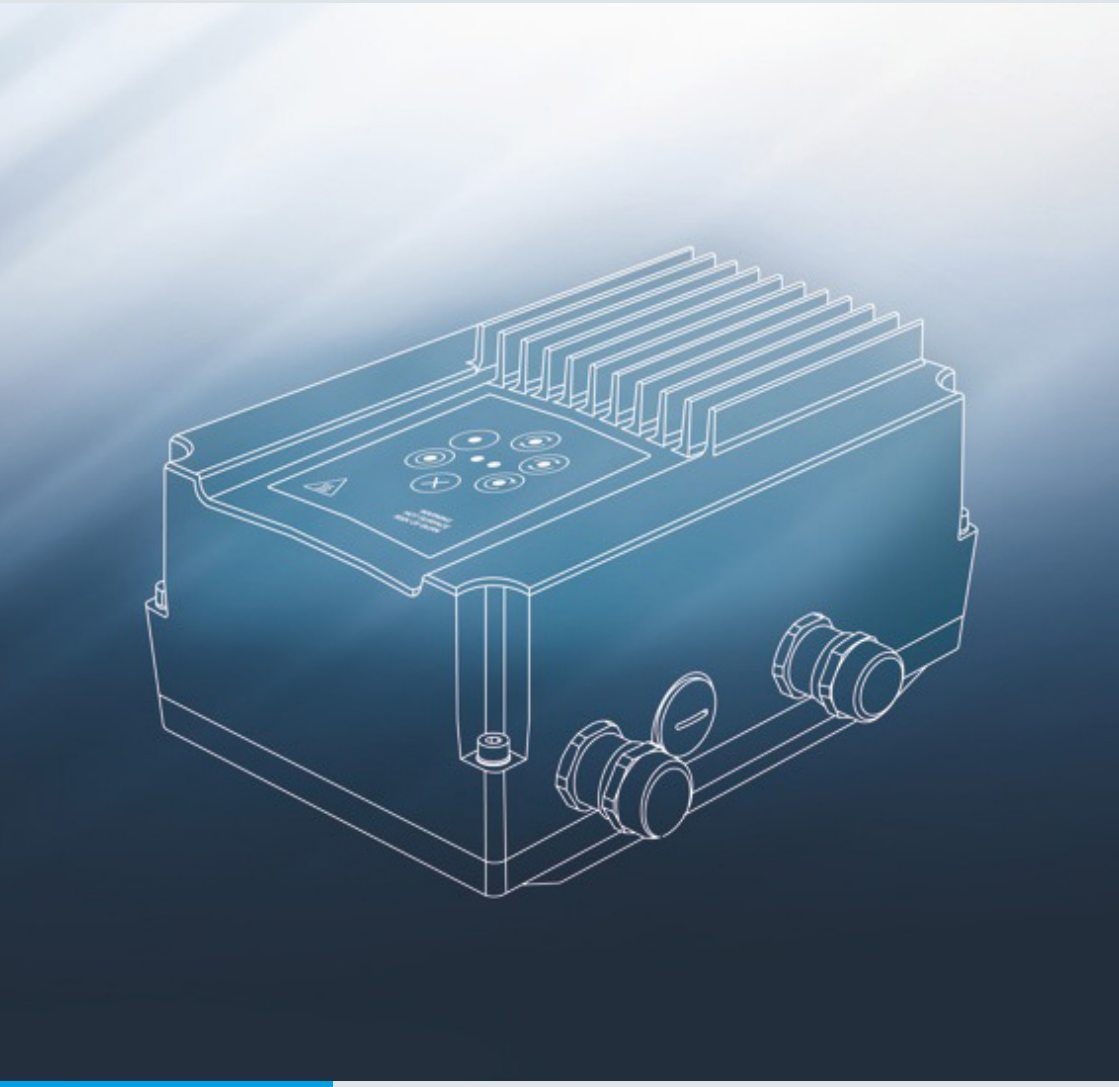
INDUSTRIE ELEKTRIK

KOSTAL



Smart connections.

# Short manual

## INVEOR Drive Controller α

## Legal notice

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The illustrations and texts have been compiled with great care. However, the possibility of errors cannot be ruled out. The compilation is made without any guarantee.

## General note on gender equality

KOSTAL is aware of how language impacts on gender equality and always make an effort to reflect this in documentation. Nevertheless, for the sake of readability we are unable to use non-gender-specific terms throughout and use the masculine form instead.

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KOSTAL

**Contents**

# 1. General information

Thank you for choosing an INVEOR α drive controller from KOSTAL Industrie Elektrik GmbH & Co KG! Our INVEOR α drive controller platform is designed to be universally usable with all common motor types.

If you have any technical questions, please call our central service hotline:

Tel.: +49 (0)2331 80 40-848
Monday to Friday: 7 am to 5 pm (UTC/GMT +1)
Fax: +49 (0)2331 80 40-602
E-mail: INVEOR-service@kostal.com
Website address
www.kostal-industrie-elektrik.com

## 1.1 Information about documentation

The following information explains how to navigate through the documentation.

Read this manual carefully in its entirety. It contains important information for operating the INVEOR α.

We assume no liability for any damage resulting from non-observance of this manual.

This manual is an integral part of the product and applies exclusively to the INVEOR α from KOSTAL Industrie Elektrik GmbH & Co KG.

Provide the operator of the system with this manual so it is available when needed.

### 1.1.1 Other applicable documents

This refers to all manuals that describe how to operate the drive controller system and any other manuals for the equipment used. Download the 3D files (.stp) for INVEOR and adapter plates from www.kostal-industrie-elektrik.com.

A description of parameters is available for download (www.kostal-industrie-elektrik.com) for parametrising the drive controller system. In the download, you will find all the information required for correct parameterisation.

### 1.1.2 Storing the documentation

Store this manual and all other applicable documents carefully so they are available when needed.

## 1.2 Notes in this manual

### 1.2.1 Warnings

The warnings refer to life-threatening dangers. Serious injuries possibly resulting in death may occur.

### 1.2.2 Warning symbols used


Danger


Danger due to electrical shock and discharge


Danger due to burns


Danger due to electromagnetic fields

### 1.2.3 Signal words

Signal words are used to identify the severity of the danger.

**DANGER**

Indicates a direct hazard with a high level of risk, which, if not avoided, will result in death or serious injury.

**WARNING**

Indicates a hazard with a moderate level of risk, which, if not avoided, will result in death or serious injury.

**CAUTION**

Indicates a hazard with a low level of risk, which, if not avoided, may result in minor or slight injury or property damage.

### 1.2.4 Information notes

Information notes contain important instructions for the installation and problem-free operation of the drive controller. These must be followed at all times. The information notes also point out that failure to observe can result in property or financial damages.

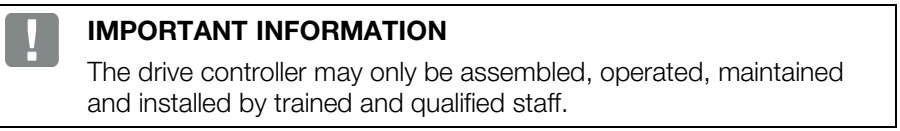


Fig.: 1 Example of an information note

#### Symbols within the information notes

Important information

Damage to property possible

Fig.: 2 Symbols within the information notes

#### Other notes

INFORMATION

Enlarged representation

## 1.3 Labels on the drive controller

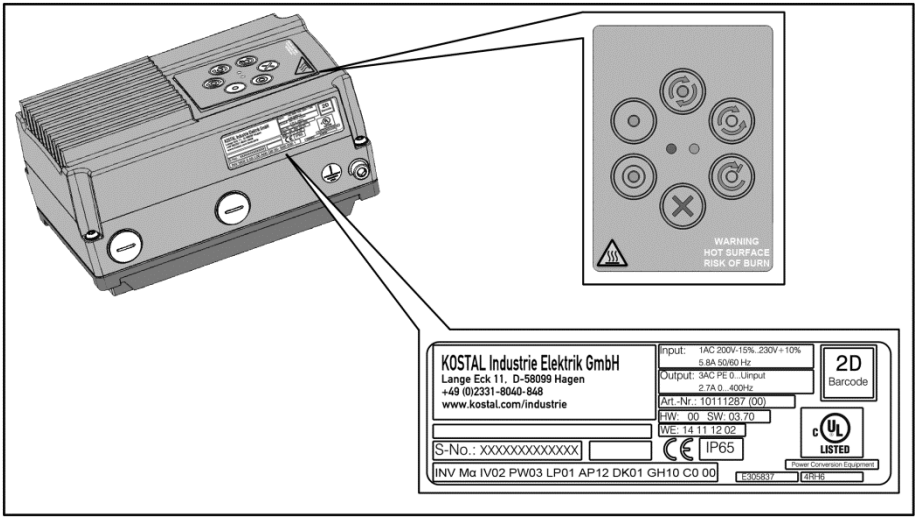


Fig.: 3 Labels on the drive controller

Signs and labels are affixed to the drive controller. These may not be altered or removed.

| Symbol | Meaning |
|---|---|
| | Danger due to electrical shock and discharge |
| | Danger due to burns<br>WARNING<br>HOT SURFACE<br>RISK OF BURN |
| 2 min | Danger due to electrical shock and discharge. Wait two minutes (discharge time of the capacitors) after shut-down |
| | Additional earth connection |
| | Observe and read operating manual |

## 1.4 Qualified staff

In the context of this operating manual, qualified staff refers to electronics specialists who are familiar with the installation, assembly, commissioning and operation of the drive controller and the dangers involved, and whose specialist training and knowledge of relevant standards and regulations provide them with the necessary abilities.

## 1.5 Proper use

If the device is installed in a machine, inverters may not be commissioned (i.e. intended operation may not begin) until it has been determined that the machine complies with the regulations of EC Directive 2006/42/EC (Machinery Directive); DIN EN 60204-1; VDE 0113-1:2007-06 must be observed.

Commissioning (i.e. beginning intended operation) is only permitted if the EMC Directive (2004/108/EC) is complied with.

The harmonised standards of DIN EN 50178; VDE 0160:1998-04 must be applied for this drive controller along with DIN EN 60439-1; VDE 0660-500:2005-01.

This drive controller may not be operated in areas where there is a danger of explosion.

Repairs may only be performed by authorised repair bodies. Independent and unauthorised intervention may result in death, injury or property damage. The warranty provided by KOSTAL will be invalidated in such cases.

External mechanical loads such as stepping on the housing are not permitted.

**IMPORTANT INFORMATION**

Using drive controllers in equipment that is not fixed is considered as an exceptional environmental condition and is only permitted if allowed by the standards and guidelines applicable on site.

## 1.6 Responsibility

As a basic principle, electronic devices are not fail-safe. The operator and/or the contractor setting up the machine or system is responsible for ensuring that the drive switches to a safe state if the device fails.

The “Electrical equipment of machines” section in DIN EN 60204-1; VDE 0113-1:2007-06, “Safety of machinery” describes the safety requirements for electrical control units. These are provided for the safety of people and machines and must be observed in order to retain the functional capability of the machine or system.

An emergency stop feature does not have to result in the power supply to the drive being switched off. To avoid dangerous situations, it may be useful for individual drives to remain operational or for specific safety procedures to be initiated. The effectiveness of emergency stop measures is evaluated by means of a risk assessment for the machine or system and its electrical equipment, and is determined by selecting a circuit category according to DIN EN 13849 “Safety of machinery – Safety-related parts of control systems”.

## 1.7 CE marking

With the CE marking, we, as the manufacturer of the device, confirm that the drive controller meets the basic requirements of the following guidelines:

- Directive on Electromagnetic Compatibility (Directive 2004/108/EC of the Council EN 61800-3:2004).
- Low Voltage Directive (Directive 2006/95/EC of the Council EN 61800-5-1:2003).

You can download the Declaration of Conformity from www.kostal-industrie-elektrik.com.

## 1.8 Safety instructions

The following warnings, precautionary measures and information are provided for your safety and serve to prevent damage to the drive controller and the components connected to it. This chapter contains warnings and information that are generally applicable when handling drive controls. They are split into general information, transport & storage and dismantling & disposal.

Specific warnings and comments that apply to specific activities can be found at the start of the appropriate chapters and are repeated or added to at various critical points in these chapters.

Please read this information carefully as it is provided for your personal safety and will also prolong the life of the drive controller and connected devices.

### 1.8.1 General information

**IMPORTANT INFORMATION**

Carefully read this operating manual and the warning signs affixed to the drive controller before installation and commissioning. Make sure that all warning signs on the drive controller are legible; replace any missing or damaged signs.

They contain important information on the installation and operation of the drive controller. In particular, note the information in the "Important information" chapter. KOSTAL Industrie Elektrik GmbH & Co KG assumes no liability for damages arising from the non-observance of this operating manual.

This operating manual is an integral part of the product. It applies exclusively to the drive controller from KOSTAL Industrie Elektrik GmbH & Co KG.

Keep the operating manual close to the drive controller so it is easily accessible to all users.

Continues on next page

Continuation

**IMPORTANT INFORMATION**

The drive controller can only be operated safely if the required environmental conditions listed in the “Suitable environmental conditions” chapter are met.

**DANGER**

**Risk of death due to electrical shock!**

**Death or serious injury!**

De-energise drive controller and secure it against being switched back on.

**DANGER**

**Risk of death due to revolving mechanical parts!**

**Death or serious injury!**

De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.

**WARNING**

**Risk of death due to fire or electrical shock!**

**Death or serious injury!**

Always use the drive controller as intended.

Do not modify the drive controller.

Only use spare parts and accessories sold or recommended by the manufacturer.

During assembly, ensure a sufficient distance from neighbouring parts.

Continues on next page

Continuation

|  | **CAUTION** |
|---|---|
|  | **Risk of burns from hot surfaces!**<br>**Serious burns to the skin from hot surfaces!**<br>Allow the drive controller's cooling elements to cool sufficiently. |

**IMPORTANT INFORMATION**

Do not place flammable parts (e.g. cable ducts) directly or indirectly on the drive controller.

### 1.8.2 Transport & storage

**Damage to property possible**

Risk of damage to drive controller!

Risk of damage to drive controller from improper transport, storage, installation and assembly!

Transport the drive controller properly in its original packaging.

Always store the drive controller properly.

Only allow qualified staff to undertake installation and assembly.

### 1.8.3 Information about commissioning

**DANGER**

**Risk of death due to electrical shock!**

**Death or serious injury!**

De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.

