

Wilo-Control CC-Booster (CC, CC-FC, CCe)



en Installation and operating instructions

Fig. 1a:

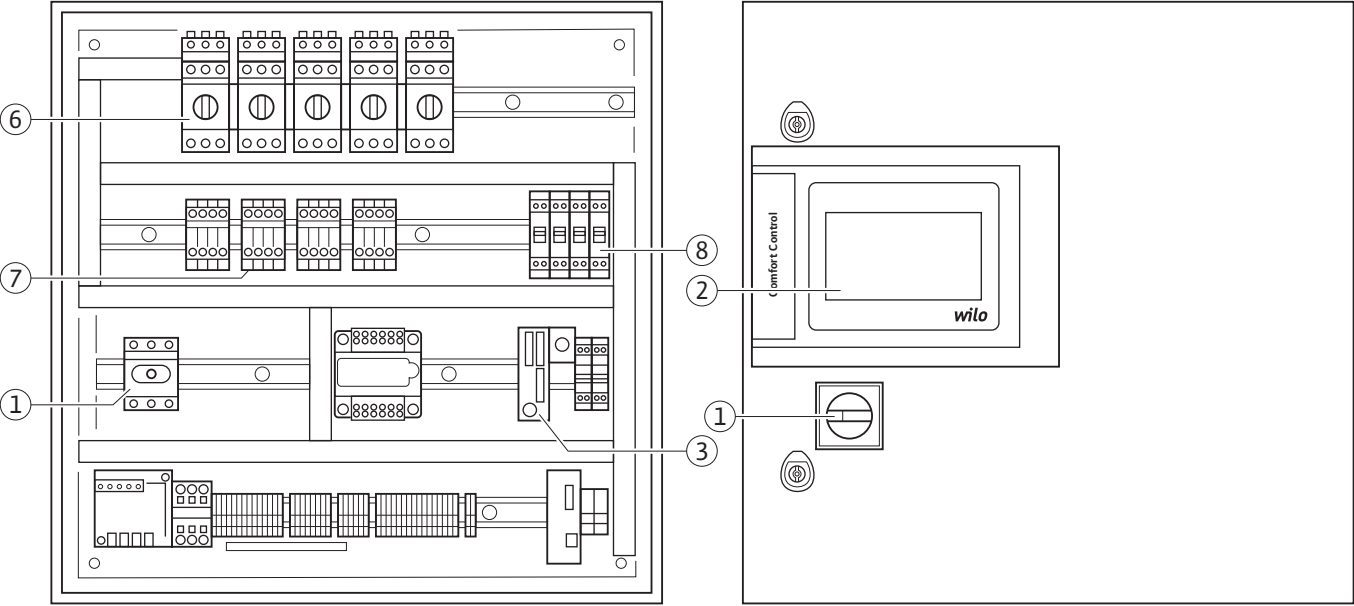


Fig. 1b:

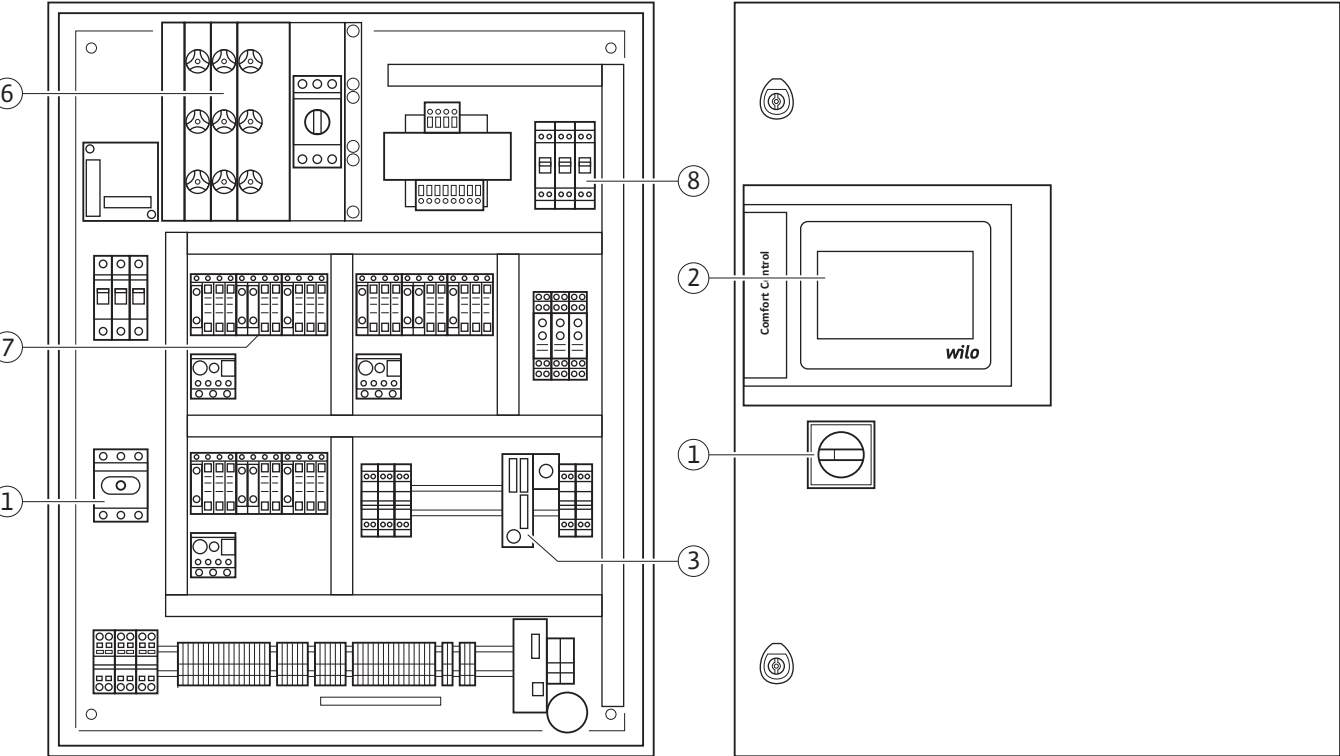


Fig. 1c:

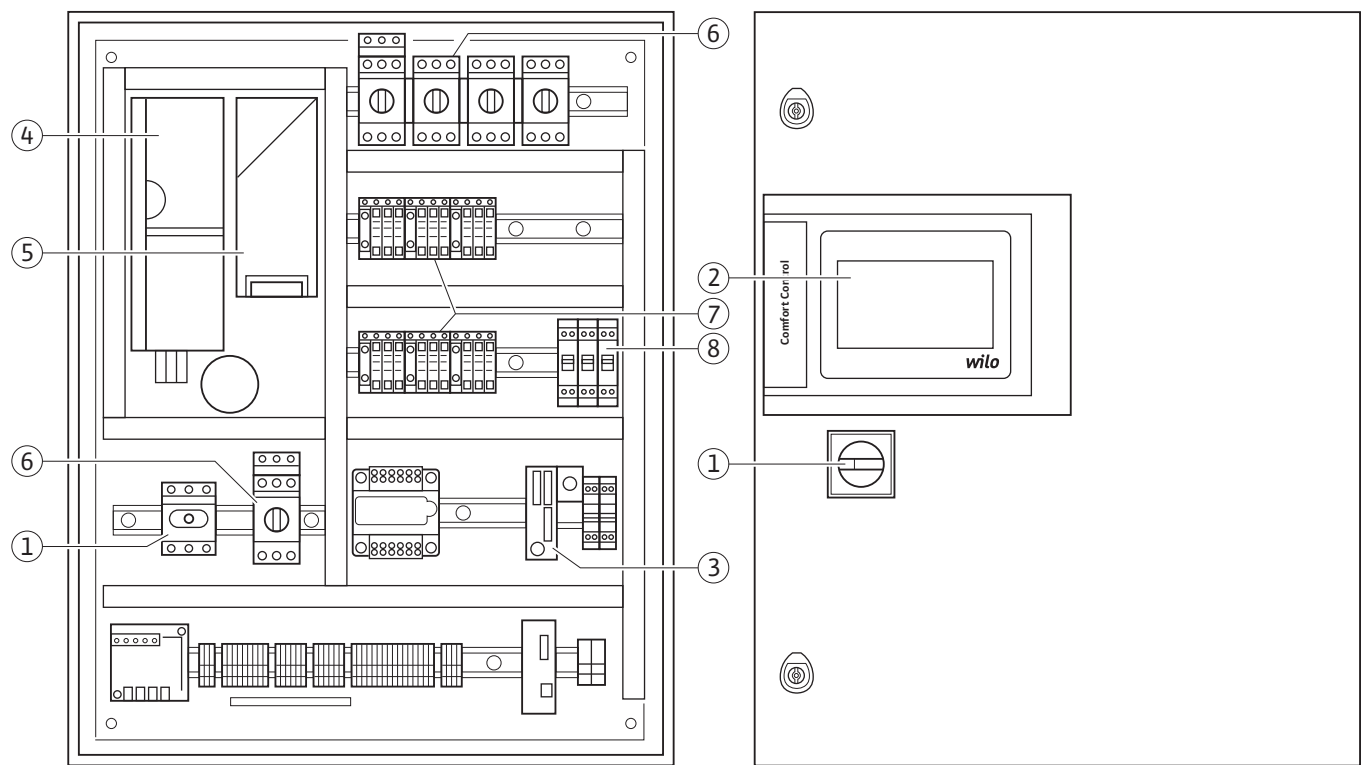


Fig. 1d:

