



Smart  
connections.

## Operating manual

**INVEOR MP Modular**

## Legal notice

KOSTAL Industrie Elektrik GmbH  
An der Bellmerlei 10  
58513 Lüdenscheid  
Germany  
Tel. +49 (0)2351 16-0  
Fax + 49 (0)2351 16-2400  
info-industrie@kostal.com

## Exclusion of liability

MP All names, trademarks, product names or other designations used in this manual may be legally protected even if not indicated as such (e.g. as a trademark). KOSTAL assumes no liability for their free usage.

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.

## © 2019 KOSTAL Industrie Elektrik GmbH

All rights reserved by KOSTAL, including those of reproduction by photocopy and storage in electronic media. Commercial use or distribution of the texts, displayed models, diagrams and photographs appearing in this product is not permitted. This manual may not be reproduced, stored, transmitted or translated in any form or by means of any medium - in whole or in part - without prior written permission.

## Contents

<b>1. General information.....</b>	<b>5</b>	<b>4. Commissioning.....</b>	<b>35</b>
1.1 Information about documentation.....	5	4.1 Safety instructions for commissioning .....	35
1.1.1 Other applicable documents.....	5	4.2 Communication .....	35
1.1.2 Storing the documentation .....	5	4.3 Block diagram .....	37
1.2 Notes in this manual .....	5	4.4 Commissioning steps.....	38
1.2.1 Warnings.....	5	4.4.1 Commissioning using the PC: .....	38
1.2.2 Warning symbols used .....	6	4.4.2 Commissioning using PC, combined with MMI option .....	39
1.2.3 Signal words .....	6		
1.2.4 Information notes.....	6	<b>5. Parameter .....</b>	<b>40</b>
1.3 Symbols used in this manual .....	6	5.1 Safety instructions for working with parameters .	40
1.4 Labels on the drive controller .....	7	5.2 General information on parameters.....	40
1.5 Qualified staff.....	7	5.2.1 Explanation of operating modes .....	40
1.6 Proper use .....	7	5.2.2 Structure of the parameter tables .....	41
1.7 Responsibility.....	8	5.3 Application parameters .....	42
1.8 CE marking .....	8	5.3.1 Basic parameter .....	42
1.9 Safety instructions .....	8	5.3.2 Fixed frequency .....	46
1.9.1 General information .....	8	5.3.3 Analogue inputs.....	47
1.9.2 Transport & storage .....	9	5.3.4 Digital inputs.....	48
1.9.3 Information about commissioning .....	9	5.3.5 Digital outputs .....	49
1.9.4 Instructions concerning operation .....	10	5.3.6 Virtual output .....	50
1.9.5 Maintenance and inspection.....	11	5.3.7 External fault.....	51
1.9.6 Repairs.....	11	5.3.8 Motor current limit.....	52
		5.3.9 Stall detection .....	52
<b>2. Overview of the drive controller .....</b>	<b>12</b>	5.3.10 Fieldbus.....	55
2.1 Model description .....	12	5.3.11 Bluetooth.....	56
2.2 Scope of delivery .....	13	5.4 Performance parameters.....	57
2.3 MMI*/connecting cable PIN assignment.....	13	5.4.1 Drive type .....	57
2.4 MMI*/connecting cable PIN assignment.....	13	5.4.2 Motor data.....	57
2.5 Description of INVEOR MP Modular drive controller.....	13	5.4.3 I <sup>2</sup> t.....	60
		5.4.4 Switching frequency .....	61
<b>3. Installation.....</b>	<b>14</b>	5.4.5 Controller data.....	62
3.1 Safety instructions for installation.....	14	5.4.6 Quadratic characteristic curve .....	65
3.2 Recommended preliminary fuses / line protection.....	14	<b>6. Error detection and troubleshooting .....</b>	<b>66</b>
3.3 Installation requirements.....	15	6.1 List of the LED flash codes for error recognition. 66	
3.3.1 Suitable ambient conditions .....	15	6.2 List of errors and system errors .....	67
3.3.2 Suitable installation location for the motor-integrated drive controller.....	16		
3.3.3 Basic connection versions .....	16	<b>7. Disassembly and disposal .....</b>	<b>69</b>
3.3.4 Short circuit and ground protection.....	18	7.1 Drive controller disassembly .....	69
3.3.5 Wiring instructions .....	19	7.2 Information on correct disposal.....	69
3.3.6 Preventing electromagnetic interferences .....	20		
3.4 Installing the drive controller integrated in the motor .....	20	<b>8. Technical data .....</b>	<b>70</b>
3.4.1 Mechanical installation .....	20	8.1 General data.....	70
3.4.2 Power connection.....	23	8.1.1 General technical data for 400 V devices.....	70
3.4.3 Connections for brake resistor.....	25	8.1.2 Specification of interfaces.....	71
3.4.4 Connection using Harting plug .....	25	8.2 Derating of output power .....	71
3.4.5 PHOENIX Quickon connection .....	26	8.2.1 Derating due to increased ambient temperature. 72	
3.4.6 Connection via main switch.....	26	8.2.2 Derating due to installation altitude.....	73
3.4.7 Connection diagram (IO module option).....	27	8.2.3 Derating due to switching frequency.....	74
3.4.8 Basic fieldbus integrated on MP Modular.....	28		
3.4.9 IO module / assignment of plugs (option) .....	29		
3.5 Installing the wall-mounted drive controller.....	30		
3.5.1 Suitable installation location for wall mounting....	30		
3.5.2 Mechanical installation of sizes A - B .....	30		

<b>9. Optional accessories .....</b>	<b>75</b>	<b>10. Approvals, standards and guidelines .....</b>	<b>79</b>
9.1 Adapter plates .....	75	10.1 EMC limit classes .....	79
9.1.1 Motor adapter plates .....	75	10.2 Classification acc. to IEC/EN 61800-3 .....	80
9.1.2 Motor adapter plates (specific) .....	77	10.3 Standards and guidelines.....	80
9.1.3 Wall adapter plates (standard) .....	77		
9.2 MMI handheld controller including a 3 m RJ9 connection cable with M12 plug.....	78	<b>11. Quickstart guide.....</b>	<b>81</b>
9.3 PC communication cable USB on M12/RS485 plug (converter integrated).....	78	11.1 Quickstart guide .....	81
9.4 Bluetooth stick M12.....	79	11.2 Quickstart guide for synchronous motors .....	82
		<b>12. Index.....</b>	<b>83</b>

# 1. General information

Thank you for choosing an INVEOR MP Modular drive controller from KOSTAL Industrie Elektrik GmbH! Our INVEOR MP Modular line of drive controllers 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](http://www.kostal-industrie-elektrik.com)

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

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/downloads/downloadmanager#Antriebstechnik](http://www.kostal-industrie-elektrik.com/downloads/downloadmanager#Antriebstechnik)

A description of parameters is available for download ([www.kostal-industrie-elektrik.com/downloads/downloadmanager#Antriebstechnik](http://www.kostal-industrie-elektrik.com/downloads/downloadmanager#Antriebstechnik)) for parameterising the drive controller.

In the download, you will find all the information required for correct parameterisation.

## 1.1.2 Storing the documentation

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

## 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 MP Modular.

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

## 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.

Each warning consists of the following elements:

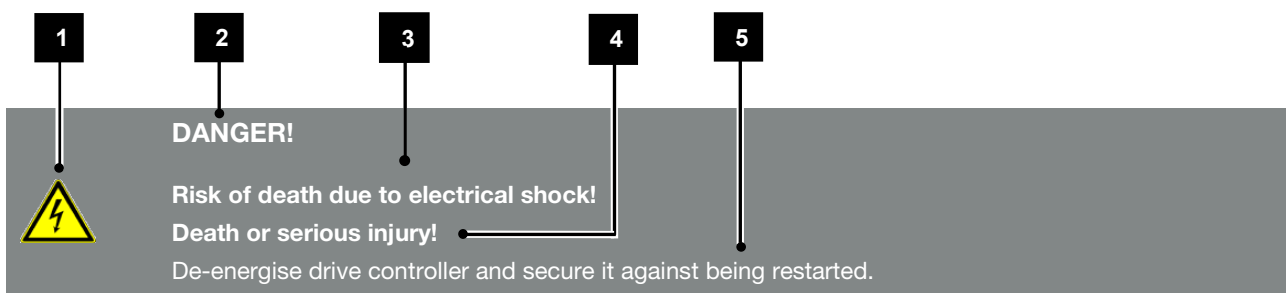





Fig. 1: Structure of the warnings

- 1** Warning symbol
- 2** Signal word
- 3** Type of danger and its source
- 4** Possible consequence(s) of failure to comply
- 5** Corrective actions

## 1.2.2 Warning symbols used

Symbol	Meaning
	Danger
	Danger due to electrical shock and discharge
	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 damage to property or financial damages.






	<b>IMPORTANT INFORMATION</b>
The drive controller may only be assembled, operated, maintained and installed by trained and qualified staff.	

Fig. 2: Example of an information note

## Symbols within the information notes

Symbol	Meaning
	Important information
	Damage to property possible

## Other notes

Symbol	Meaning
	INFORMATION
	Enlarged view

## 1.3 Symbols used in this manual

Symbol	Meaning
1., 1., 3. ...	Consecutive steps in a handling instruction
➔	Effect of a handling instruction
✓	Final result of a handling instruction
■	List

Fig. 3: Symbols and icons used

## Abbreviations used

Abbreviation	Explanation
Tab.	Table
Fig.	Figure
It.	Item
Ch.	Chapter

## 1.4 Labels on the drive controller

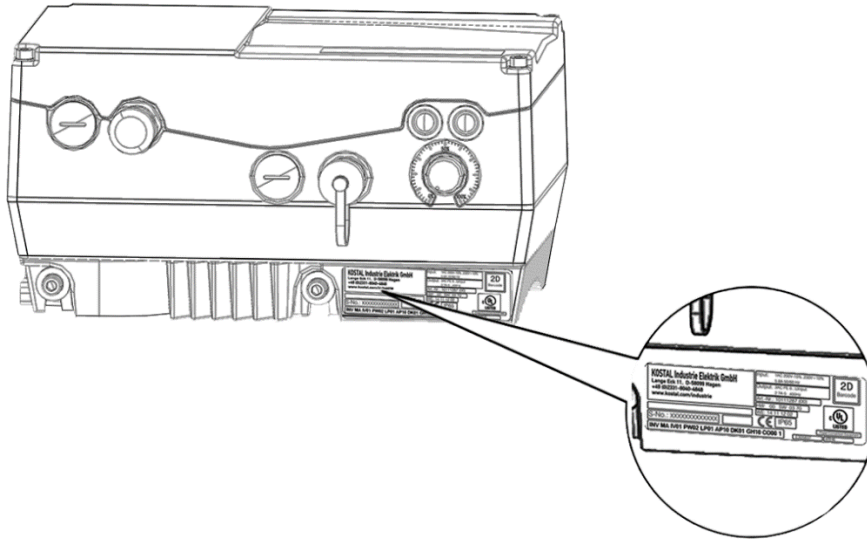






Fig. 4: Labels on the drive controller

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 electrical shock and discharge. Wait two minutes (discharge time of the capacitors) after shut-down
	Additional earth connection
	Observe and read operating manual

### 1.5 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.

Commissioning (i.e. beginning intended operation) is only permitted if the EMC Directive (2014/30/EU) is complied with.

The harmonised standards of DIN EN 50178; VDE 0160 must be applied for this drive controller along with DIN EN 61439-1/DIN EN 61439-2; VDE 0660-600.

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.

## 1.6 Proper use

If the device is installed in a machine, drive controllers 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 must be observed.





### IMPORTANT INFORMATION

- External mechanical loads on the housing are not permitted!
- 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.

## 1.7 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, “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 voltage 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”.

## 1.8 CE marking

**KOSTAL Industrie Elektrik GmbH** hereby declares that the drive controller described in this document complies with the basic requirements and other relevant conditions of the directives listed below.

- Directive 2014/30/EU  
(on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC)).
- Directive 2014/35/EU  
(on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits – in short: Low Voltage Directive).
- Directive 2011/65/EU  
(Restriction of the use of certain hazardous substances in electrical and electronic equipment, in short: RoHS Directive)
- Directive 2014/53/EU  
(relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC)

You will find a detailed EU Declaration of Conformity at:

[www.kostal-industrie-elektrik.com/downloads/downloadmanager#Antriebstechnik](http://www.kostal-industrie-elektrik.com/downloads/downloadmanager#Antriebstechnik)

## 1.9 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 controllers. 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.

### 1.9.1 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 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.

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

- 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 restarted.



### **DANGER!**

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

**Death or serious injury!**

Always ground the device in accordance with DIN EN 61140; VDE 0140, NEC and other relevant standards.

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

If spring elements are not used when assembling the adapter plate, there must be an extra connection between the motor and drive controller to produce a correct protective conductor connection.



### **DANGER!**

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

**Death or serious injury!**

De-energise drive controller and secure it against being restarted.



### **DANGER!**

**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.



### **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.

## 1.9.2 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!
- In general, transport the drive controller correctly in its original packaging on a pallet.
- Always store the drive controller properly.
- Only allow qualified staff to undertake installation and assembly.

## 1.9.3 Information about commissioning



### **DANGER!**

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

**Death or serious injury!**

De-energise drive controller and secure it against being restarted.

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

- Supply terminals X1: L1, L2, L3
- Motor connection terminals X2: U, V, W
- Connecting terminals X6, X7: Relay contacts for relays 1 and 2



### **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.



### IMPORTANT INFORMATION

- Only use mains connections with hardwiring.
- Ground the drive controller in accordance with DIN EN 61140; VDE 0140-1.
- The INVEOR 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 under the mains supply (position marked with a ground symbol) on the outside of the device. A M6 x 12 screw (4.0 Nm torque) suitable for this connection is provided with the adapter plate.
- If three-phase frequency converters are used, the use of conventional type A FI protection switches RCDs (residual current-operated protective devices) are not permissible as protection 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).



### 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 3 sec. must be observed between consecutive grid connections for devices with three-phase feed-in in sizes A - B (0.55 to 5.5 kW).
- Certain parameter settings may result in the drive controller restarting automatically after the supply voltage has failed.

#### 1.9.4 Instructions concerning operation



#### DANGER!

**Risk of death due to electrical shock!**  
**Death or serious injury!**

De-energise drive controller 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 restarted.



### 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<sup>2</sup>t 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<sup>2</sup>t is ON by default. Motor overload protection can also be ensured via an external PTC.
- The drive controller must not be used as "Emergency stop equipment" (see DIN EN 60204-1; VDE 0113-1:2007-06).

### 1.9.5 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. If devices are fitted with integrated fans, we would recommend cleaning with compressed air.

#### 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 stack of an INVEOR MP Modular 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 MP Modular's connection cables must be disconnected before testing.
- a 500 V DC insulation tester should be used.

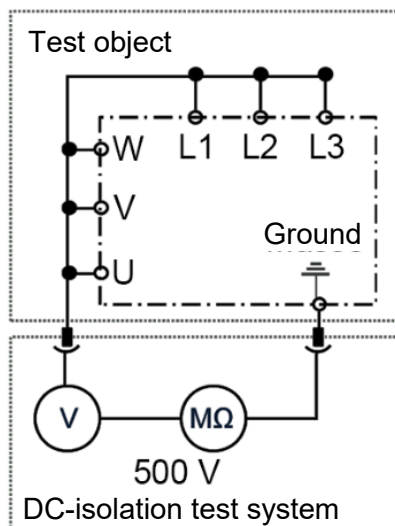


Fig. 5: Insulation test on the power board

### Pressure test on an INVEOR MP



#### IMPORTANT INFORMATION

A pressure test is not permitted on a standard INVEOR.

### 1.9.6 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.

#### DANGER!



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

**Death or serious injury!**

De-energise drive controller 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

### 2.1 Model description

#### INVEOR MP Modular

INVEOR type			A	B
INV MP	Inverter, motor-integrated, P		X	X
	Size		A	B
A	Size A		X	
B	Size B			X

#### Features:

Model / sector (new feature to differentiate between the sub-variants)															A	B								
INV MP	x	VS02	Modular												X	X								
			IV01	Supply voltage												A	B							
				400 V												X	X							
				PWxx	Recommended motor rating												A	B						
					PW03	0.55 kW											X							
					PW04	0.75 kW											X							
					PW05	1.10 kW											X							
					PW06	1.50 kW											X							
					PW07	2.20 kW												X						
					PW08	3.00 kW												X						
					PW09	4.00 kW												X						
					PW46	2.20 kW LD											X							
					PW49	5.50 kW LD												X						
					LPxx	Power-conducting plate												A	B					
						LP01	Without brake chopper											X	X					
						LP02	With brake chopper											X	X					
						APxx	Application PCB												A	B				
							AP00	With module carrier											X	X				
							AP90	Without module carrier											X	X				
							GHxx	Housing type												A	B			
								GH01	Passive cooling, potentiometer											X	X			
								GH02	Passive cooling											X	X			
								GH44	Passive cooling, brake resistor, potentiometer											X	X			
								GH45	Passive cooling, brake resistor											X	X			
								GH50	Passive cooling, Harting, M12 IO, potentiometer											X	X			
								GH51	Passive cooling, Harting, M12 IO											X	X			
								GH52	Passive cooling, Quickon, M12 IO, potentiometer											X	X			
								GH53	Passive cooling, Quickon, M12 IO											X	X			
								GH54	Passive cooling, brake resistor, Harting, M12 IO, potentiometer											X	X			
								GH55	Passive cooling, brake resistor, Harting, M12 IO											X	X			
								GH56	Passive cooling, brake resistor, Quickon, M12 IO, potentiometer											X	X			
								GH57	Passive cooling, brake resistor, Quickon, M12 IO											X	X			
								DKxx	Cover type												A	B		
									DK01	Without foil keypad											X	X		
									DK05	MMI option											X	X		
									DK11	Main switch											X	X		
									DK15	Main switch, MMI option											X	X		
									OAxx	Optional module												A	B	
										OA00	No option module											X	X	
										OA10	Main switch											X	X	
										IOxx	IO module												A	B
											IO00	Without IO module											X	X
											IO01	IO module 1											X	X
											IO02	IO module 1 with Bluetooth											X	X
											IO03	IO module 1 with M12 MMI plug											X	X
											IO04	IO module 1 with Bluetooth, M12 MMI plug											X	X
COxx	Customer												A	B										
	CO00	KOSTAL INVEOR											X	X										

## 2.2 Scope of delivery

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

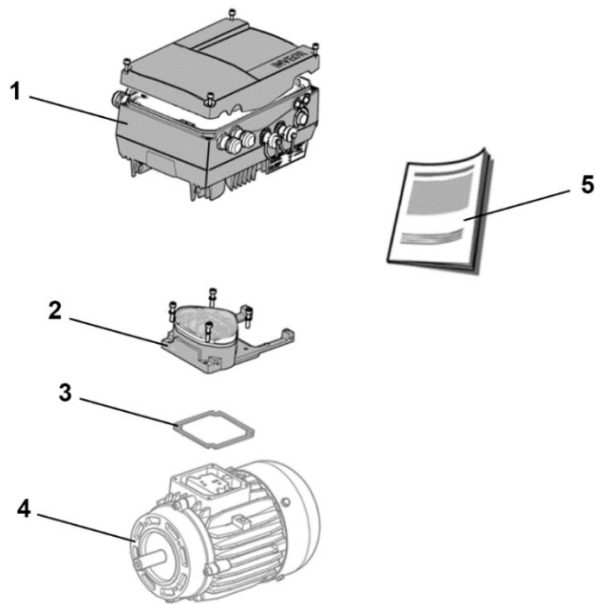


Fig. 6: Scope of delivery

Key	
Drive controller article number	
1	Drive controller (variant)
2	Adapter plate with terminal (not part of the scope of delivery)
3	Seal (not part of the scope of delivery)
Adapter plate article number	
4	Motor (not part of the scope of delivery)
5	Operating manual

## 2.3 MMI\*/connecting cable PIN assignment

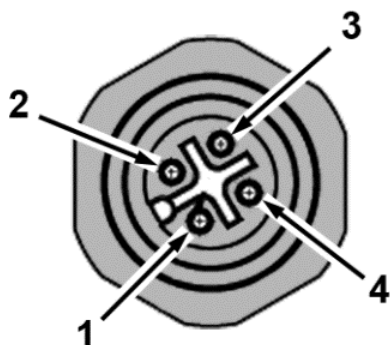


Fig. 7: M12 plug PIN assignment

Description: Round plug (plug) 4-pin M12 A-coded

M12 plug assignment	Signal
1	24 V
2	RS485 - A
3	GND
4	RS485 - B

## 2.4 MMI\*/connecting cable PIN assignment

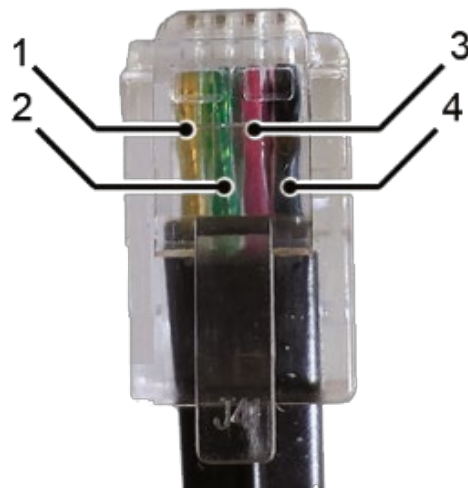


Fig. 8: RJ9 plug connector

Pin	Signal
1	yellow
2	green
3	Red
4	brown
Attention: The colours may vary!	

## 2.5 Description of INVEOR MP Modular drive controller

The INVEOR MP Modular drive controller is a device for the speed control of 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 mounting 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.

\* Man-machine interface

## 3. Installation

### 3.1 Safety instructions for installation



#### **DANGER!**

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

**Death or serious injury!**

De-energise drive controller and secure it against being restarted.

Only allow appropriately qualified staff to install the drive controller.

Only use staff who are trained in mounting, installation, commissioning and handling.

