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Magnetic Bearing Electronics

# MBC5000

BG13500-xxN

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# Operating Instructions

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Translation of the original operating instructions  
BG50001-01NB V1.00  
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## EC-Declaration of Conformity

**Manufacturer:** MECOS AG  
**Address:** Hardstrasse 319, 8005 Zurich, Switzerland

Name of the person who is authorized to compile the technical documentation:

**Name:** Manuel Robbiani  
**Function:** Project Manager

**Equipment Type:** Magnetic bearing controller  
**Type:** MBC5000  
**Brand:** MECOS  
**Item No.:** BG13500-xxN

The CE mark was first applied in 2017.

Herewith we declare, that the above-mentioned equipment is compliant with all relevant requirements of the following EU Directives:

- Low voltage directive 2014/35/EU
- EMC directive 2014/30/EU
- ROHS Directive 2011/65/EU

Furthermore, we declare that the following standards (or parts or clauses thereof) have been applied:

EN 61010-1:2010 +A1:2019 +A1:2019/AC:2019	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
EN 60204-1: 2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
EN 61000-6-2: 2015	Electromagnetic compatibility (EMC) – Part 6: Generic standards – Section 2: Immunity for industrial environments
EN 61000-6-4: 2007 / A1: 2011	Electromagnetic compatibility (EMC) – Part 6: Generic standards – Section 4: Emission standard for industrial environments

This product may be used exclusively in a switch cabinet or a similar appliance. Operating this product is not allowed as long as the necessary protective measures for the entire system cannot be guaranteed and as long as the whole system is not in conformity with the provisions of the Low Voltage Directive.

The relevant technical documentation in accordance with the above mentioned EU Directive(s) has been compiled. In response to a justified request, the documentation can be transmitted in digital format to the responsible market surveillance authorities of one of the Member States.

This declaration relates exclusively only to the product in the condition in which it was placed on the market, and explicitly excludes components added and/or operations carried out subsequently by the final user. The declaration will become invalid, if the product is modified without the consent of MECOS AG.

Zurich, 9. August 2021

  
Stefan Jung  
Director Electronics

  
Heinz Zürcher  
COO MECOS AG

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## 1. General information

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### 1.1 Device description

The MBC5000 magnetic bearing electronics is a device that can support rotor systems in five axes without contact. It consists of an amplifier module with output filter and a controller board with integrated sensor electronics and I/O interfaces.

The power amplifiers have a large bandwidth so that position deviations of the levitating rotor can be corrected quickly. Control is performed by a multi-processor system, which simultaneously carries out various control and monitoring functions. The real-time measurement of the rotor position allows the active influencing of various rotor dynamic effects, for example the unbalance can be actively compensated by the control system.

Basic operation is carried out via the digital I/O interface. This can be used to perform basic functions such as lifting and lowering the rotor. For more advanced operation, e.g. reading out errors, the optional fieldbus interface or the Toolbox mentioned below can be used.

The integrated Ethernet interface allows communication with a PC. With the optionally available MATLAB® Toolbox for MECOS magnetic bearing systems (MecosTools), a large number of system parameters can be changed. In addition, real-time measurements of all process variables of the magnetic bearing system can be carried out.

The external DC power supply unit of the MBC5000 magnetic bearing electronics is usually supplied via a UPS-supported mains voltage. The magnetic bearing electronics have two connection points for the power supply, so that a power supply from a second source is also possible in parallel to the mains supply. As the input goes via a rectifier, feedback is excluded. The MBC5000 has no internal devices for load equalisation; it draws its voltage from the source with the highest voltage.

The technical data of the MBC5000 magnetic bearing electronics are described in chapter 4.

A glossary explaining the most common abbreviations can be found at the end of these operating instructions.

#### 1.1.1 EC Directives

Magnetic bearing electronics is a component intended for installation in fixed electrical systems or machines. Commissioning (i.e. commencement of intended operation) is only permitted if the EMC Directive is complied with.



The EMC regulations for the installation are listed in chapter 6.3.

## 1.2 Information on the operating instructions

These operating instructions are an essential aid for the successful and safe use of the magnetic bearing electronics. They contain important information on how to operate the electronics safely, properly and economically. Observing them helps to **avoid hazards**, reduce repair costs and downtimes and increase the reliability and service life of the electronics.

### 1.2.1 Location and reading obligation

Keep the current version of the operating instructions in the immediate vicinity of the magnetic bearing electronics to ensure constant access. This applies for the entire service life of the magnetic bearing electronics.

The **operator** of the magnetic bearing electronics must ensure that all persons working with it are familiar with and comply with the contents of the operating instructions.

Carry out the work in accordance with the revision notice if you receive a revision of the operating instructions from MECOS AG.

## 1.3 Property rights

MECOS AG reserves all property rights to these operating instructions. You should therefore adhere to the following rules:

- Reproductions of any kind and for any application, even in extracts, may only be made with the consent of MECOS AG.
- Prevent third parties from accessing the operating instructions. This also applies to extracts and reproductions of any kind.
- Inform MECOS AG if you transfer the magnetic bearing electronics to another owner and pass the operating instructions on to the new owner.

MECOS AG reserves the right to take legal action in the event of non-compliance.

## 1.4 Manufacturer, service address

Manufacturer: MECOS AG  
Hardstrasse 319  
8005 Zurich  
Switzerland

Phone: +41 52 355 52 11  
[www.mecos.com](http://www.mecos.com)

Service: MECOS AG  
[aftersales@mecos.com](mailto:aftersales@mecos.com)

## 1.5 Access aids and conventions

A distinction is made between safety instructions and pictograms for the structural elements appearing in the operating instructions (based on EN 82079-1).

### 1.5.1 Safety instructions

The signal words are assigned to different hazard levels in accordance with EN 82079 and ANSI Z535:



#### **DANGER!**

The signal word **DANGER!** indicates an immediate hazard with a high risk that will result in death or serious injury if you do not avoid the situation.

**DANGER!** is used to draw attention to an immediate hazard.



#### **WARNING!**

The signal word **WARNING!** indicates a possible hazard with medium risk, which will result in death or serious injury if you do not avoid the situation.

**WARNING!** is used to draw attention to a risk.



#### **CAUTION!**

The signal word **CAUTION!** indicates a low-risk hazard that could result in minor or moderate injury if you do not avoid the situation.

**CAUTION!** is used to draw attention to a dangerous or unsafe procedure.



#### **NOTICE!**

The signal word **NOTICE!** indicates a dangerous situation that can lead to material damage if you do not avoid the situation.

### 1.5.2 Pictograms

The following pictograms are used to emphasise information and facts:



Useful tip or fact.



Important technical information or reference to further technical information.



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## 2. Safety

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This chapter is aimed at all users of the magnetic bearing electronics. It contains information on the safety concept and provides the minimum requirements for the safe use of the magnetic bearing electronics.



Information on the connections can be found in chapter 6.5 can be found in chapter 6.5.

### 2.1 Safety concept

The magnetic bearing electronics have been developed and manufactured in accordance with the state of the art and recognised safety regulations. Nevertheless, danger to persons or damage to the electronics and other property may occur during use if:

- the specifications for personal authorisation are not observed (see chapter 2.1.3)
- the electronics are not operated as intended (see chapter 2.1.1)
- the electronics are transported, installed or maintained improperly (see chapter 2.1.2, 2.1.4 and 6)

#### 2.1.1 Intended use

The magnetic bearing electronics are used exclusively to control active magnetic bearing systems from MECOS AG. It may only be used in the commercial sector. Written authorisation from MECOS AG is required for other purposes or areas of application.

The following operating options are available:

- Five-axis active magnetic bearing of a rotor system
- Lifting and lowering of the magnetically levitated rotor (switching the magnetic bearings on and off) via an external signal or via the optional fieldbus interface
- Switching between several predefined controller parameter sets (only with corresponding implementation of the parameter sets)
- Communication with an external control system via a configurable interface
- Carrying out measurements using the MATLAB® Toolbox for MECOS magnetic bearing systems (optional)
- Modification of control and other system parameters using the MATLAB® Toolbox for MECOS magnetic bearing systems (optional)

The information in chapter 4 «Technical data» must be observed and complied with.

The intended use of the magnetic bearing electronics also includes compliance with the precautionary measures prescribed in these instructions as well as the operating and maintenance regulations.

This device is intended for use in clean and dry environments in accordance with pollution degree 2 and overvoltage category II (see chapter 4.2).

Any other use or use beyond this is considered improper use. The user/operator of the magnetic bearing electronics is solely liable for any resulting damage. This also applies to unauthorised modifications to the electronics.

### 2.1.2 Safety instructions for transport

Packaging and transport of the magnetic bearing electronics must be carried out by qualified personnel. Particular attention must be paid to the weight and the resulting hazards.