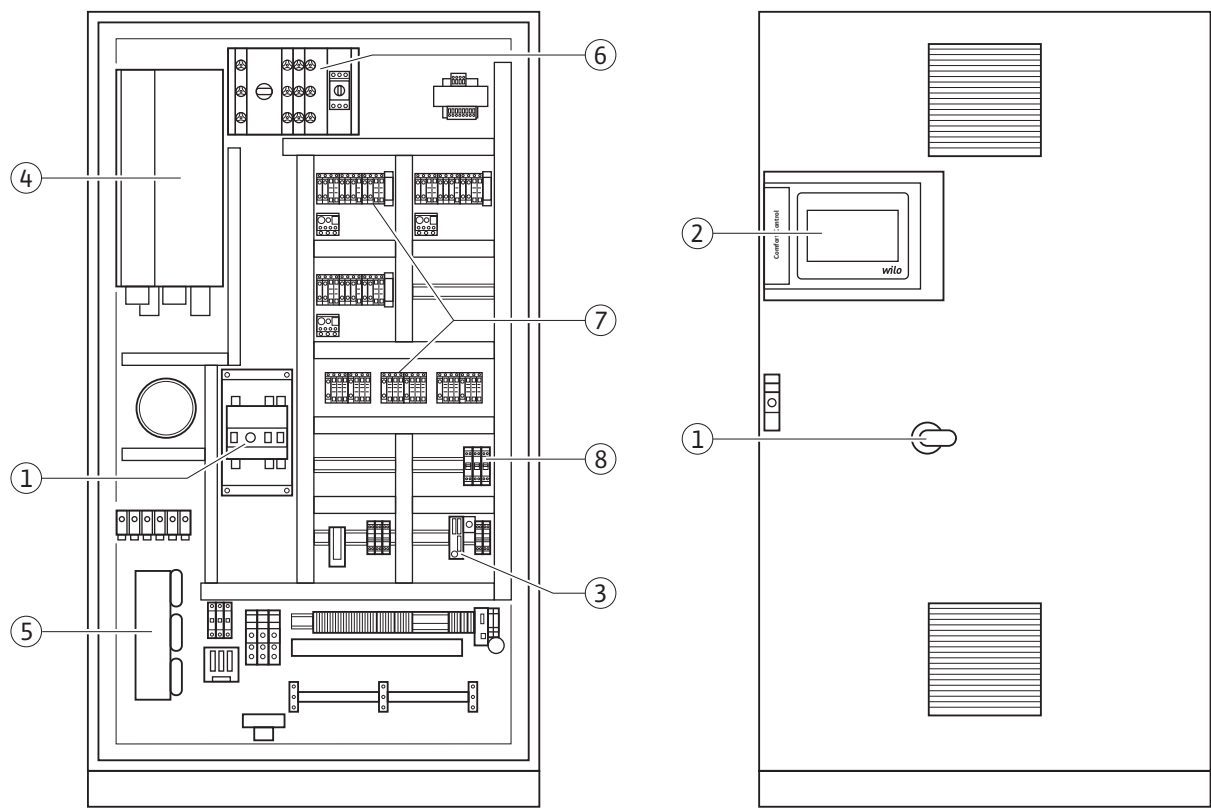


Fig. 1e:

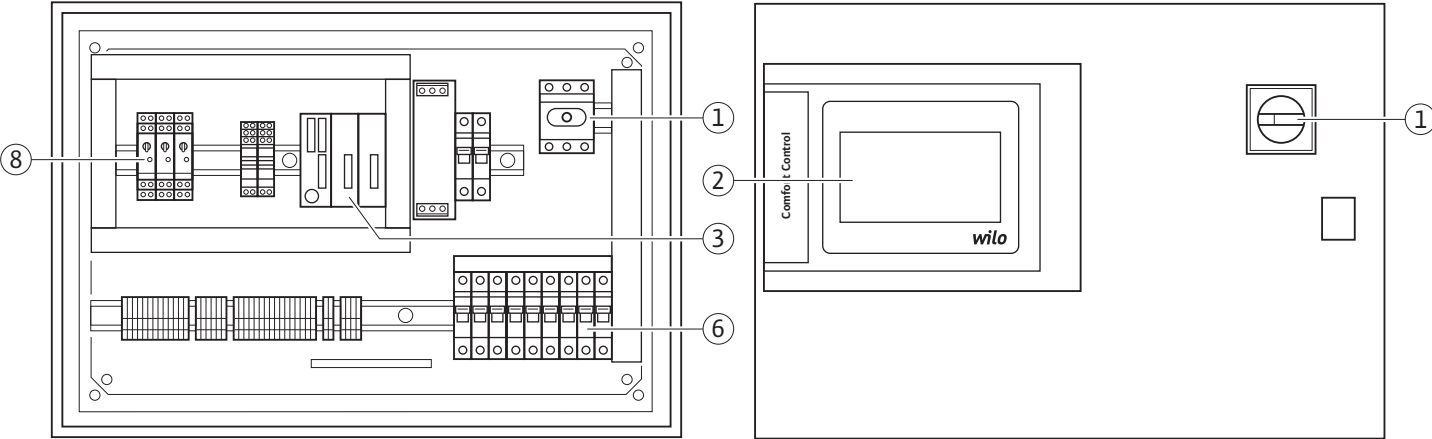


Fig. 2:

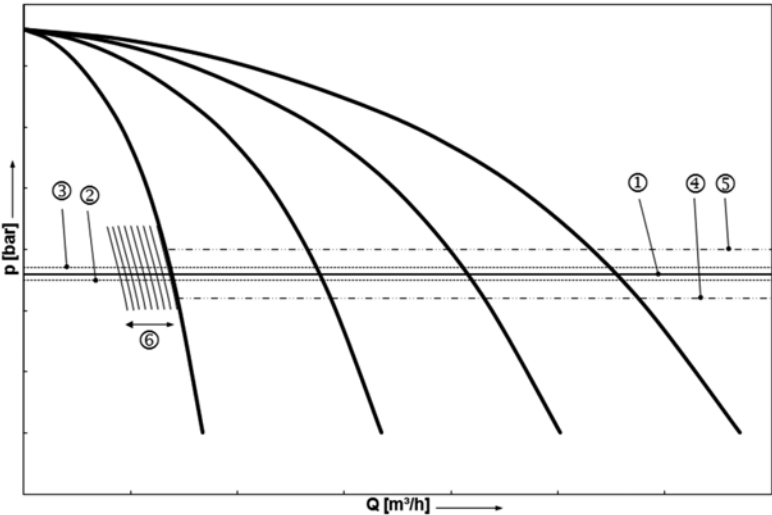


Fig. 3:

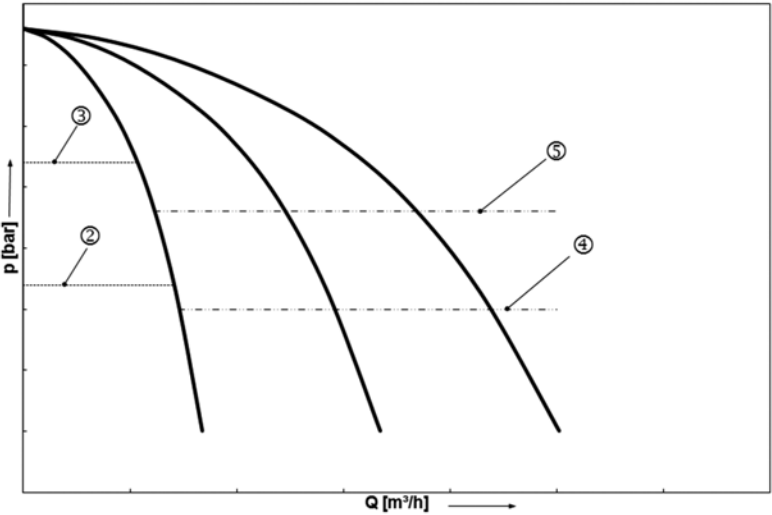


Fig. 4a:

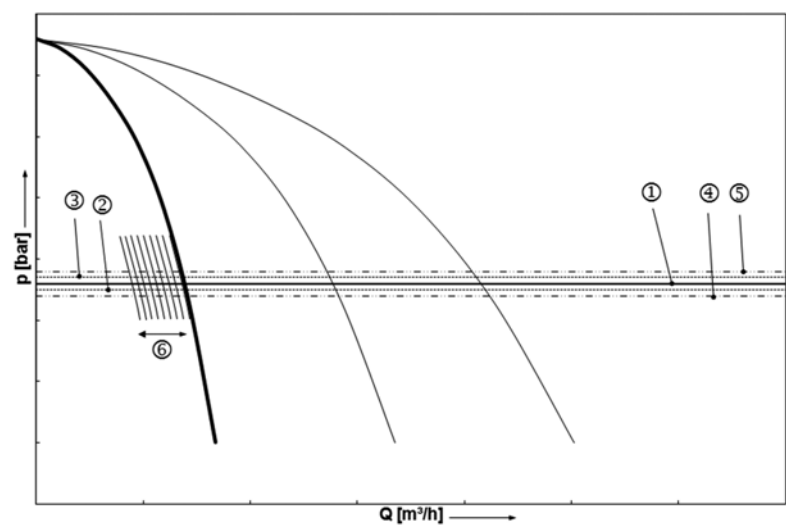


Fig. 4b:

