Bonfiglioli
Riduttori

User instructions. DGM speed regulator

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Forever Forward

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General equal treatment

BONFIGLIOLI is aware of the linguistic importance regarding the equal rights of men and women and takes this constantly into account. However, to make reading easier, we were obliged to omit the common formulations of distinction.

Table of contents

1. General information

Thank you for choosing a DGM speed regulator from Bonfiglioli Riduttori S.p.A. Our range of DGM speed regulators is designed for use with the motors in the BONFIGLIOLI range.

1.1 Information about the documentation

The following information provides a guide for the entire documentation.

Read these instructions carefully and completely. They contain important information regarding the use of the DGM.

We do not accept any liability for damage caused by the failure to follow these instructions.

This manual is an integral part of the product and applies only to the DGM manufactured by Bonfiglioli Riduttori S.p.A.

Deliver this manual to the plant manager to ensure that the instructions are available if needed.

1.1.1 Documentation storage

Carefully store these user instructions as well as the remaining documentation so they are available if needed.

1.2 Warnings related to these instructions

1.2.1 Warnings

The warnings call attention to physical and lethal hazards. Serious damage can be caused to personnel, which can also be lethal.

Each warning is marked with the following elements:

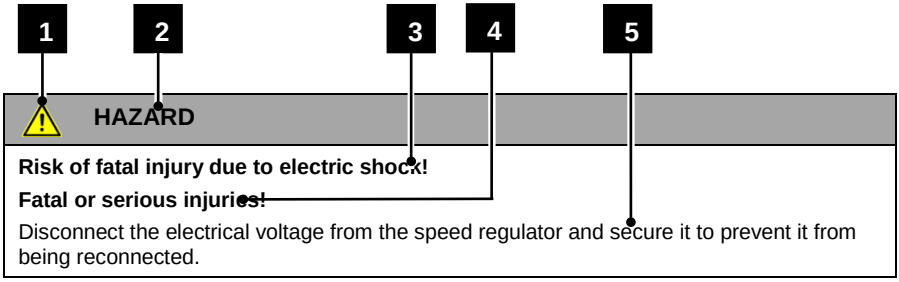


Fig. 1: Structure of the warnings

1	Warning symbol
2	Keyword
3	Type of hazard and relative origin
4	Possible consequence if not observed
5	Solution

1.2.2 Warning symbols used


Hazard


Risk of electric shock and electric discharge


Risk due to electromagnetic fields

1.2.3 Keywords

The keywords indicate the type of hazard.

HAZARD

This indicates an imminent threat with a high degree of risk that, if not avoided, results in death or serious injuries.

WARNING

This indicates a threat with a medium degree of risk that, if not avoided, results in death or serious injuries.

CAUTION

This indicates a threat with a low degree of risk that, if not avoided, could cause moderate injuries or material damage.

1.2.4 Information notes

The information notes contain important instructions for installation and the optimal operation of the speed regulator. They must be complied with. The information notes call attention to the fact that, if not observed, material or economic damage is possible.

IMPORTANT INFORMATION

The assembly, use, maintenance and installation of the speed regulator must be carried out only by specialized, properly trained and qualified personnel.

Fig. 2: Example of an information note

Symbols used in the information notes

Important information

Material damage is possible

Other notes

INFORMATION

Image enlarged

1.3 Symbols used in these instructions

Symbol	Meaning
1., 1., 3. …	Consecutive steps of user instructions
➔	Implications of the user instructions
✓	Final result of the user instructions
■	List

Fig. 3: Utilized symbols and icons

Utilized abbreviations

Abbreviation	Explanation
Table	Table
Fig.	Figure
Pos.	Position
Chap.	Chapter

1.4 Marks on the speed regulator

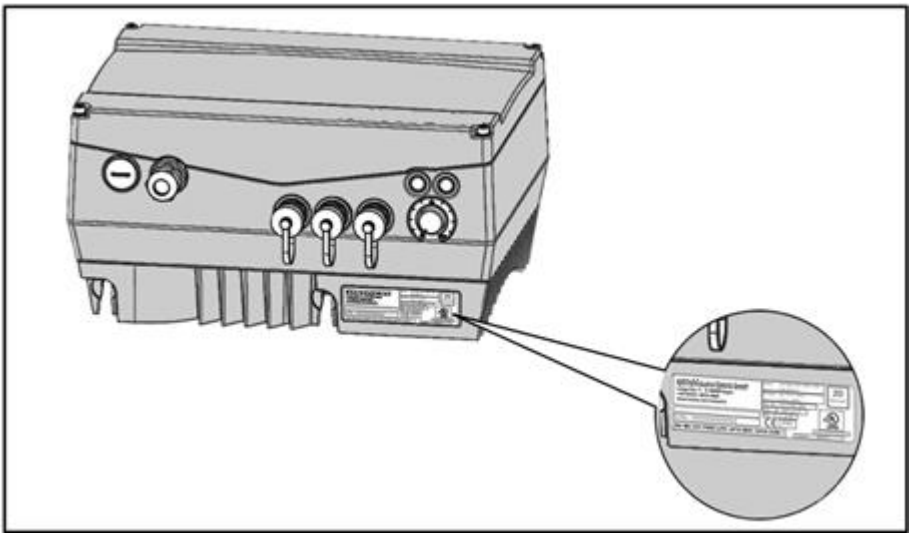


Fig. 4 Marks on the speed regulator

Plates and marks are applied on the speed regulator. Do not change or remove them.

Symbol	Meaning
	Risk of electric shock and electric discharge
	Risk of electric shock and electric discharge. After shut-off, wait two minutes (time for capacitor discharge)
	Supplementary ground connection
	Read and follow the user instructions

1.5 Qualified personnel

Qualified personnel, for the purpose of these user instructions, are electricians who have knowledge and experience concerning the installation, assembly, start-up and use of the speed regulator and who have been informed of the correlated risks. Furthermore, thanks to their professional training, they have the necessary knowledge concerning the relevant standards and provisions.

1.6 Use compliant with the intended use

When carrying out the installation on machines, the speed regulator may not be started up (e.g. operation in accordance with its intended use) until it has been verified that the machine complies with the provisions of EC Directive 2006/42/EC (machine directive); observe DIN EN 60204-1; VDE 0113-1.

Start-up (e.e. operation in accordance with its intended use) is only permitted in compliance with the EMC Directive (2014/30/EU).

The harmonized standards of the series DIN EN 50178; VDE 0160 together with DIN EN 61439-1/DIN EN 61439-2; VDE 0660-600 must be applied for this speed regulator.

This speed regulator may not be used in areas at risk of explosion!

The repairs may only be made by authorized repair centers. Arbitrary, unauthorized interventions can cause death, physical injuries and material damage. In this case, the warranty offered by Bonfiglioli is voided.

IMPORTANT INFORMATION
Mechanical loads are not permitted on the housing!

IMPORTANT INFORMATION

The use of speed regulators in non-fixed equipment is considered an extraordinary ambient condition and is permitted only in compliance with the locally applicable standards and directives.

1.7 Responsibility

In principle, electronic equipment is not fault free. The machine/system installer and/or operator is responsible for the implementation of safety measures for the system in case of an equipment fault.

DIN EN 60204-1; VDE 0113-1 "Safety of machinery", chapter "Electrical machine equipment" illustrates the safety requirements for the electrical controls. These are used to guarantee the safety of persons and machinery, and to maintain the functionality of the machine or the plant, and therefore must be observed.

The operation of an emergency stop device must not cause the deactivation of the power supply voltage for the drive system. To exclude dangers, it may be useful to keep individual drive systems in function or start certain safety procedures.
The implementation of emergency stop measures is assessed considering the risk to the machine/system, including the electrical equipment, and determined based on DIN EN 13849 "Safety of command system components, relative to machine safety" according to the circuit category.

1.8 CE MARK

The company **Bonfiglioli Riduttori S.p.A.** declares herewith that the speed regulators described in this document satisfy the fundamental requirements and the other relevant provisions of the directives indicated below.

- Directive 2014/30/EU
  (electromagnetic compatibility, EMC).
- Directive 2014/35/EU
  (placing on the market of electric material to be used within some 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)

1.9 Safety instructions

The following warnings, precautionary measures and instructions are provided for your own safety and to avoid damaging the speed regulator or the components connected to it. This chapter provides a summary of the warnings and instructions that apply in general when working with speed regulators. They are divided into: General aspects, transport and storage, deinstallation and disposal.

The specific warnings and instructions that apply to specific activities can be found at the beginning of the respective chapter and are repeated and integrated in that chapter, in the critical points.

Read this information carefully as it is intended for your personal safety and also to extend the service life of the speed regulator and the equipment connected to it.

1.9.1 General aspects

IMPORTANT INFORMATION

Before installation and start-up, read these user instructions and the warning plates applied on the speed regulator carefully. Make sure that all the warning plates applied to the speed regulator are legible; if necessary, replace any missing or damaged plates.

They contain important information regarding the installation and operation of the speed regulator. Follow in particular the instructions provided in the chapter “Important information”. Bonfiglioli Riduttori S.p.A. is not responsible for damage caused by the failure to follow these user instructions.

This user instruction manual is an integral part of the product. It is only applicable to the Bonfiglioli Riduttori S.p.A. DGM speed regulator.

Keep these user instructions near the speed regulator where it is accessible to all users.

IMPORTANT INFORMATION

The speed regulator can be operated safely only if the requested ambient conditions have been observed, which can be found in the chapter “Suitable ambient conditions".

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Connect the device to the ground in compliance with DIN EN 61140; VDE 0140, NEC and other pertinent standards.

The speed regulator must be ground connected together with the motor, as required. Otherwise, this can cause fatal or serious injuries.

If spring washers are not used during the installation of the adapter plate in order to create a correct connection to the protective conductor, a supplementary connection must be made between the motor and the speed regulator.

HAZARD

Risk of fatal injury due to moving mechanical components!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

WARNING

Risk of fatal injury due to fire or electric shock!

Fatal or serious injuries!

Use the speed regulator in compliance with its intended use.

Do not make changes to the speed regulator.

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

During installation, make sure that there is a sufficient distance from nearby components.

CAUTION

Risk of burns due to extremely hot surfaces!

Serious burns due to extremely hot surfaces!

Let the speed regulator heat dissipator cool down sufficiently.

Let the nearby components cool down sufficiently.

If necessary, install a protective guard.

1.9.2 Transport and storage

Material damage is possible

Risk of damaging the speed regulator!

Risk of damaging the speed regulator due to improper transport, storage, installation and assembly!

Transport the speed regulator in a vertical position, in its original packaging.

Store the speed regulator properly.

Have it installed and assembled only by qualified personnel.

1.9.3 Storing the devices for a long period of time

IMPORTANT INFORMATION

For speed regulators that were stored for more than 2 years, prior to installation and/or use in nominal conditions, the following regeneration process must be carried out:

- The speed regulator must be connected to the network voltage (+/- 3%) for 30 minutes, without the device being loaded. This concerns both the connection to the motor as well as to other users and connections on the application.
- Carry out this procedure once before start-up.

In all cases, observe the general requirements for the storage of speed regulators!

1.9.4 Instructions for start-up

HAZARD

Risk of fatal injury due to electric shock!
Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

The following terminals can conduct dangerous voltage, also when the motor is off:

- Network power supply terminals X1: L1, L2, L3
- Motor connection terminal boards X2: U, V, W
- Connection terminal boards X6, X7: Relay contacts 1 and 2
- Connection terminal boards PTC T1/T2

IMPORTANT INFORMATION

- Only used fixed wired connections to the network.
- Connect the speed regulator to the ground in compliance with DIN EN 61140; VDE 0140-1.
- There may be contact current > 3.5 mA in the DGM.
  For this reason, apply a protective conductor for supplementary grounding with the same section of the protective conductor for the original grounding, in compliance with DIN EN 61800-5-1. It is possible to connect a second protective conductor for grounding below the network power supply (marked by the earth symbol) on the external side of the device.
- When three-phase current frequency converters are used, it is not permitted to use a traditional type A FI automatic circuit breakers, also called RCDs (residual-current-operated protective devices) for protection against direct or indirect contact! The FI automatic circuit breaker must be an automatic FI that provides protection against all types of currents (RCD type B) in compliance with DIN VDE 0160 and EN 50178!

IMPORTANT INFORMATION

- Using different levels of voltage (for ex. +24 V / 230 V), crossing of lines must always be avoided! Furthermore, the user must also make sure that the current standards are observed (e.g. double or reinforced insulation, in compliance with standard DIN EN 61800-5-1)!
- The speed regulator contains components that are sensitive to electrostatic charges. They can be destroyed due to improper handling. Therefore respect all the precautions against electrostatic charges when working on these components.

1.9.5 Information regarding operation

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

HAZARD

Risk of fatal injury due to moving mechanical components!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

IMPORTANT INFORMATION

Always keep the following information in mind during operation:

- The speed regulator operates with high voltage.
- When the electrical devices are operating, certain parts of these devices are always subject to hazardous voltage.
- The emergency stop devices compliant with DIN EN 60204-1; VDE 0113-1:2007-06 must remain functional in all operating modes of the control unit. Resetting an emergency stop device must not cause an uncontrolled or indefinite start-up.
- To guarantee a safe separation from the network, the network cable must be disconnected from the speed regulator, in a synchronous manner and for all poles.
- For devices with a single-phase power supply and for those with size D (11 to 22 kW), observe a pause of at least 1-2 minutes between the consecutive activations of the network, one following the other.
- For devices with three-phase power supply, models A - C (from 0.55 to 7.5 kW), observe a pause of at least 3 seconds between consecutive network activations.
- Certain parameter settings can cause the automatic restart of the speed regulator after the power supply voltage has failed.

Material damage is possible

If the instructions are not observed, the speed regulator can be damaged and be destroyed at the next start-up!

Always keep the following information in mind during operation:

- To suitably protect the motor against overloads, the motor parameters, and in particular the I^2T settings, must be configured correctly.
- The speed regulator offers internal protection against motor overloads. In this respect, see parameters 33.010 and 33.011.
  In compliance with the default settings, the function I^2T is active (ON).
  Protection against motor overload can also be guaranteed by an external PTC.
- The speed regulator must not be used as an “emergency stop device” (see DIN EN 60204-1; VDE 0113-1:2007-06).

1.9.6 Maintenance and inspection

Maintenance and inspection of the speed regulator may only be carried out by suitably trained electricians. Unless otherwise indicated specifically in these user instructions, the changes to the hardware and the software may only be performed by BONFIGLIOLI experts or by persons authorized by BONFIGLIOLI.

Cleaning the speed regulator

The speed regulator does not require maintenance when used correctly. If the air is dusty, the cooling fins of the motor and the speed regulator must be cleaned regularly. In the case of devices with integrated fans (standard for size D), it is recommended to use compressed air for cleaning.

Measurement of the control board insulation resistance

It is not permitted to check the insulation on the input terminals of the control board.

Measurement of the power module insulation resistance.
During on-line testing, the DGM power module is tested with 2.02 kV.

If during the system check it becomes necessary to measure the insulation resistance, do so under the following conditions:

- The insulation can only be checked for the power module.
- To avoid excessively high voltages, disconnect all the DGM connection cables before performing the check.
- A 500 Vdc device for checking the insulation must be used.

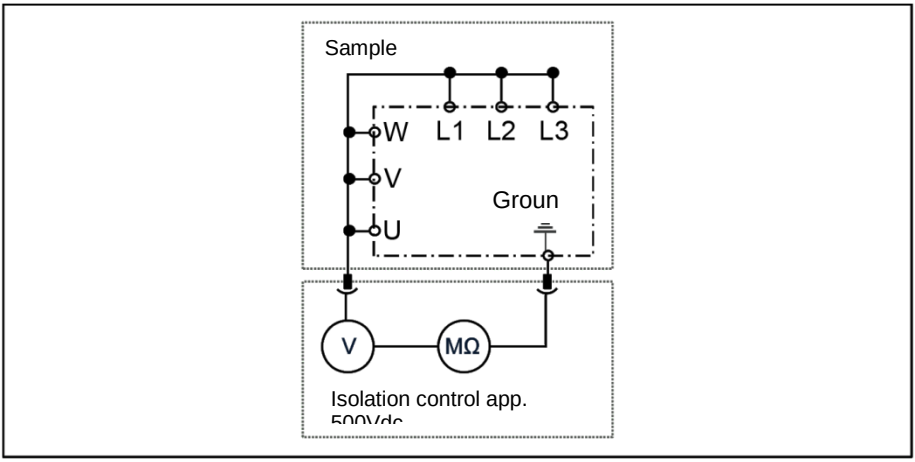


Fig. 5: Power module insulation check

DGM pressure check

IMPORTANT INFORMATION

It is not permitted to check the pressure of a standard DGM.

1.9.7 Repairs

Material damage is possible

If the instructions are not observed, the speed regulator can be damaged and be destroyed at the next start-up!

- The speed regulator may only be repaired by the BONFIGLIOLI support service.

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

Risk of electric shock and electric discharge. After shut-off, wait two minutes (time for capacitor discharge)

2. Speed regulator overview

This chapter contains information about the supply of the speed regulator and a description of its operation.

2.1 Model description

2.1.1 Selection of the model

INVERTER TYPE	POWER MOTOR	BOARD CONTROL	COVER	BOARD POWER
DGM0 Entry Level	**0025**-0.25 kW	**C01**-Basic	**L01**-Simple cover	**P01**-Without brake chopper
DGM1-Single phase	**0037**-0.37 kW	**C02**-Standard	**L02**- Simple cover + potentiometer	**P02**-With brake chopper
DGM3-Three-phase	**0055**-0.55 kW	**C03**-Standard + CANopen	**L03**-Cover with MMI	**P03**-For IT networks (without brake chopper)
	0075-0.75 kW	**C04**-Standard + EtherCAT	**L04**-Cover with MMI + potentiometer	
	0110-1.1 kW	**C05**-Standard + Profibus	**L05**-Cover with foil keypad	
	0150-1.5 kW	**C06**-Standard + Profinet		
	0220-2.2 kW	**C07**-Standard + SercosIII		
	0300-3 kW	**C12**-Functional safety		
	0400-4 kW	**C13**-Functional safety + CANopen		
	0550-5.5 kW	**C14**-Functional safety + EtherCAT		
	0750-7.5 kW	**C15**-Functional safety + Profibus		
	1100-11 kW	**C16**-Functional safety + Profinet		
	1500-15 kW	**C17**-Functional Safety + Sercos III		
	1850-18.5 kW			
	2200-22 kW			

2.1.2 Division of the sizes

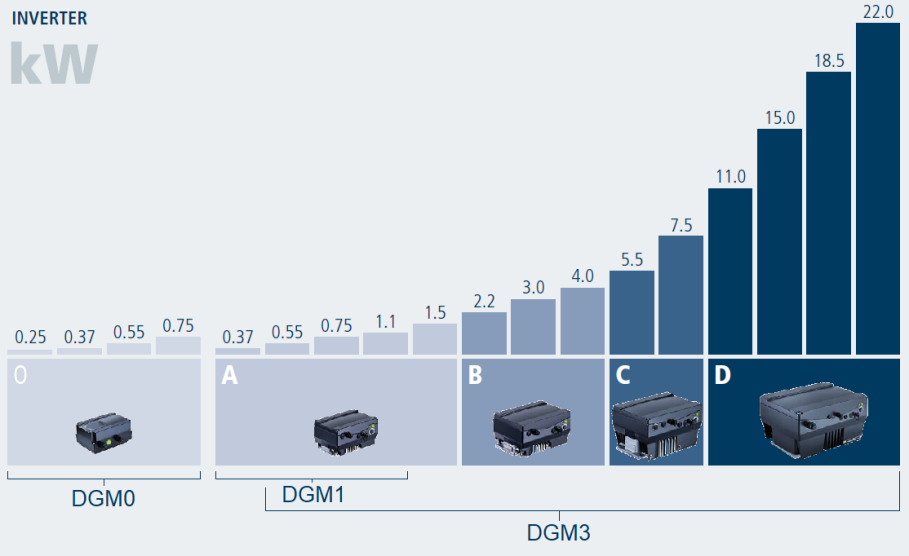


Table 1 Division of the sizes

2.2 MMI*/connection cable PIN assignment

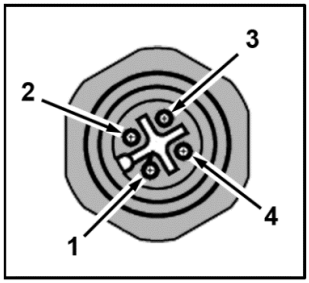


Fig. 6: PIN assignment connector M12

Description: Round connector (connector)
4 poles M12 coded A

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

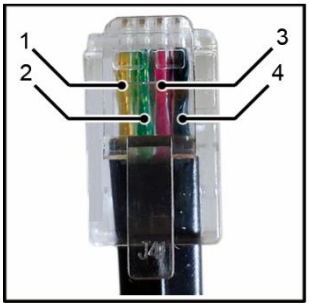


Fig. 7: Connector RJ9

Description: Connector RJ9

Pin	Signal
1	yellow
2	green
3	red
4	brown
Attention: the colors can be different!	

* Man machine interface

2.3 Description of the DGM speed regulator

The DGM speed regulator is a device for regulating the speed of three-phase AC motors.

The speed regulator can be used as an element integrated in the motor (with an adapter plate) or near the motor (with an adapter plate for wall installation).

The ambient temperatures permitted and indicated in the technical data refer to use with a nominal load.
Higher temperatures may be permitted in many applications after a careful technical analysis. They must be approved by BONFIGLIOLI on a case by case basis.

3. Installation

3.1 Safety instructions for installation

HAZARD

Risk of fatal injury due to moving mechanical components!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

Installation may only be performed by suitably qualified personnel.

Only use instructed personnel for set-up, installation, start-up and use.

Connect the device to the ground in compliance with DIN EN 61140; VDE 0140, NEC and other pertinent standards.

The speed regulator must be ground connected together with the motor, as required. Otherwise, serious or fatal injuries can result.

If spring elements are not used during the installation of the adapter plate in order to create a correct connection to the protective conductor, a supplementary connection must be made between the motor and the speed regulator.

The unused open ends of cables in the motor connection boxes must be isolated.

Automatic circuit breakers must be used between the network and the speed regulator as appropriate for the nominal current.

The connections to the network must be wired in a fixed manner.

3.2 Recommended fuses/automatic circuit breaker

DGM	Size A 1 x 230 Vac	Size A 3 x 400 Vac	Size B 3 x 400 Vac	Size C 3 x 400 Vac	Size D 3 x 400 Vac	Size D 3 x 400 Vac
Motor power	up to 1.1 kW	up to 1.5 kW	up to 4.0 kW	up to 7.5 kW	up to 15 kW	up to 22 kW
Network current	9.2 A	3.3 A	7.9 A	14.8 A	28.2 A	39.9 A
150% network current (overload 60 s)	13.8 A	4.95 A	11.85 A	22.2 A	42.3 A	51.87 A
Automatic circuit breaker - recommended	C 16	C 10	C 16	C 25	C 50	C 63
	Characteristic C = automatic circuit breaker Resolution between 6 and 10 times In					
	The network cable section must be provided based on the type of installation and the maximum permitted current. The protection of the network line must be guaranteed by the technician responsible for start-up.					

3.3 Installation requirements

3.3.1 Suitable ambient conditions

Conditions	Values
Installation altitude:	up to 1000 m.a.s.l. / above 1000 m.a.s.l. with reduced performance (1% every 100 m) (max. 2000 m), see chap. “Derating of the output power”
Ambient temperature:	from - 25° C to + 50° C (possible variations in ambient temperature in individual cases), see chap. “Derating of the output power”
Air relative humidity	≤ 96 % no condensation allowed.
Vibration and impact resistance:	DIN EN 60068-2-6 degree of intensity 2 (transport vibrations) DIN EN 60068-2-27 (vertical impact test) 2…200 Hz for sinusoidal oscillations.
Electromagnetic compatibility:	Resistance to disturbances in compliance with DIN EN 61800-3
Cooling:	Surface cooling: Sizes A to C: free convection; Size D: with integrated fans.

Table 2: Environmental conditions

- Make sure that the type of housing (protection class) is suitable for the operating environment:
  - All the cable glands that are not used must be closed hermetically.
  - Check that the speed regulator cover is closed and tightened with the following torque:
    - Sizes A – C (4 x M4 x 28) 2 Nm,
    - Size D (4 x M6 x 28) 4 Nm.

POSSIBLE MATERIAL DAMAGE

Failure to observe the warning could cause damage to the speed regulator!
When installing a cover with an integrated foil keypad, make sure that the flat cable does not remain stuck.

In the standard variant, the DGM is supplied in RAL 9005 (black).

If the printed circuit boards are deinstalled (also in order to paint or cover the parts of the housing), the right to the warranty is voided!

The tightening points and the seal surfaces must be kept free of paint for reasons of EMC and ground connection!

3.3.2 Suitable place of installation for the speed regulator integrated on the motor

Make sure that the motor with the integrated speed regulator is mounted and operated only according to the arrangement shown in the following image.

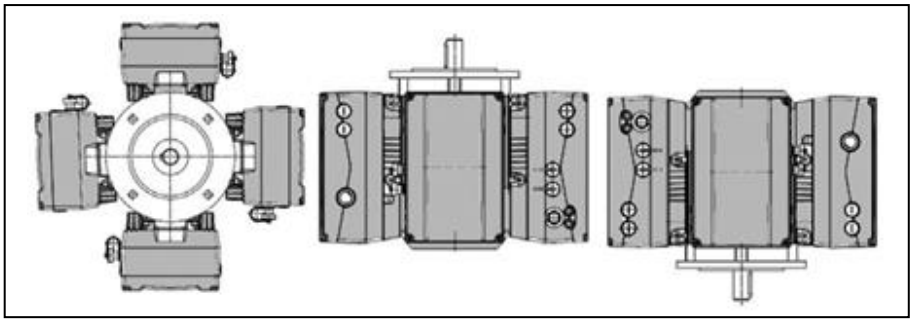


Fig. 8: Installation position of the motor/permitted orientations

IMPORTANT INFORMATION

Also once installation is complete, condensate water must not be permitted to pass from the motor to the speed regulator.

3.3.3 Fundamental connection variants

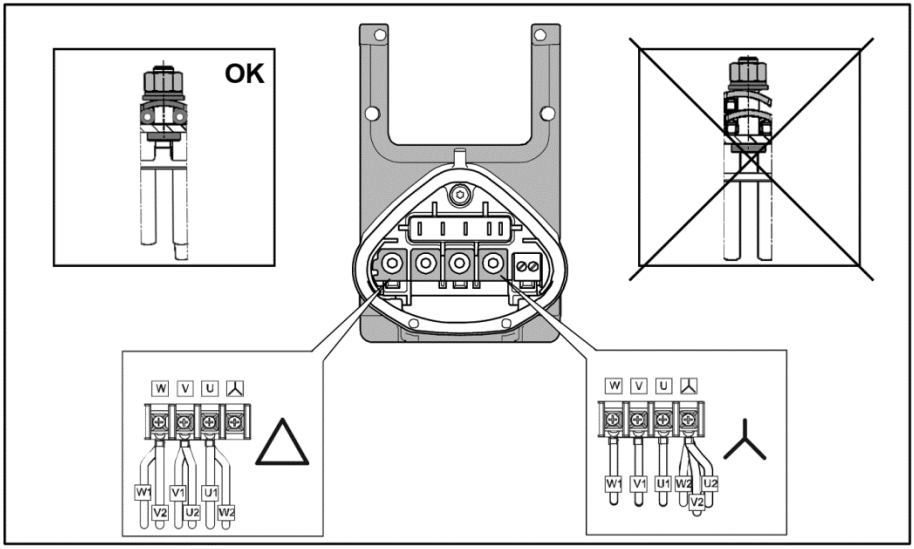
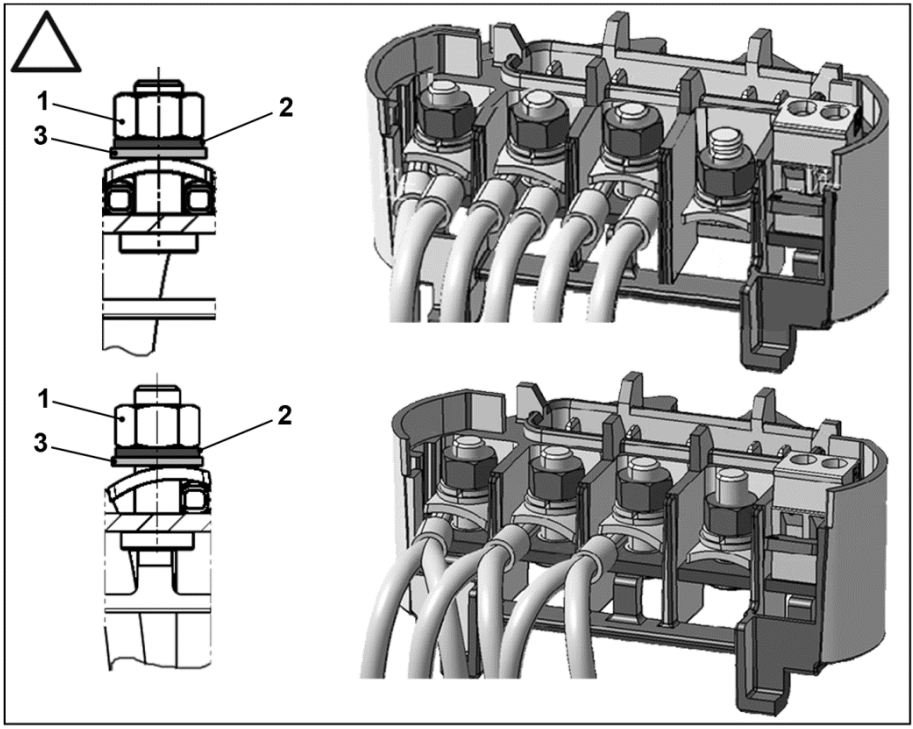


Fig. 9: Star or delta connection for the speed regulator integrated on the motor

Delta connection variant



1. Nut M_A = 5 Nm
2. Spring washer
3. Washer

HAZARD

Risk of fatal injury due to electric shock!

