Wilo-Stratos /-D/-Z

Installation and operating instructions

Notice de montage et de mise en service

Instrucciones de instalación y funcionamiento

2 095 796-Ed.01 / 2011-02-Wilo

Fig. 1a:

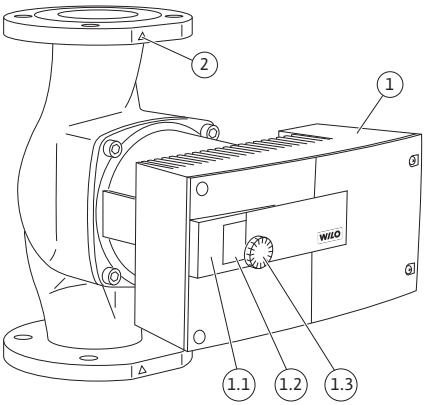


Fig. 1b:

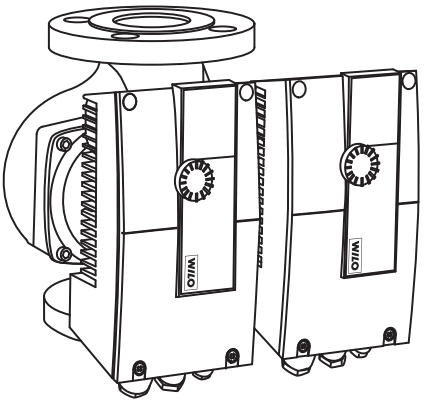


Fig. 2a:

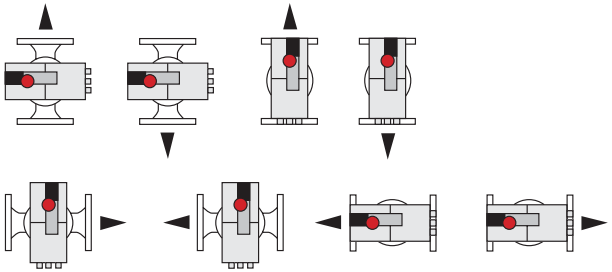


Fig. 2b:

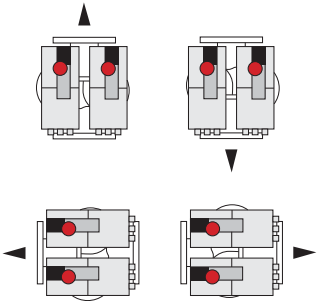


Fig. 3:

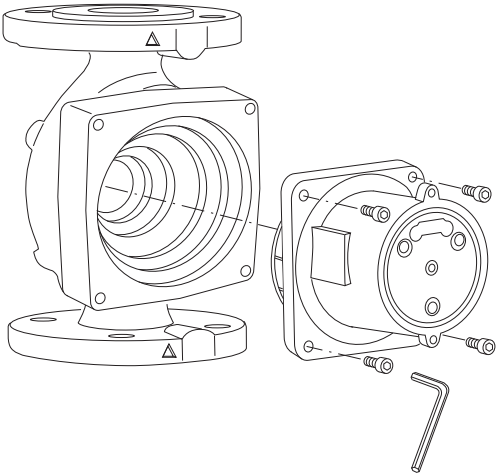


Fig. 4:

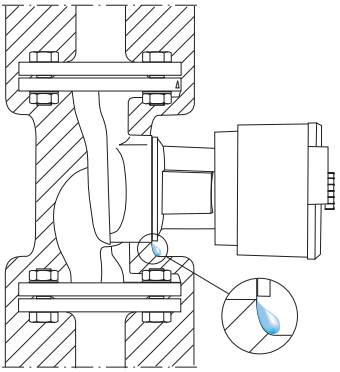


Fig. 5:

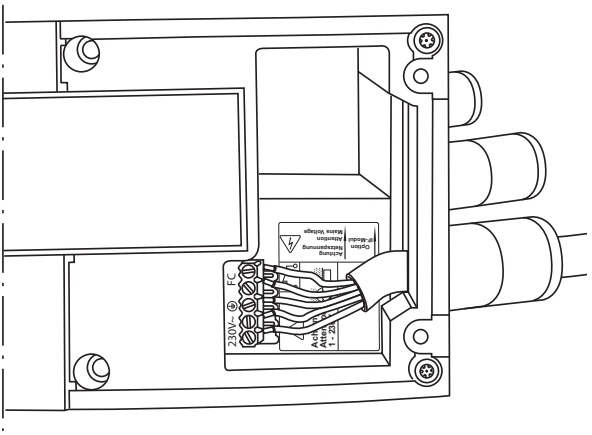


Fig. 6:

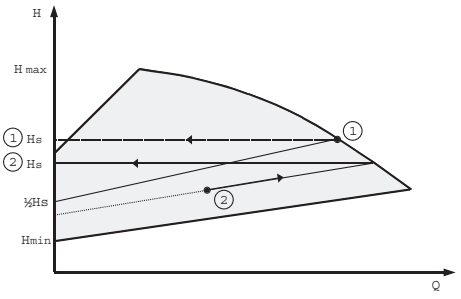


Fig. 7:

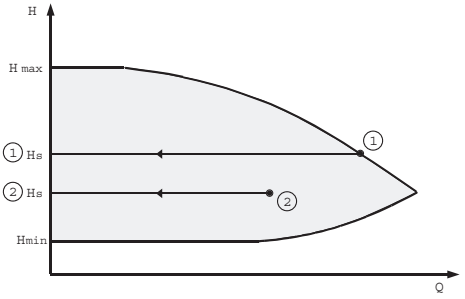


Fig. 8:

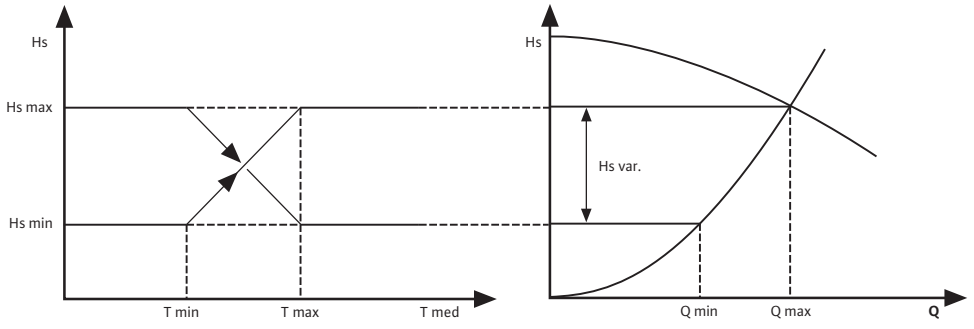


Fig. 9:

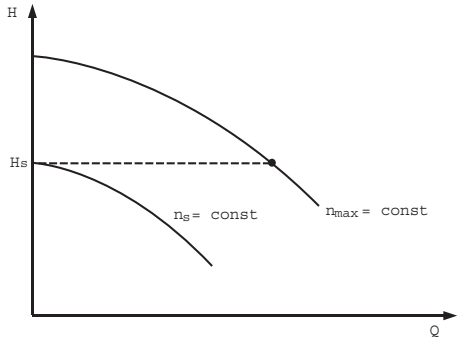
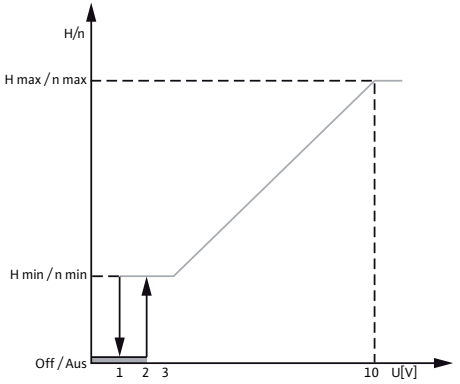

H
Hs
ns = const
nmax = const
Q

Fig. 10:


H/n
H max / n max
H min / n min
Off / Aus
1
2
3
10
U[V]

1 General

About this document

These Installation and Operating Instructions form an integral part of the product. They must be kept close to the product and in readiness whenever required. Precise observance of these instructions is a pre-condition for use of the product for the intended purpose and for its correct operation.
These Installation and Operating Instructions conform to the relevant version of the equipment and the underlying safety standards valid at the time of going to press.