Always ground the device in accordance with DIN EN 61140; VDE 0140, NEC and other relevant standards.

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


If spring elements are not used when assembling the adapter plate, there must be an extra connection between the motor and drive controller to produce a correct protective conductor connection

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

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

Mains connections must be hardwired.

### 3.2 Recommended preliminary fuses / line protection

INVEOR M	Size A 3 x 400 V AC		Size B 3 x 400 V AC	
Rated motor speed	up to 1.5 kW	2.2 kW LD	up to 4 kW	5.5 kW LD
Line current	3.3 A	3.9 A	7.9 A	9.3 A
Line current 150% (overload 60 s)	4.95 A	4.3 A	11.85 A	10.2 A
Line current 200% (overload 3 s)	6.6 A	5.85 A	15.8 A	14 A
Line circuit breaker - recommendation	C 10		C 16	
	Characteristics C = line circuit breaker tripping between 6 – 10 times I <sub>n</sub>			
	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.			



### 3.3 Installation requirements

#### 3.3.1 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:	- 40 °C to + 50 °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 60721-3-3 3M7 (5 – 200 Hz, 3g)
Electromagnetic compatibility:	Immune to interference acc. to DIN EN 61800-3
Cooling:	Surface cooling: sizes A to B: free convection;

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 that the cover of the drive controller is closed and bolted down tightly.
  - Size A – B (4 x M4 x 28) 2 Nm,



#### **DAMAGE TO PROPERTY POSSIBLE**

Failure to comply with the information may result in damage to the drive controller!

When attaching a cover with integrated foil keypad, be absolutely sure that the flat ribbon cable is not pinched.

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 MP Modular is supplied in 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!

## 3.3.2 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.

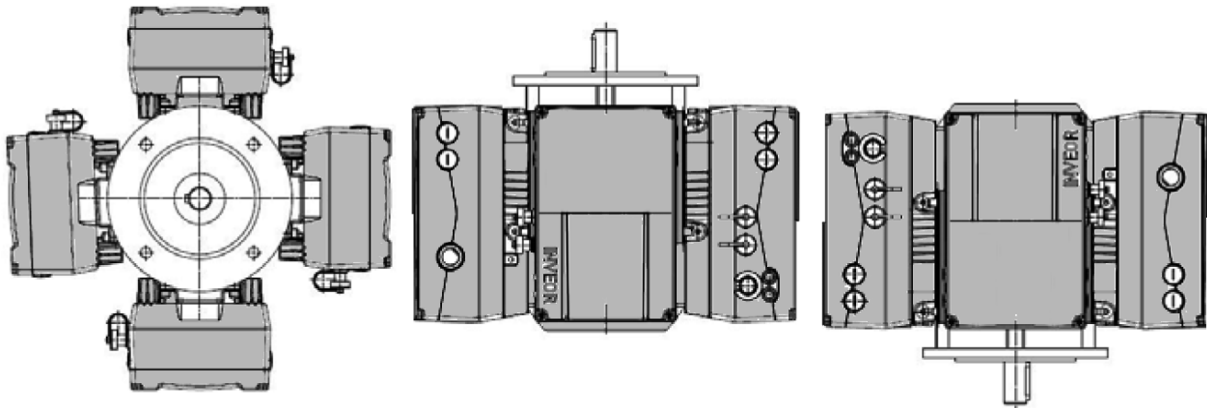


Fig. 9: Motor installation location/permited alignments



### IMPORTANT INFORMATION

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

## 3.3.3 Basic connection versions

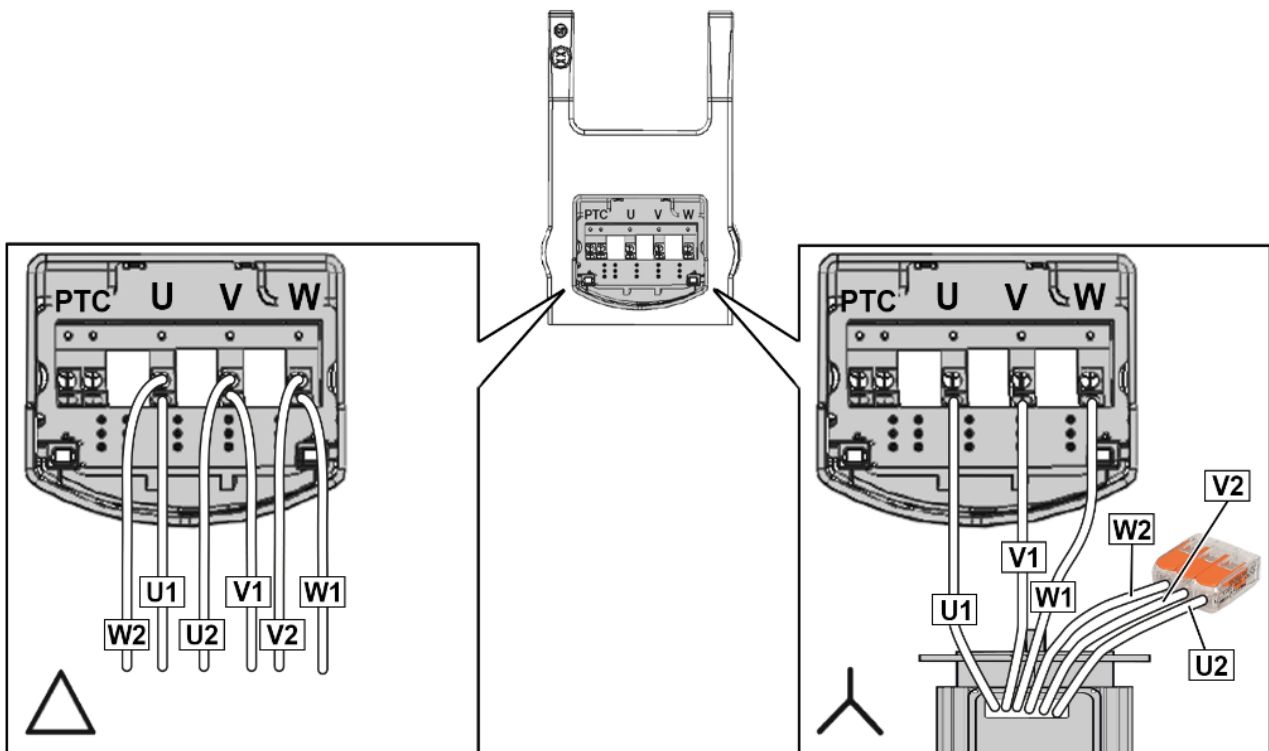


Fig. 10: Star or triangle connection, size A

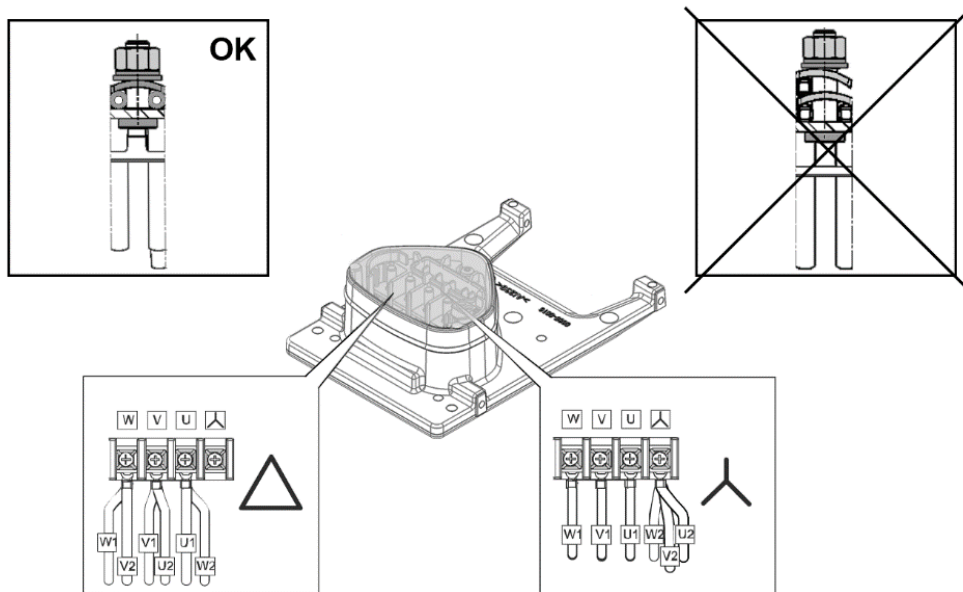
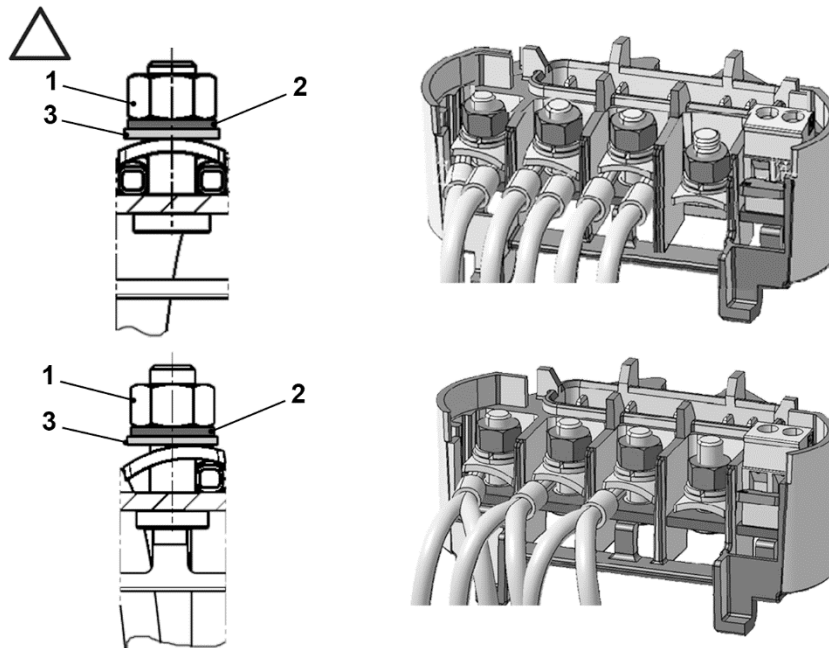


Fig. 11: Star or triangle connection, size B

## Triangle connection variant, size B



1. Nut  $M_A = 5 \text{ Nm}$

2. Circlip

3. Plain washer



### DANGER!

Risk of death due to electrical shock!  
Death or serious injury!

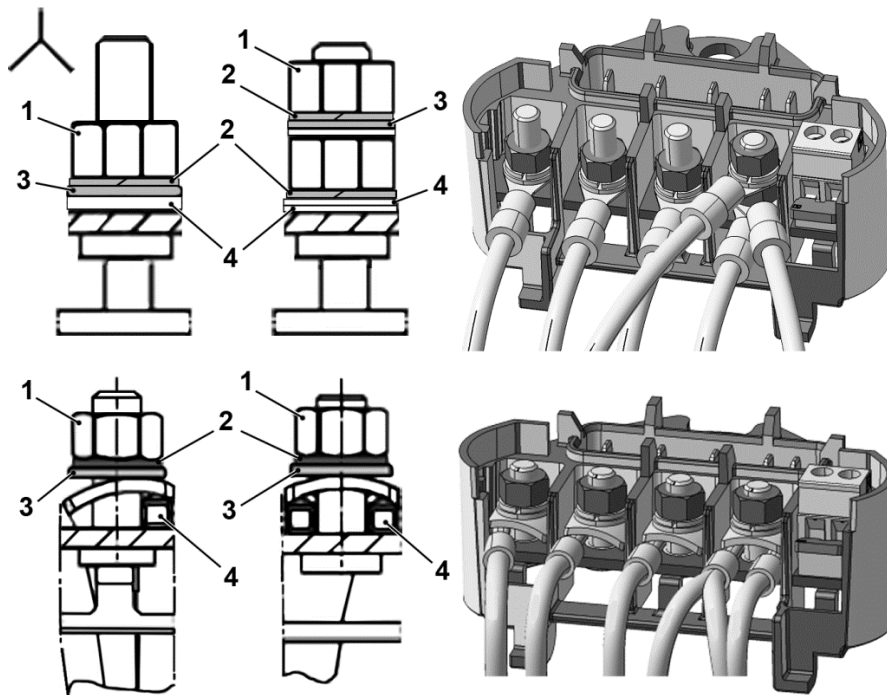
De-energise drive controller and secure it against being restarted.



### IMPORTANT INFORMATION

Regularly check that the nuts (1) are secure!

## Star connection variant



1. Nut  $M_A = 5 \text{ Nm}$
2. Circlip

3. Plain washer
4. Cable shoe



### DANGER!

**Risk of death due to electrical shock!**  
**Death or serious injury!**

De-energise drive controller and secure it against being restarted.

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



### DANGER!

**Risk of death due to electrical shock!**  
**Death or serious injury!**

De-energise drive controller and secure it against being restarted.



### 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.



### IMPORTANT INFORMATION

If a thermal resistor (PTC or Klixon) is used, the bridging contact fitted on the connection terminal for the PTC in the delivery state has to be removed.



### IMPORTANT INFORMATION

Regularly check that the nuts (1) are secure!

The supplied assembly material can be used to connect core end sleeves and cable shoes.

Fig. 5 shows the different connection variants.

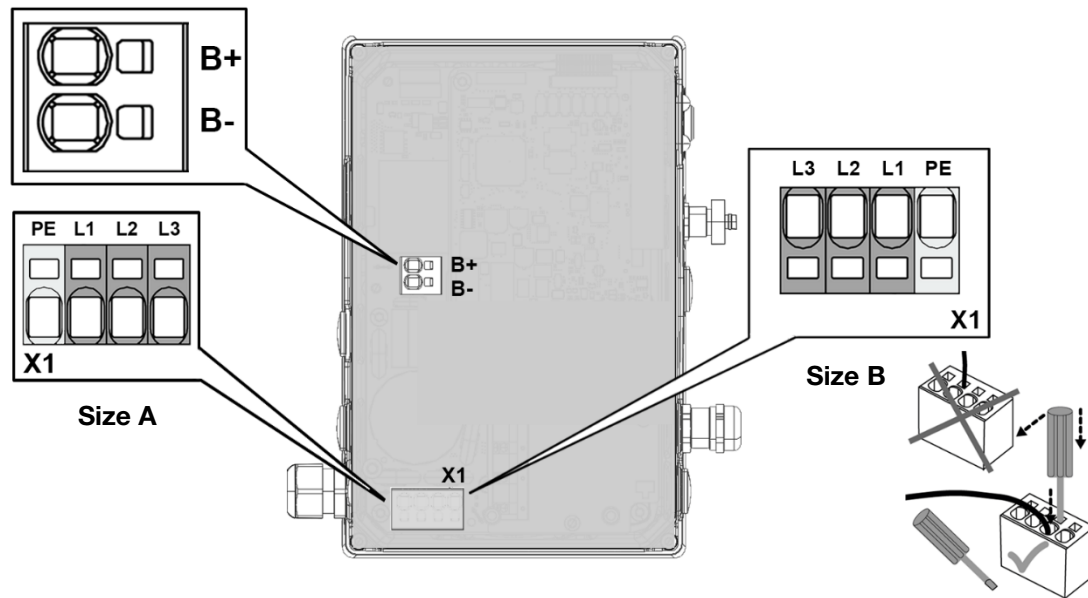
The cross-section of the supply line must be designed according to the transfer category and maximum permitted current. The contractor commissioning the device must ensure protection for the power line.

### 3.3.4 Short circuit and ground protection

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

## 3.3.5 Wiring instructions

### Connection overview (sizes A – B)



Sizes A - B			
X1 mains	The terminals for the mains cable are located inside the drive controller. The INVEOR also has the option of being equipped with terminals for connecting a brake resistor. Depending on the variant, the assignment and position of the terminals may differ.		
	Core end sleeves with plastic collars and lugs are recommended.		
	Terminals:	Spring force connection (slot screwdriver, max. width 2.5 mm)	
	Conductor cross-section, rigid	min. 0.2 mm <sup>2</sup>	max. 10 mm <sup>2</sup>
	Conductor cross-section, flexible	min. 0.2 mm <sup>2</sup>	max. 6 mm
	Conductor cross-section, flexible with core end sleeve without plastic sleeve	min. 0.25 mm <sup>2</sup>	max. 6 mm
	Conductor cross-section, flexible with core end sleeve with plastic sleeve	min. 0.25 mm <sup>2</sup>	max. 4 mm
	2 conductors of the same cross-section, flexible with TWIN-AEH with plastic sleeve	min. 0.25 mm <sup>2</sup>	max. 1.5 mm
	AWG/kcmil conductor cross-section according to UL/CUL	min. 24	max. 8
	Length of stripped insulation:	15 mm	
	Mounting temperature:	-5 °C to +100 °C	

### 3.3.6 Preventing electromagnetic interferences

To ensure immunity to interference, be sure that control lines run separately from grid and motor cables. Where possible use shielded lines for analogue control circuits. At the line end, the shielding should be fitted with great care. The use of EMC cable screw connections is recommended for this purpose. These are not part of the scope of delivery.

Ensure that no parasitic currents (compensating currents etc.) can flow via an analogue control 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 as far as possible.

Upstream switch 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.

## 3.4 Installing the drive controller integrated in the motor

### 3.4.1 Mechanical installation

#### Mechanical installation of sizes A - B

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.

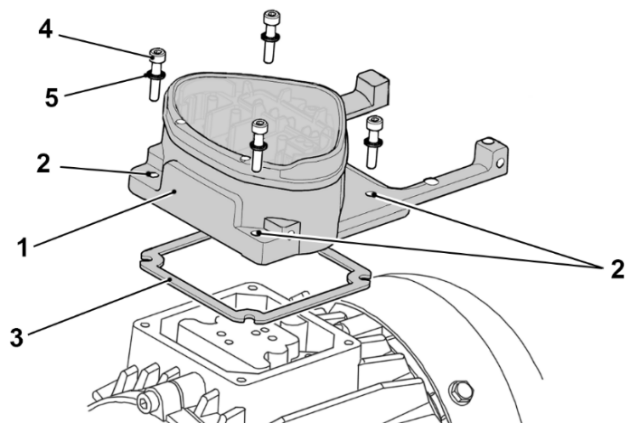


Fig. 12: Assembly sequence:  
Connection box – adapter plate (sizes A - B)

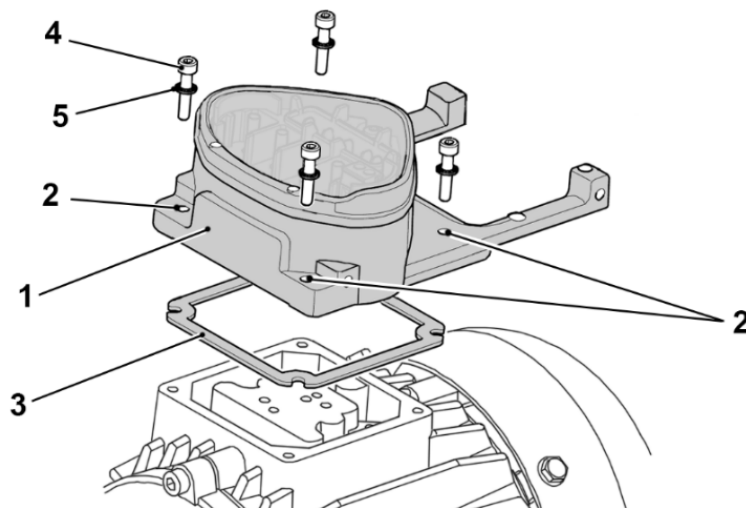


#### INFORMATION

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.





### 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 (2) for mounting on the motor.



### 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 (3).
7. Lead the motor connection line past the connection terminal and through the adapter plate (1) and screw down to the motor with the four retaining bolts (4) and the four spring elements (torque: 2.0 Nm).



### IMPORTANT INFORMATION

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

All contact points must be free of dirt/paint because otherwise a correct protective conductor connection is not ensured!

8. Attach the motor wires in the correct circuit.  
We would recommend using isolated M5 ring cable lugs.



### IMPORTANT INFORMATION

When installing the motor wires, ensure that all bolts on the terminal board are fitted with the nuts provided even if the star point is not connected!



### DANGER!

**Risk of death due to electrical shock!**  
**Death or serious injury!**

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

If spring elements (5) are not used when assembling the adapter plate, there must be an extra connection between the motor and drive controller to produce a correct protective conductor connection.

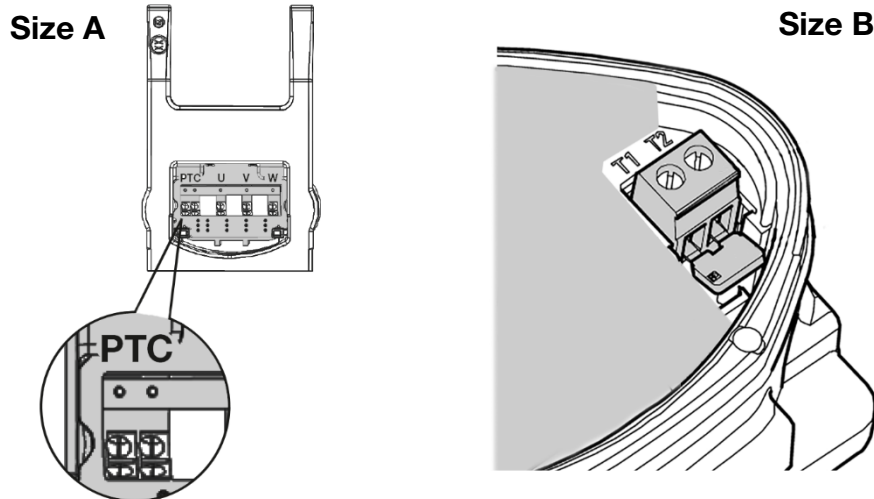


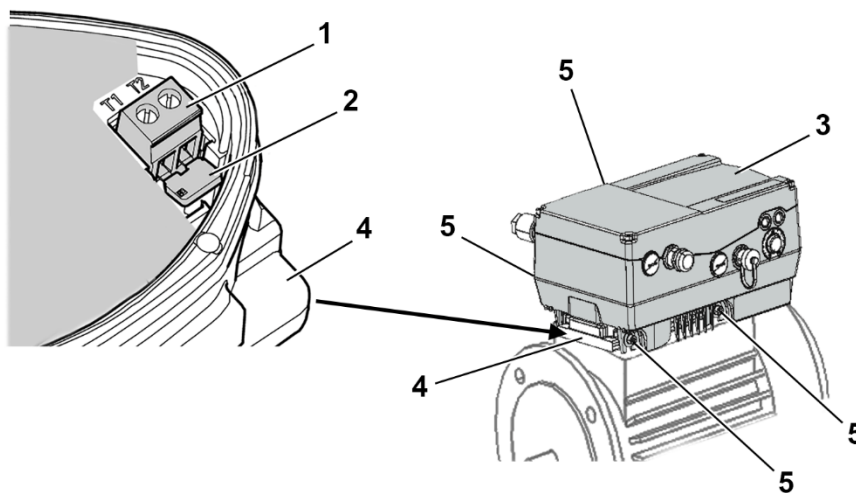
Fig. 13: Bridging contact

9. If present, wire the connection cable of the motor PTC/Klixon to the T1 and T2 terminals (1) (torque: 0.6 Nm).



## IMPORTANT INFORMATION

During assembly, ensure that the connection cable is not crushed!