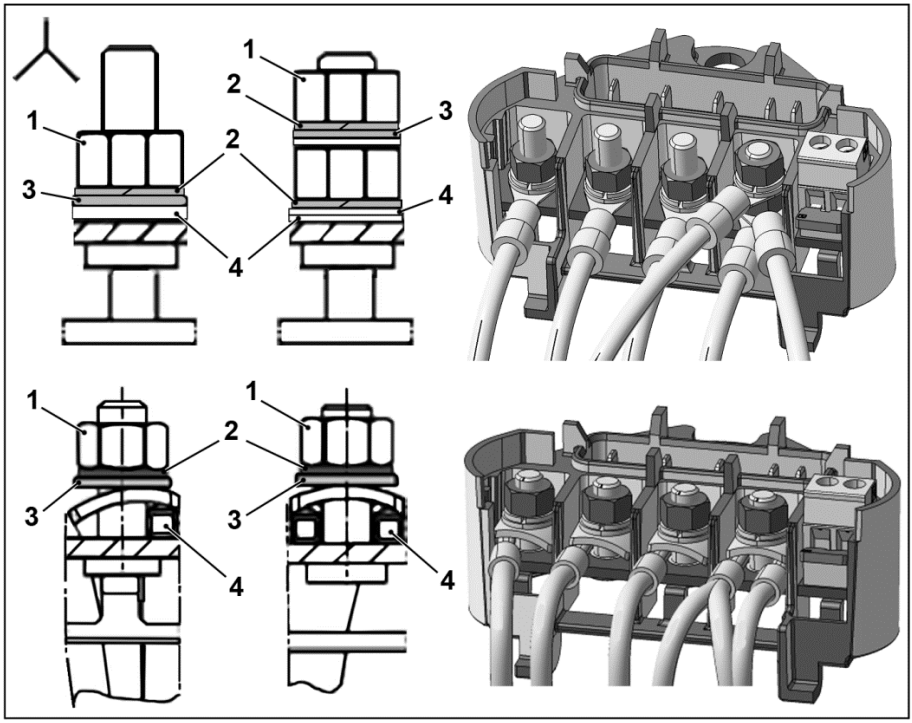
Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

IMPORTANT INFORMATION

Check regularly that the nuts are well tightened in their seat (1)!

Star connection variant



1. Nut M_A = 5 Nm
2. Spring washer
3. Washer
4. Cable terminal

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

IMPORTANT INFORMATION

Check regularly that the nuts are well tightened in their seat (1)!

Material damage is possible

Risk of damage to the speed regulator.
When connecting the speed regulator, the correct phase assignment must be observed.
Otherwise the motor can be overloaded.

With the supplied installation material, it is possible to connect terminal tips as well as cable terminals.

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

The unused open ends of cables in the motor connection boxes must be isolated.

IMPORTANT INFORMATION

If a thermal resistor is used (PTC or Klixon), the jumper must be removed that upon delivery is located in the connection terminal for the PTC.

The network cable section must be provided based on the type of installation and the maximum permitted current. The protection of the network line must be guaranteed by the technician responsible for start-up.

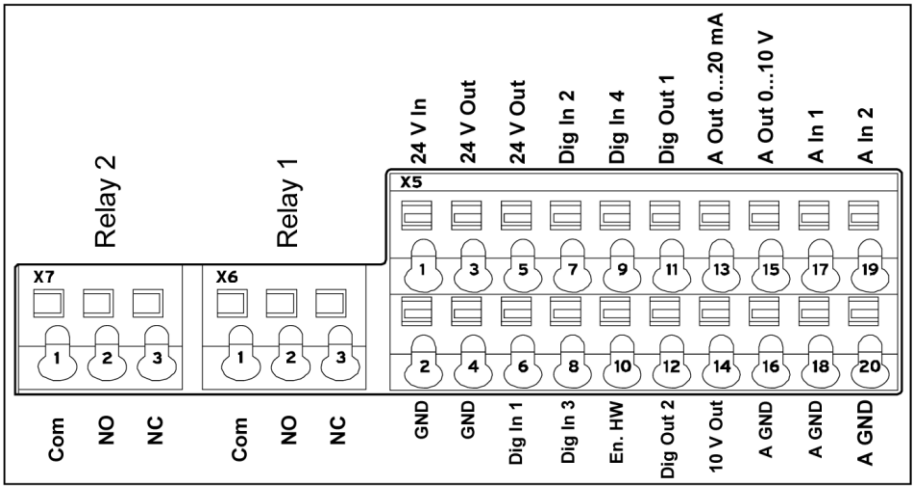
3.3.4 Protection against short circuits and ground leakage

The speed regulator has internal protection against short circuits and ground leakage.

3.3.5 Wiring instructions

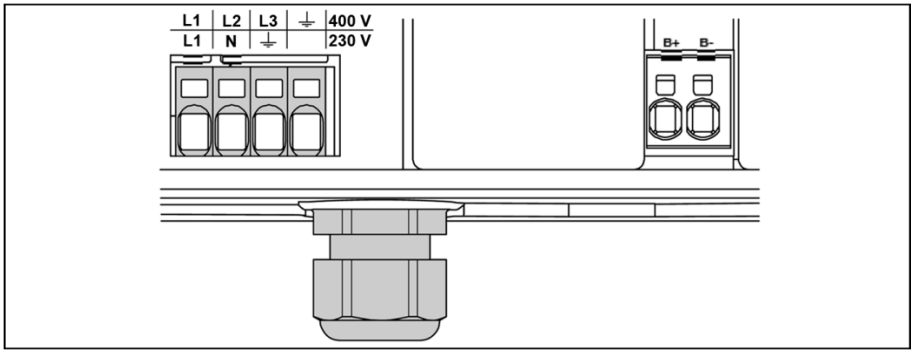
The board control connections for the applications are located inside the speed regulator. The assignment can differ depending on the version.

Control terminals (sizes A – D)



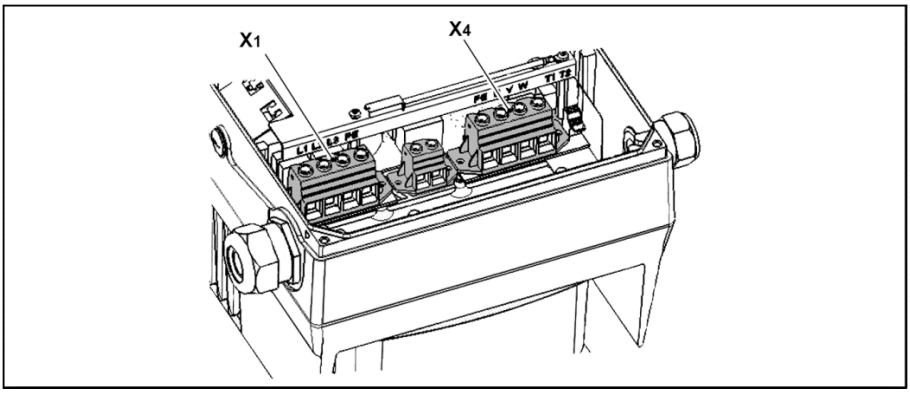
Sizes A – D		
X5 – X7	Connection terminal board:	Quick terminal connection with actuation presser (flat-head screwdriver, max. width 2.5 mm)
	Connection section:	from 0.5 to 1.5 mm², single wire, from AWG 20 to AWG 14
	Connection section:	from 0.75 to 1.5 mm², thin wire, from AWG 18 to AWG 14
	Connection section:	from 0.5 to 1.0 mm², thin wire (terminal tips with or without plastic neck)
	Stripping length:	from 9 to 10 mm

Power connections (sizes A - C)



Sizes A - C		
Network X1 + B - Brake chopper	The connection terminal boards for the network cable are located inside the speed regulator. Optionally, the DGM is equipped with terminals for connection to a brake chopper. The assignment can differ depending on the version.	
	It is recommended terminal tips with a plastic neck and tab.	
	Connection terminal board:	Spring connection (flat-head screwdriver, max. width 2.5 mm)
	Rigid conductor section	min. 0.2 mm² max. 10 mm²
	Flexible conductor section	min. 0.2 mm² max. 6 mm²
	Flexible conductor section with terminal tip without plastic sleeve	min. 0.25 mm² max. 6 mm²
	Flexible conductor section with terminal tip and plastic sleeve	min. 0.25 mm² max. 4 mm²
	2 flexible conductors with an equal section with TWIN-AEH and plastic sleeve	min. 0.25 mm² max. 1.5 mm²
	AWG/kcmil conductor section according to UL/CUL	min. 24 max. 8
	Stripping length:	15 mm
	Installation temperature:	between -5 °C and +100 °C

Power connections (size D)



Size D		
Network X1 / Motor X4 + B - Brake chopper	The connection terminal boards for the network cable are located inside the speed regulator. Optionally, the DGM is equipped with terminals for connection to a brake chopper. The assignment can differ depending on the version.	
	It is recommended terminal tips with a plastic neck and tab.	
	Tightening torques min. 2.5 Nm / max. 4.5 Nm	
	Conductor section:	Rigid min. 0.5 mm² / rigid max. 35 mm²
	Flexible conductor section:	Min. 0.5 mm² / max. 25 mm²
	Flexible conductor section with terminal tip without plastic neck	min. 1 mm² max. 25 mm²
	Flexible conductor section with terminal tips and plastic sleeve	min. 1.5 mm² max. 25 mm²
	AWG/kcmil conductor section according to UL/CUL	min 20 max. 2
	2 rigid conductors with the same section	min. 0.5 mm² max. 6 mm²
	2 flexible conductors with the same section	min. 0.5 mm² max. 6 mm²
	2 flexible conductors with an equal section with AEH without plastic sleeve	min. 0.5 mm² max. 4 mm²
	2 flexible conductors with an equal section with TWIN-AEH and plastic sleeve	min. 0.5 mm² max. 6 mm²
	AWG based on UL/CUL	min. 20 max. 2

3.3.6 Exclusion of electromagnetic disturbances

If possible, use shielded cables for the control circuits.
At the end of the cable, the shielding must be applied carefully, avoiding the presence of non-shielded wires on long segments.

Attention must be paid to eddy currents (transitory currents, etc.) by shielding the analogue cable.
Position the control lines as far as possible from the power lines. Under certain circumstances, separate power channels must be used.
In case of crossed cables, an angle of 90° must be observed.

Upstream switching element disturbances must be eliminated, such as brake coils or switching elements that are connected via the speed regulator outputs. In case of alternating voltage contactors, RC couplings are suitable. In case of direct current contactors, flyback diodes or variostors are usually used. These remedies for eliminating disturbances are applied directly on the contactor coils.

IMPORTANT INFORMATION
If possible, the power supply to a mechanical brake must be made to pass through its own separate cable.

The power connections between the speed regulator and the motor must be shielded or armed.
The shielding must be ground connected over a large area to both ends! It is recommended to use EMC cable glands. They are not included in the package.
In general, it is mandatory to provide wiring that ensures EMC.

3.4 Installation of the speed regulator integrated on a generic motor

If the inverter is ordered together with the gear motor, the assemblies are implemented by Bonfiglioli.
The operations for carrying out the assembly independently are provided below.

3.4.1 Mechanical installation of sizes A - C

Proceed as follows for the mechanical installation of the speed regulator:

1. Open the series connection box for the motor.
2. Disconnect the connection terminal board cables. Note the connection sequence.

3. If necessary, remove the motor terminal board.
4. Remove the screws fastening the connection housing and remove the latter. Be careful not to damage the gasket.

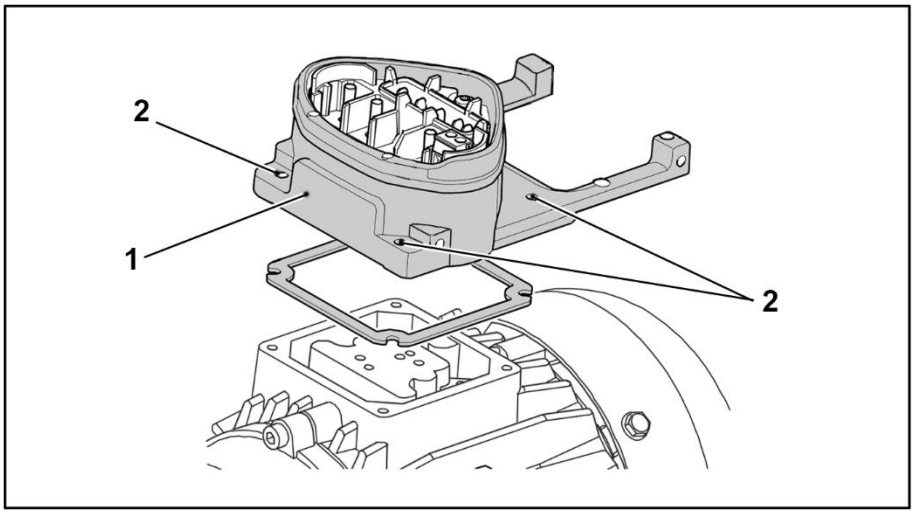


Fig. 10: Assembly sequence: Connection box - Adapter plate (sizes A - C)

INFORMATION

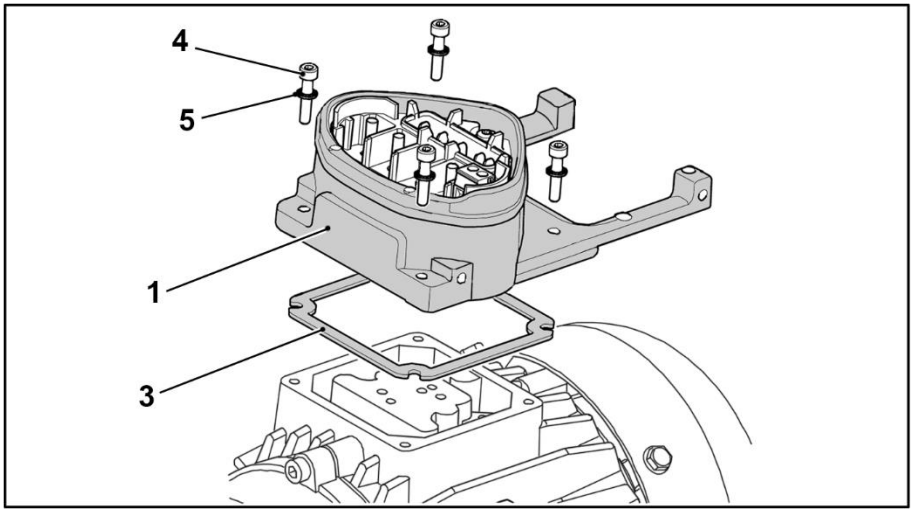
The standard adapter plate is an adapter plate whose lower part is not machined; that is holes were not made.

If the DGM is ordered together with the gear motor, the adapter plate will be machined and installed by Bonfiglioli.

5. Adapt the adapter plate (1), making the relative holes (2) in it to fasten it to the motor.

INFORMATION

The technician responsible for start-up is responsible for observing the protection class for the seal of the adapter plate on the motor.
In the case of questions, contact your contact persons at Bonfiglioli.



6. Apply the gasket (3).
7. Pass the motor connection cable to the connection terminal board through the adapter plate (1) and fasten it with the four fastening screws (4) and the four elastic motor elements (tightening torque: 2.0 Nm).

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

The speed regulator must be ground connected together with the motor, as required. Otherwise, serious or fatal injuries can result.

If spring elements (5) are not used during the installation of the adapter plate to create a correct connection to the protective conductor, a supplementary connection must be made between the motor and the speed regulator.

IMPORTANT INFORMATION

During the installation of the adapter plates, make sure that all four of the screws, including the elastic elements, are tightened with the relative torque (2 Nm)!
All contact points must be free of dirt and paint, otherwise the correct connection of the protective conductor is not guaranteed!

8. Connect the motor cables according to the correct wiring, (torque: 5.0 Nm). It is recommended to use isolated M5 eyelet terminals with a 4 to 6 mm^2 section.

IMPORTANT INFORMATION

During installation of the motor cables, make sure that all of the terminal board bolts have the supplied nuts applied, even if the star point is not connected!

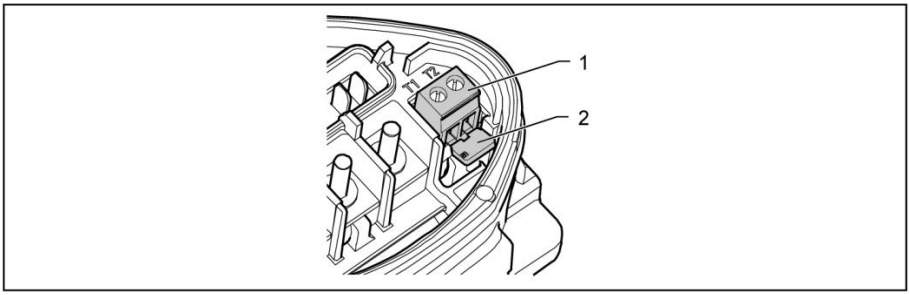
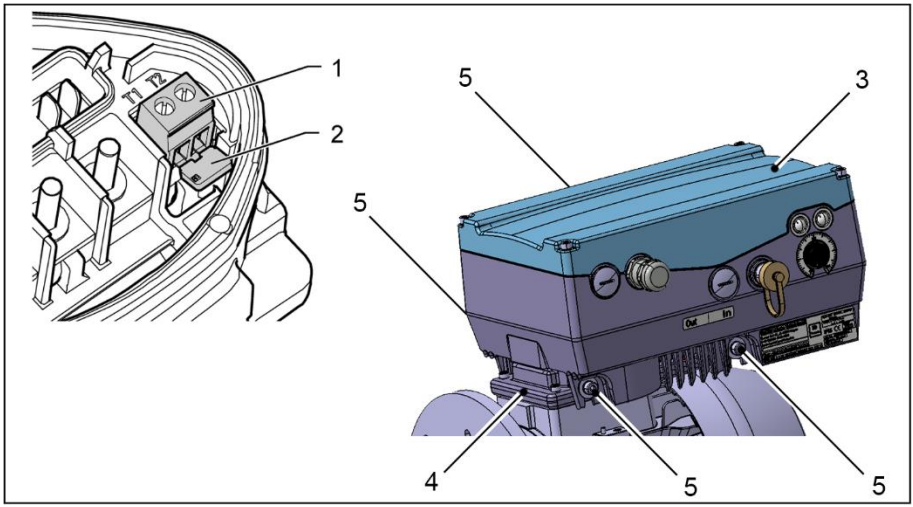


Fig. 11: Jumper

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

IMPORTANT INFORMATION

During installation, be careful not to crush the connection cables!



IMPORTANT INFORMATION

If the motor has a temperature sensor, it must be connected to terminals T1 and T2 (1).
For this purpose, remove the jumper inserted when initially supplied (2).
If the jumper remains inserted, the motor temperature will not be monitored!
Only PTC motors that comply with DIN 44081/44082 can be connected!

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Risk of fatal injury due to electric shock!
Fatal or serious injuries!

The speed regulator must be ground connected together with the motor, as required. Otherwise, this can cause fatal or serious injuries.

10. Engage the speed regulator (3) in the adapter plate (4) and fasten it regularly with the four side screws (5) (sizes A – C) (torque: 4.0 Nm).

3.4.2 Mechanical installation of size D

Proceed as follows for the mechanical installation of the speed regulator:

1. Open the series connection box for the motor.
2. Remove the screws fastening the connection housing and remove the latter.

Material damage is possible

Be careful not to damage the gasket.

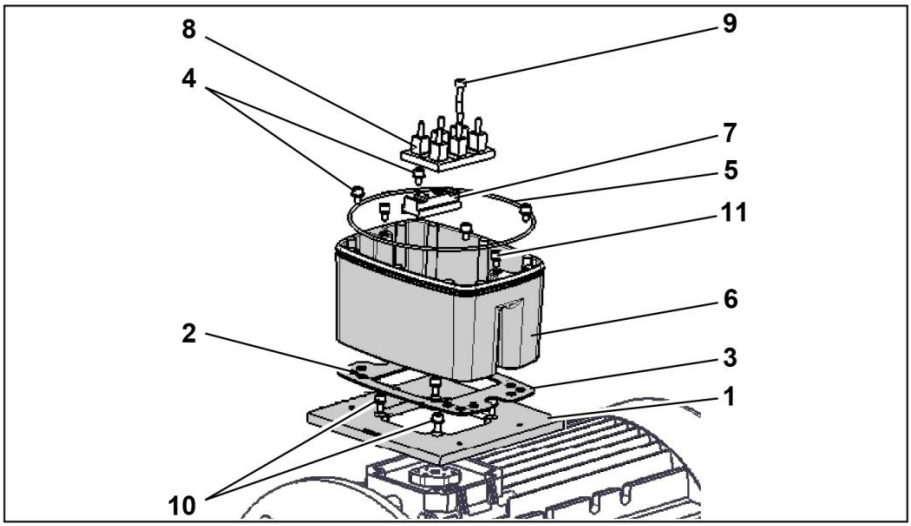


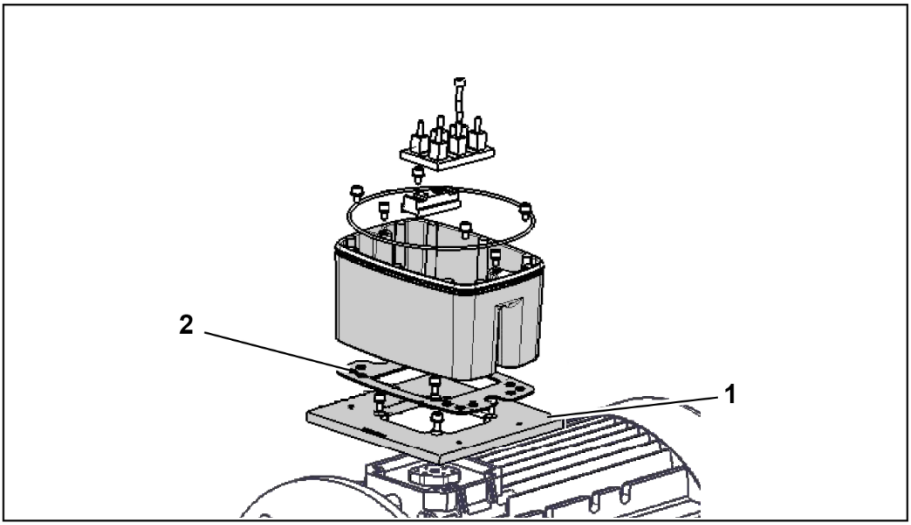
Fig. 12 Assembly sequence: Connection box - Adapter plate size D

Key			
1	Optional adapter plate (variant)	**7**	Optional terminal board extension
2	Holes in correspondence of the motor	**8**	Original terminal board (not included in the package)
3	Gasket	**9**	Optional long screw (for pos.7)
4	Fastening screws with elastic elements	**10**	Optional fastening screws with elastic elements
5	O-ring	**11**	DGM/support fastening screws
6	Adapter plate/DGM support		

INFORMATION

The standard adapter plate is an adapter plate whose lower part is not machined; that is holes were not made.

If the DGM is ordered together with the gear motor, the adapter plate will be machined and installed by Bonfiglioli.



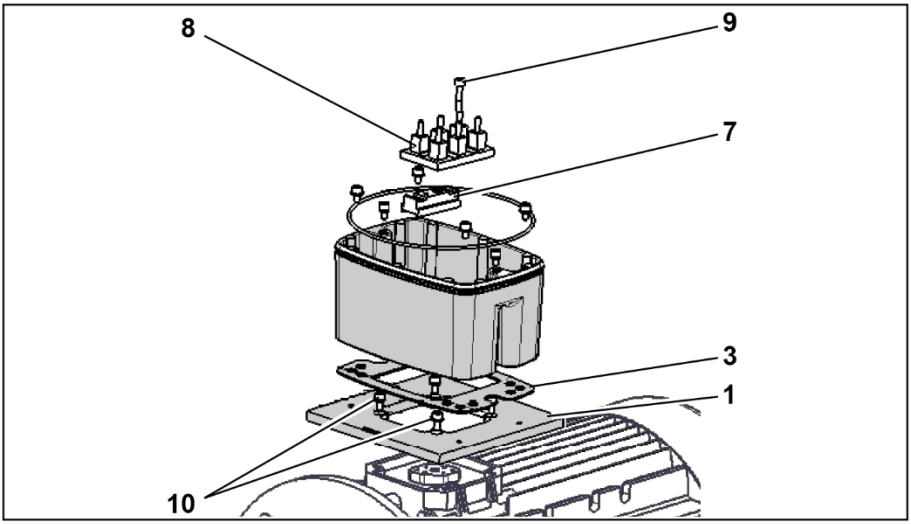
3. Adapt the adapter plate (1), making the relative holes (2) in it to fasten it to the motor.

IMPORTANT INFORMATION

It is very important for there to be a proper sealed closure between the adapter plate and the motor in order to comply with the protection class.

The technician responsible for start-up is exclusively responsible for this.

In the case of questions, contact your contact persons at Bonfiglioli.

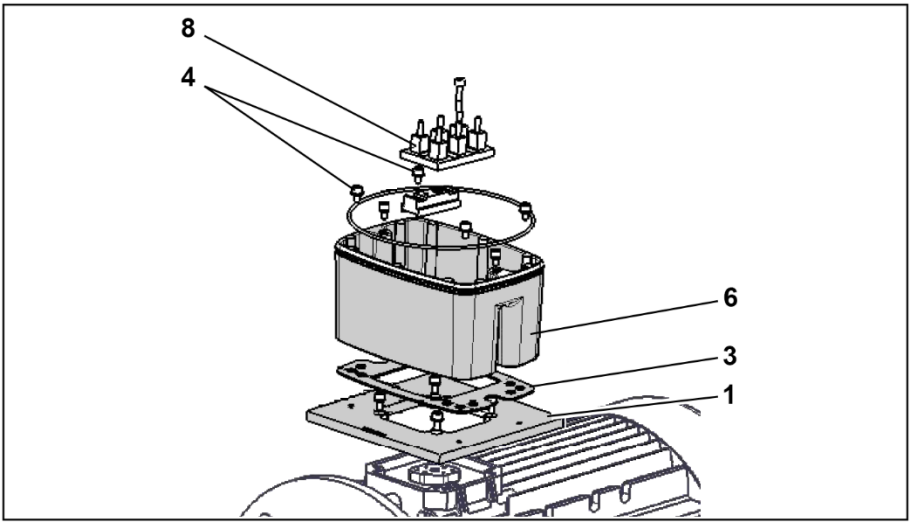


4. Apply the gasket (3).
5. Tighten the adapter plate (1) with the four fastening screws (10) and the four elastic elements, on the motor
   (torque: M4 with 2.4 Nm, M5 with 5.0 Nm, M6 with 8.5 Nm).

IMPORTANT INFORMATION

During the installation of the adapter plate (1), pay attention that all four of the fastening screws (10), including the elastic elements, are tightened with the relative torque!
All contact points must be free of dirt and paint, otherwise a correct connection of the protective conductor is not guaranteed!

6. Fasten the original terminal board (8) on the motor, using the optional terminal board extension (7) and the optional long screws (9) as an aid if necessary.



7. Connect the four cables (PE, U, V, W) with the relative section (depending on the power of the utilized DGM), to the original terminal board (8).

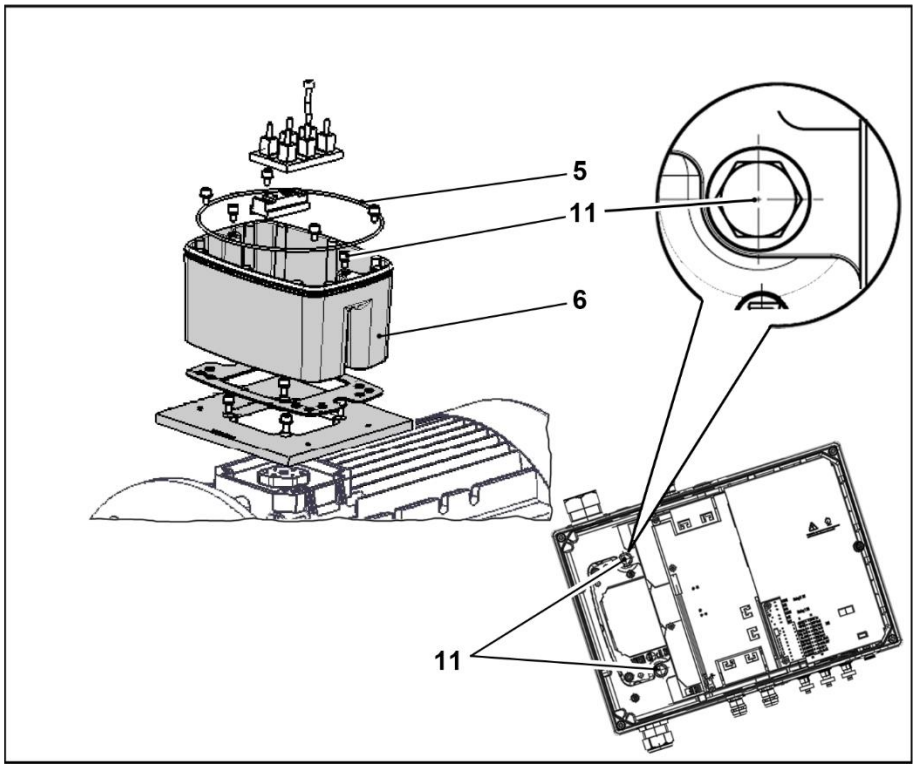
IMPORTANT INFORMATION

The connection cables (approx. 30 cm) needed for wiring the motor/DGM terminal board are not included in the package!

INFORMATION

Check that the gasket (3) is well housed in its seat!

8. Tighten the support (6) on the adapter plate (1) with four fastening screws (4), including the elastic elements (torque: 8.5 Nm).



9. Pass the four cables (PE, U, V, W) through the DGM support.

IMPORTANT INFORMATION

Check that the O-ring (5) is well housed in its seat!

10. Carefully engage the speed regulator on the support (6) and fasten it uniformly with the two M8 screws (11) (torque: max. 25.0 Nm).

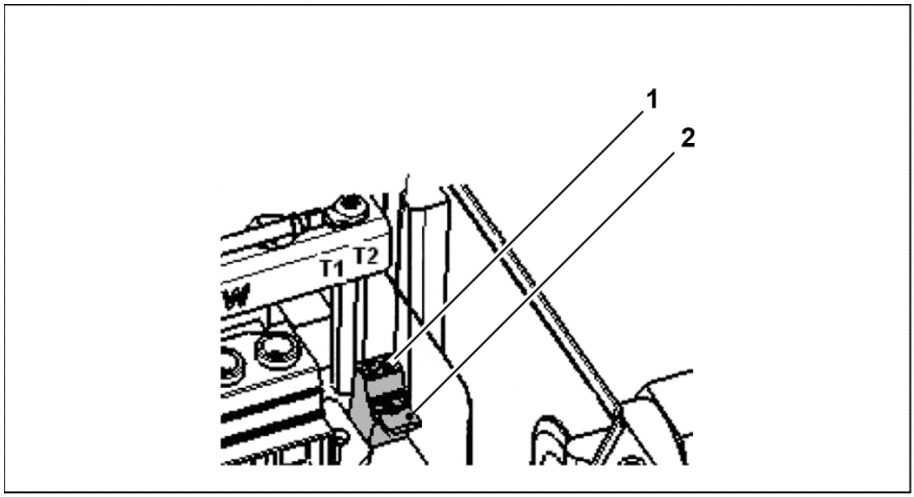


Fig. 13: Jumper

IMPORTANT INFORMATION

During installation, be careful not to crush the connection cables!