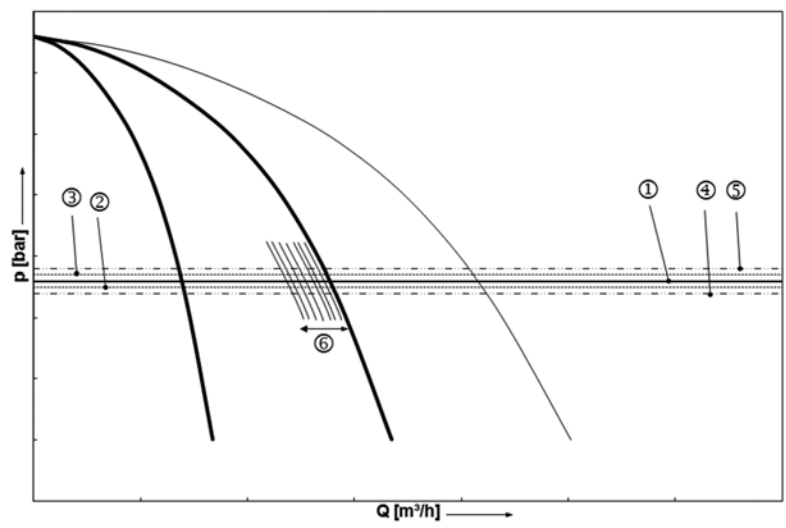
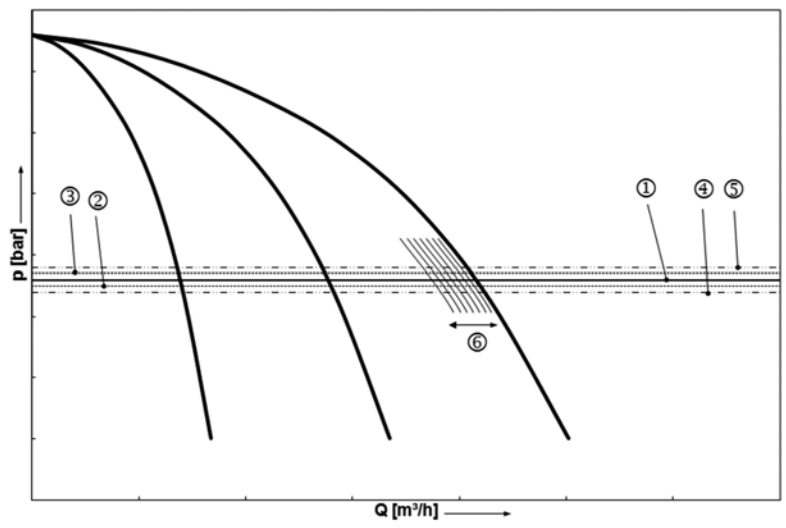


Fig. 4c:



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1 General information

About this document

The language of the original operating instructions is German. All other languages of these instructions are translations of the original operating instructions.

These installation and operating instructions are an integral part of the product. They must be kept readily available at the place where the product is installed. Strict adherence to these instructions is a precondition for the intended use and correct operation of the product.

These installation and operating instructions correspond to the relevant version of the product and the underlying safety standards valid at the time of going to print.

EC-Declaration of conformity:

A copy of the EC-Declaration of conformity is an integral part of these installation and operating instructions.

If a technical modification is made to the designs named in the declaration without our prior agreement, or the declarations made in the installation and operating instructions on product/personnel safety are not observed, this declaration is no longer valid.

2 Safety

These installation and operating instructions contain basic information which must be adhered to during installation, operation and maintenance. For this reason, it is mandatory that these installation and operating instructions are read by the service technician and the responsible qualified personnel/operator before installation and commissioning.

Not only must the general safety instructions listed under this main "Safety" section be adhered to, but also the special safety instructions that are marked by danger symbols and included under the following main sections.

2.1 Symbols and signal words in the operating instructions

Symbols:



General danger symbol



Danger due to electrical voltage



NOTICE

Signal words:

DANGER!

Acutely dangerous situation.

Non-observance will result in death or extremely serious injuries.

WARNING!

The user could suffer (serious) injuries.

"Warning" implies that (serious) injury to persons is probable if this information is disregarded.

CAUTION!

There is a risk of damaging the product/unit.

"Caution" implies that damage to the product is likely if this information is disregarded.

NOTICE:

Useful information on handling the product. It draws attention to possible problems.

Information that appears directly on the product, such as

- direction of rotation arrow,
 - identifiers for connections,
 - rating plate,
 - warning stickers,
- must be strictly complied with and kept in a fully legible condition.

2.2 Personnel qualifications

The installation, operation and maintenance personnel must have the appropriate qualifications for this work. The area of responsibility, responsibility and monitoring of the personnel are to be ensured by the operator. If the personnel do not possess the necessary knowledge, they are to be trained and instructed. This can be carried out, if necessary, by the product manufacturer at the operator's request.

2.3 Danger in the event of non-observance of the safety instructions

Non-observance of the safety instructions can result in the risk of injury to persons and damage to the environment and the product/unit. Non-observance of the safety instructions will render any claims for damages null and void.

In particular, non-observance can, for example, result in the following risks:

- danger to persons due to electrical, mechanical and bacteriological factors,
- damage to the environment due to leakage of hazardous materials,
- material damage,
- failure of important product/unit functions,
- failure of required maintenance and repair procedures.

2.4 Safety consciousness on the job

The safety instructions included in these installation and operating instructions, the existing national regulations for accident prevention, together with any operator's internal working, operating and safety regulations are to be complied with.

2.5 Safety instructions for the operator

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or who lack experience and knowledge, unless they have been given supervision or instruction concerning the use of the device by a person responsible for their safety. Children should be supervised to ensure that they do not play with the device.

- If hot or cold components on the product/the unit lead to hazards, measures must be taken on-site to prevent them from being touched.
- Guards for moving components (such as the coupling) must not be removed whilst the product is in operation.
- Leakages (e.g. from the shaft seals) of hazardous fluids (which are explosive, toxic or hot) must be discharged so that no danger to persons or to the environment arises. National statutory provisions are to be complied with.
- Highly flammable materials should always be kept a safe distance from the product.
- Danger due to electrical current must be eliminated. Local directives or general directives [e.g. IEC, VDE etc.] and instructions from local energy supply companies must be adhered to.

2.6 Safety instructions for installation and maintenance work

The operator must ensure that all installation and maintenance work is carried out by authorised and qualified personnel who have sufficiently familiarised themselves with the installation and operating instructions by studying them in detail.

Work on the product/unit must only be carried out when at a standstill. The procedure described in the installation and operating instructions for shutting down the product/unit must be strictly observed.

Immediately after completing work, all safety and protective devices must be put back in position and/or recommissioned.

2.7 Unauthorised modification and manufacture of spare parts

Unauthorised modification and manufacture of spare parts will impair the safety of the product/personnel and void the manufacturer's declarations regarding safety.

Modifications to the product are only permissible following consultation with the manufacturer.

Original spare parts and accessories authorised by the manufacturer ensure safety. The use of other parts will absolve the manufacturer of liability for any consequences arising therefrom.

2.8 Improper use

The operational reliability of the supplied product is only guaranteed if used as intended and in accordance with section 4 of the installation and operating instructions. The limit values must on no account fall under or exceed those values specified in the catalogue/data sheet.

3 Transport and temporary storage

Immediately after receiving the product:

- Check product for transport damage,
- In the event of damage in transit, take the necessary steps with the forwarding agent within the respective time limits.



CAUTION! Risk of property damage!

Incorrect transport and temporary storage can cause damage to the product.

- **The switchgear is to be protected against moisture and mechanical damage.**
- **It must not be exposed to temperatures outside the range of -10 °C to +50 °C.**

4 Application (Intended use)

The CC switchgear is used for automatic, convenient control of pressure-boosting systems (single and multi-pump systems).

The field of application is water supply in residential towers, hotels, hospitals, offices and industrial buildings.

When used in conjunction with suitable signal transmitters, the pumps offer low-noise and energy-saving operation. The performance of the pumps is adapted to the constantly changing requirements in the heating / water-supply system.

Intended use also includes compliance with this manual.

Any other use is regarded as non-intended use.