#### **WARNING!**

The total weight of the MBC5000 magnetic bearing electronics together with the packaging exceeds 25 kg. Failure of the transport equipment or improper handling poses a corresponding health hazard. The national and local regulations for handling heavy loads must be observed. Only suitable and tested lifting gear and slings are to be used.



#### **NOTICE!**

Detailed information on transport can be found in chapter 5.

### 2.1.3 Safety instructions for operation

The responsibilities for the various activities within the scope of operation must be clearly defined by the operator, and the personnel deployed must comply with these specifications.

The magnetic bearing electronics may only be used when in perfect technical condition and in accordance with its intended use, in a safety-conscious and hazard-conscious manner and in compliance with these operating instructions! In particular, faults that could impair safety must be rectified immediately.

Work on the electrical system (wiring of the cabinet, magnetic bearing electronics and magnetic bearing components) may only be carried out by qualified electricians. The relevant international, national and local regulations must be observed.



#### **WARNING!**

The magnetic bearing electronics are operated with a dangerous voltage. The device must not be opened during operation and no cables may be connected or disconnected. There is a danger of fatal electric shock and unintentional ejection of the machine's rotor.

### 2.1.4 Safety instructions for repairs/servicing/maintenance

Repairs to the magnetic bearing electronics are carried out exclusively by MECOS. The device must not be opened.



#### **WARNING!**

The magnetic bearing electronics are operated with a dangerous voltage and have components for storing electrical energy. The device must not be opened during operation and cables must not be connected or disconnected. There is a danger of fatal electric shock and unintentional ejection of the machine's rotor, which can lead to personal injury and damage to property.

### 2.1.5 Residual dangers

Even if all safety regulations are observed, certain residual dangers remain when handling the magnetic bearing electronics.

All persons working on and with the magnetic bearing electronics must be aware of these dangers and follow the safety instructions in the operating instructions or on the magnetic bearing electronics.

### 2.1.6 Safety instructions for the operator

The operator must organise the responsibilities of the personnel in accordance with the specifications in these operating instructions. The different requirements within the life phases (transport, installation, commissioning, operation, troubleshooting, maintenance) must be taken into account and appropriately qualified persons must be specified!

The operator must also observe and implement the accident prevention and health and safety regulations applicable at the place of use of the machine.



#### **NOTICE!**

Installation, operation and maintenance must be carried out by qualified personnel.

## 2.2 Electricity

The magnetic bearing electronics are operated with a voltage of 300 V<sub>DC</sub>, which is classified as dangerous, via an external power supply unit. The corresponding precautionary measures for handling electricity must be observed.

Proper earthing of the electrical system of the magnetic bearing control unit and the associated magnetically levitated machine must be ensured by a protective conductor system.



#### **WARNING!**

The magnetic bearing electronics are operated with a dangerous voltage and have components for storing electrical energy. Unauthorised opening of the device and improper intervention can lead to personal injury and damage to property. The device must not be opened.



#### **WARNING!**

The magnetic bearing electronics are supplied externally. Even after the power supply is switched off, these cables are still live and there is a danger of electric shock.

## 2.3 Immediate measures in the event of accidents involving electrical current

Basic procedure in the event of an electrical accident:

1. Disconnect the circuit
2. Assess the severity of the accident
3. Call the rescue service/emergency medical service
4. If unconscious, place the affected person in the recovery position
5. In the event of muscle cramp and palpitations, place the affected person in the supine position
6. Start resuscitation in the event of unconsciousness and respiratory arrest

As a general rule, anyone who has come into contact with an electric current should be taken to a doctor for a check-up.

The life of an injured person often depends on first aid being administered as quickly as possible at the scene of the accident.

## 2.4 Fighting electrical fire

Basic procedure in the event of an electrical fire:

1. Switch off affected circuits in consultation with the operator
2. Support for the fire brigade by qualified electricians
3. Extinguish fire
4. Ventilate the fire room and immediately provide specialised medical care to persons, who have come into contact with decomposition products

## 2.5 Noise

The airborne noise emissions of the magnetic bearing electronics are caused exclusively by the built-in fans and depend on the installation location. Local regulations must be observed.

Fan sound power level: max. 53 dB(A)

## 2.6 Safety devices

The magnetic bearing electronics do not have a built-in main switch. The DC supply must therefore be switched on or off with an external switch. The LED displays (see chapter 7.2) can be used to check whether the electronics are switched on and therefore energised.



### WARNING!

The magnetic bearing electronics are supplied externally. Even after the power supply has been switched off, these cables may still be live and there is a danger of electric shock.

## 2.7 Safety instructions on the device

The safety instructions on the magnetic bearing electronics have the following meaning:

### **!! WARNUNG !!    !! WARNING !!    !! AVERTISSEMENT !!**

Kondensatorentladezeit: 10 Minuten. Gefahr eines elektrischen Schlages an berührbaren Teilen.  
Während der Entladezeit keine Kabel abziehen oder Gerät öffnen.

Capacitor discharge time: 10 minutes. Electrical shock hazard from parts exposed to touch.  
Do not remove cables or open device during the discharge period.

Temps de décharge de condensateur: 10 minutes. Risque de décharge électrique sur les pièces accessibles. Pendant le temps de décharge, ne pas retirer le câble ou ouvrir l'appareil.

Figure 1: Warning label on capacitor discharge time

After disconnecting the power supply, wait for 10 minutes until the internal capacitors have discharged and the DC link voltage has dropped to a safe level.

## 2.8 Operating modes

The magnetic bearing electronics are designed for continuous operation.

### 3. Device configurations

The magnetic bearing electronics are available in various configurations. The project-specific configuration of the electronics can be determined from the ML diagram belonging to the project (see chapter 13 [1]).

There can be several device variants with the same hardware configuration, but these differ in the project-specific parameterisation of the software. The parameterisation in the software that is relevant for the customer is described in the corresponding reports (see chapter 13).

#### 3.1 External pulse

The system normally works with an internal pulse for speed detection, which is fed into the control unit via the sensor connectors. Alternatively, it is also possible to use an external pulse. In this case, please contact MECOS.

#### 3.2 Temperature measurement

With the ITB6 expansion card, it is possible to read in up to six external temperature sensors in two- and four-wire technology. Details on this configuration can be found in chapter 4.6.

#### 3.3 Sensor connection

As a standard, the sensor signals are routed to two separate sensor cables via two Hummel M23 connectors. However, a 25-pin D-Sub connector with only one sensor cable can also be used as an option.



As the sensor signals are usually introduced at two different positions on the machine side, two separate sensor cables make more sense. However, if a sensor amplifier box (see chapter 12.3) is used, the connection between the magnetic bearing electronics and the sensor amplifier box can be realised with just one cable.

#### 3.4 Fieldbus interfaces

MECOS uses ANYBUS™ CompactCom modules as the communication interface (see also chapter 4.6). These modules offer various external communication solutions so that the MBC5000 can communicate accordingly via these interfaces. The «Modbus TCP» module is fitted as a standard, but one of the following modules can also be used as an option:

	Modbus TCP (standard)	Ethernet/IP	EtherCAT	Profibus	Profinet
Connection	RJ45	RJ45	2 x RJ45	D-Sub 9 pin	2 x RJ45
Transmission speed	10/100 Mbit/s	10/100 Mbit/s	10/100 Mbit/s	9.6 kbit/s ... 12 Mbit/s	100 Mbit/s

#### 3.5 Protective coating for harsh environmental conditions

In the following device variant, the printed circuit boards have a protective coating:

Article no.	Sensor connection	SMX8 / SMX8A	Temperature measurement	Fieldbus interface	UL approval
BG13500-13N	Hummel M23	no	no	Ethernet/IP	yes

### 3.6 UL approval

The following device variants have UL approval (file number E226179):

Article no.	Sensor connection	SMX8 / SMX8A	Temperature measurement	Fieldbus interface	Protective coated printed circuit boards
BG13500-10N	Hummel M23	no	no	Ethernet/IP	no
BG13500-13N	Hummel M23	no	no	Ethernet/IP	yes
BG13500-14N	D-Sub (SMX8)	yes	no	Ethernet/IP	no

## 4. Technical data

### 4.1 Ambient conditions

Operating temperature	0 ... +55 °C
Storage temperature	-20 ... +60 °C
Maximum installation height	2000 m above sea level
Relative humidity	< 95 % (non-condensing)

### 4.2 General data

Dimensions (L x W x H)	546 mm x 310 mm x 240 mm
Degree of protection	IP20
Weight	20 kg
Supply voltages	300 V <sub>DC</sub> ±10 % / floating, galvanically isolated
Overvoltage category of connection	II
Degree of pollution	2
Electrical safety	According to the Declaration of Conformity
UL CCN / File number	NMTR / E226179 <sup>1</sup>
Power consumption (depending on machine, cable length and parameterisation)	Typically 1100 W
Maximum power consumption	12 A
Cooling	3 PWM-controlled axial fans

### 4.3 Power amplifier

Model	MPA5000
DC link voltage	300 V <sub>DC</sub>
DC link capacity	5600 µF
Amplifier type	10 channel PWM unipolar amplifier
Maximum power output (dynamic)	10 x 5000 VA
Number of magnetic bearing axes	5 (4 radial, 1 axial)
Output current	12 A per channel
Continuous	17 A
Peak value	
PWM switching frequency	20 kHz

<sup>1</sup> Only certain variants of the MBC5000 are UL-certified, see chapter 3.6

#### 4.4 Controller board and position sensors

Controller board model	FDC261
Processor	Multi-processor system consisting of a DSP, an ARM microcontroller and an FPGA
Sensor measuring principle	Configurable, variable excitation frequency
Sensor resolution	Depending on the sensor used
Number of sensor inputs	8 (4 radial, 2 axial, 2 pulse)

#### 4.5 Interfaces

PC communication	
Communication interface	Ethernet (10/100 Mbit/s)
Protocol	Proprietary MECOS protocol via UDP
Identifier	5-digit serial number of the controller board

With the help of the MATLAB® Toolbox for MECOS magnetic bearing systems (optional), complete access to the processor of the controller board is possible. See chapter 12.4.