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

IMPORTANT INFORMATION

If the motor has a temperature sensor, it must be connected to terminals T1 and T2 (1).

For this purpose, remove the jumper inserted when initially supplied (2).

If the jumper remains inserted, the motor temperature will not be monitored!

3.4.3 Power connection for sizes A - C

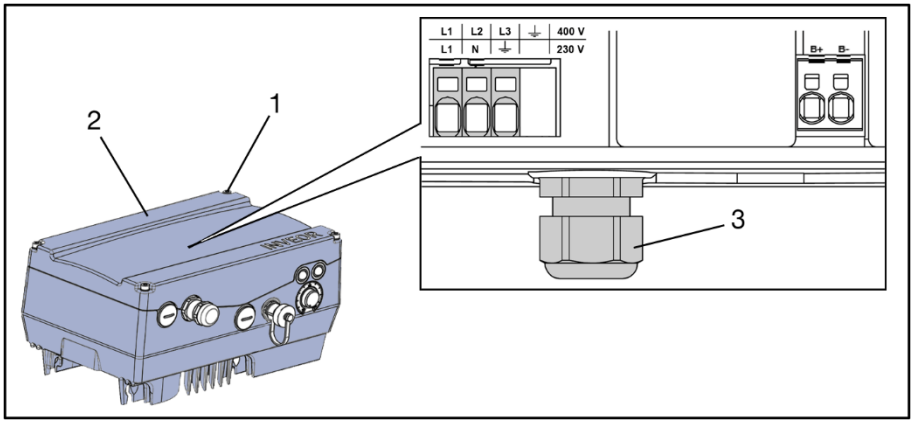


Fig. 14: Power connection sizes A – C

IMPORTANT INFORMATION
If connecting a brake chopper to an optional brake resistor, use shielded cables with double insulation!

HAZARD

Risk of fatal injury due to electric shock!

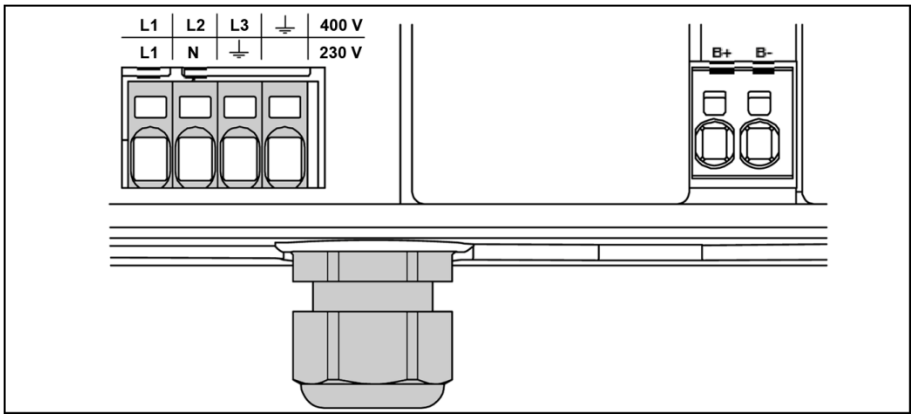
Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

1. Unscrew the four screws (1) on the housing cover (2) of the speed regulator and remove the cover.
2. Pass the connection cable to the network through the cable gland (3).
3. Connect the cables in the connection terminal board as follows:

230 V connection		
L1	N	PE

400 V connection			
L1	L2	L3	PE

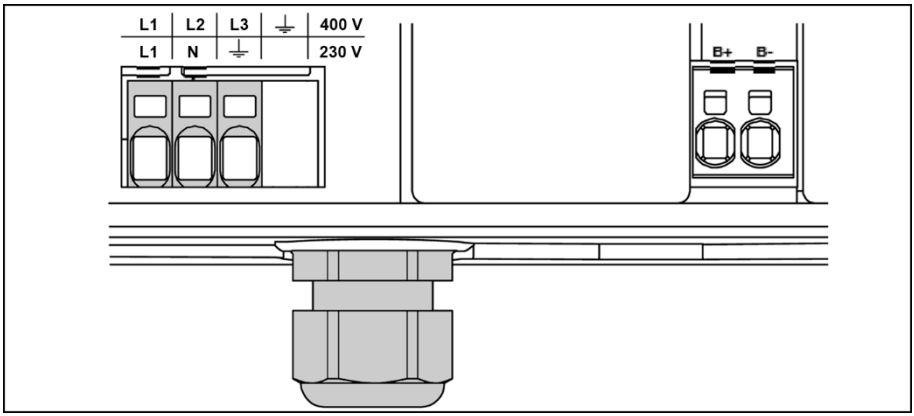


Terminal no.	Name	Assignment
1	L1	Network phase 1
2	L2	Network phase 2
3	L3	Network phase 3
4	PE	Protective conductor

Table 3: Terminal assignment X1 - 3 x 400 Vac

Terminal no.	Name	Assignment
1	L1	DC (+) 565 V network
2	L2	Not assigned
3	L3	DC (-) network
4	PE	Protective conductor

Table 4: Terminal assignment X1 - DC power supply from 250 to 750 V



Terminal no.	Name	Assignment
1	L1	Network phase 1
2	N	Neutral conductor
3	PE	Protective conductor

Table 5: Terminal assignment X1 - 1 x 230 Vac

Terminal no.	Name	Assignment
1	L1	DC (+) 325 V network
2	N	DC (-) network
3	PE	Protective conductor

Table 6: Terminal assignment X1 - DC power supply from 120 to 350 V

3.4.4 Power connection size D

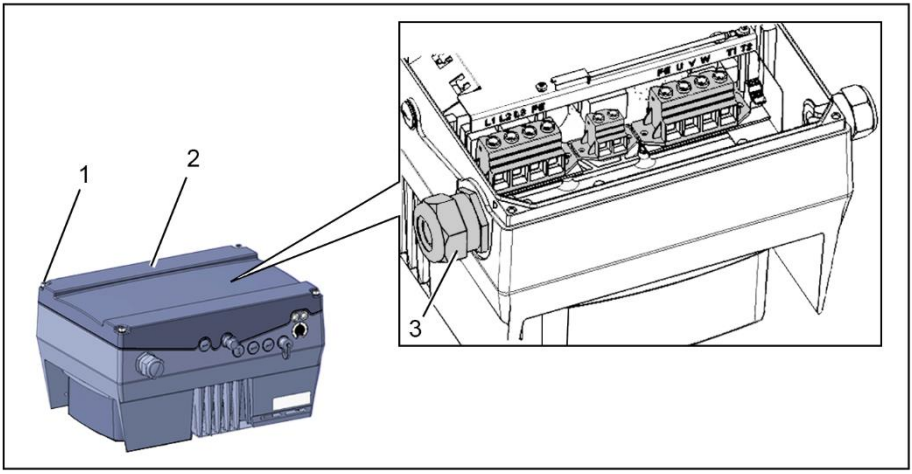


Fig. 15: Power connection size D

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the device and secure it to prevent it from being reconnected.

1. Unscrew the four screws (1) on the housing cover (2) of the speed regulator and remove the cover.
2. Pass the connection cable to the network through the cable glands (3).

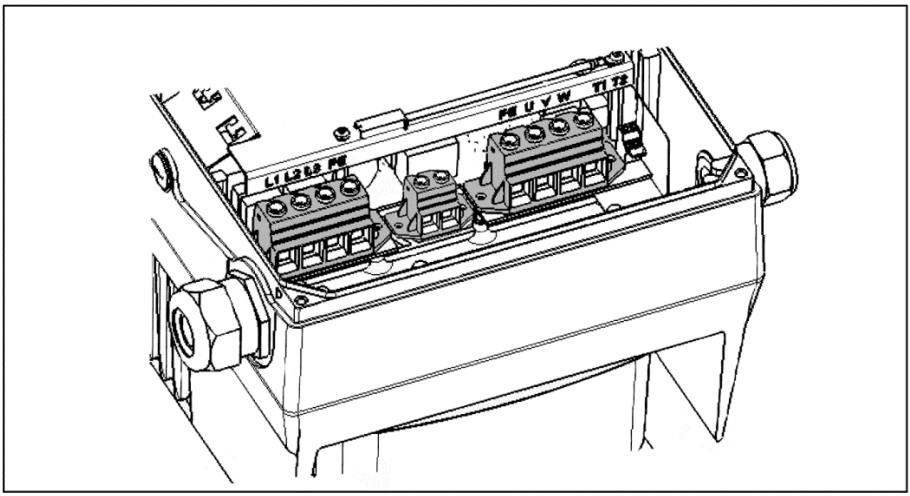
IMPORTANT INFORMATION

The cable gland is used to lighten the traction; the PE connection cable must be connected in advance (significantly longer)!

3. Connect the cables in the connection terminal board as follows:

400 V connection			
L1	L2	L3	PE

The protective conductor must be connected to the "PE" contact.

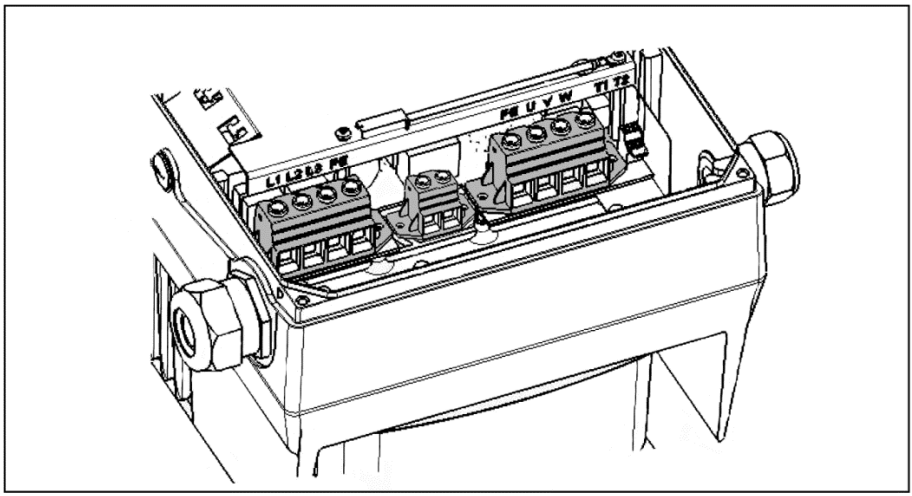


IMPORTANT INFORMATION

If connecting a brake chopper to an optional brake resistor, use shielded cables with double insulation!

Terminal no.	Name	Assignment
1	L1	Network phase 1
2	L2	Network phase 2
3	L3	Network phase 3
4	PE	Protective conductor

Table 7: Terminal assignment X1 - 3 x 400 Vac



Terminal no.	Name	Assignment
1	L1	DC (+) 565 V network
2	L2	Not assigned
3	L3	DC (-) network
4	PE	Protective conductor

Table 8: Terminal assignment X1 - DC power supply from 250 to 750 V

Terminal no.	Name	Assignment
1	PE	Protective conductor
2	U	Motor phase 1
3	V	Motor phase 2
4	W	Motor phase 3

Table 9: Motor connection assignment X4

3.4.5 Brake chopper connections

Terminal no.	Name	Assignment
1	B +	Brake chopper connection (+)
2	B -	Brake chopper connection (-)

Table 10 Assignment of the optional brake chopper terminals

3.4.6 Control connections X5, X6, X7

Control connections for the standard application board

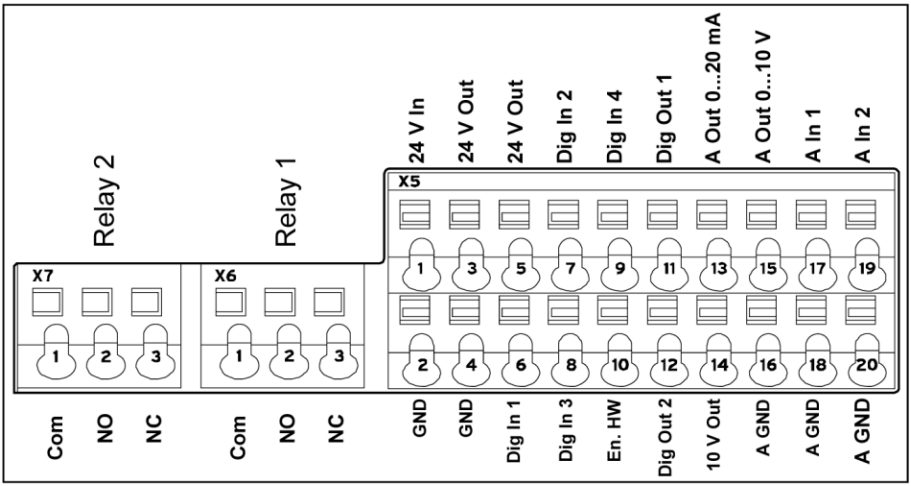


Fig. 16: Control connections for the standard application board

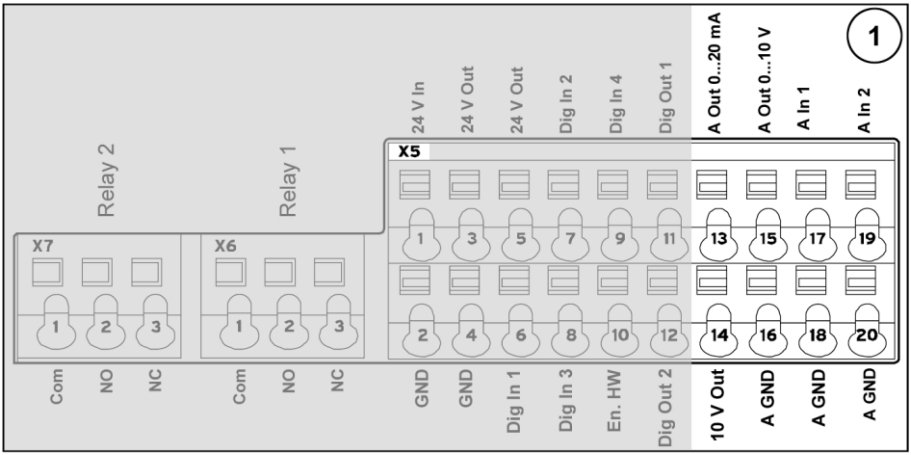
IMPORTANT INFORMATION

Risk of external signal input.

Only use shielded control lines!

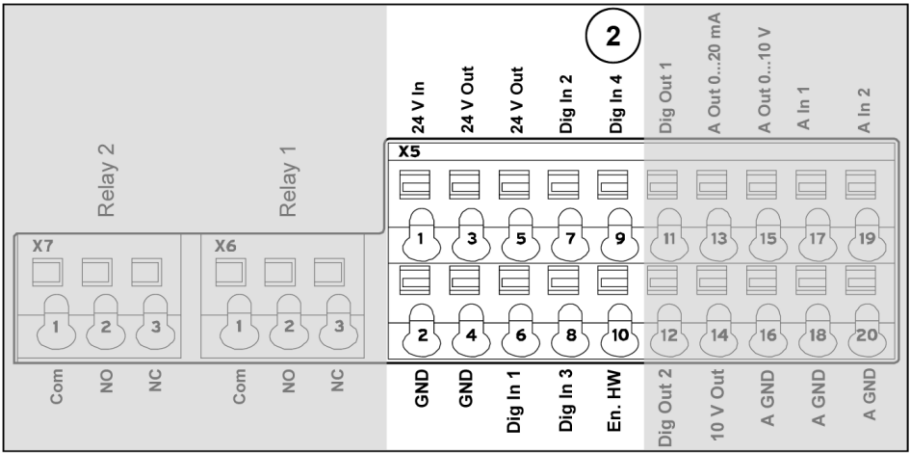
1. Insert the necessary control line through the cable glands into the housing.
2. Connect the control lines in compliance with the figure and/or table. Use shielded control lines for this purpose.
3. Connect the cover on the speed regulator housing and tighten it with the following torque:

Size	Tightening torque
A - C	2 Nm (4 x M4 x 28)
D	4 Nm (4 x M6 x 28)

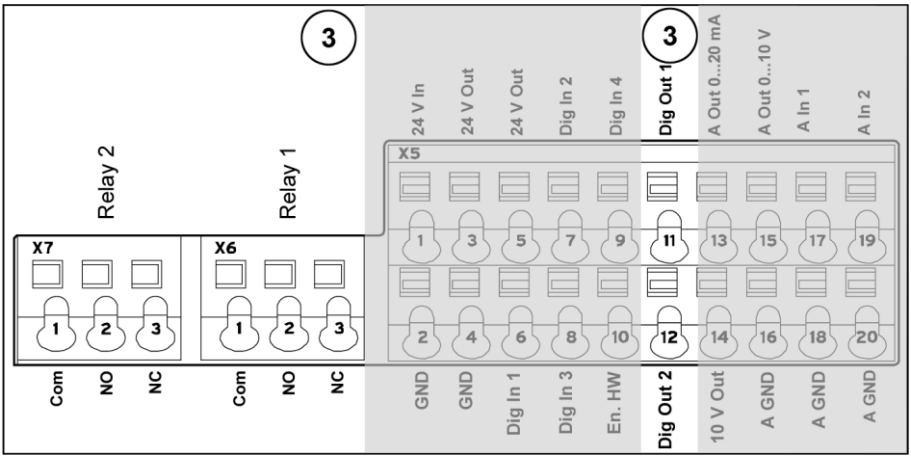


Terminal no.	Name	Assignment
13	A. Out 0 … 20 mA	Actual frequency value (parameter 4.100)
14	10 V Out	For external.
15	A. Out 0 … 10 V	Actual frequency value (parameter 4.100)
16	A GND (Ground 10 V)	Ground
17	A. In 1	Actual PID value (parameter 3.060)
18	A GND (Ground 10 V	Ground
19	A. In 2	free (not assigned)
20	A GND (Ground 10 V)	Ground

Table 11: Terminal assignments X5 of the standard application board



Terminal no.	Name	Assignment
1	24 V In	External power supply voltage
2	GND (Ground)	Ground
3	24 V Out	Internal power supply voltage
4	GND (Ground)	Ground
5	24 V Out	Internal power supply voltage
6	Dig. In 1	Reference value enabling (parameter 1.131)
7	Dig. In 2	free (not assigned)
8	Dig. In 3	free (not assigned)
9	Dig. In 4	Error reset (parameter 1.180)
10	En-HW (enabling)	Hardware enabling



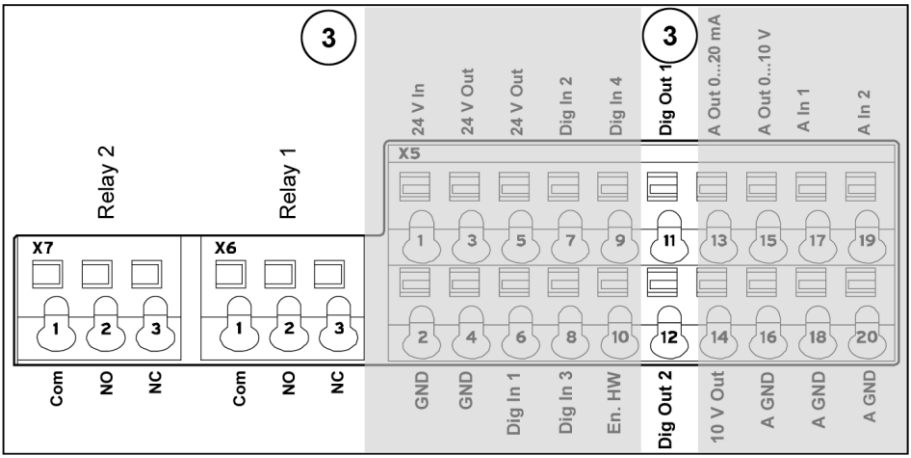
Terminal no.	Name	Assignment
11	Dig. Out 1	Error message (parameter 4.150)
12	Dig. Out 2	free (not assigned)

X6 Relay 1

Terminal no.	Name	Assignment
1	COM	Central contact relay 1
2	NO	Closing contact relay 1
3	NC	Opening contact relay 1

Table 12: Terminal assignment X6 (relay1)

INFORMATION
In the factory settings, relay 1 is programmed as the “error relay” (parameter 4.190).



X7 Relay

Terminal no.	Name	Assignment
1	COM	Central contact relay 2
2	NO	Closing contact relay 2
3	NC	Opening contact relay 2

Table 13: Terminal assignment X7 (relay2)

INFORMATION
In the factory settings, “no function” is assigned to relay 2 (parameter 4.210).

Control connections for the basic application board

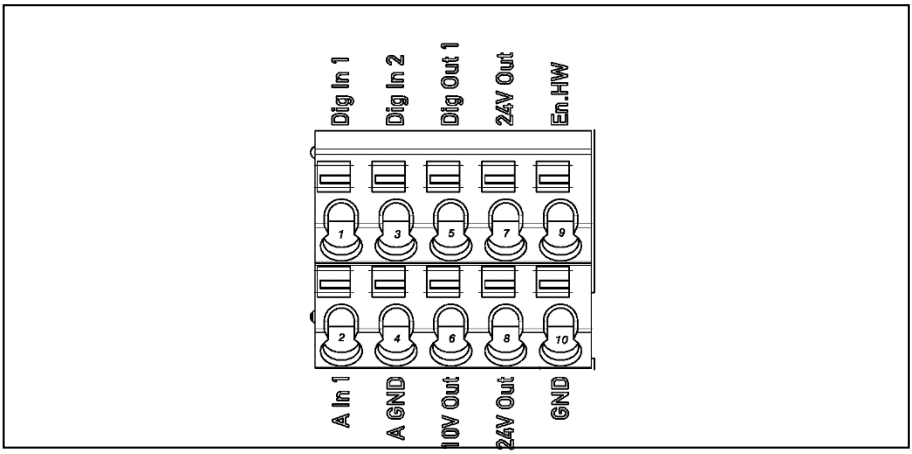


Fig. 17: Control connections for the basic application board

Terminal no.	Name	Assignment
1	Dig. In 1	Reference value enabling (parameter 1.131)
2	A. In 1	free (not assigned)
3	Dig. In 2	free (not assigned)
4	A GND (Ground 10 V)	Ground
5	Dig. Out	Error message (parameter 4.150)
6	10 V Out	For external
7	24 V Out	Internal power supply voltage
8	24 V Out	Internal power supply voltage
9	En-HW (enabling)	Hardware enabling
10	GND (Ground)	Ground

3.4.7 Connection diagram

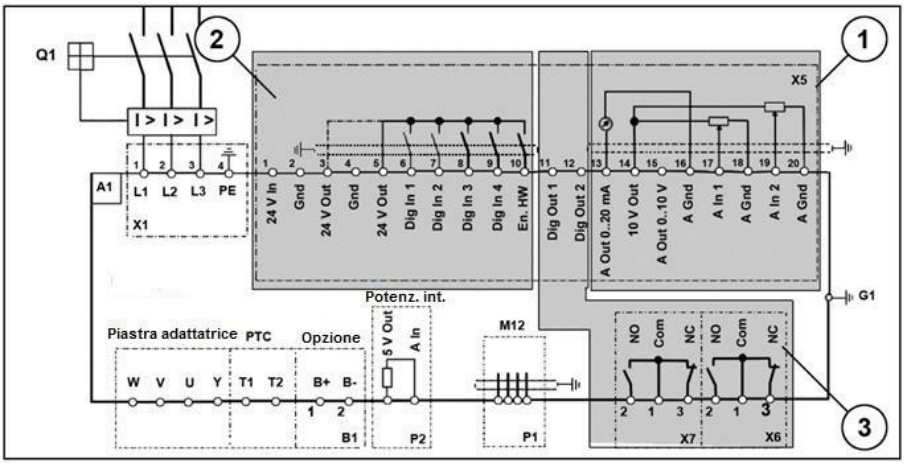


Fig. 18: Control connections

Abbreviation	Explanation
A1	Speed regulator type: DGM (3 x 400 Vac)
B1	Connection for external brake chopper (optional)
G1	M6 – Ground connection crew (connection for fault currents> 3.5 mA)
P1	RS485 programming interface (connector M12)
P2	Internal potentiometer
Q1	Motor protection or on-load switch (optional)
X1	Network connection terminal board
X5 – X7	Digital/analog inputs and outputs

After connecting the network power supply 3 x 400 Vac (to terminals L1 to L3) or 565 Vdc (to terminals L1 and L3), the speed regulator is ready for use.

Alternatively, it is possible to start the speed regulator by connecting an external voltage of 24 Vdc.

3.5 Wall-mounted installation of the speed regulator

3.5.1 Location suitable for the wall-mounted installation

Make sure that the location for the wall-mounted installation of a DGM satisfies the following conditions:

- The speed regulator must be mounted on a flat, stable surface.
- The speed regulator must be mounted only on non-flammable bases.
- There must be a free space of at least 200 mm around the speed regulator to guarantee free convection.

The following images show the mounting measurements and the minimum distances necessary for installing the speed regulator.

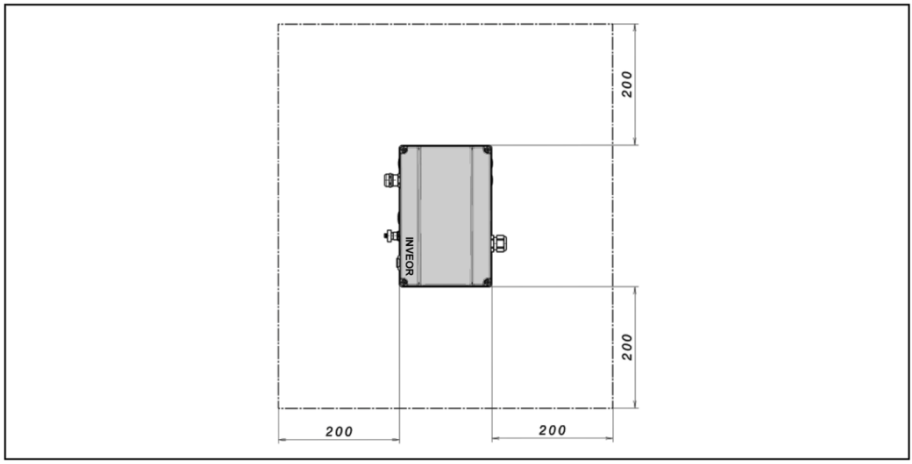


Fig. 19: Minimum distances

In the variant "wall-mounted installation", the following maximum power cable lengths are permitted between the motor and the DGM:

DGM size	Maximum shielded length	Maximum non-shielded length
A	5 m	5 m
B	5 m	5 m
C	20 m	100 m
D	20 m	100 m

(exception, see chapter “EMC limit value classes”)

IMPORTANT INFORMATION
Use only shielded cables with the section necessary.
A PE connection must be made (below the wall adapter terminal board)!

3.5.2 Mechanical installation sizes A - C

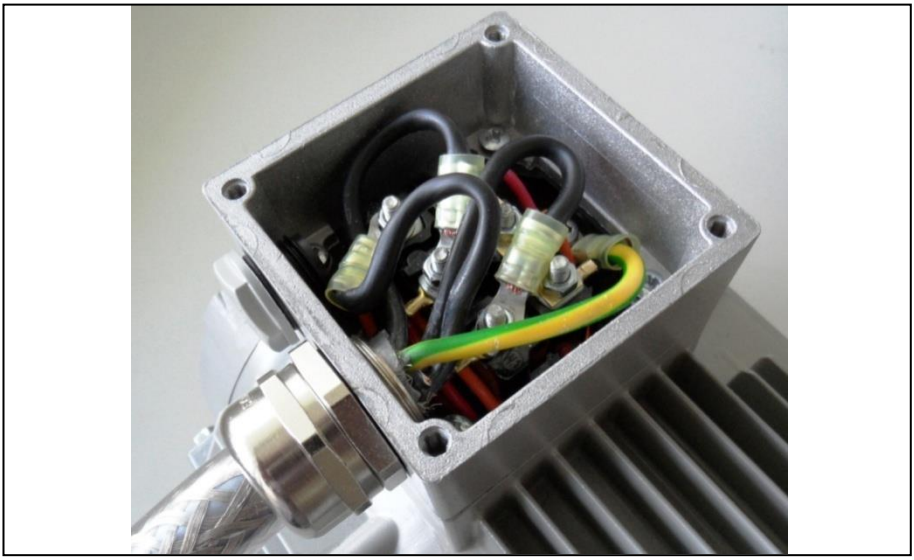


Fig. 20: Wiring in the motor connection box

1. Open the motor connection box.

IMPORTANT INFORMATION

Depending on the desired voltage in the motor, a star or delta connection must be made in the motor connection box!

2. Use the appropriate EMC screw connections to connect the shielded motor cable to the motor connection box,!
   Make sure that the shielding contact is implemented properly (large surface area)!
3. Connect the prescribed PE connection in the motor connection box!
4. Close the motor connection box.

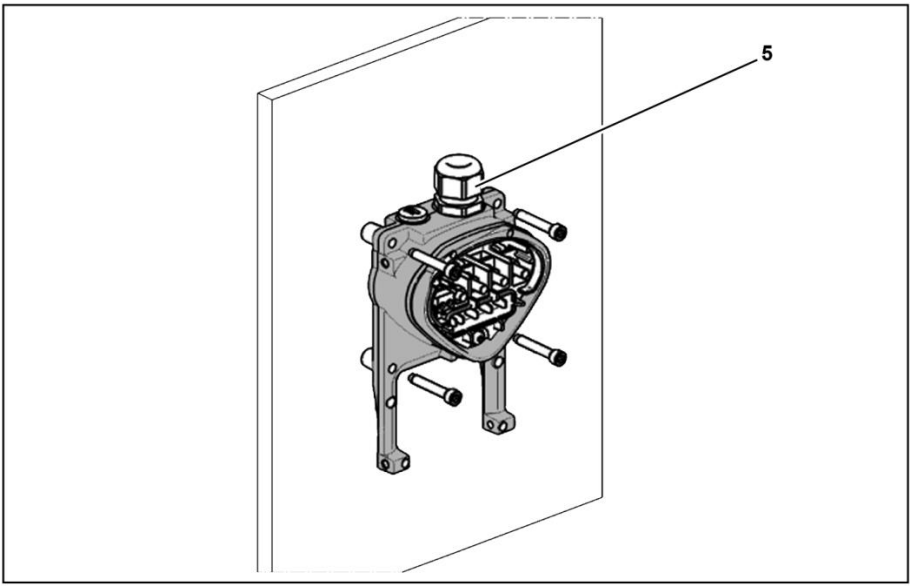


Fig. 21: Fastening the adapter plate to the wall

IMPORTANT INFORMATION

The speed regulator must not be mounted without an adapter plate!