5 Product information

5.1 Type key

e.g.: Wilo-Control CC-B 3x10A T34 DOL FC WM	
CC	Comfort Control switchgear for fixed speed pumps
CCe	Comfort Control switchgear for electronic pumps
	Pressure boosting application
4 x	Number of pumps 1 – 6
10	Max. rated current per pump in amperes [A]
T	Mains connection: M = alternating current (1~) T = three-phase current (3~)
34	Rated voltage: 2 = 220 – 230 V 34 = 380 – 400 V
DOL	Pump activation type: DOL = direct SD = star-delta
FC	With Frequency Converter
WM	Installation type: WM = Switchgear is mounted on a mounting bracket (w all m ounted) BM = Floor model (b ase m ounted)

5.2 Technical data

Mains supply voltage [V]:	See rating plate
Frequency [Hz]:	50/60 Hz
Control voltage [V]:	24 VDC; 230 VAC
Max. current consumption [A]:	See rating plate
Protection class:	IP54
Max. fuse protection on mains side [A]:	See circuit diagram
Ambient temperature [°C]:	0 to +40 °C
Electrical safety:	Pollution degree II

5.3 Scope of delivery

- CC-Booster switchgear
- Circuit diagram
- CC-Booster installation and operating instructions
- Frequency converter installation and operating instructions (only for CC... FC version)
- Factory test report

5.4 Accessories

Accessories must be ordered separately:
(see also Wilo-Select)

Option	Description
Signal module	Relay output module for outputting individual operation signals and fault signals
DDC and control module	Input terminal assembly for switching potential-free control contacts
GSM module	Mobile radio module for dialling into GSM networks
GPRS module	Mobile radio module for dialling into GPRS networks
WebServer	Controller module for connection to Internet or Ethernet data transmission
Communication module "Profibus DP"	Bus communication module for "Profibus DP" networks
Communication module "CanOpen"	Bus communication module for "CanOpen" networks
Communication module "LON"	Bus communication module for "LON" networks
Communication module "ModBus RTU"	Bus communication module for "ModBus" networks
Communication module "BACnet"	Bus communication module for "BACnet" networks
Mains switching	External auxiliary device for switching to redundant supply network

Other options on request

6 Description and function

6.1 Description of the product (Fig. 1)

6.1.1 Function description

The Comfort switchgear, controlled by a programmable logic controller (PLC), is used to control pressure-boosting systems with up to 6 single pumps. The pressure of a system is controlled as a function of the load with appropriate signal transmitters. The controller acts on a frequency converter (CC-FC version), which in turn influences the speed of the base-load pump. A modification of the speed changes the volume flow and thus the rated power of the pressure-boosting system. Only the base-load pump is speed-controlled. Uncontrolled peak-load pumps are switched on and off automatically according to load requirements, while the base-load pump handles fine-tuning to the pre-set setpoint. In the CCe version, each pump has an (integrated) frequency converter.

6.1.2 Set-up of the switchgear

The set-up of the switchgear is dependent on the performance of the pumps that are to be connected, and the version (CC, CC-FC, CCe) (see: Fig. 1a CC direct starting; Fig. 1b CC star-delta starting, Fig. 1c CC-FC direct starting; Fig. 1d CC-FC star-delta starting, Fig. 1e CCe). It consists of the following main components:

- Main switch: Switches the switchgear on/off (item 1).
- Touch display: Display of operating data (see menus) and the operating status. Menu selection and parameter input possible via touch sensitive surface (item 2).
- Programmable logic controller: Modular design PLC with power supply unit. The configuration depends on the system (item 3).

- Frequency converter: Frequency converter for load-sensitive speed control of base-load pump – only available for CC-FC version (item 4).
- Motor filter: Filter for ensuring a sinusoidal motor voltage and for suppressing voltage peaks – only in the CC-FC version (item 5).
- Fuse protection for drives and frequency converter: Fuse protection for the pump motors and the frequency converter. For devices with $P_2 \leq 4.0 \text{ kW}$: Motor protection switch. On the CCe version: Circuit breaker for the fuse for the pump mains supply cable (item 6).
- Contactors/contactor combinations: Contactors for switching on the pumps. In devices with $P_2 \geq 5.5 \text{ kW}$, including the thermal tripping devices for excess current protection (default value: $0.58 \cdot I_N$) and the time relay for the star-delta switchover (item 7).
- Manual-0-Automatic switch: Switch for selecting the pump operating modes "manual" (emergency/test operation on the mains; motor protection available), "0" (pump switched off – no activation possible via PLC) and "auto" (automatic mode enabled via PLC) (item 8).
The speed of every pump (0 – 100 %) can be set in manual mode with the manual control in the CCe version.

6.2 Function and operation



DANGER! Risk of fatal injury!

When working on the open switchgear, there is a danger of electric shock from touching the live components.

The work must only be carried out by qualified personnel!

**NOTICE:**

After connecting the switchgear to the supply voltage, as well as after every mains interruption, the switchgear returns to the operating mode set before the power interruption.

6.2.1 Switchgear operating modes

Normal operation of switchgears with frequency converter – CC-FC version (see Fig. 2)

An electronic signal transmitter (measurement range to be set in menu 4.3.2.3) supplies the control variable actual value as a 4...20 mA current signal. Then the controller maintains the system pressure constant by means of the comparison of the setpoint/actual value (for setting of the reference setpoint ① see menu 3.1).

If there is no "external off" signal and no fault, the base-load pump with load-sensitive speed control starts when its start level ② is undershot. If the power requirement cannot be met by this pump, the switchgear switches on a peak-load pump and, if the requirement increases further, other peak-load pumps (start level: ④). The peak-load pumps run at constant speed, the speed of the base-load pump is controlled to the setpoint ⑥ in each case.

If the requirement drops until the controlling pump is working in its lower performance range and no peak-load pump is required any longer in order to meet the requirement then the peak-load pump switches off (stop level: ⑤). The base-load pump switches off independently via the zero-flow cut-off (stop level: ③). If the pressure drops again below the start level ②, then the pump restarts.

The parameter settings required for switching on and off the peak-load pump (switching level ④/⑤; delay times) can be set in menu 4.3.3.2. A selection can be made between the same switch-off level for all pumps and pump-specific switch-off level. The system suggests pump-specific switch-off levels. For this it is necessary to enter Q_{nom} and H_0 in menu 1.2.

To avoid pressure peaks when switching on or pressure troughs when switching off a peak-load pump, the speed of the base-load pump can be raised or reduced during these switching operations. Corresponding frequency settings of these so-called peak filters can be undertaken in 4.3.5.1 – page 2.

Normal operation of switchgears without frequency converter – CC version (see Fig. 3)

The controlled variable is taken from comparison of the setpoint/actual value for switchgear without a frequency converter (mains operation) or with a faulty frequency converter. Because there is no possibility of load-sensitive speed adaptation of the base-load pump, the system works as a two-point controller between ②/③ or ④/⑤.

The peak-load pump is activated and deactivated in the manner described above.

For switching off the base-load pump, a separate switching threshold ③ can be set in menu 4.3.3.1.

Normal operation of switchgear in the CCe version (see Fig. 4)

A selection can be made between 2 operating modes for switchgear in the CCe version. The setting parameters described for switchgear CC...FC are used each time for this.

The cascade mode corresponds in its operation to the normal operation of switchgears in the CC...FC version (see Fig. 2), whereby the peak-load pumps are activated with maximum speed.

In Vario mode (see Fig. 4), one pump starts as a load-sensitive speed-controlled base-load pump (Fig. 4a). If the required power requirement can no longer be met by this pump at maximum speed, another pump starts and takes over the speed control. The previous base-load pump continues at max. speed as a peak-load pump (Fig. 4b). This procedure is repeated at increasing load until the maximum number of pumps is reached (here: 3 pumps – see Fig. 4c).

If demand falls, the controlling pump will be switched off when the minimum speed is reached and a former peak-load pump takes over control.

The switchgear has the following additional operating modes whose parameterisation is described on the user interface:

Zero-flow cut-off

To avoid the pump running without water consumption, the switchgear performs a zero-flow test that may lead to pump deactivation where necessary.

Pump cycling

Various pump cycling mechanisms are used selectively to ensure that the load is distributed as evenly as possible between all pumps and to thereby balance the running times of the pumps.

Standby pump

One pump can be defined as the standby pump and is available in the event that another pump fails.

Pump test run

To avoid longer standstill times, a cyclic test run of the pumps is provided.

Fault-actuated switchover of multi-pump system

Switchgears with frequency converter – CC-FC version:

If the base-load pump has a fault, it is switched off and another pump is switched onto the frequency converter. If the frequency converter has a fault, the switchgear switches to "auto without frequency converter" operating mode with the associated control characteristics.

Switchgears without frequency converter – CC version:

If the base-load pump has a fault, it is switched off and one of the peak-load pumps is managed by the switchgear as a base-load pump.

Switchgears in the CCe version:

If the base-load pump has a fault, it is switched off and another pump takes over the control function. As a result of a fault of the peak-load pump, it is always switched off and a further peak-load pump (if necessary, also the standby pump).

Low water

A low water signal can be sent to the switchgear via a normally closed contact based on the signal from a suction-side pressure switch, break tank float switch or optional level relay.

Monitoring of maximum and minimum pressure

Limit values for safe system operation can be set.

Ext. Off

It is possible to deactivate the switchgear externally using a normally closed contact. This function takes precedence; all pumps are deactivated.

Operation in the event of a sensor fault

In the event of a sensor fault (e.g. wire break), the behaviour of the switchgear can be defined.

Operating mode of the pumps

The operating mode of the respective pump can be specified with the PLC (manual, off, auto) during activation.

Emergency operation

In the event of the control failing, there is the option to commission the pumps individually by means of the manual-0-auto switch (Fig. 1a-e; item 8) on the mains (or per manual control with individually settable speed for each pump – only CCe version). This function takes precedence over pump activation by the control.

Setpoint changeover

The switchgear can work with 3 different setpoints.

Remote setpoint adjustment

Remote adjustment of the setpoint is possible using an analogue current signal (optional voltage signal) by means of the corresponding terminals (acc. to circuit diagram).

Constant speed

Constant speed mode is possible via an analogue current signal (optional voltage signal) using the corresponding terminals (according to circuit diagram).

Logic reversal of the collective fault signal (SSM)

The required logic of the SSM can be set.

Function of the collective run signal (SBM)

The required function of the SBM can be set.

Fieldbus connection

The switchgear is prepared for connection via ModBus TCP as standard. Connection is established via an Ethernet interface (electrical connection as per chapter 7.2).

