Pioneering for You

Consulting guide

WILO-STRATOS MAXO
THE FUTURE IS CONNECTED.

* We define smart-pumps as a new category of pumps which go far beyond our high-efficiency pumps or pumps with pump intelligence. The combination of the latest sensor technology and innovative control functions (e.g. Dynamic Adapt plus and Multi-Flow Adaptation), bidirectional connectivity (e.g. Bluetooth, integrated analogue inputs, binary inputs and outputs, Wilo Net interface), software updates and excellent usability (e.g. thanks to the Setup Guide, the preview principle for predictive navigation and the tried and tested Green Button Technology) make this pump a smart-pump.

Contents

Twelve Wilo-Stratos MAXO units provide the optimum temperature in a new building of the Bielefeld company GOLDBECK. They are the first of the innovative smart pump series being used in practice. The four-storey building spanning 9,500 square metres comprises office workstations and an auditorium for in-house events.

1. Applications and fields of application

1.1. Introduction

The Wilo-Stratos MAXO series is a high efficiency glandless pump and the world's first smart-pump*. With its optimised and innovative energy-saving functions, it sets new energy efficiency standards for heating, cooling and drinking water applications. Furthermore, the outstanding user-friendliness offers a hitherto unparalleled ease of operation for the user. The Wilo-Stratos MAXO can be installed as a circulator in heating, cooling, air conditioning and domestic hot water circulation systems in residential buildings as well as in hospitals, commercial and public buildings, schools and large properties.

1.2. Applications

1.2.1. Heating

When appropriately dimensioned, the Wilo-Stratos MAXO ensures sufficient volume flow at all times in heat generator circuits, heat source circuits, distribution circuits or heating circuits with consumers in rooms, while at the same time avoiding system noises and significantly reducing energy costs.

Due to its corrosion-resistant stainless steel pump housing, the Wilo-Stratos MAXO-Z is also suitable for use in installations where oxygen entry is possible, e.g. open heating systems.

1.2.2. Drinking water

Pumps installed in domestic hot water circulation systems are subject to specific requirements, which the Wilo-Stratos MAXO-Z duly fulfils.

All plastic parts that come into contact with pumped fluid comply with the German water regulations advisory scheme's recommendations. All metal parts that are water-wetted correspond to normative and regulatory requirements.

1.2.3. Cooling

When appropriately dimensioned, the Wilo-Stratos MAXO ensures sufficient volume flow at all times in cooling applications with cold water, e.g. in cooling generator circuits, heat sink circuits, distribution circuits or cooling circuits with consumers in the room.

Condensation water forms on cold surfaces if the fluid temperature in the pump and the pipe network falls below the ambient temperature. The Wilo-Stratos MAXO pump can also be used in such cases. The pump's design prevents condensation water from damaging its electronic components.

Corrosion-proof pump design
Corrosion-proof versions are required for cooling applications, for example. The pump housing is equipped with a special coating (KTL: cataphoretic coating) for this purpose. This provides optimal corrosion protection against corrosion caused by the formation of condensation water on the pump housing in cold-water installations, and is highly scratch and knock resistant.

Alternatively, the Wilo-Stratos MAXO-Z with corrosion-resistant stainless steel pump housing can be used as the highest-quality version.

1.3. Fields of application

1.3.1. Permissible fluids

The Wilo-Stratos MAXO is resistant to **heating water** pursuant to the German guideline VDI 2035 Parts 1 and 2.

The Wilo-Stratos MAXO is resistant to **demineralised water**. Guideline VDI 2035 describes demineralised water as follows: Fill-up and make-up water for warm water heating systems pursuant to VDI2035-2 Chapter 8.1 “Water quality” Table 1 “Operation with low salt content”.

→ Electrical conductivity at 25 °C: 10 – 100 µS/cm
→ Appearance: free of sediment
→ pH value at 25 °C: 8.2 – 10.0 [1) 2)]
→ Oxygen: < 0.1 mg/l [3)]

Reference values for hot water

	Low-salt	Salty
Electrical conductivity at 25 °C	< 100 µS/cm	100 – 1500 µS/cm
Appearance	free of sediment	free of sediment
pH value at 25 °C	8.2 – 10.0	8.2 – 10.0
Oxygen	< 0.1 mg/l	< 0.02 mg/l

The Wilo-Stratos MAXO is resistant to **water-glycol mixtures** for cooling applications or for use in geothermal circuits. These water-glycol mixtures are produced by different manufacturers; the mixtures’ characteristics, substances and concentrations vary slightly and must be used in accordance with the manufacturers’ recommendations.

Various fluids can be used for the application of e.g. heat pumps in geothermal circuits. Due to environmental protection requirements, the fluid to be used for this purpose depends on the heat pump system’s location. The preferred fluids are water-glycol mixtures. They must be used in accordance with the manufacturers’ recommendations.

If **salty fluids** containing carbonate, acetate or formate are used, the fluid temperature must remain below 40 °C. In addition, a corrosion inhibitor must be used. Salty fluids are far more corrosive than water-glycol mixtures. Temperatures over 40 °C can lead to severe corrosive effects. The proportion of corrosion inhibitor present must therefore be continuously monitored.

The Wilo-Stratos MAXO-Z is suitable for **applications in domestic hot water installations** with due regard to the German Federal Environment Agency guidelines on operating conditions in domestic hot water circulation systems. This relates to drinking water pursuant to the EU Drinking Water Directive and clean, non-aggressive, low-viscosity fluids in accordance with national drinking water provisions. In order to disinfect the drinking water network, the pump must be removed and the provisions of DVGW-W557 observed.

1) For aluminium and aluminium alloys, the pH value range is restricted, also see section 7.4. „ ... for pH values > 8.5, even when no oxygen is present, aluminate [Al(OH)4]– forms due to the generation of hydrogen. As aluminate is soluble, no covering layers form. As a consequence of the raised pH value of the hot water, the corrosion of the aluminium continues unchecked.” For this reason, as a fundamental rule no aluminium should be used for parts in contact with water.
2) The fluid must be subjected to a pH value treatment in accordance with VDI 2035!
3) For proper design, installation, regular maintenance and repair it should be assumed that the oxygen content in regular operation of systems that are closed from a corrosion perspective is set to values under 0.02 mg/ℓ.

1.3.2. Viscous fluids

All pump curves included in the Wilo catalogue relate to the pumping of water (kinematic viscosity = 1 mm^2/s). The hydraulic values of the pump and the pipe system will deviate when pumping fluids of different density and/or viscosity (e.g. water-glycol mixtures). This must be taken into account when dimensioning and adjusting the pump.

1.3.3. Permitted operating temperatures

The permitted fluid temperature range for Wilo-Stratos MAXO/-D extends from -10 °C to +110 °C without restriction at an ambient temperature of -10 °C to a maximum of +40 °C.

The permitted fluid temperature range for Wilo-Stratos MAXO-Z in domestic hot water circulation systems extends from 0 °C to +80 °C at an ambient temperature of 0 °C to +40 °C.

1.3.4. Installation environment

In terms of its electromagnetic compatibility, the Wilo-Stratos MAXO complies with regulations on emitted interference for residential, business and commercial environments as well as light-industrial environments (C1) and interference resistance for industrial environments (C2), pursuant to EN 61800-3:2004. It can therefore be installed and operated in the aforementioned building types.

Installation within a building:
→ The Wilo-Stratos MAXO should be installed in a dry, well ventilated and dust-free room – in accordance with the IPX4D protection class.

Installation outside a building (outdoor installation):
→ The Wilo-Stratos MAXO should be installed in a chamber (e.g. light well, ring chamber) with a cover or in a chamber or housing to protect against the weather.
→ Avoid exposing the Wilo-Stratos MAXO to direct sunlight.
→ Protect the Wilo-Stratos MAXO so that the condensation drain grooves remain free of dirt.
→ Protect the Wilo-Stratos MAXO against rain and snow.
→ Implement suitable measures to prevent the formation of condensation water.

1.3.5. System pressure (rated pressure)

The maximum system pressure (rated pressure) for the Wilo-Stratos MAXO is listed in the respective descriptions of each individual model in the product catalogue and the price list. The Wilo-Stratos MAXO is available in the following rated pressure classes: PN 6, PN 10 and PN 16.

Since the third expansion stage was completed, the Dortmund stadium today is among the largest stadiums in Europe. With space for 81,365 fans now, Dortmund's stadium is the biggest in Germany. For its smooth operation, the sports venue in the Ruhr area relies on the smart pump technology provided by the Wilo-Stratos MAXO.

2. Dimensioning of the Wilo-Stratos MAXO

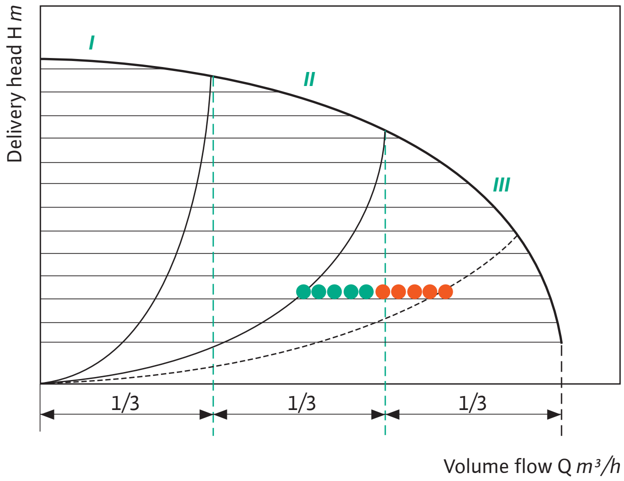
2.1. Hydraulic dimensioning

The best overall efficiency of the circulator is in the middle third of the characteristic curve chart, close to the maximum pump curve. The design point should therefore always be close to the maximum characteristic curve.

For systems with a constant volume flow (e.g. a generator circuit), the design point should be in the middle third of the characteristic curve chart, in Area II.