## IMPORTANT INFORMATION

If the motor is fitted with a temperature sensor, this is connected to the T1 and T2 terminals (1).  
Remove the bridging contact (2) inserted for delivery for this purpose.  
When the bridge is in place, the temperature of the motor is not monitored!  
Only motor PTCs corresponding to DIN 44081/44082 may be connected!



## DANGER!

**Risk of death due to electrical shock!**  
**Death or serious injury!**

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

10. Plug the drive controller (3) onto the adapter plate (4) and secure uniformly using the four lateral bolts (5) (sizes A – B) (torque: 4.0 Nm).

### 3.4.2 Power connection

#### Power connection for sizes A - B

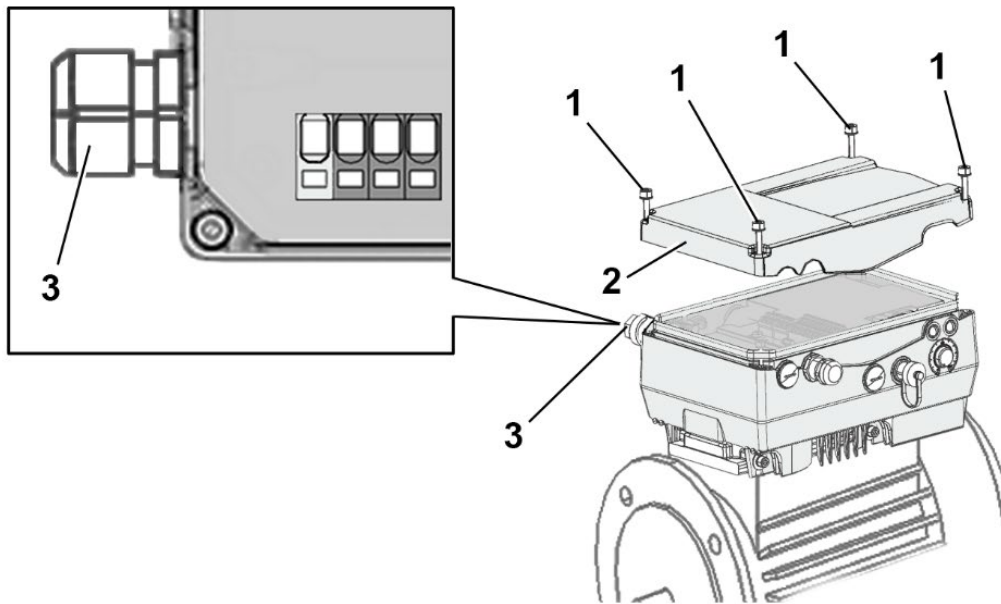


Fig. 14: Power connection sizes A - B



#### IMPORTANT INFORMATION

When connecting a brake resistor to an optional braking module, cables with shielding and double insulation must be used!

1. Unscrew the four screws (1) from the drive controller's housing cover (2) and then take it off.
2. Guide mains connection cable through cable screw connection (3) into housing of drive controller.

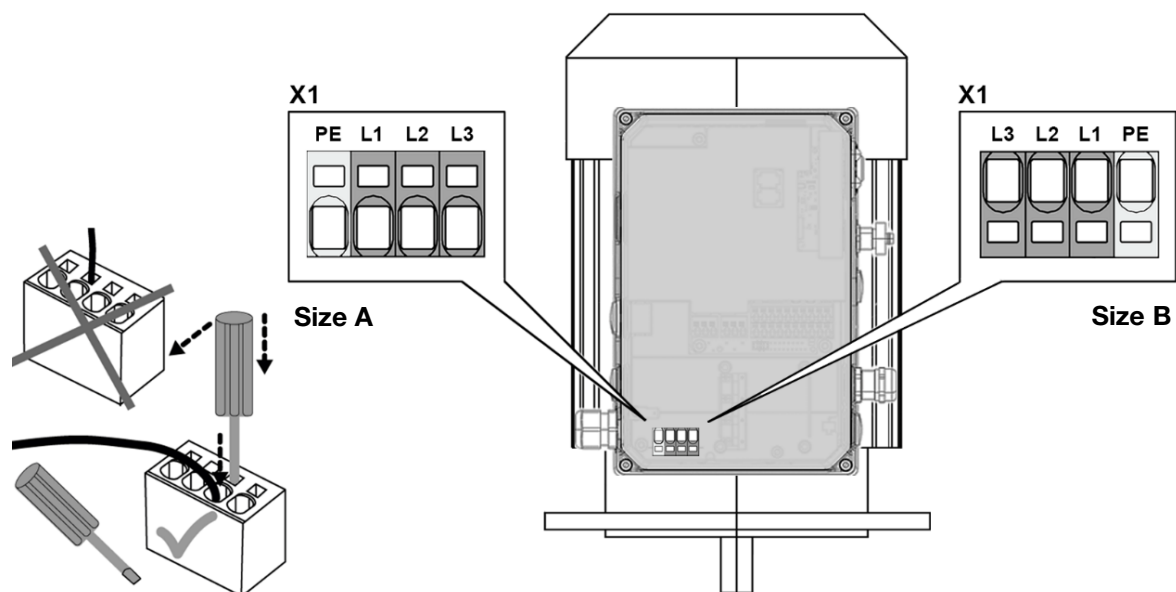


#### DANGER!

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

**Death or serious injury!**

De-energise drive controller and secure it against being restarted.



3. Connect the cables with the terminals as follows:

Size	400 V connection			
A	PE	L1	L2	L3
B	L3	L2	L1	PE

Terminal no.	Designation	Assignment
1	L1	Mains phase 1
2	L2	Mains phase 2
3	L3	Mains phase 3
4	PE	Protective conductor

Tab. 2: 3 x 400 VAC terminal assignment X1

Terminal no.	Designation	Assignment
1	L1	DC mains (+)
2	L2	Not assigned
3	L3	DC mains (-)
4	PE	Protective conductor

Tab. 3: DC feed 565 V terminal assignment X1

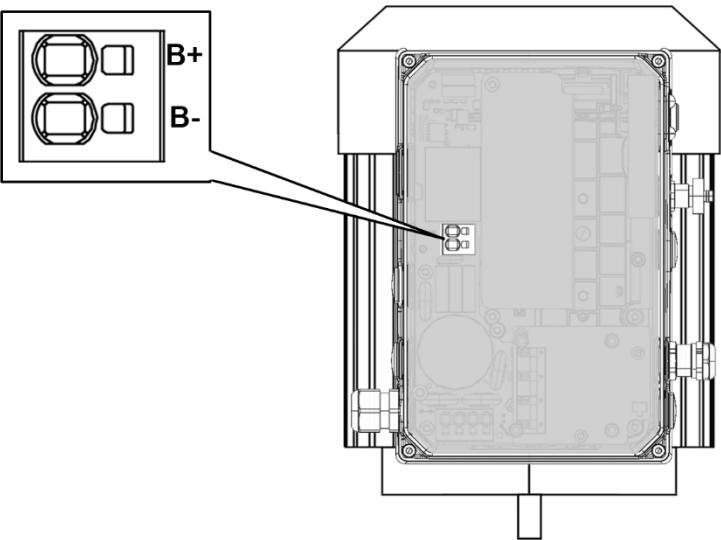


Fig. 15: Terminal assignment for brake chopper

3.4.3 Connections for brake resistor

Terminal no.	Designation	Assignment
1	B+	Connection for brake resistor (+)
2	B -	Connection for brake resistor (-)

Depending on the variant, the assignment and position of the terminals may differ.

Tab. 4 Optional terminal assignment for brake chopper

3.4.4 Connection using Harting plug

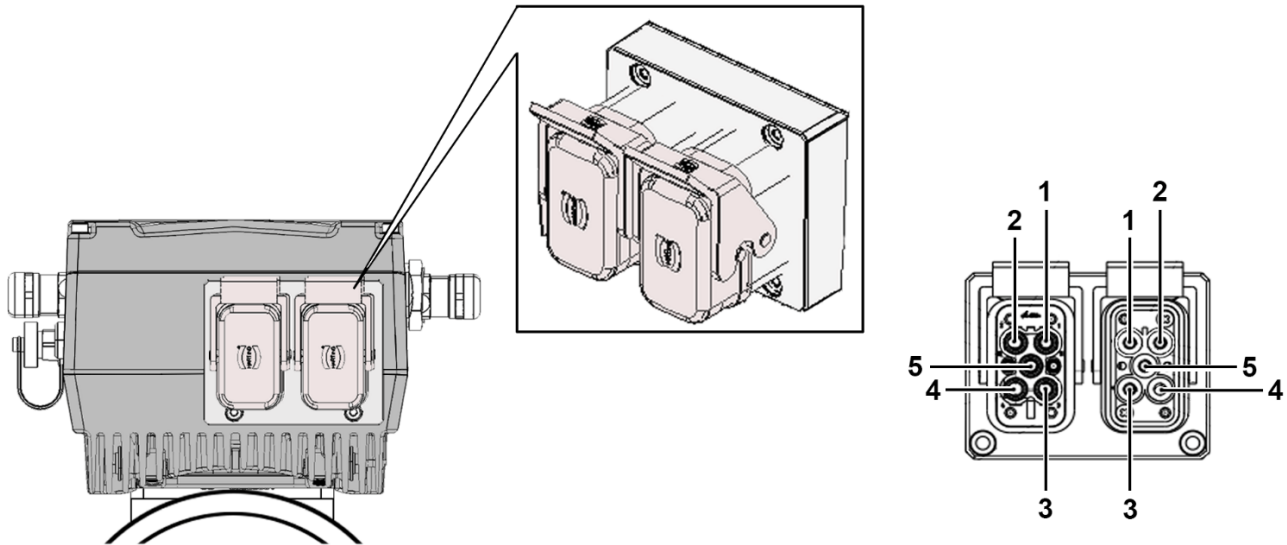


Fig. 16: Harting plug

Pin male connector	Pin female connector	Assignment
1	1	L1
2	2	L2
3	3	L3
4	4	-
5	5	PE

3.4.5 PHOENIX Quickon connection

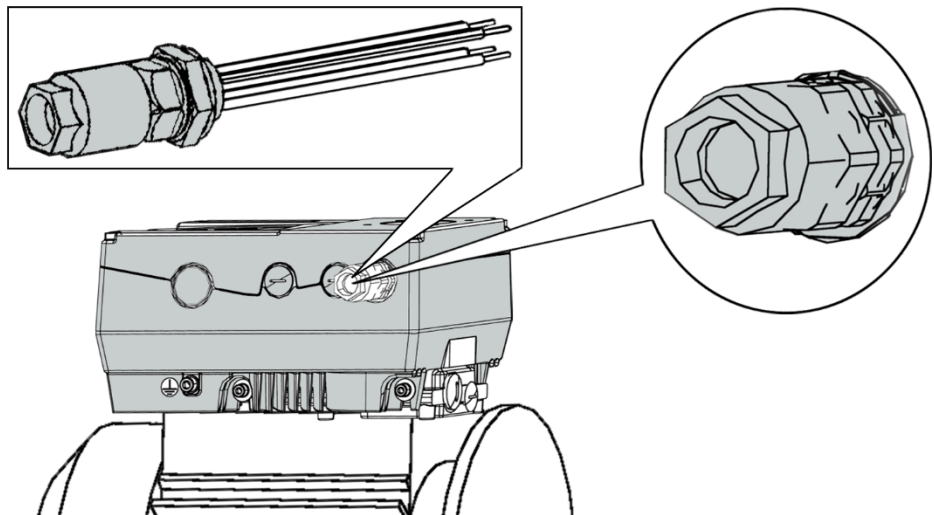


Fig. 17: PHOENIX Quickon

Pin	Colour	Assignment
1	Sw / BK	L1
2	br / BN	L2
3	gr / GY	L3
4	ge / YE	PE

3.4.6 Connection via main switch

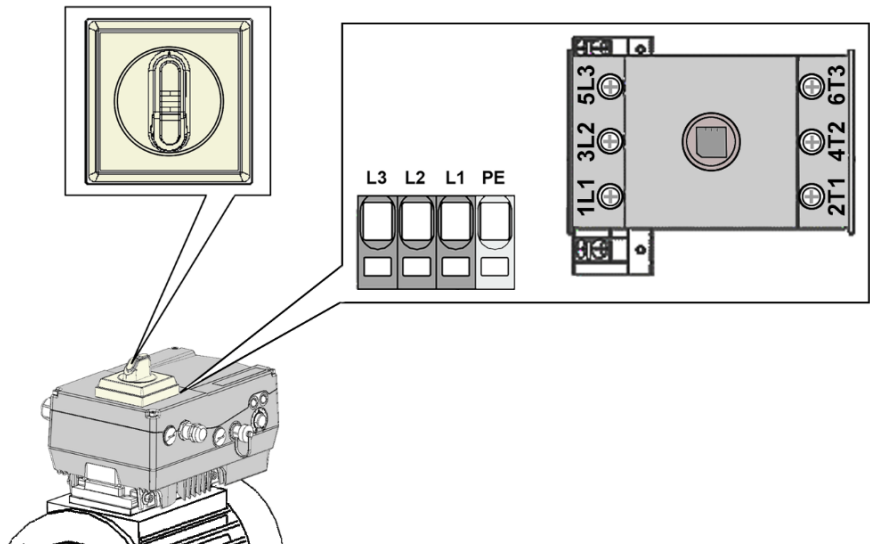


Fig. 18: Main switch

Pin	Assignment
1L1	L1
3L2	L2
5L3	L3
PE	PE



## 3.4.7 Connection diagram (IO module option)

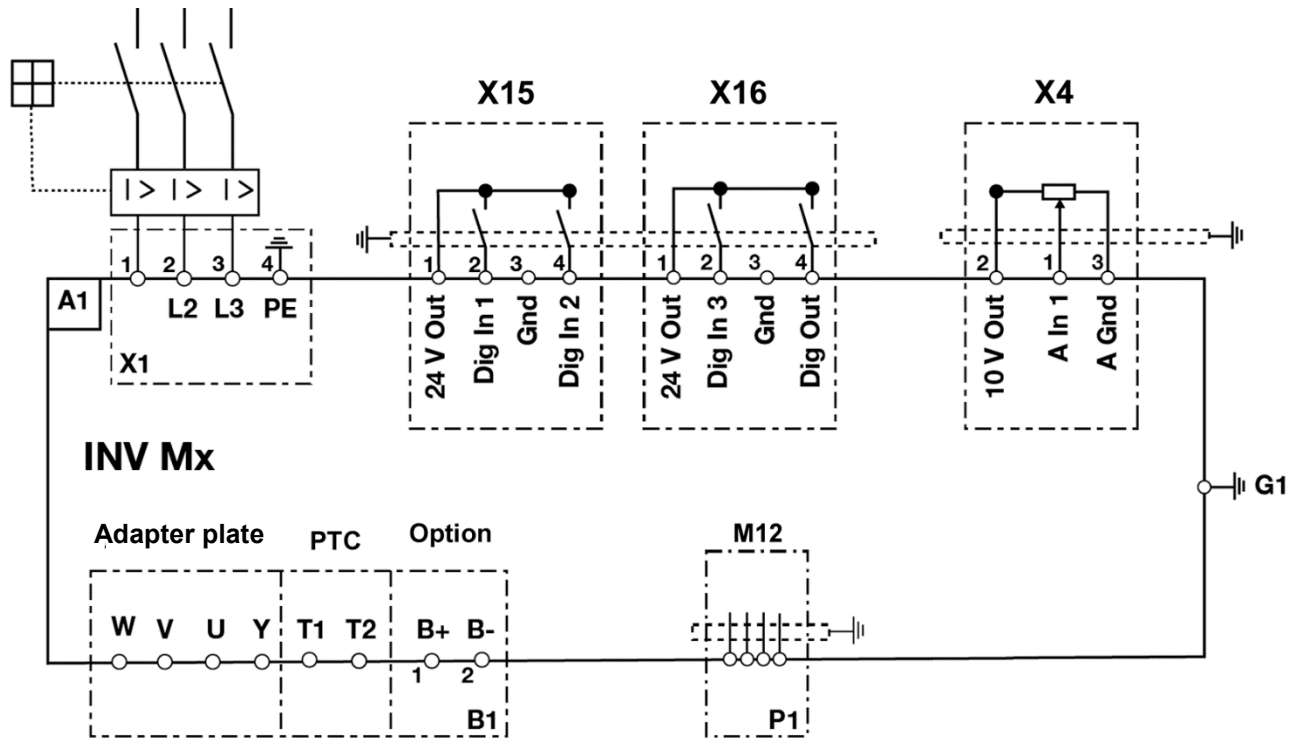


Fig. 19: Connection diagram (IO module option)

Characters	Explanation
<b>A1</b>	Drive controller type: INV Mx IV01 (3 x 400 VAC)
<b>B1</b>	Connection for external brake resistor (option)
<b>G1</b>	M6 grounding screw (connection for residual currents > 3.5 mA)
<b>P1</b>	RS485 programming interface (M12 plug)
<b>X4</b>	Internal potentiometer / analogue input 1
<b>Q1</b>	Motor protection switch or load break switch (optional)
<b>X1</b>	Mains terminals
<b>X15 – X16</b>	Digital inputs and outputs

The drive controller is ready once a 3 x 400 VAC mains supply has been activated (on terminals L1 to L3) or a 565 V DC mains supply has been activated (on terminals L1 and L3).

3.4.8 Basic fieldbus integrated on MP Modular

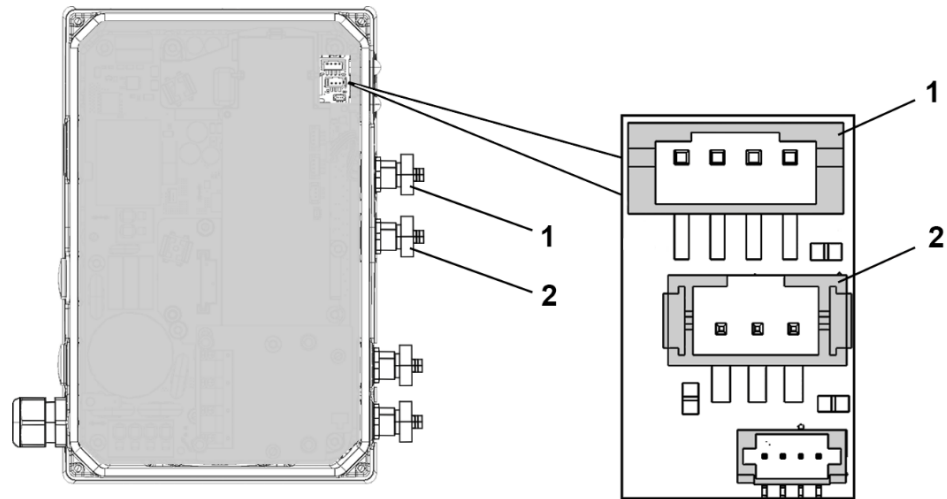


Fig. 20: Basic fieldbus integrated on MP Modular

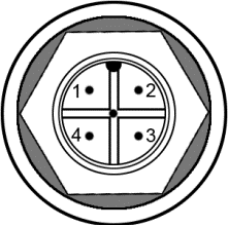
Pin assignment of interfaces for M12 socket for MODBUS			
JST RS485			
Socket		Pin no.	Signal
1		1	n. c.
		2	RS 485 - A
		3	GND
		4	RS 485 - B
		Housing	Shielding

Fig. 21: Round plug connector, 4-pin, M12, A-coded for MODBUS fieldbus

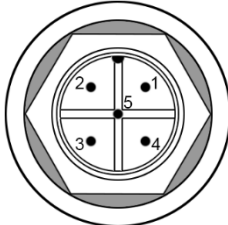
Pin assignment of interfaces for M12 plug for CANopen			
JST CANopen			
Plug		Pin no.	Signal
2		1	Not assigned
		2	Not assigned
		3	CAN_GND
		4	CAN_H
		5	CAN_L
		Housing	Shielding

Fig. 22: Round plug connector, 5-pin, M12, A-coded for CANopen fieldbus

## 3.4.9 IO module / assignment of plugs (option)

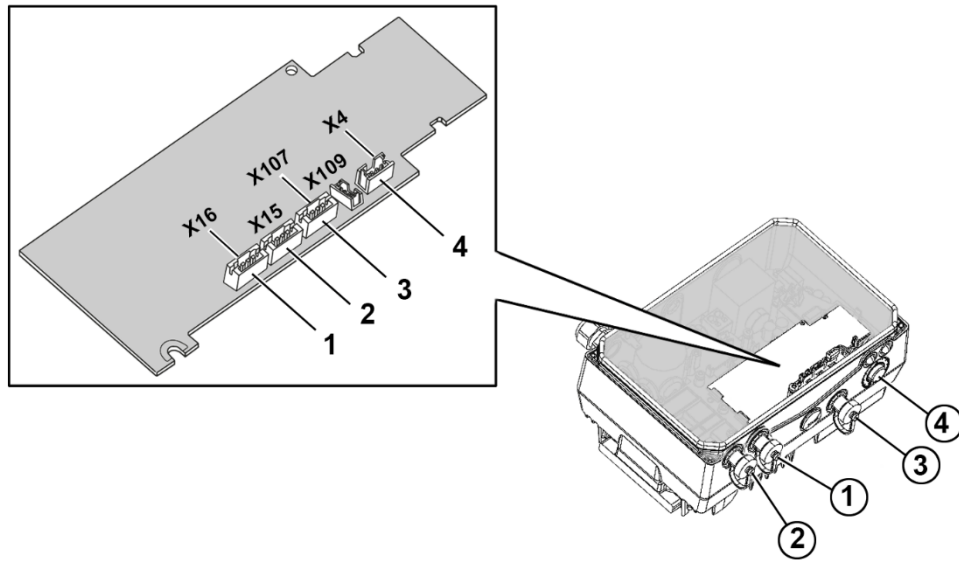


Fig. 23: IO module / assignment of plugs (option)

It.	JST I/O 2			
<b>1</b>		JST pin	M12 pin	Signal
		1	1	24 V
		2	2	Dig In 3
		3	3	GND
		4	4	Dig Out 1

Fig. 24: Round plug connector, 4-pin, M12, A-coded for IO plug 2

It.	JST I/O 1			
<b>2</b>		JST pin	M12 pin	Signal
		1	1	24 V
		2	2	Dig In 1
		3	3	GND
		4	4	Dig In 2

Fig. 25: Round plug connector, 4-pin, M12, A-coded for IO plug 1

It.	JST RS485 24 V MMI plug			
<b>3</b>		JST pin	M12 pin	Signal
		1	1	24 V
		2	2	RS485 - A
		3	3	GND
		4	4	RS485 - B

Fig. 26: Round plug connector, 4-pin, M12, A-coded for MMI plug

It.	JST potentiometer			
<b>4</b>		JST pin	M12 pin	Signal
		1		Analogue In 1 0 V – 10 V
		2		10 V
		3		GND

Fig. 27: Round plug connector, 4-pin, M12, A-coded for internal potentiometer

## 3.5 Installing the wall-mounted drive controller

### 3.5.1 Suitable installation location for wall mounting

Ensure that the installation location for an INVEOR 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.