2 Safety

These instructions contain important information which must be followed when installing and operating the pump. It is therefore imperative that they be read by both the installer and the operator before the circulator is installed or started up.
Both the general safety instructions in the 'Safety precautions' section and those in subsequent sections indicated by danger symbols should be carefully observed.

2.1 Symbols and signal words used in these operating instructions

Symbols:

General Safety symbol

Hazards from electrical causes

NOTE:

Signal words:

DANGER!
Imminently hazardous situation.
Will result in death or serious injury if not avoided.

WARNING!
The user can be exposed to (severe) injury. 'Warning' refers that harm to the user when the user is neglecting the procedure.

CAUTION!
The product is at risk of damage. 'Caution' refers to the product when the user is neglecting the procedures.

NOTE: A notice with useful information for the user in relation to the product. It attends the user to possible problems.

2.2 Qualified Personnel

The personnel installing the pump must have the appropriate qualifications for this work.

2.3 Risks incurred by failure to comply with the safety precautions

Failure to comply with the safety precautions could result in personal injury or damage to the pump or installation. Failure to comply with the safety precautions could invalidate warranty and/or damage claims.
In particular, failure to comply with these safety precautions could increase the possibility of the following risks:

- the failure of important parts of the pump or installation,
- personal injury due to electrical and mechanical causes,
- material damage.

2.4 Safety precautions for the operator

Existing regulations for the prevention of accidents must be observed.
National Electrical Codes, local codes and regulations must be followed.
This device is not intended to be operated by persons (including children) with impaired physical, sensory or mental capacities or lack of experience and/or lack of knowledge, except in cases where they are supervised by a person responsible for their safety or where they receive instructions from such a person as to how the device is to be operated. Children must be kept under supervision in order to ensure that they do not play with the device.

2.5 Safety precautions for inspection and installation

The operator must ensure that all inspection and installation work is carried out by authorized and qualified specialists who have carefully reviewed these instructions.
Work on the pump/unit must be carried out only with the pump disconnected (locked out) from the electrical supply and at complete standstill.

2.6 Unauthorized alterations and manufacture of spare parts

Alterations to the pump or installation may only be carried out with the manufacturer's consent. The use of original spare parts and accessories authorized by the manufacturer will ensure safety. The use of any other parts may invalidate claims involving the liability of the manufacturer for any consequences.

2.7 Improper use

The operational safety of the pump or installation supplied can only be guaranteed if it is used in accordance with paragraph 4 of the operating instructions. The limits given in the catalogue or data sheet must under no circumstances be exceeded.

3 Transport and interim storage

When receiving the material, check that there has been no damage during the transport. If shipping damage has occurred, take all necessary steps with the carrier within the allowed time.

CAUTION! Outside influences may cause damages!

If the delivered material is to be installed later on, store it in a dry place and protect it from impacts and any outside influences (humidity, frost etc.).

Handle the pump carefully so as not to damage the unit prior to installation.

4 Intended use (Application)

CAUTION! Possible damage of the pump!

This pump is intended for use with water and water/glycol only .

The high-efficiency pumps of the Wilo-Stratos/-D/-Z series are used to circulate fluids (no oil or oleiferous fluids, no foodstuffs) in

- Hot water heating systems,
- Cooling and cold water circuits,
- Closed circulation systems.

WARNING! Health hazard!

The materials of the Wilo-Stratos/-D can cause damage to one's health, since they are not approved for use in secondary hot water circulation systems.
Do not use Wilo-Stratos/-D pumps in secondary hot water systems.

Permissible liquids and requirements:

- Heating water according the requirements of accepted standards of water quality in heating systems.

- Water and water/glycol mixtures in a maximum ratio up to 1:1. High glycol concentration and low temperature systems may require a reassessment of the hydraulic data to compensate for the increased viscosity (please contact your WILO representatives for more information). Use of additives (corrosion inhibitors, oxygen scavengers etc.) must be in compliance with the manufacturer instructions.
- If other fluids or additives are used, please contact WILO for proper authorization.

CAUTION! Possible damage of the pump!

Unacceptable fluids may destroy the pump.
Observe the specifications of the manufacturer regarding the mixing ratios.
Add additives to the fluid on the pressure side of the pump.

The high-efficiency pumps of the Wilo-Stratos-Z series are also suitable for use in

- Secondary hot water circulation systems

5 Product details

5.1 Type key

Example: Stratos-D 2x3-40	
Stratos	**High-efficiency pump** Wet-rotor circulating pump
D	= single-head pump (no letter) -D = twin-head pump -Z = single-head pump for secondary hot water circulation systems
2	Pipe connection [inch]
3-40	Infinitely variable nominal pump head 3 to 40 [ft] H_{min}: 3.3 ft, H_{max}: 39.4 ft

5.2 Technical Data	
Power supply	1~230 V ± 10%
Frequency	60 Hz
Degree of protection	Enclosure 2
Insulation class	H
Motor protection	Standard built-in full motor protection
Maximum sound pressure level	54 dB(A)
Liquid temperature	Heating, ventilation, air-conditioning applications: 14°F (-10°C) to 230°F (+110°C) Secondary hot water circulation applications: 32°F(0°C) to 176°F(+80°C)
Max. ambient temperature	104°F (40°C)
Max. rel. humidity	≤ 95%
Max. working pressure at the pump	145 psi
Residual current	ΔI ≤ 3.5 mA (see also Chap. 7.2)

Min. pump inlet pressure [psi] at the suction side during operation by Wilo-Stratos model:

	At these liquid temps T_{Med}		
	14°F...122°F (– 10°C...+50°C)	203°F (+95°C)	230°F (+110°C)
1.25 inch	4.4 (psi)	14.5 (psi)	23.2 (psi)
1.5 and 2 inch	7.3 (psi)	17.4 (psi)	26.1 (psi)
3 inch	10.2 (psi)	21.8 (psi)	33.4 (psi)

The values apply up to 984 ft above sea level, add-on for higher altitudes: 0.15 psi/328 ft increase in height

5.3 Scope of Supply

- Complete pump
- Installation and operating instructions
- 2 flange gaskets (only for 1.25, 1.5 and 2 inch flange pumps)

5.4 Accessories

- Accessories such as companion flanges must be ordered separately.
- Companion flanges (included bolts, nuts and gaskets) for flange-pipe connection.
- IR (infra-red) module for special setup and diagnostics.
- IF (interface) Module Stratos Ext. Off/SBM, Ext.Min, LON, BACnet.

6 Description and function

6.1 Pump description

Wilo-Stratos high-efficiency pumps are glandless pumps with integrated differential pressure control and "**E**lectronic **C**ommutated **M**otor" (ECM) technology. They can be installed as **single-head** (Fig. 1a) or **twin-head pumps** (Fig. 1b).

1 Control module
1.1 Infrared interface
1.2 LC display
1.3 Red button
2 Pump housing

6.2 Operation of the pump

If the pump has an axial design, there is a control module (Fig. 1a, Pos.1) on the motor housing, which regulates the differential pressure of the pump to an adjustable setpoint within the control range. The differential pressure is based on different criteria, depending on the control mode. In all control modes, however, the pump constantly adapts to the changing output requirements of the system, which arise in particular when using thermostatic valves, zone valves or mixers.

The main benefits of electronic control are:

- it saves energy while reducing operating costs,
- it reduces noise caused by the excess flow,
- it does not require pressure bypass valves.