For systems with a variable volume flow, the design point should be in Area III. The actual duty point is then also usually in Area II.

Duty point in pump's characteristic curve chart with variable volume flow



The duty point shifts into Area II (middle third).
Area I (left-hand third): Choose a smaller pump if the duty point is in this area.
Area II (middle third): The pump will operate in the optimal operating area for 98 % of its operating time.
Area III (right-hand third): The controlled pump will only operate in the least efficient operating area at its design point (on the warmest/coldest day of the year), i.e. for 2 % of its operating time.

2.1.1. Min. inlet pressure

To prevent cavitation (vapour bubble formation within the pump), it is necessary to maintain a sufficiently high overpressure (positive suction head) at the pump suction port in relation to the vapour pressure of the fluid.

Minimum inlet pressure (above atmospheric pressure) at the pump's suction port to avoid cavitation noises (at fluid temperature):

Wilo-Stratos MAXO	Fluid temperature		
Nominal diameter	-10...+50 °C	up to +95 °C	up to +110 °C
Rp 1	0.3 bar	1.0 bar	1.6 bar
Rp 1 ¼	0.3 bar	1.0 bar	1.6 bar
DN 32 (H_{max} = 8 m, 10 m, 12 m)	0.3 bar	1.0 bar	1.6 bar
DN 32 (H_{max} = 16 m)	0.5 bar	1.2 bar	1.8 bar
DN 40 (H_{max} = 4 m, 8 m)	0.3 bar	1.0 bar	1.6 bar
DN 40 (H_{max} = 12 m, 16 m)	0.5 bar	1.2 bar	1.8 bar
DN 50 (H_{max} = 6 m)	0.3 bar	1.0 bar	1.6 bar
DN 50 (H_{max} = 8 m, 9 m, 12 m)	0.5 bar	1.2 bar	1.8 bar
DN 50 (H_{max} = 14 m, 16 m)	0.7 bar	1.5 bar	2.3 bar
DN 65 (H_{max} = 6 m, 9 m)	0.5 bar	0.9 bar	2.3 bar
DN 65 (H_{max} = 12 m, 16 m)	0.7 bar	1.5 bar	2.3 bar
DN 80	0.7 bar	1.5 bar	2.3 bar
DN 100	0.7 bar	1.5 bar	2.3 bar

Notice:
Effective up to 300 m above sea level. For higher altitudes, +0.01 bar/100 m increase in height. In case of higher fluid temperatures, fluids of lower density, higher flow resistances or lower atmospheric pressure, adjust the values accordingly. The maximum installation height is 2000 metres above mean sea level (MSL).

2.1.2. Flow rates

The pipe network and the suitable pump are configured according to recognised technical rules and standards. The flow rates for the respective hydraulic sections described therein must be observed.

The Rauch Group produces furniture at a 50,000 square metre large site in Mastershausen. 50,000 square metres, which need to be heated. 15 new Wilo-Stratos MAXO units are taking care of this task, with maximum energy efficiency.

3. Functions of the Wilo-Stratos MAXO

3.1. Application-related control modes

Finding the optimal control mode for an application is often not a simple, straight-forward task, as it also greatly depends on the respective installation system. However, the system type (e.g. radiator in the consumer circuit) in which the pump is used is known. This serves as a simple guide which can be used to configure the appropriate control mode for the Wilo-Stratos MAXO.

The Wilo-Stratos MAXO includes a number of standard and new control modes in order to guarantee optimal pump operation in every application. The control modes can be divided into the following basic groups:

- → Pressure control modes, such as Dynamic Adapt plus, Δp-v, Δp-c
- → Temperature controls like fluid temperature T-const, fluid temperature ΔT-const, room air temperature T-const
- → Flow rate controls like volume flow Q-const, speed n-const, Multi-Flow Adaptation

In addition to these basic control modes, a range of additional functions can also be activated: $\text{Q-Limit}_{\text{Max}}$, $\text{Q-Limit}_{\text{Min}}$, No-Flow Stop, night-time setback operation, etc.

The control modes are described in detail in the following.

Application-based control mode setting
The Wilo-Stratos MAXO offers a preselection of pre-configured control modes suitable and specially configured for several applications:

Heating
- → Radiator
- → Underfloor heating
- → Ceiling heating
- → Fan heater
- → Hydraulic shunt
- → Heat exchanger

Drinking water
- → Circulation
- → Clean water storage facility

Cooling
- → Ceiling cooling
- → Underfloor cooling
- → Air-conditioning device
- → Hydraulic shunt
- → Heat exchanger

For application recommendations for setting the control mode depending on the system type, refer to the tables in the appendix.

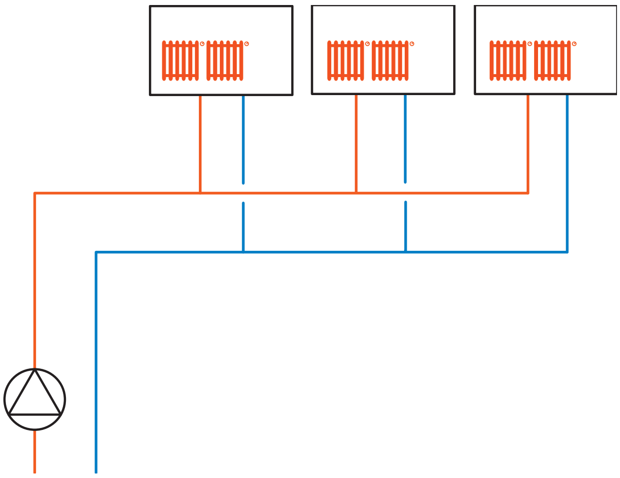
3.2. Heating application

3.2.1. Heating: Radiator consumer circuit

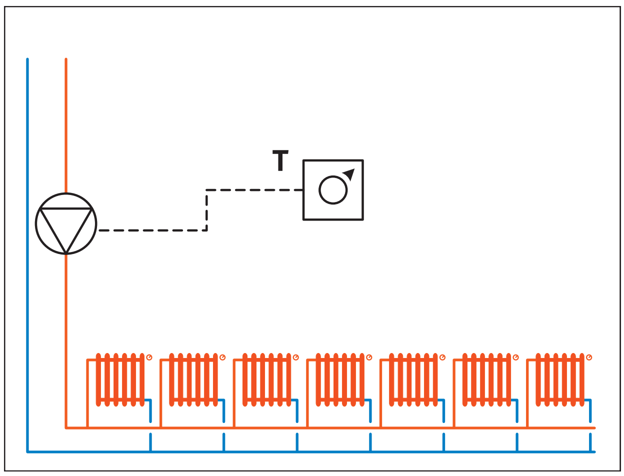
Description
The pump is installed in a consumer circuit that supplies a static heating system with radiators. The pressure-controlled Δp-v, Dynamic Adapt plus or temperature-controlled "Hall temperature T-const" control modes can be selected for this application.

Pressure control
If the heating circuit supplies multiple rooms, the radiators will be fitted with control valves to regulate the individual rooms' temperatures. In this case, Δp-v (nominal delivery head setting required) or Dynamic Adapt plus (nominal delivery head setting not required) can be selected. For this application, Wilo recommends the Dynamic Adapt plus control mode.

Hall temperature control
If the heating circuit supplies heat to a large thermal zone, e.g. a hall, the control valves on the radiators are redundant or are not present in an existing building. The pump can then directly regulate the hall temperature to the desired setpoint T = 3 °C ... 30 °C using the "Hall temperature T-const" control mode. For this purpose, it is necessary to install a temperature sensor or a room user interface in the hall to measure the temperature and act as a setpoint controller. These values are transmitted to the pump via the analogue inputs. The temperature sensor to measure the actual temperature can either be connected directly as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal. The setpoint can also be transmitted via a current- or voltage-controlled signal. If only one actual value sensor is installed in the room, the setpoint can also be set directly on the pump as a fixed value.



Pressure control in a radiator consumer circuit



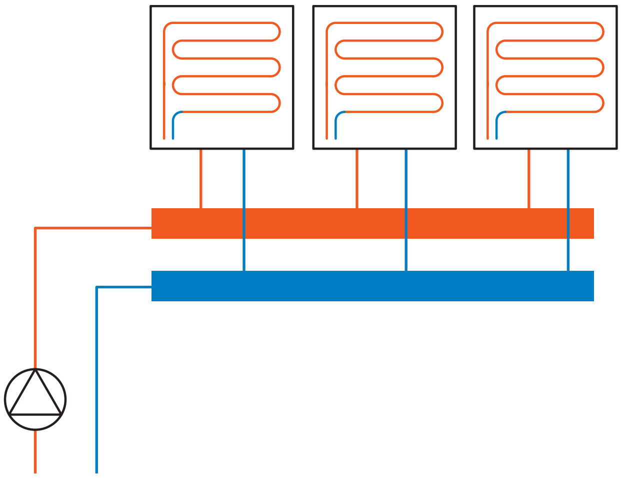
Hall temperature control in a radiator consumer circuit

3.2.2. Heating: Underfloor heating consumer circuit

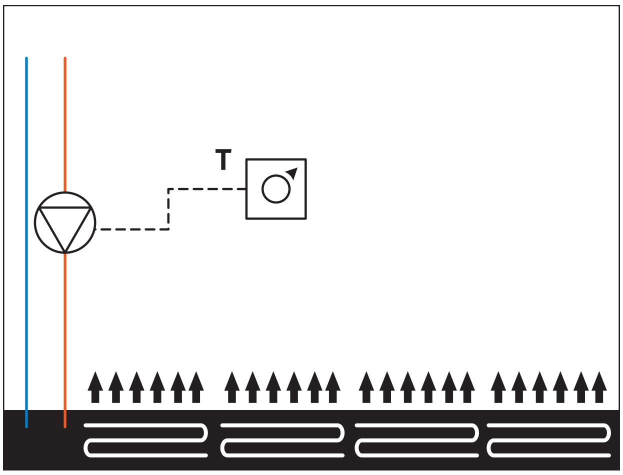
The pump is installed in a consumer circuit that supplies a slow surface heating system, e.g. underfloor heating. The pressure-controlled Δp-c, Dynamic Adapt plus or temperature-controlled "Hall temperature T-const" control modes can be used for this application.