For the "wall mounting" version, the line length between the motor and INVEOR may not exceed 5 m (for exception, see Chapter 10.1 **Fehler! Verweisquelle konnte nicht gefunden werden.**). Only use a shielded cable with the required cross-section.

There must be a PE connection (underneath the wall mounting's terminal board)!

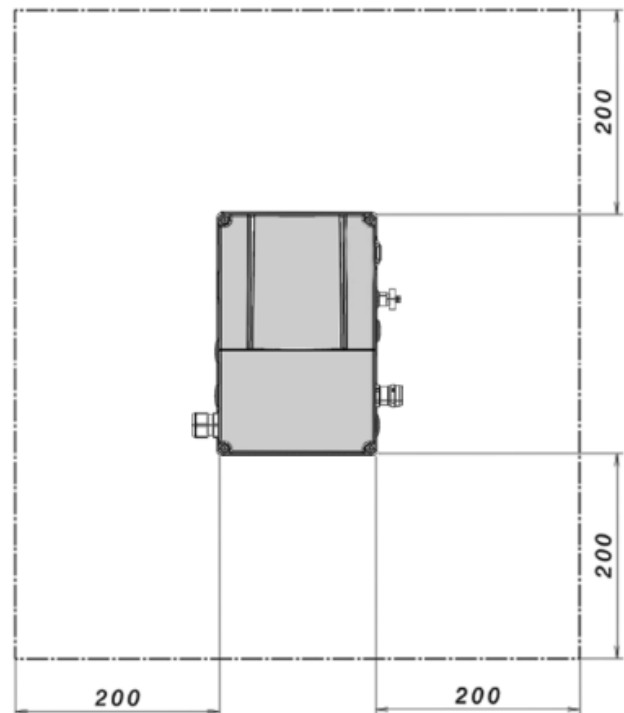


Fig. 28: Minimum clearances

### 3.5.2 Mechanical installation of sizes A - B

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.



Fig. 29: Wiring on the motor connection box

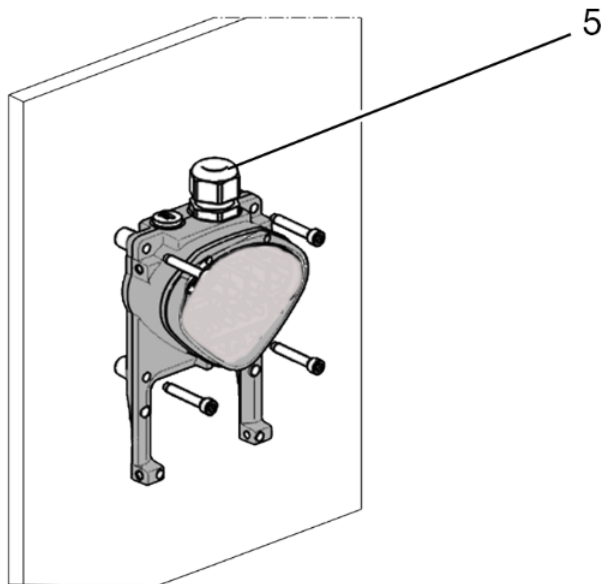


Fig. 30: Fastening the adapter plate to the wall



## IMPORTANT INFORMATION

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

- Find a position that meets the required ambient conditions described in the "[Installation requirements](#)" section.
- To achieve optimum self-convection of the drive controller, ensure that the (EMC) screw connection (5) is facing upwards during installation.
- If there is no additional ventilation for the INVEOR MP Modular, only vertical installation is permitted.

## Wiring of wall adapter plate, size A

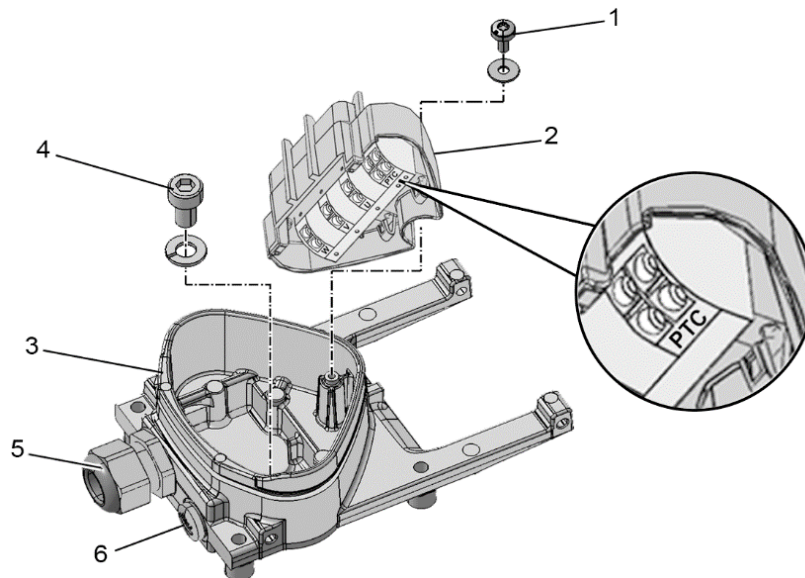
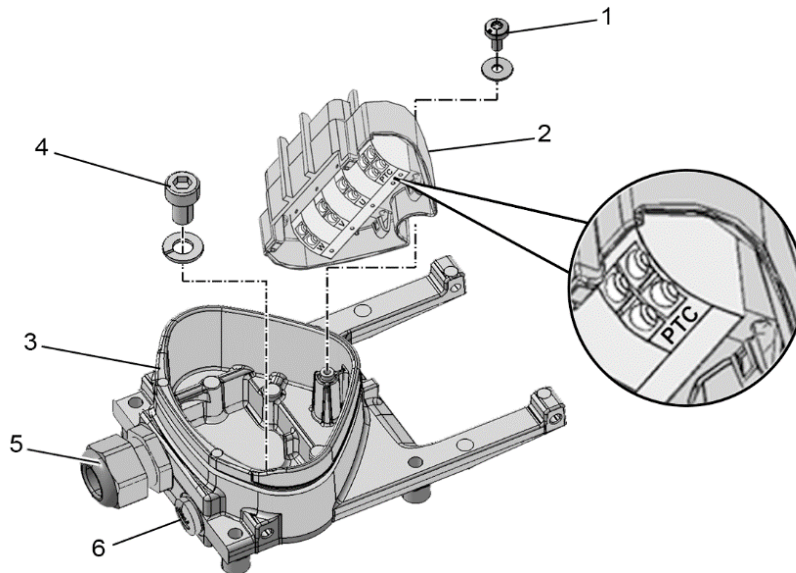


Fig. 31: Wiring of wall adapter plate, size A

1. Release the screw (1) to remove the contact plate (2) from the adapter plate (3).  
The (M6 x 12) PE connection (4) is underneath the contact plate.
2. Guide the connection cable from the motor to the adapter plate (3) through the integrated EMC screw connection (5).



3. This PE connection (torque: 4.0 Nm) must be made to the same ground potential as the motor.  
The cross-section of the equipotential bonding line must correspond to at least the cross-section of the power cable.

### DANGER!



**Risk of death due to electrical shock!**  
**Death or serious injury!**

The drive controller must be grounded with the motor according to relevant regulations.  
The PE connection between the motor and drive controller should be established using the hexagon socket screw (4) and the spring ring included in the scope of supply for the adapter plate (3).

4. Wire the motor cable to contacts U, V, W (and the star point in some cases) in the connection terminal, as described in the "**Basic connection versions**" chapter.
5. If there is a motor PTC present, connect to the corresponding terminals of contact plate (2).  
Replace the dummy screw connection (6) with a suitable standard screw connection and guide the connecting cable to the motor PTC into the adapter plate (3).



### IMPORTANT INFORMATION

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

If the motor is **not** fitted with a temperature sensor, you must use the bridges contained in the scope of delivery of the drive controller on the terminal PTC.

6. Refit the contact plate (2) in the adapter plate (3).
7. Fasten the contact plate (2) using the screw (1) (torque: 1.2 Nm).



### INFORMATION

After fastening the contact plate (2), ensure that it is mounted floating.



## Installation

8. Position the drive controller (7) on the adapter plate (3) so that the collar of the adapter dips into the opening on the floor of the cooling element.
9. Fasten the drive controller (7) to the adapter plate (3) with the help of the screws (8) provided (torque: 4.0 Nm)

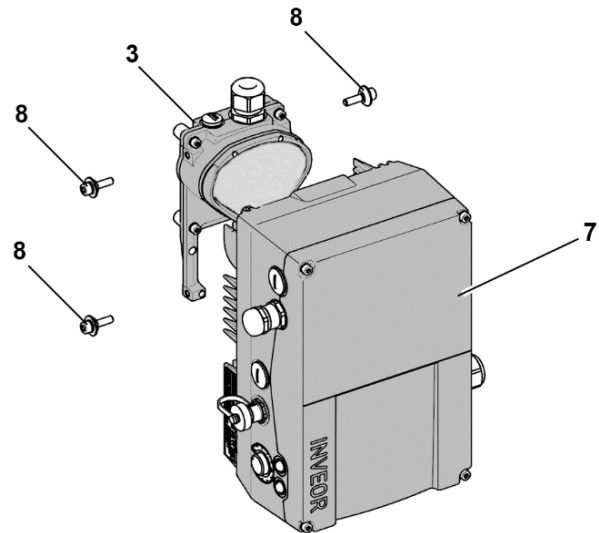


Fig. 32: Attaching the drive controller

## Wiring of wall adapter plate, size B

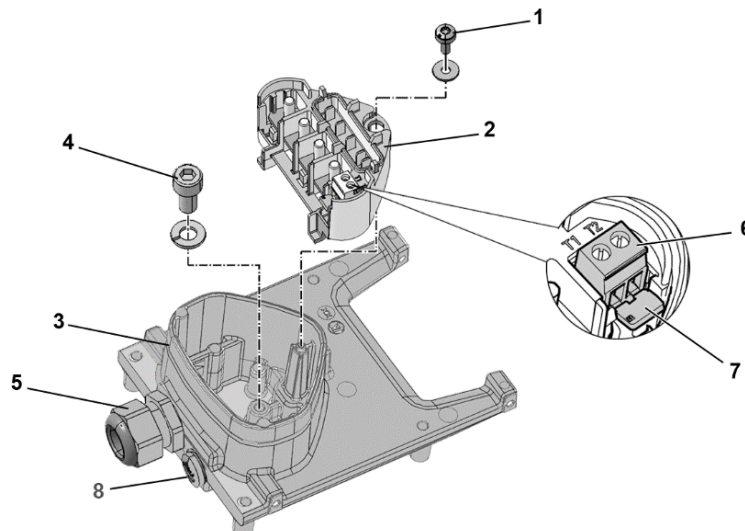


Fig. 33: Wiring of wall adapter plate, size B

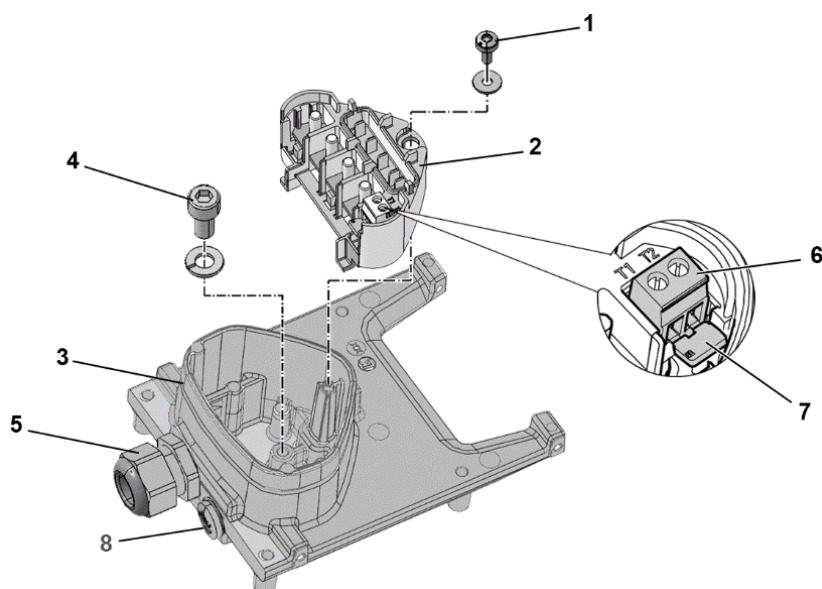
1. Release the screw (1) to remove the contact plate (2) from the adapter plate (3).  
The (M6 x 12) PE connection (4) is underneath the contact plate.
2. Guide the connection cable from the motor to the adapter plate (3) through the integrated EMC screw connection (5).
3. This PE connection (torque: 4.0 Nm) must be made to the same ground potential as the motor.  
The cross-section of the equipotential bonding line must correspond to at least the cross-section of the power cable.



### DANGER!

**Risk of death due to electrical shock!  
Death or serious injury!**

The drive controller must be grounded with the motor according to relevant regulations. The PE connection between the motor and drive controller should be established using the hexagon socket screw (4) and the spring ring included in the scope of supply for the adapter plate (3).



4. Wire the motor cable to contacts U, V, W (and the star point in some cases) in the connection terminal, as described in the "**Basic connection versions**" chapter. Use cable shoes (M5) to do this.
5. Before connecting an existing motor PTC to the T1 and T2 terminals (6), remove the pre-assembled short-circuit bridge (7).  
Replace the dummy screw (8) with a suitable standard screw connection and guide both ends to T1 and T2 (6).



## IMPORTANT INFORMATION

If the motor is fitted with a temperature sensor, this is connected to the T1 and T2 terminals (6). Remove the bridging contact (7) inserted for delivery for this purpose.

When the bridge is in place, the temperature of the motor is not monitored!

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

6. Refit the contact plate (2) in the adapter plate (3).
7. Fasten the contact plate (2) using the screw (1) (torque: 1.2 Nm).



## INFORMATION

After fastening the contact plate (2), ensure that it is mounted floating.

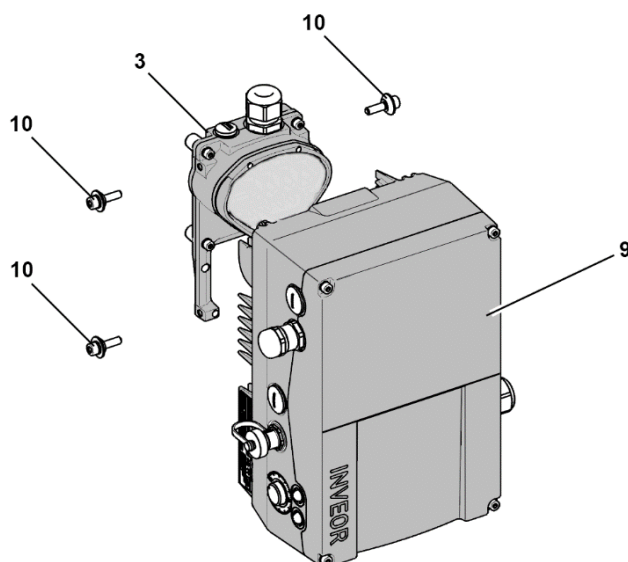


Fig. 34: Attaching the drive controller

8. Position the drive controller (9) on the adapter plate (3) so that the collar of the adapter dips into the opening on the floor of the cooling element.
9. Fasten the drive controller (9) to the adapter plate (3) with the help of the screws (10) provided (torque: 4.0 Nm).

## 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.



#### **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 INVERTERpc PC software
- using the INVEOR MMI handheld controller\*

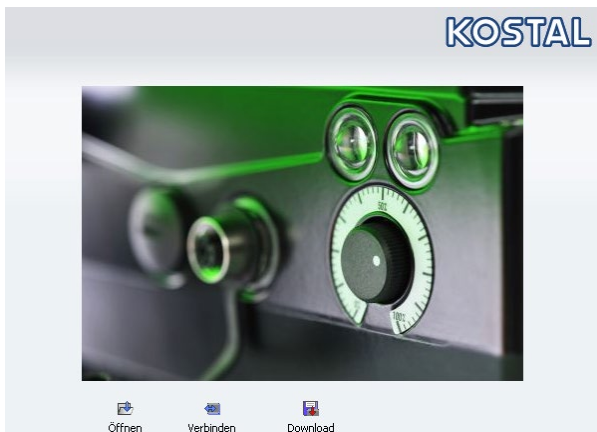


Fig. 35: PC software – start screen



Fig. 36: MMI handheld controller

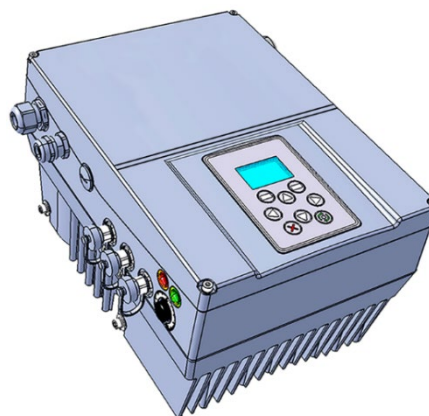


Fig. 37: MMI option

\* **Man-machine interface**

- using Bluetooth (option)

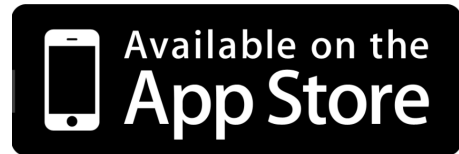


Fig. 38: INVERTERapp

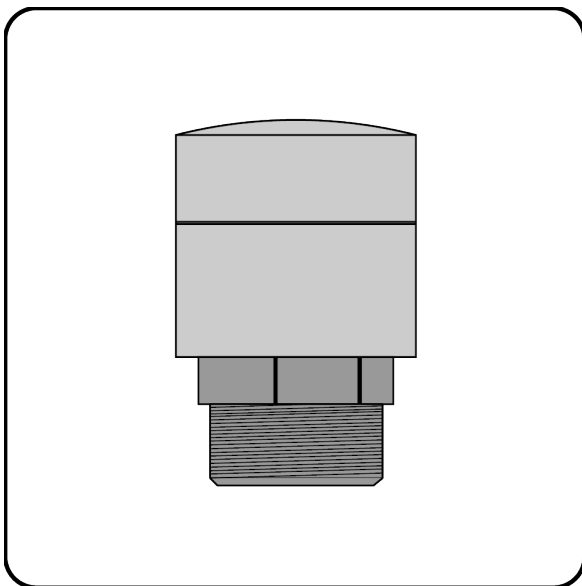


Fig. 39: Bluetooth module M16 (permanently fitted ex factory)

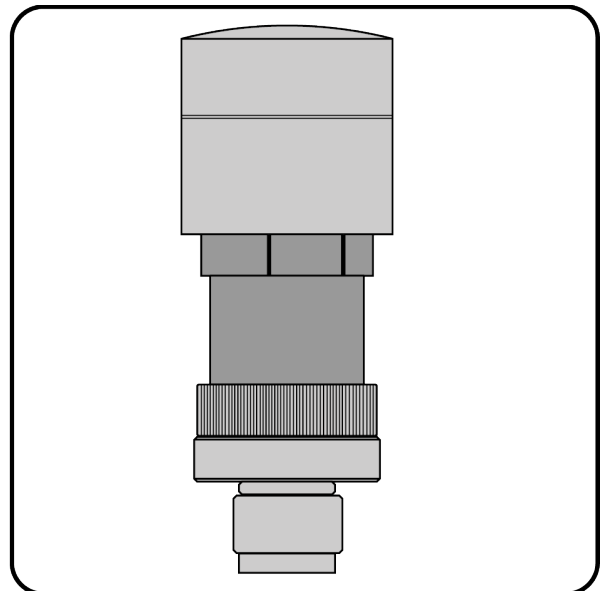


Fig. 40: Bluetooth stick M12 (optional accessories)

### NOTE

If using the Bluetooth stick, the password is fixed as 000000.