- Identify a position that complies with the required ambient conditions described in the chapter "**Installation requirements**".
- To obtain optimal convection for the speed regulator, pay attention during installation to the position of the screw connection (EMC) (5): it must face upward.
- Only vertical installation is permitted if the DGM does not have supplementary ventilation.

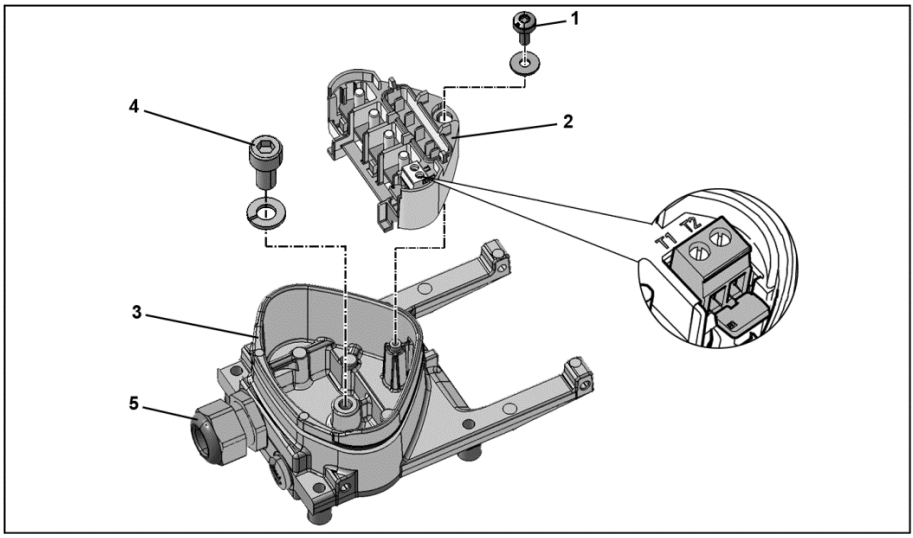


Fig. 22: Wiring

1. Unscrew the screw (1) to disconnect the terminal board (2) from the adapter plate (3). The PE union is located below the terminal board (M6 x 12) (4).
2. Insert the motor connection cable in the adapter plate (3) through the integrated EMC screw (5).
3. This PE union (torque: 4.0 Nm) must be connected with the same motor ground potential. The section of the potential compensation conductor must correspond at least to the section of the network connection cable.

HAZARD

Risk of fatal injury due to moving mechanical components!

Fatal or serious injuries!

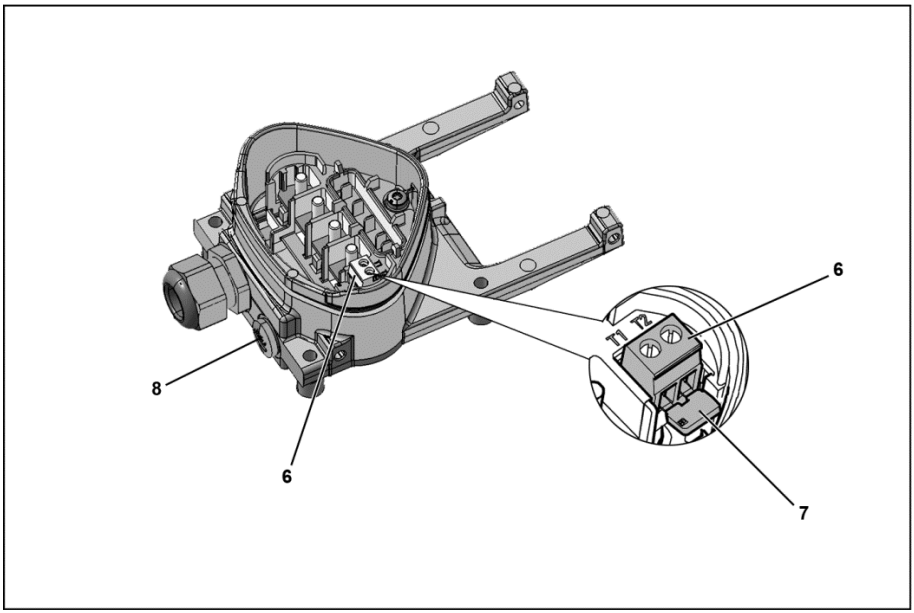
The speed regulator must be connected to the ground with the motor, as required.

The PE connection between the motor and the speed regulator must be made using the Allen screw (4) and the compressed spring washer included in the adapter plate supply (3).

4. Reinsert the terminal board (2) in the adapter plate (3).
5. Fix the terminal board (2) with the screw (1) (torque: 1.2 Nm).

INFORMATION

After fastening the terminal board (2), makes sure that it is supported in floating mode.



6. Wire the motor cables with contacts U, V, W (under certain circumstances, also the star point) in the connection terminal board, as described in the chapter "**Fundamental connection variants**". Use cable terminal (M5) for this purpose.
7. Before connecting a motor PTC to terminals T1 and T2 (6), remove the jumper that was pre-installed to prevent short circuits (7).

HAZARD

Risk of fatal injury due to moving mechanical components!

Fatal or serious injuries!

After connecting the DGM, the motor has potential energy.

Therefore, the connection must be made using a separate line, with insulation suitable for the motor cable!

Only PTCs for motors that comply with DIN 44081/44082 can be connected!

For this purpose, replace the blind union (8) with a suitable standard cable gland and connect both ends to T1 and T2 (6).

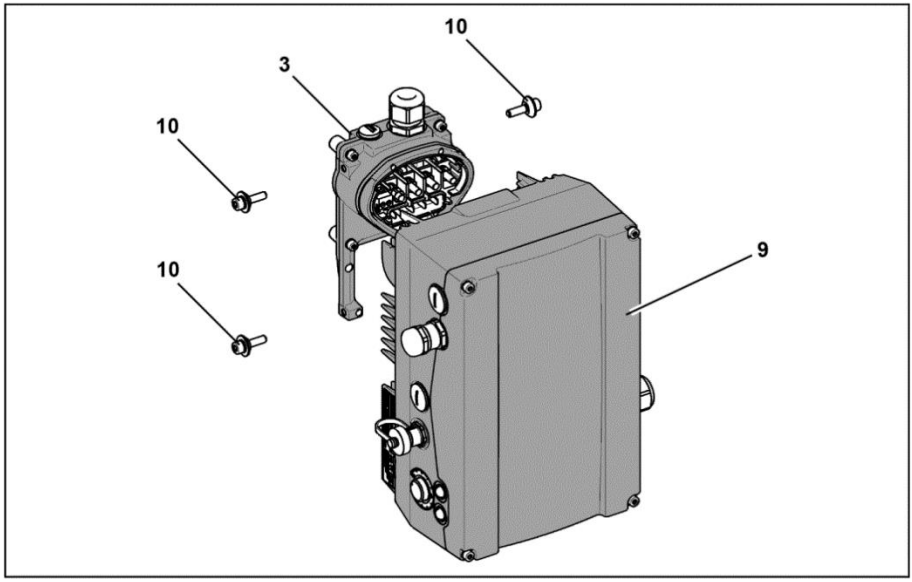


Fig. 23: Installing the speed regulator

8. Place the speed regulator (9) on the adapter plate (3) such that the adapter neck enters in the opening at the base of the heat dissipator.
9. Fasten the speed regulator (9) using the provided screws (10) on the adapter plate (3) (torque: 4.0 Nm).

3.5.3 Mechanical installation size D

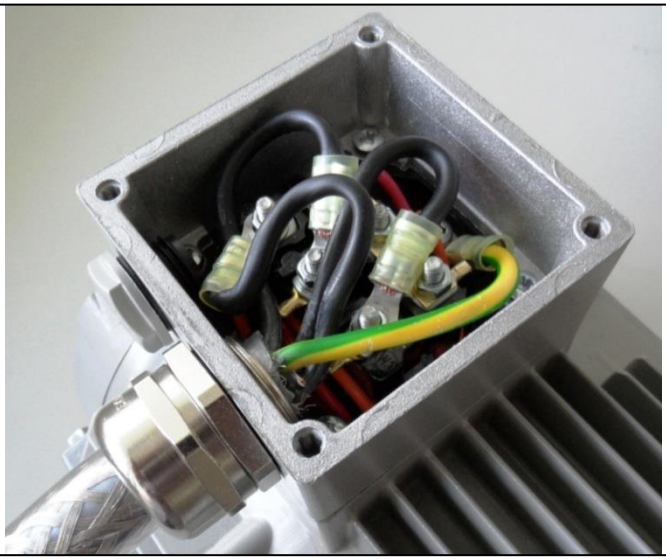


Fig. 24: Wiring in the motor connection box

1. Open the motor connection box.

IMPORTANT INFORMATION

Depending on the desired voltage in the motor, a star or delta connection must be made in the motor connection box!

2. Use the appropriate EMC screw connections to connect the shielded motor cable to the motor connection box,!
   Make sure that the shielding contact is implemented properly (large surface area)!
3. Connect the prescribed PE connection in the motor connection box!
4. Close the motor connection box.

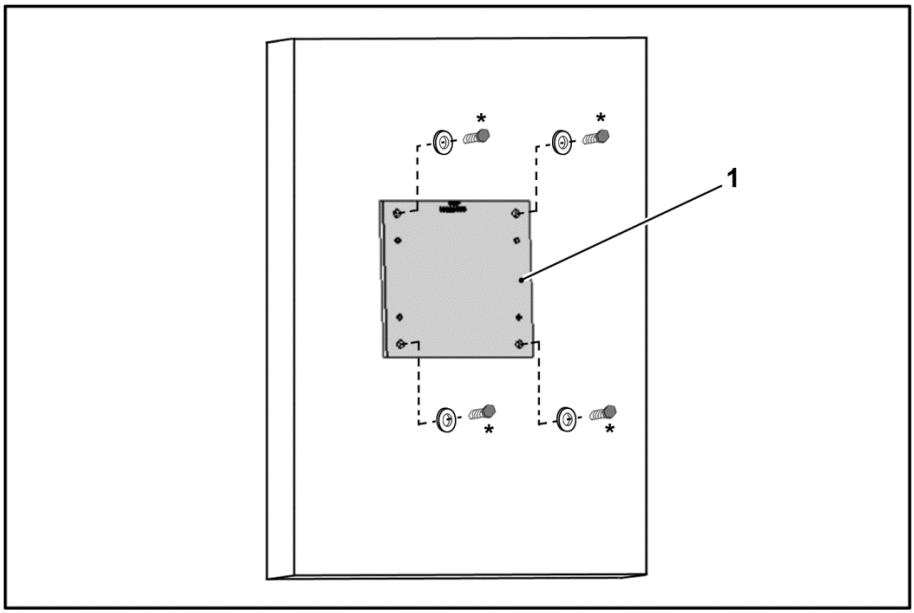


Fig. 25: Fastening the adapter plate size D to the wall

IMPORTANT INFORMATION

The speed regulator must not be mounted without an adapter plate (1)!

- Identify a position that complies with the required ambient conditions described in the chapter "Installation requirements".

5. Mount the adapter plate (1) with four screws***** on the wall.

*** The screws are not included in the scope of delivery.**

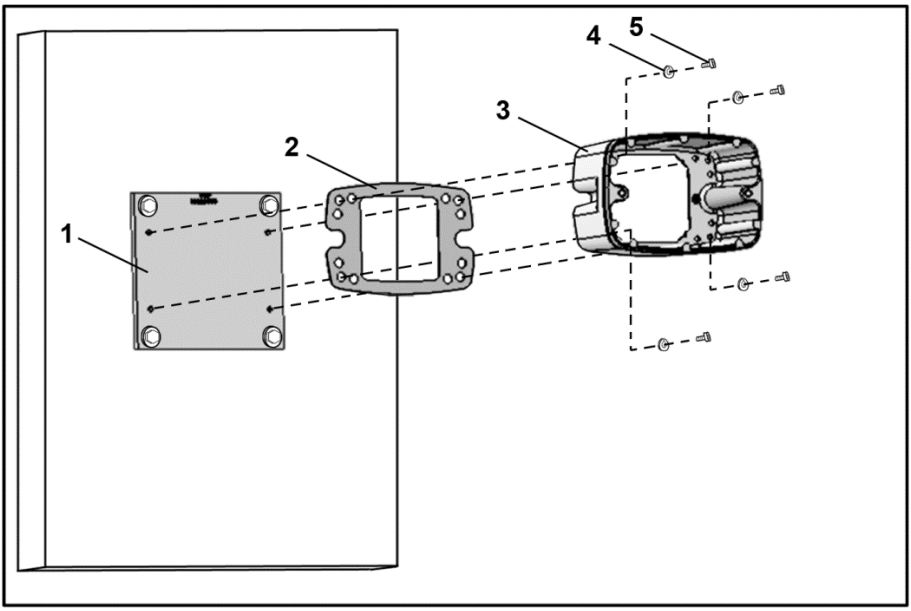


Fig. 26: Fastening the size D support on the adapter plate

6. Install the gasket (2) together with the support (3) on the adapter plate (1).
   For this purpose, use the fastening screws (5) included in the scope of delivery with the spring elements (4) (torque 8.5 Nm).

IMPORTANT INFORMATION

Check that the gasket (2) is well housed in its seat!

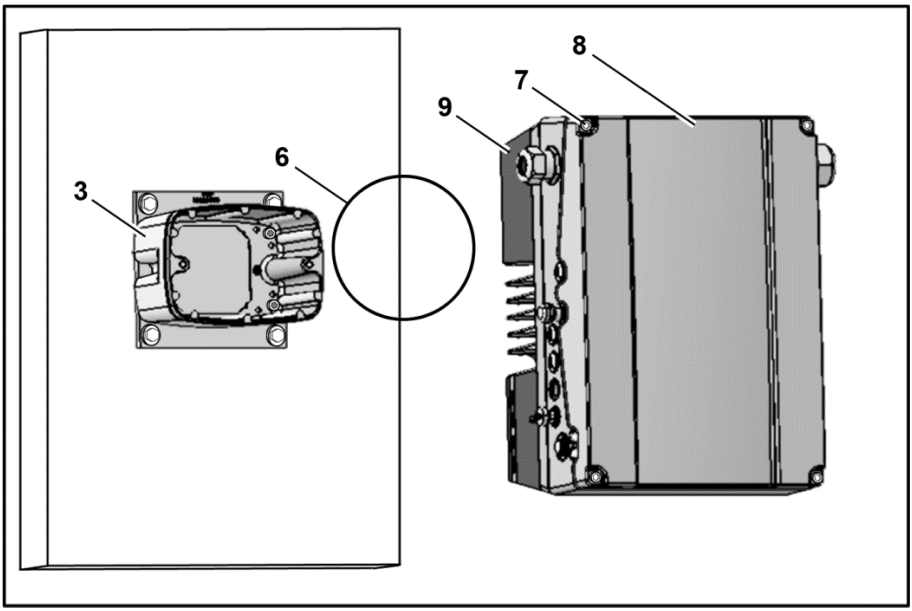


Fig. 27: Using the size D o-ring

7. Set the o-ring (6) in the groove of the support (3).

IMPORTANT INFORMATION

Check that the O-ring (6) is well housed in its seat!

8. Unscrew the four screws (7) from the cover (8) of the speed regulator (9).
9. Remove the cover (8).

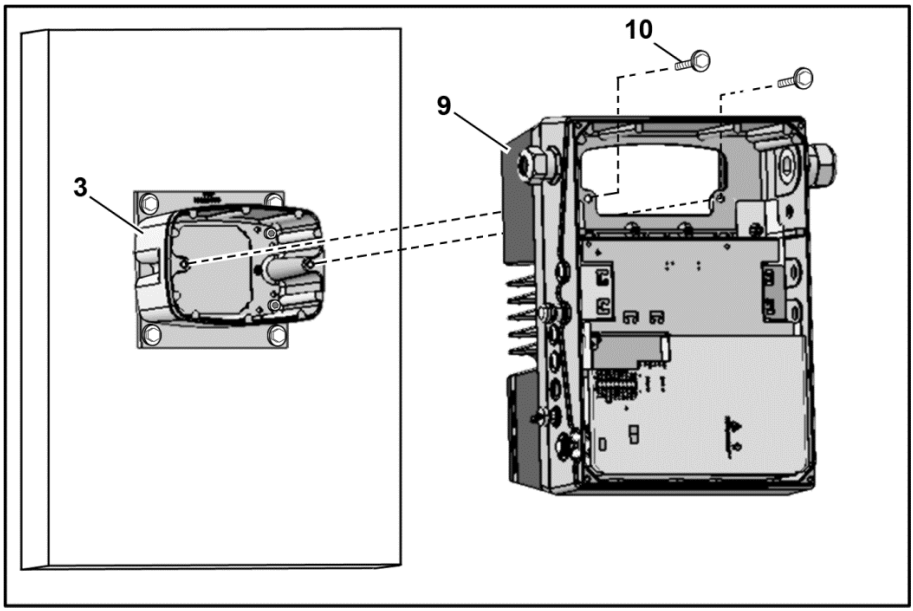


Fig. 28: Fastening the speed regulator on the size D support

10. Carefully insert the speed regulator (9) on the support (3).
11. Tighten the two parts evenly with the two M8 screws (10) (torque: max. 25,0 Nm).

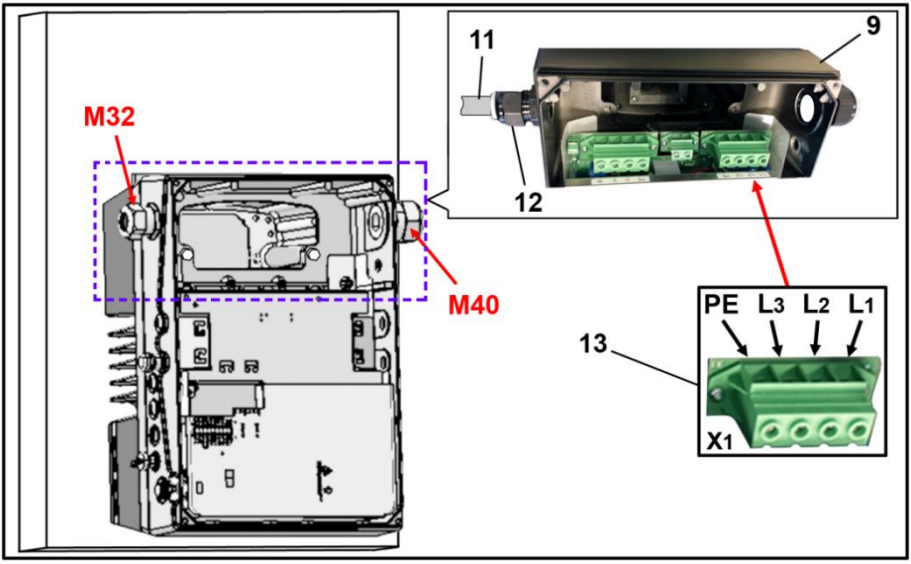


Fig. 29: Connection to the network D

12. Lead the connection cable to the network (11) through the cable gland (12) [M32] in the speed regulator (9).

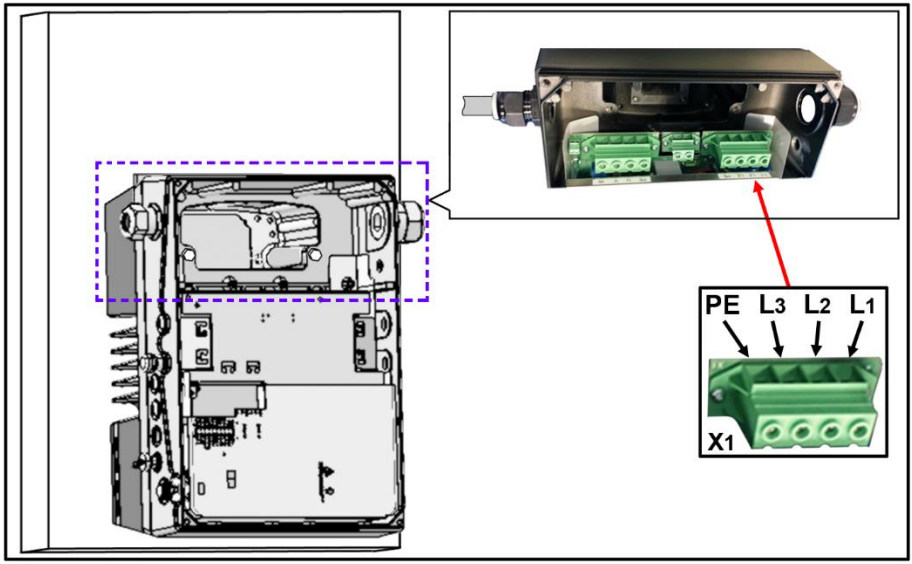
IMPORTANT INFORMATION

The cable gland is used to lighten the traction; the PE connection cable must be connected in advance (significantly longer)!

13. Connect the cables in the connection terminal board [X1] (13) as follows:

400 V connection			
L1	L2	L3	PE

The protective conductor must be connected to the "PE" contact.



Terminal no.	Name	Assignment
1	L1	Network phase 1
2	L2	Network phase 2
3	L3	Network phase 3
4	PE	Protective conductor

Table 14: Terminal assignment X1 - 3~ 400 V

Terminal no.	Name	Assignment
1	L1	DC (+) (565 V) network
2	L2	Not assigned
3	L3	DC (-) network
4	PE	Protective conductor

Table 15: Terminal assignment X1 - DC power supply from 250 to 750 V

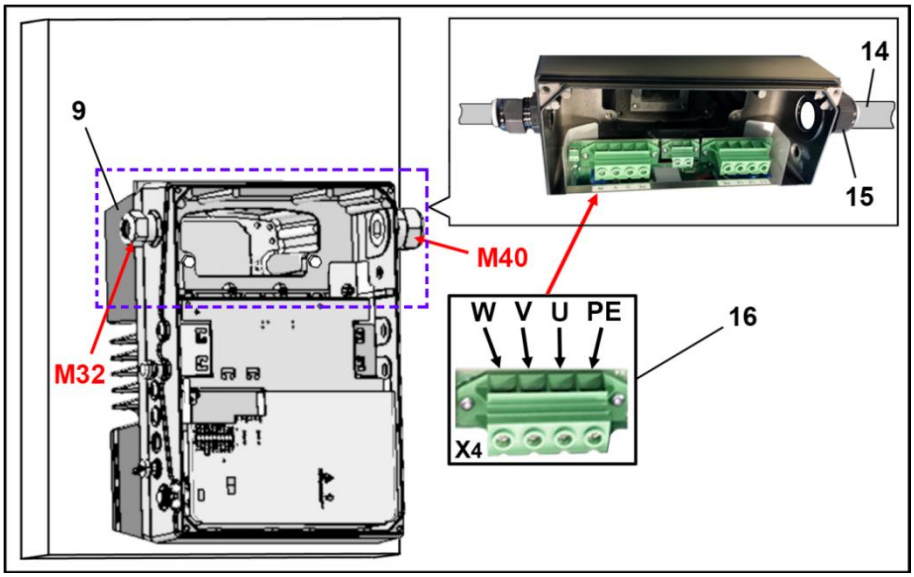


Fig. 30: Motor connection size D

14. Lead the connection cable to the motor (14) through the cable gland (15) [M40] in the speed regulator (9).

IMPORTANT INFORMATION

The cable gland is used to lighten the traction; the PE connection cable must be connected in advance (significantly longer)!

15. Connect the cables in the connection terminal boards [X4] (16) as follows:

Terminal no.	Name	Assignment
1	PE	Protective conductor
2	U	Motor phase 1
3	V	Motor phase 2
4	W	Motor phase 3

Table 16: Motor connection assignment X4

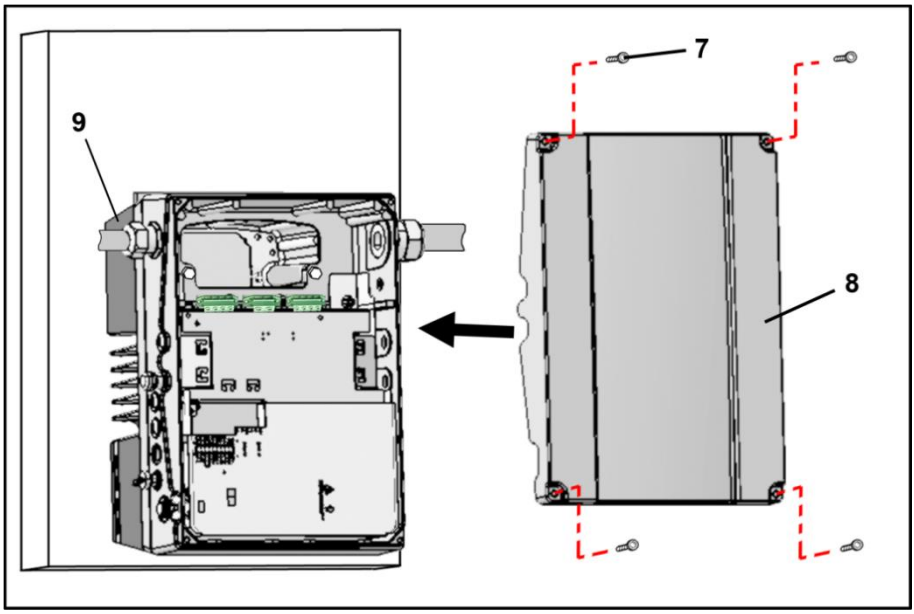


Fig. 31: Closing the housing size D

16. Place the cover (8) on the speed regulator housing (9).
17. Tighten the two parts with the four screws (7) (torque 4 Nm).

3.5.4 Power connection

The power connections are made as described in the chapter "**Installation of the speed regulator integrated on a** generic motor **generic**".

3.5.5 Brake chopper connections

The brake chopper connections are made as described in the chapter "
Installation of the speed regulator integrated on a generic motor **generic**".

3.5.6 Control connections X5, X6, X7

The control connections are made as described in the chapter "
Installation of the speed regulator integrated on a generic motor **generic**".

3.6 Deinstalling and installing the DGM fan size “D”

The following section describes the replacement of the fan in the DGM size "D". For safety reasons, closely observe the safety instructions and information.

HAZARD

Risk of fatal injury due to moving mechanical components!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

Have it deinstalled and installed only by qualified personnel.

Only use instructed personnel for set-up, installation, start-up and use.

Connect the device to the ground in compliance with DIN EN 61140; VDE 0140, NEC and other pertinent standards.

3.6.1 Deinstalling the fan

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

Risk of electric shock and electric discharge. After shut-off, wait two minutes (time for capacitor discharge)

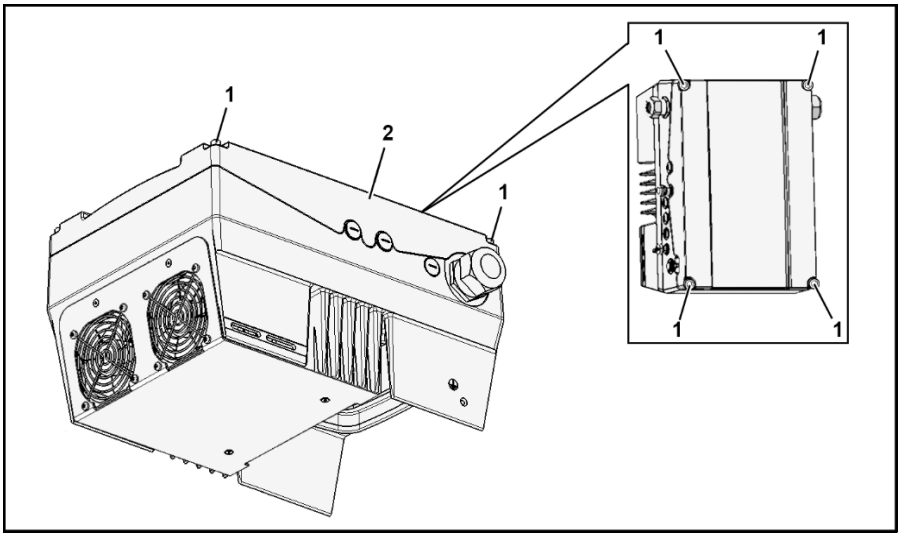
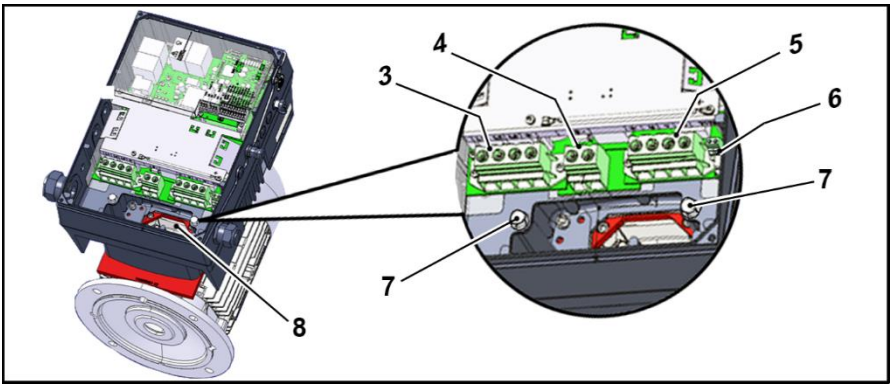


Fig. 32: Fan deinstallation size D

1. Unscrew the four screws (1) from the cover (2) of the speed regulator.
2. Remove the cover (2) of the speed regulator.



HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

3. Disconnect the cables from the following connections:
   (3) "Network terminal [X1]",
   (4) "Brake chopper [X2] (optional)",
   (5) "Motor terminal [X4]",
   (6) "PTC/Klixon motor [X11]".
4. Unscrew both screws (7).
5. Carefully lift the speed regulator up off the support (8) and place it on a clean, flat surface.

