connections and defective cables immediately.
- ▶ All connections may only be connected when de-energized.



Safety and protective functions

DANGER

Dangerous movements

- ▶ Look out for sufficient protective devices in the equipment / systems because dangerous movements occur as a result of incorrect control of the motors.

Possible correctives include:

- ▶ Do not stay within the area of movement of the equipment or system.
- ▶ Ensure sufficient stability of the (protective) covers and housing against the maximum kinetic or rotational energy.
- ▶ Before opening the equipment or entering the danger zone, safely stop all drivers and ensure they will not restart.



Mechanical movement

DANGER

Automatic product

If voltage is applied, the drives can restart automatically depending on the execution after a power failure, surge or under-voltage or blockage.

- ▶ Do not linger in the product's danger zone.
- ▶ If working on the product, switch off the supply voltage and ensure it will not restart unintentionally.



Do not make any changes to the product

WARNING

Improper high load

- ▶ After an improperly high load (e.g. impact, heat, surge, axial or radial load), the product can become damaged and must be disabled; before restarting, it must be checked that it is in its proper condition.



WARNING

Rotating parts (shaft / rotor)

Objects like long hair, hanging pieces of clothing and jewellery can get caught in the rotating/moving parts. Risk of injury!

- ▶ Do not wear any loose or hanging clothing or jewellery or other objects when working on moving parts.
- ▶ Protect long hair with a hair net.



WARNING

Electromagnetic radiation

Interference could occur through interaction within electromagnetic compatibility (EMC) when the product is integrated in the system. Ensure the EMC of the entire system.



WARNING

Health hazard for persons with pacemakers, metal implants and hearing aids

These persons are prohibited from accessing the following areas:

- ▶ Areas in which electrical devices and parts are mounted, operated or put into operation.
- ▶ Area in which motor parts with permanent magnets are stored, repaired or mounted.



WARNING

Depending on the installation and operating conditions, a sound pressure level greater than 70 dB(A) can be produced

Risk of noise-induced hearing loss

- ▶ Take technical protective measures.
- ▶ Provide the operating staff with appropriate protective equipment, such as hearing protection.



CAUTION

Hot surface - risk of burns High temperature in drives

- ▶ Ensure there is sufficient protection against accidental contact.
- ▶ Take care that there is sufficient cooling.



Establish mechanical connection

CAUTION

Danger of cutting and crushing when removing the product from the packaging and during assembly

Lift the product carefully by the housing from the packaging. Avoid impacts!

- ▶ Wear safety shoes and cut-resistance protective gloves.
- ▶ Use suitable assembly facilities.



NOTICE

Risk of damage to electronic parts

- ▶ Use ESD protective equipment during assembly.



Establish electrical connection

The electrical connection will be established **after** mechanical installation.

DANGER

Risk to life from electric shock when touching live parts

- ▶ Only have work carried out by an electrician.
- ▶ Ensure that the connecting cables are not live.
- ▶ Ensure that the operating voltage will not unintentionally restart.
- ▶ Never work on live parts.

**CAUTION****Electrical voltage****The product is an installation part and has no electrical switches**

- ▶ Only connect the product to suitable circuits. Note that the power supply must always have suitable protection from generative voltage produced from the secondary circuit.
- ▶ When working on the drives, you **must** shut down the equipment/machine and ensure it will not restart unintentionally.

**Requirements before connecting and starting up:**

- ▶ Make sure before connecting the product that the supply voltage matches the product voltage.
- ▶ Check whether the data on the type plate or in the detail specification match the connection data of the power supply.
- ▶ Only use cables which are designed for the currents according to the type plate and the corresponding environmental conditions. Ensure the mechanical protection of the electrical connection.

4.2 Malfunctions, possible causes and remedies

Do not carry out any repairs on the product yourself.

**DANGER****Electrical voltage in the drives**

Do not open the device until the motor is at a halt and after the voltage is switched off at all poles.

| Malfunctions | Possible causes | Possible remedies |
|--------------------|------------------------------|---|
| Drives not turning | Mechanical block | Switch off, de-energize and remove mechanical block |
| | Defective mains voltage | Check mains voltage, re-establish power supply |
| | Defective connection | Correct connection, see pin configuration |
| | Drives are too hot | Cool off motor, find cause of malfunction |
| | Motor winding broken | Exchange product |
| | Ambient temperature too high | Reduce ambient temperature |



In case of further malfunctions and running noises, please contact ebm-papst ZEITLAUF.

The drives may not be operated until the issue is conclusively clarified.

4.3 Operation

Unless otherwise specified in the product data sheet, the drives are suitable for an ambient temperature range of -20 °C to +80 °C. They are suitable for S1 operation, i.e. continual operation. In short time operation, higher loads than those specified in the product data sheet are permissible. In this case, please contact ebm-papst for further information.

Where components are combined with different safety provisions, the safety provision for the entire system is based on the lowest safety provision of the individual components. The safety provision is determined according to EN 60529.

| first code number | protection against contact and foreign substances |
|-------------------|---|
| 0 | no protection |
| 1 | protection against large foreign bodies $\varnothing > 50$ mm |
| 2 | protection against medium sized bodies $\varnothing > 12$ mm |
| 3 | protection against small bodies $\varnothing > 2,5$ mm |
| 4 | protection against grain-formed bodies $\varnothing > 1$ mm |
| 5 | protection against noxious dust deposits |
| 6 | protection against dust |

| second code number | protection against water |
|--------------------|--|
| 0 | no protection |
| 1 | protection against vertical water drops (drip proof) |
| 2 | protection against diagonal water drops ($90^\circ \pm 15$) |
| 3 | protection against spray water ($30^\circ - 150^\circ$) |
| 4 | protection against water jets from all directions (splash proof) |
| 5 | protection against stream water from all directions (hose proof) |
| 6 | protection against flooding |
| 7 | protection against dipping |
| 8 | protection against immersing |

The technical specifications and usage parameters agreed by the contract of sale apply as standard for the product you have purchased.

The information on the technical specifications and the electrical connection of the drive (circuit diagram) can also be found in the current catalogues of the individual motor series and on the internet under www.ebmpapst.com or www.zeitlauf.com.

Should you be unable to access either of these sources, please contact ebm-papst. We will immediately provide you with the relevant technical specifications.

6 Wiring Diagrams, Terminal Assignment.

6.1 AC/DC/EC-Motors



Pin assignment and circuit diagrams can be found on the internet under www.ebmpapst.com or in the current catalogues of the individual motor series. Ensure that the polarity of the connections is correct, in accordance with the desired rotation direction.

6.2 Components

- Added components
 - Spring action brake
 - Magnetic pulse transducer
 - Optoelectronic angle step counter

For connection information visit www.ebmpapst.com or refer to the current catalogues of the individual motor series.

- Additional components
 - Operating electronics
 - Speed controller/rotation speed regulators
 - Switching power supplies

For connector see product-specific operating instructions of respective components.

7 Malfunctions.

Should malfunctions occur, e.g. such as unusual running noises or temperature developments, please contact ebm-papst. You will need to provide the following specifications:

- Rating plate specifications
- Type and extent of the malfunction
- Circumstances of the malfunction
- Application data (torque cycle, rotation speed, loads, local conditions, etc.)

Do not operate the drive/application until final clarification is available.

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