Pressure control
If the heating circuit supplies multiple rooms, the underfloor heating circuits will be fitted with control valves to regulate the individual rooms' temperatures. For underfloor heating, the pressure fluctuations through valves are rather low in relation to the pressure loss in the pipe network. For this reason, Δp-c (nominal delivery head setting required) or Dynamic Adapt plus (nominal delivery head setting not required) can be selected in this case. For this application, Wilo recommends the Dynamic Adapt plus control mode.

Hall temperature control
If the heating circuit supplies heat to a large thermal zone, e.g. a hall, the control valves on the underfloor heating's distributor connections are redundant and are often not present in existing buildings. The pump can then directly regulate the hall temperature to the desired setpoint T = 3 °C ... 30 °C using the "Hall temperature T-const" control mode. For this purpose, it is necessary to install a temperature sensor or a room user interface in the hall to measure the temperature and act as a setpoint controller. These values are transmitted to the pump via the analogue inputs. The temperature sensor to measure the actual temperature can either be connected directly as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal. The setpoint can also be transmitted via a current- or voltage-controlled signal. If only one actual value sensor is installed in the room, the setpoint can also be set directly on the pump as a fixed value.



Pressure control in an underfloor heating consumer circuit



Hall temperature control in an underfloor heating consumer circuit

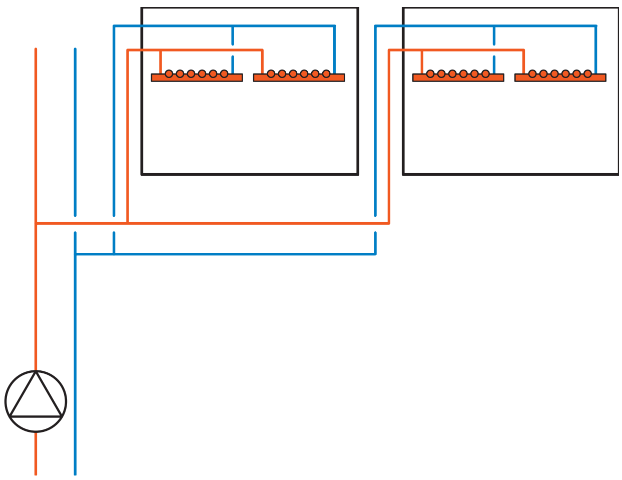
Further information on room user interfaces can be found in section 3.9 Accessories.

3.2.3. Heating: Ceiling heating consumer circuit

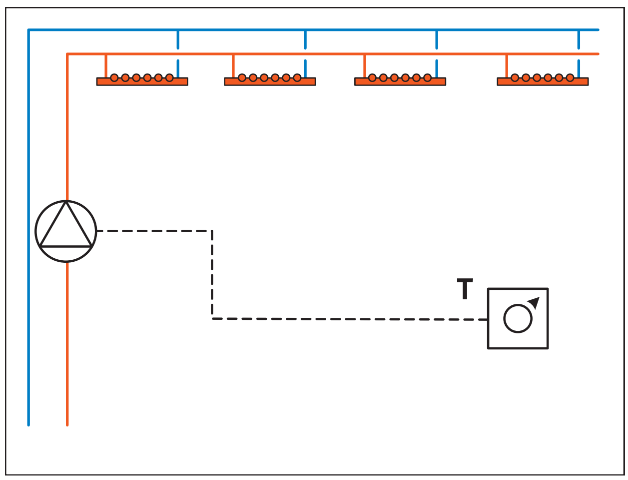
The pump is installed in a consumer circuit that supplies a ceiling heating. The pressure-controlled Δp-c, Dynamic Adapt plus or temperature-controlled "Hall temperature T-const" control modes can be used for this application.

Pressure control
If the heating circuit supplies multiple rooms, the ceiling heating circuits will be fitted with control valves to regulate the individual rooms' temperatures. For ceiling heating, the pressure fluctuations through valves are rather low in relation to the pressure loss in the pipe network. For this reason, Δp-c (nominal delivery head setting required) or Dynamic Adapt plus (nominal delivery head setting not required) can be selected in this case. For this application, Wilo recommends the Dynamic Adapt plus control mode.

Hall temperature control
If the heating circuit supplies heat to a large thermal zone, e.g. a hall, the control valves on the ceiling heating's distributor connections are redundant and are often not present in existing buildings. The pump can then directly regulate the hall temperature to the desired setpoint T = 3 °C ... 30 °C using the "Hall temperature T-const" control mode. For this purpose, it is necessary to install a temperature sensor or a room user interface in the hall to measure the temperature and act as a setpoint controller. These values are transmitted to the pump via the analogue inputs. The temperature sensor to measure the actual temperature can either be connected directly as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal. The setpoint can also be transmitted via a current- or voltage-controlled signal. If only one actual value sensor is installed in the room, the setpoint can also be set directly on the pump as a fixed value.



Pressure control in a ceiling heating consumer circuit



Hall temperature control in a ceiling heating consumer circuit

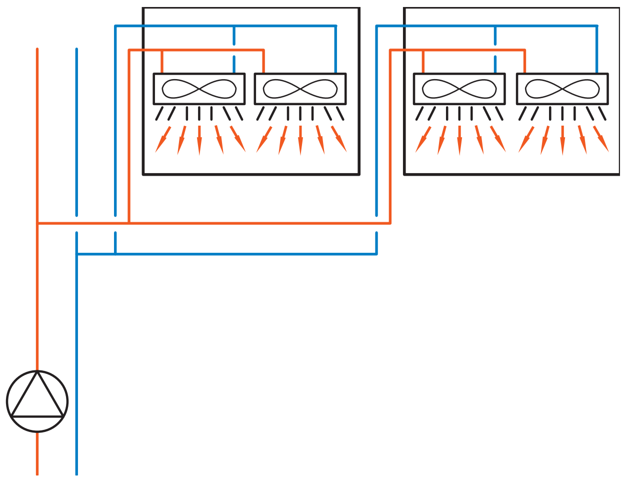
3.2.4. Heating: Fan heater consumer circuit

The pump is installed in a consumer circuit that supplies very fast air heating, e.g. a fan heater. The pressure-controlled Δp-v, Dynamic Adapt plus or temperature-controlled “Hall temperature T-const” control modes can be selected for this application.

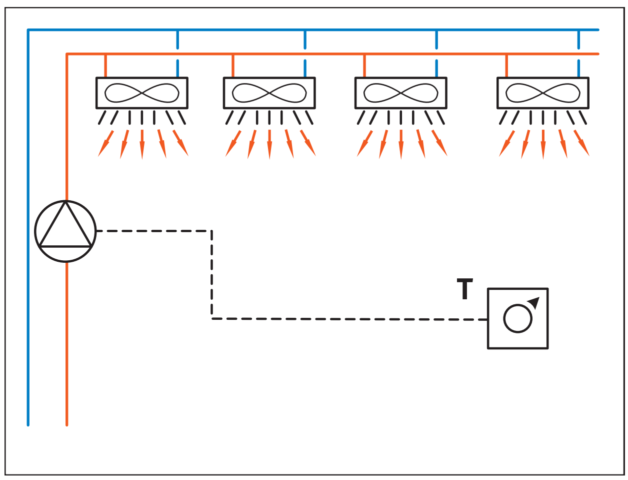
Pressure control
If the heating circuit supplies multiple rooms, the radiators will be fitted with control valves to regulate the individual rooms’ temperatures. In this case, Δp-v (nominal delivery head setting required) or Dynamic Adapt plus (nominal delivery head setting not required) can be selected. For this application, Wilo recommends the Dynamic Adapt plus control mode.

Hall temperature control
If the heating circuit supplies heat to a large thermal zone, e.g. a hall, the control valves on the fan heaters are redundant or are not present in an existing building. The pump can then directly regulate the hall temperature to the desired setpoint T = 3 °C ... 30 °C using the “Hall temperature T-const” control mode. For this purpose, it is necessary to install a temperature sensor or a room user interface in the hall to measure the temperature and act as a setpoint controller. These values are transmitted to the pump via the analogue inputs. The temperature sensor to measure the actual temperature can either be connected directly as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal.

The setpoint can also be transmitted via a current- or voltage-controlled signal. If only one actual value sensor is installed in the room, the setpoint can also be set directly on the pump as a fixed value.



Pressure control in a fan heater consumer circuit



Hall temperature control in a fan heater consumer circuit

Further information on room user interfaces can be found in section 3.9 Accessories.

3.2.5. Heating: Generator or feeder circuit with hydraulic shunt

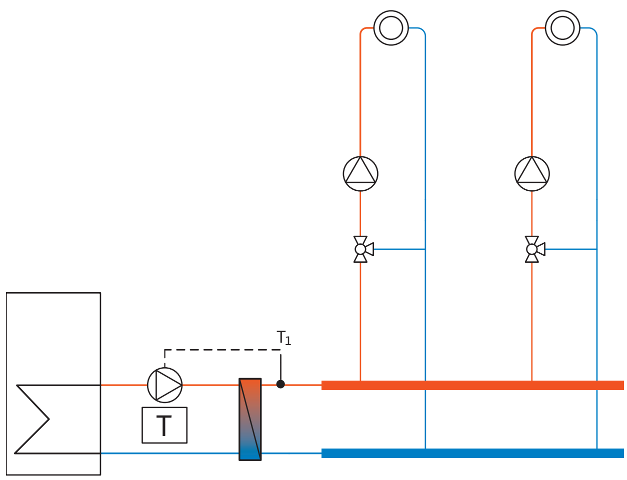
The pump is installed in a generator or feeder circuit that supplies a hydraulic shunt with heat. Hydraulic shunts are installed to hydraulically decouple two systems. In this context, a distinction must be made between two objectives:

1. The feed temperature is to be set on the secondary side. To do this, the volume flow on the primary side must be reduced accordingly in relation to the secondary side. The Wilo-Stratos MAXO provides the “Secondary feed temperature” control mode for this purpose.