The following terminals may lead to dangerous currents even when the motor is not running:

- Supply terminals X1: L
- Motor connection terminals X411: T1, T2, U, V, W
- Connecting terminals X6: Relay contacts

Continues on next page

Continuation

**IMPORTANT INFORMATION**

- Only use mains connections with hardwiring.
- Ground the drive controller in accordance with DIN EN 61140; VDE 0140-1.
- The INVEOR α may have touch currents of > 3.5 mA. In accordance with DIN EN 61800-5-1, an extra protective grounding conductor of the same cross-section as the original protective grounding conductor should therefore be fitted. A second protective grounding conductor can be connected on the outside of the device. A suitable M6 x 8 screw (torque $M_A$ = 4.0 Nm) is provided with the INVEOR.
- If 1~INVEOR devices are used, it is permitted to use standard type A FI protection switches or RCDs (residual current-operated protective devices) in accordance with DIN VDE 0160 and EN 50178 to protect against direct or indirect contact.
- If 3~ INVEOR devices are used, it is not permitted to use standard type A FI protection switches or RCDs (residual current-operated protective devices) to protect against direct or indirect contact. According to DIN VDE 0160 and EN 50178, the FI protection switch must be universal current sensitive (RCD type B).

Continues on next page

Continuation

**IMPORTANT INFORMATION**

- If different voltages are used (e.g. +24 V/230 V), crossing cable runs are not permitted under any circumstances. The operator must also ensure compliance with the applicable regulations (e.g. double or reinforced insulation acc. to DIN EN 61800-5-1).
- The drive controller contains components susceptible to electrical discharge. These may be destroyed through improper handling. Therefore, precautionary measures against electrostatic charges must be taken when work is performed on these components.

### 1.8.4 Instructions concerning operation

**DANGER**

**Risk of death due to electrical shock!**

**Death or serious injury!**

De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.

**DANGER**

**Risk of death due to revolving mechanical parts!**

**Death or serious injury!**

De-energise drive controller and secure it against being switched back on.

Continues on next page

Continuation

**IMPORTANT INFORMATION**

Observe the following instructions during operation:

- The drive controller runs at high voltages.
- When electrical devices are operated, some of their parts are always subject to dangerous voltage.
- Emergency stop equipment according to DIN EN 60204-1; VDE 0113-1:2007-06 must function in all the control device's operating modes. Resetting the emergency stop equipment may not result in uncontrolled or undefined restarting.
- In order to ensure safe disconnection from the mains, the mains cable has to be fully disconnected from the drive controller in a synchronous manner.
- A pause of at least 1 to 2 mins must be observed between consecutive mains activations for devices with a single-phase feed.
- Certain parameter settings may result in the drive controller restarting automatically after the supply voltage has failed.

Continues on next page

Continuation

**Damage to property possible**

If the information is not observed, the drive controller could be damaged and destroyed during subsequent commissioning.

Observe the following instructions during operation:

- The motor parameters, especially the $I^2T$ settings, have to be configured properly to provide proper motor overload protection.
- The drive controller has internal motor overload protection. See parameters 33.010 and 33.011.
  $I^2T$ is ON by default. Motor overload protection can also be ensured via an external PTC.
- The drive controller may not be used as “Emergency stop equipment” (see DIN EN 60204-1; VDE 01131:2007-06).

### 1.8.5 Maintenance and inspection

The drive controllers may only be maintained and inspected by electricians with recognised training. Unless explicitly described in this operating manual, changes to hardware and software may only be undertaken by KOSTAL experts or persons authorised by KOSTAL.

#### Cleaning the drive controllers

Drive controllers are maintenance-free if operated as intended. If the air contains dust, the cooling fins of the motor and drive controller have to be cleaned regularly.

#### Measurement of insulation resistance on control part

An insulation test on the control card's input terminals is not permitted.

### Measurement of insulation resistance on power part

The power part of an INVEOR α is tested with 2.02 kV in the course of series testing.

Should the insulation resistance have to be measured during a system test, this can be done under the following conditions:

- an insulation test can be undertaken for the power part alone,
- to avoid excessively high voltages, all the INVEOR α's connection cables must be disconnected before testing,
- a 500 V DC insulation tester should be used.

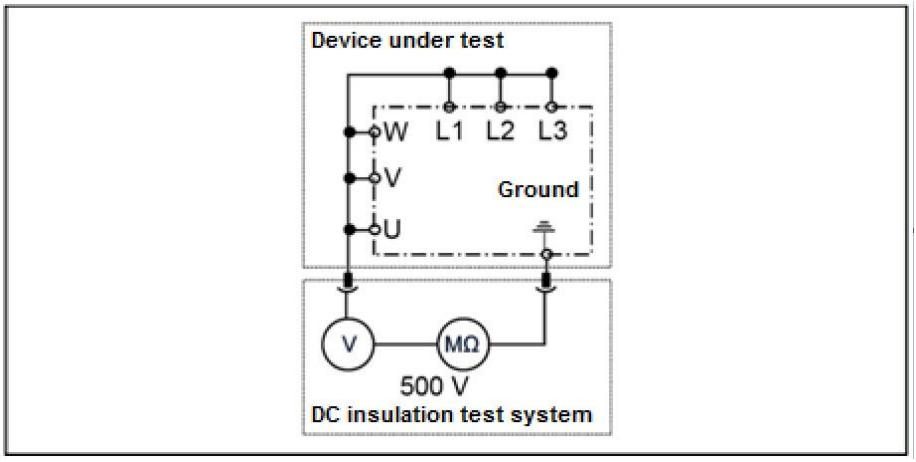


Fig.: 4 Insulation test on the power board

### Pressure test on an INVEOR α

**IMPORTANT INFORMATION**

A pressure test is not permitted on a standard INVEOR.

### 1.8.6 Repairs

**Damage to property possible**

If the information is not observed, the drive controller could be damaged and destroyed during subsequent commissioning.

- Repairs to the drive controller may only be performed by the KOSTAL Service department.

| | CAUTION |
|---|---|
| | **Risk of burns from hot surfaces!**<br>**Serious burns to the skin from hot surfaces!**<br>Allow the drive controller's cooling elements to cool sufficiently. |

**DANGER**

**Risk of death due to electrical shock!**

**Death or serious injury!**

De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.


Danger due to electrical shock and discharge. Wait two minutes (discharge time of the capacitors) after shut-down

# 2. Overview of the drive controller

This chapter contains information on the scope of delivery for the drive controller and the function description.

## 2.1 Model description

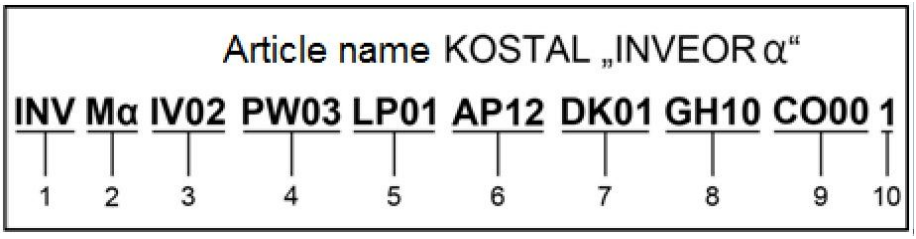


Fig.: 5 Item description

| Key | | | |
|---|---|---|---|
| **1** | Drive controller series: INVEOR | **6** | Application printed circuit board:<br>AP12 – Standard<br>AP13 - CANopen |
| **2** | Installation location/size: M-motor-integrated, size: α | **7** | Operation: DK01 – Standard (without operating film)<br>DK04 – With operating film |
| **3** | Input voltage: IV02 – 230 V | **8** | Housing: GH10 – Standard cooling elements (painted black) |
| **4** | Recommended motor power:<br>PW01 (0.25 kW); PW02 (0.37 kW);<br>PW03 (0.55 kW); PW04 (0.75 kW) | **9** | Firmware version: CO00 – Standard<br>CO01 - Specific |
| **5** | Performance printed circuit board:<br>LP01 – Standard<br>LP07 – IT network | **10** | Equipment generation: 1 – current version |

## 2.2 Scope of delivery

Compare the scope of delivery of your product with that provided below.

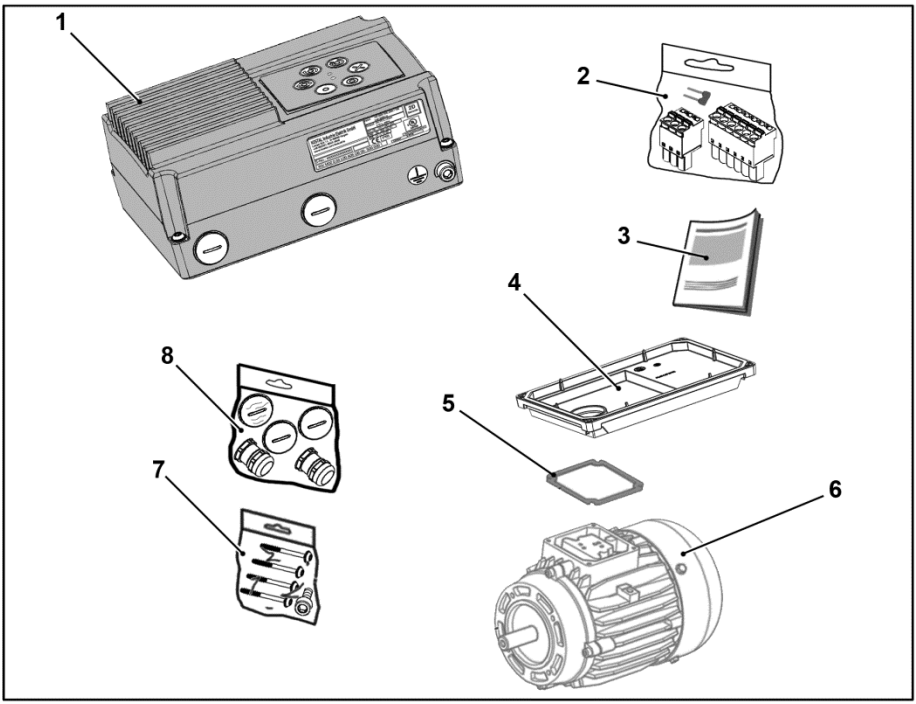


Fig.: 6 Scope of delivery

| Key | | | |
|---|---|---|---|
| 1 | INVEOR α drive controller (variant) | 5 | Seal<br>(not part of the scope of delivery) |
| 2 | Poly bag containing plug terminals<br>(grid and motor terminal) and PTC bridge | 6 | Motor<br>(not part of the scope of delivery) |
| 3 | Operating manual | 7 | Poly bag containing fastening bolts<br>Cooling elements and M6 ground screw |
| 4 | Adapter plate<br>(not part of the scope of delivery) | 8 | Poly bag containing 2 x M16 cable screw connections,<br>2 x M16 plugs and<br>1 x M16 transparent plugs |

## 2.3 Description of INVEOR α drive controller

The INVEOR α drive controller is a device for speed control in three-phase AC motors.

The drive controller can be integrated in the motor (with the standard adapter plate) or fitted close to the motor (with the wall installation adapter plate).

The permitted ambient temperatures specified in the technical data refer to operation at nominal load.
In many cases, higher temperatures may be permitted after a detailed technical analysis. These have to be approved by KOSTAL on a case-by-case basis.

# 3. Installation

## 3.1 Safety instructions for installation

| ⚠ DANGER |
| --- |
| **Risk of death due to revolving mechanical parts!**<br>**Death or serious injury!**<br>De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.<br>Only allow appropriately qualified staff to install the drive controller.<br>Only use staff who are trained in mounting, installation, commissioning and handling.<br>Always ground the device in accordance with DIN EN 61140; VDE 0140, NEC and other relevant standards.<br>Mains connections must be hardwired. |

| ⚠ | CAUTION |
| --- | --- |
|  | **Risk of burns from hot surfaces!**<br>**Serious burns to the skin from hot surfaces!**<br>Allow the drive controller's cooling elements to cool sufficiently. |

## 3.2 Installation requirements

### 3.2.1 Suitable ambient conditions

| Conditions | Values |
|---|---|
| Altitude of the installation location: | up to 1000 m above sea level / over 1000 m with reduced performance (1 % per 100 m) (max. 2000 m), see chapter 8.2 |
| Ambient temperature: | - 10 °C to + 40 °C (different ambient temperatures may be possible in individual cases), see chapter 8.2 |
| Relative air humidity | ≤ 96 %, condensation not permitted. |
| Resistance to vibration and shock: | DIN EN 60068-2-6 severity 2 (max. 50 m/s$^2$; 5…200 Hz)<br>DIN EN 60068-2-27 (300 m/s$^2$) |
| Electromagnetic compatibility: | Immune to interference acc. to DIN EN 61800-3 |
| Cooling: | Surface cooling |

Tab. 1: Ambient conditions

- Ensure that the housing type (protection class) is suitable for the operating environment:
  - Ensure that the seal between the motor and the adapter plate is inserted correctly.
  - All unused cable screw connections must be sealed.
  - Check whether the drive controller's cooling elements have been closed and screwed down to the adapter plate with the following torque, size α (4 x T20 4 x 35) 1.2 Nm

Continues on next page

Continuation

Although the drive controller can, in principle, be painted later on, the user must nevertheless check the material compatibility of the intended paint.

**Damage to property possible**

Failure to comply with this requirement may eventually result in the loss of the protection class (particularly in respect to seals and fibre-optic elements).

The INVEOR α is supplied in black RAL 9005 (black) as standard.

Disassembling the circuit boards (even for the purpose of painting the housing sections) renders the warranty void!

Mounting points and sealing surfaces must be kept free of paint for purposes of EMC and grounding!

### 3.2.2 Suitable installation location for the motor-integrated drive controller

Ensure that the motor with a motor-integrated drive controller is only installed and operated if aligned as shown in the following diagram.

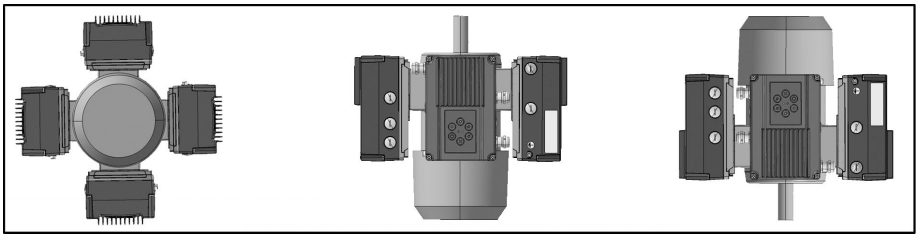

Fig.: 7 Motor installation location/permitted alignments

**IMPORTANT INFORMATION**

Ensure that no condensate from the motor can enter the drive controller during and after installation.