The serial number for Ethernet communication is located next to the RJ45 socket on the underside of the magnetic bearing electronics.

Digital inputs	
Quantity	6
Electrical description (see Figure 2)	Inputs isolated by optocouplers with common GND
Maximum input voltage	30 V <sub>DC</sub>
Logic level of input voltage HIGH / LOW	> 10 V <sub>DC</sub> / < 5 V <sub>DC</sub>
Maximum input current at 24 V	10 mA
Description: The function of the inputs can be parameterised, see chapter 7.4.	

Digital outputs	
Quantity	6
Electrical description (see Figure 3)	Outputs isolated by optocouplers with common 24V supply
Maximum output voltage	30 V <sub>DC</sub>
Maximum output current	100 mA
Description: The function of the outputs can be parameterised, see chapter 7.4	



### NOTICE!

The digital outputs are not short-circuit-proof!



## Schematic extract of the digital I/O

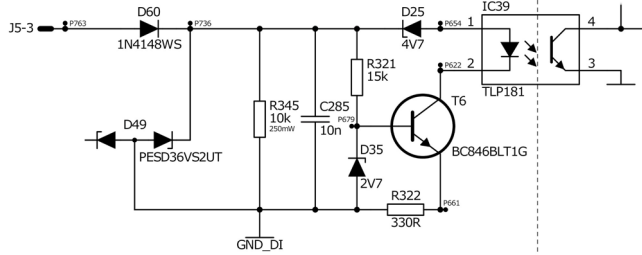


Figure 2 : Schematic extract of digital input

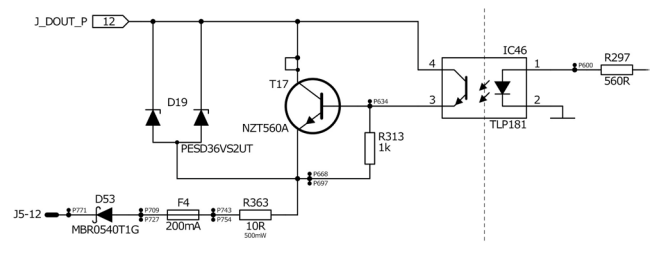


Figure 3: Schematic extract of digital output



Additional information for the I/O interface is provided in chapter 7.4.

## UPS interface

Quantity	4 inputs / 1 output
Electrical description	Identical to the digital I/O (see Figure 2 and Figure 3)
Electrical parameters	Identical to the digital I/O
Description: The functions correspond to those of a typical UPS interface, but can also be parameterised.	

## 4.6 Expansion module

## Expansion interface

Quantity	1
Description: The magnetic bearing electronics have an expansion slot. MECOS currently has the following expansion cards in its range. The expansion cards are intended for factory installation.	

### 4.6.1 Expansion card ITB6 (temperature measurement and Anybus™ slot)

## Temperature measurement

Quantity	6
Type	PT100/PT1000 4-wire measurement
Measuring current	1 mA



Due to the common power supply of two sensors, the sensors must always be connected in pairs, as only one channel alone does not work (channel 1+2, channel 3+4 and channel 5+6).

## Anybus CompactCom™ slot

Quantity	1
Available Anybus CompactCom™ modules	Standard: Modbus TCP Optional: Ethernet/IP, EtherCAT, Profibus, Profinet



The detailed description of the bus interface can be found on the Anybus website ([www.anybus.de](http://www.anybus.de)). The modules are parameterised in consultation with the customer. See chapters 3.4 and 7.6.3.

#### 4.6.2 Expansion card IBP262 (Anybus™ slot)

Anybus CompactCom™ slot	
Quantity	1
Available Anybus CompactCom™ modules	Standard: Modbus TCP Optional: Ethernet/IP, EtherCAT, Profibus, Profinet



The detailed description of the bus interface can be found on the Anybus website ([www.anybus.de](http://www.anybus.de)). The modules are parameterised in consultation with the customer. See chapters 3.4 and 7.6.3.

## 5. Transport

For longer journeys and especially for outdoor transport, the original packaging of the magnetic bearing electronics must be used as impact and moisture protection. It is therefore essential to keep the original packaging.

No special packaging precautions need to be taken for transport within a building. However, care must be taken to ensure that the electronics are not exposed to any shocks or loads.

## 6. Assembly and installation



### WARNING!

When unpacking, the magnetic bearing electronics must be checked for transport damage. Visibly damaged devices must never be connected to the mains supply. Any transport damage must be reported to the manufacturer immediately. The original packaging must be retained.



### DANGER!

Assembly and installation may only be carried out by qualified specialist personnel and with a separate power supply. Observe the safety instructions in chapter 2.

## 6.1 Assembly view

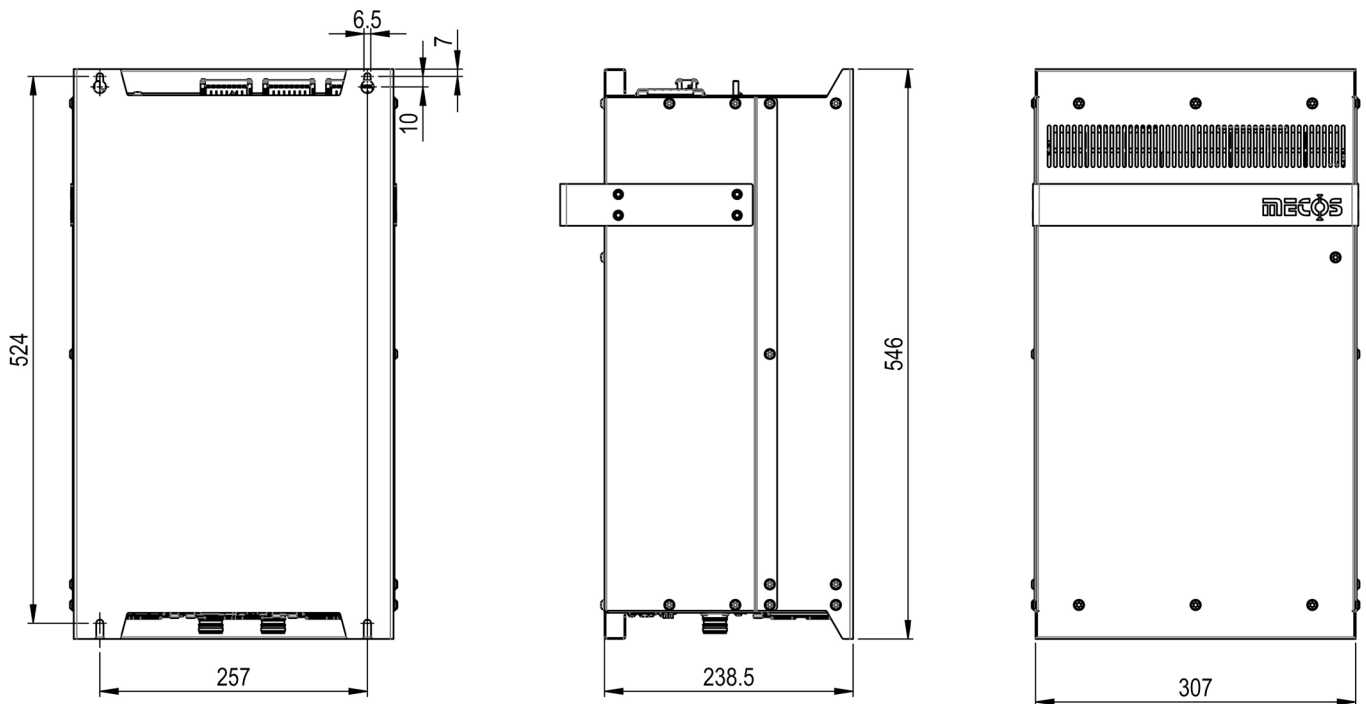


Figure 4 : Dimensional drawing (dimensions in millimetres)

The magnetic bearing electronics must be installed in a switch cabinet. It is installed in a vertical position (see Figure 4). Use the four fixing points provided on the rear panel of the device for this purpose. Appropriate M6 screws must be used for installation.