2. The energy is to be transferred without raising the return temperature if at all possible, so that the demands placed on the return temperature by the boiler manufacturers or district heating substations are met. In this case, it is necessary to adjust the volume flow on the primary side to that on the secondary side. The Wilo-Stratos MAXO provides the “Return ΔT-const” and Multi-Flow Adaption control modes for this purpose.

Temperature control: Constant secondary feed temperature T-const

The feed temperature behind the hydraulic shunt (secondary side) is regulated to the defined setpoint T = 20 °C ... 130 °C by adjusting the speed of the pump in front of the shunt (primary side). To do this, a temperature sensor (PT1000 or active sensor with current- or voltage-controlled signal) must be installed in the secondary feed. The pump is connected via one of the two analogue inputs.



Temperature control T-const of feeder pump via hydraulic shunt

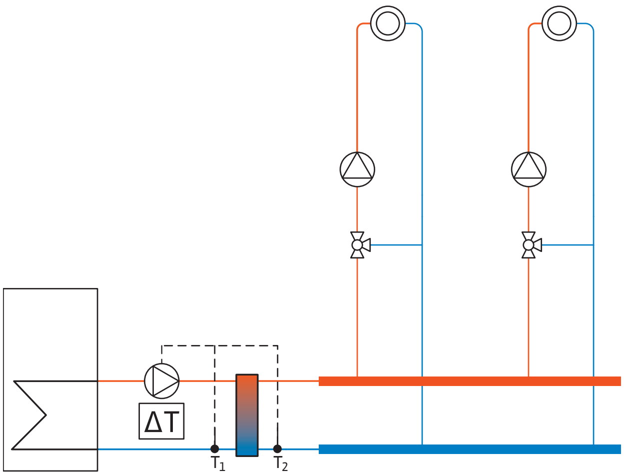
An immersion temperature sensor with suitable immersion sleeves is described in section 3.9 Accessories.

Temperature control: ΔT-const between primary side return and secondary side return
The temperature difference between the hydraulic shunt primary and secondary returns is controlled to reach the defined setpoint ΔT = 2 K ... 10 K. Independent of the differential pressure, the pump provides the exact volume flow required to maintain the specified setpoint temperature difference. The volume flow in the primary circuit is thereby aligned with the secondary volume flow. To do this, one or two temperature sensors (PT1000 or active sensor with current- or voltage-controlled signal) must be installed in the primary and secondary return. The connection to the pump is made via the two analogue inputs.

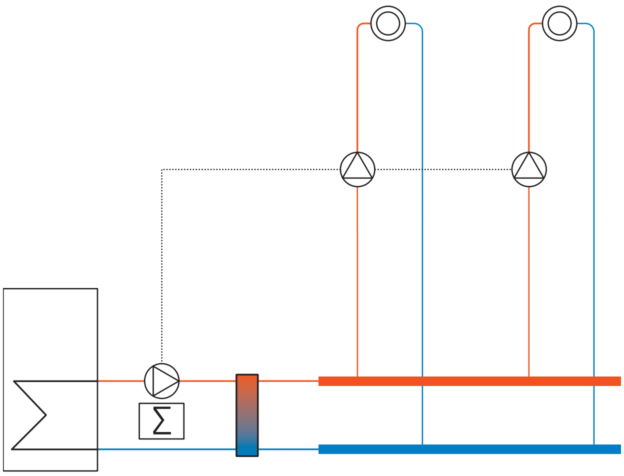
The correct setting of the control function requires the correct configuration of the installed temperature sensors. T1 is measured in the return on the primary side and T2 in the return on the secondary side.

Control is based on the following formula: T1 = T2 + ΔT. T1 is to be seen here as the reference variable and the temperature that can be influenced, which is dependent on the flow rate of the pump. T2 represents a reference value in the system that cannot be directly influenced by the pump.

Multi-Flow Adaptation
With the Multi-Flow Adaptation control mode, the volume flow in the generator/feeder circuit (primary circuit) is aligned with the volume flow in the consumer circuits (secondary circuit). Multi-Flow Adaptation is set in the Wilo-Stratos MAXO feeder pump in the primary circuit upstream of the hydraulic shunt. The Wilo-Stratos MAXO feeder pump is connected to the Wilo-Stratos MAXO pumps in the secondary circuits via a data cable. The feeder pump continuously receives the respective required volume flow from each individual secondary pump in short intervals. The sum of the required volume flows from all secondary pumps is set by the feeder pump as the target volume flow. On commissioning, all associated secondary pumps must be connected to the primary pump so that it can take their volume flows into consideration. The connection of the pumps via the Wilo bus system Wilo Net is described in more detail in section 4.2.6. A fixed volume flow requirement can be entered for non-communication-capable secondary pumps so that their flows are also taken into consideration. It is also possible to set a correction factor on the feeder pump, which provides additional supply security.



Temperature control ΔT-const of feeder pump via hydraulic shunt



Multi-Flow Adaptation of feeder pump via hydraulic shunt with secondary pumps in the line without mixer

3.2.6. Heating: Generator or feeder circuit with heat exchanger

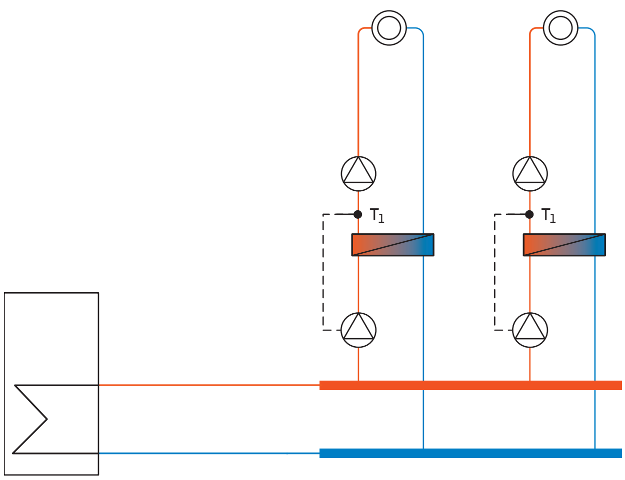
The pump is installed in a generator or feeder circuit (primary circuit) that supplies a heat exchanger with heat. Heat exchangers are installed to separate two hydraulic systems and transfer thermal energy from one system to another. In this context, a distinction must be made between two objectives:

1. The feed temperature is to be set on the secondary side. This is the case, for example, in an underfloor heating circuit which is supplied from one distributor along with static heating circuits. To do this, the volume flow on the primary side must be adjusted accordingly. The Wilo-Stratos MAXO provides the "Secondary feed temperature" control mode for this purpose.

2. The energy is to be transferred without raising the return temperature even in the event of a reduction in the heat requirement of the heating circuits if at all possible. In this case, it is necessary to adjust the volume flow on the primary side to that on the secondary side. The Wilo-Stratos MAXO provides the "Feed ΔT" and Multi-Flow Adaptation control modes for this purpose.

Temperature control: Constant secondary feed temperature T-const

The feed temperature behind the heat exchanger (secondary side) is regulated to the defined setpoint T = 20 °C ... 130 °C by adjusting the speed of the pump upstream of the heat exchanger (primary side). To do this, a temperature sensor (PT1000 or active sensor with current- or voltage-controlled signal) must be installed in the secondary feed. The pump is connected via one of the two analogue inputs.



Heating: Temperature control T-const behind the heat exchanger

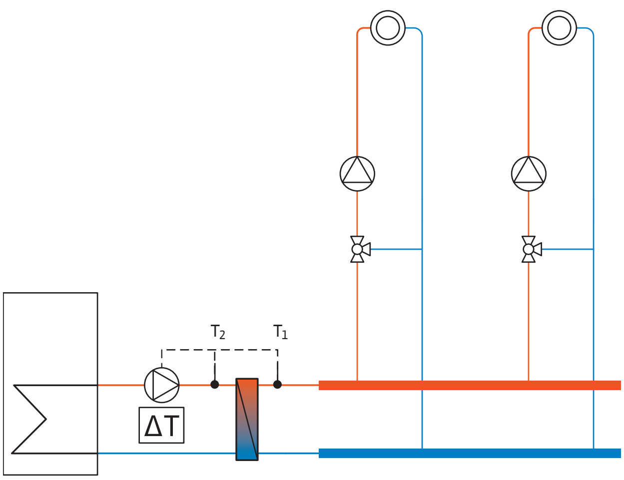
An immersion temperature sensor with suitable immersion sleeves is described in section 3.9 Accessories.

Temperature control: ΔT-const between primary side feed and secondary side feed
The temperature difference between the heat exchanger's primary and secondary feeds is controlled to reach the defined setpoint ΔT = 2 K ... 20 K. Independent of the differential pressure, the pump provides the exact volume flow required to maintain the specified setpoint temperature difference. The volume flow in the primary circuit is thereby aligned with the secondary volume flow. It is therefore necessary to install one temperature sensor (PT1000 or active sensor with current- and voltage-controlled signal) in both the primary and secondary feeds. The sensor in the pump can be used for the primary side, meaning that the temperature sensor is connected to the pump on the secondary side. The connection to the pump is made via the two analogue inputs.