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Continuation

### 3.2.3 Basic connection versions

#### Triangle connection variant

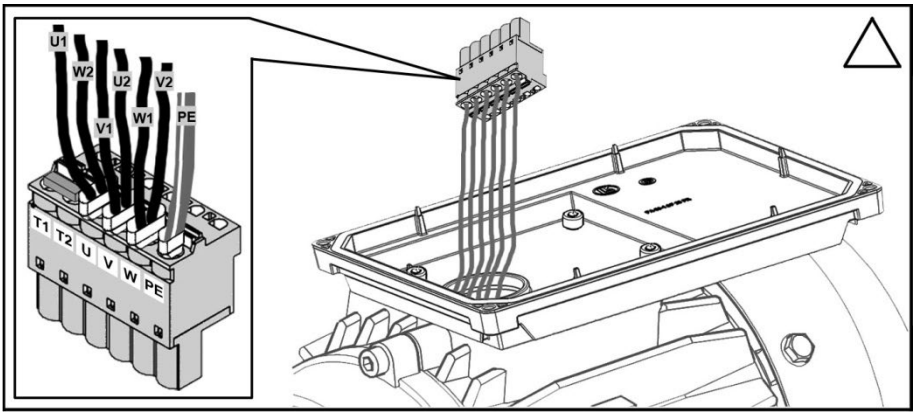


Fig.: 8 Triangle connection with motor-integrated drive controller

| Triangle connection terminal assignment | |
|---|---|
| **U** | W2, U1 |
| **V** | U2, V1 |
| **W** | V2, W1 |
| **PE** | PE |
| **T1, T2** | Connect bridge (see scope of delivery) |

**⚠ DANGER**

**Risk of death due to electrical shock!**

**Death or serious injury!**

De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.

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Continuation

### Star connection variant

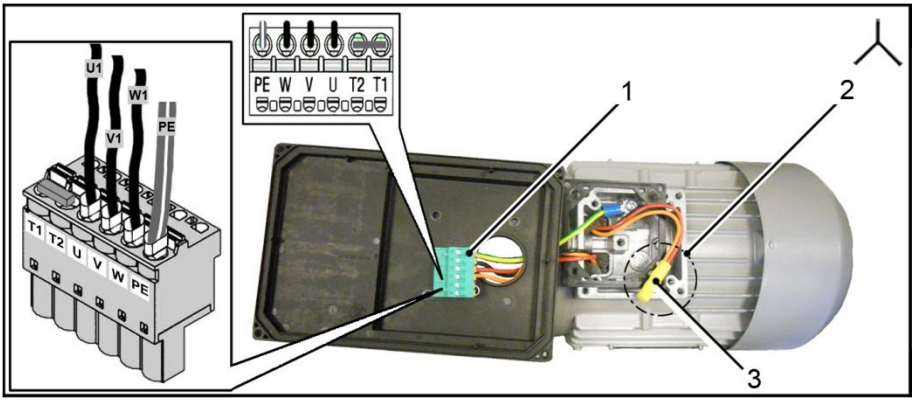


Fig.: 9 Star connection with motor-integrated drive controller

**1** Motor connector
**2** Star point
**3** Butt connector

| Star connection terminal assignment | |
|---|---|
| **U** | U1 |
| **V** | V1 |
| **W** | W1 |
| **PE** | PE |
| **T1, T2** | Connect bridge (see scope of delivery) |

| Star formation |
|---|
| **W2, U2, V2** |

**⚠ DANGER**

**Risk of death due to electrical shock!**

**Death or serious injury!**

De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.

Continues on next page

Continuation

**Damage to property possible**

Risk of damage to the drive controller.

Correct phase assignment must be observed when connecting the drive controller,

otherwise the motor may be overloaded.

The supplied assembly material can be used to connect core end sleeves and cable shoes.
Fig. 5 and 6 show the different connection options.

**DANGER**

Risk of death due to electrical shock!

Death or serious injury!

De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.

Unused open cable ends in the motor terminal box must be insulated.

**IMPORTANT INFORMATION**

If a thermal resistor (PTC or Klixon) is not used, the T1 and T2 bridging contacts supplied must be connected (as described in chapter 3.3.1).

The cross-section of the supply line must be designed according to the transfer category and maximum permitted current. The contractor commissioning the device must ensure protection for the power line.

### 3.2.4 Short circuit and ground protection

The drive controller contains an internal short circuit and ground protection.

### 3.2.5 Wiring instructions

The control connections of the application card are located inside the drive controller.

The configuration may vary depending on the version.

#### Control terminals (size α)

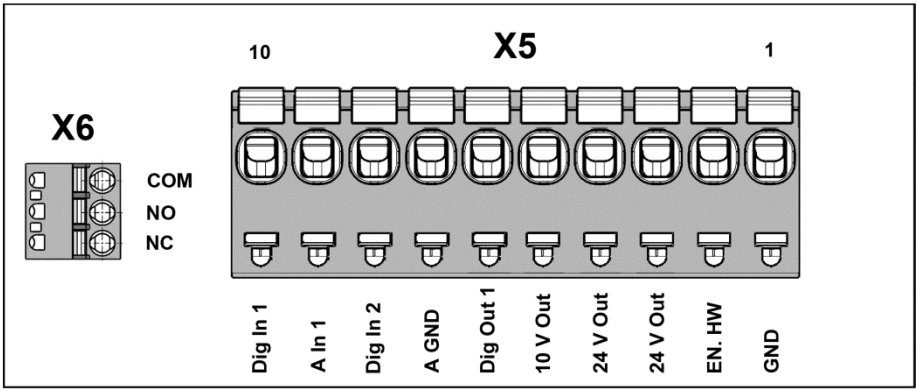


Fig.: 10 Control terminals (size α)

| Size α | | |
|---|---|---|
| X5 – X6 | Terminals: | Plug terminal clamp with activation button (slot screwdriver, max. width 2.5 mm) |
| | **[X5]** Connection cross-section: | 0.14 to 1.5 mm², fine-wired, AWG 30 to AWG 16 |
| | **[X6]** Connection cross-section: | 0.2 to 2.5 mm², fine-wired, AWG 30 to AWG 12 |
| | Connection cross-section: | 0.5 to 1.0 mm², fine-wired (core end sleeves with and without plastic collars) |
| | Length of stripped insulation: | 9 to 10 mm |

For technical data for the power connections, see page 32

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Continuation

## Power connections (size α)

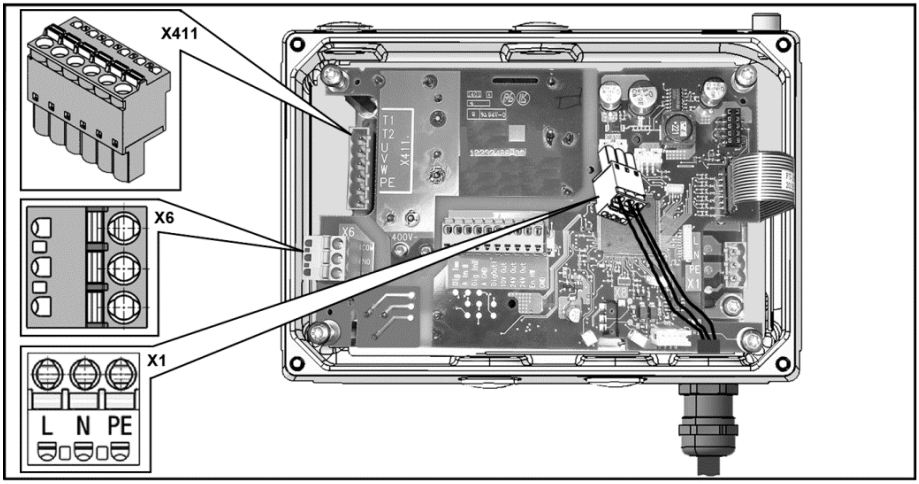


Fig.: 11 Power connections (size α)

| Size α | | |
|---|---|---|
| X1 mains X6 Relais + X411 Motor / PTC | The terminals for the mains cable are located inside the drive controller. The configuration may vary depending on the version. | |
| | Core end sleeves with plastic collars and lugs are recommended. | |
| | Terminals: | Spring force connection<br>(slot screwdriver, max. width 2.5 mm) |
| | Conductor cross-section, flexible | min. 0.2 mm²<br>max. 2.5 mm² |
| | Conductor cross-section, flexible with core end sleeve without plastic sleeve | min. 0.25 mm²<br>max. 2.5 mm² |
| | Conductor cross-section, flexible with core end sleeve with plastic sleeve | min. 0.25 mm²<br>max. 2.5 mm² |
| | 2 conductors of the same cross-section, flexible with TWIN-AEH with plastic sleeve | min. 0.25 mm²<br>max. 1.25 mm² |
| | Conductor cross-section AWG | min. 30<br>max. 12 |
| | Length of stripped insulation: | 10 mm |
| | Mounting temperature: | -5 °C to +100 °C |

### 3.2.6 Preventing electromagnetic interferences

Where possible use shielded lines for control circuits.
The shielding should be applied to the line end with special care and without laying the leads across longer stretches without shielding.

Ensure that no parasitic currents (compensating currents etc.) can flow via the analogue cable's shielding.
Route the control lines as far away as possible from the power lines. Under certain circumstances, separate power ducts should be used.
If lines do cross, an angle of 90° should be observed.

Upstream circuit elements, such as protector switches and brake coils, or circuit elements that are operated via the outputs of the drive controller have to be interference-suppressed. RC circuits are suitable as AC voltage protector switches, while free-wheeling diodes or varistors are usually used as DC voltage protector switches. These interference suppression devices are attached directly to the protector switch coils.

**IMPORTANT INFORMATION**

Where possible, the power for a mechanical brake should be supplied in a separate cable.

Power connections between the drive controller and motor should always be shielded or reinforced, and the shielding must have large-scale grounding at both ends! The use of EMC cable screw
connections is recommended. These are not part of the scope of delivery.

Wiring suitable for EMC must be ensured.

Continues on next page

Continuation

## 3.3 Installing the drive controller integrated in the motor

### 3.3.1 Mechanical installation

#### Mechanical installation of size α

Proceed as follows to mechanically install the drive controller:

1. Open the standard motor connection box.
2. Disconnect the wires from the connection terminals. Memorise or write down the connection sequence.
3. Remove the motor terminal block if necessary.
4. Remove the connection housing's retaining bolts and take the housing off. Be careful not to damage the seal.

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Continuation

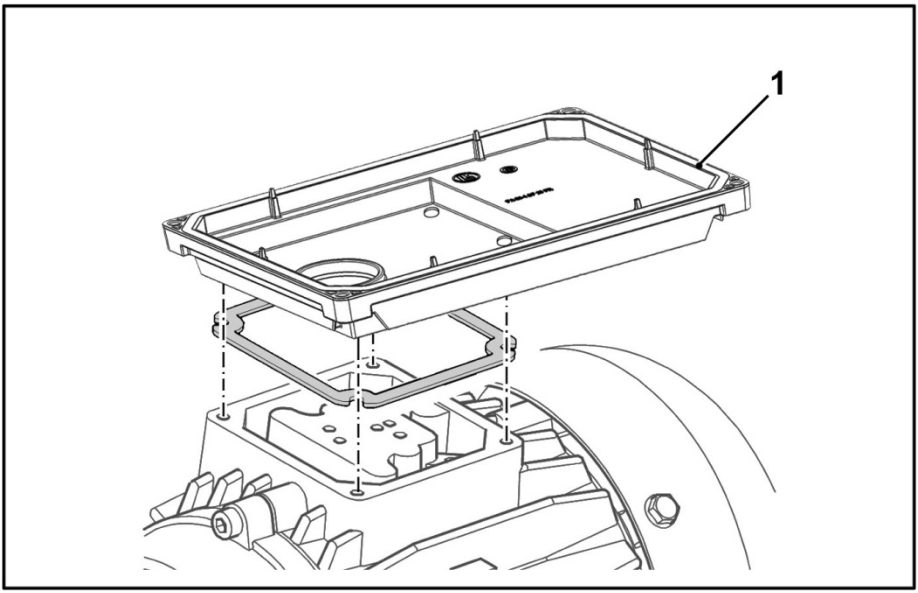


Fig.: 12 Assembly sequence: Connection box – adapter plate (size)

**INFORMATION**

The standard adapter plate is a plate the underside of which is not reworked; i.e. no holes have been produced yet.

You can order individually modified adapter plates from KOSTAL for selected motors.

5. Modify the adapter plate (1) by producing the necessary holes for mounting on the motor.

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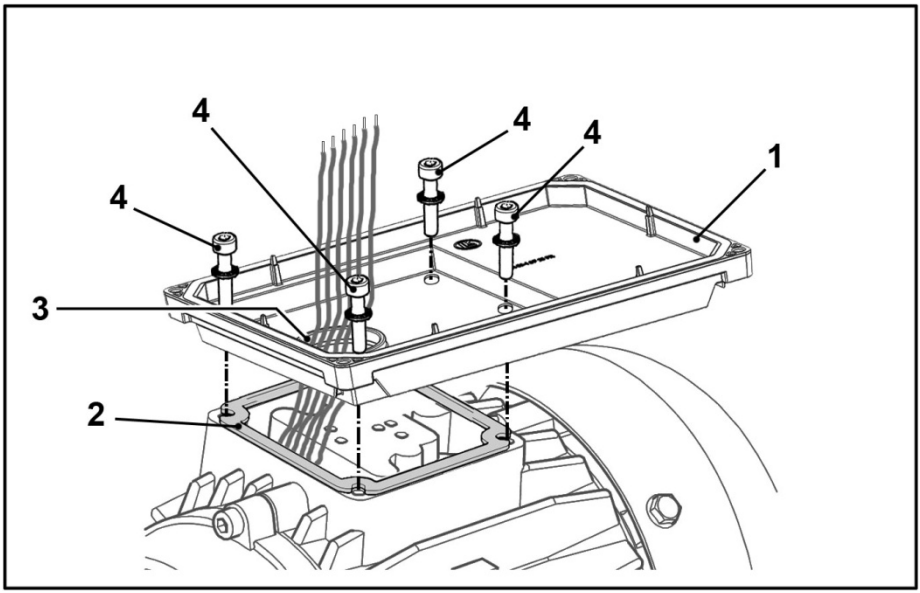
Continuation

**INFORMATION**
The commissioning technician is responsible for protection class compliance when sealing the adapter plate on the motor.
If you have any questions, please ask your KOSTAL contact.