This wet rotor pump is designed to have all rotating parts surrounded by the liquid being pumped. The pump is maintenance free and requires no further maintenance after the air bleeding procedure during the initial start-up (no after start-up maintenance).

High-efficiency pumps of the Wilo-Stratos-Z series are adapted specifically to the operating conditions in secondary hot water circulation systems due to the materials selected and their design. All materials which come into contact with the fluid are approved in accordance with KTW/WRC (WRAS).

6.2.1 Operating modes

The Stratos series can be operated in the operating modes "Heating" or "Cooling/ air-conditioning". The two operating modes are distinguished from one another in their tolerance for faults in the handling of fault signals that occur.

"Heating" operating mode:

Faults are handled in a tolerant fashion (as is normally the case), e.g. depending on the type of fault, the pump does not signal a fault until the same fault has occurred repeatedly within a particular time period. Error matrix: **"HV"**

"Cooling/air-conditioning" operating mode:

For all applications for which each fault (in the pump or the system) must be recognised quickly (e.g. air-conditioning applications).

Each fault, with the exception of the fault E10 (blocking), will be signalled at once (< 2 sec.). In the event of a blocking (E10), various restart attempts will be carried out, which means that in such cases no fault message will occur until after a maximum of 40 sec. Error matrix: **"AC"**

Both operating modes distinguish between faults and warnings. In the event of a malfunction, the motor is switched off, the error code on the monitor is displayed and the malfunction is signalled with the red LED.

Malfunctions always lead to activation of the SSM.

In the case of twin-head pump management (twin-head pump or 2x singlehead pumps), the standby pump starts within the time period specified below following the appearance of the fault.

Stratos, Stratos-D, Stratos-Z	Starting time
1.25x3-20, 1.25x3-25	approx. 9 sec
1.25x3-30, 1.25x3-35, 1.5x3-25	approx. 4 sec
1.5x3-40, 2x3-30, 2x3-35, 2x3-40	approx. 4 sec
3x3-30	approx. 3 sec
3x3-40	approx. 7 sec

6.2.2 Differential-pressure control systems

The **control systems** which can be selected are:

- **Δp-v**: (Factory default setting) The electronics increase the pump's differential pressure set point in a straight line between ½ Hs and Hs. The differential pressure set point Hs increases or decreases in accordance with the required flow rate (fig. 6).
- **Δp-c**: The electronics keep the differential pressure generated by the pump at a constant differential pressure set point Hs over the entire operation range of the pump (fig. 7).
- **Δp-T**: The electronics alter the nominal differential pressure set point dependant on the fluid temperature measured. This control system can only be adjusted with the IR module. There are two possible settings (fig. 8):
  - Positive control: As the system temperature rises, the nominal differential pressure set point is **increased** linearly between Hsmin and Hsmax. (setting on IR module: $Hs_{max} > Hs_{min}$).
    Used e.g. with standard boilers with sliding flow temperature.
  - Negative control: As the system temperature rises, the nominal differential pressure set point is **decreased** linearly between Hsmin and Hsmax (setting on IR module: $Hs_{max} < Hs_{min}$).
    Used e.g. with condensing boilers where a specific maxium return water temperature must be maintained to achieve as much condensing as possible to insure maxium boiler effeciency. To do this, the pump must be installed in the system's return flow section.

6.2.3 Other energy-saving operating modes

- Speed regulation mode operation: The speed of the pump is kept at an externally set constant speed between minimum and maximum speeds (fig. 9). The speed regulation mode deactivates the differential pressure control.
- In the "auto" operating mode (factory default setting) the pump is able to recognize a minimum system heat output requirement due to a sustained drop in the system temperature and then automitically switch to **night setback mode**. If the heat output requirement rises, the pump automatically switches to standard mode. This setting ensures that the pump's energy consumption is reduced to a minimum and in most cases is the optimum setting.

CAUTION! Possible damage of the pump!

Setback mode may only be enabled when the system is hydraulically balanced. Inadequately supplied system parts may otherwise freeze in the event of frost.

6.2.4 General pump functions

- The pumps are fitted with an electronic **overload protection system** which switches the pump off should it become overloaded.
- The control module is equipped with a non-volatile memory for **data storage**. What this means is that data is saved, even during long periods of down time. Once the voltage returns the pump starts operating again with the values set before the power outage.

- **Pump kick**: Any pumps switched off via the menu (ON/OFF), a bus communication, the infrared interface, the Ext.Off control input or 0–10V start running for a short time every 24 hours to prevent blockages in the event of long periods of standstill. The mains voltage must not be interrupted for this function.
  If the mains is intended to be switched off for a long period of time, the pump kick must be assumed by the heating/boiler control system by briefly switching on the mains voltage. For this purpose, the pump must be switched on by the control system prior to the interruption to the mains supply (display → motor/ module symbol lit up).

Connections to the building management system (BMS)

- **FC**: A collective fault contact FC (potential-free closed contact) can be connected to a control point (building management system) as standard. The internal contact is closed if the pump is turned off, or there are no problems or failures on the part of the control module. The faults are described in detail in chapter 10.
- **IF**(**I**nter**f**ace) **modules (accessory)**:
  Analog interfaces are available in the form of add-on IF modules for connecting to external control system (e.g. DDC/BMS).

6.2.5 Twin-head pump operation

Twin-head pumps or two corresponding single pumps in a parallel pump installation can be fitted with built-in double-pump management.

- **Stratos IF module**: Two IF modules connected via the DP (double pump) interface are required for communication between pumps. In addition to double pump management, the IF modules provide other interfaces for the double pump.
  This double pump management has the following functions:
- **Master/Slave**: Both pumps are controlled by the master. All settings are made by the master.
- **Optimum-efficiency peak-load operation**: The twin-head pumps or two corresponding single pumps can be run in a low/high flow application where if the lead pump can not keep up with the flow demand the lag pump will operate automatically. At partial load, the hydraulic capacity is provided by one pump only. The second pump is switched on at optimum efficiency, when the sum of power consumptions P_1 of both pumps is less than the power consumptions P_1 of one pump. Both pumps are then adjusted upwards simultaneously to max. speed if necessary. In relation to the conventional peak load operation (load controlled switch on and off) a further energy saving is reached by this mode of operation.
- **Duty/Standby mode**: Each of the two pumps produces the design delivery rate. The other pump can be used in the event of the first pump malfunctioning or following a pump swap. Only one pump operates at a time.
- In the event that one pump experiences a **failure/problem**, the other will run as a single pump in standard mode as instructed by the master.

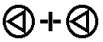
- In the event of a **break in communication**: The slave pump runs at the last set value of the master prior to the interruption.
- **Pump swap**: If only one pump is operational (duty/standby, peak- or low-load operation), the pumps are swapped after every 24 hrs' of actual operating time. Both pumps are running at the time of the pump alteration in order to ensure that operation is not interrupted.

NOTE: Both pumps will always be running if both the manual control mode and the synchronous mode are active at the same time.
No pump alteration takes place. No pump alteration takes place during the active night reduction after 24 h of effective running time.

- **FC**: The collective fault contact (FC) of the master can be connected to a central control point. In this case, contact is only established with the master. The reading is valid for both pumps.
  As an option, the error message contacts of master and slave can be programmed as single fault signal with the IR module. For the single fault signals, contact must be established with each pump.

6.2.6 Definition of the symbols on the LC display

Symbol	Definition
auto ☼	Control mode; automatic switch-over to night setback mode is enabled. Night-time mode is activated at minimum heat output requirement (default).
auto ☾	Pump runs in night-time mode (night setback operation) at min. speed.
(no symbol)	Automatic switch-over to night setback mode blocked, i.e. pump runs in standard mode only.
☾	Night setback mode activated via PLR/LON/CAN interface Ext.Min, regardless of the system temperature.
☼	Pump runs in warm-up mode at maximum speed. The setting can be activated only via PLR/LON/CAN.
	Pump switched on (default).
	Pump switched off.
	Differential pressure set value set to H = 18.0 ft. (example)
	Control mode Δp-v, regulated to variable differential pressure set value (fig. 6) (default).
	Control mode Δp-c, regulated to constant differential pressure set value (fig. 7).