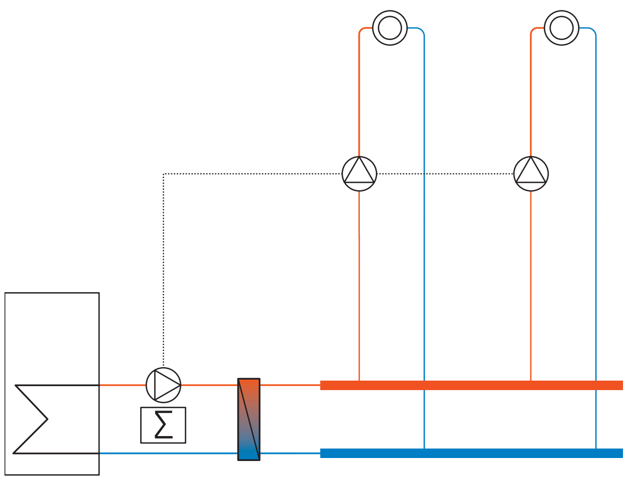
The correct setting of the control function requires the correct configuration of the installed temperature sensors. T1 is measured in the feed on secondary side, and T2 in the feed on primary side.

Control is based on the following formula: T1 = T2 + ΔT. T1 is to be seen here as the reference variable and the temperature that can be influenced, which is dependent on the flow rate of the pump. T2 represents a reference value in the system that cannot be directly influenced by the pump. As the setpoint configuration for ΔT occurs without sign on the pump, the value is adjusted according to the direction of action.

Multi-Flow Adaptation
With the Multi-Flow Adaptation control mode, the volume flow in the generator/feeder circuit (primary circuit) is aligned with the volume flow in the consumer circuits (secondary circuit). Multi-Flow Adaptation is set in the Wilo-Stratos MAXO feeder pump in the primary circuit upstream of the heat exchanger. The Wilo-Stratos MAXO feeder pump is connected to the Wilo-Stratos MAXO pumps in the secondary circuits via a data cable. The feeder pump continuously receives the respective required volume flow from each individual secondary pump in short intervals. The sum of the required volume flows from all secondary pumps is set by the feeder pump as the target volume flow. On commissioning, all associated secondary pumps must be connected to the primary pump so that it can take their volume flows into consideration. The connection of the pumps via the Wilo bus system Wilo Net is described in more detail in section 4.2.6. A fixed volume flow requirement can be entered for non-communication-capable secondary pumps so that their flows are also taken into consideration. It is also possible to set a correction factor on the feeder pump, which provides additional supply security.



Temperature control ΔT-const of inputs via a heat exchanger



Multi-Flow Adaptation of the feeder pump in front of a heat exchanger with secondary pumps in the line without mixer

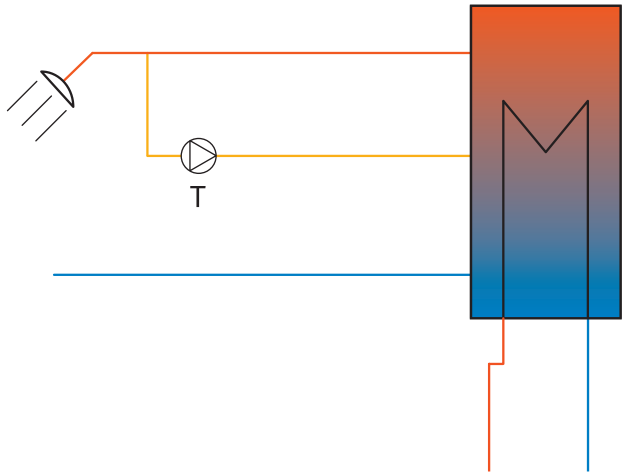
3.3. Drinking water application

3.3.1. Drinking water: Circulation

The pump is installed as a circulator. The T-const control mode can be used for this application in order to enable safe, hygienic operation.

Temperature control
The pump in the circulation line changes its speed so that the water returning to the tank is always at the desired specified warm water temperature. The temperature setting range on the Wilo-Stratos MAXO-Z ranges from T = 35 °C ... 80 °C. The temperature sensor for this purpose is located in the pump. A separate sensor is not necessary for this control.

For this application, Wilo recommends the additional control function for detecting thermal disinfection (section 3.6.8.).

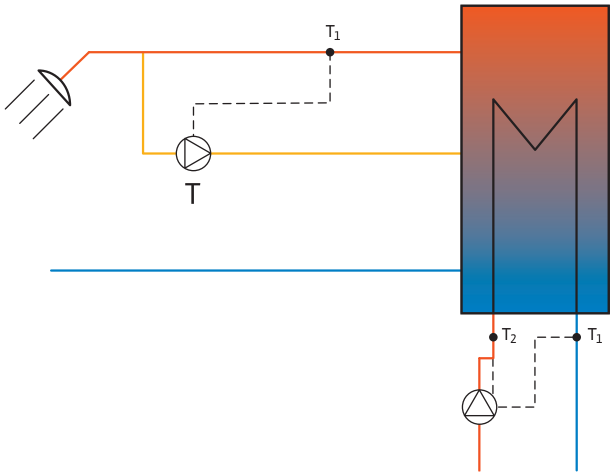


Temperature control of the domestic hot water circulator

The Wilo-Stratos MAXO-Z series is supplied with the factory setting "Drinking water: circulation".

3.3.2. Drinking water: Clean water storage facility

The pump is installed in a storage charging circuit with integrated heat exchanger. The ΔT-const control mode can be used for this application in order to achieve system optimisation and at the same time increase in efficiency.



Differential temperature ΔT const storage charge pump – drinking water

Temperature control
The pump regulates the differential temperature between feed and return to an adjusted setpoint ΔT = 2 K ... 50 K. Independent of the differential pressure, the pump provides the exact volume flow required to maintain the specified setpoint temperature difference.

To do this, up to two temperature sensors (PT1000 or active sensor with current- or voltage-controlled signal) must be installed in the feed and return of the storage charging circuit. Depending on the installation situation, the sensor in the pump can be used to measure the tem-perature in the feed and return, so that only one additional temperature sensor needs to be installed in the other pipe. The pump is connected via one of the two analogue inputs.

The correct setting of the control function requires the correct configuration of the installed temperature sensors. T1 is measured in the return of the storage charging circuit, and T2 in the feed.

Control is based on the following formula: T1 = T2 + ΔT. T1 is to be seen here as the reference variable and the temperature that can be influenced, which is dependent on the flow rate of the pump. T2 represents a reference value in the system that cannot be directly influenced by the pump. As the setpoint configuration for ΔT occurs without sign on the pump, the value is adjusted according to the direction of action.

An immersion temperature sensor with suitable immersion sleeves is described in section 3.9 Accessories.

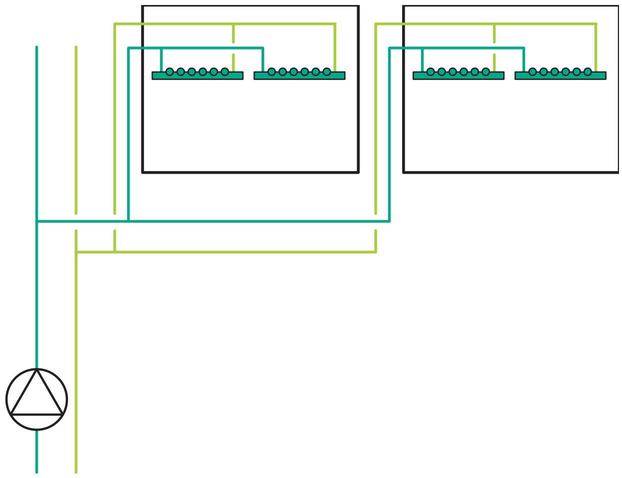
3.4. Cooling applications

3.4.1. Cooling: Ceiling cooling consumer circuit

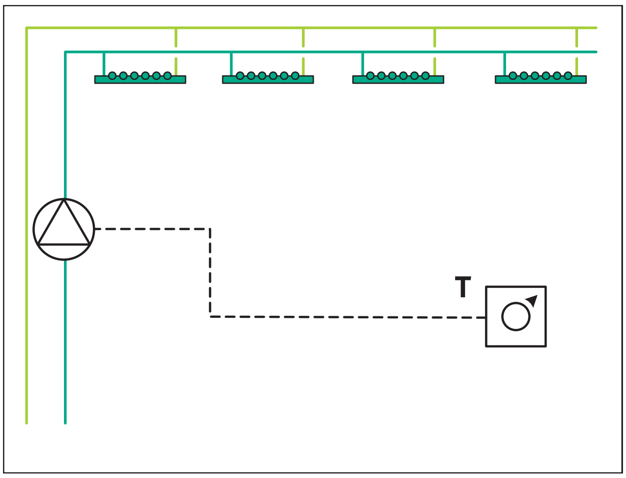
The pump is installed in a consumer circuit that supplies fast surface cooling, e.g. a cooling ceiling or ceiling canopy. The pressure-controlled Δp-c, Dynamic Adapt plus or temperature-controlled "Hall temperature T-const" control modes can be used for this application.

Pressure control
If the cooling circuit supplies multiple rooms, the cooling area circuits will be fitted with control valves to regulate the individual rooms' temperatures. For ceiling cooling, the pressure fluctuations through valves are rather low in relation to the pressure loss in the pipe network. For this reason, Δp-c (nominal delivery head setting required) or Dynamic Adapt plus (nominal delivery head setting not required) can be selected in this case. For this application, Wilo recommends the Dynamic Adapt plus control mode.

Hall temperature control
If the cooling circuit cools a large thermal zone, e.g. a hall, the control valves on the ceiling cooling's distributor connections are redundant and are often not present in existing buildings. The pump can then directly regulate the hall temperature to the desired setpoint T = 15 °C ... 40 °C using the "Hall temperature T-const" control mode. For this purpose, it is necessary to install a temperature sensor or a room user interface in the hall to measure the temperature and act as a setpoint controller. These values are transmitted to the pump via the analogue inputs. The temperature sensor to measure the actual temperature can either be connected directly as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal. The setpoint can also be transmitted via a current- or voltage-controlled signal. If only one actual value sensor is installed in the room, the setpoint can also be set directly on the pump as a fixed value.