6. Fit the seal (2).
7. Lead the motor connection lines through the opening (3) in the adapter plate (1).

**INFORMATION**
If the motor connection lines are too short, extend them as required with the cable set extension (option)
Article no.: 10118226

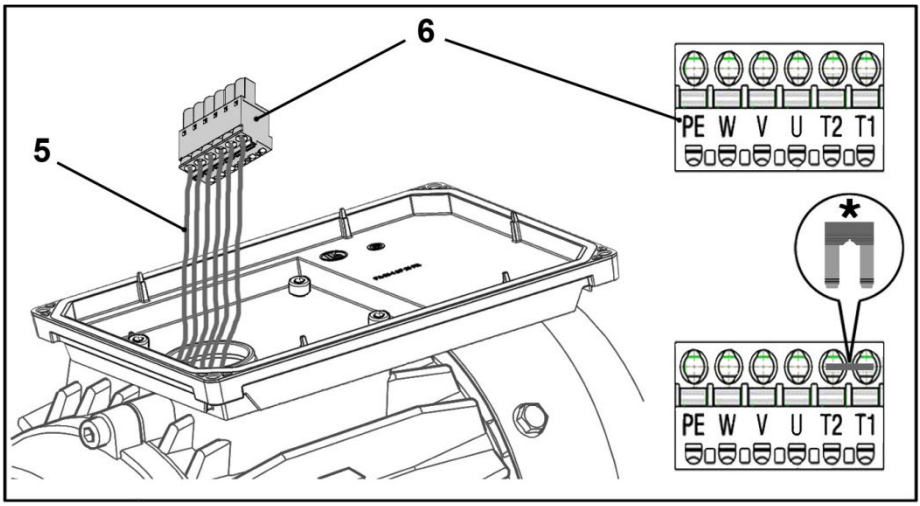
8. Screw the adapter plate on to the motor with the four retaining bolts (4) and four spring elements.

Continues on next page

Continuation

**IMPORTANT INFORMATION**
When mounting the adapter plates, ensure that all four screws, including the spring elements, are tightened to the necessary torque ($M_A$ = 2 Nm)!

9. Attach the motor lines (5) in the correct circuit to plug of motor plugs (6).3




10. If present, wire the connection cable of the motor PTC/Klixon to the T1 and T2 terminals.

    * If the motor used does not have a motor PTC, you must connect the bridge included in the scope of delivery.

      If the bridge is not connected, the red status LED lights up and the motor does not start.

**IMPORTANT INFORMATION**
Only motor PTCs corresponding to DIN 44081/44082 may be connected!

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### 3.3.2 Power connection

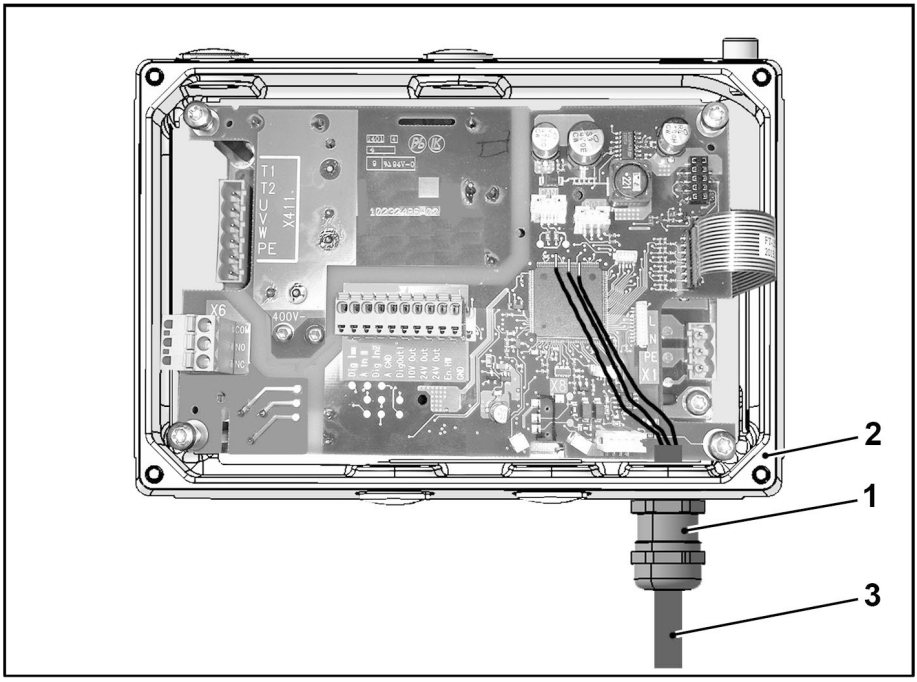


Fig.: 13 Mains connection cable connection

1. Screw cable screw connection (1) into cooling elements (2) ($M_A$ = 3 Nm).
2. Guide mains connection cable (3) through cable screw connection (1) into cooling elements (2).

   Fix mains connection cable (3) by tightening ($M_A$ = 3 Nm) rear section of cable screw connection (1).

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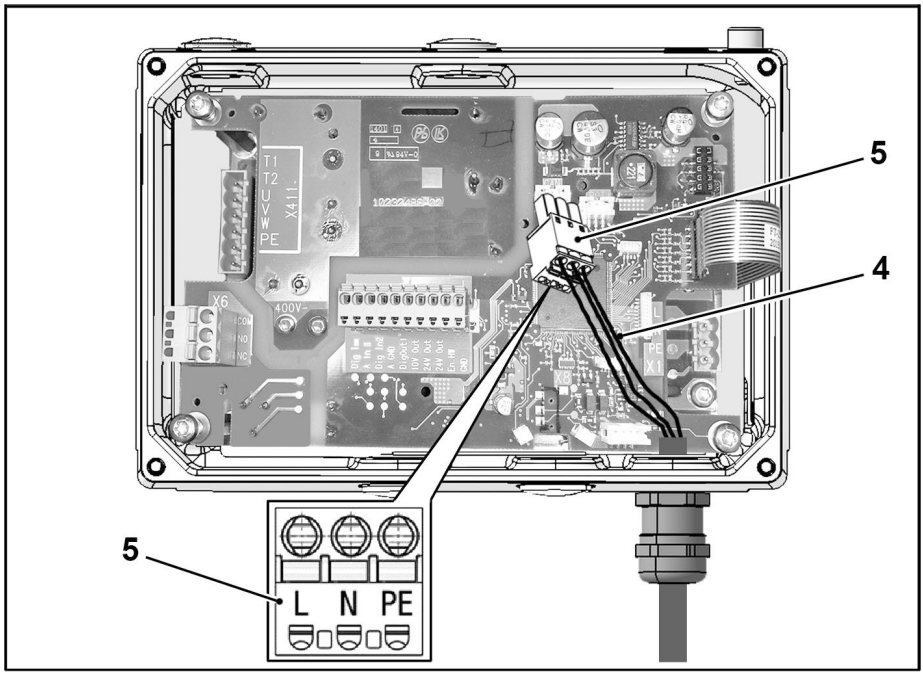
Continuation




3. Connect mains cables (4) to mains plug (5) as follows:

| 230 V connection | | |
|---|---|---|
| L | N | PE |

| Terminal no. | Designation | Assignment |
|---|---|---|
| **1** | L | Mains phase |
| **2** | N | Neutral wire |
| **3** | PE | Protective conductor |

4. Plug mains plug (5) onto mains connection socket X1.

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Continuation

### 3.3.3 Control connections of application board

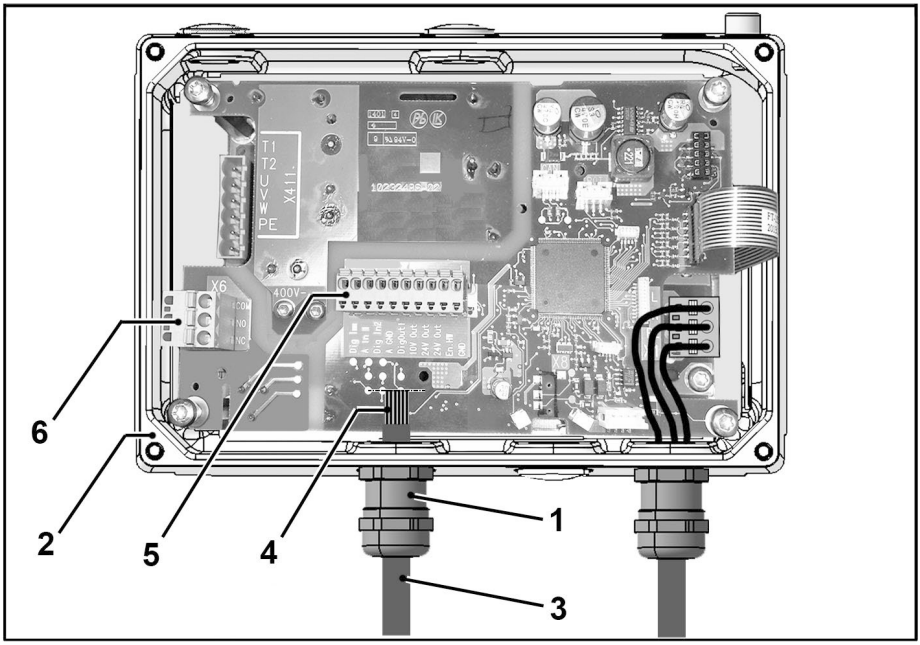


Fig.: 14 Control connections of application board

1. Screw cable screw connection (1) into cooling elements (2) ($M_A$ = 3 Nm).
2. Guide control line (3) through cable screw connection (1) into cooling elements (2).

   Fix control line (3) by tightening ($M_A$ = 3 Nm) rear section of cable screw connection (1).
3. Connect control lines (4) to control connection terminals X5 (5) and X6 (6) respectively.

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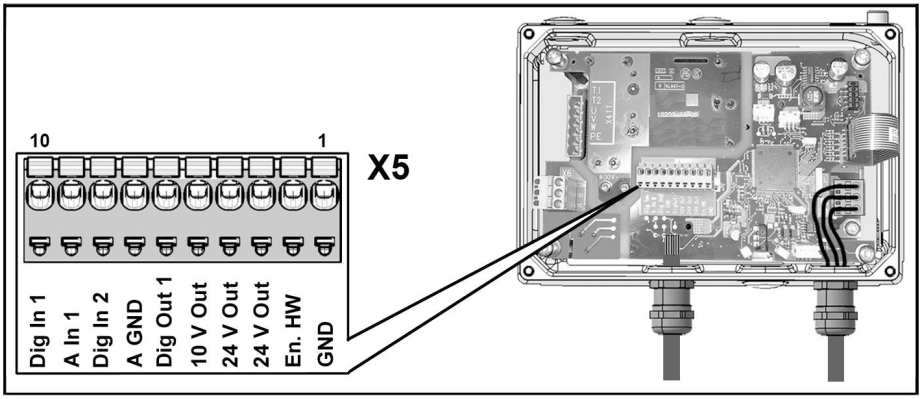
Continuation




| Control connection X5 | | |
|---|---|---|
| **Terminal no.** | **Designation** | **Assignment** |
| **1** | GND (ground) | Ground |
| **2** | En HW (enable) | Enable hardware |
| **3** | 24 V Out | Int. power supply |
| **4** | 24 V Out | Int. power supply |
| **5** | 10 V Out | For ext. voltage divider |
| **6** | Dig. Out1 | Fault message (parameter 4.150) |
| **7** | A GND (ground 10 V) | Ground |
| **8** | Dig. In 2 | Free (not assigned) |
| **9** | A. In 1 | Free (not assigned) |
| **10** | Dig. In 1 | Target value enable (parameter 1.131) |

**IMPORTANT INFORMATION**

If a control line is not attached, a bridge must be connected between "24 V Out" and "En. HW".

When the bridge is connected, the drive controller's output stage is always enabled.

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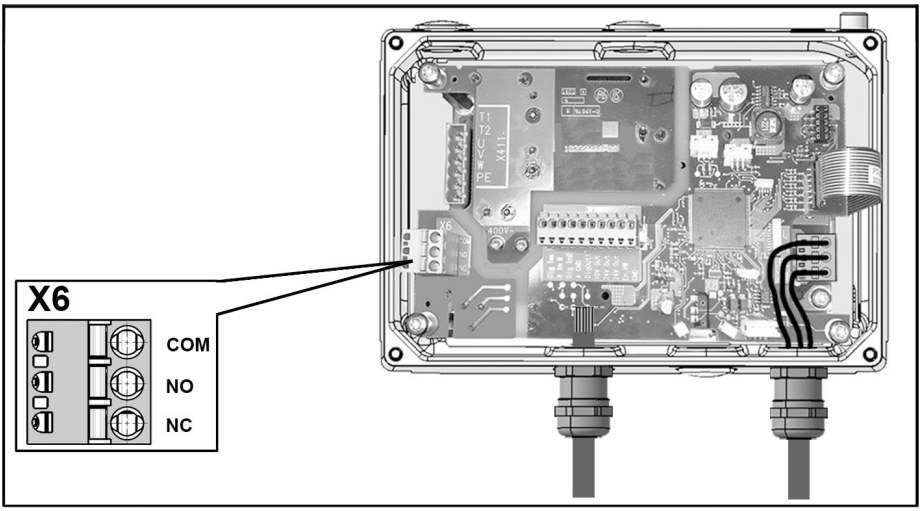
Continuation




| Relay X6 | |
|---|---|
| **Designation** | **Assignment** |
| COM | Centre contact relay |
| NO | Normally open contact relay |
| NC | Normally closed contact |