Horizontal hole spacing: 257 mm, vertical hole spacing: 524 mm

To ensure proper cooling of the MBC5000, a minimum distance of 20 cm must be maintained for the air inlet and outlet (see Figure 5).



### WARNING!

The mounting plate must be earthed.



### NOTICE!

The distances for cooling the magnetic bearing electronics must be observed (see chapter 6.2). If the specified minimum distances are not guaranteed, the reduced air circulation can lead to overheating of the magnetic bearing electronics, which can cause the control unit to switch off prematurely.

## 6.2 Ventilation

The ventilation of the switch cabinet must fulfil the requirements described in chapter 4.1. Ensure that the air flow generated by the built-in fans is not blocked. For the supply air and exhaust air, the space above and below the enclosure must remain free up to a distance of at least 200 mm. The minimum distance for the other sides is 40 mm, and 60 mm towards the front.

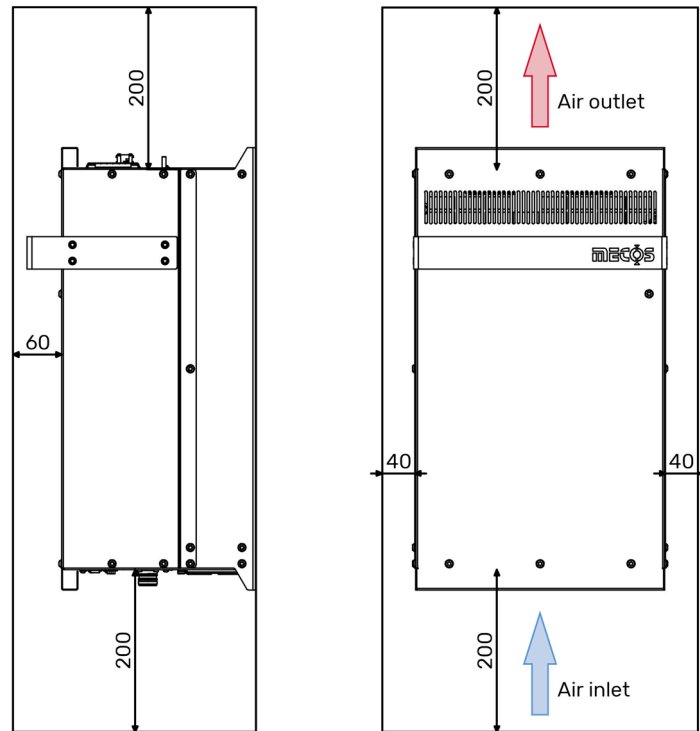


Figure 5 : Minimum distances in the switch cabinet and air flow direction (dimensions in millimetres)

## 6.3 EMC regulations

For compliant operation in accordance with the EMC Directive, the specifications of the power supply unit must be observed. In addition, the mounting plate must be earthed for the discharge of high-frequency interference signals.

## 6.4 Protective earth connection (housing)

An M5 threaded bolt with a length of 14 mm is provided on the housing below connector X9 (Mains) for a secure earth connection of the MBC5000 housing. The cable cross-section of the PE connection must be the same size as or larger than the cross-section of the supply cable between the power supply and MBC5000. It is recommended to use a cable with a cross-section of at least 2.5 mm<sup>2</sup>.

Connection type: Ring cable lug M5 + ribbed disc M5 + nut M5 (torque 1.2 Nm)



### DANGER!

Danger of electric shock due to missing or improper earth connection. Without an earth connection, personal injury can occur in the event of a fault due to dangerous voltages on the housing. A controlled, proper and secure earth connection of the magnetic bearing electronics is therefore essential for safe operation. When connecting, ensure that the earth connection is firmly screwed in and secured against loosening with ribbed discs.

## 6.5 Electrical connections

The necessary wiring details can be found in the diagram of the magnetic bearing system in chapter 13 [1].

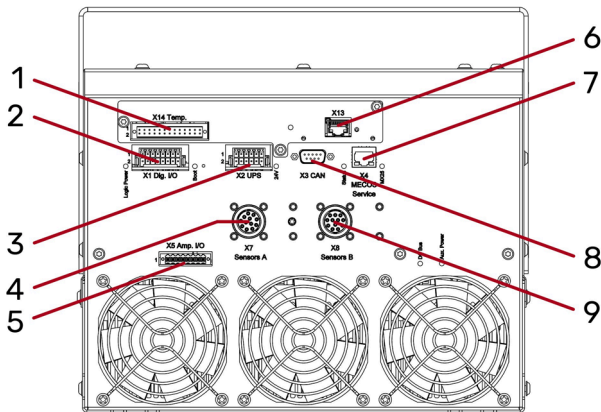


Figure 6: Bottom of the device

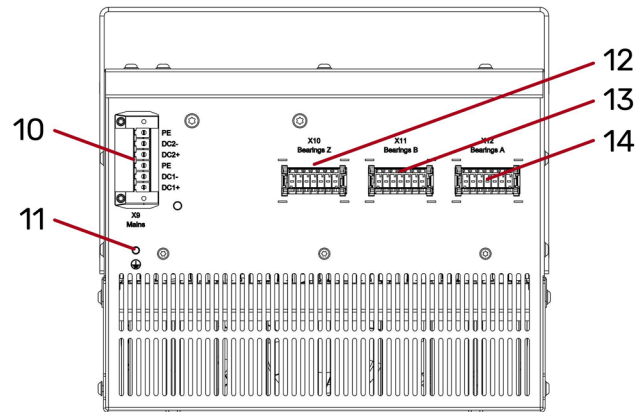


Figure 7: Top of the device

The following connections are located on the top and bottom of the magnetic bearing electronics:

No.	Designation	Description
1	X14 Temp.	Connection of temperature sensors (expansion card ITB6), see chapter 6.6.2
2	X1 Dig. I/O	Connection of digital inputs and outputs, see chapter 6.5.1
3	X2 UPS	UPS connection, see chapter 6.5.2
4	X7 Sensors A	Connection of sensor cable A, see chapter 6.5.6
5	X5 Amp. I/O	Connection of analogue inputs and outputs, see chapter 6.5.5
6	X13 Anybus™ slot	Connection of communication interface (expansion card ITB6 or IBP262), see chapter 6.6.1
7	X4 MECOS Service	Ethernet connection for service purposes, see chapter 6.5.4
8	X3 CAN	CAN interface connection, see chapter 6.5.3
9	X8 Sensors B	Connection of sensor cable B, see chapter 6.5.6
10	X9 Mains	Connection of DC power supply(s), see chapter 6.5.9
11	⊕ Earthing bolt	Protective earth connection, see chapter 6.4
12	X10 Bearings Z	Connection of bearing cable Z, see chapter 6.5.8
13	X11 Bearings B	Connection of bearing cable B, see chapter 6.5.8
14	X12 Bearings A	Connection of bearing cable A, see chapter 6.5.8



### DANGER!

The magnetic bearing electronics may only be switched on when all connections have been made correctly. All devices must be connected to the mains last. When laying the connection cables, ensure that they are neither pinched nor routed over sharp corners and edges.


**NOTICE!**

Ensure that the DC supply voltage matches the input voltage range of the magnetic bearing electronics (see chapter 4.2).


**NOTICE!**

Improper connection can damage the magnetic bearing electronics.

**6.5.1 X1 - Dig. I/O**

X1 is a 16-pin connector for communication between the customer interface and MBC5000 via digital inputs and outputs. Six digital inputs (DI1-6) and six digital outputs (DO1-6) are available for this purpose. In addition, the external power supply for the digital outputs can be connected to connector pins 9 and 10.

Plug connector of control unit: Wago | 713-1428/116-000

Plug connector of cable: Wago | 713-1108/037-000

Pin no.	Designation	Description
1	DI_GND	GND of the digital inputs. Common GND for all DI
2	DI_GND	GND of the digital inputs. Common GND for all DI
3	DI1	Digital input 1
4	DI2	Digital input 2
5	DI3	Digital input 3
6	DI4	Digital input 4
7	DI5	Digital input 5
8	DI6	Digital input 6
9	DO_P	Digital output power supply. Common external power supply for all DO
10	DO_P	Digital output power supply. Common external power supply for all DO
11	DO1	Digital output 1
12	DO2	Digital output 2
13	DO3	Digital output 3
14	DO4	Digital output 4
15	DO5	Digital output 5
16	DO6	Digital output 6



When connecting, ensure that the plug is secured against loosening using the integrated fixing.