### 4.3 Block diagram

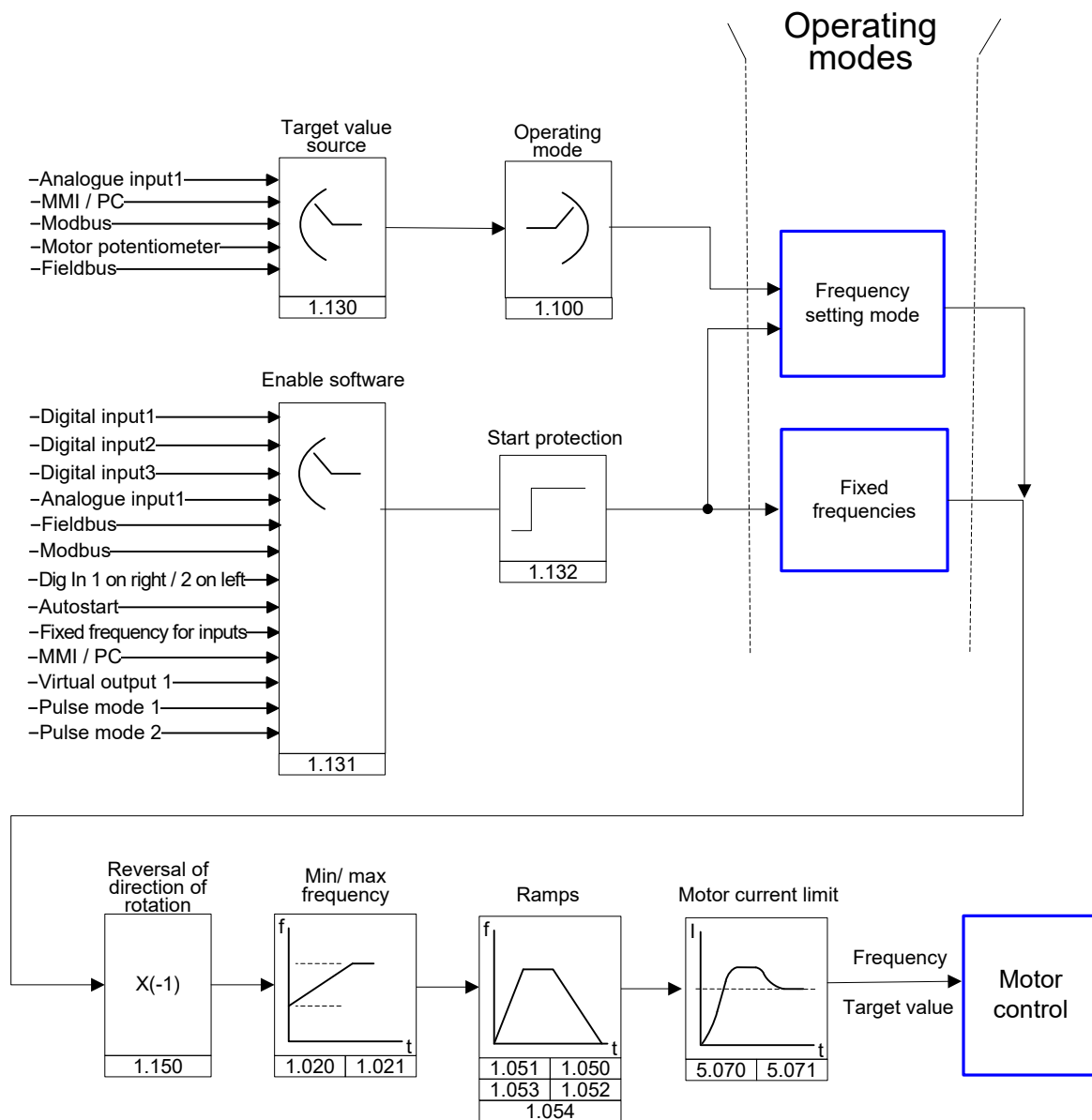


Fig. 41: General structure of target value generation

### 4.4 Commissioning steps



#### INFORMATION

Parameterisation is possible prior to device installation!  
Parameterisation can be performed before the drive controller is installed in the motor.

The drive control has a 24 V low-voltage input for this purpose, which can supply the electric system without requiring mains power.

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).

#### 4.4.1 Commissioning using the PC:

1. Install the INVERTERpc software (you can obtain programming software from KOSTAL free of charge. Operating system required: Windows XP or Windows 7 [32 / 64 bit]).  
We recommend undertaking the installation process as an administrator.
2. Connect the PC to the M12 plug M1 with the optional connection cable.
3. Load or determine the motor data record (parameters 33.031 to 33.050); it may be necessary to optimise the speed control (parameters 34.090 to 34.091).
4. Perform the application settings (ramps, inputs, outputs, target values etc.).
5. Optional: Define an access level (1 – MMI, 2 – user, 3 – manufacturer).

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.

See Fig. in chapter [Quickstart guide 11](#)

### 4.4.2 Commissioning using PC, combined with MMI option

1. Install the INVERTERpc software (you can obtain programming software from KOSTAL free of charge. Operating system required: Windows XP or Windows 7 [32 / 64 bit]).  
We recommend undertaking the installation process as an administrator.
2. Connect the PC to the M12 plug M1 with the optional connection cable.



#### IMPORTANT INFORMATION

After the power on the drive controller has been switched on, the diagnosis interface (M12 PC/MMI) is initially inactive.

To activate this interface, the "MMI option" has to be put into standby mode.

To do this, simultaneously press buttons (1) and (2) for approx. 1.5 sec.

"Standby" appears in the MMI display and internal communication is interrupted for 25 sec.

If communication for the INVERTERpc tool is established within 25 sec., the "MMI option" remains in standby mode.

Data can now be exchanged with the PC and/or an external MMI.  
If communication is aborted or cannot be established within 25 sec., the "MMI option" switches from standby mode to normal mode.



### Turning the display 180 °

Depending on how the INVEOR is installed within the system, the display may have to be turned 180°.

You can turn the display 180 ° using parameter 5.200 by setting the parameter value to "1"

Alternatively, the display can also be turned 180 ° in "normal mode".

To do this, simultaneously press buttons (3) and (4) for approx. 1.5 sec.

The display and functional button assignment are turned 180 °.



#### INFORMATION

The display is only turned 180 ° once the "Disconnect" button has been pressed in the "INVERTERpc tool".



## 5. Parameter

This chapter contains the following:

- an introduction to the parameters
- an overview of the most important commissioning and operation parameters

### 5.1 Safety instructions for working with parameters



#### **DANGER!**

**Risk of death due to restarting motors!**  
**Death or serious injury!**

Non-observance may result in death, serious injury or damage.

Certain parameter settings and changing parameter settings during operation may result in the INVEOR drive controller restarting automatically after the supply voltage has failed, or in undesirable changes in the operating behaviour.



#### **INFORMATION**

If parameters are changed while the device is in operation, it may take a few seconds for the effect to become noticeable.

### 5.2 General information on parameters

#### 5.2.1 Explanation of operating modes

The operating mode is the instance in which the target value is generated. In the case of frequency setting mode, this is a simple conversion of the raw input target value into a rotation speed target value.

#### **Frequency setting mode:**

The target values from the "target value source" (1.130) are rescaled into frequency target values.

0 % is the "minimum frequency" (1.020).

100 % is the "maximum frequency" (1.021).

The target value's plus or minus sign is the decisive factor in rescaling.

### Fixed frequency

This operating mode controls the drive controller with up to 7 fixed target values.

These are selected under parameter 2.050, where you can select how many fixed frequencies are to be used.

Parameter	Name	Selection options	Function	Number of digital inputs needed
2.050	Fixed frequency/mode	0	1 fixed frequency	1
		1	3 fixed frequencies	2
		2	7 fixed frequencies	3

Depending on the number of fixed frequencies required, up to 3 digital inputs are permanently assigned in the table.

Parameter	Name	Presetting	DI 3	DI2	DI1
1,020	Min. frequency	0 Hz	0	0	0
2.051 to 2.057	Fixed frequency 1	10 Hz	0	0	1
2.051 to 2.057	Fixed frequency 2	20 Hz	0	1	0
2.051 to 2.057	Fixed frequency 3	30 Hz	0	1	1
2.051 to 2.057	Fixed frequency 4	35 Hz	1	0	0
2.051 to 2.057	Fixed frequency 5	40 Hz	1	0	1
2.051 to 2.057	Fixed frequency 6	45 Hz	1	1	0
2.051 to 2.057	Fixed frequency 7	50 Hz	1	1	1

Tab. 5: Logic table for fixed frequencies

## 5.2.2 Structure of the parameter tables

1	2	3	4	5
1,100	Operating mode		Unit: integer	
Relationship to parameter:  1.130 1.131 2.051 to 2.057 3.050 to 3.071	Transfer status: 2	min.:	0	Own value (to be entered!)
		max.:	3	
		def.:	0	
		Selecting the operating mode Following software enabling (1.131), the drive controller runs as follows: 0 = frequency setting mode, with the target value of the selected target value source (1.130) 2 = fixed frequencies, with the frequencies defined in parameters 2.051 – 2.057		
8	7	6		

Fig. 42 Example of a parameter table

Key			
1	Parameter number	5	Unit
2	Parameter name	6	Field for entering an own value
3	Transfer status 0 = switch drive controller off and on for transfer 1 = at speed of 0 2 = during operation	7	Explanation of the parameter
4	Value range (from – to – factory setting)	8	Other parameters related to this parameter.

## 5.3 Application parameters

### 5.3.1 Basic parameter

1,020	Minimum frequency	Unit: Hz	
<b>Relationship to parameter:</b>  1.150 3.070 5,085	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 599	
		def.: 0	
	The minimum frequency is the frequency which is supplied by the drive controller as soon as it is enabled and there is no additional target value. The frequency falls below this level if: a) the drive accelerates from stationary b) the frequency converter is blocked. The frequency then falls to 0 Hz before it is blocked. c) the frequency converter reverses (1.150). The field of rotation reverses at 0 Hz. d) the standby function (3.070) is active. d) the current limit is reached		

1,021	Maximum frequency	Unit: Hz	
Relationship to parameter:  1.050 1.051	Transfer status: 2	min.: 5	Own value (to be entered!)
		max.: 599	
		def.: 50	
	The maximum frequency is the highest frequency produced by the inverter depending on the target value.		

1,050	Deceleration time 1	Unit: s	
Relationship to parameter:  1.021 1.054	Transfer status: 2	min.: 0.001	Own value (to be entered!)
		max.: 1000	
		def.: 5	
	Deceleration time 1 is the time that the drive controller needs to brake to 0 Hz from the max. frequency (1.021). If the set deceleration time cannot be reached, the fastest possible deceleration time is implemented.		

1,051	Run up time 1	Unit: s		
Relationship to parameter:  1.021 1.054	Transfer status: 2	min.:	0.001	Own value (to be entered!)
		max.:	1000	
		def.:	5	
	Run up time 1 is the time that the drive controller needs to accelerate from 0 Hz to the max. frequency. The run up time can be increased as a result of certain circumstances, e.g. if the drive controller is overloaded.			

## Parameter

1,052	Deceleration time 2	Unit: s	
<b>Relationship to parameter:</b>  1.021 1.054	Transfer status: 2	min.: 0.001	Own value (to be entered!)
		max.: 1000	
		def.: 10	
	Deceleration time 2 is the time that the drive controller needs to brake to 0 Hz from the max. frequency (1.021). If the set deceleration time cannot be reached, the fastest possible deceleration time is implemented.		

1,053	Run up time 2	Unit: s	
Relationship to parameter:  1.021 1.054	Transfer status: 2	min.: 0.001	Own value (to be entered!)
		max.: 1000	
		def.: 10	
	Run up time 2 is the time that the drive controller needs to accelerate from 0 Hz to the max. frequency. The acceleration time can be increased as a result of certain circumstances, e.g. if the drive controller is overloaded.		

1,054	Ramp selection	Unit: integer	
Relationship to parameter:  1.050 - 1.053	Transfer status:  2	min.: 0	Own value (to be entered!)
		max.: 9	
		def.: 0	
	Selection of used ramp pair 0 = deceleration time 1 (1.050) / acceleration 1 (1.051) 1 = deceleration time 2 (1.052) / acceleration 2 (1.053) 2 = digital input 1 (false = ramp pair 1 / true = ramp pair 2) 3 = digital input 2 (false = ramp pair 1 / true = ramp pair 2) 4 = digital input 3 (false = ramp pair 1 / true = ramp pair 2) 7 = analogue input 1 (must be selected in parameter 4.030) 9 = virtual output (4.230)		

1,100	Operating mode	Unit: integer	
<b>Relationship to parameter:</b>  <b>1.130</b> <b>1.131</b> <b>2.051 to 2.057</b> <b>3.050 to 3.071</b>	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 3	
		def.: 0	
	Selecting the operating mode Following software enabling (1.131), the drive controller runs as follows: 0 = frequency setting mode, with the target value of the selected target value source (1.130) 2 = fixed frequencies, with the frequencies defined in parameters 2.051 – 2.057		

1,130	Target value source	Unit: integer	
Relationship to parameter:  3.062 to 3.069	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 10	
		def.: 0	
	Determines the source from which the target value is to be read. 0 = internal potentiometer 1 = analogue input 1 3 = MMI/PC 4 = Modbus 9 = field bus 10 = INVEOR soft PLC		

1,131	Enable software	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 16	
		def.: 0	

1.132

1.150

2.050

4.030

DANGER!

The motor may start immediately, depending on the change made.

Selection of the source for the control release.

0 = digital input 1

1 = digital input 2

2 = digital input 3

4 = analogue input 1 (must be selected in parameter 4.030)

6 = field bus

7 = Modbus

8 = digital input 1 on right / digital input 2 on left

1.150 must be set to "0"

9 = autostart

The motor may start immediately if a target value is present!

This cannot be prevented even with parameter 1.132.

11 = fixed frequency inputs

(all inputs which were selected in parameter 2.050)

14 = MMI/PC

15 = virtual output (4.230)

17 = edge for Dig In 1 start / Dig In 2 stop

18 = edge for Dig In 1 start on right /

edge for Dig In 2 start on left /

Dig In 3 stop

(1.150 must be set to "0")

1,132	Start-up protection	Unit: integer	
Relationship to parameter:  1.131	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 8	
		def.: 1	
	Selection of behaviour in response to enabling software (parameter 1.131). No effect if autostart was selected. 0 = immediate start with high signal at input of control enable 1 = start only with rising edge at input of control enable 2 = digital input 1 (function active with high signal) 3 = digital input 2 (function active with high signal) 4 = digital input 3 (function active with high signal) 7 = analogue input 1 (must be selected in parameter 4.030)		

1,133	Free shutdown	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 3	
		def.: 0	
	As well as enabling the software, the parameter can be used to parameterise another input for the free shutdown. When the input is switched off, the output stages are shut down and the motor spins. The function runs regardless of software enabling. 0 = no free shutdown 1 = digital input 1 2 = digital input 2 3 = digital input 1		

## Parameter

1,150	Rotation direction	Unit: integer	
Relationship to parameter:  1.131 4.030 4,030	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 16	
		def.: 0	
	Selection of direction of rotation specification 0 = dependent on target value (depending on the plus or minus sign of the target value: positive: forwards; negative: backwards) 1 = forwards only (no change in direction of rotation possible) 2 = backwards only (no change in direction of rotation possible) 3 = digital input 1 (0 V = forwards, 24 V = backwards) 4 = digital input 2 (0 V = forwards, 24 V = backwards) 5 = digital input 3 (0 V = forwards, 24 V = backwards) 8 = analogue input 1 (must be selected in parameter 4.030) 13 = virtual output (4.230)		

1,180	Acknowledge function	Unit: integer	
Relationship to parameter:  1.181 1.182	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 7	
		def.: 4	
	Selection of the source for error confirmation. Errors can only be acknowledged once the error is no longer present. Auto acknowledgement via parameter 1.181. 0 = manual acknowledgement not possible 1 = rising flank at digital input 1 2 = rising flank at digital input 2 3 = rising flank at digital input 3 5 = foil keypad (Ackn key) 6 = analogue input 1 (must be selected in parameter 4.030)		

1,181	Automatic acknowledge function	Unit: s	
Relationship to parameter:  1.180 1.182	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1000	
		def.: 0	
	In addition to the acknowledge function (1.180), an automatic fault acknowledgement can be selected. 0 = no automatic acknowledgement > 0 = time for automatic resetting of error in seconds		

1,182	Number of automatic acknowledgements	Unit:	
Relationship to parameter:  1.180 1.181	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 500	
		def.: 5	
	In addition to the automatic acknowledge function (1.181), it is possible to limit the maximum number of automatic acknowledgements here. 0 = no restriction on automatic acknowledgements > 0 = maximum number of automatic acknowledgements		



## INFORMATION

### INFORMATION

The internal counter for automatic acknowledgements already undertaken is reset if the motor is operated for the "maximum number of acknowledgements x auto acknowledgement time" period without any errors occurring (motor current > 0.2 A).

#### Example of resetting the auto acknowledgement counter

max. number of acknowledgements = 8	}	8 x 20 sec. = 160 sec.
auto acknowledgement time = 20 sec.		

After 160 sec. of motor operation without errors, the internal counter for "auto acknowledgements" undertaken is reset to "0".

In this example, 8 "auto acknowledgements" were accepted.

If an error occurs within the 160 sec., "error 22" is triggered on the 9th acknowledgement attempt.

This error has to be acknowledged manually by switching off the mains.

### 5.3.2 Fixed frequency

This mode has to be selected in parameter 1.100, see also the section on selecting the operating mode.

2.050	Fixed frequency mode	Unit: integer	
Relationship to parameter:  1.100 2.051 to 2.057	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 4	
		def.: 2	
	Selection of the digital inputs used for fixed frequencies 0 = Digital In 1 (Fixed frequency 1) (2.051) 1 = Digital In 1, 2 (Fixed frequencies 1 - 3) (2.051 to 2.053) 2 = Digital In 1, 2, 3 (Fixed frequencies 1 - 7) (2.051 to 2.057)		

2.051 to 2.057	Fixed frequency	Unit: Hz	
Relationship to parameter:  1.020 1.021 1.100 1.150 2.050	Transfer status: 2	min.: - 599	Own value (to be entered!)
		max.: + 599	
		def.:	
	The frequencies that are to be output at the digital inputs 1 - 3 specified in parameter 2.050 depending on the switching patterns. See chapter 5.2.1 Explanation of operating modes / fixed frequency.		



## 5.3.3 Analogue inputs

For analogue input 1

4,023	Ai1 dead time	Unit: %	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 100	
		def.: 0	
	Dead time as percentage of the range of the analogue inputs.		

4,024	Ai1 filter time	Unit: s	
Relationship to parameter:	Transfer status: 2	min.: 0.02	Own value (to be entered!)
		max.: 1.00	
		def.: 0	
	Filter time of analogue inputs in seconds.		

4,030	Ai1 function	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1	
		def.: 0	
	Function of analogue inputs 1/2 0 = analogue input 1 = digital input		

4,033	Ai1 physical unit		Unit:
Relationship to parameter:  4,034 4,035	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 15	
		def.: 0	
	Selection of different physical values to be displayed.		
	0	=	%
	1	=	bar
	2	=	mbar
	3	=	psi
	4	=	Pa
	5	=	m³/h
	6	=	l/min
	7	=	°C
	8	=	°F
	9	=	m
	10	=	mm

4,034	Ai1 physical minimum	Unit:	
Relationship to parameter:  4.033 4.035	Transfer status: 2	min.: - 10000	Own value (to be entered!)
		max.: + 10000	
		def.: 0	
	Selection of the lower limit of a physical value to be displayed.		

4.035 / 4.065	Ai1 physical maximum	Unit:	
Relationship to parameter:  4.033 4.034	Transfer status: 2	min.: - 10000	Own value (to be entered!)
		max.:+ 10000	
		def.: 100	
	Selection of the upper limit of a physical value to be displayed.		

4,037	Ai1 inverted		Unit: integer
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1	
		def.: 0	
	The signal of the analogue input can be inverted here. 0 = disable (example: 0 V = 0 %    10 V = 100 %) 1 = enable (example: 0 V = 100 %    10 V = 0 %)		

## 5.3.4 Digital inputs

4.110 to 4.112	Dlx inverted	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1	
		def.: 0	
	This parameter can be used to invert the digital input. 0 = disable 1 = enable		

## 5.3.5 Digital outputs

For digital outputs 1 (Dox display DO1)

4.150 / 4.170	Dox function	Unit: integer	
Relationship to parameter:  4.151 / 4.171 4.152 / 4.172	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 51	
		def.: 0	
	Selection of the process variable to which the output should switch.		
	0	=	Not used
	1	=	Intermediate circuit voltage
	2	=	Grid voltage
	3	=	Motor voltage
	4	=	Motor current
	5	=	Actual frequency value
	6	=	-
	7	=	-
	8	=	IGBT temperature
	9	=	Inner temperature
	10	=	Error (NO)
	11	=	Error inverted (NC)
	13	=	Digital input 1
	14	=	Digital input 2
	15	=	Digital input 3
	17	=	Ready for operation (mains supply on, no HW enable, motor stationary)
	18	=	Ready (mains supply on, HW enable set, motor stationary)
	19	=	Operation (mains supply on, HW enable set, motor running)
	20	=	Ready for operation + Ready
	21	=	Ready for operation + Ready + Operation
	22	=	Ready + Operation
	23	=	Motor rating
	24	=	Torque
	25	=	Field bus
	26	=	Analogue input 1
	32	=	Target frequency value after ramp
	33	=	Target frequency value
	34	=	Actual speed value
	35	=	Actual frequency value sum
	36	=	Torque sum
	37	=	Nominal frequency value after ramp sum
	38	=	Target frequency value sum
	39	=	Actual speed value sum
	40	=	Virtual output
	50	=	Motor current limit enabled

4.151 / 4.171	Dox on	Unit:	
Relationship to parameter:  4.150 / 4.170	Transfer status: 2	min.: - 32767	Own value (to be entered!)
		max.: 32767	
		def.: 0	
	If the set process variable exceeds the switch-on limit, the output is set to 1.		