The switchgear works as a Modbus slave. Basic settings are adjusted on the user interface. Different parameters can be read and also changed to some extent via the Modbus interface. An overview of individual parameters and a description of the data types used are shown in the appendix.

Pipe filling

The pipe filling function can be activated to avoid pressure peaks when filling empty pipelines or pipelines under low pressure.

6.2.2 Motor protection

Excess temperature protection

Motors with an WSK (thermal winding contact) signal an excess winding temperature to the switchgear by opening a bimetal strip contact. The connection of the WSK is carried out according to the circuit diagram.

Faults on motors that are equipped with a temperature-dependent resistor (PTC) for excess temperature protection can be detected using optional evaluation relays.

Excess current protection

Motors on switchgears up to and including 4.0 kW are protected by motor protection switches with thermal and electromagnetic trip triggers. The trigger current must be set directly.

Motors on switchgears from 5.5 kW are protected by thermal motor protection relays. These are installed directly on the motor protections. The trigger current must be set and is $0.58 \cdot I_{nom}$ with the Y-Δ starting of the pumps used.

All motor protection devices protect the motor during operation with the frequency converter or in mains operation. Pump faults which reach the switchgear result in deactivation of the corre-

sponding pump and activation of the SSM. After the cause of the fault has been rectified, it is necessary to acknowledge the fault.

The motor protection is also active in emergency operation, and leads to deactivation of the corresponding pump.

In the CCE version, the pump motors protect themselves by mechanisms integrated in the frequency converters. The error messages from the frequency converters are handled in the switchgear as described above.

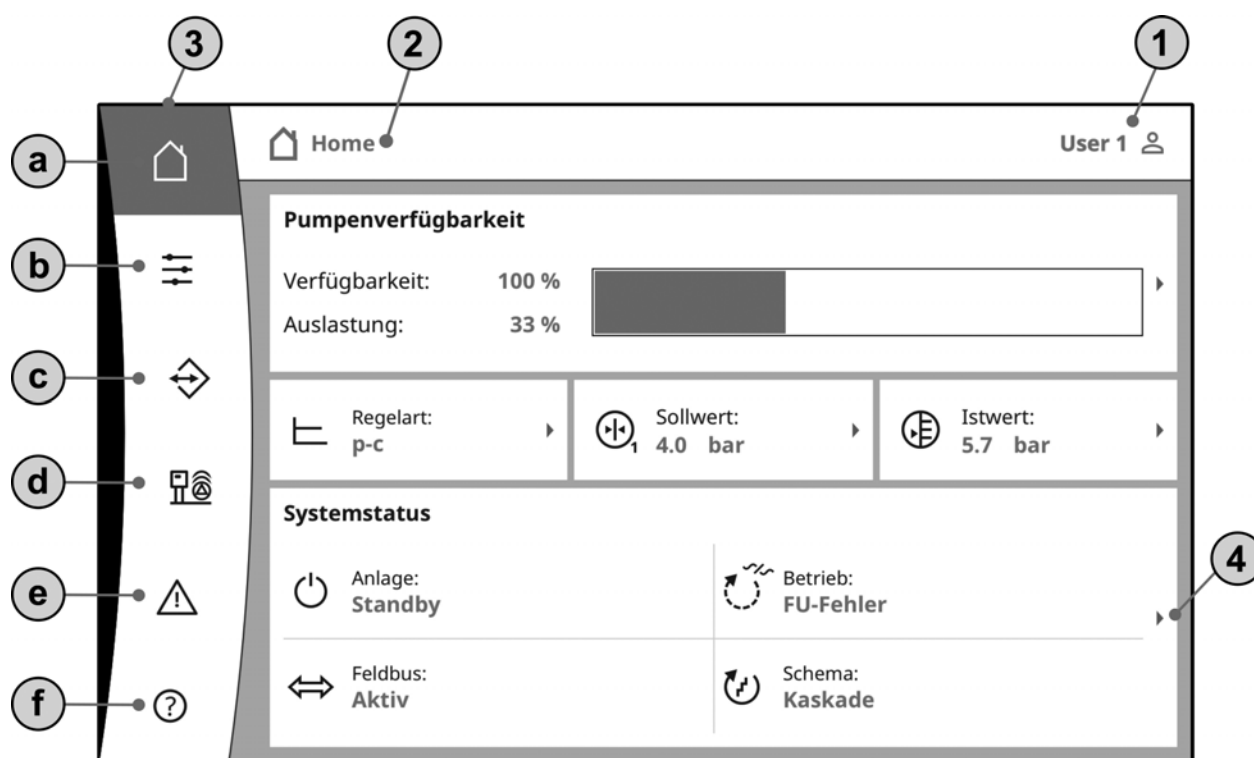
6.2.3 Operation of the switchgear

Operating elements

- **Main switch** on/off (lockable in "Off" position)
- The **touch display** (graphics-capable) shows the operating statuses of the pumps, the controller, and the frequency converter. Additionally, all switchgear parameters can be set using the display.

The relevant operating elements appear context-related on the touch display and can be selected directly. Input fields for parameters are marked with a line at the bottom.

The basic layout of the user interface is shown below:



1 – Current user status display; access to login page

2 – Navigation bar: Current screen display; press for direct navigation

3 – Quicklinks/main menu:

a – Home (return to main menu screen)

b – Control (e.g. setpoints)

c – Interaction (e.g. HMI, BMS)

d – System (e.g. pump data, sensors)

e – Current alarms

f – Help (e.g. online manual)

4 – Pressing an arrow leads to the next operation level

More information on operation can be found in the online manual on the user interface

User levels

Operation and parameterisation of the switchgear is protected by a three-stage security system. After the user level is selected and the corresponding password is entered (user symbol on main screen or INTERACTION->HMI->LOGIN), the system is released on the relevant user level.

User 1 (standard user – no login):

The display of almost all menu items is released in this level (typical: local user, e.g. building caretaker). Parameter input is limited.

User 2:

The display of almost all menu items is released in this level (typical: operator). Parameter input is possible with almost no limitations.

The password for this user level is 2222.

The other user levels are reserved for Wilo.

Selecting the display language

The user can select the display language (INTERACTION->HMI->LANGUAGE).

7 Installation and electrical connection

Installation and electrical connection must be carried out in accordance with local regulations and only by qualified personnel.



WARNING! Risk of personal injury!

Existing accident prevention regulations must be adhered to.



Warning! Danger of electric shock!

Danger due to electrical current must be eliminated.

Local directives or general directives [e.g. IEC, VDE etc.] and instructions from local energy supply companies must be adhered to.

7.1 Installation

- Wall fixation, WM (wall mounted): For pressure-boosting systems, the WM switchgears are mounted on the compact unit. If the wall device should be mounted separately from the compact unit, this is done using 4 screws, Ø 8 mm. Suitable measures should be used to ensure the protection class.
- Floor model, BM (base mounted): The floor model is set up free-standing on a level surface (with sufficient bearing capacity). In the standard version, there is an up-right panel support with a height of 100 mm for the cable inlet. Other supports are available on request.

7.2 Electrical connection



WARNING! Danger of electric shock

Electrical connection must be carried out by an electrician authorised by the local energy supply company and in accordance with the applicable local regulations [e.g. VDE regulations].

Mains connection

Warning! Danger of electric shock!

There is a potentially fatal voltage on the supply side, even when the main switch is turned off.

- The mains type, current type and voltage of the mains connection must match the details on the rating plate of the switchgear.

- Mains requirements:



NOTICE:

In accordance with DIN EN / IEC 61000-3-11 (see table below), the switchgear and pump with motor power of ... kW (column 1) are provided for operation on a mains power supply with a system impedance of Z_{\max} at the house connection of max. ... ohm (column 2) for a maximum number of ... connections (column 3).

If the mains impedance and the number of connections per hour are greater than the values given in the table, the switchgear with the pump may lead to temporary voltage drops and also to disturbing voltage fluctuations (flickering) due to the unfavourable mains conditions.

Therefore, measures may need to be taken before the switchgear and the pump can be operated on this connection as intended. The necessary information must be obtained from the local energy supply company and the manufacturer.

	Power [kW] (Column 1)	System impedance [Ω] (Column 2)	Connections per hour (Column 3)
3~400 V 2-pole Direct starting	2.2	0.257	12
	2.2	0.212	18
	2.2	0.186	24
	2.2	0.167	30
	3.0	0.204	6
	3.0	0.148	12
	3.0	0.122	18
	3.0	0.107	24
	4.0	0.130	6
	4.0	0.094	12
	4.0	0.077	18
	5.5	0.115	6
	5.5	0.083	12
	5.5	0.069	18
	7.5	0.059	6
	7.5	0.042	12
	9.0 – 11.0	0.037	6
	9.0 – 11.0	0.027	12
	15.0	0.024	6
	15.0	0.017	12
3~400 V 2-pole S-D starting	5.5	0.252	18
	5.5	0.220	24
	5.5	0.198	30
	7.5	0.217	6
	7.5	0.157	12
	7.5	0.130	18
	7.5	0.113	24
	9.0 – 11.0	0.136	6
	9.0 – 11.0	0.098	12
	9.0 – 11.0	0.081	18
	9.0 – 11.0	0.071	24
	15.0	0.087	6
	15.0	0.063	12
	15.0	0.052	18
	15.0	0.045	24
	18.5	0.059	6
	18.5	0.043	12
	18.5	0.035	18
	22.0	0.046	6
	22.0	0.033	12
	22.0	0.027	18
	30.0	0.027	6
	30.0	0.020	12
	30.0	0.016	18
	37.0	0.018	6
	37.0	0.013	12
	45.0	0.014	6
	45.0	0.010	12

**NOTICE:**

The maximum number of connections per hour specified in the table for each power is determined by the pump motor and must not be exceeded (adjust the parameterisation of the controller accordingly; see follow-up times, for example).