**NOTE!**

Maximum voltage and current values of the Dig. I/O must be observed, otherwise the hardware may be damaged (see chapter 4.5).

## 6.5.2 X2 - UPS

The 12-pin plug connector X2 is used for communication between a UPS and the magnetic bearing electronics.

Plug connector of control unit: Wago | 713-1426/116-000

Plug connector of cable: Wago | 713-1106/037-000

Pin no.	Designation	Description
1	GND_UPS	GND of the UPS digital inputs. Common GND for all DI
2	GND_UPS	GND of the UPS digital inputs. Common GND for all DI
3	DI1_UPS	Digital input 1
4	DI2_UPS	Digital input 2
5	DI3_UPS	Digital input 3
6	DI4_UPS	Digital input 4
7	DO_UPS_P	Digital output power supply
8	DO_UPS	Digital output
9	+24V_ISO	Isolated 24V voltage (output voltage for Dig. I/O)
10	+24V_ISO	Isolated 24V voltage (output voltage for Dig. I/O)
11	GND_ISO	GND of the isolated 24V voltage
12	GND_ISO	GND of the isolated 24V voltage



The functions of the individual inputs and outputs can be parameterised (see chapter 7.6.1).



When connecting, ensure that the plug is secured against loosening using the integrated fixing.



### NOTICE!

Maximum voltage and current values of the Dig. I/O must be observed, otherwise the hardware may be damaged (see chapter 4.5).

## 6.5.3 X3 - CAN

CAN communication via a D-Sub connector. Intended for future extensions, MECOS does not currently offer any compatible devices for this interface.

Plug connector of control unit: D-Sub plug connector 9-pin pin

Plug connector of cable: D-Sub plug connector 9-pin socket

Pin no.	Designation	Description
1	-	Not assigned
2	CAN_L	CAN Low
3	GND	GND
4	-	Not assigned
5	GND	GND
6	GND	GND
7	CAN_H	CAN High
8	-	Not assigned
9	U_EM_CAN	12V power supply for expansion module (maximum current: 500 mA)



This interface is not a complete CAN-Open interface. Details can be requested from MECOS.



When connecting, ensure that the plug is secured against loosening using the integrated screw connection.

## 6.5.4 X4 - MECOS Service

The Ethernet socket X4 allows PC communication using a standard network cable. With the help of the MATLAB® Toolbox for MECOS magnetic bearing systems (optional), full access to the processor of the controller board is possible.

Plug connector of control unit: RJ45 socket

Plug connector of cable: RJ45 plug



The connection can be established directly or via a switch.

## 6.5.5 X5 - Amp. I/O

Up to two external relays can be controlled via the 8-pin plug connector (switched earth via transistor), up to two external NTC sensors and an external 12V power supply can be connected.

The connection of an external 12V power supply is used to supply the FDC261 magnetic bearing controller with power during a failure of the 300 V<sub>DC</sub> supply voltage. This ensures that relevant data from the magnetic bearing system (positions, current and voltage values) can continue to be recorded.

Plug connector of control unit: Weidmüller | SL3.50/08/90F 3.2SN OR BX

Plug connector of cable: Weidmüller | BLZF 3.50/08/180F SN OR BX

Pin no.	Designation	Description
1	EXT_12V	External 12 V power supply for operating the controller board without DC link voltage
2	RELAY_1	Switched connection ext. relay 1 to GND
3	U_EM_CAN	12 V power supply for relays 1 and 2 (max. 1 A)
4	RELAY_2	Switched connection ext. relay 2 to GND
5	NTC_1	Connection of an external NTC sensor with a resistance of 10 kΩ
6	GND	GND for NTC
7	NTC_2	Connection of an external NTC sensor with a resistance of 10 kΩ
8	GND	GND for NTC



MECOS will be happy to assist you with the design of an external 12V power supply to support the power supply of the controller.



### NOTICE!

Ensure that the voltage does not exceed 14 V when connecting an external power supply and that the current for the external relays does not exceed 1 A, as this can destroy the magnetic bearing controller.



### 6.5.6 X6 - Sensors (option with D-Sub plug connector)

The sensors for detecting the rotor position in planes A, B and Z as well as the pulse are connected to X6.

For longer cable lengths, a sensor amplifier box (SMX8A, see chapter 12.3) should be used to improve the signal quality of the sensors.

Plug connector of control unit: D-Sub plug connector 25-pin socket

Plug connector of cable: D-Sub plug connector 25-pin pin

Pin no.	Designation	Description
1	IN_EXT_ID	Cable/machine identification
2	S_IN_AX_P	Position, X-axis, P-direction, bearing/plane A
3	S_IN_AY_P	Position, Y-axis, P-direction, bearing/plane A
4	S_IN_BX_P	Position, X-axis, P-direction, bearing/plane B
5	S_IN_BY_P	Position, Y-axis, P-direction, bearing/plane B
6	S_IN_Z1_P	Position, Z-axis, P-direction
7	S_IN_COS_P	Pulse, cosine input (pulse 1), positive
8	S_GND	Signalling earth
9	S_IN_Z2_P	Position, Z-axis, P-direction
10	S_IN_SIN_P	Pulse, sine input (pulse 2), positive
11	U_SENS	Power supply for sensor amplifier box SMX8
12	EXC_S_P	Positive excitation signal for sensor amplifier box SMX8
13	GND	Housing earth
14	GND	Housing earth
15	S_IN_AX_N	Position, X-axis, N-direction, bearing/plane A
16	S_IN_AY_N	Position, Y-axis, N-direction, bearing/plane A
17	S_IN_BX_N	Position, X-axis, N-direction, bearing/plane B
18	S_IN_AY_N	Position, Y-axis, N-direction, bearing/plane B
19	S_IN_Z1_N	Position, Z-axis, N-direction
20	S_IN_COS_N	Pulse, cosine input (pulse 1), negative
21	S_GND	Signalling earth
22	S_IN_Z2_N	Position, Z-axis, N-direction
23	S_IN_SIN_N	Pulse, sine input (pulse 2), negative
24	U_SENS	Power supply for sensor amplifier box SMX8
25	EXC_S_N	Negative excitation signal for sensor amplifier box SMX8



When connecting, ensure that the plug is secured against loosening using the integrated screw connection.

### 6.5.7 X7 + X8 - Sensors A and B (standard)

The sensors for detecting the rotor position in planes A, B and Z and the pulse are connected to X7 and X8.

For longer cable lengths, a sensor amplifier box (SMX8, see chapter 12.3) should be used to improve the signal quality of the sensors.

Plug connector of control unit: Hummel | M23 12-pin socket  
 Plug connector of cable: Hummel | M23 12-pin pin

#### X7 - Sensors A

Pin no.	Designation	Description
1	S_IN_AX_P	Position, X-axis, P-direction, bearing/plane A
2	S_IN_AX_N	Position, X-axis, N-direction, bearing/plane A
3	S_IN_AY_P	Position, Y-axis, P-direction, bearing/plane A
4	S_IN_AY_N	Position, Y-axis, N-direction, bearing/plane A
5	S_IN_Z1_P	Position, Z-axis, P-direction
6	S_IN_Z1_N	Position, Z-axis, N-direction
7	EXC_S_N	Negative excitation signal for sensor amplifier box SMX8
8	EXC_S_P	Positive excitation signal for sensor amplifier box SMX8
9	U_SENS	Power supply for sensor amplifier box SMX8
10	U_SENS	Power supply for sensor amplifier box SMX8
11	GND	Housing earth
12	S_GND	Signalling earth

Coding: Position X

#### X8 - Sensors B

Pin no.	Designation	Description
1	S_IN_BX_P	Position, X-axis, P-direction, bearing/plane B
2	S_IN_BX_N	Position, X-axis, N-direction, bearing/plane B
3	S_IN_BY_P	Position, Y-axis, P-direction, bearing/plane B
4	S_IN_BY_N	Position, Y-axis, N-direction, bearing/plane B
5	S_IN_Z2_P	Position, Z-axis, P-direction
6	S_IN_Z2_N	Position, Z-axis, N-direction
7	S_IN_COS_P	Pulse, cosine input (pulse 1), positive
8	S_IN_COS_N	Pulse, cosine input (pulse 1), negative
9	S_IN_SIN_P	Pulse, sine input (pulse 2), positive
10	S_IN_SIN_N	Pulse, sine input (pulse 2), negative
11	n.c.	Not assigned
12	S_GND	Signalling earth

Coding: Position N



Experience has shown that the assembly and installation of the Hummel connectors repeatedly leads to problems for customers. Mecos has instructions for this, which can be obtained on request.



## NOTICE!

The plug connectors X7 and X8 are coded. The coding is intended to prevent the cables from being mixed up, but the coding can be damaged if handled incorrectly. This must be taken into account during installation.

### 6.5.8 X10, X11, X12 - Bearings Z, Bearings B, Bearings A

The radial bearings A and B and the axial bearing are connected to the plug connectors X10 - X12.