4.152 / 4.172	Dox off	Unit:	
Relationship to parameter:  4.150 / 4.170	Transfer status: 2	min.: - 32767	Own value (to be entered!)
		max.: 32767	
		def.: 0	
	If the set process variable exceeds the switch-off limit, the output is again set to 0.		

### 5.3.6 Virtual output

The virtual output can be parameterised like a relay and is available as an option with the following parameters:

1.131 Software enable / 1.150 Direction of rotation / 1.054 Ramp selection /  
5.090 Parameter set change / 5.010 + 5.011 External error 1 + 2

4,230	VO function	Unit: integer	
Relationship to parameter:  1,054 1,131 1,150 4.231 4.232 5.010 / 5.011 5,090	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 51	
		def.: 0	
	Selection of the process variable to which the output should switch.		
	0 =	Not used	
	1 =	Intermediate circuit voltage	
	2 =	Grid voltage	
	3 =	Motor voltage	
	4 =	Motor current	
	5 =	Actual frequency value	
	6 =	-	
	7 =	-	
	8 =	IGBT temperature	
	9 =	Inner temperature	
	10 =	Error (NO)	
	11 =	Error inverted (NC)	
	13 =	Digital input 1	
	14 =	Digital input 2	
	15 =	Digital input 3	
	17 =	Ready for operation (mains supply on, no HW enable, motor stationary)	
	18 =	Ready (mains supply on, HW enable set, motor stationary)	
	19 =	Operation (mains supply on, HW enable set, motor running)	
	20 =	Ready for operation + Ready	
	21 =	Ready for operation + Ready + Operation	
	22 =	Ready + Operation	
	23 =	Motor rating	
	24 =	Torque	
	25 =	Field bus	
	26 =	Analogue input 1	
	32 =	Target frequency value after ramp	
	33 =	Target frequency value	
	34 =	Actual speed value	
	35 =	Actual frequency value sum	
	36 =	Torque sum	
	37 =	Nominal frequency value after ramp sum	
	38 =	Target frequency value sum	
	39 =	Actual speed value sum	
	50 =	Motor current limit enabled	
	51 =	Nominal-actual comparison (para. 6.070 – 6.071)	

4,231	VO-On	Unit:	
Relationship to parameter:  4.230	Transfer status: 2	min.: - 32767	Own value (to be entered!)
		max.: 32767	
		def.: 0	
	If the set process variable exceeds the switch-on limit, the output is set to 1.		

4,232	VO-Off	Unit:	
Relationship to parameter:  4.230	Transfer status: 2	min.: - 32767	Own value (to be entered!)
		max.: 32767	
		def.: 0	
	If the set process variable exceeds the switch-off limit, the output is again set to 0.		

4,233	VO-On delay	Unit: s	
Relationship to parameter:  4.234	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 10000	
		def.: 0	
	Specifies the length of the switch-on delay.		

4,234	VO-Off delay	Unit:	
Relationship to parameter:  4.233	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 10000	
		def.: 0	
	Specifies the length of the switch-off delay.		

4,235	VO inverted	Unit: integer	
Relationship to parameter:  4,230	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1	
		def.: 0	
	This parameter can be used to invert the virtual output. 0 = disable 1 = enable		

## 5.3.7 External fault

5.010 / 5.011	External fault 1/2	Unit: integer	
Relationship to parameter:  4.110 / 4.113 4,230	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 7	
		def.: 0	
	Selection of source via which an external fault can be reported.  0 = Not used 1 = Digital input 1 2 = Digital input 2 3 = Digital input 3 5 = Virtual output (parameter 4.230) 6 = Analogue input 1 (must be selected in parameter 4.030)  If there is a high signal at the selected digital input, the drive controller with error no. 23 / 24, switches external error ½.  Parameters 4.110 to 4.113 Dix inverse can be used to invert the logic of the digital input.		

## 5.3.8 Motor current limit

This function limits the motor current to a parameterised maximum value after a parameterised current-time zone has been reached.

This motor current limit is monitored at application level and thereby limits with relatively low dynamics. This has to be taken into consideration when selecting this function.

The maximum value is determined using the “motor current limit as %” parameter (5.070).

This is stated as a percentage and relates to the nominal motor current specified in the “motor current” type plate data (33.031).

The maximum current-time zone is calculated from the product of the “motor current limit in s” parameter (5.071) and the fixed overcurrent of 50% of the required motor current limit.

As soon as this current-time zone is exceeded, the motor current is restricted to the limit value by reducing the speed. If the output current of the drive controller exceeds the motor current (parameter 33.031) multiplied by the set limit as % (parameter 5.070) for the set time (parameter 5.071), the output current of the drive controller is limited permanently to the parametrised value.

The entire function can be deactivated by setting the “motor current limit as %” parameter (5.070) to zero.

5,070	Motor current limit as %	Unit: %	
Relationship to parameter:  5.071 33.031	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 250	
		def.: 0	
	0 = disable See description 5.3.8		

5,071	Motor current limit S	Unit: s	
Relationship to parameter:  5.070 33.031	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 100	
		def.: 1	
	See description 5.3.8		

5,075	Gearbox factor		Unit:	
Relationship to parameter:  33.034	Transfer status: 2	min.:	0	Own value (to be entered!)
		max.:	1000	
		def.:	1	
	A gearbox factor can be set here. The mechanical speed display can be adjusted using the gearbox factor.			

## 5.3.9 Stall detection

5,080	Blocking detection	Unit: integer	
Relationship to parameter:  5.081 34,110	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1	
		def.: 0	
	This parameter can be used to activate stall detection. 0 = disable 1 = enable  This function only works reliably if the motor data has been entered correctly and the slip compensation has not been deactivated.		

## Parameter

5,081	Blocking time	Unit: s	
Relationship to parameter:  5.080	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 50	
		def.: 2	
	Indicates the time after which a blockage is detected.		

5,082	Start-up error active	Unit: integer	
Relationship to parameter:  4.233	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1	
		def.: 1	
	Start-up error is defined as follows: Actual value does not reach 10 % of the rated motor frequency after 30 seconds (if target frequency < 10 %, the error is not generated). If the acceleration time is parametrised as > 60 seconds, half the acceleration time is used in place of the 30 seconds. 0 = Function disabled 1 = Function enabled		

5,085	F. min monitoring	Unit: s	
Relationship to parameter:  1,020	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 10000	
		def.: 0	
	<p>The delay for monitoring the minimum frequency can be set here.</p> <p>If the minimum frequency for the set time is not reached, error 28 is generated.</p> <p>0s = function disabled</p> <p>&gt;0s = function enabled</p> <p>The time must be long enough for the motor to be able to reliably start.</p>		

5,086	F. max monitoring	Unit: s	
Relationship to parameter: 1,021	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 10000	
		def.: 0	
	The delay for monitoring the maximum frequency can be set here. If the maximum frequency for the set time is exceeded, error 28 is generated. 0s = function disabled >0s = function enabled		



5,090	Parameter set change	Unit: integer	
Relationship to parameter:  4,030	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 12	
		def.: 0	
	Selection of the active data set.  0 = Not used 1 = Data set 1 active 2 = Data set 2 active 3 = Digital input 1 4 = Digital input 2 5 = Digital input 3 6 = Digital input 4 7 = INVEOR soft PLC 8 = Virtual output (parameter 4.230) 9 = Analogue input 1 (must be selected in parameter 4.030)  10 = Analogue input 2 (must be selected in parameter 4.060)  11 = Foil keypad key I for data set 1, key II for data set 2  12 = Foil keypad key I for data set 1, key II for data set 2 storing		
The 2nd data set is only displayed in the PC software if this parameter is <> 0. The values of the data set currently selected are always displayed in the MMI.			

5,200	Turning MMI* display	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1	
		def.: 0	
	Only for MMI in cover. Here the user can define whether the screen / key assignment is turned 180 °. 0 = Function disabled 1 = Function enabled		

5,201	Save MMI* display	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 1	Own value (to be entered!)
		max.: 5	
		def.: 1	
	The status screen displayed in the MMI * can be selected here. 1 = status 01: Target / actual frequency / motor current 2 = status 02: Speed / motor current / process value 1 3 = status 03: Speed / motor current / process value 2 4 = status 04: Speed / PID target value / PID actual value 5 = status 05: Customer PLC output variable 1 / 2 / 3		

5,202	MMI* password	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 9999	
		def.: 0	
	A password can be allocated here, which is requested when expert mode is selected in the MMI * or the app is queried. 0: Password request deactivated The password can be individually set in both data sets.		

## \* Man-machine interface

5,210	MMI* option language	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 1	
		def.: 0	
	This parameter can be used to select the language which the MMI * option displays. 0 = local language (factory setting is German) 1 = English This setting does not affect the language choice for the MMI handheld controller.		

## 5.3.10 Fieldbus

6,060	Fieldbus address	Unit: integer	
Relationship to parameter:	Transfer status: 0	min.: 0	Own value (to be entered!)
		max.: 127	
		def.: 0	
	For this address to be used, the address coding switches in the device must be set to 00. A change to the fieldbus address is only undertaken once INVEOR is restarted		

6,061	Field bus baud rate	Unit: integer	
Relationship to parameter:	Transfer status: 2	min.: 1    0	Own value (to be entered!)
		max.: 8	
		def.: 2	
	Only for CanOpen:    0 = 1 Mbit, 2 = 500 kBit, 3 = 250 kBit, 4 = 125 kBit, 6 = 50 kBit, 7 = 20 kBit, 8 = 10 kBit		

6,062	Bus time-out	Unit in s	
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)
		max.: 100	
		def.: 5	
	Bus timeout, if no fieldbus telegram is received after the set time has expired, the INVEOR shuts down with the "Bus timeout" error. The function is only activated once a telegram has been successfully received. 0 = Monitoring disabled		



### IMPORTANT INFORMATION

Changing a parameter value via the fieldbus includes direct EEPROM write access.

\* Man-machine interface

## 5.3.11 Bluetooth

6,202	Bluetooth password	Unit integer	
Relationship to parameter:	Transfer status: 0	min.: 0	Own value (to be entered!)
		max.: 999999	
		def.: 000000	
	The Bluetooth standard 4.2 low energy is used for communication. A 6-digit password is absolutely essential for this. <b>Bluetooth module</b> (fitted permanently ex factory) A password can be allocated here, which is requested when establishing a connection between the KOSTAL INVERTERapp and the permanently fitted Bluetooth module. If a password with fewer than 6 digits is entered, leading zeros are added. 0 = 000000 1 = 000001		
<b>Bluetooth stick</b> If using the Bluetooth stick, the password is fixed as 000000.			

6,203	Bluetooth strength	Unit integer	
Relationship to parameter:	Transfer status: 0	min.: 0	Own value (to be entered!)
		max.: 7	
		def.: 0	
	<b>Bluetooth module</b> (fitted permanently ex factory) The transmission power of the Bluetooth module permanently fitted ex factory can be reduced here. 0: 4 dB 1: 0 dB 2: -4 dB 3: -8 dB 4: -12 dB 5: -16 dB 6: -20 dB 7: -30 dB		
<b>Bluetooth stick</b> If using the Bluetooth stick, the maximum transmission power is fixed.			

	Bluetooth name	Unit: Text	
Relationship to parameter: 4.150 / 4.170 4,230	Transfer status: 2	min.: 3 characters	Own value (to be entered!)
		max.: 10 characters	
		def.: INV-xxx-xx	
	<b>Bluetooth module</b> (fitted permanently ex factory) The PC software (Tools Bluetooth device name) can be used to specify an individual name for the permanent Bluetooth module.		
<b>Bluetooth stick</b> If using the Bluetooth stick, the name “INV stick” is fixed.			

## 5.4 Performance parameters

### 5.4.1 Drive type

33,010	Drive type	Unit: integer			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 299			
		def.: 20			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
This can be used to select the motor type and type of control.					
10 = ASM V/f					
20 = ASM open-loop (motor identification needed)					
100 = PMSM standard mode (motor identification needed)					
110 = PMSM efficiency mode*					
200 = RSM standard mode (motor identification needed)					
210 = RSM efficiency mode*					
* For special motors					

### 5.4.2 Motor data

33,031	Motor current	Unit: A			
Relationship to parameter:  5.070	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 150			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
This is used to set the nominal motor current $I_{M,N}$ for either the star or triangle connection.					

33,032	Motor rating	Unit: W			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 55000			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	x
A performance value P <sub>M,N</sub> has to be set here that corresponds to the nominal motor rating.					

33,034	Motor speed	Unit: rpm			
Relationship to parameter:  34.120 5.075	Transfer status: 1	min: 0		Own value (to be entered!)	
		max: 10000			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
The value from the motor's type plate data has to be entered here for the nominal motor rotation speed $n_{M,N}$ .					

33,035	Motor frequency	Unit: Hz			
Relationship to parameter:	Transfer status: 1	min.: 10	Own value (to be entered!)		
		max.: 599			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
This is where the nominal motor frequency $f_{M,N}$ is set.					

33,050	Stator resistance	Unit: Ohm			
Relationship to parameter:	Transfer status: 1	min.: 0	Own value (to be entered!)		
		max.: 100			
		def.: 0.001			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	x
The automatically calculated value (of motor identification) for stator resistance can be adjusted here.					

33,105	Leakage inductance	Unit: H			
Relationship to parameter:	Transfer status: 1	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
			x		
The automatically calculated value (of motor identification) for leakage inductance can be adjusted here.					

33,110	Motor voltage	Unit: V			
Relationship to parameter:	Transfer status: 1	min.: 0	Own value (to be entered!)		
		max.: 1500			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
This is used to set the nominal motor voltage $U_{M,N}$ for either the star or triangle connection.					

33,111	Motor cos phi	Unit:			
Relationship to parameter:	Transfer status: 1	min.: 0.5	Own value (to be entered!)		
		max.: 1			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
			x		x
The value from the motor's type plate data has to be entered here for the power factor cos phi.					

33,112	Boost v/f		Unit: V		
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 200			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
		x			
The torque can be increased here at low frequencies. This parameter determines the output voltage at 0 Hz for increasing the available torque at low speeds.					
Note: If the breakaway torque isn't sufficient, we would recommend setting parameter 33.010 drive type to 20: ASM open-loop.					

33,201	Nominal flux		Unit: mVs			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)		
		max.: 10000				
		def.: 0				
	Drive type	V/f	ASM	PMSM	SRM	
				x		
The automatically calculated value (of motor identification) for nominal flux can be adjusted here.						

33,248	d inductance	Unit: H			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 1			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
				x	
The automatically calculated value (of motor identification) for series inductance can be adjusted here.					

33,249	q inductance	Unit: H			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 1			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
				x	
The automatically calculated value (of motor identification) for shunt inductance can be adjusted here.					

33,255	R of f	Unit: Ohm/Hz			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 1000			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
				x	
The switching frequency-dependent change in resistance calculated automatically (via motor identification) is displayed here.					

### 5.4.3 I<sup>2</sup>t

33,015	I <sup>2</sup> T function		Unit:			
<b>Relationship to parameter:</b>  33,031 33.012 to 33.014	Transfer status: 2	min.: 0		Own value (to be entered!)		
		max.: 1				
		def.: 1				
	Drive type	V/f	ASM	PMSM	SRM	
		x	x	x	x	
I <sup>2</sup> T can be activated here with the protective function. 0 = I <sup>2</sup> T function disabled 1 = I <sup>2</sup> T function enabled						

33.012 to 33.014	I <sup>2</sup> T limit 1 to 3		Unit: %														
Relationship to parameter:  33,031 33,015	Transfer status: 2	min.: 10		Own value (to be entered!)													
		max.: 500															
		def.: 100															
	Drive type	V/f	ASM	PMSM	SRM												
		x	x	x	x												
The percentage current threshold (in relation to motor current 33.031) at the start of integration can be set here for various frequency ranges.																	
<table><tr><th>Parameter</th><th>Frequency range as % of rated frequency</th><th>Default value as % of rated current</th></tr><tr><td>33,012</td><td>0 – 50 %</td><td>100 %</td></tr><tr><td>33,013</td><td>50 – 100%</td><td>100 %</td></tr><tr><td>33,014</td><td>&gt; 100 %</td><td>100 %</td></tr></table>						Parameter	Frequency range as % of rated frequency	Default value as % of rated current	33,012	0 – 50 %	100 %	33,013	50 – 100%	100 %	33,014	> 100 %	100 %
Parameter	Frequency range as % of rated frequency	Default value as % of rated current															
33,012	0 – 50 %	100 %															
33,013	50 – 100%	100 %															
33,014	> 100 %	100 %															
We recommend using winding protection contacts in heat-sensitive applications!																	

33,011	I <sup>2</sup> T time	Unit: s			
Relationship to parameter:	Transfer status: 2	min.: 0		Own value (to be entered!)	
		max.: 1200			
		def.: 30			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
	Time for calculating the I <sup>2</sup> t time period.				

33.016	Motor phase monitoring	Unit: integer			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 1			
		def.: 1			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	x
The “Motor connection interrupted” error monitoring (error -45) can be disabled with this parameter 0 = Monitoring disabled 1 = Monitoring enabled.					



33,138	Holding current time	Unit: s			
Relationship to parameter:  33.010	Transfer status: 2	min.: 0		Own value (to be entered!)	
		max.: 3600			
		def.: 2			
	Drive type	V/f	ASM	PMSM	SRM
			x		
This is the time during which the drive is held at continuous current after the brake ramp has been completed.					

#### 5.4.4 Switching frequency

The internal switching frequency can be changed in order to control the power element.  
A high setting reduces noise in the motor but results in increased EMC emissions and losses in the drive controller.

34,030	Switching frequency	Unit: Hz			
Relationship to parameter:  33.010	Transfer status: 2	min.: 0		Own value (to be entered!)	
		max.: 6			
		def.: 1			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
Selection of the switching frequency for the drive controller: 0 = 2 kHz 1 = 4 kHz 2 = 6 kHz 3 = 8 kHz 4 = 12 kHz 5 = 16 kHz 6 = auto*					
* The drive starts at the maximum switching frequency set in parameter 34.032. Depending on the interior / IGBT temperature, the switching frequency is gradually reduced to no more than the minimum switching frequency set in parameter 34.031. As soon as the temperature drops again, the switching frequency is gradually increased.					

34,031	Auto sw.f. min	Unit: integer			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 5			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
	0 = 2 kHz 1 = 4 kHz 2 = 6 kHz 3 = 8 kHz 4 = 12 kHz 5 = 16 kHz				

34,032	Auto sw.f. max	Unit: integer			
Relationship to parameter:	Transfer status: 1	min.: 0		Own value (to be entered!)	
		max.: 5			
		def.: 5			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
	0 = 2 kHz 1 = 4 kHz 2 = 6 kHz 3 = 8 kHz 4 = 12 kHz 5 = 16 kHz				

## 5.4.5 Controller data

34,015	Ramp corr. active	Unit: integer			
Relationship to parameter:	Transfer status: 1	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 1			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	x
0 = the ramp correction can be disabled to increase dynamism. With slow ramps, this may lead to an unintended dead time. 1 = the ramp generator takes account of the actual frequency. An impermissibly large deviation between target and actual value is suppressed.					

34,020	Flying restart	Unit:			
Relationship to parameter:  34,021	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 1			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	
The flying restart can be used to switch the drive controller to a rotating motor.  0 = disable 1 = enable					

34,021	Catch time	Unit: ms			
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 10,000			
		def.: 100			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	
For asynchronous motors: The catch time can be optimised here, if the automatically determined results (of the motor identification) are insufficient.  For synchronous motors The time during which the motor speed is determined can be set here.					

34,090	Speed controller $K_p$	Unit: mNm / rad / s			
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 10000			
		def.: 150			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	x
The control boost of the speed controller can be optimised here, if the automatically determined results (of the motor identification) are insufficient.					

34,091	Speed controller T <sub>n</sub>	Unit: s			
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 10			
		def.: 4			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	x
<p>For asynchronous motors: The reset time of the speed controller can be optimised here, if the automatically determined results (of the motor identification) are insufficient.</p> <p>For synchronous motors: The reset time of the speed controller must be optimised here, we would recommend a value between 0.1 s and 0.5 s.</p>					

34,110	Slip trimmer	Unit:			
Relationship to parameter:  5,080 33.034	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 1.5			
		def.: 1			
	Drive type	V/f	ASM	PMSM	SRM
			x		
<p>This parameter can be used to optimise or deactivate slippage compensation. 0 = disable (performance as on the grid) 1 = compensation for slippage. Example: 4 pole asynchronous motor at 1410 rpm, target frequency 50 Hz Motor idling 0 = approx. 1500 rpm 1 = 1500 rpm Motor at nominal point 0 = 1410 rpm 1 = 1500 rpm 50 Hz is always displayed as the actual frequency. Deactivating slip compensation may result in stall detection no longer working reliably.</p>					

34,130	Voltage control reserve	Unit:			
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 0.95			
	Drive type	V/f	ASM	PMSM	SRM
			x	x	
This parameter can be used to adjust voltage output.					

34,220	Injection RANGE	Unit:			
Relationship to parameter:	Transfer status: 1	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 0.02			
	Drive type	V/f	ASM	PMSM	SRM
				x	x
The range calculated automatically (via motor identification) during which the pulse injection procedure runs is displayed here.					

34,225	Field weakening	Unit: integer			
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
0 = disable, the motor cannot be run in the field weakening. 1 = enable, the motor can be placed in the field weakening until the drive controller has reached its current limit or the maximum permissible electromotive force.					