Symbol	Definition
	Manual control mode deactivates the module pressure variations. The speed of the pump is kept at a constant level. The speed is set internally using the contol button (fig. 9).
	Pump set to a constant speed (2.600 rpm example shown) – manual control mode.
	In the manual control mode, the speed or nominal lift of operating mode Δp-c or Δp-v of the pump is set via input 0...10 V of the Stratos IF module Ext.Min. The button then has no set value input function. (fig. 10)
	Control mode Δp-T, regulated to temperature dependent differential pressure set value (fig. 8). The maximum set value Hs_{max} is displayed. This control mode can only be activated via the IR module or via PLR/ LON/CAN.
	All settings on module except "acknowledge error" blocked. Settings locked out by IR module. Settings can only be altered using IR .
	The pump is operated via a serial data interface. The “On/Off” function is not activated at the module. Only ⏀+⏀, ⏀ I ⏀, the display position and fault acknowledgement still have to be set on the module. Operation at the interface can be interrupted temporarily with the IR-Monitor/IR-module (for inspection or for reading out data).
	Pump runs as slave pump. No changes can be made to the position setting of the display.
	Two single pumps as double pump running in peak load mode (master + slave)
	Two single pumps as double pump running in duty / standby mode (master or slave)
	Displayed for pump with IF module LON in order to send a service message to the building control centre.
	The pump is set in the “SI units” mode.
	Fault-tolerant error matrix activated. Heating operating mode (in case of malfunction, see Chap. 10)
	Fault-tolerant error matrix deactivated. Air-conditioning operating mode (in case of malfunction, see Chap. 10)

Menu structure: There are three menu levels. The levels beneath the display of the basic settings are always accessed from 1 level by pressing the control button
for different lengths of time.
Level 1 – Status display (display of the operating state)
Level 2 – Operation menu (setting the basic functions):
- Pressing the control button longer than 1 s

Level 3 – Options menu (additional settings):
- Pressing the control button longer than 6 s

NOTE: After 30 s without any new entry being made, the display jumps back to Level 1 (display of the operating state). Temporary, non-acknowledged modifications are discarded.

7 Installation and electrical connection

Installation and electrical work in compliance with any local codes and by qualified personnel only!

DANGER! Electrical shock hazard!

Dangers caused by electrical energy must be excluded.
National Electrical Codes, local codes and regulations must be followed.

WARNING! Bodily injury!

Existing regulations for the prevention of accidents must be observed.

7.1 Pump installation

- Installation within a building: install the pump in a dry, well ventilated and frostresistant room.
- Installation outside a building (outdoor installation):
  - Install the pump in a shaft (e.g. light well, annular shaft) with cover or in a cupboard/housing as weather protection.
  - Avoid exposure of the pump to direct sunlight.
  - Protect the pump against rain. Dripping water from above is permitted, provided the electrical connection is established in accordance with the installation and operating instructions and the terminal box is closed properly.

CAUTION! Possible damage of the pump!

Dirt and solder drops in the pump body can effect the pump operation.
- **It is recommended that any welding and soldering work be done before installing the pump.**
- **Thoroughly flush the system prior to installing and operating the pump.**
- **Foreign material in the system resulting from construction may damage the pump and is not warrantable.**

- The pump must be installed in an easily accessible position to facilitate inspection or replacement.
- The pump should never be located at the lowest point of the piping system, where dirt and sediment collect. Nor should it be located at the highest point of the piping system, where air accumulates. Please ensure at least a minimum of three pipe diameters of straight on the suction side of the pump.
- It is recommended that isolation valves be installed on the suction and discharge side of the pump.
  This will save having to drain and refill the system if the pump / pump head needs exchange-service. The valves are to be installed so that any water that escape cannot drip onto the pump motor or terminal box.
- An arrow on the pump housing indicates the direction of water flow (fig.1, pos.2).
- Install the pump in an easily accessible place, so that subsequent servicing work can easily be carried out.
  Installation is to be carried out such that dripping water cannot drip onto the pump motor or control module.
- Pump must be installed with the shaft in the horizontal position in such a way that it is not stressed by the pipework. (Installation positions in fig. 2). When installing in confined spaces, for example in compact distributors, the control module can be placed in a vertical position by rotating the motor, see chapter 7.1.1.
- In order to obtain the correct terminal box position the motor housing can be turned after removing the four allen screws (fig. 3).

WARNING! Risk of scalding!

If the pump is already installed in the system, the system must be drained or the isolating valves on both sides of the pump must be closed before the allen screws are removed as the pumped liquid may be scalding hot and/or under pressure.
Do not start the pump until the system has been filled with liquid and vented.

- Permitted terminal box positions see fig. 2

CAUTION! Possible damage of the pump!

When rotating the motor housing, ensure the O-ring between the cartridge and pump housing (volute) does not become damaged.

- Carefully lift the pump head and rotate it so the terminal box is in the desired position. Replace the pump head onto the pump housing and thighten the allen screws evenly in a diagonal method.
  Torque to:
  - M6 ..... 7 ft lb
  - M10 ..... 22 ft lb

DANGER! Electrical shock hazard!

If the pump is operated by means of a generator, a dangerous voltage is created at the motor terminals after the control module is removed. The motor terminals are designed as VDE-approved bushings, so that there is no danger if simply touched with the finger. However, there would be a danger if a pointed object (nail, screwdriver, wire) were poked into one of the bushings.

7.1.1 Removing/installing the motor head unit

If the control module is to be moved into a different position, the motor does not need to be completely removed from the pump housing. The motor can be turned to the desired position in the pump housing.

CAUTION! Possible damage of the pump!

Be careful not to damage the O-ring situated between the motor head and the pump housing. The O-ring must lie untwisted in the bevel of the end shield pointing to the impeller.

CAUTION! Possible damage of the pump!

The impeller is permemtantly attached to the shaft, the end shield and the rotor. As the rotor has extremely strong rare earth magnets, if the rotor is removed from the rotor can, it has a considerable potential for danger e.g. by suddenly attracting objects made from iron/steel, influencing electrical equipment (risk to people with pacemakers), destroying magnetic cards, etc.

To remove the motor, (4x) M6 or (4x) M10 hexagon socket screws must be loosened. These screws can be reached with the following tools (fig. 3):

- 90° offset socket-head screwdriver
- spherical head socket-head screwdriver
- ¼" reversing ratchet with suitable bit

7.1.2 Insulating the pump in refrigerating/air-conditioning systems

The Wilo-Stratos series is suitable for use in refrigeration and air-conditioning systems with flow medium temperatures down to 14°F (-10°C).
Use the diffusion-proof Wilo-ClimaForm low-temperature insulation shell in cooling and air-conditioning systems.

CAUTION! Possible damage of the pump!

If the diffusion-proof insulation is created by the customer, the pump housing may be insulated towards the motor only up to the motorflange, so that the condensate drain openings remain open and allow the condensate accumulating in the motor to flow out without obstruction (fig. 4).

7.2 Electrical connection

DANGER! Electrical shock hazard!

Dangers caused by electrical energy must be excluded.

- **Electrical work by a qualified electrician only!**
- **National Electrical Codes, local codes and regulations must be strictly followed.**
- **All electrical connections must be performed after the electrical supply has been switched off and secured against unauthorized switching.**
- **For safe installation and operation a proper grounding of the pump to the power supply's grounding terminals is required.**

- Suitable mains fuse is required to protect the motor per local electrical codes.
- The operating voltage and frequency are marked on the rating plate.
- The pump must be connected with a power supply equipped with a grounded plug-connection and a main power switch.
- A minimum cable size of 14 AWG should be used (refer to the local code for wiring restrictions).