For technical data for the power connections, see page 32

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Continuation

### 3.3.4 Placing cooling elements on adapter plate

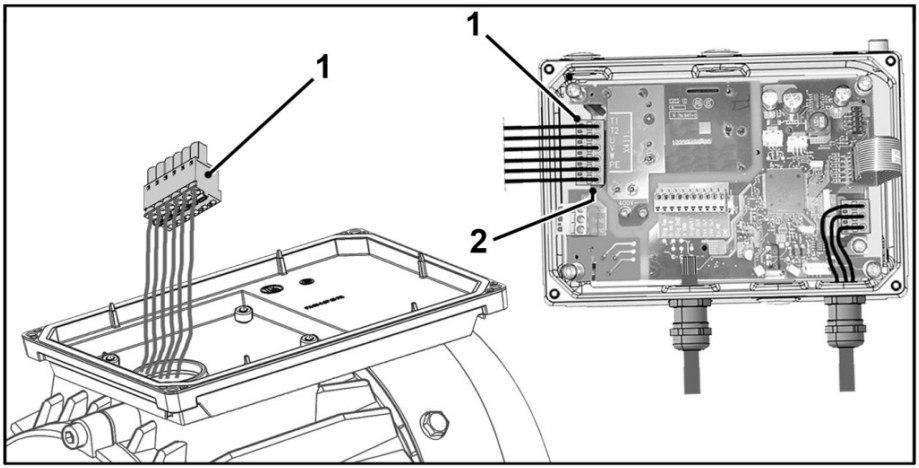
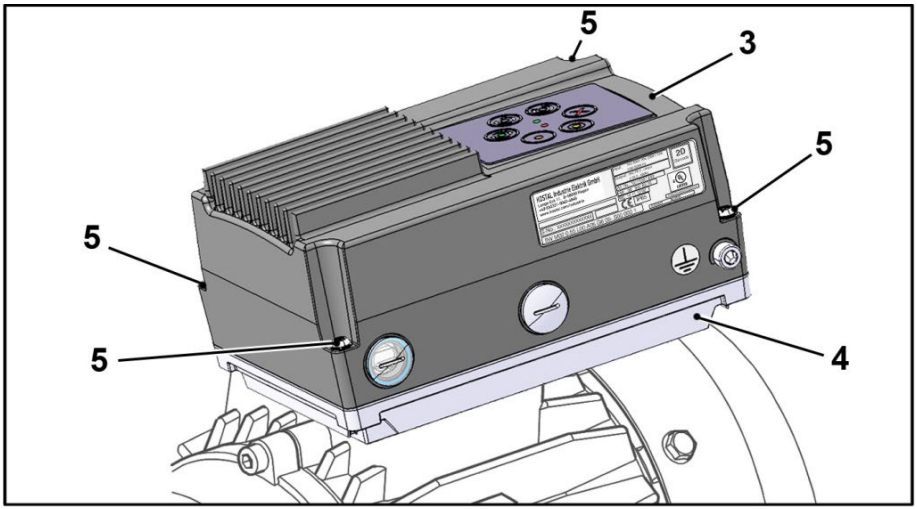



Fig.: 15 Placing cooling elements on adapter plate

1. Plug motor plug (1) onto motor terminal X411 (2).




2. Carefully attach cooling elements (3) on adapter plate (4).
3. Screw down cooling elements (3) to adapter plate (4) using four retaining bolts (5) ($M_A$ = 1.2 Nm).

## 3.4 Installing the wall-mounted drive controller

### 3.4.1 Suitable installation location for wall mounting

Ensure that the installation location for an INVEOR α wall mounting meets the following conditions:

- The drive controller has to be mounted on an even and fixed surface.
- The drive controller may only be mounted on non-flammable bases.
- There must be clearance of 200 mm around the drive controller to ensure free convection.

The following figure shows the assembly dimensions and the free spaces required for installing the drive controller.

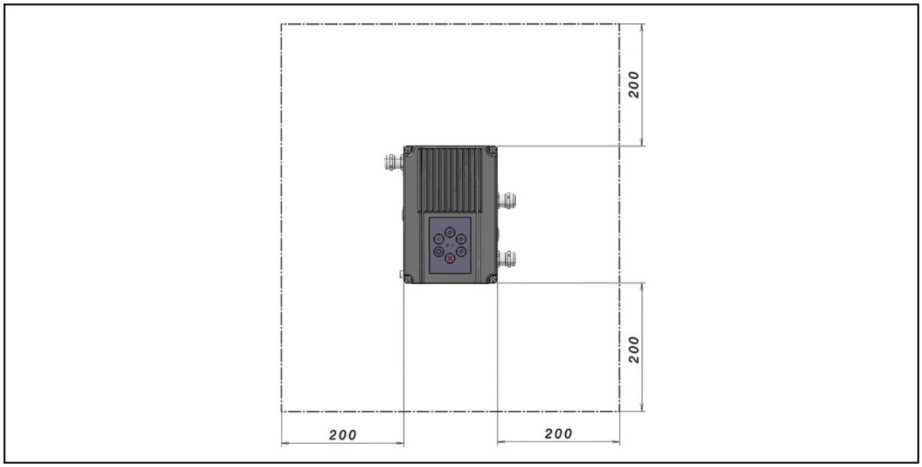



Fig.: 16 Installing the wall-mounted drive controller

For the "wall mounting" version, the line length between the motor and INVEOR α may not exceed 5 m. Only use a shielded cable with the required cross-section.

### 3.4.2 Mechanical installation

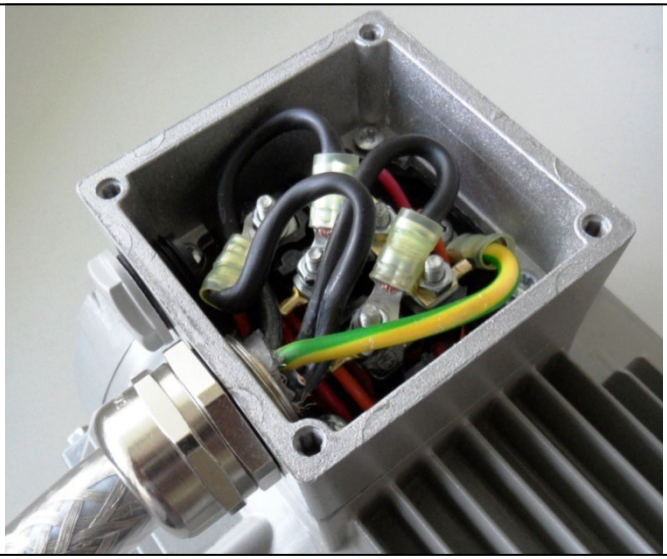


Fig.: 17 Wiring on the motor connection box

1. Open the motor connection box.

> **IMPORTANT INFORMATION**
> Depending on the required motor voltage, the star or triangle connection must be made in the motor connection box!

2. Use a suitable EMC screw connection to attach the shielded cable to the motor connection box!
   Ensure that the shielding contact is in order (large surface)!
3. Connect the prescribed PE connection in the motor connection box!
4. Close the motor connection box.

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Continuation

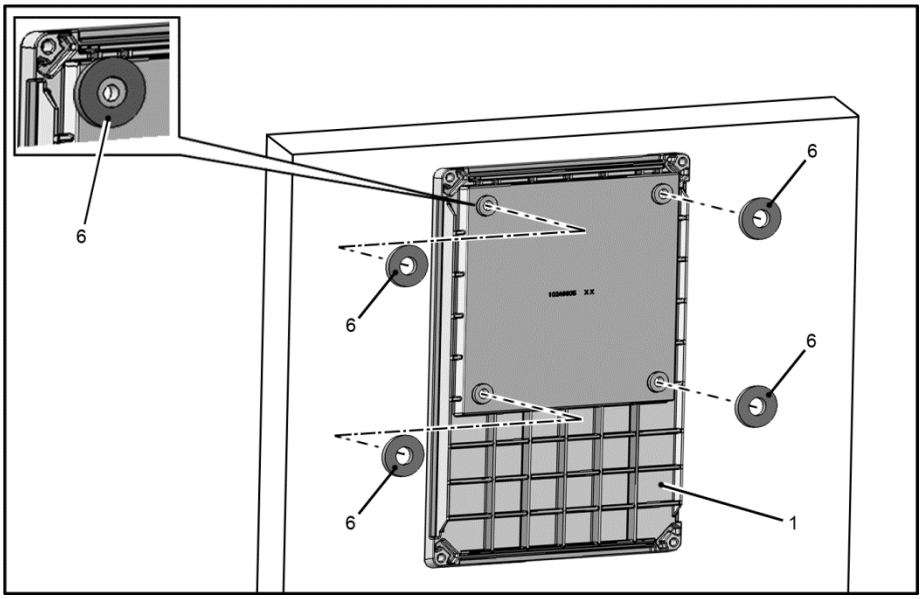


Fig.: 18 Placing flat seals on rear of adapter plate

**IMPORTANT INFORMATION**

The drive controller may not be installed without an adapter plate!

5. Find a position that meets the required ambient conditions (see "Installation requirements" section).
6. Carefully place flat seals (6) on the rear of adapter plate (1).

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Continuation

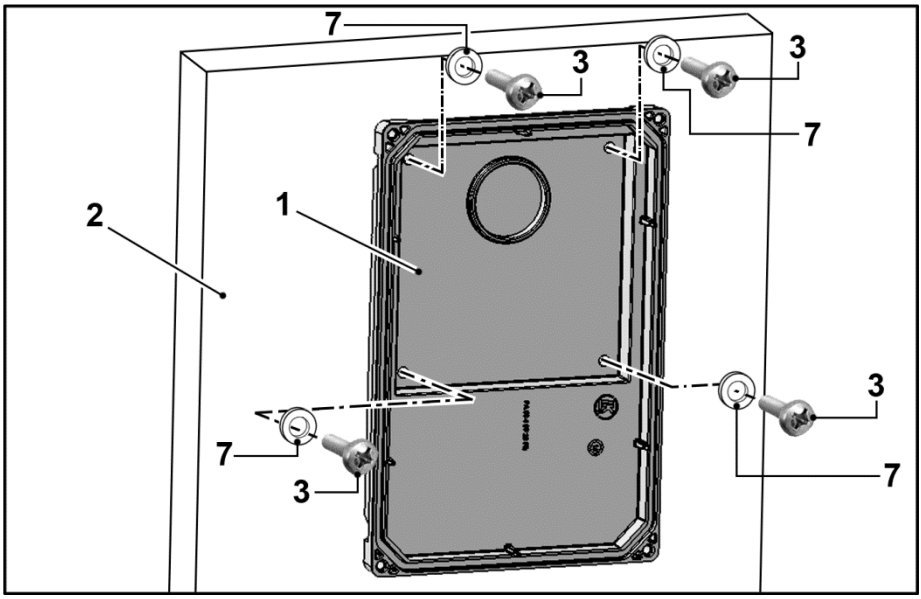


Fig.: 19 Fastening the adapter plate to the wall

**IMPORTANT INFORMATION**

The adapter plate must not be fitted overhead!

7. Secure adapter plate (1) to your chosen base (2).
8. Depending on the base, use appropriate retaining bolts* (3) and plain washers** (7) for securing.

**IMPORTANT INFORMATION**

Screw drive controller down to base with no clearance.
Ensure that the seals are in full contact with the base.

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* Not part of the scope of delivery
** Not part of the scope of delivery

Continuation

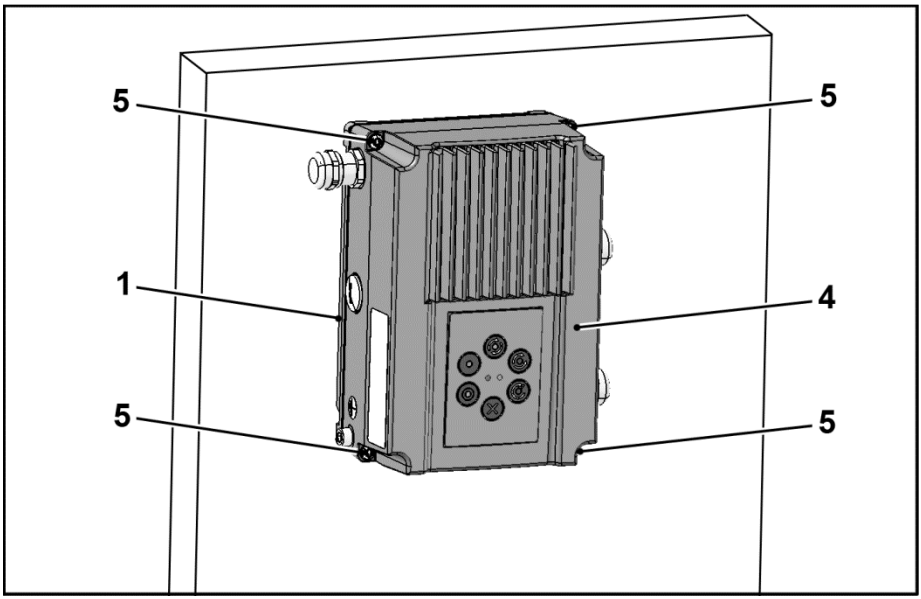


Fig.: 20 Attaching drive controller (wall mounting)

9. Place drive controller (4) on adapter plate (1).
10. Screw down cooling elements (4) to the adapter plate (1) with the help of the screws (5) provided (torque: $M_A$ = 1.2 Nm).

### 3.4.3 Power connection

The power connections should be designed as described in section 3.3 ff. "Installation des motorintegrierten Antriebsreglers".

### 3.4.4 Control connections

The control connections should be designed as described in section 3.3 ff. "Installation des motorintegrierten Antriebsreglers".

# 4. Commissioning

## 4.1 Safety instructions for commissioning

**Damage to property possible**

If the information is not observed, the drive controller could be damaged and destroyed during subsequent commissioning.

Commissioning may only be performed by qualified staff. Safety precautions and warnings must always be observed.

**CAUTION**

**Risk of burns from hot surfaces!**

**Serious burns to the skin from hot surfaces!**

Allow the drive controller's cooling elements to cool sufficiently.

**DANGER**

**Risk of death due to electrical shock!**

**Death or serious injury!**

Be sure that the power supply provides the correct voltage and is designed for the required current.

Use suitable circuit breakers with the prescribed nominal current between the mains and drive controller.

Use suitable fuses with appropriate current values between the mains and drive controller (see technical data).

The drive controller must be grounded with the motor according to relevant regulations. Non-compliance may result in serious injury.