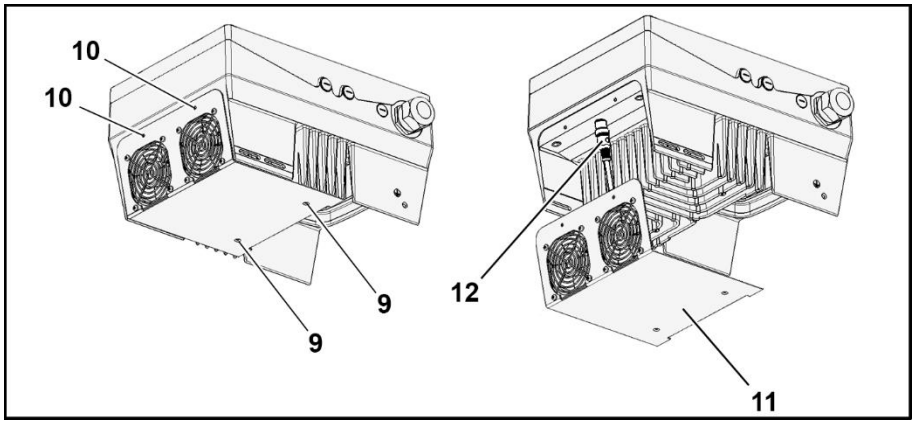
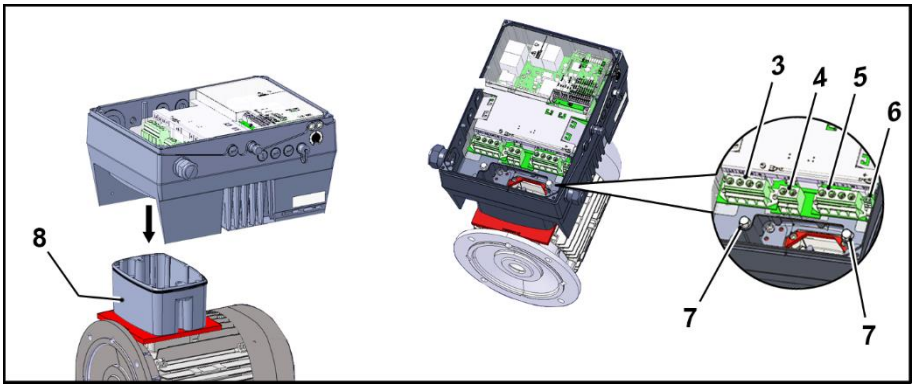


Fig. 33: Deinstallation and installation of the fan size D

6. Unscrew the screws (9) and (10).
7. Carefully unscrew the fan unit (11) from the speed regulator.
8. Disconnect the M12 connector (12).

3.6.2 Installing the fan

1. Insert the M12 connector (12) for the new fan unit (11) in the speed regulator connector.
2. Insert the new fan unit (11) in the speed regulator and tighten the screws (9) and (10).



IMPORTANT INFORMATION
When placing the speed regulator on the support (8) make sure that the gasket is inserted correctly!

3. Carefully engage the speed regulator on the support (8) and fasten it regularly with the two M8 screws (7) (torque: max. 25.0 Nm).

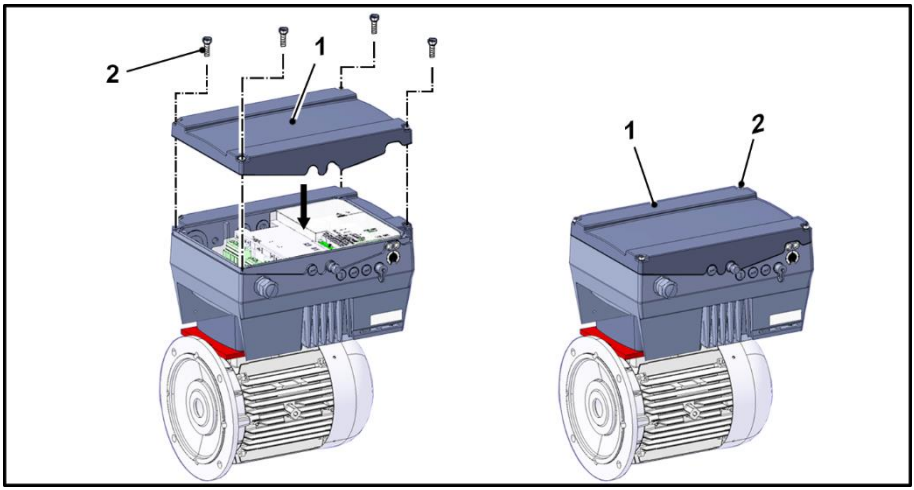
HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Disconnect the electrical voltage from the speed regulator and secure it to prevent it from being reconnected.

4. Connect all the cables to the following connections:
   (3) "Network terminal [X1]"
   (see chapter "Power connection/size D")
   (4) "Brake chopper [X2] (optional)"
   (5) "Network terminal [X4]"
   (see chapter "Power connection/size D")
   (6) "PTC/Klixon motor [X11]" (optional)



5. Place the cover (1) on the speed regulator housing.
6. Tighten the two parts with the four screws (2) (torque: 4 Nm).

4. Start-up

4.1 Safety instructions for start-up

Material damage is possible

If the instructions are not observed, the speed regulator can be damaged and be destroyed at the next start-up!

Start-up may only be performed by suitably qualified personnel. Always observe the safety measures and warnings.

HAZARD

Risk of fatal injury due to electric shock!

Fatal or serious injuries!

Make sure that the power supply supplies the exact voltage and that it was designed for the necessary current.

Use appropriate circuit breakers with the prescribed rated current between the network and the speed regulator.

Use suitable fuses with the relative current values between the network and the speed regular (see the technical data).

The speed regulator must be ground connected together with the motor, as required. Otherwise, serious injuries may occur.

4.2 Communication

The speed regulator can be started up as follows:

- via the VPlus Dec software

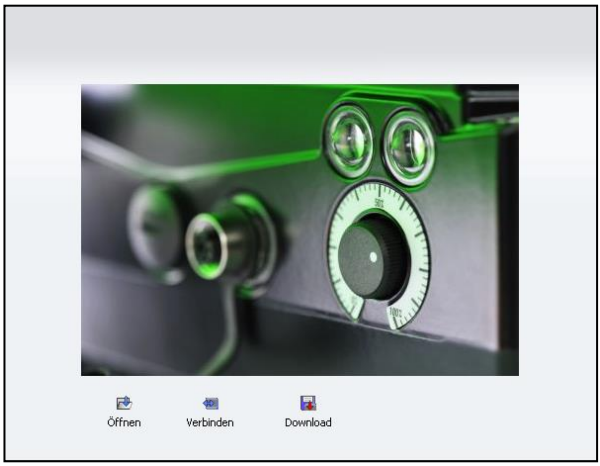


Fig. 34: PC software - start-up mask

- via the hand-held MMI control device*****

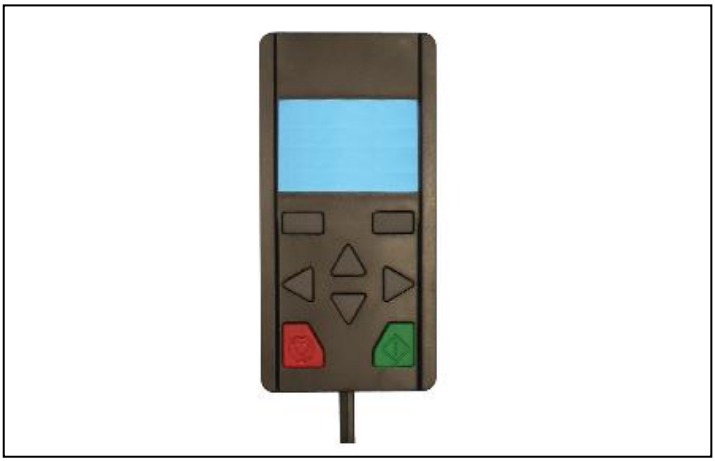


Fig. 35: Hand-held MMI control device

*** Man machine interface**

- via the MMI* integrated in the cover (optional)

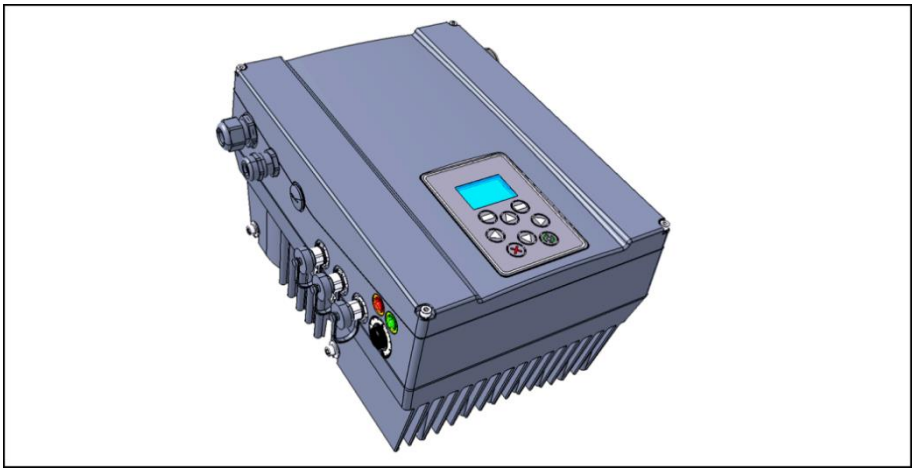


Fig. 36: MMI option

*** Man machine interface**

4.3 Block diagram

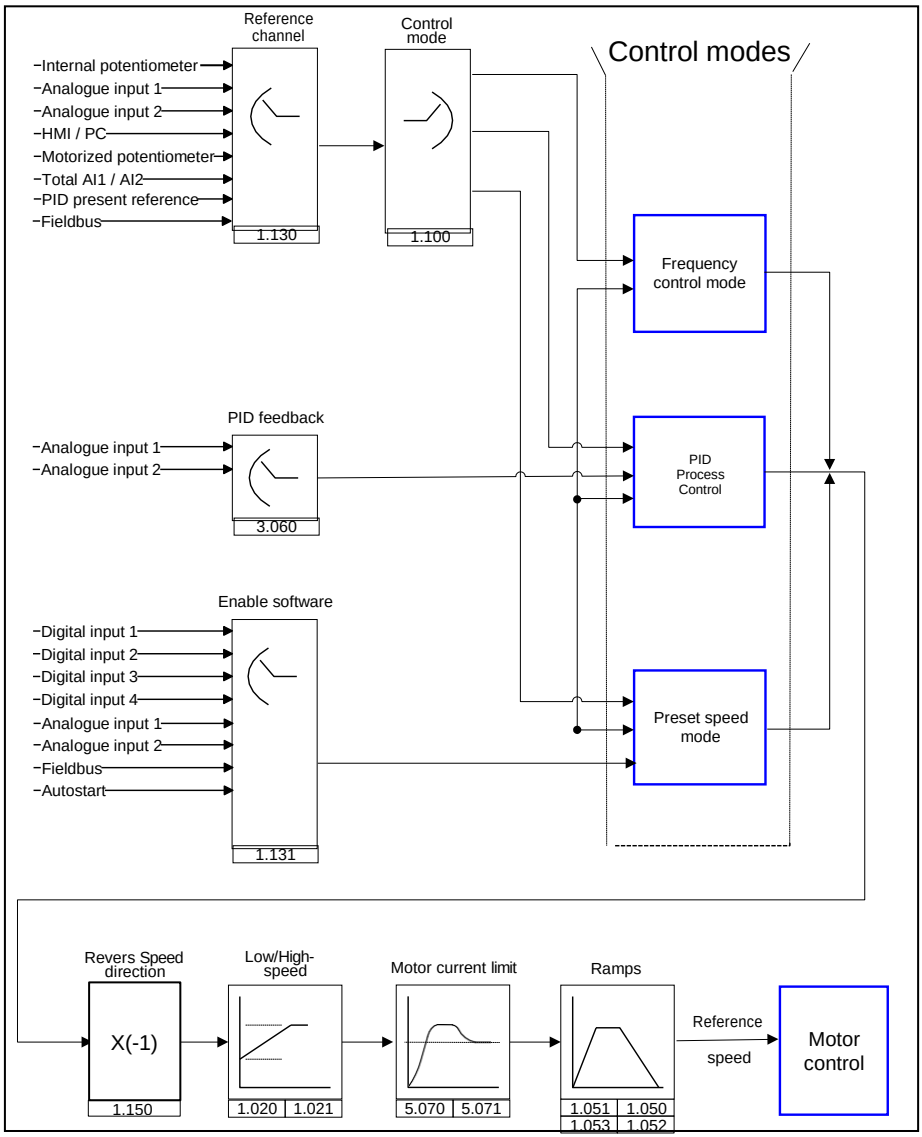


Fig. 37: General generation structure of reference values

4.3 Steps for start-up

INFORMATION
Parameterization can be carried out before installing the device!

Parameterization can be carried out already before installing the speed regulator on the motor!

For this purpose, the speed regulator has a reduced voltage input (24 V), through which the electronics are powered without applying network voltage.

Start-up can be carried out using the USB cable for communication with the PC on the M12 connector with the integrated interface converter RS485/RS232 or via the manual control device MMI with the connection cable RJ9 on the M12 connector.

4.3.1 Start-up via the PC:

1. Install the VPlus Dec software (the programming software is supplied free of charge by BONFIGLIOLI. Required operating system Windows XP, Windows 7 or Windows 10 [32 / 64 Bit]). It is recommended to carry out the installation procedure as the administrator.
2. Connect the PC to the M12 connector using the optional connection cable.
3. Load or detect the motor data set (parameters 33.030 to 33.050); it may be necessary to optimize the speed regulation (parameters 34.100 to 34.101).
4. Make the application settings (ramps, inputs, outputs, reference values, etc.).
5. Optional: Define an access level (1 – MMI, 2 – User, 3 – Manufacturer).

See the block diagram fig. in chapter Quick start-up quick.

To guarantee an optimal control structure of the PC software, the parameters are divided into access levels.

They are divided as follows:

1. MMI: - the speed regulator is programmed via a hand-held control device.
2. User: - the speed regulator can be programmed with the basic parameters via the PC software.
3. Manufacturer: - the speed regulator can be programmed with a wider selection of parameters, via the PC software.

4.3.2 Start-up via the PC, combined with the optional MMI

1. Install the Vplus Dec software (the programming software is supplied free of charge by Bonfiglioli. Required operating system Windows XP, Windows 7 or Windows 10 [32 / 64 Bit]). It is recommended to carry out the installation procedure as the administrator.
2. Connect the PC to the M12 connector using the optional connection cable.

IMPORTANT INFORMATION

After "Power On" of the speed regulator, the diagnostics interface (M12 PC/MMI) is deactivated.

To activate the diagnostics interface, put the "MMI option" in standby.

Press keys (1) and (2) at the same time for approx. 1.5 sec.

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

If communication with Vplus Dec takes place within 25 sec., the "'MMI option" remains in standby mode.
At this point, data can be exchanged with the PC and/or an external MMI.

If communication is interrupted or it cannot be established within 25 seconds, the “MMI option” switches from standby mode back to normal mode.

180° display rotation

Depending on the DGM installation position in the system, it may be necessary to rotate the display 180°.

With the parameter 5.200 it is possible to rotate the display 180°.

For this purpose, set the parameter value to "1".

INFORMATION

The display is rotated 180° only after the “Disconnect” button is pressed in the Vplus Dec software.

Alternatively, the message on the display can be turned 180° in normal mode.

Press keys (3) and (4) at the same time for approx. 1.5 sec.

The display and the assignment of the function keys are rotated 180°.

5. Parameters

This chapter contains:

- an introduction to the parameters
- an overview of the main start-up and operating parameters

5.1 Safety warnings for parameter use

HAZARD

Risk of fatal injury due to restarting motors!

Fatal or serious injuries!

Failure to observe can cause death, serious physical injuries or considerable material damage!

Certain parameter settings or the change to parameter settings during operation can cause the DGM speed regulator to restart automatically after a period without the power supply voltage, or undesired changes can take place in operational behavior.

INFORMATION
If parameters are changed during operation, a few seconds may pass before a visual effect can be detected.

5.2 General aspects concerning the parameters

5.2.1 Explanation of the operating modes

Operating mode is the moment in which the actual reference value is generated.
In the case of the frequency regulation mode, this is a simple conversion of the “raw” input reference value into a speed reference value. In the case of regulation of the PID process, the reference value and the actual value are compared and as a result the system regulates based on a certain process quantity.

Frequency regulation mode:

The "Setpoint reference" values (1.130) are scaled into frequency reference values.

0 % corresponds to the "minimum frequency” (1.020).

100 % corresponds to the "maximum frequency” (1.021).

The sign placed before the reference value is decisive for the scaling.

PID process regulation:

The reference value for the PID process regulator is read as a percentage, as for the “Frequency regulation mode". 100 % corresponds to the working range of the connected sensor, which is read via the input of the actual value (selected via the"actual PID” value).

Based on the regulation difference, a speed control value is output based on the proportional P (3.050), integral I (3.051) and derivative D (3.052) gain factors.

If there are uncontrollable regulation differences, to prevent an infinite increase of the integral part, it is limited by a certain set value (corresponding to the "maximum frequency” (1.021)).

PID inversion:

It is possible to invert the actual PID value using the parameter 3.061. The actual value is read inversely, meaning 0 V…10 V corresponds internally to 100 %…0 %.

Keep in mind that also the reference value must be indicated inversely!

Example:

A sensor with an analog output signal (0 V…10 V) must be used as an actual value source (on AIx). For an output quantity of 7 V (70 %), regulation must be inverted. The actual internal value corresponds therefore to
100 % - 70 % = 30 %.

This means, the reference value to indicate is 30 %.

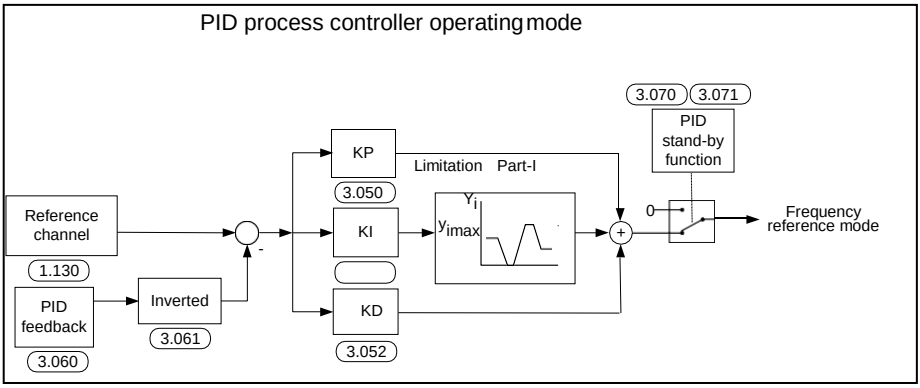


Fig. 38: PID process regulation

Standby function for PID process regulation

This function can help save energy in applications, such as pressure increase systems, where the PID process regulation is used to control a certain process variable and the pump must rotate at a “minimum frequency" (1.020). As the speed regulator can reduce the number of pump rotations during normal operation with the process quantity decreasing, without ever dropping below the “minimum frequency" (1.020), it is therefore possible to stop the motor if it is rotating within a wait interval, the “PID standby time” (3.070) at the "minimum frequency" (1.020).

As the actual value deviates from the reference value for the set % value, the «PID standby hysteresis» (3.071), regulation (the motor) is restarted.

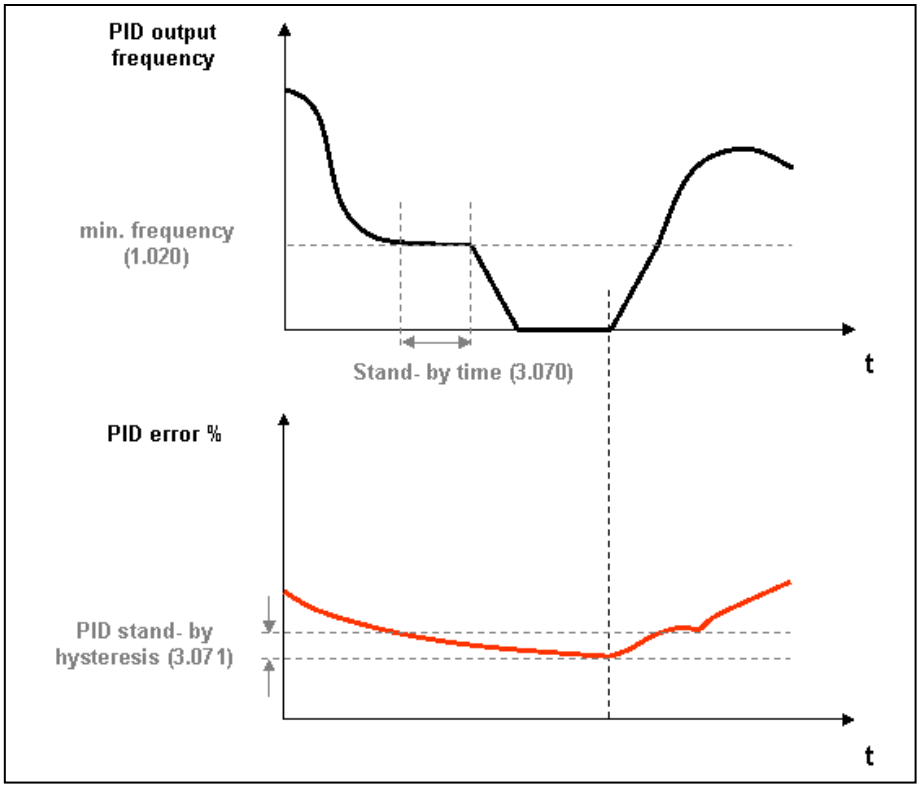


Fig. 39: PID process regulation standby function

Fixed frequency

This operating mode controls the speed regulator using up to 7 fixed reference values.
Selection takes place using parameter 2.050, through which the number of fixed frequencies to be used can be selected.

Parameter	Name	Possible selections	Function	Number of digital inputs necessary
2,050	Fixed frequency	0	1 fixed frequency	1
		1	3 fixed frequencies	2
		2	7 fixed frequencies	3
	Foil keypad (Optional)	3	2 fixed frequencies	-
	Foil keypad (Optional)	4	2 fixed frequencies	-

Up to 3 digital inputs are assigned in the table depending on the number of fixed frequencies that are necessary.

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

Table 17: Fixed frequency logic table

5.2.2 Structure of the parameter tables

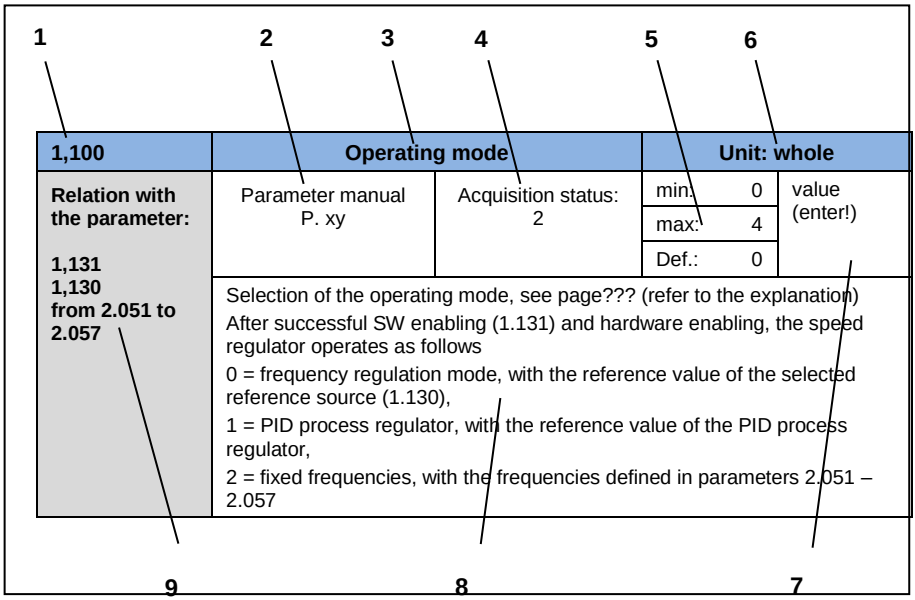


Fig. 40: Example of a parameter table

Key			
1	Parameter number	**6**	Number
2	Description in the parameter manual on page...	**7**	Field for entering the relative value
3	Parameter name	**8**	Explanation of the parameter
4	Acquisition status 0 = turn the speed regulator off and on for acquisition 1 = at speed 0 2 = during operation	**9**	Other parameters correlated to this parameter.
5	Value range (from – to – factory setting)		

5.3 Applicable parameters

5.3.1 Basic parameters

1,020	Minimum frequency		Unit: Hz	
Relation with the parameter: **1,150** **3,070** **3,080**	Parameter manual: P.xy	Acquisition status: 2	min.: 0 max.: 400 Def.: 0	value (enter!)
	The minimum frequency is the frequency supplied by the speed regulator as soon as it is enabled, and there are no additional reference values. This frequency is dropped below if: a) there is an acceleration when the drive system is stopped b) the frequency converter is blocked. The frequency is therefore reduced down to 0 Hz before blocking. c) the frequency converter is inverted (1.150). The inversion of the rotating field takes place at 0 Hz. d) the standby function (3.070) is active.			

1,021	Maximum frequency		Unit: Hz	
Relation with the parameter: **1,050** **1,051**	Parameter manual: P.xy	Acquisition status: 2	min.: 0 max.: 400 Def.: 0	value (enter!)
	The maximum frequency is the maximum frequency supplied by the speed regulator, based on the reference value.			

1,050	Braking time 1		Unit: s	
Relation with the parameter: **1,021** **1,054**	Parameter manual: P.xy	Acquisition status: 2	min.: 0.1 max.: 1000 Def.: 5	value (enter!)
	Braking time 1 is the time the speed regulator requires to brake from the maximum frequency (1.021) to 0 Hz. If the set braking time cannot be observed, the quickest possible braking time is implemented.			

1,051	Acceleration time 1		Unit: s	
Relation with the parameter: **1,021** **1,054**	Parameter manual: P.xy	Acquisition status: 2	min.: 0.1 max.: 1000 Def.: 5	value (enter!)
	Acceleration time 1 is the time the regulator needs to accelerate from 0 Hz to the maximum frequency. The acceleration time can be extended by certain circumstances, such as the overload of the speed regulator.			

1,052	Braking time 2		Unit: s	
Relation with the parameter: **1,021** **1,054**	Parameter manual: P.xy	Acquisition status: 2	min.: 0.1 max.: 1000 Def.: 10	value (enter!)
	Braking time 2 is the time the speed regulator requires to brake from the maximum frequency (1.021) to 0 Hz. If the set braking time cannot be observed, the quickest possible braking time is implemented.			

1,053	Acceleration time 2		Unit: s	
Relation with the parameter: **1,021** **1,054**	Parameter manual: P.xy	Acquisition status: 2	min.: 0.1 max.: 1000 Def.: 10	value (enter!)
	Acceleration time 2 is the time the speed regulator needs to accelerate from 0 Hz to the maximum frequency. The acceleration time can be extended by certain circumstances, such as the overload of the speed regulator.			

1,054	Ramp selection		Unit: whole		
Relation with the parameter: **1,050 - 1,053**	Parameter manual: P. xy	Acquisition status: 2	min.: max.: Def.:	0 9 0	value (enter!)
	Selection of the utilized ramp torques 0 = Braking time 1 (1.050) / acceleration time 1 (1.051) 1 = Braking time 2 (1.052) / acceleration time 2 (1.053) 2 = Digital input 1 (False = ramp torque1 / True = ramp torque 2) 3 = Digital input 2 (False = ramp torque 1 / True = ramp torque 2) 4 = Digital input 3 (False = ramp torque 1 / True = ramp torque 2) 5 = Digital input 4 (False = ramp torque 1 / True = ramp torque 2) 6 = PLC client 7 = Analog input 1 (must be selected in parameter 4.030) 8 = Analog input 2 (must be selected in parameter 4.060) 9 = Virtual output (4.230)				

1,088	Quick stop		Unit: s		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: max.: Def.:	0.1 1000 10	value (enter!)
	Only in case of a model with the STO function The quick stop parameter is the time the inverter needs to brake from the maximum frequency (1.021) to 0 Hz. If the quick stop time cannot be observed, the quickest possible braking time is implemented. The quick stop is activated when the value of DIG.IN.5 is 0V.				

1,100	Operating mode		Unit: whole		
Relation with the parameter: **1,130** **1,131** **from 2.051 to 2.057** **from 3.050 to 3.071**	Parameter manual: P. xy	Acquisition status: 2	min.: max.: Def.:	0 3 0	value (enter!)
	Selection of the operating modes After successful software enabling (1.131) and hardware enabling, the speed regulator operates in one of the following modes: 0 = frequency regulation mode, based on the selected setpoint reference value (1.130) 1 = PID process regulator, based on the PID regulator reference value (3.050 – 3.071), 2 = fixed frequencies, according to the frequencies defined in parameters 2.051 – 2.057 3 = selection via DGM Soft-PLC				

1,130	Setpoint of reference		Unit: whole		
Relation with the parameter: **from 3.062 to 3.069**	Parameter manual: P. xy	Acquisition status: 2	min.: max.: Def.:	0 10 0	value (enter!)
	Determines the source from which the reference value is read. 0 = Internal potentiometer 1 = Analog input 1 2 = Analog input 2 3 = MMI/PC 4 = SAS 6 = Motor potentiometer 7 = Sum of the analog inputs 1 and 2 8 = PID fixed reference values (from 3.062 to 3.069) 9 = Fieldbus 10 = DGM Soft-PLC				

1,131	Software enabling		Unit: whole		
Relation with the parameter: **1,132** **1,150** **2,050** **4,030** **4,030 / 4,060**	Parameter manual: P. xy	Acquisition status: 2	min.: max.: Def.:	0 16 0	value (enter!)

⚠DANGER!

Depending on the selection made, the motor can start immediately.

Selection of the source for regulation enabling.