CAUTION! Possible damage of the pump!

All conductors must be for at least 167°F (75°C).

- The following minimum requirements are to be met if a shutdown takes place by means of an onsite network relay: nominal current ≥10 A, nominal voltage 250 VAC.
- Leakage current per pump $I_{eff} \leq 3{,}5$ mA
- The electrical cable must be installed so that it never touches the pipework and/or the pump and motor housing.
- The connecting cable can be fed through the cable entry below or beside the terminal box, depending on it's orientation. It is advisable to install the screwed cable glands with the entrance of the conduit pointing downwards. The cable entry which is not used must be closed by a blind plug (fig. 5).
- Watertight screwed cable glands and conduit connections must be used to prevent any entrance of water to the terminal box.
- Connect power as shown in fig. 5.
- Mains fuse: see rating plate
- Pump/installation must be grounded in compliance with regulations.

CAUTION! Possible damage of the pump!

In insulation tests with a high-voltage generator the pump is to be disconnected on all poles from the mains in the control module. The free cable ends are to be insulated in accordance with the voltage of the high-voltage generator.

7.2.1 Electrical pump connection (fig. 5)

- **230 V~, ⏚ :** Mains voltage, single-phase current 1~230 V AC ±10%, 60 Hz
  Voltage across terminals “230V~” must be total 230 volt
  either
  - 230 volt “hot” lines and neutral line

  or
  - two 230 volt “hot” lines.
- **FC:** A built-in collective fault signal is available on the FC (fault contact) terminals as a potential-free closed contact.
  Permissible contact load:
  - minimum: 12 V DC, 10 mA,
  - maximum: 250 V AC, 1 A.

  Max. tightening torque of the connecting terminal screws (230 V~, ⏚, FC): 2.2 lb inch
- **Twin-head pumps or two single pumps as double pump:**
  Both motors in the parallel pump installation are to be provided with a separate mains cable and a separate mains fuse protection.

NOTE: If a single motor in a parallel pump installation is switched off-load, the built-in double-pump management is deactivated.

- **Switching frequency:**
  - On-/Off switching by mains supply ≤ 20 times / 24 h
  - On-/Off switching by Ext. Off or 0...10 V Signal ≤ 20 times/ h
- **Assignment of supply terminals:** The following table shows the possibilities for which combinations of circuits the individual cable glands in a cable can be assigned.

	Cable gland ½”	Cable gland ¼”	Cable gland PG 7
Function Cable type	Mains cable FC 5x14 AWG		
Function Cable type	Mains cable 3x14 AWG 3x14 AWG	FC 2-core cable	
Function Cable type	Mains cable 3x14 AWG 3x14 AWG 3x14 AWG	FC / Ext.Off / SBM or FC / 0...10 V / Ext.Min multicore control cable, number of cores in acc. with number of circuits, if nec. shielded	DP-management 2-core cable (l ≤ 2.5 m)

8 Commissioning

8.1 Filling and Venting

- Proper fill and pressurize the system with liquid.

CAUTION! Possible damage of the pump!

Never operate the pump dry.
The system must be filled before starting the pump. Ensure that all isolation valves are open.

- The pump is normally vented automatically after a short operational period.

WARNING! Risk of burning!

Depending on the operating condition of the pump and/or installation (fluid temperature) the entire pump can become very hot.
Avoid touching the pump owing to the risk of burning.
The temperature at the heat sink can be up to 158°F (+70°C) within the permissible operating conditions.

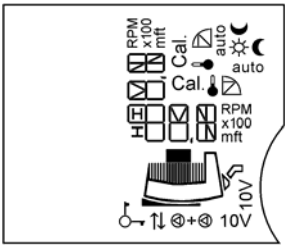
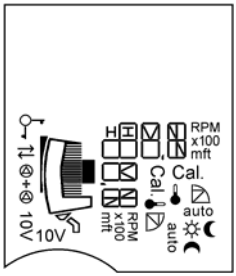
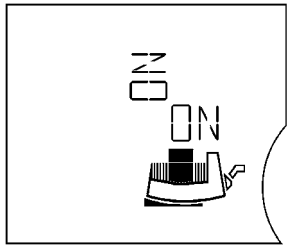
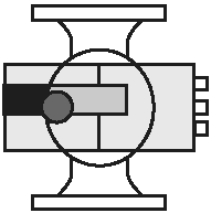
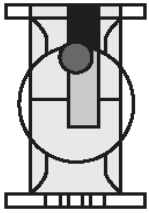
8.2 Setting the menu

8.2.1 Using the control button (fig. 1, pos. 1.3)

- From the basic setting, the setting menus are selected one after another by pressing the button (press longer than 1 second for the first menu). The current symbol flashes. The parameters can be moved backwards or forwards on the display by turning the button clockwise or anti-clockwise. The newly set symbol flashes. The new setting is applied and the next setting option is activated by pressing the button.
- The setpoint (differential pressure or speed) is changed in the basic setting by turning the control button. The new value flashes. The new setpoint is saved by pressing the button.
- The old value is retained and the basic setting is displayed again if the new setting is not confirmed within 30 seconds.

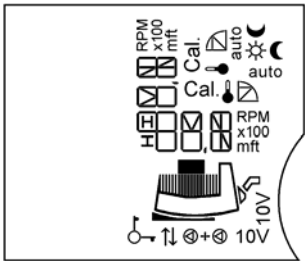
8.2.2 Switchover of the display

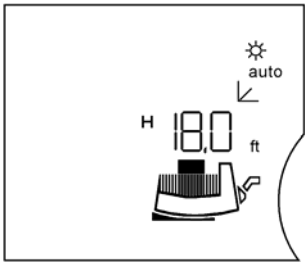
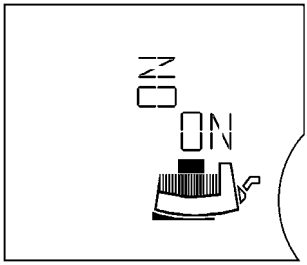
It can be set whether the display is to be turned by 90° for the respective arrangement of the control module, depending on whether it is installed in horizontal or vertical position. The positional setting can be made in menu point 3. The display position specified by the basic setting flashes with “ON” (for horizontal installation position). The display can be switched over by turning the setting knob. “ON” flashes for the vertical installation position. The setting is confirmed by pressing the setting button.

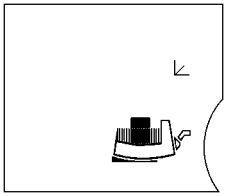
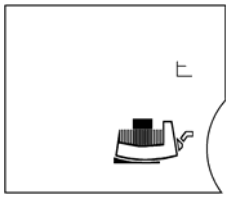
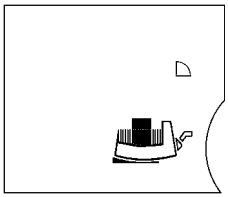
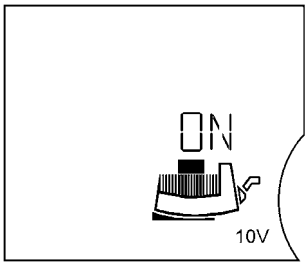
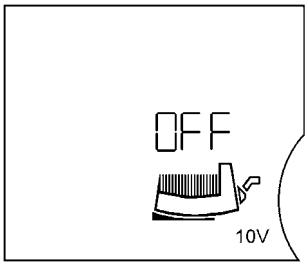
Switchover of the display		
		
		
Horizontal	Vertikal	Position setting in menu point 3

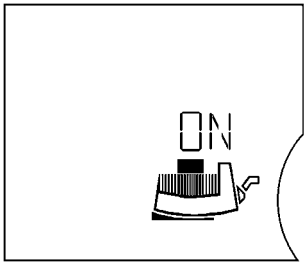
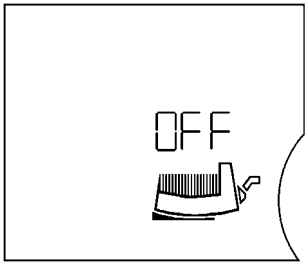
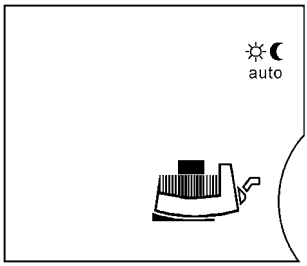
8.2.3 Settings in the menu

The following menus appear in succession on the pump display:
(horizontal representation of display)
Single pump mode: Setting when first used / Menu order during standard use

	LC display	Setting
①		After switching on the module, **all symbols** appear on the display for 2 seconds. The current setting ② then engages.