## 4.2 Communication

The drive controller can be commissioned in the following ways:

- using the INVEORpc PC software

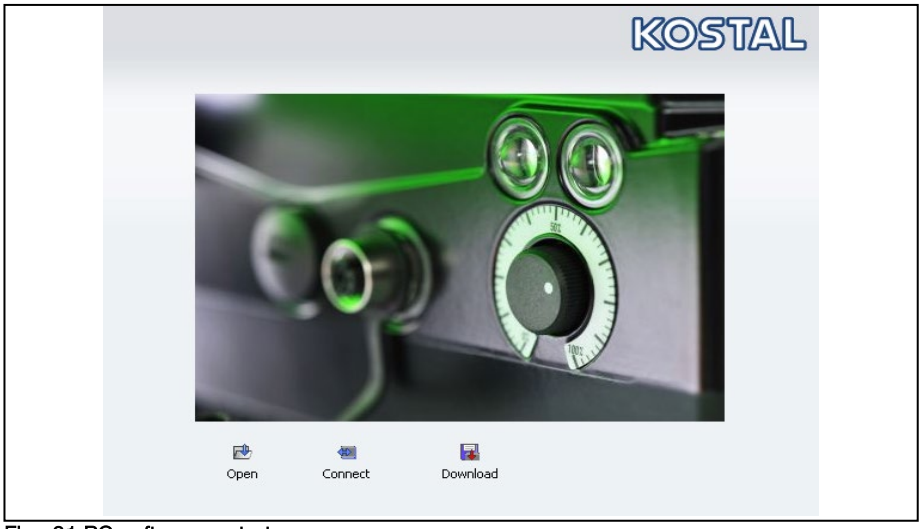


Fig.: 21 PC software – start screen

- using the INVEOR MMI handheld controller


Fig.: 22 MMI handheld controller

## 4.3 Commissioning steps

The commissioning can be performed using a PC communication cable USB at M12 plug with integrated interface converter RS485/RS232 (part no. 10023950) or using the INVEOR handheld controller MMI with connection cable RJ9 at M12 plug (part no. 10004768).

As an option, an INVEOR α adapter cable (jack plug on M12) must be used (article no.:10118219)

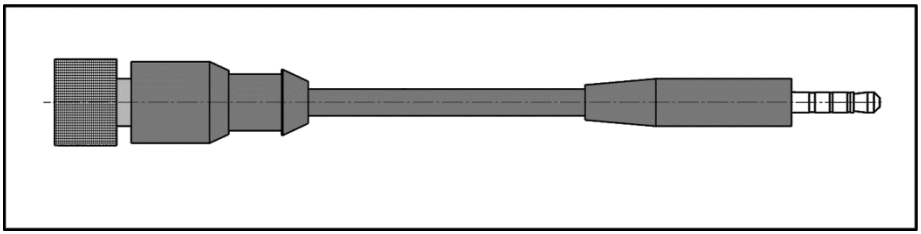

Fig.: 23 INVEOR α adapter cable

The above commissioning options (PC communication cable/handheld controller MMI) may only be used in conjunction with the option (jack plug on M12) (art. no. 10118219).

Commissioning can also be carried out using MMI M12 plugs (line set MMI 4-pin) (art. no. 10118216) (optional).

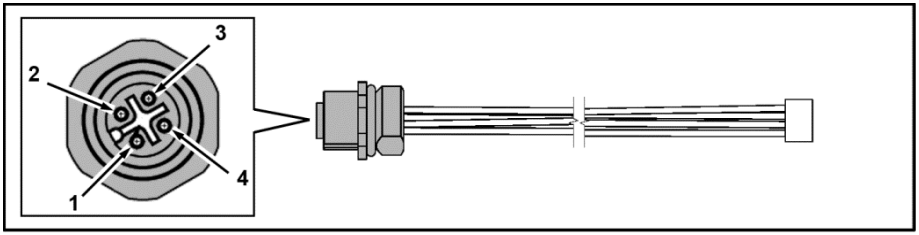


Fig.: 24 MMI M12 plug (JST plug)

| M12 plug assignment | Signal |
|---|---|
| 1 | 24 V |
| 2 | RS485 - A |

| M12 plug assignment | Signal |
|---|---|
| 3 | GND |
| 4 | RS485 - B |

Continues on next page

Continuation

**Commissioning using the PC:**

1. Install the INVEORpc software (you can obtain programming software from KOSTAL homepage free of charge). Operating system required: Windows XP or Windows 7 [32 / 64 bit]). We recommend undertaking the installation process as an administrator.
2. Unscrew the transparent screw connection.

**Sachschäden möglich**
Der Antriebsregler kann bei Nichtbeachten der Hinweise beschädigt werden!

- Bewegen Sie das Adapterkabel INVEOR α beim Anschließen an die Klinkenbuchse nicht in die dargestellten Pfeilrichtungen.
- Schließen Sie das Adapterkabel INVEOR α nur gerade an der Klinkenbuchse an.

3. Use the optional PC connection cable (art. no. 10023950) to connect the PC to the M12 plug M1 (adapter plug option, art. no. 10118219).
4. Load or determine the motor data record (parameters 33.030 to 33.050); it may be necessary to optimise the speed control (parameters 34.100 to 34.101).
5. Perform the application settings (ramps, inputs, outputs, target values etc.).
6. Optional: Define an access level (1 – MMI, 2 – user, 3 – manufacturer).

Continues on next page

Continuation

**Sachschäden möglich**
Der Antriebsregler kann bei Nichtbeachten der Hinweise beschädigt werden!

- Bewegen Sie das Adapterkabel INVEOR α beim Abziehen von der Klinkenbuchse nicht in die dargestellten Pfeilrichtungen.
- Ziehen Sie das Adapterkabel INVEOR α nur gerade von der Klinkenbuchse ab.

7. Ziehen Sie das Adapterkabel INVEOR α gerade von der Klinkenbuchse ab.
8. Screw the transparent screw connection back in.

See Fig. of block diagram in chapter Schnellinbetriebnahme 11

In order to ensure an ideal operating structure for the PC software, the parameters are classified into different access levels.

The following levels exist:

1. Handheld controller: The drive controller is programmed using the handheld controller.
2. User: The basic parameters can be programmed into the drive controller using the PC software.
3. Manufacturer: An extended selection of parameters can be programmed into the drive controller using the PC software.

# 5. Parameters

You will find the “Parameters” chapter in the detailed operating manual for the INVEOR α.

# 6. Error detection and troubleshooting

This chapter contains the following:

- A list of the LED flash codes for error recognition.
- A description of error recognition using PC tools.
- A list of errors and system errors.
- Notes on error detection with the MMI.

| ⚠ DANGER |
| --- |
| Risk of death due to electrical shock!<br>Death or serious injury!<br>De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.<br>If damaged parts or components need replacing, only ever replace with original parts. |
|  Danger due to electrical shock and discharge. Wait two minutes (discharge time of the capacitors) after shut-down. |

## 6.1 List of the LED flash codes for error recognition

When an error occurs, the LEDs on the drive controller display a flashing code that allows the errors to be diagnosed.

The following table contains an overview:

| Red LED | Green LED | State |
|---|---|---|
| ☀ | ○ | Boot loader active (flashing in turn) |
| ○ | ☀ | Ready for operation (activate En_HW for operation) |
| ○ | ● | Operation / ready |
| ☀ | ● | Warning |
| ● | ○ | Error |
| ● | ● | Identification of motor data |
| ○ | ✺ | Initialisation |
| ✺ | ✺ | Firmware update |
| ✺ | ● | Bus error operation |
| ✺ | ☀ | Bus error ready for operation |

Tab. 2: LED flash codes

| Key | | | |
|---|---|---|---|
| ○ | LED off | ● | LED on |
| ☀ | LED flashing | ✺ | LED flashing quickly |

## 6.2 List of errors and system errors

The driver controller shuts down if an error occurs. Consult the flash code table / PC tool for the corresponding error numbers.

**IMPORTANT INFORMATION**

Error messages can only be acknowledged once the error has been remedied.

Error messages can be acknowledged as follows:

- Digital input (can be programmed)
- Using MMI (handheld controller )
- Auto acknowledgement (parameter 1.181, page 73)
- Switch device off and on again
- Via fieldbus (CANOpen, Profibus DP, EtherCAT)

The following section contains a list of possible error messages. Please contact the KOSTAL service department if you encounter errors that are not listed here.

| No. | Error name | Description of error | Possible causes/remedy |
|---|---|---|---|
| 1 | Undervoltage 24 V application | Supply voltage for the application is less than 15 V | 24 V supply overload |
| 2 | Overvoltage 24 V application | Supply voltage for the application is greater than 31 V | Internal 24 V supply is not OK or external supply is not OK |
| 6 | Customer PLC version error | The version of the customer PLC doesn't match the device firmware | Check the version numbers of the customer PLC and device firmware |
| 8 | Communication application <> power | Internal communication between the application plate and the power-conducting plate is not OK | EMC interference |
| 10 | Parameter distributor | The internal distribution of parameters during initialisation failed | Parameter set is incomplete |

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Continuation

| No. | Error name | Description of error | Possible causes/remedy |
|---|---|---|---|
| **11** | Time-out power | The power part does not respond | Operation with 24 V without mains feed-in |
| **13** | Cable break at analogue in1 (4–20 mA / 2–10 V) | Current or voltage is less than the lower limit of analogue input 1 (monitoring for this error is activated automatically by setting parameter 4.021 to 20 %). | Cable break, faulty external sensor |
| **15** | Stall detection | The drive shaft of the motor is stalled. 5.080 | Remove the blockage |
| **16** | PID dry run | No PID actual value despite maximum speed | PID actual value sensor defective. Extend dry run time (parameter 3.072) |
| **17** | Start-up error | Motor not starting up or starting up incorrectly. 5.082 | Check motor connections/check motor and controller parameters; if necessary, disable error (5.082). |
| **18** | Excess temperature for frequency converter application | Inner temperature too high | Insufficient cooling, low motor speed and high torque, switching frequency too high. |
| **21** | Bus time-out | No response from bus sharing unit or MMI/PC | Check bus wiring |
| **22** | Acknowledgement error | The number of maximum automatic acknowledgements (1.182) was exceeded | Check error history and remedy error |
| **23** | External fault 1 | The parameterised fault input is active. 5.010 | Correct the external fault |
| **24** | External fault 2 | The parameterised fault input is active. 5.011 | Correct the external fault |
| **25** | Motor detection | Motor identification error | Check INVEOR/motor and PC / MMI / INVEOR connections / restart motor identification |
| **32** | Trip IGBT | Protection of the IGBT module against overcurrent has been triggered | Short circuit in the motor or motor feed line / controller settings |

Continues on next page

Continuation

| No. | Error name | Description of error | Possible causes/remedy |
|---|---|---|---|
| **33** | Overvoltage of intermediate circuit | The maximum intermediate circuit voltage has been exceeded | Feedback by motor in generator mode / mains voltage too high / faulty setting for rotation speed controller / brake resistor not connected or defective / ramp times too short |
| **34** | Undervoltage of intermediate circuit | The minimum intermediate circuit voltage has not been reached | Mains voltage too low, mains connection defective / check wiring |
| **35** | Excess motor temperature | Motor PTC has been triggered | Overload of the motor (e.g. high torque at low motor speed) / ambient temperature too high |
| **36** | Power failure | Interruption of the grid voltage | A phase is missing / mains voltage has been disrupted |
| **38** | Excess IGBT module temperature | Excess IGBT module temperature | Insufficient cooling, low motor speed and high torque, switching frequency too high |
| **39** | Overcurrent | Maximum output current of drive controller exceeded | Motor stalled / check motor connection / incorrect speed controller setting / check motor parameters / ramp times too short / brake not open |
| **40** | Excess frequency converter temperature | Inner temperature too high | Insufficient cooling / low motor speed and high torque / switching frequency too high permanent overload / reduce ambient temperature / check fan |
| **42** | $I^2t$ motor protection shut-off | The internal $I^2t$ motor protection (can be parameterised) has been triggered | Permanent overload |
| **43** | Ground leak | Ground leak during a motor phase | Insulation fault |

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Continuation

| No. | Error name | Description of error | Possible causes/remedy |
|---|---|---|---|
| **45** | Motor connection disrupted | No motor current in spite of control through frequency converter | No motor connected or not completely connected.<br>Check phases or motor connections and connect correctly when necessary.<br>* |
| **46** | Motor parameters | Plausibility check for motor parameters failed | Parameter set not OK |
| **47** | Drive controller parameters | Plausibility check for drive controller parameters failed | Parameter set not OK Please check the parameters 33.001 and 34.010 |
| **48** | Type plate data | No motor data entered | Please enter the motor data according to the type plate |
| **49** | Power class restriction | Max. overload of the drive controller exceeded for more than 60 sec. | Check application / reduce load / use larger drive controller |
| **53** | Motor tipped | Only for synchronous motors, field orientation lost | Load too high. Optimise controller parameters. |

Tab. 3: Error detection

* In exceptional cases, the error may be displayed erroneously when idling (very low motor current) synchronous motors.

Set parameter 33.016 accordingly when the phases or motor connections are connected correctly.

# 7. Disassembly and disposal

This chapter contains the following:

- A description of how to disassemble the drive controller.
- Information on correct disposal.

## 7.1 Drive controller disassembly

| | CAUTION |
|---|---|
| | **Risk of burns from hot surfaces!**<br>**Serious burns to the skin from hot surfaces!**<br>Allow the drive controller's cooling elements to cool sufficiently. |

| | DANGER |
|---|---|
| | **Risk of death due to electrical shock!**<br>**Death or serious injury!**<br>De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.<br>  Danger due to electrical shock and discharge. Wait two minutes (discharge time of the capacitors) after shut-down. |

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Continuation

1. Release four retaining bolts of cooling elements.
2. Carefully lift cooling elements off adapter plate.
3. Remove all power lines.
4. Remove the drive controller.
5. Release the adapter plate's retaining bolts.
6. Remove the adapter plate.

## 7.2 Information on correct disposal

Dispose of drive controller, packaging and replaced parts in accordance with the regulations of the country in which the drive controller has been installed. The drive controller may not be disposed of with household waste.