- Fuse on mains side in accordance with the information in the circuit diagram.

- Feed the ends of the mains cable through the threaded cable glands and cable inlets and wire them according to the markings on the terminal strips.
- The 4-wire cable (L1, L2, L3, PE) is to be provided on-site. The connection is established at the main switch (Fig. 1a – e, item 1) or for systems of higher power at the terminal strips in accordance with the circuit diagram, the PE is connected to the earth rail.



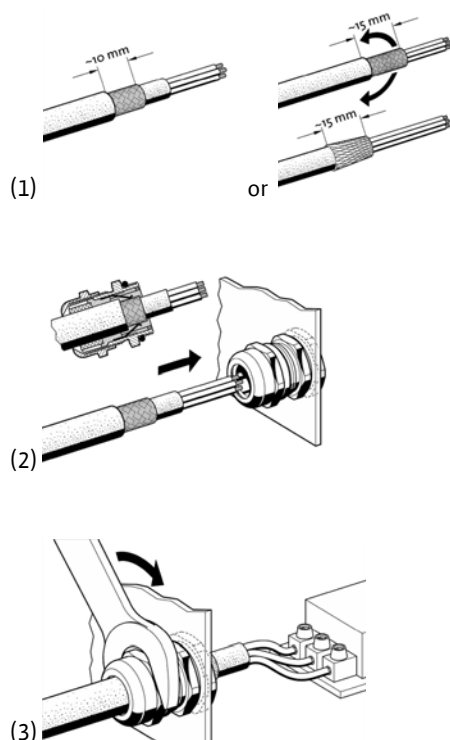
Pump mains connections

CAUTION! Risk of damage to the product!
Observe the installation and operating instructions for the pumps!

Power connection

The pumps must be connected to the terminal strips in accordance with the circuit diagram, PE must be connected to the earth rail. Use shielded motor cables.

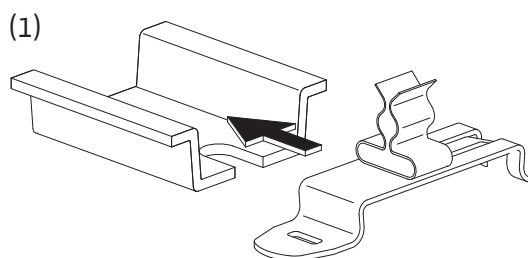
Connecting cable shields to the EMC threaded cable glands (CC ... WM)



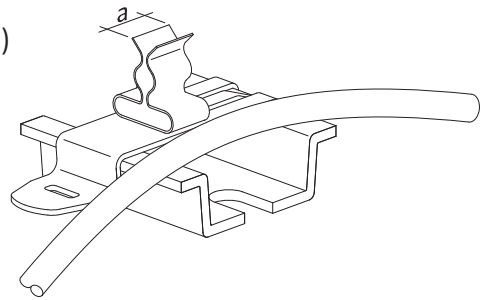
Connecting cable shields to the shield clamps (CC ... BM)



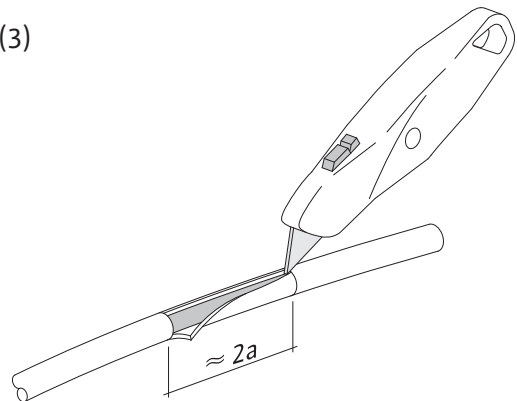
NOTICE:
The length of the cut (step 3) must be matched exactly to the width of the clamp used!



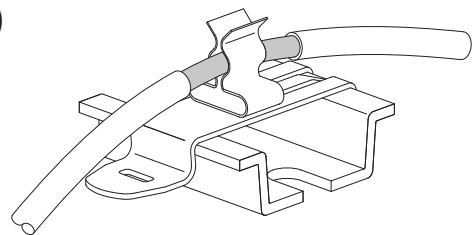
(2)



(3)



(4)



NOTICE

If the pump connection cables are extended beyond the dimension supplied ex-works, it is necessary to comply with the EMC note in the operating manual of the frequency converter (only CC-FC version).

Connection of excess temperature protection/pump fault

The thermal winding contacts or fault signal contacts (CCe version) on the pumps can be connected to the terminals in accordance with the circuit diagram.



CAUTION! Risk of damage to the product!
Do not connect any external voltage to the terminals!

Connection of pump control signal (CCe version only)

Analogue control signals of the pumps (0 – 10V) can be connected to the terminals in accordance with the circuit diagram. Use shielded cables.



CAUTION! Risk of damage to the product!
Do not connect any external voltage to the terminals!

Sensors

Connect the sensor correctly to the terminals according to the circuit diagram in the installation and operating instructions.

Use a shielded cable, place the shield on one side in the switchbox.



CAUTION! Risk of damage to the product!
Do not connect any external voltage to the terminals!



NOTICE:
Observe the correct polarity of the pressure sensor! Do not attach an active pressure sensor.

Analogue IN, setpoint remote adjustment/speed remote adjustment

Remote adjustment of the setpoint or, in the "constant speed" operating mode of the speed, is possible using an analogue signal (0/4...20 mA or 0/2...10 V) by means of the corresponding terminals in accordance with the circuit diagram. Use a shielded cable, place the shield on one side in the switchbox.

Setpoint changeover

Using the corresponding terminals in accordance with the circuit diagram, it is possible to force a switchover from setpoint 1 to setpoint 2 or 3 using a potential-free contact (normally open contact).

Logic diagram

Contact		Function
Setpoint 2	Setpoint 3	
o	o	Setpoint 1 active
x	o	Setpoint 2 active
o	x	Setpoint 3 active
x	x	Setpoint 3 active

x: Contact closed; o: Contact open



CAUTION! Risk of damage to the product!
Do not connect any external voltage to the terminals!

External activation/deactivation

Using the corresponding terminals in accordance with the circuit diagram, it is possible to connect a remote activation/deactivation by means of a potential-free contact (normally closed contact) after removing the converter bridge (pre-assembled as a factory setting).

External activation/deactivation

Contact closed:	Automatic ON
Contact open:	Automatic OFF, signal by symbol on the display
Contact load:	24 V DC/10 mA



CAUTION! Risk of damage to the product!
Do not connect any external voltage to the terminals!

Protection against low water level

Using the corresponding terminals (in accordance with the circuit diagram), it is possible to connect a function for protection against low water level by means of a potential-free contact (normally closed contact) after removing the converter bridge (pre-assembled as a factory setting).

Protection against low water level

Contact closed:	No low water
Contact open:	Low water
Contact load:	24 V DC/10 mA



CAUTION! Risk of damage to the product!
Do not connect any external voltage to the terminals!

Collective run/collective fault signals (SBM/SSM)

Potential-free contacts (changeover contacts) for external signals are available via the corresponding terminals in accordance with the circuit diagram.

Potential-free contacts, contact load:

- Minimum: 12 V, 10 mA
- Maximum: 250 V, 1 A



DANGER! Risk of fatal electrical shock!
There can be a potentially fatal voltage on these terminals, even when the main switch is switched off.

Display of actual pressure value

A 0 to 10 V signal for an external measurement/display option of the current control variable actual value is available via the corresponding terminals in accordance with the circuit diagram. 0 to 10 V corresponds to the pressure sensor signal 0 to pressure sensor limit value e.g.

Sensor	Display pressure range	Voltage/pressure
16 bar	0 ... 16 bar	1 V = 1.6 bar



CAUTION! Risk of damage to the product!
Do not connect any external voltage to the terminals!

Actual frequency display

For switchgear with frequency converter (CC-FC and CCe versions), a 0 to 10 V signal for an external measuring/display option of the current actual frequency of the base-load pump is available via the corresponding terminals as per the circuit diagram.

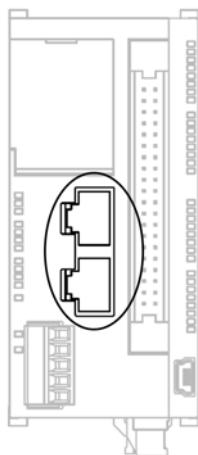
0 ... 10 V corresponds to the frequency range 0...f_{max}.



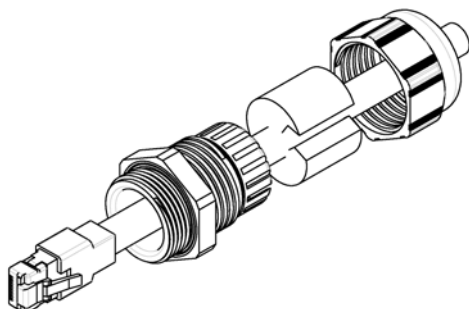
CAUTION! Risk of damage to the product!
Do not connect any external voltage to the terminals!