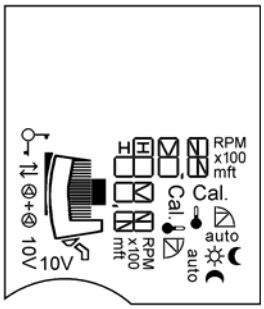
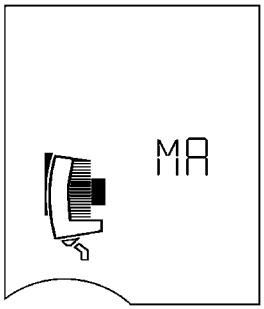
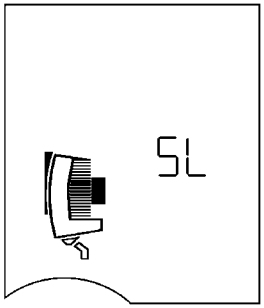
	LC display	Setting
②		**Current (basic) setting (factory default):** auto ☼ • automatic night setback enabled, Pump runs in control mode ◀ I ◀ • missing = Single-head pump e.g. **H 18.0 ft** • present differential pressure setpoint H_s = 18.0 ft at same time ½ $H_{s\ max}$ (factory setting depending on pump type) ∠ • Control mode Δp-v ↶↷ The differential pressure set point can be altered by turning the control button. The new differential pressure set point flashes. ↓ The new setting is stored by pressing the button briefly. If no button is pressed, the previously set flashing differential pressure set point returns to the previous value after 30 seconds. ↓ Press control button for > 1 second. The next menu point ③ appears.
	If no setting is made in the subsequent menus for 30s, the basic setting ② re-appears in the display.	
③		Position setting of display vertical / horizontal The set position of the display is shown by the flashing "ON". ↶↷ By turning the control button the other position can be selected. ↓ Setting stored.

	LC display	Setting
④	  	The currently set **control mode** flashes.  By turning the contro button other control modes can be selected. The new selected control mode flashes.  Pressing the button stores the new control mode and switches to the next menu.
⑤		**Menu point (5) only appears if a Stratos IF module was inserted with input 0...10 V.** **Switch input 0...10 V on/off** **Activate input 0...10 V: "ON"** and the **"module motor symbol"** appears in the display.  The setting can be altered by turning the control button.
		**Deactivate input 0...10 V: "OFF"** appears in the display and the **"motor symbol"** disappears.  Setting stored. If the input was switched on, the menu manager jumps to menu point (7a).

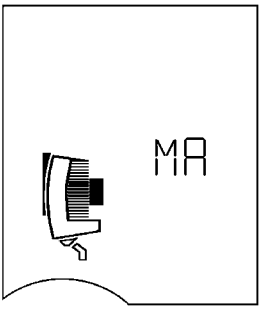
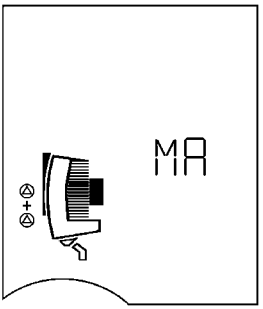
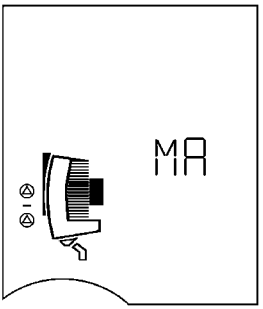
	LC display	Setting
⑥		**Switch pump on/off.** **Switch on pump,** "**ON**" and the **"module motor symbol"** appear in the display The setting can be altered by turning the control button.
		**Switch off pump,** "**OFF**" appears in the display and the **"motor symbol"** disappears. Setting stored.
⑦		Menu point ⑥ is skipped if regulator mode was selected Either flash auto ☾ • **automatic night setback** Pump runs in standard mode Menu point ② then shows "auto ☼" during autom. control mode or "auto ☾" during automatic night-setback ☼ • normal **control mode**, automatic night-setback disabled**.** Menu point ② does not contain any symbol. call up one of the two settings and store. Display jumps to the next menu. Menu point ⑦ is skipped if: • the pump is operated at PLR/LON/CAN • regulator mode was selected, • the input 0...10 V was activated

	LC display	Setting
(7a)		In single-pump mode the display returns to basic setting (2). **In the event of an error the error menu (10) appears** before the basic setting (2). **In double pump mode (twin-head pump or two single pumps) the display jumps to menu (8).**

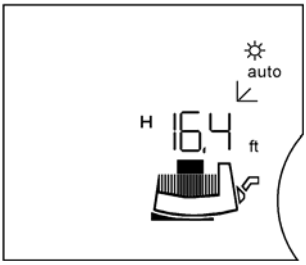
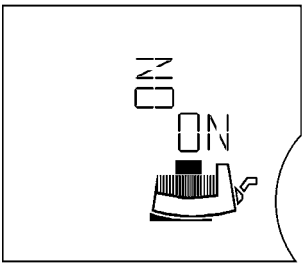
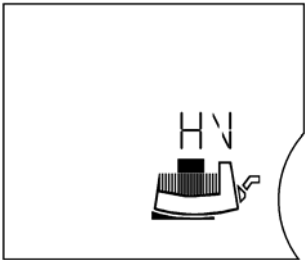
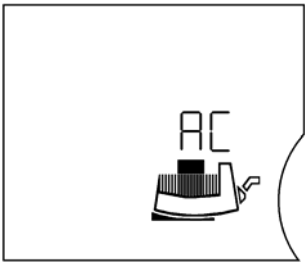
Double pump mode (as twin-head pump or two single pumps): Setting when starting up for the first time
(vertical display)

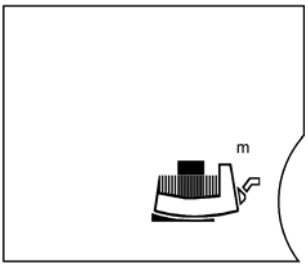
	LC display	Setting
(1)		When the module is switched on **all symbols** appear in the display for 2 seconds. Menu (1a) then appears.
(1a)	 	The symbol **MA** = Master appears on the display of both pumps. If no setting is made, both pumps run at constant differential pressure (HS = ½ Hmax. where Q = 0 USGM). By  on the master pump control button the setting mode menu (9) appears on the display. **SL** = Slave appears automatically on the slave pump display. The configuration: left pump Master, right pump Slave is thus selected. The control button on the slave pump is deactivated. No more settings can be made here. A position setting for the display cannot be made on the slave pump. Position setting on the slave pump is taken over from the settings of the master pump.

Double pump mode: Menu order during normal use:
After switching on the module, **all symbols** (1) appear on the display for 2 seconds. The current setting (2) then sets itself. When "scrolling" in the MA display the same menu order (2)...(7) appears as for the single pump. Then the **MA** menu appears and remains on the screen permanently.

	LC display	Setting
(8)		SL appears on this display by ↶↷ on MA. The other (right-hand) pump becomes the master if SL is confirmed by ↓. Master and slave have now been exchanged. Programming can now only be performed on the right-hand (MA) pump. Settings cannot be made at the SL. Master and slave can only be exchanged at the master.
(9)	 	Setting **Peak load and duty / standby mode** ↶↷ The other setting blinks. ↓ Setting stored. Display returns to basic setting (2).