0 = Digital input 1
1 = Digital input 2
2 = Digital input 3
3 = Digital input 4
4 = Analog input 1 (must be selected in parameter 4.030)
5 = Analog input 2 (must be selected in parameter 4.060)
6 = Fieldbus
7 = SAS / Modbus
8 = Digital input 1 to the right / digital input 2 to the left
1.150 must be set to "0"
9 = Autostart
If hardware enabling has taken place and a reference value has been supplied, the motor could start operating immediately!
Not even the parameter 1.132 can stop it.
10 = DGM Soft-PLC
11 = Fixed frequency inputs (all the inputs that were selected in parameter 2.050)
12 = Internal potentiometer
13 = Foil keypad (Start and Stop keys)
14 = MMI/PC
15 = Virtual output (4.230)
16 = Integrated foil keypad

1,132	Protection against start-up		Unit: whole		
Relation with the parameter: **1,131**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	8	
			Def.:	1	
	Selection of the behavior after software enabling (parameter 1.131). No effect, if autostart was selected. 0 = Immediate start-up with high signal at software enabling input 1 = Start-up only with the rising edge at software enabling input 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) 5 = Digital input 4 (function active with high signal) 6 = DGM Soft-PLC 7 = Analog input 1 (must be selected in parameter 4.030) 8 = Analog input 2 (must be selected in parameter 4.060)				

1,150	Direction of rotation		Unit: whole		
Relation with the parameter: **1,131** **4,030** **4,030 / 4,060**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	16	
			Def.:	0	
	Selection of the direction of rotation 0 = based on the reference value (depends on the sign before the reference value: positive: forward; negative: backward) 1 = only forward (no changes to the direction of rotation are permitted) 2 = only backward (no changes to the direction of rotation are permitted) 3 = Digital input 1 (0 V = forward, 24 V = backward) 4 = Digital input 2 (0 V = forward, 24 V = backward) 5 = Digital input 3 (0 V = forward, 24 V = backward) 6 = Digital input 4 (0 V = forward, 24 V = backward) 7 = DGM Soft-PLC 8 = Analog input 1 (must be selected in parameter 4.030) 9 = Analog input 2 (must be selected in parameter 4.060) 10 = Foil keypad: direction of rotation inversion key (only with the motor operating) 11 = Foil keypad: key I forward / II backward (inversion always possible) 12 = Foil keypad: key I forward / II backward (inversion only possible with the motor stopped) 13 = Virtual output (4.230) 14 = Integrated foil keypad: direction of rotation inversion key (only when operating) 15 = Integrated foil keypad: key I + II 16 = Integrated foil keypad: key I + II (only with the motor stopped)				

1,180	Reset function		Unit: whole	
Relation with the parameter: **1,181** **1,182**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 7 Def.: 4	value (enter!)
	Selection of the source for error resetting. The errors can only be confirmed if the error is no longer present. Certain errors can be confirmed only by turning the regulator off and back on; see the error list. Automatic reset via parameter 1.181. 0 = manual reset is not possible 1 = rising edge on digital input 1 2 = rising edge on digital input 2 3 = rising edge on digital input 3 4 = rising edge on digital input 4 5 = Foil keypad (confirm key) 6 = Analog input 1 (must be selected in parameter 4.030) 7 = Analog input 2 (must be selected in parameter 4.060)			

1,181	Automatic reset function		Unit: s	
Relation with the parameter: **1,180** **1,182**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 1000000 Def.: 0	value (enter!)
	In addition to the reset function (1.180), it is possible to select an automatic reset of the errors. 0 = no automatic confirmation > 0 = time for the automatic reset of the error in seconds			

1,182	Number of automatic resets		Unit:		
Relation with the parameter: **1,180** **1,181**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	500	
			Def.:	5	
	In addition to the automatic reset function (1.181), it is possible to limit the maximum number of automatic resets. 0 = no automatic reset limit > 0 = maximum number of permitted automatic resets permitted				

INFORMATION

The internal automatic reset counter is reset if the motor is made to operate without an error occurring (motor current > 0.2 A) for a period equivalent to the "maximum number of automatic resets x automatic reset time".

Example of resetting the automatic reset counter

max. number of resets = 8
Automatic reset time = 20 sec. } 8 x 20 sec. = 160 sec.

After 160 sec. of operation without errors, the internal “automatic reset” counter is reset.

In the example, 8 “automatic resets" were accepted.

If an error occurs within 160 sec., at the 9th reset attempt "Error 22” occurs.

This error must be confirmed manually, by turning off the inverter power supply.

5.3.2 Fixed frequency

This mode must be selected with parameter 1.100; see also the selection of the operating mode.

2,050	Fixed frequency mode		Unit: whole		
Relation with the parameter: **1,100 from 2.051 to 2.057**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	4	
			Def.:	2	
	Selection of the digital inputs used for the fixed frequencies 0 = Digital In 1 (Fixed frequency 1) (2.051) 1 = Digital In 1, 2 (Fixed frequency 1 - 3) (from 2.051 to 2.053) 2 = Digital In 1, 2, 3 (Fixed frequency 1 - 7) (from 2.051 to 2.057) 3 = Foil keypad (key I = fixed frequency 1 / key II = fixed frequency 2) 4 = Integrated foil keypad (key I = fixed frequency 1 / key II = fixed frequency 2)				

from 2.051 to 2.057	Fixed frequency		Unit: Hz		
Relation with the parameter: **1,020** **1,021** **1,100** **1,150** **2,050**	Parameter manual: P. xy	Acquisition status: 2	min.:	- 400	value (enter!)
			max.:	+ 400	
			Def.:	0	
	Frequencies that must be set based on the connection model for digital inputs 1– 3 set in parameter 2.050. See the chapter Explanation of the operating modes/fixed frequency.				

5.3.3 Motor potentiometer function

This operating mode must be selected in parameter 1.130.
The function can be used as a reference value source for the frequency mode and for the PID process regulator.

Via the motor potentiometer, it is possible to increase and reduce the reference value (PID/frequency) in increments. For this purpose, use parameters 2.150 to 2.154.

2,150	MOP digital input		Unit: whole		
Relation with the parameter: **1,130** **4,030** **4,050**	Parameter manual: P. xy	Acquisition status: 2	min.: max.: Def.:	0 8 3	value (enter!)
	Selection of the source for increasing and reducing the reference value 0 = Digital input 1 + / digital input 2 - 1 = Digital input 1 + / digital input 3 - 2 = Digital input 1 + / digital input 4 - 3 = Digital input 2 + / digital input 3 - 4 = Digital input 2 + / digital input 4 - 5 = Digital input 3 + / digital input 4 - 6 = Analog input 1 + / analog input 2 - (must be selected in parameter 4.030 / 4.050) 7 = DGM Soft- PLC 8 = Foil keypad (key I - / key II +)				

2,151	MOP pitch amplitude		Unit: %		
Relation with the parameter: **1,020** **1,021**	Parameter manual: P. xy	Acquisition status: 2	min.: max.: Def.:	0 100 1	value (enter!)
	Interval, based on which the reference value must be modified each time the key is pressed.				

2,152	MOP interval		Unit: s		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0.02	value (enter!)
			max.:	1000	
			Def.:	0.04	
	Indicates the time during which the reference value is totalized in presence of a permanent signal.				

2,153	MOP reaction time		Unit: s		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0.02	value (enter!)
			max.:	1000	
			Def.:	0.3	
	Indicates the time after which the present signal is indicated as permanent.				

2,154	MOP storage		Unit: whole		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1	
			Def.:	0	
	Determines if the reference value of the motor potentiometer remains even after the network current is absent. 0 = deactivated 1 = activated				

5.3.4 PID process regulator

This mode must be selected in parameter 1.100, the source of the reference value must be selected in parameter 1.130, see also chapter 5.2.1 Explanation of the operating modes/fixed frequency.

3,050	Gain factor PID-P		Unit:		
Relation with the parameter: **1,100** **1,130**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	100	
			Def.:	1	
	Proportional part of the gain factor for the PID regulator				

3,051	Gain factor PID-I		Unit: 1/s		
Relation with the parameter: **1,100** **1,130**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	100	
			Def.:	1	
	Integral part of the gain factor for the PID regulator				

3,052	Gain factor PID-D		Unit: s		
Relation with the parameter: **1,100** **1,130**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	100	
			Def.:	0	
	Differential part of the gain factor for the PID regulator				

3,055	PID mode		Unit: whole		
Relation with the parameter:	Parameter manual:	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1	
			Def.:	0	
	Here it is possible to switch to PID mode: 0: Standard (without considering the actual frequency) 1: considering the actual frequency				

3,060	Instantaneous PID value		Unit: whole	
Relation with the parameter: **1,100** **1,130** **3,061**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 3 Def.: 0	value (enter!)
	Selection of the input source, from which the actual value is read for the PID process regulator: 0 = Analog input 1 1 = Analog input 2 2 = DGM Soft-PLC 3 = Fieldbus (fixed input quantity specific for the customer)			

3,061	PID inversion		Unit: whole	
Relation with the parameter: **3,060**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 1 Def.: 0	value (enter!)
	The source of the actual value (parameter 3.060) is inverted 0 = deactivated 1 = activated			

from 3.062 to 3.068	PID fixed reference values		Unit: %	
Relation with the parameter: **1,130** **3,069**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 100 Def.: 0	value (enter!)
	PID fixed reference values that must be output based on the connection model to the digital inputs 1 – 3 set in parameter 3.069 (the selection must be made in parameter 1.130).			

3,069	Fixed PID reference model		Unit: whole		
Relation with the parameter: **1,100 from 3.062 to 3.068**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	2	
			Def.:	0	
	Selection of the digital inputs used for the fixed frequencies 0 = Digital In 1 (Fixed reference value PID 1) (3.062) 1 = Digital In 1, 2 (Fixed reference value PID 1 - 3) (from 3.062 to 3.064) 2 = Digital In 1, 2, 3 (Fixed reference value PID 1 - 7) (from 3.062 to 3.068)				

3,070	PID standby time		Unit: s		
Relation with the parameter: **1,020**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	10000	
			Def.:	0	
	If the speed regulator proceeds for the set time with its minimum frequency (parameter 1.020), the motor is stopped (0 Hz); see also chap. 5.2.1 Explanation of the operating modes/PID process regulation. 0 = deactivated > 0 = wait time until activation of the standby function				

3,071	PID standby hysteresis		Unit: %		
Relation with the parameter: **3,060**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	50	
			Def.:	0	
	Wakeup condition for the PID regulator from the standby function. When the regulation difference is greater than the value set in %, regulation restarts; see also the PID regulator operating modes.				

3,072	PID dry cycle time		Unit: s		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	32767	
			Def.:	0	
	If after this set time the actual PID value did not reach at least 5% and the speed regulator is at its maximum limit, the DGM switches to the PID dry cycle with error no. 16.				

3,073	Minimum PID reference value		Unit: %		
Relation with the parameter: **3,074**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	100	
			Def.:	0	
	The PID reference value can be limited within 2 parameters. Example: 0 -10 V potentiometer of the reference value Para. Minimum PID reference value = 20 % Para. Maximum PID reference value = 80 % (3.074) Reference value for < 2 V = 20 % Reference value for 2 V – 8 V = 20 % - 80 % Reference value for > 8 V = 80 %				

3,074	Maximum PID reference value		Unit: %		
Relation with the parameter: **3,073**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	100	
			Def.:	100	
	The PID reference value can be limited within 2 parameters. Example: 0 -10 V potentiometer of the reference value Para. Minimum PID reference value = 20 % Para. Maximum PID reference value = 80 % (3.073) Reference value for < 2 V = 20 % Reference value for 2 V – 8 V = 20 % - 80 % Reference value for > 8 V = 80 %				

3,080	Minimum frequency PID 2		Unit: Hz		
Relation with the parameter: **1,020**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	400	
			Def.:	0	
	The minimum frequency is calculated based on the PID reference value Example: Minimum frequency 1.020 = 10 Hz Minimum PID frequency 3.080 2 = 20 Hz Minimum frequency for PID reference value 0 % = 10 Hz Minimum frequency for PID reference value 50 % = 15 Hz Minimum frequency for PID reference value 100 % = 20 Hz				

5.3.5 Analog inputs

For the analog inputs 1 and 2 (AIx – representation AI1 / AI2)

4,020/4,050	AIx input type		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 1 max.: 2 Def.: 1	value (enter!)
	Function of the analog inputs 1 / 2. 1 = voltage input 2 = current input			

4,021 / 4,051	AIx-norm. Minimum		Unit: %	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 100 Def.: 0	value (enter!)
	Defines the minimum value of the analog inputs as a percentage of the interval. Example: 0…10 V or 0…20 mA = 0 %...100 % 2…10 V or 4…20 mA = 20 %...100 %			

4,022 / 4,052	AIx Maximum		Unit: %	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 100 Def.: 100	value (enter!)
	Defines the maximum value of the analog inputs as a percentage of the interval. Example: 0…10 V or 0…20 mA = 0 %...100 % 2…10 V or 4…20 mA = 20 %...100 %			

4,023 / 4,053	AIx lost movement		Unit: %		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	100	
			Def.:	0	
	Lost movement as a percentage of the interval of the analog inputs.				

4,024 / 4,054	AIx filter time		Unit: s		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0.02	value (enter!)
			max.:	1.00	
			Def.:	0	
	Filter time of the analog inputs in seconds.				

4,030 / 4,060	AIx function		Unit: whole		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1	
			Def.:	0	
	Function of the analog inputs 1/2 0 = Analog input 1 = Digital input				

4,033 / 4,063	AIx physical unit		Unit:	
Relation with the parameter: **4,034 / 4,064** **4,035 / 4,065**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 10 Def.: 0	value (enter!)
	Selection of the different physical quantity to display. 0 = % 1 = bar 2 = mbar 3 = psi 4 = Pa 5 = m^3/h 6 = l/min 7 = ° C 8 = ° F 9 = m 10 = mm			

4,034 / 4,064	Minimum AIx value		Unit:	
Relation with the parameter: **4,033 / 4,063** **4,035 / 4,065**	Parameter manual: P. xy	Acquisition status: 2	min.: - 10000 max.: + 10000 Def.: 0	value (enter!)
	Selection of the lower limit of a physical quantity to display.			

4,035 / 4,065	Maximum AIx value		Unit:	
Relation with the parameter: **4,033 / 4,063** **4,034 / 4,064**	Parameter manual: P. xy	Acquisition status: 2	min.: - 10000 max.:+ 10000 Def.: 100	value (enter!)
	Selection of the upper limit of a physical quantity to display.			

4,036 / 4,066	AIx wire breakage time		Unit:	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0	value (enter!)
			max.: 32767	
			Def.: 0.5	
	After connections to the network, wire breakage recognition is activated only after the set time			

4,037 / 4,067	AIx inversion		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0	value (enter!)
			max.: 1	
			Def.: 0	
	Here it is possible to invert the analog input signal. 0 = inactive (example: 0 V = 0 % 10 V = 100 %) 1 = active (example: 0 V = 100 % 10 V = 0 %)			

5.3.6 Digital inputs

from 4.110 to 4.113	DIx inversion		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0	value (enter!)
			max.: 1	
			Def.: 0	
	With this parameter, it is possible invert the digital input. 0 = inactive 1 = active			

5.3.7 Analogue output

4,100	AO1 function		Unit: whole	
Relation with the parameter: **4,101** **4,102**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 40 Def.: 0	value (enter!)

Selection of the process value output on the analog output.
Depending on the selected process value, the min. and max. values must be adapted (4.101 / 4.102).

0 = not assigned / DGM Soft-PLC
1 = Intermediate circuit voltage
2 = Network voltage
3 = Motor voltage
4 = Motor current
5 = Actual frequency
6 = Number of revs measured externally via a revolution sensor (if present)
7 = Instantaneous angle or position (if present)
8 = IGBT temperature
9 = Internal temperature
10 = Analog input 1
11 = Analog input 2
12 = Reference frequency
13 = Motor power
14 = Torque
15 = Fieldbus
16 = PID reference value
17 = Actual PID value
18 = Frequency reference value after ramp
19 = Actual number of revs value
20 = Actual frequency value amount
21 = Torque amount
22 = Absolute frequency reference value after ramp
23 = Frequency reference value amount
24 = Actual number of revs value amount

4,101	AO1-Min		Unit:	
Relation with the parameter: **4,100**	Parameter manual: P. xy	Acquisition status: 2	min.: - 10000 max.:+ 10000 Def.: 0	value (enter!)
	Describes the area for which distribution should be carried out in output voltage 0 – 10 V or output current 0 – 20 mA.			

4,102	AO1-Max		Unit:	
Relation with the parameter: **4,100**	Parameter manual: P. xy	Acquisition status: 2	min.: - 10000 max.:+ 10000 Def.: 0	value (enter!)
	Describes the area for which distribution should be carried out in output voltage 0 – 10 V or output current 0 – 20 mA.			

5.3.8 Digital outputs

For the digital outputs 1 and 2 (DOx – representation DO1 / DO2)

4,150 / 4,170	DOx function		Unit: whole	
Relation with the parameter: **4,151 / 4,171** **4,152 / 4,172**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 51 Def.: 0	value (enter!)
	Selection of the process quantity on which the output must be switched. 0 = not assigned / DGM Soft-PLC 1 = Intermediate circuit voltage 2 = Network voltage 3 = Motor voltage 4 = Motor current 5 = Actual frequency value 6 = - 7 = - 8 = IGBT temperature 9 = Internal temperature 10 = Error (NO) 11 = Inverted error (NC) 12 = Final phase enabling **Table continues on the following page**			

4,150 / 4,170	DOx function		Unit: whole		
Relation with the parameter: **4,151 / 4,171** **4,152 / 4,172**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	51	
			Def.:	0	

Selection of the process quantity on which the output must be switched.

Continued table

13 = Digital input 1
14 = Digital input 2
15 = Digital input 3
16 = Digital input 4
17 = Ready to start operating (network power supply ON, no HW enabling, the motor is stopped)
18 = Ready (network power supply ON, HW enabling set, the motor is stopped)
19 = Operation (network power supply ON, HW enabling set, the motor is operating)
20 = Ready to start operating + Ready
21 = Ready to start operating + Ready + Operation
22 = Ready + Operation
23 = Motor power
24 = Torque
25 = Fieldbus
26 = Analog input 1
27 = Analog input 2
28 = PID reference value
29 = Actual PID value
30 = STO channel 1
31 = STO channel 2
32 = Frequency reference value after ramp
33 = Frequency reference value
34 = Actual PID value
35 = Actual frequency value
36 = Absolute torque value
37 = Absolute frequency reference value after ramp

38 = Absolute frequency reference value
39 = Instantaneous absolute number of revs value
50 = Active motor current limit
51 = Technical-actual comparison (Para. 6.070 – 6.071)

4,151 / 4,171	DOx-On		Unit:	
Relation with the parameter: **4,150 / 4,170**	Parameter manual: P. xy	Acquisition status: 2	min.: - 32767 max.: 32767 Def.: 0	value (enter!)
	If the set process quantity exceeds the activation limit, the output is set to 1.			

4,152 / 4,172	DOx-Off		Unit:	
Relation with the parameter: **4,150 / 4,170**	Parameter manual: P. xy	Acquisition status: 2	min.: - 32767 max.:. 32767 Def.: 0	value (enter!)
	If the set process quantity exceeds the deactivation limit, the output is reset to 0.			

5.3.9 Relay

For relays 1 and 2 (relay x – representation relay 1/ relay 2)

4,190 / 4,210	Relay x function		Unit: whole	
Relation with the parameter: **4,191 / 4,211** **4,192 / 4,212**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 51 Def.: 0	value (enter!)
	Selection of the process quantity on which the output must be switched. 0 = not assigned / DGM Soft-PLC 1 = Intermediate circuit voltage 2 = Network voltage 3 = Motor voltage 4 = Motor current 5 = Actual frequency value 6 = - 7 = - 8 = IGBT temperature 9 = Internal temperature 10 = Error (NO) 11 = Inverted error (NC) 12 = Final phase enabling **Table continues on the following page**			

<table>
<tr><th>4,190 / 4,210</th><th colspan="2">Relay x function</th><th colspan="2">Unit: whole</th></tr>
<tr><td rowspan="2">Relation with the parameter:

4,191 / 4,211
4,192 / 4,212</td><td>Parameter manual:

P. xy</td><td>Acquisition status:

2</td><td>min.: 0
max.: 51
Def.: 0</td><td>value (enter!)</td></tr>
<tr><td colspan="4">Selection of the process quantity on which the output must be switched.
Continued table

13 = Digital input 1
14 = Digital input 2
15 = Digital input 3
16 = Digital input 4
17 = Ready to start operating (network power supply ON, no HW enabling, the motor is stopped)
18 = Ready (network power supply ON, HW enabling set, the motor is stopped)
19 = Operation (network power supply ON, HW enabling set, the motor is operating)
20 = Ready to start operating + Ready
21 = Ready to start operating + Ready + Operation
22 = Ready + Operation
23 = Motor power
24 = Torque
25 = Fieldbus
26 = Analog input 1
27 = Analog input 2
28 = PID reference value
29 = Actual PID value
30 = STO channel 1
31 = STO channel 2
32 = Frequency reference value after ramp
33 = Frequency reference value
34 = Actual PID value
35 = Actual frequency value
36 = Absolute torque value
37 = Absolute frequency reference value after ramp

38 = Absolute frequency reference value
39 = Instantaneous absolute number of revs value
50 = Active motor current limit
51 = Technical-actual comparison (Para. 6.070 – 6.071)</td></tr>
</table>

4,191 / 4,211	Relay x-On		Unit:	
Relation with the parameter: **4,190 / 4,210**	Parameter manual: P. xy	Acquisition status: 2	min.: - 32767 max.: 32767 Def.: 0	value (enter!)
	If the set process quantity exceeds the activation limit, the output is set to 1.			

4,192 / 4,212	Relay x-Off		Unit:	
Relation with the parameter: **4,190 / 4,210**	Parameter manual: P. xy	Acquisition status: 2	min: - 32767 max: 32767 Def.: 0	value (enter!)
	If the set process quantity exceeds the deactivation limit, the output is reset to 0.			

4.193/ 4.213	Relay x-On delay		Unit: s	
Relation with the parameter: **4,194 / 4,214**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 10000 Def.: 0	value (enter!)
	Indicates the duration of the activation delay.			

4.194/ 4.214	Relay x-Off delay		Unit:	
Relation with the parameter: **4,193 / 4,213**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 10000 Def.: 0	value (enter!)
	Indicates the duration of the deactivation delay.			

5.3.10 Virtual output

The virtual output can be parameterized like a relay and is available as a selection in the following parameters:
1.131 Software consent/ 1.150 direction of rotation / 1.054 ramp selection/ 5.090 Change parameter set / 5.010 + 5.011 External error 1 + 2

<table>
<tr><th>4,230</th><th colspan="2">VO operation</th><th colspan="2">Unit: whole</th></tr>
<tr><td rowspan="2">Relation with the parameter:

1,054
1,131
1,150
4,231
4,232
5,010 / 5,011
5,090</td><td>Parameter manual:
P. xy</td><td>Acquisition status:
2</td><td>min.: 0
max.: 51
Def.: 0</td><td>value (enter!)</td></tr>
<tr><td colspan="4">Selection of the process quantity on which the output must be switched.
0 = not assigned / DGM Soft-PLC
1 = Intermediate circuit voltage
2 = Network voltage
3 = Motor voltage
4 = Motor current
5 = Actual frequency value
6 = -
7 = -
8 = IGBT temperature
9 = Internal temperature
10 = Error (NO)
11 = Inverted error (NC)
12 = Hardware enabling
13 = Digital input 1
14 = Digital input 2
15 = Digital input 3
16 = Digital input 4
17 = Ready to start operating (network power supply ON, no HW enabling, the motor is stopped)
18 = Ready (network power supply ON, HW enabling set, the motor is stopped)
19 = Operation (network power supply ON, HW enabling set, the motor is operating)
20 = Ready to start operating + Ready
21 = Ready to start operating + Ready + Operation
22 = Ready + Operation
23 = Motor power
24 = Torque
25 = Fieldbus
Table continues on the following page</td></tr>
</table>

4,230	VO operation		Unit: whole	
Relation with the parameter: **1,054** **1,131** **1,150** **4,231** **4,232** **5,010 / 5,011** **5,090**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 51 Def.: 0	value (enter!)
	Selection of the process quantity on which the output must be switched. **Continued table** 26 = Analog input 1 27 = Analog input 2 28 = PID reference value 29 = Instantaneous PID value 30 = STO channel 1 31 = STO channel 2 32 = Frequency reference value after ramp 33 = Frequency reference value 34 = Actual number of revs value 35 = Actual instantaneous frequency value 36 = Absolute torque value 37 = Absolute value of the reference frequency after ramp 38 = Absolute value of the reference frequency 39 = Instantaneous absolute number of revs value 50 = Motor current active limit 51 = Technical-actual comparison (Para. 6.070 – 6.071)			

4,231	VO On		Unit:	
Relation with the parameter: **4,230**	Parameter manual: P. xy	Acquisition status: 2	min.: - 32767 max.: 32767 Def.: 0	value (enter!)
	If the set process quantity exceeds the activation limit, the output is set to 1.			

4,232	VO Off		Unit:	
Relation with the parameter: **4,230**	Parameter manual: P. xy	Acquisition status: 2	min.: - 32767	value (enter!)
			max.:. 32767	
			Def.: 0	
	If the set process quantity exceeds the deactivation limit, the output is reset to 0.			

4,233	VO On delay		Unit: s	
Relation with the parameter: **4,234**	Parameter manual: P. xy	Acquisition status: 2	min.: 0	value (enter!)
			max.: 10000	
			Def.: 0	
	Indicates the duration of the activation delay.			

4,234	VO Off delay		Unit:	
Relation with the parameter: **4,233**	Parameter manual: P. xy	Acquisition status: 2	min.: 0	value (enter!)
			max.: 10000	
			Def.: 0	
	Indicates the duration of the deactivation delay.			

5.3.11 External error

<table>
<tr><th>5,010 / 5,011</th><th colspan="2">External error 1/2</th><th colspan="2">Unit: whole</th></tr>
<tr><td rowspan="2">Relation with the parameter:

4,110 / 4,113
4,230</td><td>Parameter manual:

P. xy</td><td>Acquisition status:

2</td><td>min.: 0
max.: 7
Def.: 0</td><td>value (enter!)</td></tr>
<tr><td colspan="4">Selection of the source via which an external error can be communicated.
0 = not assigned / DGM Soft-PLC
1 = Digital input 1
2 = Digital input 2
3 = Digital input 3
4 = Digital input 4
5 = Virtual output (parameter 4.230)
6 = Analog input 1 (must be selected in parameter 4.030)
7 = Analog input 2 (must be selected in parameter 4.060)</td></tr>
<tr><td></td><td colspan="4">If there is a high signal at the selected digital input, the speed regulator switches with error codes 23 / 24 of external error ½.
With the aid of parameters 4.110 to 4.113 DIx inversion, it is possible to invert the digital input logic.</td></tr>
</table>

5.3.12 Motor current limit

This function limits the motor current to a maximum set value when reaching a parameterized current-time area.

This motor current limit is monitored on the application level and therefore implements the limitation with relatively modest dynamics. This is an aspect that should be taken into account appropriately when selecting this function.

The maximum value is determined via the parameter "Motor current limit %“ (5.070). It is indicated as a percentage and refers to the nominal motor current from the “Motor current” plate data (33.031).

The maximum current-time area is calculated by the product of the parameter “Motor current limit in s" (5.071) and the overcurrent fixed at 50% of the desired motor current limit.

As soon as this current-time area is exceeded, the motor current is limited to the limit value, reducing the number of revs. If therefore the output current of the speed regulator exceeds the motor current (parameter 33.031) multiplied by the limit set in % (parameter 5.070) for the set time (parameter 5.071), the output current of the frequency regulator is limited to the set value.

The total function can be deactivated by setting the parameter "Motor current limit %" (5.070) to zero.

5,070	Motor current limit %		Unit: %		
Relation with the parameter: **5,071** **33,031**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	250	
			Def.:	0	
	0 = deactivated **see description 5.3.12**				

5,071	Motor current limit s		Unit: s		
Relation with the parameter: **5,070** **33,031**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	100	
			Def.:	1	
	see description 5.3.12				

5,075	Reduction factor		Unit:		
Relation with the parameter: **33,034**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1000	
			Def.:	1	
	A reduction factor can be set here. The indication of the number of mechanical revs can be adapted using the reduction factor.				

5.3.13 Block detection

5,080	Block detection		Unit: whole		
Relation with the parameter: **5,081** **34,110**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1	
			Def.:	0	
	Block detection can be activated with this parameter. 0 = inactive 1 = active This function works reliably only if the motor data has been entered correctly and the slip compensation has not been deactivated.				

5,081	Blocking time		Unit: s		
Relation with the parameter: **5,080**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	50	
			Def.:	2	
	Indicates the time after which a block is detected.				

5,082	Start error active		Unit: whole		
Relation with the parameter: **4,233**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1	
			Def.:	1	
	The start error is defined as follows: 10% of the nominal motor frequency reached after 30 seconds (if nominal frequency is < 10%, the error is not generated). If the acceleration time is > 30 seconds, instead of 30 seconds, half of the acceleration ramp time is considered. 0 = function deactivated 1 = function active				

5,083	Error log 11 deactivation		Unit: whole		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	10	
			Def.:	0	
	If an external 24 V power supply is used, the log-in for error no. 11 "Power time out" can be deactivated. The error counter itself is not affected. 0 = function deactivated 1 = function active				

5,090	Change parameter set		Unit: whole		
Relation with the parameter: **4,030 / 4,060 4,230**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	12	
			Def.:	0	
	Parameter set selection active. 0 = not assigned 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 = DGM Soft-PLC 8 = Virtual output (parameter 4.230) 9 = Analog input 1 (must be selected in parameter 4.030) 10 = Analog 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 saving data set 1, key II for saving data set 2				
	The 2nd data set is displayed in the PC software only if this parameter is <> 0. The MMI always displays the values of the currently selected data set.				

5,200	MMI display rotation		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 1 Def.: 0	value (enter!)
	Only for the MMI integrated in the cover. It can be defined if the display and/or key assignment must be rotated 180°. 0 = function deactivated 1 = function active			

5,201	Save MMI display		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 1 max.: 5 Def.: 1	value (enter!)
	The state to be shown on the MMI display can be selected here. 1 = State 01: Reference frequency/actual/motor current 2 = State 02: Number of revs/motor current/process value 1 3 = State 03: Number of revs/motor current/process value 2 4 = State 04: Number of revs/PID reference value/actual PID value 5 = State 05: PLC client output value 1 / 2 / 3			

5,202	MMI password		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 9999 Def.: 0	value (enter!)
	A password for accessing the expert mode on the MMI can be assigned here. 0: Password request deactivated The password can be set individually in both data sets.			

5,210	MMI language option		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	**Relation with the parameter:**	Parameter manual: P. xy
			max.: 9999	
			Def.: 0	
	This parameter is used to select the language that displays the MMI option. 0 = specific language of the country (initial setting German) 1 = English This setting does not impact the selection of the language with the hand-held MMI control unit.			

5.3.14 Fieldbus

6,060	Fieldbus address		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 0	min.: 0	value (enter!)
			max.: 127	
			Def.: 0	
	In order for this address to be used, the device address coding switches must be set to 00. The change to the fieldbus address is only acquired after the DGM is restarted. The Profibus devices are set automatically to the address "Default 125" with the coding switch positioned to the address "00" and parameter 0.			

6,061	Fieldbus baudrate		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0	value (enter!)
			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 timeout		Unit in s	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 100 Def.: 5	value (enter!)
	Bus timeout, if a fieldbus telegram is not received when the set time expires, the DGM deactivates itself, signaling the error “bus timeout". The function is only activated after a telegram is received. 0 = control deactivated			

IMPORTANT INFORMATION
Changing a parameter value via the fieldbus involves direct EEPROM writing access.