Field bus connection "ModBus TCP"

Connection to a building management system using ModBus TCP takes place via the CPU's Ethernet interface:



Pass the cable through the special (dark grey) threaded cable gland, fix and connect it as shown.



CAUTION! No external voltage may be applied.

**NOTICE**

The information for installation and for electrical connection of optional inputs/outputs can be found in the installation and operating instructions for these modules.

8 Commissioning**WARNING! Risk of fatal injury!**

Commissioning by qualified personnel only! Improper commissioning poses a risk of fatal injury. Have commissioning performed by qualified personnel only.

**DANGER! Risk of fatal injury!**

When working on the open switchgear, there is a danger of electric shock from touching the live components.

The work must only be carried out by qualified personnel!

We recommend that you have the switchgear commissioned by Wilo customer service. Before switching on for the first time, the on-site wiring must be checked to ensure it is correct, in particular the earthing.

Tighten all connection terminals prior to commissioning!**NOTICE:**

In addition to the activities described in these installation and operating instructions, it is necessary to perform the commissioning measures in accordance with the installation and operating instructions of the overall system (pressure-boosting system).

8.1 Factory setting

The switchgear is pre-set at the factory. The factory settings can be restored by Wilo Service.

8.2 Checking the motor direction of rotation

By briefly switching on each pump in the "Manual mode" operating mode, check whether the direction of rotation of the pump in mains operation corresponds to the arrow on the pump housing. For the glandless pumps the correct or false direction of rotation is shown by an indicator LED in terminal box (see installation and operating instructions of the pump).

If the direction of rotation of **all** pumps in mains operation is incorrect, swap over any 2 live wires in the main mains cable.

Switchgear without frequency converter (CC version):

- If the direction of rotation of only one pump in mains operation is wrong, swap over any 2 phases on motors $P_2 \leq 4$ kW (direct starting) in the motor terminal box.
- If the direction of rotation of only one pump in mains operation on motors $P_2 \geq 5.5$ kW (star-delta starting) is wrong, swap over 4 connections in the motor terminal box. In this case, swap the winding start and winding end of 2 live wires (e.g. V1 for V2 and W1 for W2).

Switchgear with frequency converter (CC-FC version):

- Mains operation: Set each pump to "Manual mode" individually in the menu. Afterwards, proceed like with switchgear without frequency converter.
- Frequency converter mode: In the automatic with FC operating mode, set each pump individually to "Automatic" in the menu. The direction of rotation in frequency converter mode is then checked by briefly switching on the individual pumps. If the direction of rotation of all pumps is incorrect, swap over any 2 live wires at the frequency converter output.

8.3 Setting the motor protection

- **WSK/PTC:** No adjustment is required for the excess temperature protection.
- **Excess current:** See section 6.2.2

8.4 Signal transmitters and optional modules

Comply with the installation and operating instructions for signal transmitters and optional additional modules.

9 Maintenance

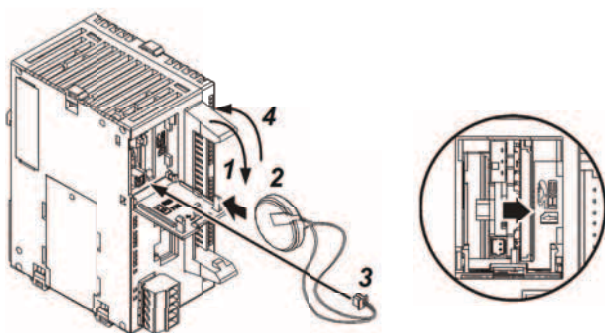
Have maintenance and repair work carried out by qualified personnel only!



DANGER! Risk of fatal injury!

There is a risk of fatal injury from electric shock when working on electrical devices.

- **The switchgear should be voltage-free and secured against unauthorised switch-on during any maintenance or repair work.**
- **Any damage to the connection cable should only ever be rectified by a qualified electrician.**
- The switch cabinet must be kept clean.
- Clean the switch cabinet and fan if they are dirty. The filter mats in the fans must be checked, cleaned and replaced if necessary.
- If the motor power is 5.5 kW or more, check the contactors for loss of contact material from time to time and replace them if there is significant loss of contact material.
- The charge level of the real-time clock backup battery is registered by the system and reported, if necessary. In addition, we recommend replacing it every 12 months. For this purpose, change the battery in the CPU assembly according to the following illustration.



10 Faults, causes and remedies



Have faults remedied by qualified personnel only! Follow the safety instructions in Chapter 2.

10.1 Fault display and acknowledgement

If a fault occurs, the background colour of the main menu turns RED, the collective fault signal is activated and the "Current alarms" page is displayed.

A signal is sent to the defined recipient(s) for systems equipped with remote diagnostics.

The fault can be acknowledged on the user interface by remote diagnostics.

If the cause of the fault is removed before acknowledgement, the background colour of the main menu turns back to white. If the fault persists after acknowledgement, the background colour of the main menu changes to yellow and the associated fault signal is marked yellow in the list of alarms.

10.2 History memory for the faults

A history memory has been set up for the switchgear and operates according to the FIFO principle (first in, first out). Each fault is stored with a time stamp (date/time of day).

The list of alarms can be viewed on the "Alarm history" page.

The following table contains a list of all fault signals.

Code	Alarm text	Causes	Remedies
E040.0 *	Sensor faulty	Pressure sensor defective	Replace sensor
		No electrical connection to the sensor	Repair the electrical connection
E040.2 *	Fault at input "Analogue IN"	There is no signal at the input (wire break or signal source error)	Repair the electrical connection
			Check external signal source
E060	Output pressure max	The output pressure of the system has risen above the set limit value (e.g. due to a controller fault)	Check controller function
			Check installation
E061	Output pressure min	The output pressure of the system has dropped below the set limit value (e.g. due to a burst pipe)	Check whether the default value corresponds to local conditions
			Check pipe and repair if necessary
E062	Low water	Protection against low water level triggered	Check inlet/break tank; pumps restart automatically
E080.1 – E080.6 * (CC/CC-FC), ** (CCe)	Pump 1...6 Alarm	Winding excess temperature (WSK/PTC)	Clean cooling fins; motors are designed for an ambient temperature of +40°C (see also installation and operating instructions of the pump)
		Motor protection triggered (excess current or short-circuit in the supply line)	Check the pump (in accordance with the installation and user manual for the pump) and the supply line
		Collective fault signal for the pump frequency converter has been activated (CCe version only)	Check the pump (in accordance with the installation and user manual for the pump) and the supply line
E082 **	FC Error	Frequency converter has signalled a fault	Read off fault in the list of alarms or on frequency converter and act in accordance with FC installation and operating instructions
		Electrical connection disrupted	Check connection to frequency converter and repair if necessary
		Motor protection of the frequency converter has tripped (e.g. short-circuit of the FC mains power cable; overload of the connected pump)	Check mains power cable and repair it if necessary; check pump (in accordance with the installation and operating instructions of the pump)
E100	Battery error	The battery charge has decreased to minimum level; an additional buffering of the real time clock is not guaranteed	Replace battery (see section 9)
E109 **	External error	The fault in an external device is reported to the switchgear via a digital input	Check external device and act according to its installation and operating instructions

* Fault must be reset manually

** You can adjust whether the error is reset manually or automatically

If the fault cannot be remedied, please contact your nearest Wilo customer service point or representative.

11 Appendix

11.1 ModBus: Data types

Data type	Description
INT16	Integers in the range from -32768 to 32767. The number range actually used for a data point may be different.
UINT16	Unsigned integers in the range from 0 to 65535. The number range actually used for a data point may be different.
ENUM	Is a list. Only one of the values listed in the parameters can be set.
BOOL	A Boolean value is a parameter with exactly two states (0 – false and 1 – true). Generally, all values greater than zero are classified as true.
BITMAP*	Is an array of 16 Boolean values (bits). Values are indexed from 0 to 15. The number read from or written to the register is the sum of all bits with the value 1 multiplied by 2 to the power of its index. Bit 0: $2^0 = 1$ Bit 1: $2^1 = 2$ Bit 2: $2^2 = 4$ Bit 3: $2^3 = 8$ Bit 4: $2^4 = 16$ Bit 5: $2^5 = 32$ Bit 6: $2^6 = 64$ Bit 7: $2^7 = 128$ Bit 8: $2^8 = 256$ Bit 9: $2^9 = 512$ Bit 10: $2^{10} = 1024$ Bit 11: $2^{11} = 2048$ Bit 12: $2^{12} = 4096$ Bit 13: $2^{13} = 8192$ Bit 14: $2^{14} = 16384$ Bit 15: $2^{15} = 32768$
BITMAP32	Is an array of 32 Boolean values (bits). Please check Bitmap for the calculation details.

* Example for clarification:

Bit 3, 6, 8, 15 are 1; all others are 0. The sum is then $2^3 + 2^6 + 2^8 + 2^{15} = 8 + 64 + 256 + 32768 = 33096$. It is also possible to do the calculation the other way round. Based on the bit with the highest index, check whether the read number is greater than/equal to the power of two. If this is the case, bit 1 is set and the power of two is deducted from the number. Then the check with the bit with the next lower index and the recently calculated residual number is repeated until bit 0 is obtained or the residual number is zero. Example for clarification: The read number is 1416. Bit 15 will be 0, since $1416 < 32768$. Bits 14 to 11 will also be 0. Bit 10 will be 1, since $1416 > 1024$. The remainder will be $1416 - 1024 = 392$. Bit 9 will be 0, since $392 < 512$. Bit 8 will be 1, since $392 > 256$. The remainder will be $392 - 256 = 136$. Bit 7 will be 1, since $136 > 128$. The remainder will be $136 - 128 = 8$. Bits 6 to 4 will be 0. Bit 3 will be 1, since $8 = 8$. The remainder will be 0. The remaining bits 2 to 0 will thus all be 0.