34,226	Starting current	Unit: %			
Relationship to parameter:  34.227	Transfer status: 2	min.: 5	Own value (to be entered!)		
		max.: 1000			
		def.: 25			
	Drive type	V/f	ASM	PMSM	SRM
Only during start-up procedure: controlled. Here the current which was stamped in the motor before starting the control can be adjusted. Value as % of nominal motor current.					

34,227	Init time PMSM	Unit: s			
Relationship to parameter:  34.226	Transfer status: 1	min.: 0	Own value (to be entered!)		
		max.: 100			
		def.: 0.25			
	Drive type	V/f	ASM	PMSM	SRM
Here the time during which the start up current 34.226 is stamped can be set.					

34.228 – 34.230	PMSM start-up procedure	Unit: integer			
Relationship to parameter:	Transfer status: 1	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
0 = regulated, the drive controller is run with regulation over the entire speed range. 1 = controlled, after the stamping phase the rotation field is increased by the control with start ramp 34.229 up to start frequency 34.230, then switched to the controller.					

34,246	Injection RANGE	Unit: s			
Relationship to parameter:	Transfer status: 1	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 0.02			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x

36,020	Deact grid monitoring	Unit: integer			
Relationship to parameter:	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
		x	x	x	x
Grid monitoring can be deactivated here. 0: deactivated 1: activated					

#### 5.4.6 Quadratic characteristic curve


34,120	Quadratic characteristic curve	Unit: integer			
Relationship to parameter:  34.121	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 1			
		def.: 0			
	Drive type	V/f	ASM	PMSM	SRM
			x		
The quadratic characteristic curve function can be activated here. 0 = disable 1 = enable					

34,121	Flux adjustment	Unit: %			
Relationship to parameter:  34.120	Transfer status: 2	min.: 0	Own value (to be entered!)		
		max.: 100			
		def.: 50			
	Drive type	V/f	ASM	PMSM	SRM
			x		
The percentage by which the flux is to be reduced can be set here. An overvoltage shutdown can occur if there are any major changes in operation.					

## 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!**

**Death or serious injury!**

De-energise drive controller and secure it against being restarted.

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. 6: 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 acknowledge function (parameter 1.181)
- switch device off and on again

using fieldbus (CANOpen, Modbus RTU)

Errors must always be rectified before acknowledgement, otherwise the drive controller may be damaged.

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
10	Parameter distributor	The internal distribution of parameters during initialisation failed	Parameter set is incomplete
11	Time-out power	The power part does not respond	Operation with 24 V without mains feed-in
13	Cable break at analogue in1 (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	Blocking detection	The drive shaft of the motor is stalled. 5,080	Remove the blockage
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).
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
28	Limit frequency exceeded / not met	The parameterised minimum / maximum frequency has not been met / has been exceeded.	The parameterised time 5.085 or 5.086 is too short / Motor blocked / Brake not opened / Motor overloaded

No.	Error name	Description of error	Possible causes/remedy
32	Trip IGBT **	Protection of the IGBT module against overcurrent has been triggered	Short circuit in the motor or motor feed line / controller settings
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	The grid voltage has dropped briefly	Grid fluctuation / grid voltage interrupted
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 <sup>2</sup> t motor protection shut-off	The internal I <sup>2</sup> t motor protection (can be parametrised) has been triggered	Permanent overload
43	Ground leak **	Ground leak during a motor phase	Insulation fault
45	Motor connection disrupted	No motor current in spite of control through frequency converter	No motor connected or not completely connected. Check phases or motor connections and connect correctly when necessary. ★
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, motor type 33.001 and control method 34.010 not plausible.
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. 7: Error detection

\* In exceptional cases, the error may be displayed erroneously when idling (very low motor current) with synchronous motors.  
Set parameter 33.016 accordingly when the phases or motor connections are connected correctly.

\*\* Should the error occur again, depending on frequency, it can only be acknowledged after the following times:

- 1 -3 acknowledgements 1 s waiting time permitted =
- 4 -5 acknowledgements 5 s waiting time permitted =
- > 5 acknowledgements 30 s waiting time permitted =

The number of acknowledgements is deleted after 120 s without any errors!





## 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



**DANGER!**

**Risk of death due to electrical shock!**  
**Death or serious injury!**  
**De-energise drive controller and secure it against being restarted.**

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

1. Open drive controller cover.
2. Release cables at terminals.
3. Remove all cables.
4. Remove connection screws for drive controller / adapter plate.
5. Remove drive controller.

### 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 400 V devices

	Size	A					B			
Electrical data	Recommended motor rating <sup>1)</sup> [kW]	0.55	0.75	1.1	1.5	2.2 LD	2.2	3.0	4.0	5.5 LD <sup>2)</sup>
	Supply voltage	3 x 200 V AC -10 %...480 V AC +10 % 280 V DC -10 %...680 V DC +10 % <sup>3)</sup>								
	Grid frequency	50/60 Hz ± 6 %								
	Network configurations	TN / TT / IT								
	Line current [A]	1.4	1.9	2.6	3.3	3.9	4.6	6.2	7.9	9.3
	Rated current output eff. [ IN at 8 kHz ]	1.7	2.3	3.1	4.0	4.8	5.6	7.5	9.5	11.0
	Min. brake resistance [Ω]	100					50			
	Overload for 60 sec. in %	150				110	150			110
	Overload for 3 sec. in %	200				150	200			150
	Switching frequency	Auto, 2 kHz, 4 kHz, 6 kHz, 8 kHz, 12 kHz, 16 kHz, (factory setting 4 kHz)								
	Output frequency	0 Hz - 599 Hz								
	Mains cycles of operation / restart	Unlimited <sup>3)</sup>								
	DIN EN 61800-5 touch current	< 3.5 mA <sup>4)</sup>								
Functional data	Protective function	Overvoltage and undervoltage, I <sup>2</sup> t restriction, short-circuit, ground leak, motor and drive controller temperature, stall prevention, blocking detection								
	Software functions	Torque control, fixed frequencies, data record changeover, flying restart, motor current limit								
Mechanical data	Housing	Two-part aluminium die-cast casing								
	Dimensions [L x W x H] mm	233 x 153 x 120					270 x 189 x 140			
	Weight including adapter plate	3.9 kg					5.0 kg			
	Protection class [IPxy]	IP 65								
	Cooling	Passive cooling								
Environmental conditions	Climate class	3K3 (50 °C)				3K3 (40 °C)	3K3 (50 °C)			3K3 (40 °C)
	Ambient temperature	- 40 °C (non-condensing) to + 50 °C (without derating)				to + 40 °C	- 40 °C (non-condensing) to + 50 °C (without derating)			to + 40 °C
	Storage temperature	- 40 °C...+ 85 °C								
	Altitude of the installation location	up to 1000 m above sea level/over 1000 m with reduced performance (1% per 100 m) / above 2000 m see chapter <a href="#">8.2.2</a>								
	Relative air humidity	≤ 96 %, condensation not permitted								
	Vibration resistance (DIN EN 60721-3-3)	3M7 (3g)								
	EMC (DIN-EN-61800-3)	C1 option <sup>5)</sup> / C2								
	Certificates and conformity	<div></div>								

Technical data for INVEOR MP Modular 400 V devices (subject to technical changes)

<sup>1)</sup> Recommended motor rating (4-pole asynchronous IE3 motor) is specified based on the 400 VAC supply voltage.

<sup>2)</sup> In compliance with the overvoltage category.

<sup>3)</sup> < 3 s may result in power failure/intermediate circuit undervoltage faults.

<sup>4)</sup> With 1LA7 asynchronous motor, motor-mounted.

<sup>5)</sup> From 2019 onwards

### 8.1.2 Specification of interfaces

Designation	Function
<b>Digital inputs 1 – 3</b>	<ul style="list-style-type: none"> <li>- Switching level low &lt; 2 V / high &gt; 18 V</li> <li>- I<sub>max</sub> (at 24 V) = 3 mA</li> <li>- R<sub>in</sub> = 8.6 kOhm</li> </ul>
<b>Analogue inputs 1</b>	<ul style="list-style-type: none"> <li>- I<sub>n</sub> +/- 10 V</li> <li>- I<sub>n</sub> 2 – 10 V</li> <li>- 10-bit resolution</li> <li>- Tolerance +/- 2 %</li> </ul> <p>Voltage input:</p> <ul style="list-style-type: none"> <li>- R<sub>in</sub> = 10 kOhm</li> </ul> <p>Current input:</p> <ul style="list-style-type: none"> <li>- Working resistance = 500 Ohm</li> </ul>
<b>Digital outputs 1</b>	<ul style="list-style-type: none"> <li>- Short-circuit proof</li> <li>- I<sub>max</sub> = 20 mA</li> </ul>
<b>Power supply 24 V</b>	<ul style="list-style-type: none"> <li>- Auxiliary voltage U = 24 V DC</li> <li>- SELV</li> <li>- Short-circuit proof</li> <li>- I<sub>max</sub> = 100 mA</li> </ul>
<b>Power supply 10 V</b>	<ul style="list-style-type: none"> <li>- Auxiliary voltage U = 10 V DC</li> <li>- Short-circuit proof</li> <li>- I<sub>max</sub> = 30 mA</li> </ul>

Tab. 8: Specification of interfaces

## 8.2 Derating of output power

Drive controllers of the INVEOR series have two integrated PTC resistors as standard which monitor both the heat sink temperature and the inner temperature. As soon as a permissible IGBT temperature of 95 °C or a permissible inner temperature of 85 °C is exceeded, the drive controller shuts down.

INVEOR MP Modular type drive controllers are designed for an overload of 150 % for 60 sec and 200 % for 3 s (every 10 min).

Reductions in the ability to handle overload and/or its duration should be taken into account in the following circumstances:

- A clocking frequency permanently set too high >4 kHz (load-dependent).
- A permanently increased heat sink temperature, caused by a blocked air flow or a thermal blockage (dirty cooling ribs).
- Depending on the type of assembly, permanently excessive ambient temperature.

The respective max. output values can be determined from the following characteristic curves.

### 8.2.1 Derating due to increased ambient temperature

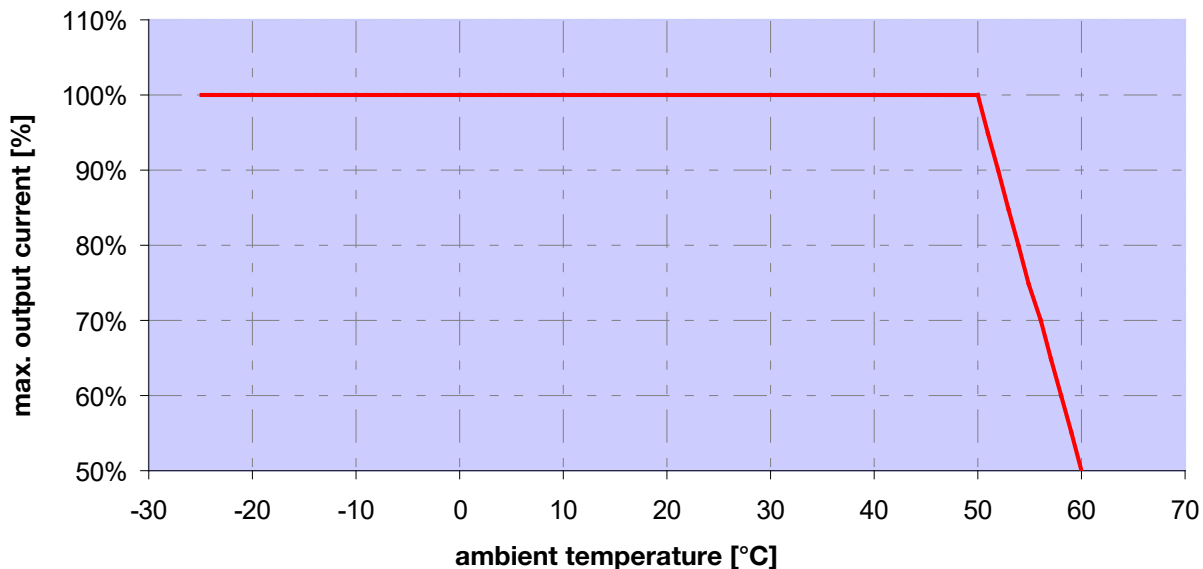


Fig. 43: Derating for motor-mounted drive controller

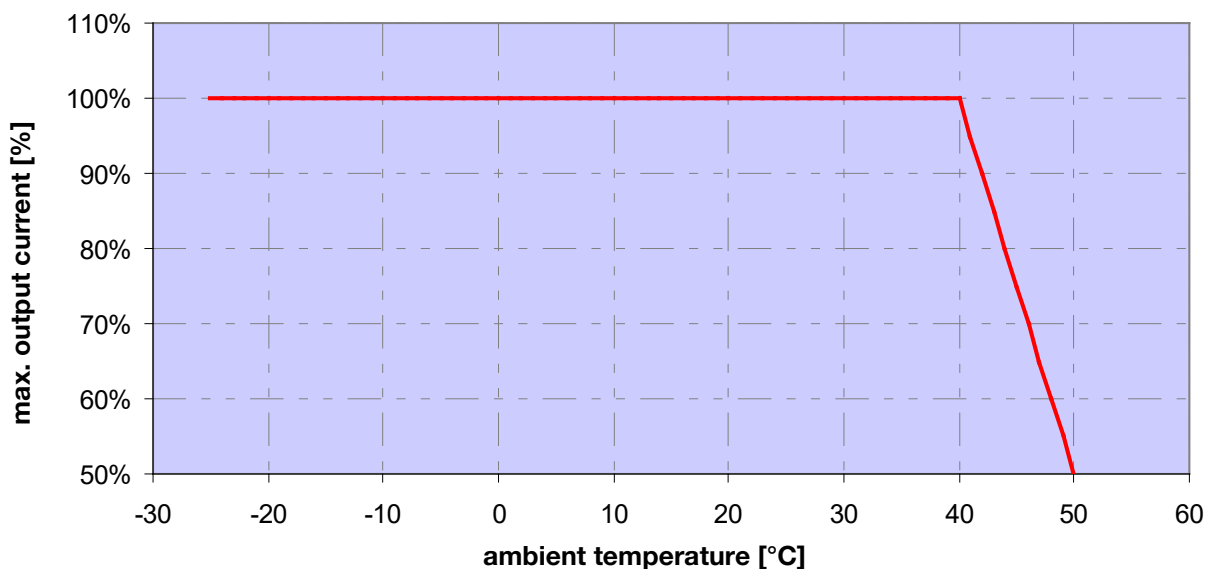


Fig. 44: Derating for wall-mounted drive controller

### 8.2.2 Derating due to installation altitude

The following applies to all INVEOR drive controllers:

- No reduction in performance is needed in S1 mode up to 1000 m above sea level.
- A reduction in performance of 1% every 100 m is needed from 1000 m  $\geq$  2000 m. Overvoltage category 3 is observed!
- Overvoltage category 2 should be observed from 2000 m  $\geq$  4000 m because of the lower air pressure!

In order to observe the overvoltage category:

- use external overvoltage protection in the INVEOR's mains cable.
- reduce the input voltage.

Please contact the KOSTAL Service department.

The respective max. output values can be determined from the following characteristic curves.

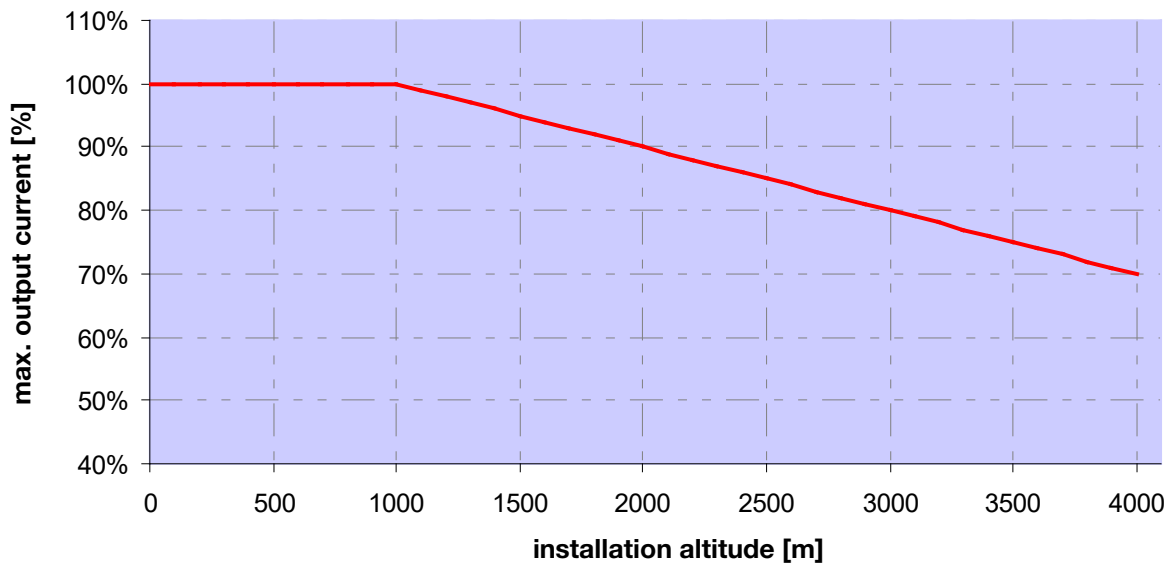


Fig. 45: Derating of maximum output current as a result of installation altitude

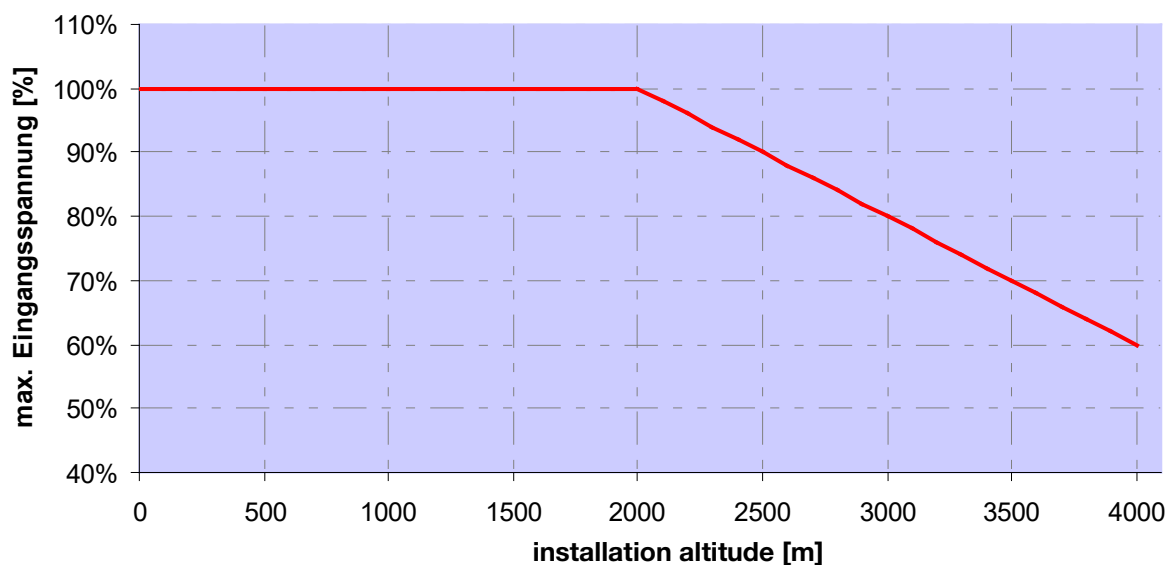


Fig. 46: Derating of maximum input voltage as a result of installation altitude

### 8.2.3 Derating due to switching frequency

The following diagram shows the output current, depending on switching frequency. To limit the thermal losses in the drive controller, the output current must be reduced.

Note: The switching frequency is not reduced automatically!

The max. output values can be determined from the following characteristic curve.

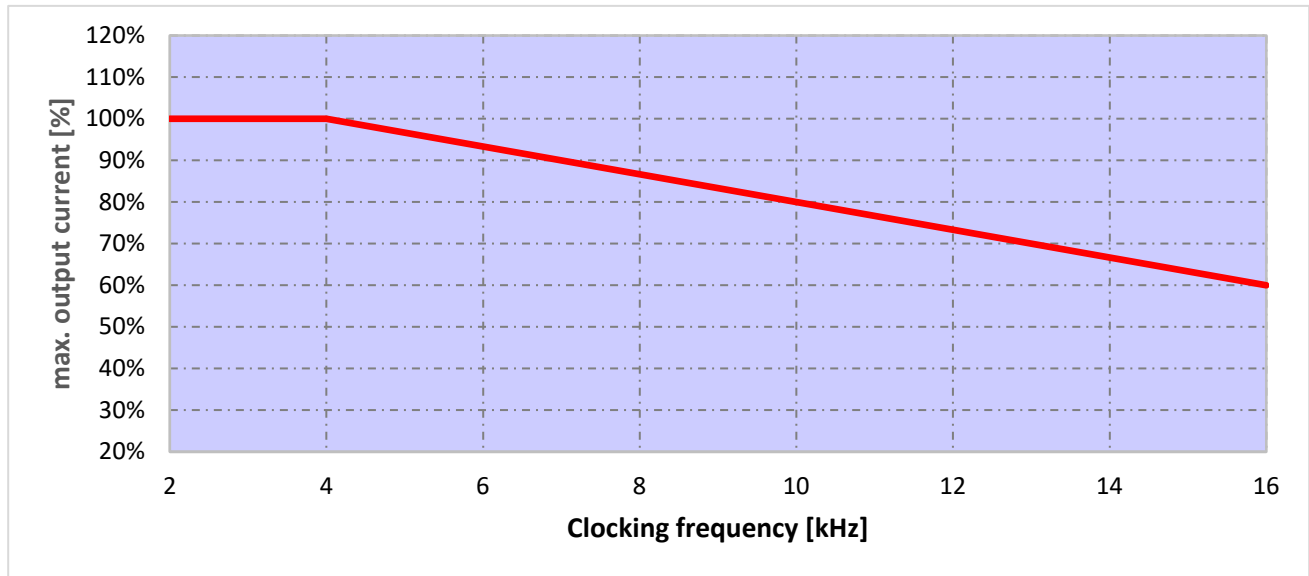


Fig. 47: Derating of maximum output current as a result of switching frequency

## 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 (with an integrated terminal board for size A up to C) is available for each INVEOR size. Download the 3D files (.stp) for INVEOR and adapter plates from

<https://www.kostal-industrie-elektrik.com/download>

INVEOR size	A	B
Power [kW]	0.55 to 2.2	2.2 to 5.5
Designation	ADP MA MOT 0000 A00 000 1	ADP MB MOT 0000 A00 000 1
Art. no.	10506789	10026184

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.