Plug connector of control unit: Wago | 769-607/006-000

Plug connector of cable: Wago | 769-107/021-000

#### X10 - Bearings Z

Pin no.	Designation	Description
1	IZP	Axial bearing ZP, connection: positive
2	IZC	Axial bearing ZC, connection: common
3	IZC	Axial bearing ZC, connection: common
4	IZN	Axial bearing ZN, connection: negative
5	n.c.	Not assigned
6	n.c.	Not assigned
7	PE	Protective earth

Coding: Position 7

#### X11 - Bearings B

Pin no.	Designation	Description
1	IXPB	Radial bearing B, X-axis, connection: positive
2	IXCB	Radial bearing B, X-axis, connection: common
3	IXNB	Radial bearing B, X-axis, connection: negative
4	IYPB	Radial bearing B, Y-axis, connection: positive
5	IYCB	Radial bearing B, Y-axis, connection: common
6	IYNB	Radial bearing B, Y-axis, connection: negative
7	PE	Protective earth

Coding: Position 4

#### X12 - Bearings A

Pin no.	Designation	Description
1	IXPA	Radial bearing A, X-axis, connection: positive
2	IXCA	Radial bearing A, X-axis, connection: common
3	IXNA	Radial bearing A, X-axis, connection: negative
4	IYPA	Radial bearing A, Y-axis, connection: positive
5	IYCA	Radial bearing A, Y-axis, connection: common
6	IYNA	Radial bearing A, Y-axis, connection: negative
7	PE	Protective earth

Coding: Position 2



### NOTICE!

The plug connectors X10 - X12 are coded. The coding is intended to prevent the cables from being mixed up, but the coding can be damaged if handled incorrectly. This must be taken into account during installation.



### DANGER!

As the bearing outputs are buffered via capacitors, a residual voltage may be present at the bearing outputs for a certain time even after the supply voltage has been switched off (see chapter 2.7). Plug installation may only be carried out by trained personnel.

#### 6.5.9 X9 - Mains

X9 is a 6-pin plug connector for connecting one or two DC power supplies. The pin assignment is printed on the front panel.

Plug connector of control unit: Phoenix Contact | DFK-PC 4/ 6-GF-7.62

Plug connector of cable: Phoenix Contact | PC 4/ 6-STF-7.62

Pin no.	Designation	Description
1	DC1+	Power supply of power supply unit 1: +300 V <sub>DC</sub> (+ pole)
2	DC1-	Power supply of power supply unit 1: Ground (- pole)
3	PE	Protective earth
4	DC2+	Power supply of power supply unit 2: +300 V <sub>DC</sub> (+ pole)
5	DC2-	Power supply of power supply unit 2: Ground (- pole)
6	PE	Protective earth



The MBC5000 magnetic bearing electronics do not have a built-in main switch. The DC supply must therefore be switched on or off with an external switch.



When connecting, ensure that the plug is secured against loosening using the integrated screw connection.



### NOTICE!

Ensure that the galvanically isolated power supply unit output voltage is not earthed and that only the MBC5000 is connected to the external power supply unit.



### NOTICE!

Devices with UL approval are intended for connection to an AC/DC power supply with a maximum output of 2000 W.

In addition, the integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes or equivalent.

## 6.6 Connections for expansion modules

The connectors listed below only relate to optional expansion cards. The available expansion cards are described in chapter 4.6.

### 6.6.1 X13 - Anybus™ slot (for the ITB6 and IBP262 expansion card)

X13 is an Anybus™ slot with a communication interface that depends on the selected Anybus™ module. The interface type and the corresponding parameter list determine the type and content of the communication. Details on the interface can be found in the corresponding Anybus variable list (see chapter 13 [4]).

	Modbus TCP	Ethernet/IP	EtherCAT	Profibus	Profinet
Plug connector	RJ45	RJ45	2 x RJ45	D-Sub 9 pin	2 x RJ45

### 6.6.2 X14 - Temp. (for expansion card ITB6)

Up to six PT100/PT1000 temperature sensors of the magnetic bearing can be connected via the 26-pin plug connector. The resistance value of the sensors can be measured using 2-wire or 4-wire technology. For pure voltage measurement of the sensor (2-wire technology), the TEMPx-2 and TEMPx-3 connector pins are connected to the sensor. For additional measurement with a constant current source (4-wire principle), TEMPx-1 and TEMPx-4 must also be connected.

Plug connector of control unit: Weidmüller | S2L-SMT 3.50/26/90LF 3.2SN BK BX

plug connector of cable: Weidmüller | B2CF 3.50/26/180F SN BK BX

Pin no.	Designation	Description
1	TEMP1-1	Sensor 1: Connection 1 (current measurement +)
2	TEMP1-2	Sensor 1: Connection 2 (voltage measurement +)
3	TEMP1-3	Sensor 1: Connection 3 (voltage measurement -)
4	TEMP1-4	Sensor 1: Connection 4 (current measurement -)
5	TEMP2-1	Sensor 2: Connection 1 (current measurement +)
6	TEMP2-2	Sensor 2: Connection 2 (voltage measurement +)
7	TEMP2-3	Sensor 2: Connection 3 (voltage measurement -)
8	TEMP2-4	Sensor 2: Connection 4 (current measurement -)
9	PE_AI0	Sensor earth/shield
10	PE_AI0	Sensor earth/shield
11	TEMP3-1	Sensor 3: Connection 1 (current measurement +)
12	TEMP3-2	Sensor 3: Connection 2 (voltage measurement +)
13	TEMP3-3	Sensor 3: Connection 3 (voltage measurement -)
14	TEMP3-4	Sensor 3: Connection 4 (current measurement -)
15	TEMP4-1	Sensor 4: Connection 1 (current measurement +)
16	TEMP4-2	Sensor 4: Connection 2 (voltage measurement +)
17	TEMP4-3	Sensor 4: Connection 3 (voltage measurement -)
18	TEMP4-4	Sensor 4: Connection 4 (current measurement -)
19	TEMP5-1	Sensor 5: Connection 1 (current measurement +)
20	TEMP5-2	Sensor 5: Connection 2 (voltage measurement +)
21	TEMP5-3	Sensor 5: Connection 3 (voltage measurement -)
22	TEMP5-4	Sensor 5: Connection 4 (current measurement -)

Pin no.	Designation	Description
23	TEMP6-1	Sensor 6: Connection 1 (current measurement +)
24	TEMP6-2	Sensor 6: Connection 2 (voltage measurement +)
25	TEMP6-3	Sensor 6: Connection 3 (voltage measurement -)
26	TEMP6-4	Sensor 6: Connection 4 (current measurement -)



### NOTICE!

Due to the common power supply of two sensors, the sensors must always be connected in pairs, as only one channel alone does not work (channel 1+2, channel 3+4 and channel 5+6).

## 6.7 Further information

- Never exceed the specified maximum temperature (see chapter 4.1)
- Avoid any contact with the electronic components
- The magnetic bearing electronics must not be operated in potentially explosive atmospheres

## 7. Operation

### 7.1 General

The MBC5000 magnetic bearing electronics do not have a built-in control panel; they are operated exclusively via the existing communication interfaces. For commissioning or test operation, full access is guaranteed using the MATLAB® Toolbox for MECOS magnetic bearing systems.

### 7.2 Status displays

The electronics have several status displays, which are described in the following table.

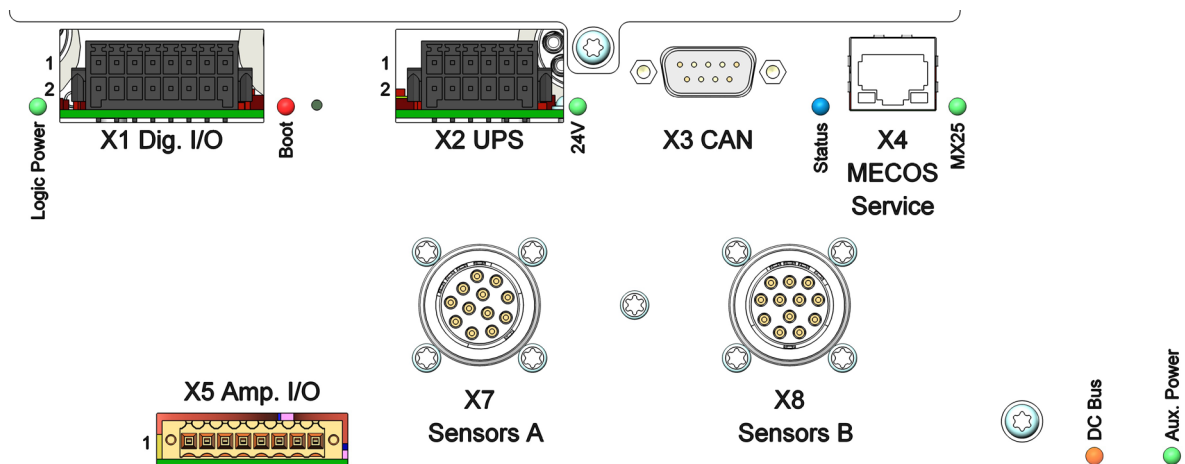


Figure 8: Status displays

Designation	Description	Colour
MX25	Lights up when there is a connection to the electronics via the service interface.	Green
Status	The rotor levitates. The rotor turns. An error has occurred. The rotor levitates and turns. The rotor levitates, turns and an error has occurred. The rotor levitates and an error has occurred. The rotor turns and an error has occurred.	Green Blue Red Cyan White Yellow Magenta
24V	Lights up when the isolated 24 V voltage is present.	Green
Boot	Lights up when the controller is in boot mode.	Red
Logic Power	Lights up when the auxiliary voltages from the controller are present.	Green
Aux. Power	Lights up when the secondary voltage from the amplifier board is present.	Green
DC Bus	Lights up when the DC link voltage is present on the amplifier board.	Orange

### 7.3 Boot button

If the boot button is pressed and held during the boot process, the controller can be switched to boot mode. Once the boot button has been pressed, the magnetic bearing cannot be activated as the electronics are permanently in boot mode.