6,070 / 6,071	Reference/actual value deviation		Unit: %	
Relation with the parameter: **4,150 / 4,170 4,190 / 4,210 4,230**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 % / 0 sec. max.: 100 % / 32767 sec. Def.: 0 % / 0 sec.	value (enter!)
	This function can be used to compare the reference and actual values. The result is output via the status word of the fieldbus or on a digital output. Parameter 6.070 can be used to define the tolerance range for the reference value. Parameter 6.071 is used to set the time the actual value must be out of the tolerance range before the output is reset. Example: Operating mode = PID regulation PID reference value = 50 % 6.070 = 10 % 6.071 = 1 sec. As soon as the actual value is between 40% and 60%, the output is set. If the reference value is outside of the range between 40% and 60% for 1 sec., the output is reset.			

5.4 Power parameters

5.4.1 Motor data

33,001	Motor type		Unit: whole	
Relation with the parameter: **33.010**	Parameter manual: P. xy	Acquisition status: 1	min.: 1 max.: 2 Def.: 1	value (enter!)
	Selection of the motor type. 1 = asynchronous motor 2 = synchronous motor (not available) Depending on the type of motor selected, the relative parameters are displayed. Also the type of regulation must be selected as a result (parameter 34.010).			

33,015	Optimization R		Unit: %	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.: 0 max.: 200 Def.: 100	value (enter!)
	If necessary, this parameter can be used to optimize the start-up behavior.			

33,016	Motor phase check		Unit: whole	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.: 0	value (enter!)
			max.: 1	
			Def.: 1	
	The error control "Motor connection interrupted" (error 45) can be deactivated with this parameter. 0 = control deactivated 1 = control activated			

33,031	Motor current		Unit: A	
Relation with the parameter: **5,070**	Parameter manual: P. xy	Acquisition status: 1	min.: 0	value (enter!)
			max.: 150	
			Def.: 0	
	The nominal motor current $I_{M,N}$ is set here, both for the star connection as well as for the delta connection.			

33,032	Motor power		Unit: W	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.: 0	value (enter!)
			max.: 55000	
			Def.: 0	
	A power value [W] $P_{M,N}$ must be set here that corresponds to the nominal motor power.			

33,034	Number of motor revs		Unit: rpm		
Relation with the parameter: **34,120** **5,075**	Parameter manual: P. xy	Acquisition status: 1	min: max: Def.:	0 10000 0	value (enter!)
	The nominal rpm value $n_{M,N}$ of the motor data plate must be entered here.				

33,035	Motor frequency		Unit: Hz		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.: max.: Def.:	10 400 0	value (enter!)
	The nominal motor frequency $f_{M,N}$ is set here.				

33,050	Stator resistance		Unit: Ohm		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.: max.: Def.:	0 100 0.001	value (enter!)
	Here the stator resistance can be optimized if the value detected automatically (during motor identification) is not sufficient.				

33,105	Dispersion inductance		Unit: H		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.: max.: Def.:	0 1 0	value (enter!)
	Only for asynchronous motors. Here the dispersion inductance can be optimized if the value detected automatically (during motor identification) is not sufficient.				

33,110	Motor voltage		Unit: V		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.:	0	value (enter!)
			max.:	1500	
			Def.:	0	
	Only for asynchronous motors. The nominal motor voltage $I_{M,N}$ is set here, both for the star connection as well as for the delta connection.				

33,111	Motor cos phi		Unit: 1		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.:	0.5	value (enter!)
			max.:	1	
			Def.:	0	
	Only for asynchronous motors. The cos phi power factor indicated on the motor plate must be entered here.				

33,200	Stator inductance		Unit: H		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.:	0	value (enter!)
			max.:	1	
			Def.:	0	
	Only for synchronous motors. (Not available) Here the stator inductance can be optimized if the value detected automatically (during motor identification) is not sufficient.				

33,201	Nominal flow		Unit: mVs		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 1	min.:	0	value (enter!)
			max.:	10000	
			Def.:	0	
	Only for synchronous motors. (Not available) Here the nominal flow can be optimized if the value detected automatically (for motor identification) is not sufficient.				

5.4.2 Control I^2T

33,010	Motor factor I^2T		Unit: %		
Relation with the parameter: **33,031** **33,011**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1000	
			Def.:	100	
	Here the current threshold can be set as a percentage (in reference to the motor current 33.031) for starting integration. 0 % = inactive For thermally sensitive applications, we recommend using contacts that protect the windings!				

33,011	Time I^2T		Unit: s		
Relation with the parameter: **33,010**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1200	
			Def.:	30	
	Time after which the speed regulator deactivates with I^2T.				

33,138	Holding current time		Unit: s	
Relation with the parameter: **33,010**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 3600 Def.: 2	value (enter!)
	Only for asynchronous motors. This is the period of time the drive system is still supplied with direct current at the end of the braking ramp.			

5.4.3 Switching frequency

The internal switching frequency can be modified to control the part related to power. A high regulation value reduces motor noise, but creates greater electromagnetic emissions (EMC) and increased losses in the speed regulator.

34,030	Switching frequency		Unit: Hz	
Relation with the parameter: **33,010**	Parameter manual: P. xy	Acquisition status: 2	min.: 1 max.: 4 Def.: 2	value (enter!)
	Selection of the speed regulator switching frequency: 1 = 16 kHz 2 = 8 kHz 4 = 4 kHz			

5.4.4 Regulator data

34,010	Type of regulation		Unit: whole	
Relation with the parameter: **33,001** **34,011**	Parameter manual: P. xy	Acquisition status: 2	min.: 100 max.: 201 Def.: 100	value (enter!)
	Selection of the regulation type: 100 = open-loop asynchronous motor 200 = open-loop synchronous motor (not available)			

34,020	Quick restart		Unit:	
Relation with the parameter: **34,021**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 1 Def.: 1	value (enter!)
	The quick restart function is activated with this parameter. 0 = inactive 1 = active			

34,021	Quick restart time		Unit: ms	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 10,000 Def.: 100	value (enter!)
	Here the quick restart time can be optimized if the results detected automatically (during motor identification) are not sufficient.			

34,090	$K_p$regulator		Unit: mA / rad / s	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 10000 Def.: 150	value (enter!)
	For asynchronous motors: Here the amplification of the control of the number of regulator revs can be optimized if the results detected automatically (during motor identification) are not sufficient. For synchronous motors: (Not available) The amplification of the control of the number of regulator revs can be set here.			

34,091	Regulator T_n		Unit: s	
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 10 Def.: 4	value (enter!)
	For asynchronous motors: Here the action time of the speed regulator can be optimized if the results detected automatically (during motor identification) are not sufficient. For synchronous motors: (Not available) Here the speed regulator action time must be optimized; a value between 0.1 s and 0.5 s is recommended.			

34,110	Slip compensation		Unit:	
Relation with the parameter: **5,080** **33,034**	Parameter manual: P. xy	Acquisition status: 2	min.: 0 max.: 1.5 Def.: 1	value (enter!)
	Only for asynchronous motors. This parameter can be used to optimize or deactivate the slip compensation. 0 = Deactivated (behavior as in the network) 1 = The slip is compensated. Example: asynchronous 4-pole motor with 1410 rpm, nominal frequency 50 Hz Motor idling 0 = approx. 1500 rpm 1 = 1500 rpm Motor at rated point 0 = 1410 rpm 1 = 1500 rpm 50 Hz is always displayed as the actual frequency. Deactivating slip compensation may cause the block detection to no longer function in a reliable manner.			

34,130	Voltage regulation reserve		Unit:		
Relation with the parameter:	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	2	
			Def.:	0.95	
	Only for asynchronous motors. This parameter can be used to adapt the voltage output.				

5.4.5 Quadratic characteristic curve

34,120	Quadratic characteristic curve		Unit: whole		
Relation with the parameter: **34,121**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1	
			Def.:	0	
	Only for asynchronous motors. The function of the quadratic characteristic curve can be activated here. 0 = inactive 1 = active				

34,121	Flow adaptation		Unit: %		
Relation with the parameter: **34,120**	Parameter manual: P. xy	Acquisition status: 2	min.:	0	value (enter!)
			max.:	100	
			Def.:	50	
	Only for asynchronous motors. The percentage at which the flow must be decreased can be set here. In case of excessive variations during operation, deactivation may take place due to overvoltage.				

5.4.6 Brake chopper

35,080	Brake resistor		Unit: Integer		
Relation with the parameter:	Parameter manual:	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1	
			Def.:	0	
	Here it is possible to activate the brake resistor. 0: deactivated 1: active				

5.4.7 Protection functions

36,020	Network monitoring deactivated		Unit: Integer		
Relation with the parameter:	Parameter manual:	Acquisition status: 2	min.:	0	value (enter!)
			max.:	1	
			Def.:	0	
	Network monitoring can be deactivated here. 0: deactivated 1: active				

6. Troubleshooting

This chapter contains

- a list of the LED flashing codes for error detection
- a description of error detection
- a list of errors and system errors
- instructions for detecting errors with the MMI

HAZARD
Risk of fatal injury due to electric shock! **Fatal or serious injuries!** Disconnect the electrical voltage from the device and secure it to prevent it from being reconnected. Only replace damaged parts or components with original spare parts.
 Risk of electric shock and electric discharge. After shut-off, wait two minutes (time for capacitor discharge)

6.1 Presentation of the LED flashing codes for error detection

When an error is verified, the speed regulator LEDs emit a flashing code that makes it possible to diagnose the error.

The following table contains a list of these errors:

Red LED	Green LED	State
	○	Bootloader active (alternating flashes)
○		Ready to start operating (activate En_HW for operation)
○	●	Operation / ready
	●	Warning
●	○	Error
●	●	Motor data identification
○		Initialization
		Firmware update
	●	Bus operating error
		Bus ready to start operating error

Table 18: Flashing LED codes

Key			
○	LED off	●	LED on
	LED flashing		LED flashing quickly

6.2 List of errors and system errors

When an error occurs, the speed regulator stops the motor. The relative error codes can be taken from the flashing code table or from Vplus Dec.

IMPORTANT INFORMATION

The error messages can only be reset if the error is no longer present!

The error messages can be reset as follows:

- digital input (programmable)
- via the MMI (hand-held control device)
- Automatic reset function (Parameter 1.181)
- turning the device off and back on
- via the fieldbus (CANOpen, Profibus DP, EtherCAT)

A list of the possible error messages is provided below. In the case of errors that are not listed here, contact BONFIGLIOLI customer service!

No.	Error name	Error description	Possible causes/remedies
1	24 V application undervoltage	Application power supply voltage less than 15 V	Overload of the 24 V power supply
2	24V application overvoltage	Application power supply voltage greater than 31 V	Internal 24 V power supply NOT OK or external power supply NOT OK
6	PLC client version error	The PLC client version is not suitable for the device firmware	Check the PLC client version number and the device firmware
8	Application <> power communication	Internal communication problems between the application's printed circuit board and the one for the power	Electromagnetic compatibility disturbances (EMC)

No.	Error name	Error description	Possible causes/remedies
10	Parameter distributor	The internal distribution of the parameters during initialization failed	Parameter set incomplete
11	Power time-out	The part related to power does not react	Operation with 24 V without network power supply
13	Breakage of the analog In1 cable (4..20 mA / 2 – 10 V)	Current or voltage below the lower limit of analog input 1 (the checking of this error is activated by setting the parameter 4.021 to 20%).	Cable breakage, external sensor defective
14	Breakage of the analog In 2 cable (4..20 mA / 2 – 10 V)	Current or voltage below the lower limit of analog input 2 (this error monitoring is activated by setting the parameter 4.051 to 20%)	Cable breakage, external sensor defective
15	Block detection	The motor transmission shaft is blocked. 5,080	Eliminate the block
16	PID dry cycle	No actual PID value even though number of revs is at the maximum	Actual PID value sensor defective. Extension of the dry cycle time parameter 3.072
17	Start error	The motor does not function or does not function correctly. 5,082	Check the motor connections/motor and regulator parameters; deactivate the error if necessary (5.082).
18	CF application overheating	Excessive internal temperature	Cooling insufficient, low number of revs and high torque, excessive pulse frequency.

No.	Error name	Error description	Possible causes/remedies
21	Bus time-out	No response from the bus user or from the MMI / PC	Check the bus wiring
22	Confirmation error	The maximum number of automatic resets (1.182) has been exceeded	Check the error chronology and eliminate the error
23	External error 1	The parameterized error input is active. 5,010	Eliminate the external error
24	External error 2	The parameterized error input is active. 5,011	Eliminate the external error
25	Motor detection	Motor identification error	Check the DGM / motor and the PC / MMI / DGM connections / restart of motor identification
26	STO input plausibility	The states of the two STO inputs were not identical for more than 2 seconds.	Incorrect connection of the STO inputs. Check the external wiring.
32	IGBT trip **	The overload protection for the IGBT module has tripped	Short circuit in the motor or the motor power supply line / regulator settings
33	Intermediate circuit overvoltage **	The maximum voltage of the intermediate circuit was exceeded	Regenerative power supply with the motor in generator mode / excessive network voltage / incorrect regulation of the revolution regulator / brake chopper not connected or defective / ramp times too short

No.	Error name	Error description	Possible causes/remedies
34	Intermediate circuit undervoltage	Drop below the minimum voltage of the intermediate circuit	Insufficient network voltage / network connection defective / check the wiring
35	Motor overheating	The motor PTC has tripped	Motor overload (e.g. high torque with low number of revs) / excessive ambient temperature
36	Power failure	The network voltage has brief interruptions	Network oscillations/network voltage interrupted
38	IGBT module overheating	IGBT module overheating	Cooling insufficient, low number of revs and high torque, excessive pulse frequency
39	Overcurrent **	Maximum output current of the speed regulator exceeded	Motor blocked / check the motor connection /incorrect setting of the revolution regulator / check the motor parameters / ramp times too short / brake not open
40	Frequency converter overheating	Excessive internal temperature	Cooling insufficient / low number of revs and high torque / excessive pulse frequency / permanent overload / reduce the ambient temperature / check the fan
42	Motor protection switch I^2T	The internal protection I^2T for the motor tripped (parameterizable)	Permanent overload
43	Ground leakage	Ground leakage of a motor phase	Isolation fault

No.	Error name	Error description	Possible causes/remedies
45	Motor connection interrupted	There is no motor current regardless of activation via the inverter	no motor connected or connected incompletely. Check the phases or the connections to the motor, connect them correctly if necessary. *
46	Motors parameters	The reliability check of the motor parameters was not successful	Parameter set NOT OK
47	Speed regulator parameters	The reliability check of the speed parameters was not successful	Parameter set NOT OK, motor model 33.001 and regulation type 34.010 not reliable.
48	Rating plate data	The motor data was not entered	Please enter the motor data according to the rating plate data
49	Power class limitation	Max. overload of the speed regulator exceeded for more than 60 sec	Check the application / reduce the load / select a larger speed regulator

Table 19: Error detection

***** If the phases and/or motor connections are connected correctly, set the parameter 33.016 accordingly.

****** If an error occurs again, it can be reset only after the following times:

1 -3	Permitted resets =	1	Wait time s
4 -5	Permitted resets =	5	Wait time s
> 5	Permitted resets =	30	Wait time s

The number of resets performed is deleted after 120 s without errors!

7. Deinstallation and disposal

This chapter contains:

- a description of the deinstallation of the speed regulator
- instructions for proper disposal

7.1 Deinstalling the speed regulator

HAZARD
Risk of fatal injury due to electric shock! **Fatal or serious injuries!** Disconnect the electrical voltage from the device and secure it to prevent it from being reconnected.
 Risk of electric shock and electric discharge. After shut-off, wait two minutes (time for capacitor discharge)

1. Remove the cover of the speed regulator.
2. Disconnect the cables from the terminals.
3. Remove all the cables.
4. Remove the connection screws between the speed regulator/adapter plate.
5. Remove the speed regulator.

7.2 Instructions for proper disposal

Dispose of the speed regulator, packaging and the replaced components in accordance with the provisions of the country where the speed regulator is installed.
The speed regulator must not be disposed of with normal household waste.

8. Technical data

8.1 General data

8.1.1 General technical data for 400 V devices

	Size	A				B			C		D			
Electric data	Recommended motor power [1] [kW]	0.55	0.75	1.1	1.5	2.2	3.0	4.0	5.5	7.5	11.0	15.0	18.5	22.0
	Network voltage	3 x 200 VAC -10 %...480 VAC +10 % 280 VDC -10 %...680 VDC +10 % [3]												
	Network frequency	50/60 Hz ± 6 %												
	Electric systems	TN / TT												
	Input current [A]	1.4	1.9	2.6	3.3	4.6	6.2	7.9	10.8	14.8	23.2	28.2	33.2	39.8
	Actual nominal output current [IN at 8 kHz]	1.7	2.3	3.1	4.0	5.6	7.5	9.5	13.0	17.8	28.0	34.0	40.0	48.0
	Min. brake chopper [Ω]	100				50			50		30			
	60 sec. overload in %	150												130
	Switching frequency	4 kHz, 8 kHz, 16 kHz, (default 8 kHz)												
	Output frequency	0 Hz - 400 Hz												
	Network start / reconnecting cycles	Unlimited [4]									2 min.			
	Contact current DIN EN 61800-5	< 3.5 mA												
Functions	Protection functions	Overvoltage and undervoltage, I^2t limitation, shortcircuit, ground fault, motor and inverter temperature, block detection, dry PID operation protection												
	Software functions	Process regulation (PID), fixed frequencies, dataset switching, quick restart, motor of current limitation												
	Soft PLC	IEC61131-3, FBD, ST, AWL												
Mechanical data	Housing	Pressure die-cast aluminum housing in two parts												
	Dimensions [L x W x H] mm	233 x 153 x 120				270 x 189 x 140			307 x 223 x 181		414 x 294 x 232			
	Weight, inc. adapter plate	3.9 kg				5.0 kg			8.7 kg		21.0 kg			
	Protection class [IPxy]					IP 65					IP 55			
	Cooling					passive cooling					active cooling			
Environmental conditions	Room temperature	25°C (without condensation) up to 50°C (without derating)												
	Storage temperature	-25 °C…+85°C												
	Installation altitude	up to 1000 m s.l.m. / above 1000 m with reduced power (1% every 100 m) / above 2000 m see the chapter “Power derating based on installation altitude”												
	Air relative humidity	≤ 96 % no condensation allowed												
	Vibration resistance (DIN EN 60068-2-6)	50 m/s²; 5…200 Hz [2]												
	Shock resistance (DIN EN 60068-2-27)	300 m/s²												
	EMC (DIN-EN-61800-3)	C2												

400 V device technical data (subject to technical changes)

[1] Recommended motor power (4-pole asynchronous motor) with network voltage equal to 400 VAC.

[2] Vibration test combined with degree of precision 2 according to FN942017, part 4.

[3] For the observance of the overvoltage category

[4] < 3 s may cause network interruption/intermediate circuit undervoltage

8.1.2 General technical data for 230 V devices

	Size	A			
Electric data	Recommended motor power [1] [kW]	0.37	0.55	0.75	1.1
	Network voltage	1 x 100 VAC -15 %...230 VAC +10 % 140 VDC -15 %...320 VDC +10 %			
	Network frequency	50/60 Hz ± 6 %			
	Electric systems	TN / TT			
	Input current [A]	4.5	5.6	6.9	9.2
	Actual nominal output current [IN at 8 kHz]	2.3	3.2	3.9	5.2
	Min. brake chopper [Ω]	50			
	60 sec. overload in %	150			
	Switching frequency	4 kHz, 8 kHz, 16 kHz, (default 8 kHz)			
	Output frequency	0 Hz – 400 Hz			
	Network start / reconnecting cycles	Every 2 min.			
	Contact current DIN EN 61800-5	< 10 mA			
Functions	Protection functions	Overvoltage and undervoltage, I^2t limitation, shortcircuit, ground fault, motor and inverter temperature, tilting prevention, block detection, dry PID operation protection			
	Software functions	Process regulation (PID), fixed frequencies, dataset switching, quick restart, motor of current limitation			
	Soft PLC	IEC61131-3, FBD, ST, AWL			
Mechanical data	Housing	Pressure die-cast aluminum housing in two parts			
	Dimensions [L x W x H] mm	233 x 153 x 120			
	Weight, inc. adapter plate	3.9 kg			
	Protection class [IPxy]	IP 65			
	Cooling	passive cooling			
Environmental conditions	Room temperature	-10 °C (without condensation) up to +40 °C (50 °C with derating)			
	Storage temperature	-25 °C…+85°C			
	Installation altitude	up to 1000 m s.l.m. / above 1000 m with reduced power (1% every 100 m) / above 2000 m see the chapter “Power derating based on installation altitude”			
	Air relative humidity	≤ 96 % no condensation allowed			
	Vibration resistance (DIN EN 60068-2-6)	50 m/s²; 5…200 Hz [2]			
	Shock resistance (DIN EN 60068-2-27)	300 m/s²			
	EMC (DIN-EN-61800-3)	C1			

230 V device technical data (subject to technical changes)

[1] Recommended motor power (4-pole asynchronous motor) with network voltage equal to 230 VAC.

[2] Vibration test combined with degree of precision 2 according to FN942017, part 4.

8.1.3 Interface specification

Name	Function
Digital inputs 1– 4	- Low switching level < 5 V / high > 18 V - Imax (at 24 V) = 3 mA - Rin = 8.6 kOhm
Hardware enable input	- Switching level Low < 3 V /High > 18 V Imax (at 24 V) = 8 mA
Analog inputs 1, 2	- In +/- 10 V or 0 – 20 mA - In 2 – 10 V or 4 – 20 mA - Resolution 10 Bit - Tolerance +/- 2 % Voltage input: - Rin = 10 kOhm Current input: - Load = 500 Ohm
Digital outputs 1, 2	- Short circuit resistance - Imax = 20 mA
Relays 1, 2	1 Exchange contact (NO/NC) Maximum switching capacity * - with ohmic load (cos φ = 1): 5 A at ~ 230 V or = 30 V - with inductive load (cos φ = 0.4 and L/R = 7 ms): 2 A at ~ 230 V or = 30 V Maximum reaction time: 7 ms ± 0.5 ms Electrical endurance: 100,000 switching cycles
Analogue output 1 (current)	- Short circuit resistance - I out = 0.. 20 mA - Load = 500 Ohm - Tolerance +/- 2 %
Analogue output 1 (Voltage)	- Short circuit resistance - Uout = 0..10 V - Imax = 10 mA - Tolerance +/- 2 %
Supply voltage 24 V	- Auxiliary voltage U = 24 V DC - Short circuit resistance - Imax = 100 mA - possible external power supply 24 V
Supply voltage 10 V	- Auxiliary voltage U = 10 V DC - Short circuit resistance - Imax = 30 mA

Table 20: Interface specification

***** according to standard UL 508C max. 2 A are permitted!

8.2 Derating of the output power

The DGM series speed regulators have two integrated PTC resistors (cold conductors) that monitor the internal temperature and the temperature of the heat dissipator. As soon as a permitted IGBT temperature of 95°C is exceeded or with a permitted internal temperature of 85°C, the speed regulator turns off.

With the exception of the 22 kW regulator (size D 130%), all DGM type speed regulators are designed for an overload of 150% for 60 sec (every 10 min).

Take a reduction in the overload capacity and the relative duration into account under the following circumstances:

- a permanently set switching frequency that is too high >8 kHz (based on the load).
- a permanently high heat dissipator temperature, caused by a blocked air flow or by clogging (cooling fins dirty).
- Ambient temperature permanently too high, depending on the type of installation.

The respective maximum output values can be determined based on the following characteristic curves.

8.2.1 Power derating based on the ambient temperature

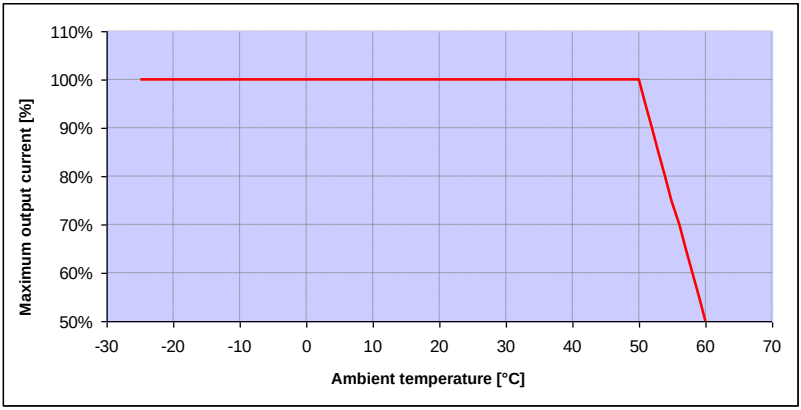


Fig. 41: Power derating for speed regulators mounted on the motor (all sizes)

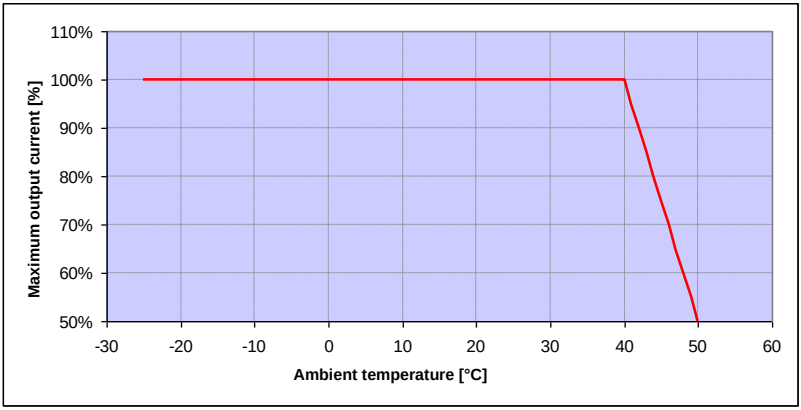


Fig. 42: Power derating for wall-mounted speed regulators (sizes A – C)

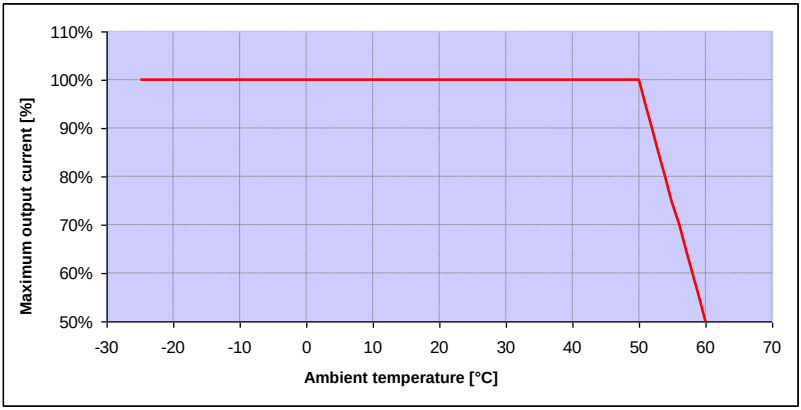


Fig. 43: Power derating for wall-mounted speed regulators (size D with fan)

8.2.2 Power derating based on the installation altitude

The following applies for all DGM speed regulators:

- In mode S1, no power reduction is necessary up to 1000 masl.
- In the range between 1000 m ≥ 2000 m, a power reduction of 1% is necessary for every 100 m of installation altitude. Overvoltage category 3 is observed!
- In the range between 2000 m ≥ 4000 m overvoltage category 2 must be observed due to the low air pressure!

To observe the overvoltage category:

- an external overvoltage protection must be used in the DGM power supply line (network cable).
- the input voltage must be reduced.

Contact BONFIGLIOLI customer service.

The respective maximum output values can be determined based on the following characteristic curves.

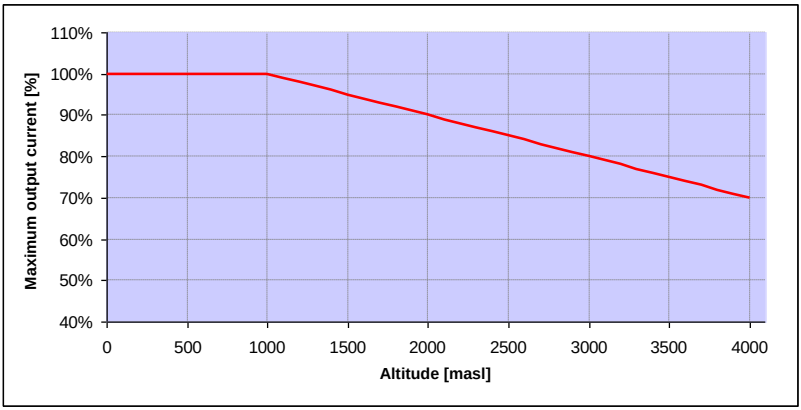


Fig. 44: Power derating of the maximum output current based on the installation altitude

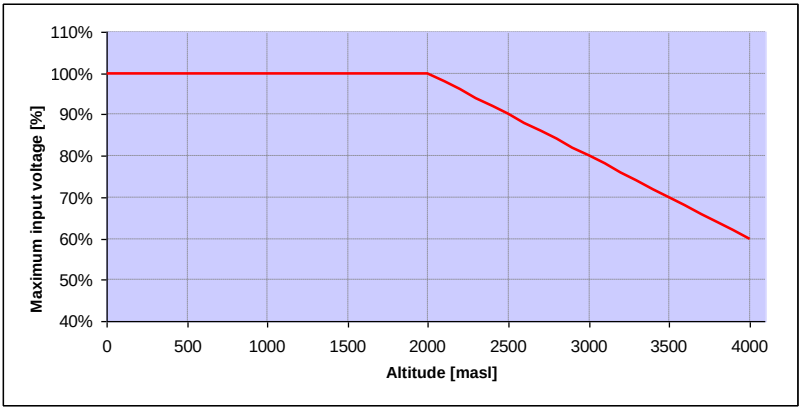


Fig. 45: Power derating of the maximum input voltage based on the installation altitude

8.2.3 Power derating based on the switching frequency

The following illustration shows the output current in function of the switching frequency. To limit heat losses in the speed regulator, the output current must be reduced.

Note: The pulse frequency is not reduced automatically!

The maximum output values can be determined based on the following characteristic curve.