# 8. Technical data

## 8.1 General data

### 8.1.1 General technical data for 230 V devices

| Size | M α | | | |
|---|---|---|---|---|
| Recommended motor rating (4-pole asynchr. motor) | 0.25 [kW] | 0.37 [kW] | 0.55 [kW] | 0.75 [kW] |
| Ambient temperature | - 10 °C (non condensing) to + 40 °C (50 °C with derating) [1] | | | |
| Mains voltage | 1~ 200 V – 10 % … 230 V + 10 % [2] | | | |
| Mains frequency | 47 Hz to 63 Hz | | | |
| Mains configurations | TN / TT / IT (option) | | | |
| Mains current | 3.1 [A] | 4.5 [A] | 5.8 [A] | 7.3 [A] |
| Nominal current, eff. [$I_N$ at 8 kHz / 230 V] | 1.4 [A] | 2.2 [A] | 2.7 [A] | 3.3 [A] |
| Maximum overload | 150 % of nominal current for 60 sec | | | |
| Switching frequency | 4 kHz, 8 kHz, 16 kHz, (factory setting 8 kHz) | | | |
| Rotating field frequency | 0 Hz – 400 Hz | | | |
| Protective function | Overvoltage and undervoltage, $I^2t$ restriction, short circuit, motor- drive controller temperature, anti-tilt protection, stall protection | | | |
| Process control | Freely configurable PID controller | | | |
| Dimensions [L x W x H] mm | 187 x 126 x 70 | | 187 x 126 x 80 | |
| Weight not including adapter plate | 1.5 kg | | | |
| Protection type [IPxy] | IP 65 | | | |
| EMC | approvals acc. to DIN EN 61800-3, class C2 | | | |
| Vibration resistance (DIN EN 60068-2-6) | Transport: 5…200 Hz<br>5 g / 49 m/s² | | | |
| Shock resistance (DIN EN 60068-2-27) | Severity 2<br>30 g / 294 m/s² | | | |

Tab. 4: Technical data for 230 V devices (subject to technical changes)

[1] In accordance with UL 61800-5-1 and CSA 22.2, see chapter 10.4!

[2] Operation with reduced input voltage is possible. As of 110 V, the drive controller is capable of function (with reduced output power).

Subject to technical change.

| Designation | Function |
|---|---|
| **Digital inputs 1 – 2** | - Switching level low < 5 V / high > 15 V<br>- Imax (at 24 V) = 3 mA<br>- Rin = 8.6 kOhm |
| **Analogue inputs 1** | - In +/- 10 V or 0 – 20 mA<br>- In 2 – 10 V or 4 – 20 mA<br>- 10-bit resolution<br>- Tolerance +/- 2 %<br>Voltage input:<br>- Rin = 10 kOhm<br>Current input:<br>- Working resistance = 500 Ohm |
| **Digital outputs 1** | - Short-circuit proof<br>- Imax = 20 mA |
| **Relay 1** | 1 changeover contact (NO/NC)<br>Maximum switching power *<br>- at ohmic load (cos φ = 1): 5 A at ~ 230 V or = 30 V<br>- at inductive load (cos φ = 0.4 and L/R = 7 ms): 2 A at ~ 230 V or = 30 V<br>Maximum reaction time: 7 ms ± 0.5 ms<br>Electric life: 100 000 switching cycles |
| **Power supply 24 V** | - Auxiliary voltage U = 24 V DC<br>- Short-circuit proof<br>- Imax = 100 mA<br>- external feeding of 24 V possible |
| **Power supply 10 V** | - Auxiliary voltage U = 10 V DC<br>- Short-circuit proof<br>- Imax = 30 mA |

Tab. 5: Specification of interfaces

* in accordance with UL-61800-5-1, the maximum allowed is 2 A!

## 8.2 Derating of output power

You will find the “Derating” chapter in the detailed operating manual for the INVEOR α.

# 9. Optional accessories

This chapter contains brief descriptions of the following optional accessories:

- Adapter plates.
- MMI handheld controller including connection cable RJ9 on M12 plug.
- Brake resistors.

## 9.1 Adapter plates

### 9.1.1 Motor adapter plates

A standard motor adapter plate is available for each INVEOR α size.
Download the 3D files (.stp) for INVEOR and adapter plates from www.kostal-industrie-elektrik.com.

| INVEOR size | M α |
|---|---|
| **Output** | **0.25 kW to 0.75 kW** |
| **Designation** | ADP Mα MOT<br>0000 A-000 1 |
| **Part no.** | 10117052 |

The customer needs to drill the four holes for mounting the standard adapter plate on the motor. Below are technical drawings showing the possible locations of the holes for each of the respective sizes.

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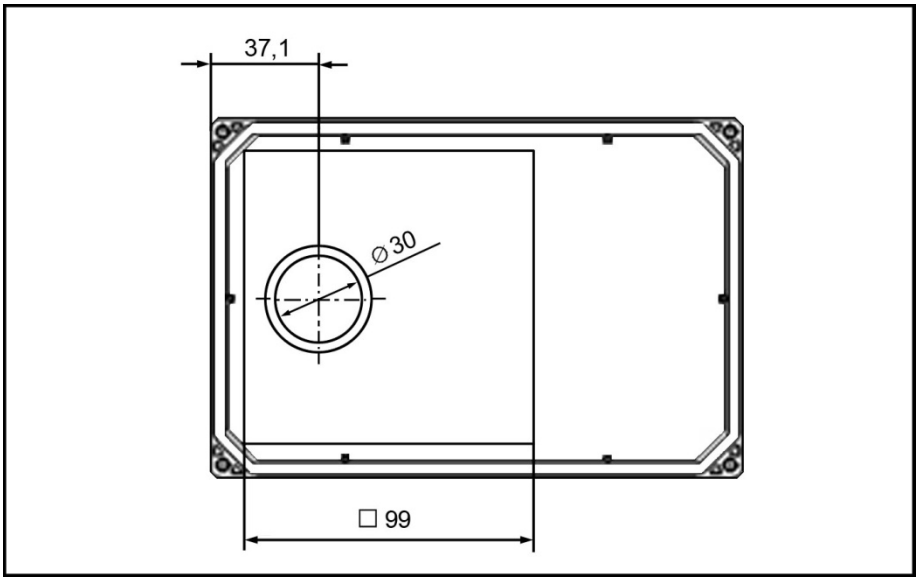


Fig.: 25 Hole pattern for size α standard adapter plate

When using cylindrical head screws (cf. DIN 912 / DIN 6912) or flat head screws (cf. DIN EN ISO 7380), the hole pattern must be drilled on the INVEOR mounting frame in compliance with the applicable drawing.

If the existing flat seals are in a good condition, they should be reused.

### 9.1.2 Motor adapter plates (specific)

In addition to the standard motor adapter plates, there are also specific versions available for various motor suppliers (on request).

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### 9.1.3 Wand adapter plates (standard)

A standard wall adapter plate is available for each INVEOR α size.
Download the 3D files for INVEOR and adapter plates from www.kostal-industrie-elektrik.com.
Four holes for mounting the adapter plate are present.

| INVEOR size | M α |
|---|---|
| **Output** | **0.25 kW to 0.75 kW** |
| **Designation** | ADP Mα WDM<br>0000 A-000 1 |
| **Part no.** | 10117051 |

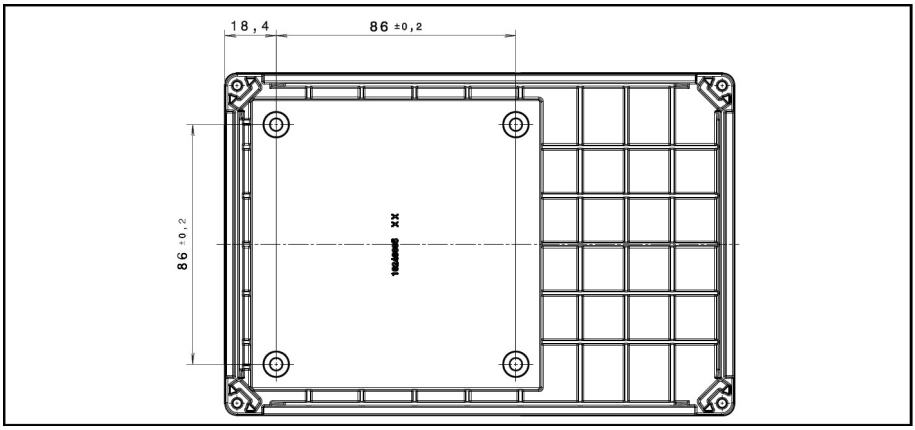


Fig.: 26 Hole pattern for size α standard wall adapter plate

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## 9.2 Foil keypad

As an option, the devices of the INVEOR α family are also available as a variant with an integrated foil keypad. This keypad can be used to operate the drive controller locally.

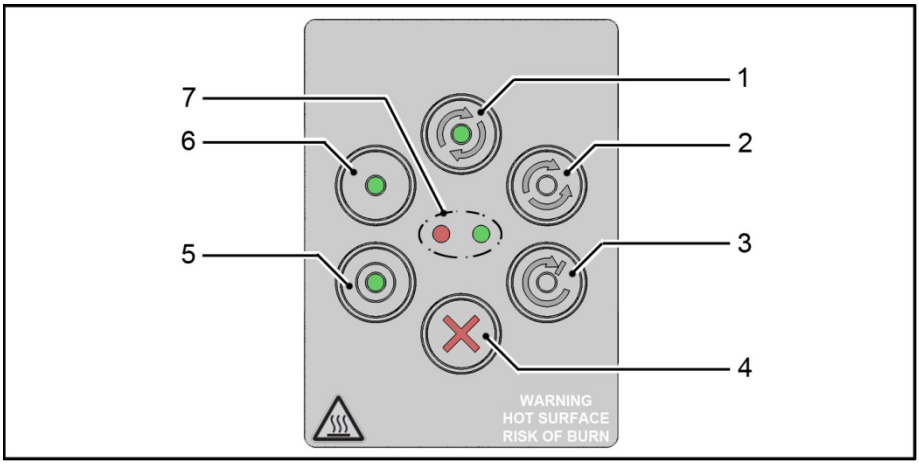


Fig.: 27 Standard foil keypad

| Key | |
|---|---|
| Item | |
| 1 | Start |
| 2 | Reversal of direction of rotation |
| 3 | Stop |
| 4 | Reset |
| 5 | Function key 2 |
| 6 | Function key 1 |
| 7 | Status LED 1 and 2 |

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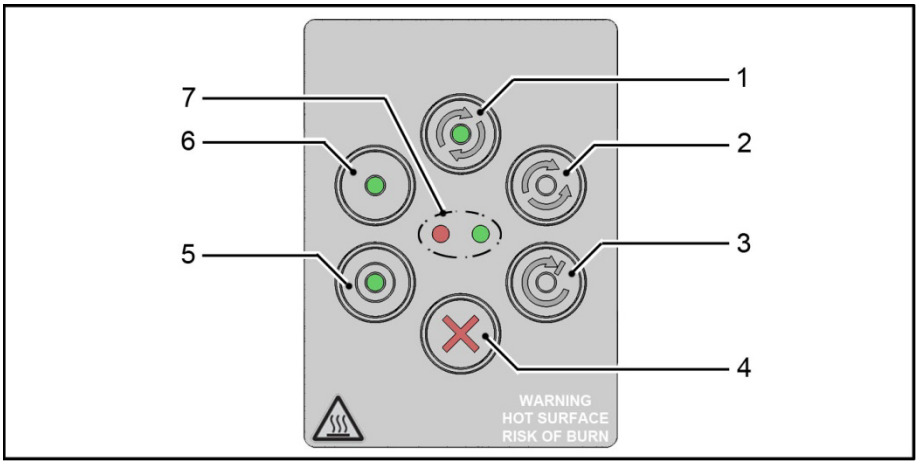


The following functionalities can be realised using the integrated foil keypad:

- **Motor potentiometer:** A motor potentiometer (parameter 2.150) can be realised using the configurable function keys (5) and (6) (MOP digit input) integrated in the foil keypad. This function can be used to increase or decrease the target value. The integrated LEDs indicate when the minimum/maximum target value is reached.

  To activate this function, the target value specification (parameter 1.130) must be set to motor potentiometer!

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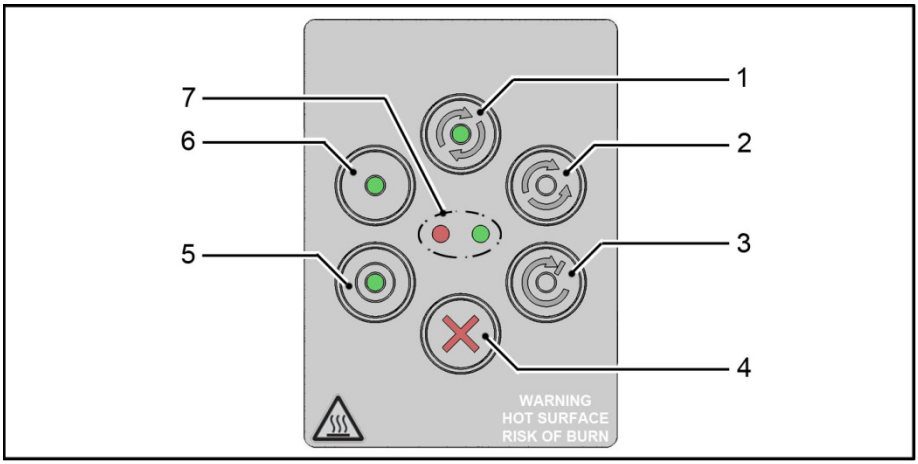


- **Target value approval:** The start (1) and stop (3) keys integrated in the foil keypad (select foil keypad) can be used to approve the drive software (parameter 1.131).
- **Direction of rotation V1:** The direction of rotation (parameter 1.150) can be changed using the key (2) integrated in the foil keypad (select foil keypad, direction of rotation key). The direction of rotation can only be changed when the motor is running.

  **Direction of rotation V2:** The direction of rotation (parameter 1.150) can be changed using keys (6) and (5) integrated in the foil keypad (select foil keypad, key I clockwise/key II anti-clockwise via stop).
  The direction of rotation can only be changed when the motor is stationary.
  The integrated LEDs indicate the current direction of rotation.

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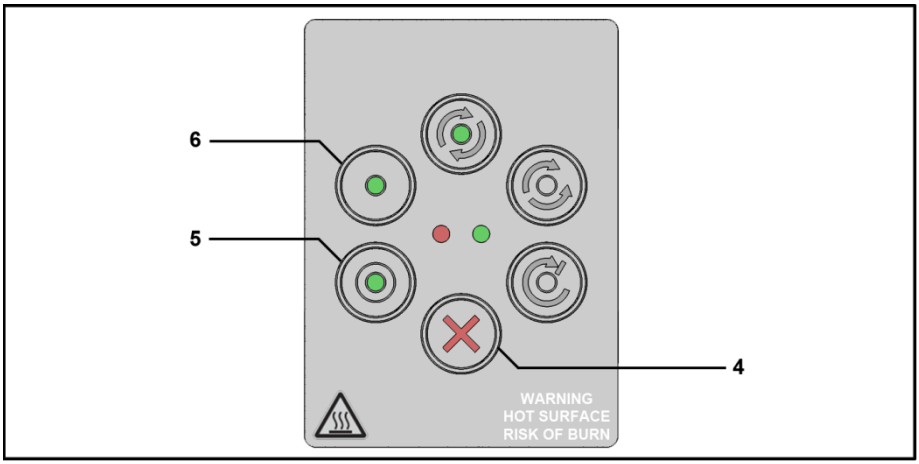


- **Direction of rotation V3:** The direction of rotation (parameter 1.150) can be changed using keys (6) and (5) integrated in the foil keypad (select foil keypad, key I clockwise/key II anti-clockwise always). The direction of rotation can be changed when the motor is running and stationary. The integrated LEDs indicate the current direction of rotation.
- **Acknowledgement function:** An error can be acknowledged (parameter 1.180) using the reset key (4) integrated in the foil keypad (select foil keypad).