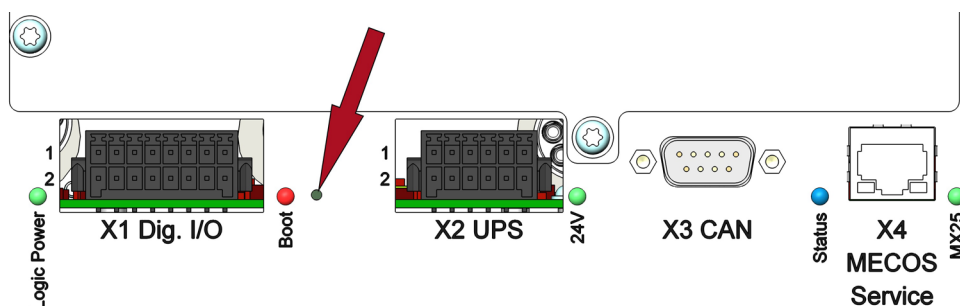


Figure 9: Boot button



#### NOTICE!

The boot button may only be operated by a MECOS service technician or appropriately trained personnel in the event of a fault in the magnetic bearing amplifier.

### 7.4 Operation via the digital I/O interface

Communication between the magnetic bearing electronics and the higher-level control unit takes place via the digital I/O interface and/or - if available - via the communication bus of the expansion card. The contact assignment of the interfaces is defined according to the connection diagram (see chapter 13 [1]). The plug connectors are described in chapter 6.5.

### 7.5 Operation via the service interface (optional)

With the help of the MATLAB® Toolbox for MECOS magnetic bearing systems (optional), full access is possible via Ethernet. In addition to the control functions, the Toolbox has a variety of different tools for parameterising and analysing the magnetic bearing system.



The functionality of the MATLAB® Toolbox is described in chapter 12.4.

### 7.6 Parameterisation of the communication interfaces

The magnetic bearing electronics have a large number of parameters that are defined depending on the project. Parameterisation is carried out via the service interface (see chapter 7.5) and can only be changed by the customer to a limited extent, as incorrect parameterisation can lead to damage or destruction of the system in addition to incorrect behaviour. MECOS delivers the control unit with the corresponding parameterisation. Subsequent changes to the configuration are only possible and permitted in consultation with MECOS and with the involvement of a service technician or service personnel accredited by MECOS. In this document, you will find the reference to the corresponding parameterisation reports (see chapter 13), which are generated on a project-specific basis.

#### 7.6.1 Digital I/O configuration

This report (see chapter 13 [2]) contains information on the parameterisation of the digital inputs and outputs as well as information on the UPS interface.



### 7.6.2 Monitoring parameters

The monitoring report (see chapter 13 [3]) contains all the parameterisation information for the monitoring interface. In addition to the bit and error number for identification, there is also a description for each parameter, details of the lower and upper limits and the parameterised error response. The respective columns are labelled and provided with an explanation. Details on the error response can be found in chapter 8.

### 7.6.3 Anybus variables

The Anybus parameterisation report (see chapter 13 [4]) contains all the parameterisation information for the Anybus™ interface. The report provides the necessary address, type and access information, unit info, area info and a description of the variable for each available variable. The respective columns are labelled and provided with an explanation. The columns may vary slightly depending on the bus type.

## 7.7 Further operating instructions



### CAUTION!

No cables may be plugged in or unplugged while the magnetic bearing electronics are switched on. This could result in an electric shock or lowering of the rotor while it is rotating.



To prevent possible data loss, magnetic data carriers such as floppy discs, hard disks, etc. must not be stored in the immediate vicinity of the magnetic bearing electronics.

## 8. Malfunctions

Personnel to be trained, instructed or undergoing general training may only work on the magnetic bearing electronics under the constant supervision of an experienced specialist!

If a fault occurs, this can have various causes. Firstly, always try to find out whether the cause of the fault lies in the system itself or in inadmissible ambient conditions (see chapter 4.1).

The MBC5000 magnetic bearing electronics continuously monitor a large number of system states. Errors and warnings are always output via the digital I/O, the service interface X4 or the optional fieldbus interface. If not described in this document, details on these interfaces can be found in the corresponding document (see chapter 13).

If no connection is possible via the service or fieldbus interface, MECOS AG service (see chapter 1.4) must be notified.

The error response of the system depends on the parameterisation, see also chapter 7.6.2. Monitoring depends on the signal type (analogue or digital). In addition to the monitoring limit and level, a delay time can also be parameterised.



Please contact MECOS if errors occur repeatedly

MECOS distinguishes between warnings and errors:

Designation	Description of the
Warning	Generates a warning message (alarm) A warning message is triggered when a warning limit value is exceeded. It remains set until the value falls below the warning limit again and the minimum time for the warning has expired. An alarm usually leads to no reaction.
Error (Fault)	Generates an error message (error) An error message is triggered if a system-critical limit value is exceeded. An error usually leads to an error response and remains set until it is reset by a clear command. An error can only be reset when it is no longer present.

Both warnings and errors can be masked or hidden.

The following behaviours can be set:

Designation	Description
noAction	No reaction
Stop	Switch off drive (Emergency Stop)
Liftdown	Lower rotor (only possible at standstill or low speed)
Dropdown	Immediate ejection of the rotor under speed
ResetDisable	Blocks the resetting of the error until the next restart
ResetNotRot	The error can only be reset at standstill
LevitatedOnly	Monitoring is only active when the rotor is levitating
History	Entry in the error memory in the SPI flash (Fault History)
EventLog	Entry in the event logger in the SPI flash (Event Log)

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## 9. Cleaning and maintenance

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The magnetic bearing electronics are not subject to wear when used as intended (see chapter 2.1.1) and are therefore maintenance-free.



### **DANGER!**

Never bring the device into contact with water or other liquids. Never penetrate the device with any objects.

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## 10. Disposal and recycling

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If the magnetic bearing electronics are decommissioned as an old system, the **laws and regulations** for disposal applicable at that time must be complied with.

It makes sense to check which materials can be **recycled** and then to do so.

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## 11. Warranty

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Unless otherwise agreed, the General Terms and Conditions (GTC) of MECOS AG shall apply.

The entitlement to any warranty services expires with the unauthorised opening of the device or the attempt to carry out repairs or modifications without consultation with written confirmation from MECOS AG.



### **DANGER!**

Unauthorised opening of the device and improper handling can lead to personal injury and damage to property. The device must not be opened.

Modifications to the device may result in undefined conditions that can lead to personal injury and damage to property.



### **NOTICE!**

No liability is accepted for damage caused by incorrect or improper operation, non-compliance with the instructions in this operating manual, misuse or unauthorised modifications or the use of non-original spare parts. In such cases, all warranty claims are void.

## 12. Accessories

### 12.1 Supply

The MBC5000 must be supplied with DC voltage of 300 V. The power supply required for this must fulfil certain technical requirements, which is why MECOS recommends using the following power supply unit for standard applications:

PFC2K-E/300UTA-S3322, manufacturer Absopulse ([absopulse.com](http://absopulse.com)).

Industrial quality power supply with a rated output of 2000 W and an input range of 190 ... 264 V<sub>AC</sub>. This power supply was customised for Mecos AG and can therefore not be found in the catalogue or on the Absopulse homepage; for data sheet see chapter 13 [5].