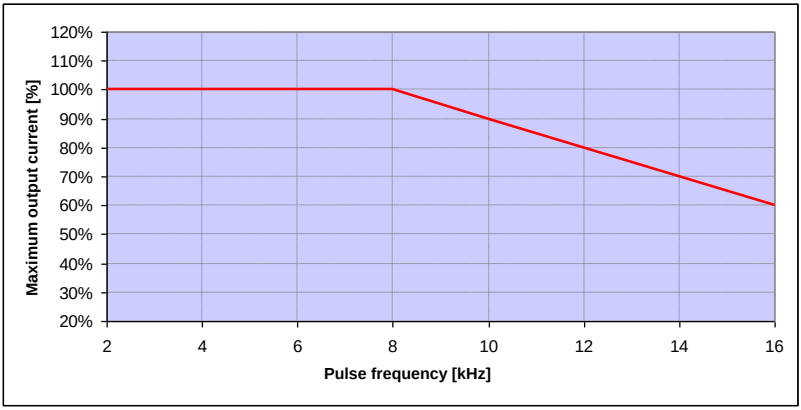


Fig. 46: Power derating of the maximum output current based on of the switching frequency

9. Accessories

This chapter contains brief descriptions of the following accessories.

- Adapter plates
- Hand-held MMI control device incl. RJ9 connection cable on the M12 connector
- Connection cable from the PC USB to the M12/RS485 connector

9.1 Adapter plates

If the inverter is ordered together with the gear motor, the assemblies are implemented by Bonfiglioli, the installed adapter plate will be machines specifically for assembly on Bonfiglioli motors.

9.1.1 Adapter plates for a generic motor

A standard motor adapter plate is available for each DGM size (with an integrated terminal board for sizes A to C).

The customer is responsible for making the four holes in the standard motor adapter plate. Technical drawings are available for the utilized size, which illustrate the possible hole positions.

INFORMATION

The following applies for the DGM speed regulator size D:
a supplementary support is not mandatory for industrial use.
In case of more substantial vibrations, a supplementary support may be necessary in individual cases on the rear side of the motor.
Contact the Bonfiglioli sales service for design help.

INFORMATION

The system integrator is responsible for making sure that the connection from the motor to the adapter plate satisfies the mechanical requirements of the application.
If the motor is not part of the scope of supply of the speed regulator, the system integrator must ensure that the following points are observed when installing the regulator on the motor.

- Fastening interface center distance
- Depth of the blind hole, diameter and type of thread of the fastening points

IMPORTANT INFORMATION

Bonfiglioli shall not be held responsible for the connection between the motor and DGM**!**

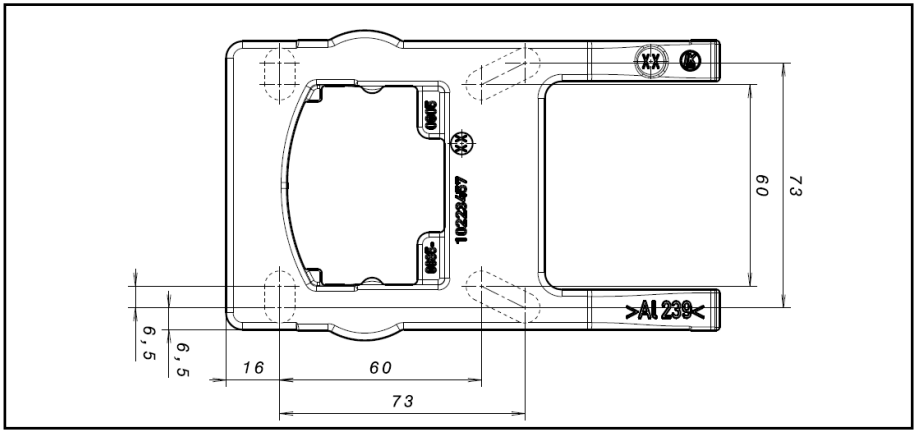


Fig. 47: Standard adapter plate drilling template size A

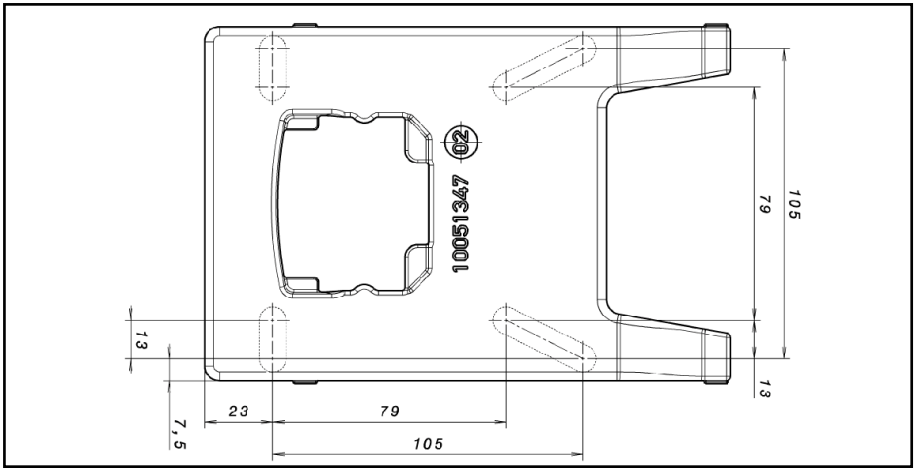


Fig. 48: Standard adapter plate drilling template size B

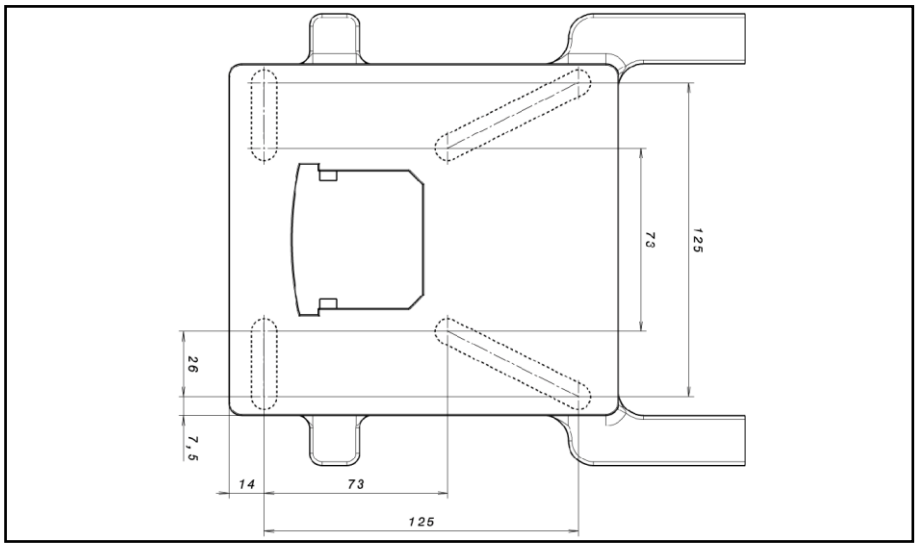


Fig. 49: Standard adapter plate drilling template size C

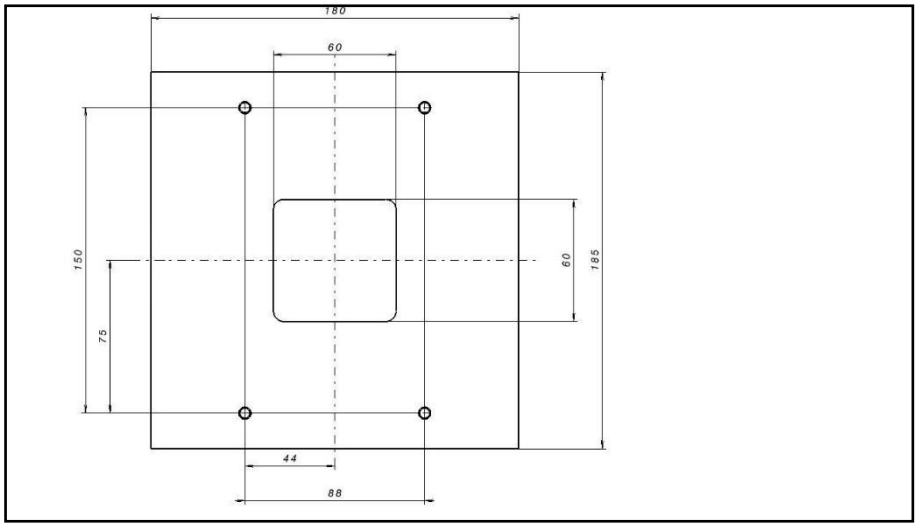


Fig. 50: Standard adapter plate drilling template size D

If using cylindrical head screws (see DIN 912 / DIN 6912) or flat head screws (see DIN EN ISO 7380), drill the drilling template on the DGM support frame, as per the relative drawings. The drilling centers must be located along the relative center lines of the slots shown in the diagrams.

If the support frame is fastened to a connection box that does not have a square drilling template, the center lines shown diagonally on the drawing shall be used as a reference.

If the fastening holes are located outside of the indicated positions, the countersunk head screws must be used to prevent collisions when mounting the DGM.

The flat gaskets must be reused if in proper conditions.

9.1.2 Bonfiglioli motor adapter plates

In addition to the standard adapter plates for a generic motor (with integrated terminal board for sizes A to C), specific variants are available for assembly on Bonfiglioli motors. In general, these plates are installed directly by Bonfiglioli.

9.1.3 Wall adapter plates (standard)

A standard wall adapter plate is available for each DGM size (with an integrated terminal board for sizes A to C).
There are already four holes for fastening the adapter plate and an EMC screw connection.

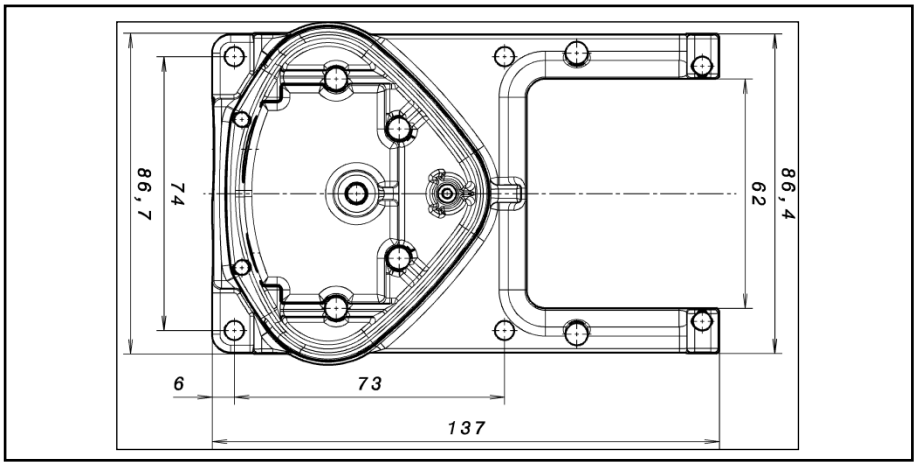


Fig. 51: Standard wall adapter plate drilling template size A

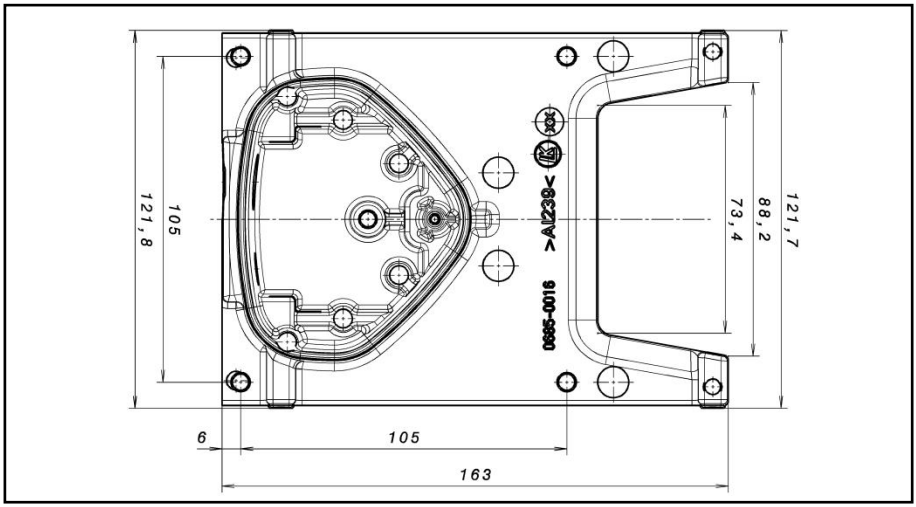


Fig. 52: Standard wall adapter plate drilling template size B

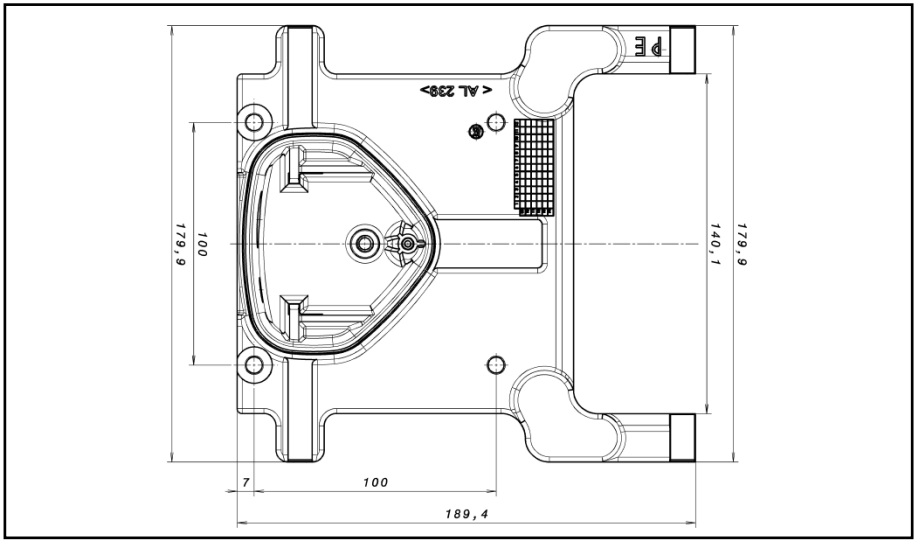


Fig. 53: Standard wall adapter plate drilling template size C

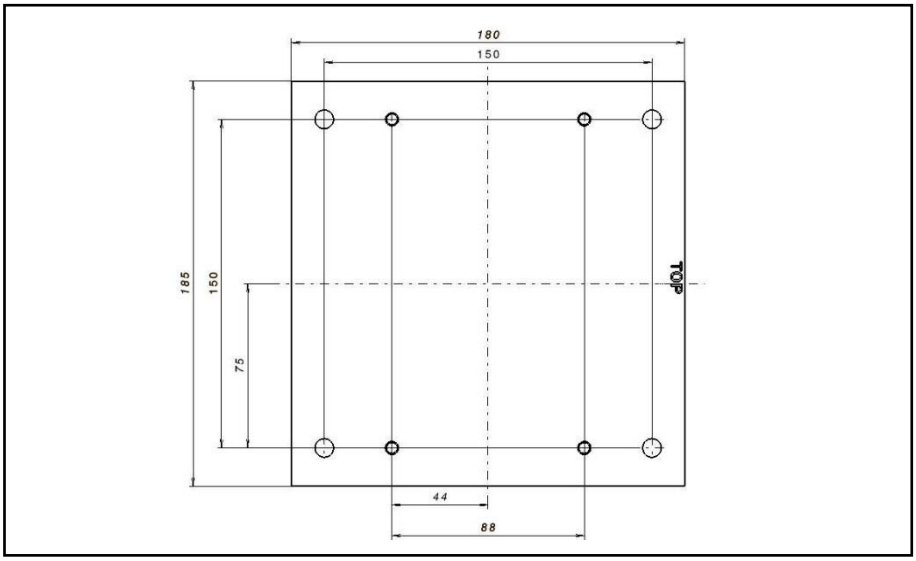


Fig. 54: Standard wall adapter plate drilling template size D

9.2 Foil keypad

As an option, the devices of the DGM family are also available with an integrated foil keypad. This keypad makes it possible to have a complete control system for the speed regulator on the device.

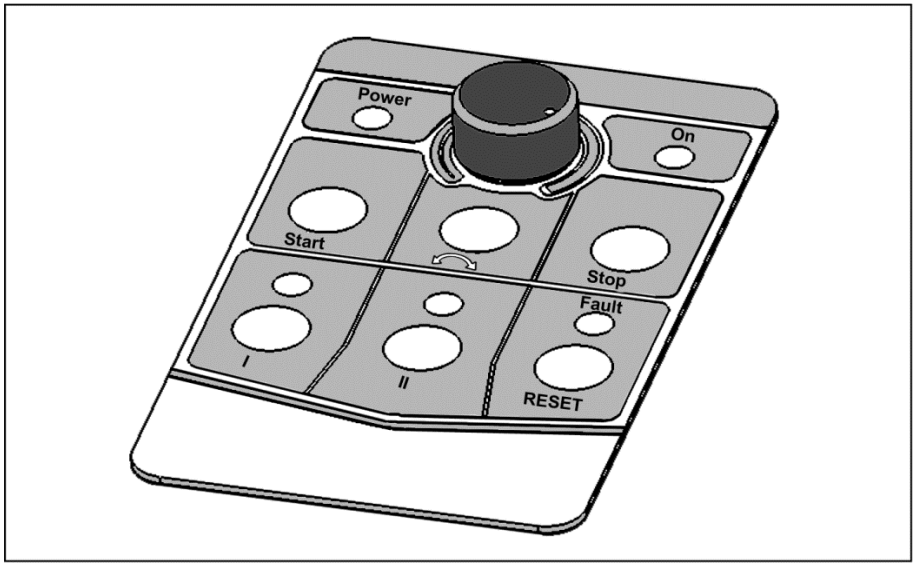
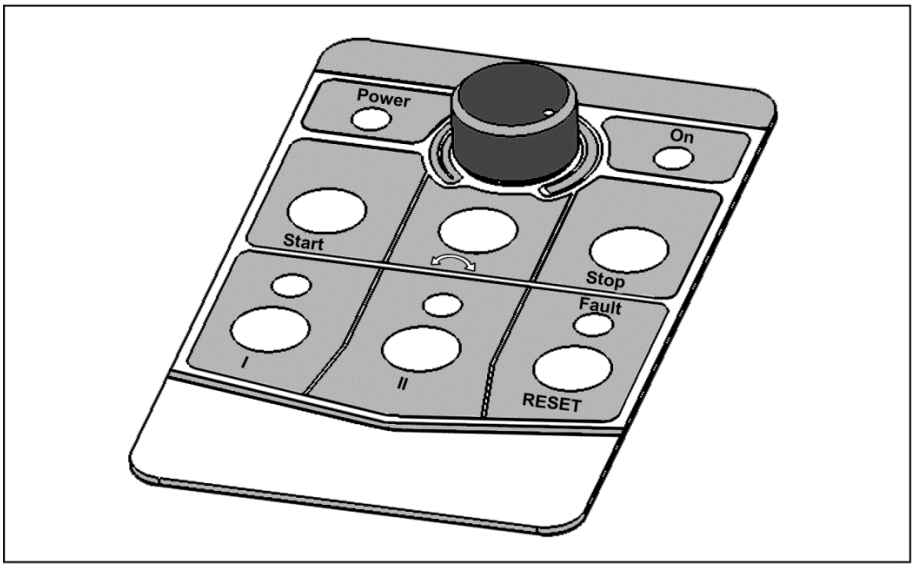


Fig. 55: Standard foil keypad

The following functions can be implemented using the foil keypad:

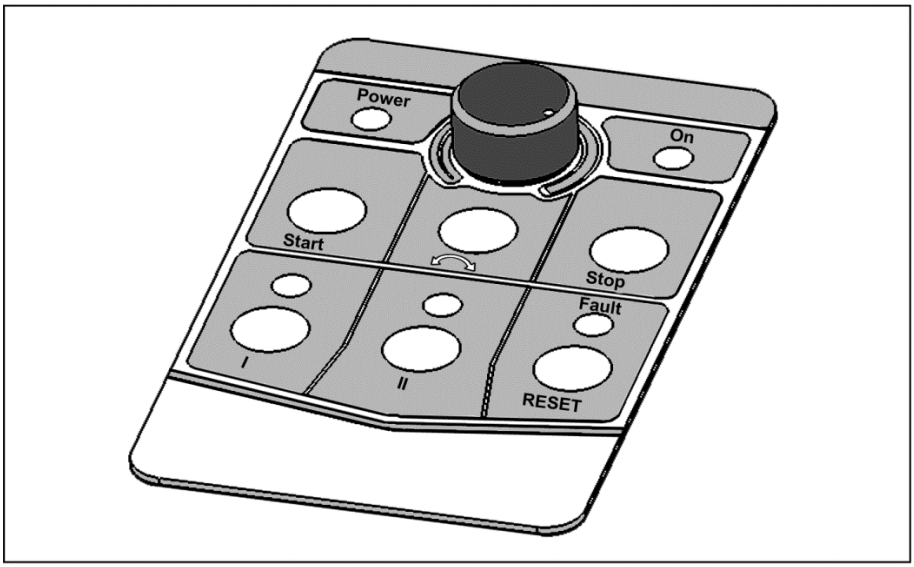
- **Indication of the reference value:** The reference setpoint (parameter 1.130) can be indicated using the potentiometer integrated in the foil keypad (internal potentiometer selection).
- **SW enabling:** The device software can be enabled (parameter 1.131) using the start and stop keys (foil keypad selection) integrated in the keypad.



- **Direction of rotation V1:** The direction of rotation (parameter 1.150) can be changed using the key integrated in the foil keypad (select the direction of rotation key on the foil keypad). The direction of rotation can be inverted only while the motor is operating.

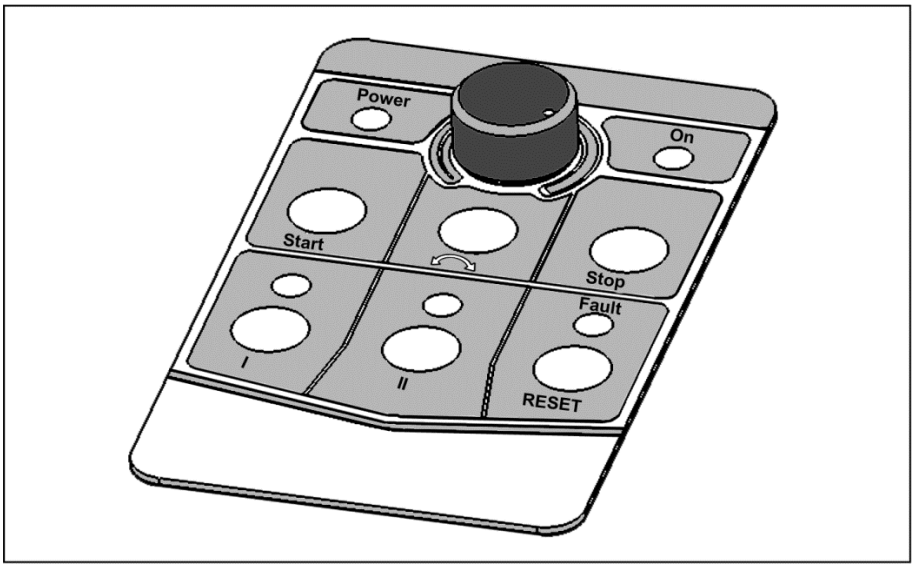
  Direction of rotation V2: The direction of rotation (parameter 1.150) can be changed using keys I and II integrated in the foil keypad (select on the foil keypad: key I to the right / key II to the left, via the stop).
  The direction of rotation can be inverted only while the motor is stopped.
  The integrated LEDs display the instantaneous direction of rotation.

  Direction of rotation V3: The direction of rotation (parameter 1.150) can be changed using keys I and II integrated in the foil keypad (select on the foil keypad: key I to the right / key II to the left always). The direction of rotation can be inverted while the motor is operating, but also when it is stopped. The integrated LEDs display the instantaneous direction of rotation.



- **Reset function:** An error can be reset (parameter 1.180) by pressing the reset key integrated in the foil keypad (foil keypad selection).
- **Motor-potentiometer function:** The motor-potentiometer function (parameter 2.150) is implemented using configurable keys I and II integrated in the foil keypad (MOP digital input). This function can be used to increase or decrease the reference value. The integrated LEDs display if the minimum and maximum reference values have been reached.

  To activate this function, the reference setpoint indication (parameter 1.130) must be set on the motor potentiometer!



- **Fixed frequency:** Two fixed frequencies (parameter 2.050) can be implemented using configurable keys I and II integrated in the foil keypad (digital input MOP). This function can be used to increase or decrease the reference value.
  The integrated LEDs display the currently selected reference value.

An overall view of the speed regulator is provided by the LEDs integrated in the foil keypad.

Power LED:	It turns on as soon as power supply voltage is present.
On LED:	This turns on during operation.
Fault LED:	This turns on when there is an error. It flashes as soon as an error can be reset.

INFORMATION

PC software is required in order to parameterize these functions.

9.3 Hand-held MMI control device incl. 3 m of RJ9 connection cable to the M12 connector

IMPORTANT INFORMATION

The hand-held MMI control device can only be used in combination with a DGM!

The hand-held MMI control device is connected to the integrated M12 interface of the DGM. With this control device, users can write (program) and display all DGM parameters. Up to 8 complete data sets can be saved in an MMI and copied to other DGMs. As an alternative to the free VPlus Dec software, it is possible to perform a complete start-up. External signals are not necessary.

9.4 PC USB communication cable on the M12/RS485 connector (integrated converter)

As an alternative to the hand-held MMI control device, a DGM can be operated also using the PC communication cable and the VPlus Dec software.

10. Authorizations, standards and directives

This chapter contains information regarding electromagnetic compatibility (EMC) and the relative authorizations and standards in force.
Binding information regarding the respective speed regulator authorizations can be found on the relative data plate!

10.1 EMC limit value classes

Please note that the classes indicated below at the EMC limits are reached only if the standard switching frequency of 8 kHz is observed.
Depending on the utilized installation material and/or in the case of extreme ambient conditions, it may be necessary to use additional filters (ferrite rings). In the case of a wall-mounted installation, the following power lengths may not be exceeded:

DGM size	Type of power	EMC class (DIN-EN-61800-3)	Max. length
A 1 AC (0.37 kW - 1.5 kW)	Shielded motor power	C1	3 m
		C2	5 m
	Unshielded motor power	-	5 m
A 3 AC (0.55 kW - 1.5 kW)	Shielded motor power	C2	3 m
		C3	5 m
	Unshielded motor power	-	5 m
B (4 kW - 5.5 kW)	Shielded motor power	C2	3 m
		C3	5 m
	Unshielded motor power	-	5 m
C (5.5 kW - 7.5 kW)	Shielded motor power	C2	3 m
		C3	20 m
	Unshielded motor power	-	100 m
D (11 kW - 22 kW)	Shielded motor power	C2	3 m
		C3	20 m
	Unshielded motor power	-	100 m

IMPORTANT INFORMATION

- In a residential environment, this product could cause disturbances at a high frequency, which may require suppression countermeasures!
- For proper EMC wiring, EMC cable glands must also be used on both sides (speed regulator side and motor side).
- When non-shielded cables are used, some EMC requirements that require additional EMC measures may not be satisfied.

IMPORTANT INFORMATION

The PTC connection cable may not exceed 5 m, otherwise the factory jumper must remain inserted.
The following is recommended for monitoring the motor temperature:

- The integrated function I^2T.
- The use of an external PTC assessment device that can be processed via the DGM.

10.2 Classification based on IEC/EN 61800-3

For each environment of the speed regulator category, the standard of reference defines test procedures and degrees of precision that must be observed.

Environment definition

First environment (residential, commercial and work area):

All the “areas” powered directly via a public low voltage connection, such as:

- Residential areas, e.g. houses, housing facilities, etc.
- Retail trade, such as shops, supermarkets
- Public institutions, such as theaters, train stations
- Outdoor areas, such as service stations and parking areas
- Light industry: such as workshops, laboratories, small companies

Second environment (industrial):

Industrial environment with its own power supply network that is separated from the low voltage public network by a transformer.

10.3 Standards and directives

The following apply in particular:

- Electromagnetic Compatibility directive (directive 2014/30/EU)
- Low Voltage directive (directive 2014/35/EU)

11. Quick start-up

11.1 Quick start-up of the asynchronous motor

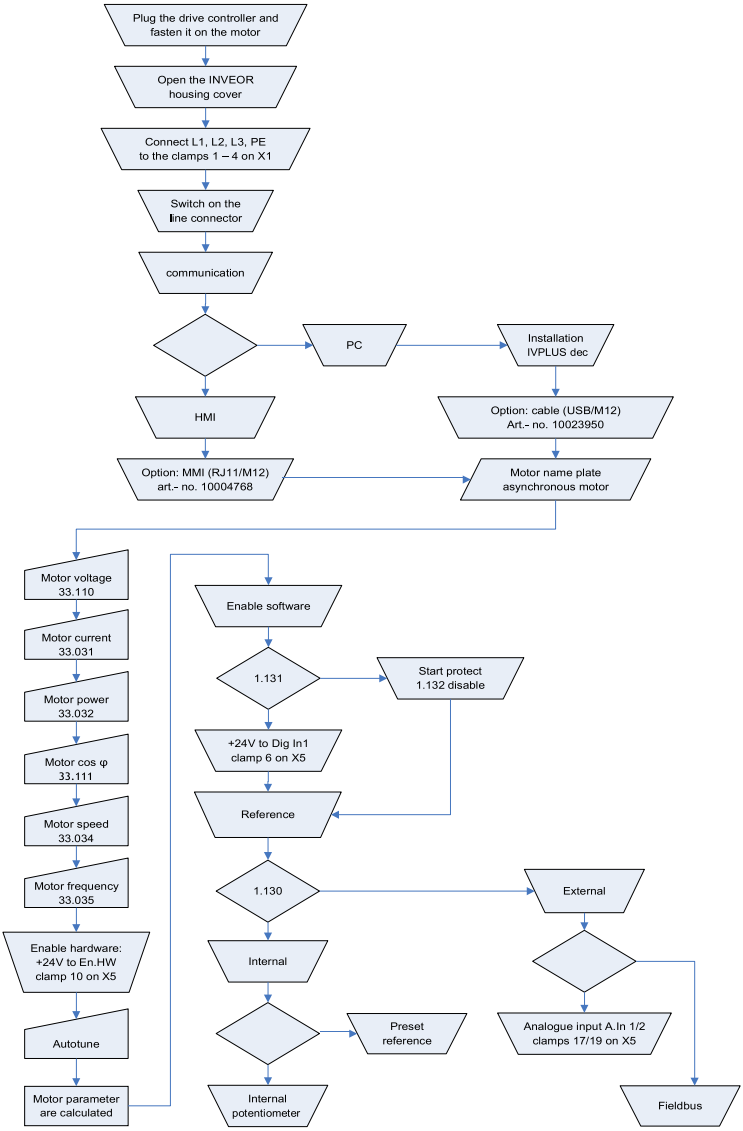


Fig. 56: Block diagram for the quick start-up of the asynchronous motor

Notes

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