#### INFORMATION

The system integrator is responsible for whether the connection between the motor and adapter plate satisfies the mechanical requirements of the application.

Because the motor does not form part of the scope of supply of the drive controller, the system integrator must ensure the following when assembling the drive controller on the motor.

- Actual dimensions of the attachment interface
- Blind hole depth, diameter and thread type of attachment points



### IMPORTANT INFORMATION

KOSTAL Industrie Elektrik GmbH assumes no liability for the connection between the motor and INVEOR!

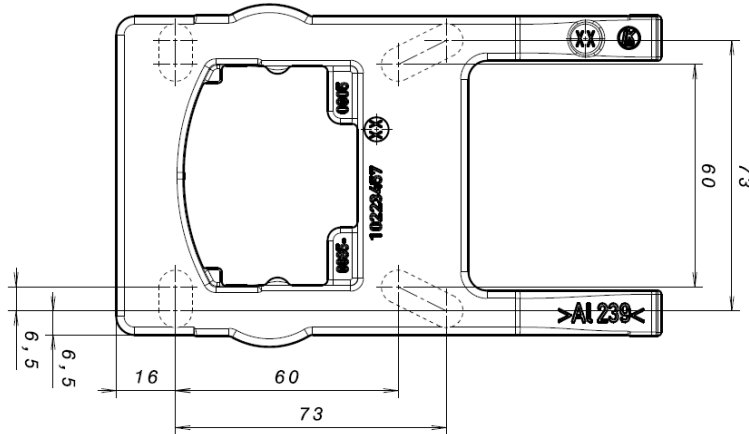


Fig. 48: Hole pattern for size A standard adapter plate

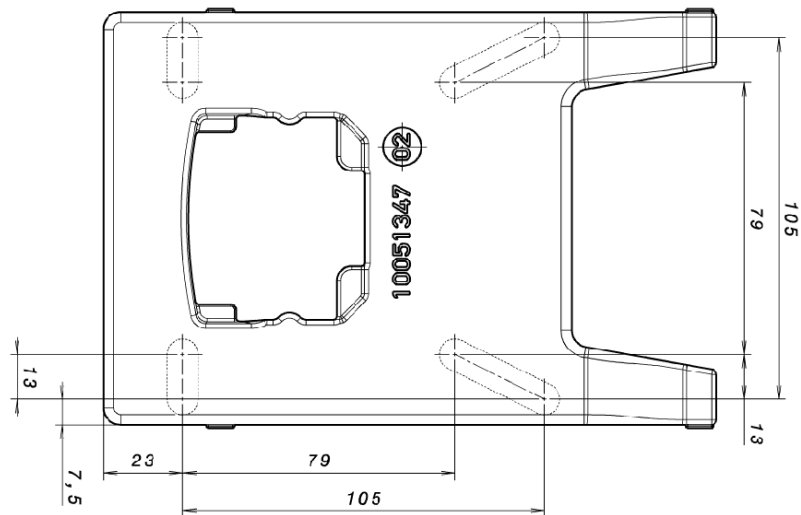


Fig. 49: Hole pattern for size B standard adapter plate

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. The drill-hole centres should be on the respective centre lines of the slots illustrated.

If the mounting frame is to be attached to a connection box that has no square hole pattern, then the drawing's diagonal centre lines are decisive.

If the mounting holes are outside the positions indicated, countersunk screws must be used to avoid fouling the attachment of the INVEOR MP Modular.

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 (with integrated terminal boards for sizes A to C), there are also specific versions available for various motor suppliers (on request).



INFORMATION

The system integrator is responsible for whether the connection between the motor and adapter plate satisfies the mechanical requirements of the application.

Because the motor does not form part of the scope of supply of the drive controller, the system integrator must ensure the following when assembling the drive controller on the motor.

- Actual dimensions of the attachment interface
- Blind hole depth, diameter and thread type of attachment points

9.1.3 Wall adapter plates (standard)

A standard wall adapter plate (with an integrated terminal board for sizes A to C) is available for each INVEOR size. Download the 3D files for INVEOR and adapter plates from <https://www.kostal-industrie-elektrik.com/downloads>. Four holes for mounting the adapter plate, as well as an EMC screw connection, are already featured.

INVEOR size	A	B
Power [kW]	0.55 to 2.2	2.2 to 5.5
Designation	ADP MA WDM 0000 A00 000 1	ADP MB WDM 0000 A00 000 1
Art. no.	10506806	10026185

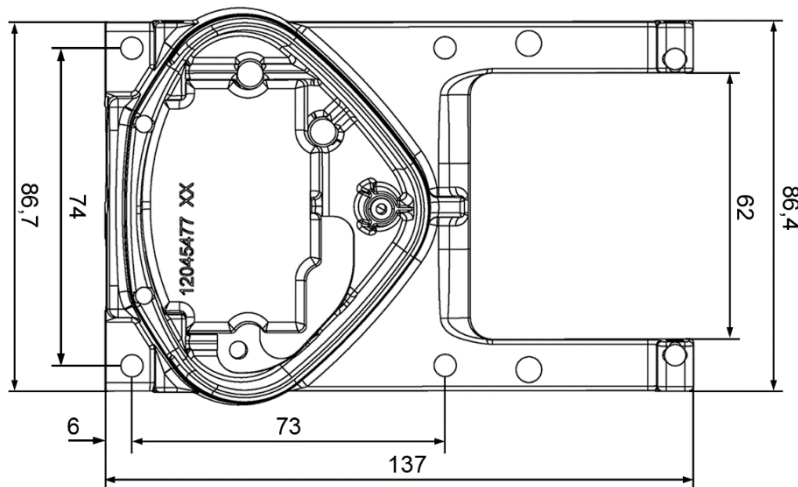


Fig. 50: Hole pattern for size A standard wall adapter plate

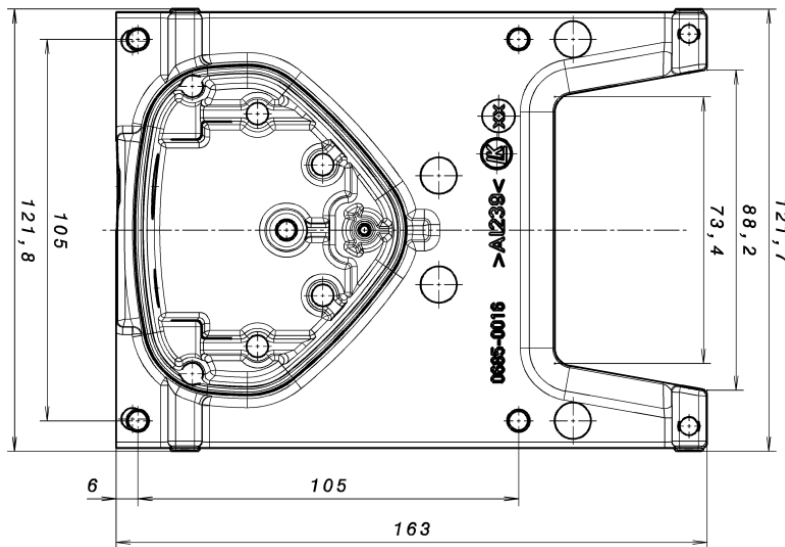


Fig. 51: Hole pattern for size B standard wall adapter plate

## 9.2 MMI handheld controller including a 3 m RJ9 connection cable with M12 plug



### IMPORTANT INFORMATION

The MMI handheld controller (part. no. 10004768) may only ever be used with an INVEOR!

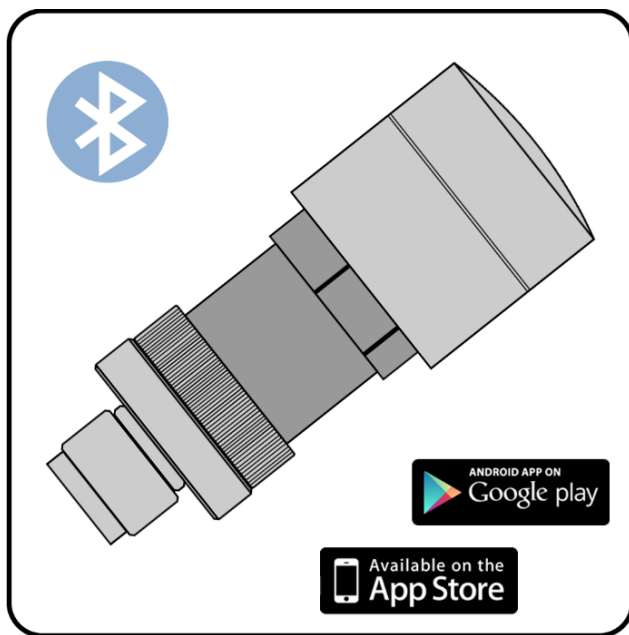
The MMI handheld controller is connected to the integrated INVEOR M12 interface. This operating unit allows the user to write (program) and/or to visualise all the parameters of the INVEOR. Up to 8 complete data sets can be stored in an MMI and copied to other INVEORs. Complete commissioning is possible as an alternative to the free INVERTERpc software. External signals are not needed.

## 9.3 PC communication cable USB on M12/RS485 plug (converter integrated)

As an alternative to the MMI handheld controller, an INVEOR can also be put into operation using the PC communication cable (art no. 10023950) and the INVERTERpc software.

The INVERTERpc software is available free of charge from the KOSTAL homepage at <https://www.kostal-industrie-elektrik.com/downloads>.

## 9.4 Bluetooth stick M12



You can start up your INVEOR MP Modular using the Bluetooth stick and a mobile end device.

To establish communication, you can download our free KOSTAL INVERTERapp onto your mobile end device from the Google Play Store (ANDROID) or App Store (Apple IOS).

**NOTE**

If using the Bluetooth stick, the password is fixed as 000000.

## 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).



**IMPORTANT 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.

### 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 2014/30/EU)
- Low Voltage Directive (Directive 2014/35/EU)

# 11. Quickstart guide

## 11.1 Quickstart guide

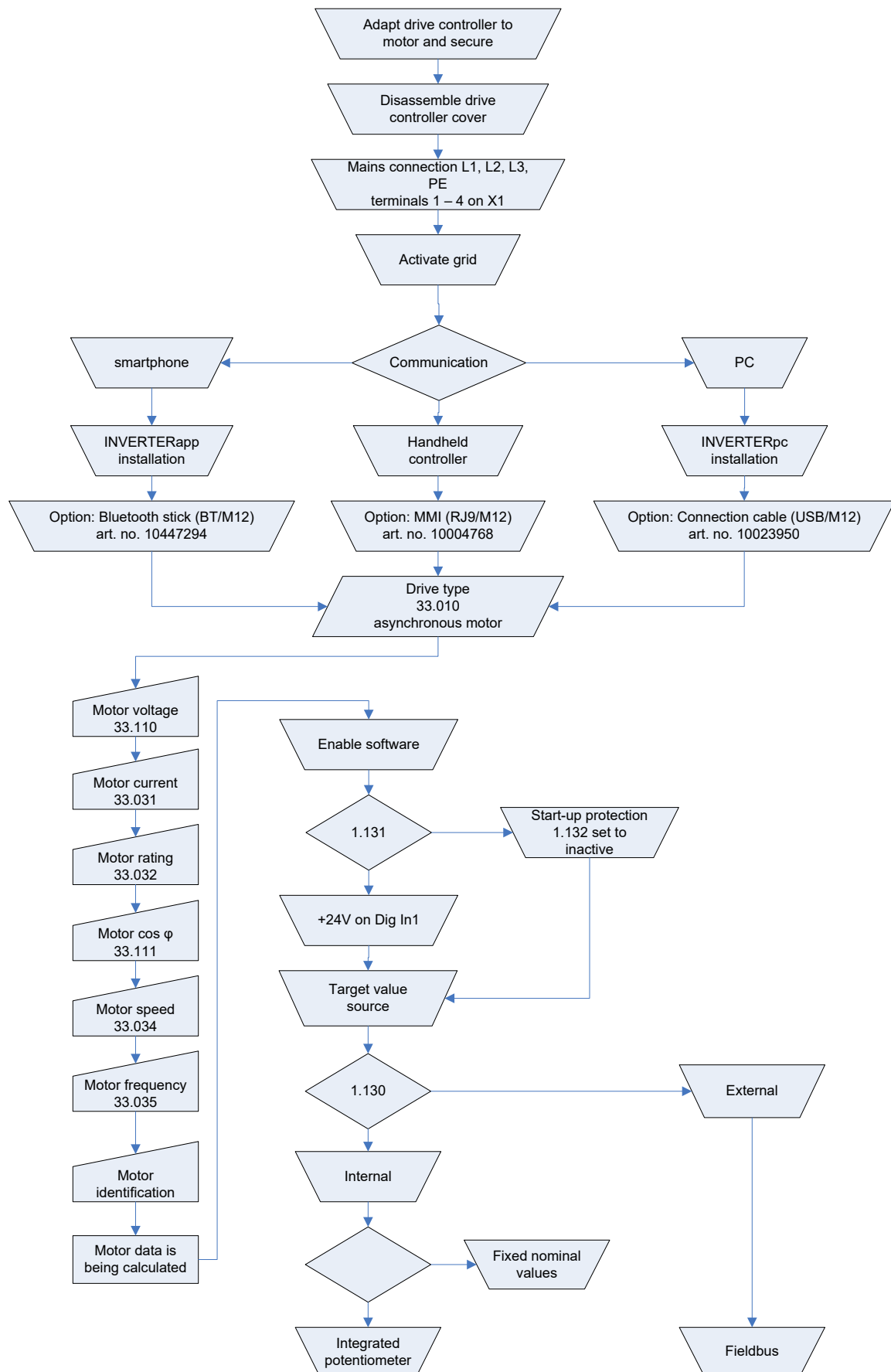


Fig. 52: Block diagram for quick start ASM

## 11.2 Quickstart guide for synchronous motors

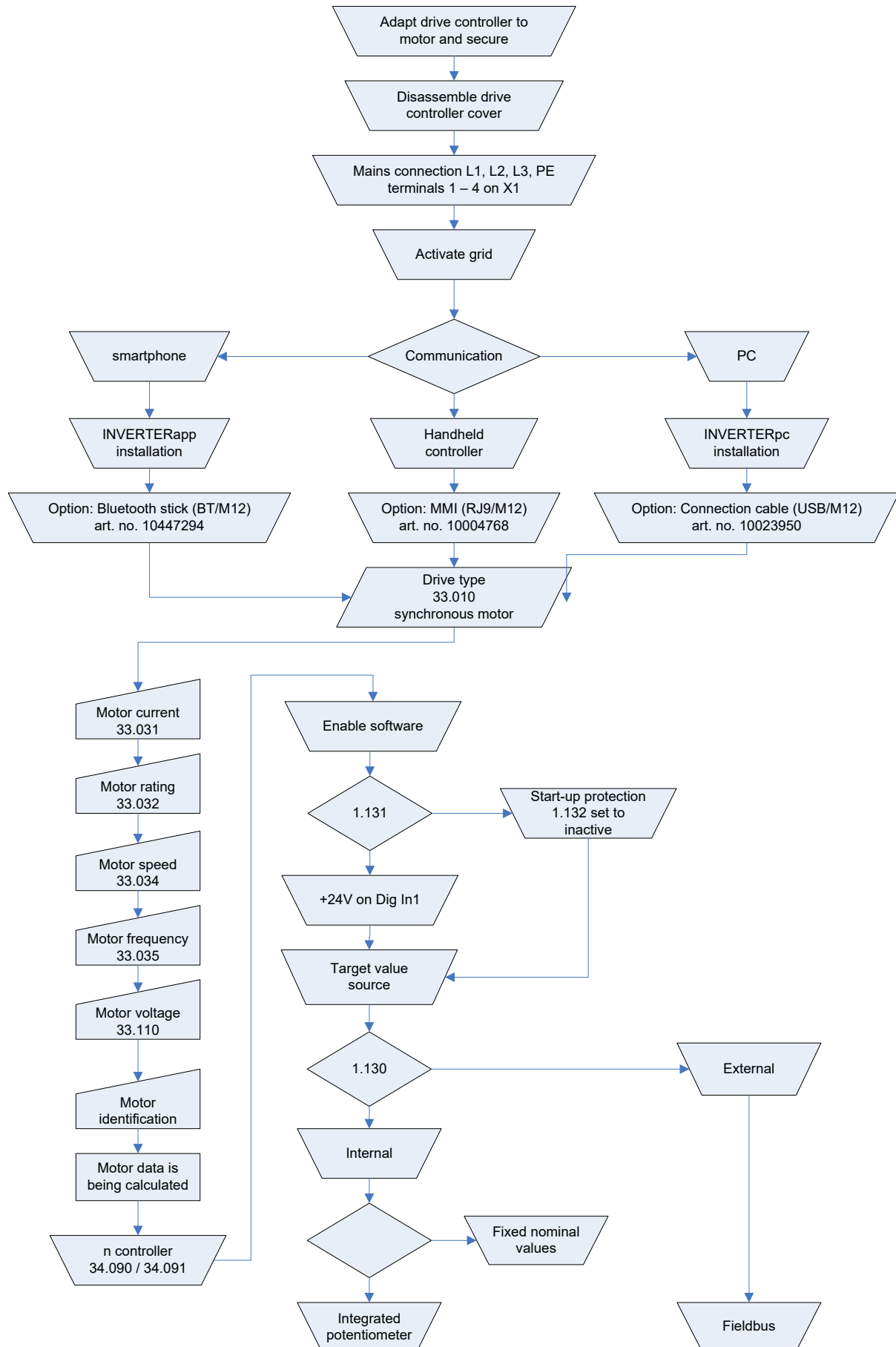


Fig. 53: Block diagram for quick start

## 12. Index

### A

Accessories .....	76
Acknowledge function .....	46
Ambient conditions .....	16
Ambient temperature.....	73
Analogue input .....	48
Application parameters .....	43
Approvals, standards and guidelines .....	80
Automatic acknowledge function .....	46, 47

### B

Block diagram .....	38
Blocking detection .....	53
Bluetooth .....	57, 80
Brake chopper.....	26
Brake resistor .....	26

### C

Cable screw connections .....	16
Cable shoes.....	19, 35
CANopen .....	29
Catch time.....	63
CE marking .....	8
Commissioning.....	36, 82
Commissioning steps .....	39
Communication .....	36
Connection diagram .....	28
Connection overview (sizes A – B) .....	20
Controller data.....	63
Convection .....	31

### D

Deceleration time .....	43
Derating .....	72
Digital input .....	49
Digital output .....	50
Disassembly and disposal .....	70
Drive type .....	58

### E

Electrical connection.....	24
EMC screw connections.....	80
Enable software .....	45
Error detection.....	67, 69
Excess temperature .....	69
External fault .....	52

### F

Factory setting .....	43
FI protection switch .....	10
Field weakening .....	65
Fieldbus.....	56
Fieldbus address .....	56
Fixed frequency .....	41, 47
Flying restart.....	63
Frequency setting mode .....	41

### G

Gearbox factor .....	53
General technical data for 400 V devices .....	71
Grid connection .....	24
Grid monitoring .....	66
Ground protection .....	19

### I

I2t.....	61
Information about commissioning.....	9
Installation .....	17, 31, 78
Installation altitude.....	16, 74
Instructions concerning operation.....	10
IO module .....	28
IO module / assignment of plugs.....	30

### L

Label on the drive controller .....	7
Leakage inductance .....	59
LED flash codes .....	67
Legal notice .....	2

### M

Maximum frequency.....	43
Mechanical installation of sizes A - B.....	21, 31
Minimum frequency .....	43
MMI .....	36, 79
Modbus.....	29
Motor .....	14
Motor adapter plates.....	76
Motor cos phi.....	59, 60
Motor current .....	58
Motor current limit .....	53
Motor data.....	58
Motor frequency.....	59
Motor rating .....	58
Motor speed .....	58
Motor voltage .....	59

### O

Operating mode.....	44
Overcurrent .....	69
Overload .....	68, 69
Overvoltage .....	68, 69

### P

Parameter .....	41
Parameter set .....	68
Parameter set change.....	55
Parameterisation .....	5, 39
PC cable.....	79
Performance parameters.....	58
Power connection for sizes A - B.....	24

### Q

Quadratic characteristic curve.....	66
Quickstart guide.....	82

## Index

<b>R</b>	
Ramp .....	44
RCD .....	10
Repairs .....	11
Rotation direction .....	46
Run up time .....	43
<b>S</b>	
Safety instructions .....	8, 15
Set bus timeout .....	56
Set field bus baud rate .....	56
Slip .....	64
Speed .....	58
Speed controller .....	63
Standards .....	81
Star connection variant .....	19
Start-up procedure SM .....	65
Start-up protection .....	45
Stator inductance .....	60
Stator resistance .....	59
Switching frequency .....	62, 75
System error .....	68
<b>T</b>	
Target value source .....	44
Technical data .....	71
Transport & storage .....	9
Triangle connection variant .....	18
<b>U</b>	
Undervoltage .....	68, 69
<b>V</b>	
Virtual output .....	51
<b>W</b>	
Wall adapter plates .....	78
Wiring instructions .....	20





# KOSTAL

KOSTAL Industrie Elektrik GmbH  
Lange Eck 11  
58099 Hagen  
Germany

[www.kostal-industrie-elektrik.com](http://www.kostal-industrie-elektrik.com)

Service hotline: +49 (0)2331 80 40-848

Telephone: +49 (0)2331 80 40-800

Fax: +49 (0)2331 80 40-602