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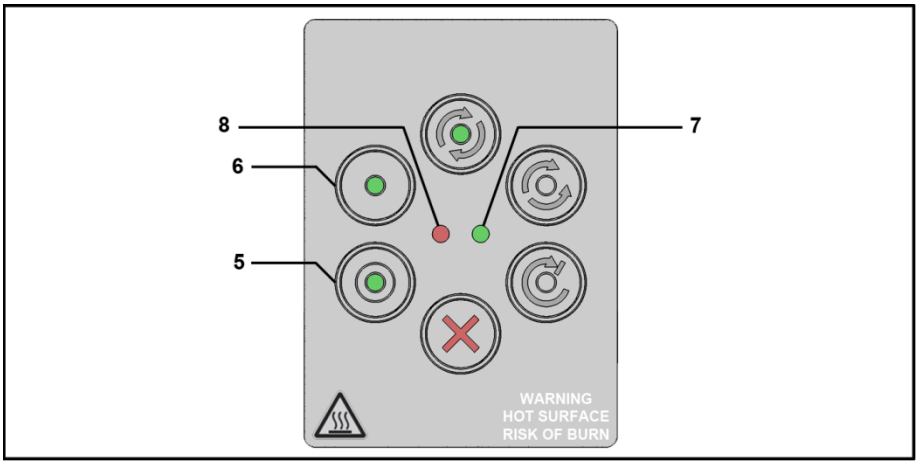


- **Fixed frequency:** Two fixed frequencies (parameter 2.050) can be realised using the configurable keys (6) and (5) integrated in the foil keypad (MOP digit.inp.). This function can be used to increase or decrease the target value.
  The integrated LEDs indicate the target value currently selected.

The LEDs integrated in the foil keypad provide a general indication of the drive controllers.

Green status LED (7):
Red status LED (8):
} For the functions of the status LEDs, please refer to the overview in chapter 6.1.

Other accessories available can be found in the detailed operating manual of the INVEOR α.

# 10. Approvals, standards and guidelines

This chapter contains information about electromagnetic compatibility (EMC), and applicable guidelines, norms and standards.

For binding information about the relevant drive controller approvals, please refer to the relevant type plate!

## 10.1 EMC limit classes

Please note that EMC limit classes are only reached if the standard switching frequency of 8 kHz is complied with.
Depending on the installation material used and/or extreme ambient conditions, it might be necessary to use additional sheath wave filters (ferrite rings).
If mounting on a wall, the shielded motor cable must not exceed a maximum length of 3 m!

Wiring suitable for EMC also requires that EMC screw connections be used on both sides (drive controller and motor).

**INFORMATION**
In a residential environment, this product can cause high-frequency disturbances that may require interference suppression measures.

## 10.2 Classification acc. to IEC/EN 61800-3

The generic standard defines test procedures and severity levels for every environment in the drive controller category; these have to be complied with.

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Continuation

**Definition of environment**

First environment (residential, commercial and industrial area):

All “areas” that are directly supplied by a public low-voltage connection, such as:

- Residential area, e.g. houses, apartments etc.
- Retail area, e.g. shops, supermarkets.
- Public institutions, e.g. theatres, stations.
- Outside areas, e.g. petrol stations and parking areas.
- Light industry, e.g. workshops, laboratories, small businesses.

Second environment (industry):

Industrial environments with their own supply network that is separated from the public low-voltage supply by a transformer.

## 10.3 Standards and guidelines

The following specifically apply:

- Directive on Electromagnetic Compatibility (Directive 2004/108/EC of the Council EN 61800-3:2004).
- Low Voltage Directive (Directive 2006/95/EC of the Council EN 61800-5-1:2003).

## 10.4 UL approval

### 10.4.1 UL Specification (English version)

#### Maximum Ambient Temperature:

| Electronics | Adapter | Ambient |
|---|---|---|
| INV Mα 2 0.25 | ADP Mα WDM * | 50 °C [122 °F] |
| INV Mα 2 0.37 | ADP Mα WDM * | 45 °C [113 °F] |
| INV Mα 2 0.55 | ADP Mα WDM * | 40 °C [104 °F] |
| INV Mα 2 0.75 | ADP Mα WDM * | 35 °C [95 °F] |

* WDM = Wall mounting

#### Required Markings

Enclosure intended for use with field-installed conduit hubs, fittings or closure plates UL approved in accordance with UL514B and CSA certified in accordance with C22.2 No. 18, environmental Type 1 or higher.

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Continuation

Suitable for use on a circuit capable of delivering not more than 5 kA rms symmetrical amperes, 240 V maximum and when protected by RK5 class fuses rated to 15 A.

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes.

All wiring terminals marked to indicate proper connections for the power supply, load and control circuitry.

For instructions for operator and servicing instructions on how to mount and connect the products using the intended motor connection adapter, please see chapter 3.3 and 9.1 in the operating manual.

Use 75° C [167° F] wires only.

Use copper conductors only.

Motor overtemperature detection is not provided by the drive.

Internal overload protection activates within 60 seconds of reaching 150 % of the motor full load current.

For use in Canada: TRANSIENT SURGE SUPPRESSION SHALL BE INSTALLED ON THE LINE SIDE OF THIS EQUIPMENT AND SHALL BE RATED TO 240 V (PHASE TO GROUND), SUITABLE FOR OVERVOLTAGE CATEGORY III, AND SHALL PROVIDE PROTECTION FOR A RATED IMPULSE WITHSTAND VOLTAGE PEAK OF 2.5 kV

### 10.4.2 Homologation CL (Version en française)

**Température ambiante maximale:**

| Électronic | Adaptateur | Ambiante |
|---|---|---|
| INV Mα 2 0.25 | ADP Mα WDM * | 50 °C [122 °F] |
| INV Mα 2 0.37 | ADP Mα WDM * | 45 °C [113 °F] |
| INV Mα 2 0.55 | ADP Mα WDM * | 40 °C [104 °F] |
| INV Mα 2 0.75 | ADP Mα WDM * | 35 °C [95 °F] |

* WDM = Montage mural

## Mentions requises

Boîtier prévu pour une utilisation avec entrées de conduit filetées installées sur le terrain, raccords ou plaques d'obturation approuvées UL conformément à UL514B et certifiées CSA 22.2 conformément à C22.2 No. 18, étiquetage environnemental de type 1 ou plus.

suite au prochaine page

suite

Convient pour une utilisation sur un circuit capable de délivrer pas plus de 5 kA ampères symétriques rms, 240 V maximum, et protégé par des fusibles de classe RK5 d'une valeur nominale de 15 A.

La protection intégrée contre les courts-circuits à semi-conducteur n'assure pas la protection du circuit de dérivation. Le circuit de dérivation doit être protégé conformément aux instructions du fabricant, au code national d'électricité et à tout autre code local additionnel.

Toutes les bornes de câblage avec repères pour les connexions correctes pour l'alimentation électrique, la charge et les circuits de commande.

Pour les instructions destinées à l'opérateur et les instructions de service relatives au montage et à la connexion des produits à l'aide de l'adaptateur de connexion du moteur prévu à cet effet, voir les chapitres 3.3 et 9.1 contenus dans le Manuel d'utilisation.

Utiliser uniquement des câbles en cuivre 75 °C [167 °F].

Aucune détection de surtempérature du moteur n'est fournie par l'entraînement.

La protection interne contre les surcharges se met en marche en l'espace de 60 secondes une fois 150 % du courant nominal du moteur atteints.

Pour une utilisation au Canada : LA SUPPRESSION DE TENSION TRANSITOIRE DOIT ÊTRE INSTALLÉE CÔTÉ LIGNE DE CET ÉQUIPEMENT ET AVOIR UNE VALEUR NOMINALE DE 240 V (PHASE-TERRE), EN COMPATIBILITÉ AVEC LA CATÉGORIE DE SURTENSION III, ET DOIT OFFRIR UNE PROTECTION CONTRE UN PIC DE TENSION ASSIGNÉE DE TENUE AUX CHOCS DE 2,5 kV

# 11. Quickstart guide

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## 11.1 Quickstart guide for asynchronous motors

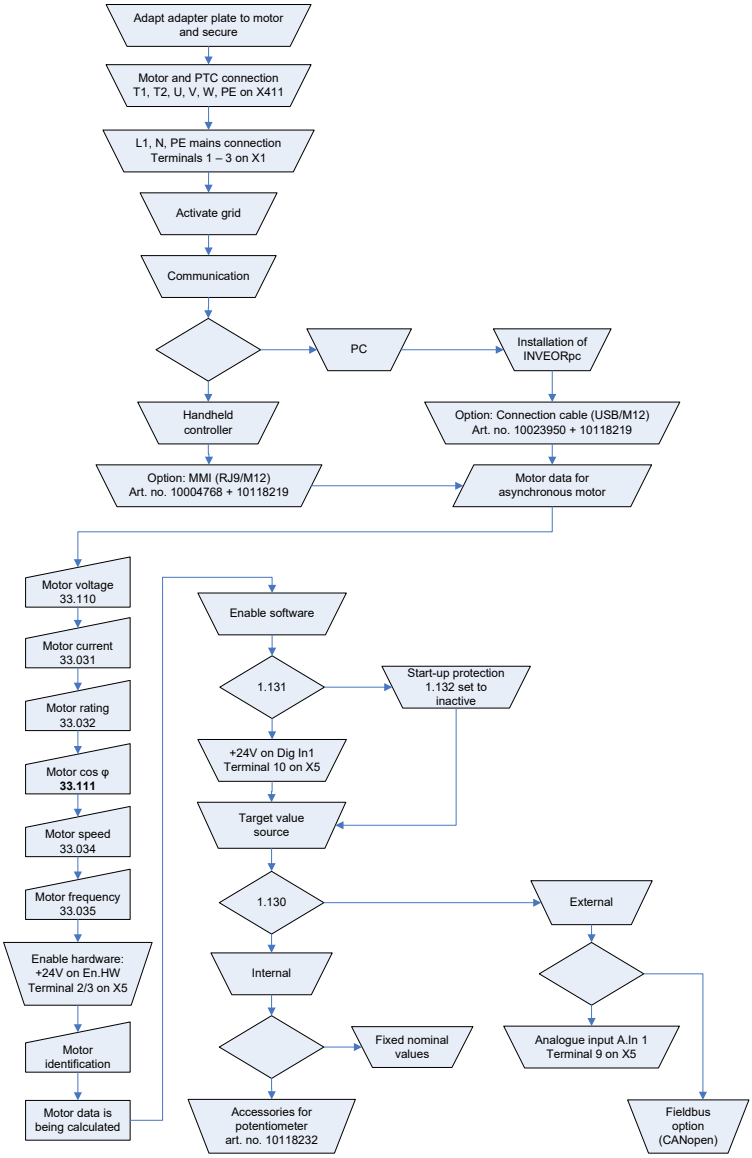


Fig.: 28 Block diagram for quick start for ASM

## 11.2 Quickstart guide for synchronous motors

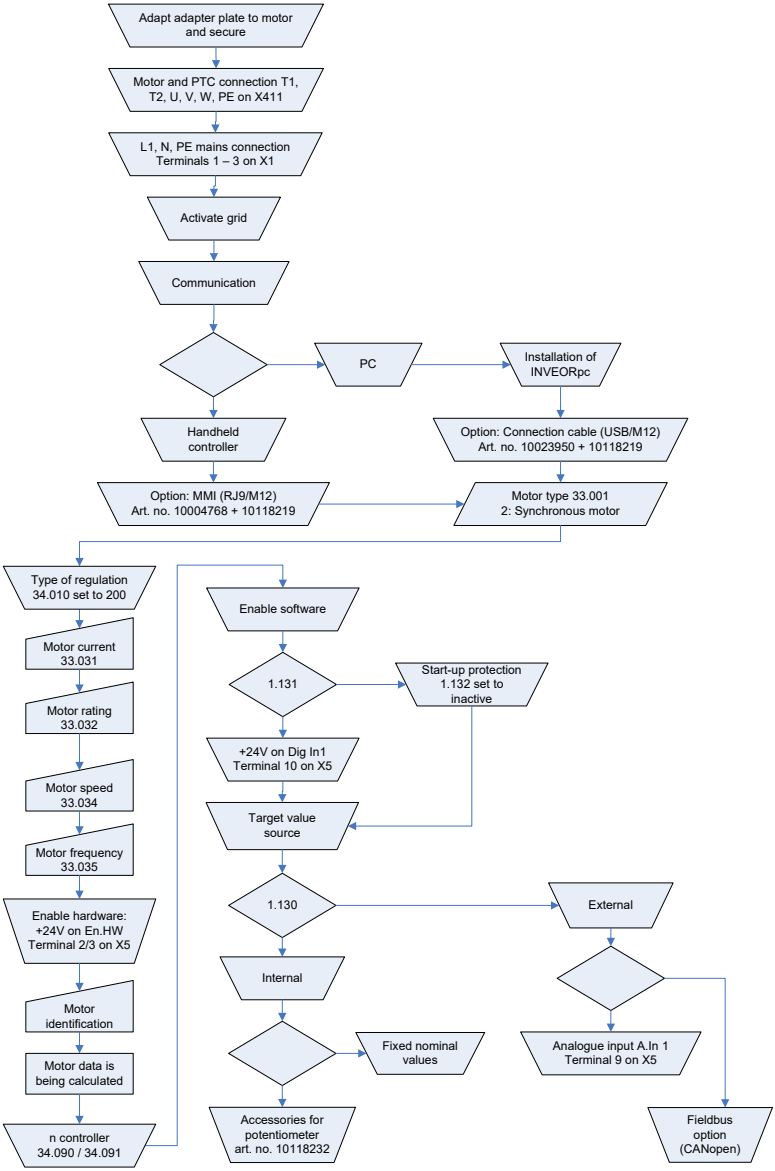


Fig.: 29 Block diagram for quick start for SM

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