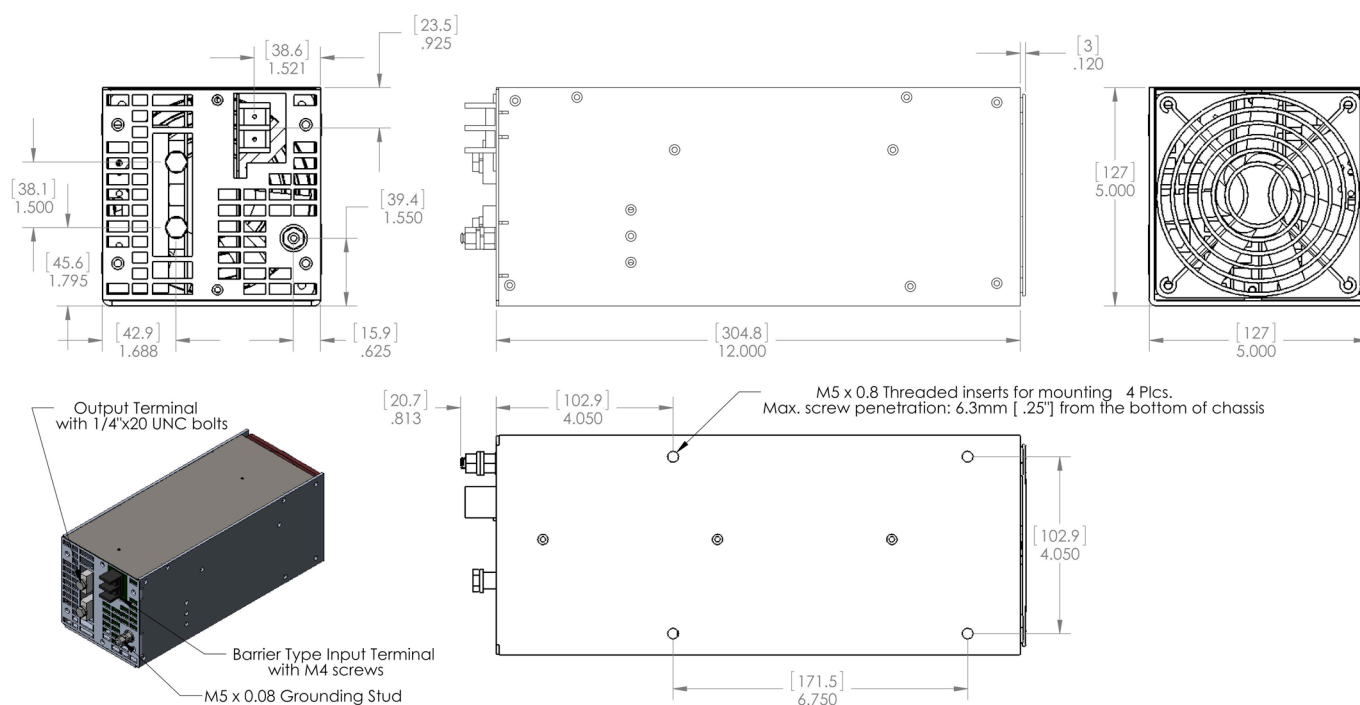




Figure 10: Dimension drawing of Absopulse power supply unit

A different power supply unit must be evaluated for applications with long cables or other special requirements.

 MECOS will be happy to assist you in evaluating a suitable power supply unit for your application.

### 12.2 UPS

The use of a UPS is recommended to ensure operation during a power failure. The UPS must be designed to cover the peak power of the system for the necessary bridging time. The MBC5000 has a communication interface to the UPS, which allows simple monitoring and control of the UPS by the magnetic bearing electronics.

 MECOS will be happy to support you in evaluating and connecting a suitable UPS for your application.

### 12.3 Sensor amplifier box SMX8 and SMX8A

The SMX8 or SMX8A sensor amplifier box is usually required for operation with long sensor cables. Please clarify with MECOS AG whether an SMX8 or SMX8A sensor amplifier box is required for your application. The box should be placed as close as possible to the sensors, i.e. near the machine.

The article is available from MECOS AG under the following article number:

Designation	Article number	Description
Sensor amplifier box SMX8 / SMX8A	BG13161-xxN	For variable sensor cable lengths

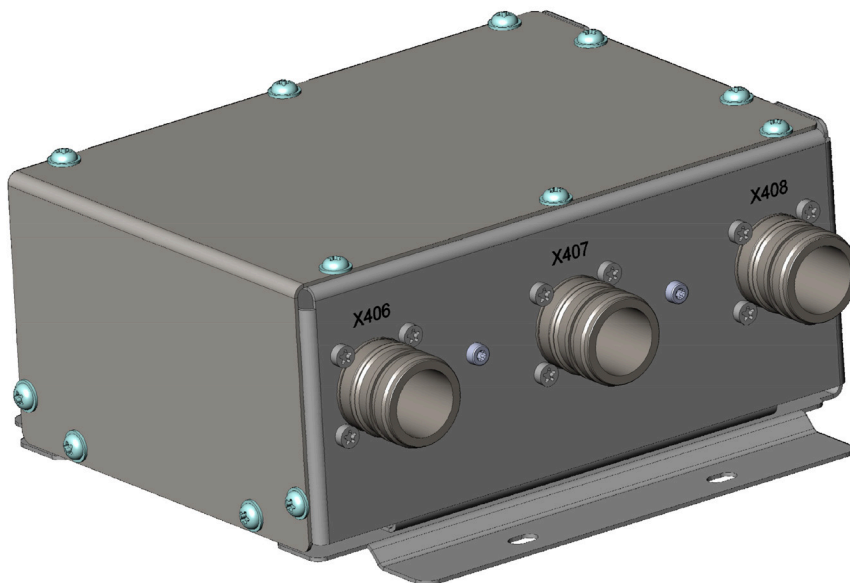


Figure 11: Sensor amplifier box SMX8A, example image shows variant BG13161-01N

### 12.4 Toolbox for MECOS magnetic bearing systems

The toolbox for MECOS magnetic bearing systems (MecosTools) can be used to change a large number of system parameters and perform real-time measurements of all processor variables of the magnetic bearing system. It contains all functions for commissioning, validation and maintenance of the magnetic bearing system.

The MecosTools are integrated as a Toolbox in the industrially recognised and widely used MATLAB<sup>®2</sup> software. This allows the potential of MATLAB<sup>®</sup> to be used for modelling, controller synthesis, simulation, visualisation and scripting.

It is possible to create a customised AMB ServiceTool based on the Toolbox for MECOS magnetic bearing systems, which can also be used without MATLAB<sup>®</sup> installed.

**i** The Toolbox for MECOS magnetic storage systems and the MECOS AMB ServiceTool can only be used under Microsoft Windows<sup>®</sup>. Admin rights are required for installation.



#### NOTICE!

Due to the various additional functions of MecosTools, it is generally possible to make changes to the controller parameter set that can lead to instability of the magnetic bearing. Under certain circumstances, this can lead to damage to the system.

2 MATLAB<sup>®</sup> is commercial software from MATHWORKS<sup>®</sup> Inc. for solving mathematical problems and visualising the results graphically. Link to the website: [www.mathworks.com](http://www.mathworks.com)

### 13. Related documents

The following documents are created on a project-specific basis and are therefore not included in these operating instructions, but are nevertheless part of the device documentation:

No.	Designation	File name
[1]	Connection diagram of ML system	BGxxxxx-xxNx_SCH_ML-System_ { <i>Project-specific</i> }_Vxxx.pdf
[2]	Digital I/O configuration parameter report	<i>File will be created on request</i>
[3]	Monitoring parameter report	<i>File will be created on request</i>
[4]	Fieldbus variables parameter report	<i>File will be created on request</i>
[5]	Data sheet of Absopulse power supply	Absopulse_PFC 2K-E 300UT-S3322.pdf

x = letter or number

Project-specific article number incl. index:

Project name:

## 14. Glossary

Term	Explanation
AMB	<b>Active Magnetic Bearings</b>
Digital I/O	Parallel customer interface on the magnetic bearing electronics with potential-free digital inputs and outputs
FDC	<b>Fast Digital Controller</b> Designation for MECOS controller board
ITB	<b>Interface Temperature and Bus</b> Expansion card for temperature measurement with Anybus™ slot
MBC	<b>Magnetic Bearing Controller</b> Designation for MECOS magnetic bearing electronics with power amplifier and controller board
ML system	MECOS german name for « <b>MagnetLagerSystem</b> » (Magnetic Bearing System) Used for magnetic bearing scheme and includes MBC, cable, machine incl. bearings and sensors and peripheral devices if necessary
MPA	<b>Motherboard for Power Amplifier</b> Designation for MECOS amplifier board
PWM	<b>Pulse Width Modulation</b>
RTC	<b>Real Time Clock</b> Battery-backed clock, in which the current time and date are stored.
SMX	<b>Sensor Matching BoX</b> Additional device that amplifies the sensor signals on the machine side and thus enables longer sensor cables
UPS	<b>Uninterruptible Power Supply</b>

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15. Notes

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Subject to technical changes