Options menu: Selection of operating mode Heating (HV) / Refrigeration Air-conditioning (AC) and conversion from US to SI units

	LC display	Setting
②		In the basic settings (menu level 1), press the operating button for > 6 s.
③		After approx. 1 s, the menu level 2 appears (position setting of the display screen).
		After another 5 s, the display switches to the menu level 3 The HV display appears (works setting).
		Rotating the control button will switch the setting to the cooling/air-conditioning (AC) operating mode. The setting is stored. The next menu is displayed.

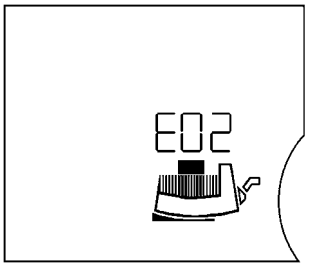


The display “m ft” appears, for which the unit that is set will be flashing. (Works setting [ft]).
Rotating the control button will change the setting to [m]. The new setting will begin flashing.
The new setting is saved by briefly press-ing the button.

Display returns to basic setting (2).

If no setting is made in the subsequent menu within 30 s, then the display will once again show the basic setting (2).

Error display

	LC display	Setting
(10)		In the event of an error the current error is displayed by **E** = Error, the **code no.** and by the flashing of the error source motor, control module or mains connection. **For code numbers and their meaning see chapter 10**

8.2.4 Priorities on the operation of the pump, IR module

The display of errors (menu 10) incl. error acknowledgment has the highest priority. This means that errors precedence on the pump's display and that they must be acknowledged and removed.
If settings are made on the control module or from the IR module and not confirmed by pressing the button, the setting will return to the previous position 30 seconds after the last entry.

- **Pump** ↔ **IR** without lockout function: The last command, whether from the IR monitor or control module, is stored by the pump.
- **Pump** ↔ **IR** with lockout function: When the "Key function on" command is received, the control module’s current settings remain in place. The display shows ⚷. The pump is now blocked and cannot be operated.

8.3 Selecting the control system

Unit type	System conditions	Recommended control system
Heating-/ventilation- and air conditioning systems with a system friction loss (heating radiator + thermostatic valve) ≤ 25% of the total resistance	1. Two-pipe systems with thermostatic/ zone valves • Flow head > 13.1 ft (high head systems) • Very long distribution lines • Heavily throttled branch shut-off valves • Branch differential pressure regulator • High pressure losses in those system parts through which the total volume flows (boilers/ refrigerating machines, poss. heat exchangers, distribution line) 2. Primary circuits with high pressure losses	**Δp-v**
Heating-/ventilation- and air conditioning systems with a system friction loss in the generator/distributor circuit ≤ 25% of the resistance in the transfer part (heating radiator + thermostatic valve)	1. Two-pipe systems with thermostatic/ zone valves and high consumer authority • Flow head ≤ 6.6 ft (low head systems) • Converted gravity systems • Retrofitting to large temperature spread (e.g. long-distance energy) • Low pressure losses in the system parts through which the total volume flows (boilers/refrigerating machines, poss. heat exchangers, distribution line) 2. Primary circuits with low pressure losses 3. Underfloor heating systems with thermostatic or zone valves 4. Single-pipe systems with thermostatic or branch shut-off valves	**Δp-c**

Unit type	System conditions	Recommended control system
Heating systems	1. Two-pipe systems • Pump installed in the supply pipe. • Flow temperature controlled by atmospheric conditions. With increasing flow temperature the flow rate will be increased. 2. Single-pipe systems • Pump installed in the return pipe. • Constant flow temperature. With increased return temperature the flow rate will be lowered. 3. Primary circuits with condensing boiler • Pump installed in the return pipe. With increased return temperature the flow rate will be lowered.	**Δp-T**
Heating-/ventilation- and air conditioning systems Circulation systems for drinking water	1. Constant flow rate	**Regulator mode**
Heating systems	1. All systems • Pump installed in the supply pipe. • Flow temperature will be lowered in light loads periods (e.g. night). • Pump runs 24h without external control.	**Night setback mode**

8.4 Setting the pump power

During the planning phase the system is designed for a certain duty point (hydraulic peak load point for calculated maximum heating requirement). The pump performance (delivery head) is set during commissioning according to the duty point of the system (see also 4.3). The factory setting does not correspond to the pump performance required for the system. It is determined by means of the curve diagram for the selected pump type (from catalogue/data sheet). See also figs. 6 to 8.

Control modes Δp-c, Δp-v and Δp-T:

	Δp-c (fig. 7)	Δp-v (fig. 6)	Δp-T (fig. 8)
Operating point on max. speed curve	Draw a line from the operating point to the left. Read set value Hs and set the pump in accordance with this value.		Settings are to be made by the infrared device.
Operating point in control range	Draw a line from the operating point to the left. Read set point Hs and set the pump in accordance with this value.	Continue the standard line until it meets the max. speed curve, then continue horizontally to the left, read set point Hs and set the pump in accordance with this value.	
Setting range	H_{min}, H_{max} see type key (chapter 5.1)		T_{min}: 68...212°F (+20...+100°C) T_{max}: 86...230°F (+30...+110°C) $\Delta T = T_{max} - T_{min} \geq$ 50°F (10°C) Increase: $\Delta HS/\Delta T \leq$ 3.3 ft/50°F (10°C) H_{min}, H_{max}

9 Maintenance/service

All servicing should be performed by an authorized service representative!

DANGER! Electrical shock hazard

Dangers caused by electrical energy must be avoided.
All electrical work must be performed after the electrical supply has been disconnected and secured against unauthorized switching.

WARNING! Risk of scalding

At high water temperatures and system pressure close isolating valves before and after the pump.
First allow pump to cool down.

These pumps are maintenance free, self-lubricated by the system fluid, and have no seals to leak or couplings to break.

CAUTION! Possible damage of the pump

If the motor head is separated from the pump housing for servicing or repair work, the O-ring situated between the motor head and pump housing must be replace by a new one. When refitting the motor head, make sure the O-ring is positioned correctly.

10 Faults, causes and remedies

Refer to the “Fault signal / warning message” sequence display and **Tables 10, 10.1, 10.2** when handling faults.

Faults	Causes	Remedy
Pump is not running although the current entry is switched on.	Electric fuse defective.	Check the fuses.
	Pump has no voltage.	Resolve the voltage interruption.
Pump is making noises.	Cavitation due to insufficient suction pressure.	Increase the system admission pressure within the admissible range.
		Check the delivery head and set it to a lower height if necessary.

Table 10: Faults with external fault sources

10.1 Fault signals – Heating/ventilation HV operating mode

- A fault occurs.
- The pump switches off, the fault signal LED (red steady light) switches on. Twin-head pump: the standby pump is switched on.
- The pump automatically goes on again after a delay of five minutes.
- The pump is permanently switched off, FC relay opens and the PLR/LON/CAN interface transmits the fault signal only if the same fault occurs for the sixth time within 24 hours. The fault must then be reset by hand.

EXCEPTION: If the warnings “E10” and “E25” in HV operating mode are pending for longer than 5 min, they are relayed as fault signals.

10.2 Fault signals – Air-conditioning AC operating mode

- A fault occurs.
- The pump switches off, the fault signal LED (continuous red light) is activated. The fault signal appears in the display, FC relay opens and the interface PLR/LON/CAN passes along the fault signal. The malfunction must then be reset manually or via CAN.
  Twin-head pump: The standby pump is switched on.

NOTE: Cod-Nrn “E04” (mains undervoltage) and “E05” (mains overvoltage) are treated as faults only in AC operation and lead to immediate deactivation.