11.2 ModBus: Parameter overview

Holding register (Protocol)	Name	Data type	Scale & unit	Elements	Access*	Added
40001 (0)	Communication profile version	UINT16	0.001		R	31,000
40002 (1)	Wink service	BOOL			RW	31,000
40003 (2)	Type of switch-gear	ENUM		3. CC 4. CC...FC 5. CCe 7. CCe NWB	R	31,000
40004 – 40005 (3 – 4)	Switchgear data PLC version	UINT32	0.000001		R	31,000
40006 – 40007 (5 – 6)	Switchgear data HMI version	UINT32	0.000001		R	31,000

Holding register (Protocol)	Name	Data type	Scale & unit	Elements	Access*	Added
40008 – 40009 (7 – 8)	Switchgear data ID	UINT32	1		R	31,000
40010 – 40011 (9 – 10)	Switchgear circuit diagram number	UINT32	1		R	31,000
40012 (11)	Switchgear data month of manufacture	UINT16	1		R	31,000
40013 (12)	Switchgear data year of manufacture	UINT16	1		R	31,000
40014 (13)	BusCommand-Timer	ENUM		0. – 1. Off 2. Set 3. Active 4. Reset 5. Manual	RW	31,000
40015 (14)	Drives on/off	BOOL			RW	31,000
40016 (15)	Pump speed manual 1	UINT16	0.1 % (CCe only)		RW	31,000
40017 (16)	Pump speed manual 2	UINT16	0.1 % (CCe only)		RW	31,000
40018 (17)	Pump speed manual 3	UINT16	0.1 % (CCe only)		RW	31,000
40019 (18)	Pump speed manual 4	UINT16	0.1 % (CCe only)		RW	31,000
40020 (19)	Pump speed manual 5	UINT16	0.1 % (CCe only)		RW	31,000
40021 (20)	Pump speed manual 6	UINT16	0.1 % (CCe only)		RW	31,000
40024 (23)	FC ON/OFF	BOOL	(CC-FC only)		R	31,000
40025 (24)	Control mode	ENUM		0. p-c	R	31,000
40026 (25)	Actual value	INT16	0.1 bar		R	31,000
40027 (26)	Current setpoint	INT16	0.1 bar		RW R (SCe NWB)	31,000
40028 (27)	Number of pumps	UINT16	1		R	31,000
40030 (29)	Standby pump ON/OFF	BOOL			R	31,000
40032 (31)	Index base-load pump	UINT16	1		R	31,000
40033 (32)	Pump status 1	BITMAP		0: Auto 1: Manu 2: Deactivated 3: Running 5: Fault	R	31,000
40034 (33)	Pump status 2	BITMAP		0: Auto 1: Manu 2: Deactivated 3: Running 5: Fault	R	31,000
40035 (34)	Pump status 3	BITMAP		0: Auto 1: Manu 2: Deactivated 3: Running 5: Fault	R	31,000

Holding register (Protocol)	Name	Data type	Scale & unit	Elements	Access*	Added
40036 (35)	Pump status 4	BITMAP		0: Auto 1: Manu 2: Deactivated 3: Running 5: Fault	R	31,000
40037 (36)	Pump status 5	BITMAP		0: Auto 1: Manu 2: Deactivated 3: Running 5: Fault	R	31,000
40038 (37)	Pump status 6	BITMAP		0: Auto 1: Manu 2: Deactivated 3: Running 5: Fault	R	31,000
40041 (40)	Pump mode 1	ENUM		0. Off 1. Manu 2. Auto	RW	31,000
40042 (41)	Pump mode 2	ENUM		0. Off 1. Manu 2. Auto	RW	31,000
40043 (42)	Pump mode 3	ENUM		0. Off 1. Manu 2. Auto	RW	31,000
40044 (43)	Pump mode 4	ENUM		0. Off 1. Manu 2. Auto	RW	31,000
40045 (44)	Pump mode 5	ENUM		0. Off 1. Manu 2. Auto	RW	31,000
40046 (45)	Pump mode 6	ENUM		0. Off 1. Manu 2. Auto	RW	31,000
40049 (48)	Pump operating mode	ENUM		0. Cascade 1. Vario	R	31,000
40050 (49)	Current speed pump 1	UINT16	0.1 % (CCe) 1 rpm (CC-FC)		R	31,000
40051 (50)	Current speed pump 2	UINT16	0.1 % (CCe) 1 rpm (CC-FC)		R	31,000
40052 (51)	Current speed pump 3	UINT16	0.1 % (CCe) 1 rpm (CC-FC)		R	31,000
40053 (52)	Current speed pump 4	UINT16	0.1 % (CCe) 1 rpm (CC-FC)		R	31,000
40054 (53)	Current speed pump 5	UINT16	0.1 % (CCe) 1 rpm (CC-FC)		R	31,000
40055 (54)	Current speed pump 6	UINT16	0.1 % (CCe) 1 rpm (CC-FC)		R	31,000
40062 (61)	General status	BITMAP		0: SBM 1: SSM	R	31,000
40068 (67)	Setpoint 1	UINT16	0.1 bar		RW	31,000
40069 (68)	Setpoint 2	UINT16	0.1 bar		RW	31,000
40070 (69)	Setpoint 3	UINT16	0.1 bar		RW	31,000
40074 (73)	Application	ENUM		0. Booster	R	31,000
40075 (74)	External setpoint	INT16	0.1 bar		R	31,000
40076 (75)	Activate external setpoint	BOOL			RW	31,000

Holding register (Protocol)	Name	Data type	Scale & unit	Elements	Access*	Added
40077 – 40078 (76 – 77)	Number of switching-on procedures of the system	UINT32	1		R	31,000
40079 – 40080 (78 – 79)	Switchgear data operating hours	UINT32	1h		R	31,000
40081 – 40082 (80 – 81)	Total switching cycles of pump 1	UINT32	1		R	31,000
40083 – 40084 (82 – 83)	Total switching cycles of pump 2	UINT32	1		R	31,000
40085 – 40086 (84 – 85)	Total switching cycles of pump 3	UINT32	1		R	31,000
40087 – 40088 (86 – 87)	Total switching cycles of pump 4	UINT32	1		R	31,000
40089 – 40090 (88 – 89)	Total switching cycles of pump 5	UINT32	1		R	31,000
40091 – 40092 (90 – 91)	Total switching cycles of pump 6	UINT32	1		R	31,000
40097 – 40098 (96 – 97)	Total operating hours for pump 1	UINT32	1h		R	31,000
40099 – 40100 (98 – 99)	Total operating hours of pump 2	UINT32	1h		R	31,000
40101 – 40102 (100 – 101)	Total operating hours of pump 3	UINT32	1h		R	31,000
40103 – 40104 (102 – 103)	Total operating hours of pump 4	UINT32	1h		R	31,000
40105 – 40106 (104 – 105)	Total operating hours for pump 5	UINT32	1h		R	31,000
40107 – 40108 (106 – 107)	Total operating hours for pump 6	UINT32	1h		R	31,000
40113 (112)	Day operating hours for pump 1	UINT16	1h		R	31,000
40114 (113)	Day operating hours for pump 2	UINT16	1h		R	31,000
40115 (114)	Day operating hours for pump 3	UINT16	1h		R	31,000
40116 (115)	Day operating hours for pump 4	UINT16	1h		R	31,000
40117 (116)	Day operating hours for pump 5	UINT16	1h		R	31,000
40118 (117)	Day operating hours for pump 6	UINT16	1h		R	31,000
40123 (122)	FC current frequency	UINT16	0.1 Hz (CC-FC only)		R	31,000
40131 (130)	FC current electricity	UINT16	0.1 A (CC-FC only)		R	31,000

Holding register (Protocol)	Name	Data type	Scale & unit	Elements	Access*	Added
40139 – 40140 (138 – 139)	Fault status	BITMAP32		0: Sensor fault 1: Maximum pressure 2: Minimum pressure 4: Dry running 5: Pump 1 error 6: Pump 2 error 7: Pump 3 error 8: Pump 4 error 9: Pump 5 error 10: Pump 6 error 11: Pump 7 error 12: Pump 8 error 14: Battery nearly empty 16: External alarm 24: E43.0 External signal	R	31,000
40240 – 40241 (239 – 240)	Fault status 2	BITMAP32			R	31,000
40141 (140)	Acknowledge	BOOL			W	31,000
40159 (158)	System control	BITMAP		0: Ext. Off 1: Pump cycling 2: Start pump 3: Stop pump 4: Constant speed analogue 5: Constant speed fieldbus	RW	31,000
40160 (159)	Control value constant speed	UINT16	0.01 %		R(W)	31,000
40247 (246)	FC type	ENUM	(CC-FC only)	0. FC202 1. VLT2800 2. VLT6000	R	31,000
40248 (247)	FC status	BITMAP	(CC-FC only)	0: Control OK 1: Drives OK 2: Interface OK 3: Warning 4: FC running 5: Voltage warning 6: Current warning 7: Temperature warning	R	31,000

*key: R = read-only; RW = read and write;
W = write only

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