Pressure control in a ceiling cooling consumer circuit



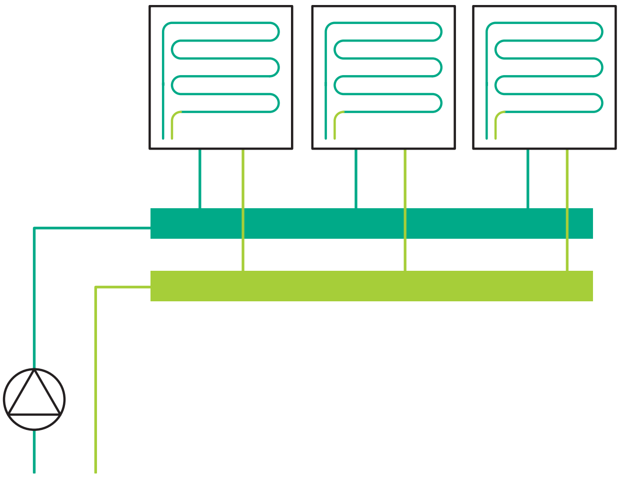
Hall temperature control in a ceiling cooling consumer circuit

3.4.2. Cooling: Underfloor cooling consumer circuit

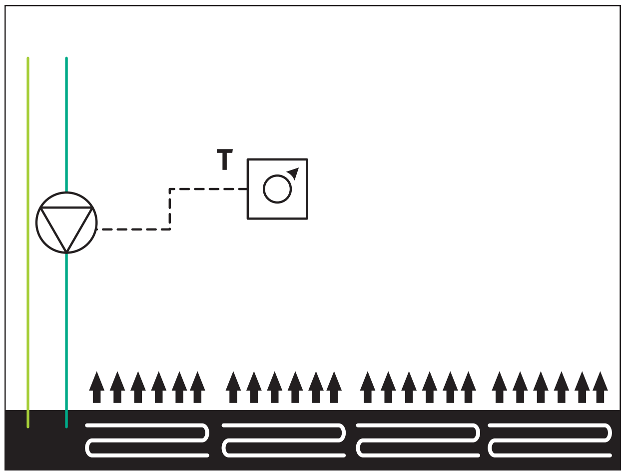
The pump is installed in a consumer circuit that supplies slow surface cooling, e.g. underfloor cooling. The pressure-controlled Δp-c, Dynamic Adapt plus or temperature-controlled "Hall temperature T-const" control modes can be used for this application.

Pressure control
If the cooling circuit supplies multiple rooms, the cooling area circuits will be fitted with control valves to regulate the individual rooms' temperatures. In this case, Δp-c (nominal delivery head setting required) or Dynamic Adapt plus (nominal delivery head setting not required) can be selected. For this application, Wilo recommends the Dynamic Adapt plus control mode.

Hall temperature control
If the cooling circuit cools a large thermal zone, e.g. a hall, the control valves on the underfloor cooling's distributor connections are redundant and are often not present in existing buildings. The pump can then directly regulate the hall temperature to the desired setpoint T = 15 °C ... 40 °C using the "Hall temperature T-const" control mode. For this purpose, it is necessary to install a temperature sensor or a room user interface in the hall to measure the temperature and act as a setpoint controller. These values are transmitted to the pump via the analogue inputs. The temperature sensor to measure the actual temperature can either be connected directly as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal. The setpoint can also be transmitted via a current- or voltage-controlled signal. If only one actual value sensor is installed in the room, the setpoint can also be set directly on the pump as a fixed value.



Pressure control in an underfloor cooling consumer circuit



Hall temperature control in an underfloor cooling consumer circuit

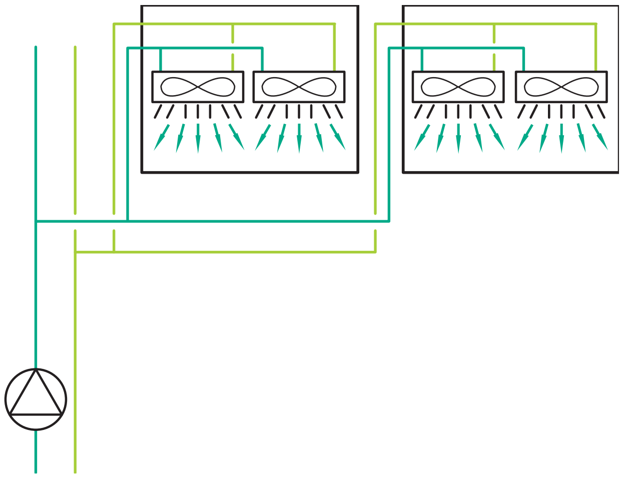
Further information on room user interfaces can be found in section 3.9 Accessories.

3.4.3. Cooling: Air-conditioning device consumer circuit

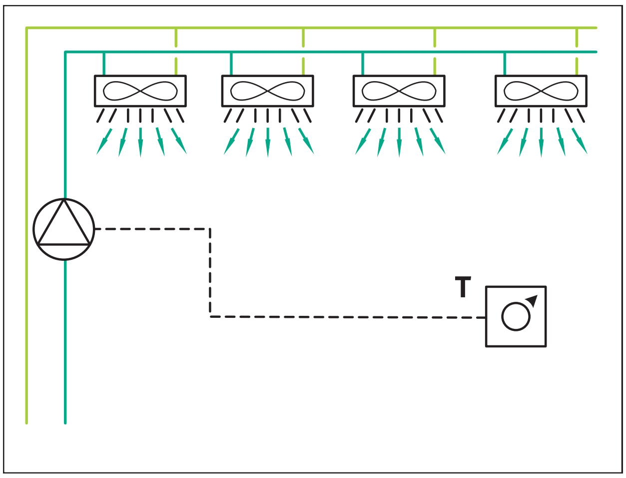
The pump is installed in a consumer circuit that supplies very fast air cooling, e.g. an air-conditioning device. The pressure-controlled Δp-v, Dynamic Adapt plus or temperature-controlled “Hall temperature T-const” control modes can be used for this application.

Pressure control
If the cooling circuit supplies multiple rooms, the air-conditioning devices will be fitted with control valves to regulate the individual rooms’ temperatures. In this case, Δp-v (nominal delivery head setting required) or Dynamic Adapt plus (nominal delivery head setting not required) can be selected. For this application, Wilo recommends the Dynamic Adapt plus control mode.

Hall temperature control
If the cooling circuit cools a large thermal zone, e.g. a hall, the control valves on the air-conditioning devices are redundant and are often not present in existing buildings. The pump can then directly regulate the hall temperature to the desired setpoint T = 15 °C ... 40 °C using the “Hall temperature T-const” control mode. For this purpose, it is necessary to install a temperature sensor or a room user interface in the hall to measure the temperature and act as a setpoint controller. These values are transmitted to the pump via the analogue inputs. The temperature sensor to measure the actual temperature can either be connected directly as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal. The setpoint can also be transmitted as a current- or voltage-controlled signal. If only one actual value sensor is installed in the room, the setpoint can also be set directly on the pump as a fixed value.



Pressure control in an air-conditioning device consumer circuit



Hall temperature control in an air-conditioning device consumer circuit

Further information on room user interfaces and immersion temperature sensors with suitable immersion sleeves can be found in section 3.9 Accessories.

3.4.4. Cooling: Generator or feeder circuit with hydraulic shunt

The pump is installed in a generator or feeder circuit (primary circuit) that supplies a hydraulic shunt with cooling. Hydraulic shunts are installed to hydraulically decouple two systems. In this context, a distinction must be made between two objectives:

1. The feed temperature is to be set on the secondary side. To do this, the volume flow on the primary side must be reduced accordingly in relation to the secondary side. The Wilo-Stratos MAXO provides the “Feed temperature T-const” control mode for this purpose.

2. The energy is to be transferred without lowering the return temperature even in the event of a reduced cooling requirement if at all possible. In this case, it is necessary to adjust the volume flow on the primary side to that on the secondary side. The Wilo-Stratos MAXO provides the “Return ΔT-const” and Multi-Flow Adaptation control modes for this purpose.

Temperature control: Constant secondary feed temperature T-const

The feed temperature behind the hydraulic shunt (secondary side) is regulated to the defined setpoint T = 5 °C ... 40 °C by adjusting the speed of the pump in front of the hydraulic shunt (primary side). To do this, a temperature sensor (PT1000 or active sensor with current- or voltage-controlled signal) must be installed in the secondary feed. The pump is connected via one of the two analogue inputs.

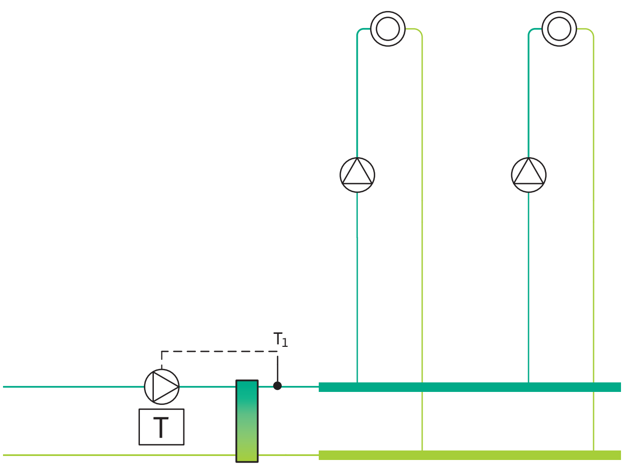
Temperature control: ΔT-const between primary side return and secondary side return

The temperature difference between the hydraulic shunt primary and secondary returns is controlled to reach a defined setpoint ΔT = 2 K ... 10 K. Independent of the differential pressure, the pump provides the exact volume flow required to maintain the specified setpoint temperature difference. The volume flow in the primary circuit is thereby aligned with the secondary volume flow. To do this, two temperature sensors (PT1000 or active sensor with current- or voltage-controlled signal) must be installed in the primary and secondary return. The connection to the pump is made via the two analogue inputs.