Code No.	Symbol flashing	Problem	cause	remedies
E04	Supply terminal	Mains undervoltage	Mains overloaded	Check electrical installation
E05	Supply terminal	Mains overvoltage	Faulty supply by the electricity supply company	Check electrical installation
E10	Motor	Pump blocked	e.g. sedimentation	De-blocking routine starts automatically. Pump switches off if blockage is not cleared within max.40 seconds. Call customer services
E20	Motor	winding overheated	Motor overloaded	Let motor cool down, check the settings
			Water temperature to high	Reduce water temperature
E21	Motor	Motor overload	Sediment in the pump	Call customer services
E23	Motor	Short circuit/contact fault	Motor defect	Call customer services
E25	Motor	Contact error	Module not correctly installed	Reinstall module
E30	Module	Excess temperature module	Limited air supply to the dissipator of the module	Free air intake
E31	Module	Excess temperature power component	Ambient temperature to high	Improve ventilation in room
E36	Module	Module faulty	Electronic components faulty	Call customer service / swap module

Table 10.1: Fault signals

10.3 Warning messages

- The fault (warning only) is displayed.
- The fault signal LED and the FC relay do not respond.
- The pump continues to run. The fault may occur any amount of times.
- The indicated faulty operating state must not occur for a long period of time. The cause should be eliminated.

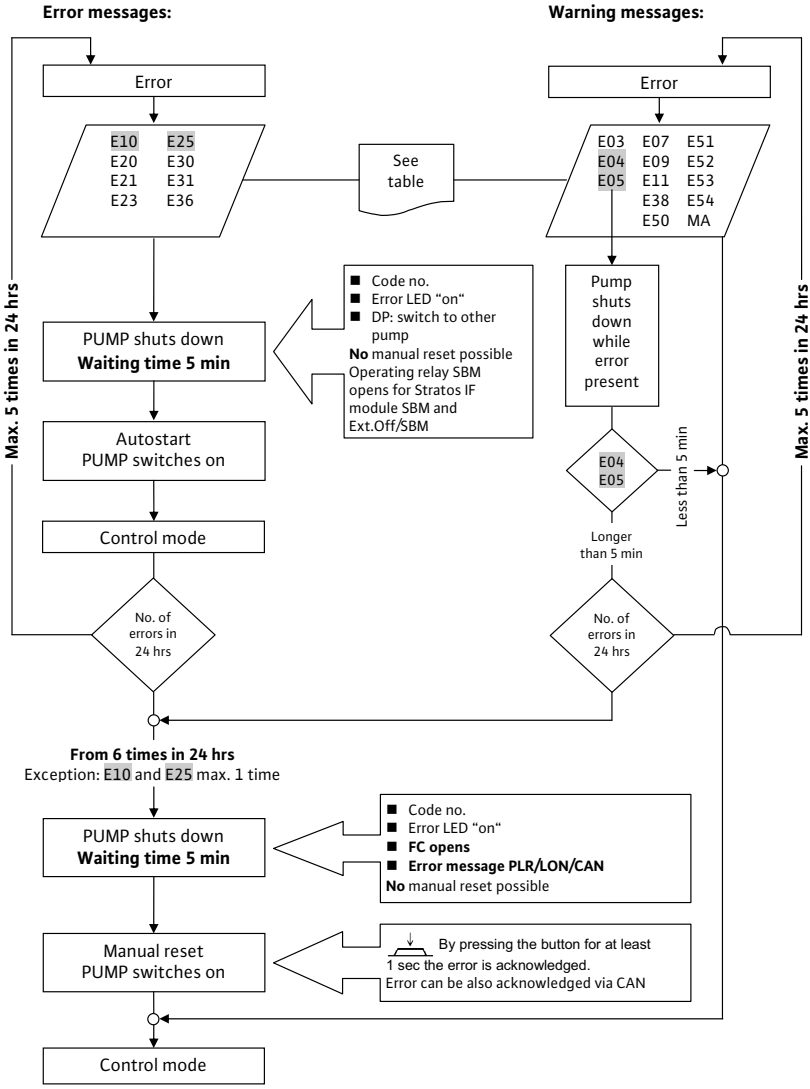
EXCEPTION: If the “E04” and “E05” in HV operation warnings apply for longer than 5 minutes, they are transmitted as fault signals (see Section 10.1).

Code No.	Symbol flashing	Problem	cause	remedies
E03		Water temperature > 110°C	Heating control incorrectly set	Set to lower temperature
E04		Mains undervoltage	Mains overloaded	Check electrical installation
E05		Mains overvoltage	Faulty supply by the electricity supply company	Check electrical installation
E07		Generator operation	Driven by admission pressure pump	Balance pump capacity regulation
E09		Turbine operation	The pump is driven backwards (pump perfusion from the pressure to the suction side)	Check circulation direction. Fit a check valve at the pressure side
E11		Pump idling	Air in the pump	Vent pump and unit
E38	Motor	Temp. sensor medium faulty	Motor faulty	Call customer services
E50		PLR/LON/CAN communication fault	Interface, core defective, IF modules not connected properly, cable defective	The control system is switched to local mode control via the interface after 5 minutes.
E51		non-permissible combination	Different pumps	
E52		Master/slave communication error	Stratos IF module not correctly positioned, cable faulty	After 5 min. the modules switch to single-pump mode. Reinstall modules, check cable
E53		Nonauthorised CAN address	Same CAN address assigned twice	Carry out addressing on the module once again
E54		Connection I/O - module	Connection I/O - module interrupted	Check connection
MA		Master/slave not set		Specify master and slave

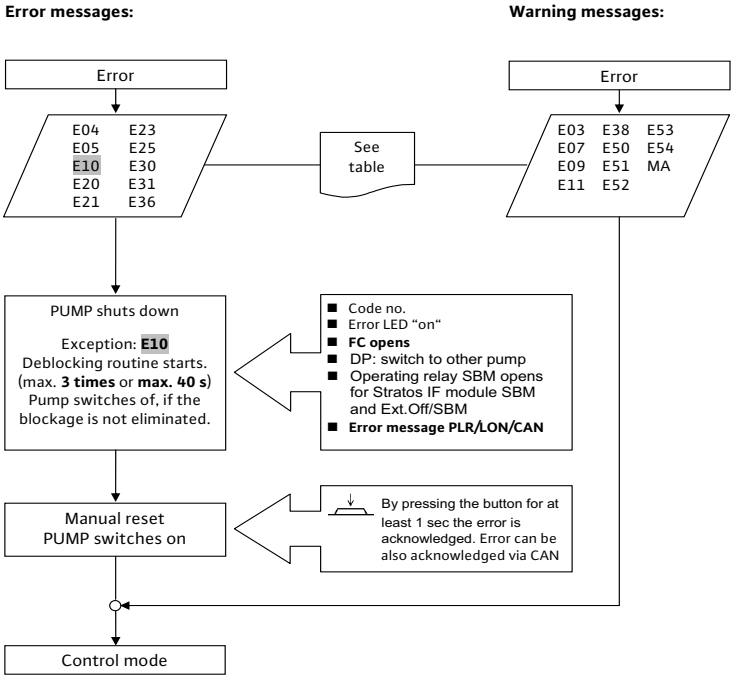
Table 10.2: Warning messages

If the fault cannot be remedied, please contact your local heating specialist or Wilo customer services.

Process presentation Fault/warning signal in HV operation



Process presentation Fault/warning signal in AC operation



11 Spare parts

Spare parts are ordered via local specialists and/or Wilo after-sales service. To avoid queries and incorrect orders, all data on the name plate should be submitted for each order.

12 Disposal

Damage to the environment and risks to personal health are avoided by the proper disposal and appropriate recycling of this product.

1. Draw on public or private waste management companies for the disposal of the product or components.
2. For more information on the correct disposal, please contact your local council or waste disposal office or the supplier from whom you obtained the product.