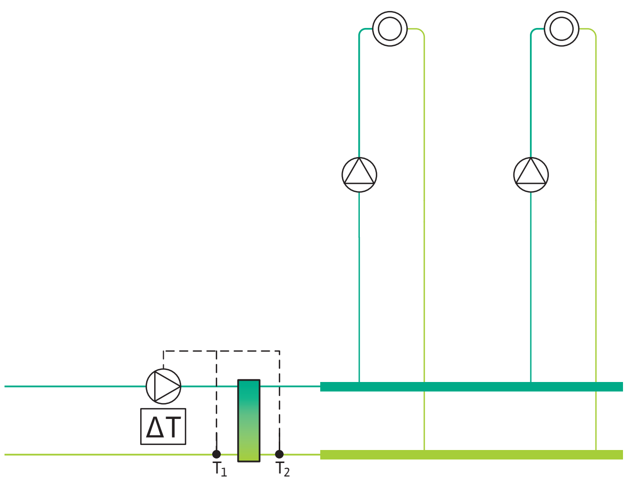
The correct setting of the control function requires the correct configuration of the installed temperature sensors. T1 is measured in the return on the primary side and T2 in the return on the secondary side.

Control is based on the following formula:
T1 = T2 + ΔT. T1 is to be seen here as the reference variable and the temperature that can be influenced, which is dependent on the flow rate of the pump. T2 represents a reference value in the system that cannot be directly influenced by the pump. As the setpoint configuration for ΔT occurs without sign on the pump, the value is adjusted according to the direction of action.

For the Multi-Flow Adaptation control mode – refer to section 3.2.6. Heating: Generator or feeder circuit with hydraulic shunt



Secondary feed temperature T-const behind hydraulic shunt – cooling



Differential temperature ΔT-const above hydraulic shunt – cooling

3.4.5. Cooling: Generator or feeder circuit with heat exchanger

The pump is installed in a generator or feeder circuit (primary circuit) that supplies a heat exchanger with cooling. Heat exchangers are installed to separate two hydraulic systems and transfer thermal energy from one system to another. In this context, a distinction must be made between two objectives:

1. The feed temperature is to be set on the secondary side. To do this, the volume flow on the primary side must be adjusted accordingly. The Wilo-Stratos MAXO provides the “Feed temperature T-const” control mode for this purpose.

2. The energy is to be transferred without lowering the return temperature even in the event of a reduced cooling requirement if at all possible. In this case, it is necessary to adjust the volume flow on the primary side to that on the secondary side. The Wilo-Stratos MAXO provides the “Return ΔT” and Multi-Flow Adaptation control modes for this purpose.

Temperature control: Constant secondary feed temperature T-const
The feed temperature behind the heat exchanger (secondary side) is regulated to the defined setpoint T = 5 °C ... 40 °C by adjusting the speed of the pump upstream of the heat exchanger (primary side).

To do this, a temperature sensor (PT1000 or active sensor with current- or voltage-controlled signal) must be installed in the secondary feed. The pump is connected via one of the two analogue inputs. An immersion temperature sensor with suitable immersion sleeves is described in the “Accessories” section.

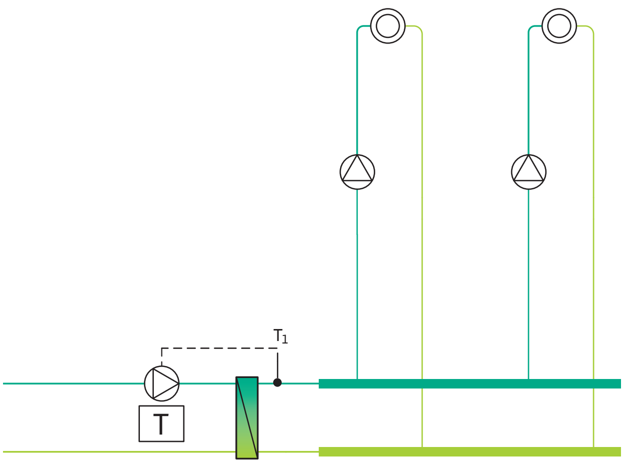
Temperature control: ΔT-const between primary side feed and secondary side feed
The temperature difference between the heat exchanger primary and secondary feed is controlled to reach a defined setpoint ΔT = 2 K ... 20 K. Independent of the differential pressure, the pump provides the exact volume flow required to maintain the specified setpoint temperature difference. The volume flow in the primary circuit is thereby aligned with the secondary volume flow.

It is therefore necessary to install one temperature sensor (PT1000 or active sensor with current- or voltage-controlled signal) in both the primary and secondary feeds. The sensor in the pump can be used for the primary side, meaning that the temperature sensor is connected to the pump on the secondary side. The connection to the pump is made via the two analogue inputs.

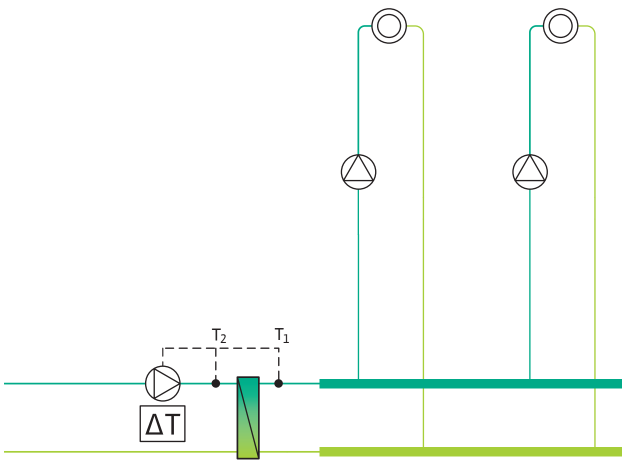
The correct setting of the control function requires the correct configuration of the installed temperature sensors. T1 is measured in the feed on the secondary side and T2 in the feed on the primary side.

Control is based on the following formula:
T1 = T2 + ΔT. T1 is to be seen here as the reference variable and the temperature that can be influenced, which is dependent on the flow rate of the pump. T2 represents a reference value in the system that cannot be directly influenced by the pump.

For the Multi-Flow Adaptation control mode, refer to section 3.2.6. Heating: Generator or feeder circuit with heat exchanger



Secondary feed temperature T-const behind heat exchanger – cooling



Differential temperature ΔT-const above heat exchanger – cooling

3.5. Basic control modes

In addition to the option of selecting the control mode based on the application, all control modes can also be directly adjusted by means of the Basic Control Mode menu point. This is the case for example when no suitable application is preconfigured in the pump for the specific installation.

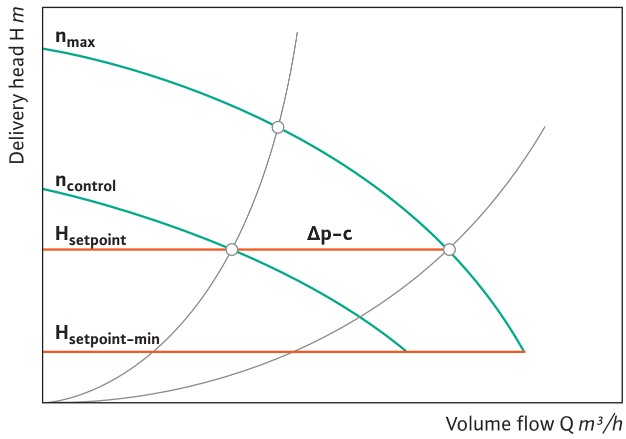
The basic control modes are freely configurable and can thus be individually adjusted to the application by the user. They can also be combined with numerous additional options. In this case, it must be checked that the pump functions correctly.

Wilo recommends using the application-based control mode settings. These have been configured and optimised for the respective application.

The following control modes are available in the Wilo-Stratos MAXO:
- → Differential pressure Δp-c
- → Differential pressure Δp-v
- → Index circuit Δp-c
- → Dynamic Adapt plus
- → Temperature T-const
- → Temperature ΔT-const
- → Volume flow Q-const
- → Multi-Flow Adaptation
- → Speed n-const
- → PID control

3.5.1. Differential pressure Δp-c

In Δp-c control mode, the pump keeps the differential pressure it generates constant at the set differential pressure setpoint $H_{setpoint}$ throughout the permissible volume flow range up to the maximum pump curve. The required differential pressure from the pipe network calculation H_n corresponds to the setpoint $H_{setpoint}$.



Control properties:
Sufficient supply is ensured, including for non-balanced hydraulic networks. The nominal delivery head must be specified. Noises may be heard if the delivery head is set too high.

Fields of application e.g.:
- → Consumer circuit with underfloor heating (heating) or underfloor/ceiling vents (cooling) in which pressure fluctuations through valves are very low in relation to the pressure loss in the pipe network.

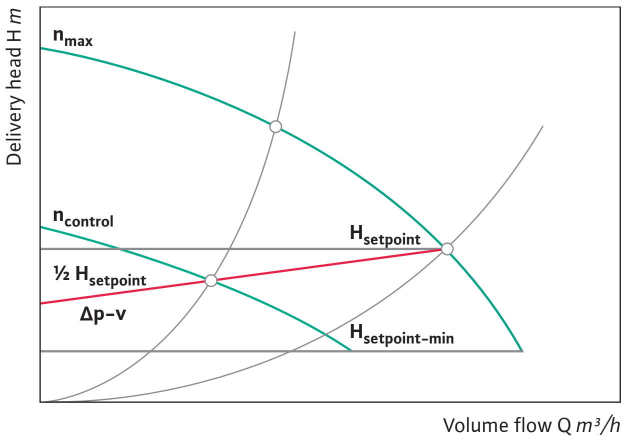
3.5.2. Differential pressure Δp-v

In the Δp-v control mode, the pump linearly varies the differential pressure setpoint to be maintained between the specified setpoint $H_{setpoint}$ on the maximum pump curve and ½ $H_{setpoint}$ at zero volume flow. The setpoint $H_{setpoint}$ does not generally correspond to the required differential pressure from the pipe network calculation, and must instead be identified using the nominal duty point and $Q_{nominal}$. The duty point (nominal volume flow and delivery head) can be directly specified using the additional "Nominal duty point" function.

Additional information on the additional function "Nominal duty point" can be found in section 3.6.3.

Control properties:
The pump variably adjusts the required volume flow according to the opened and closed valves on the consumers, thereby adjusting the power required. It saves electrical pumping energy in comparison to Δp-c. The setpoint is defined using the duty point, which can usually be taken from the pipe network calculation.

Fields of application e.g.:
→ Consumer circuit with radiators and fan heaters (heating) or air-conditioning devices (cooling).



The slope can be influenced with the additional function "Slope of the Δp-v characteristic curve". Excessive supply or inadequate supply can be compensated by adapting the slope. Additional information on the additional function "Slope of the Δp-v characteristic curve" can be found in section 3.6.4.

3.5.3. Index circuit Δp-c

In the index circuit Δp-c control mode, the pump keeps the differential pressure at a remote point in the pipe network (index circuit) constant at the set differential pressure setpoint H_s throughout the permissible volume flow range up to the maximum pump curve. The required differential pressure from the pipe network calculation Hn corresponds to the setpoint H_s.

A differential pressure sensor is installed at the index circuit and connected to the pump as an actual value sensor via an analogue input.

The nominal differential pressure to be maintained at the index circuit must be specified.

Control properties:
Just as for Δp-c, the nominal delivery head that applies precisely to the remote point in the network must be specified. An index circuit evaluation continuously monitors the sensor's pressure difference at the critical point in the pipe network.

Fields of application e.g.:
→ Primary side of a local heat supply up to the transfer station to the connected buildings.
→ Extensive existing systems with unknown hydraulic properties.

3.5.4. Dynamic Adapt plus

The pump automatically adjusts the delivery head to the hydraulic demand without the need to specify a setpoint.

After initial commissioning, the pump selects a duty point in the middle of the pump duty chart. New operating points are identified depending on change in volume flow. The aim of this control method is to select the operating point so that the valves are open as wide as possible. This allows the system to operate with respectively the lowest possible pressure loss.

Control properties:
The delivery head does not need to be specified. The pump automatically and independently adapts to variable pressure conditions. Electrical pumping energy savings of up to 20 % are possible in comparison to Δp-v. The performance range extends across almost the entire pump duty chart.

Fields of application e.g.:
Consumer circuits with variable volume flows, e.g. radiators with thermostatic valves, underfloor heating with individual room controls, cooling ceilings or air-conditioning devices

The Wilo-Stratos MAXO and Wilo-Stratos MAXO-D series are supplied with the “Dynamic Adapt plus” factory setting.

An immersion temperature sensor with suitable immersion sleeves is described in section 3.9 Accessories.

3.5.5. Temperature T-const

In the T-const control mode, the pump keeps the temperature constant at a specified setpoint. In the positive direction of action, the pump increases its speed if the actual temperature is lower than the setpoint temperature. In the negative direction of action, speed decreases. The direction of action and the controller’s amplification factors can be individually adjusted by selecting the basic control mode without selecting the application. A temperature sensor integrated in the pump detects the fluid temperature. Consequently, a separate sensor is not absolutely necessary for this control. Alternatively, a temperature sensor can be installed as an actual value sensor e.g. in the feed to the secondary circuit. These values are transmitted to the pump via the analogue inputs. The temperature sensor can either be connected directly as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal.

Control properties:
Independent of the differential pressure, the pump provides the exact volume flow required to maintain the specified setpoint temperature T = -30 °C ... +130 °C.

Fields of application e.g.:
Supply of a consumer circuit with a fixed feed temperature

3.5.6. Temperature ΔT-const

In the ΔT-const control mode, the pump keeps the temperature difference constant at a specified setpoint. In the positive direction of action, the pump increases its speed if the actual temperature difference is smaller than the setpoint temperature difference. If the setpoint is exceeded, the speed is decreased respectively. In the negative direction of action (controller inversion), the pump increases its speed if the actual temperature difference is higher than the setpoint temperature difference. If the setpoint is undercut, the speed is decreased respectively. The direction of action and the controller’s amplification factors can be individually adjusted by selecting the basic control mode without selecting the application. Two temperature sensors are installed as actual value sensors e.g. in the primary and secondary circuit feeds. These values are transmitted to the pump via the analogue inputs. The temperature sensors can either be connected directly as PT1000 sensors or as active sensors with voltage- and current-controlled signal.

Control properties:
Independent of the differential pressure, the pump provides the exact volume flow required to maintain the specified setpoint temperature difference ΔT = -99 K ... 99 K.

Fields of application e.g.:
Supply of a consumer circuit with a fixed temperature difference

3.5.7. Volume flow Q-const

In the Q-const constant volume flow control mode, the pump keeps constant at the specified volume flow setpoint. For this purpose, the speed increases within the permitted range if the measured volume flow is less than the setpoint, and vice versa.

Control properties:
The desired volume flow is kept constant, independent of the differential pressure.

Fields of application e.g.:
- → Generator circuit of a heat pump without a controlled inverter to maintain strict heat output
- → Cooling circuit with cooling tower with constant power

3.5.8. Multi-Flow Adaptation

The Multi-Flow Adaptation control mode is applicable for a Wilo-Stratos MAXO feeder pump in the primary circuit that, for example, supplies an open distributor, a hydraulic shunt or a heat exchanger. The feeder pump is connected to the Wilo-Stratos MAXO pumps in the secondary circuits via a data cable. The feeder pump continuously receives the respective required volume flow from each individual secondary pump in short intervals. The sum of the required volume flows from all secondary pumps is set by the feeder pump as the target volume flow. On commissioning, all associated secondary pumps must be connected to the primary pump so that it can take their volume flows into consideration. The connection of the pumps via the Wilo bus system Wilo Net is described in more detail in section 4.2.6. A fixed volume flow value can be entered for non-communication-capable secondary pumps. It is also possible to set a correction factor (50 % – 200 %) on the feeder pump, which provides additional supply security.

Control properties:
The feeder pump provides exactly as much volume flow as is required by the secondary pumps. It therefore saves electrical pumping energy in comparison to Δp-c control. The heat generator's degree of utilisation is optimised by a lower return temperature. This leads to fuel savings. For local and district heating transfer stations, the lower return temperature leads to higher operational reliability, as it avoids activating the return temperature limiter as well as overflows.

Fields of application e.g.:
- → Pumps in district heating transfer stations without controllers that supply distributors with secondary pumps
- → Feeder pumps that supply open distributors or heat exchangers with secondary pumps with no speed control through the heat generator

3.5.9. Speed n-const

In the constant speed n control mode, the pump control keeps constant at the specified speed setpoint.

Control properties:
The speed setpoint is usually specified via an external signal, e.g. via 0 – 10 V. The setpoint always remains the same unless changed based on demand.

Fields of application e.g.:
Control of the Wilo-Stratos MAXO by a boiler controller via the 0 – 10 V signal.

3.5.10. PID control

In the PID control mode, the pump keeps constant at a defined setpoint by means of a PID controller. This setpoint could be a temperature, a pressure or any other physical size. A signal value transmitted via one of the pump's analogue inputs can be used as the actual value. The direction of action of the controller and its amplifications factors P, I and D can be individually adjusted to the application.

Control properties:
The pump's P, I and D factors are set on the basis of individual, specific requirements. To this end, advanced knowledge of control technology is required for parameterisation.

Fields of application e.g.:
Fill level control for a boiler's feeding pump

3.6. Additional functions for the control modes

3.6.1. No-Flow Stop

The pump recognises when, despite its current speed, the volume flow supplied is low. This means that the valves in the consumer circuit are closed.

The pump stops the motor if the volume flow falls below a specified minimum level. The pump then checks at regular intervals whether the minimum volume flow has been exceeded again. As soon as this occurs, the pump continues in its set control mode in auto control mode. The minimum volume flow Q_{Min} can be set between 1 % and 20 % of the maximum volume flow Q_{Max} depending on the pump size.

This function is deactivated in the factory settings and must be activated if required.

Benefit:
Electrical pumping energy is saved by avoiding unnecessary running times.

Fields of application e.g.:
→ A pump in a consumer circuit with radiators, fan heaters, underfloor or ceiling vents in heating or cooling mode, as an additional function for all control modes except Multi-Flow Adaptation and volume flow Q-const

3.6.2. Automatic detection of setback operation

The pump detects a significant reduction in fluid temperature over a defined period of time. The pump thereby deduces that the heat generator is in setback operation.

The pump independently reduces its speed until a high fluid temperature is once again detected over a longer period of time. This leads to savings in electrical pumping energy.

Benefit:
Electrical pumping energy is saved by avoiding unnecessary running times.

Fields of application e.g.:
→ A pump in a heat generator circuit in control modes Δp-v or Δp-c supplying a system with radiators or fan heaters
→ A pump in heat generator circuits in control mode T-const or ΔT-const
→ A pump in a consumer circuit with radiators or fan heaters in control modes Dynamic Adapt plus or Δp-v

3.6.3. Nominal duty point in Δp-v control

The additional function of a nominal duty point can be used together with Δp-v. Instead of the delivery head on the maximum pump curve, the nominal duty point can be entered directly. This is made up of the nominal volume flow and the nominal delivery head. Both values can usually be taken from the pipe network calculation and are often provided on the heating or cooling schematics in the pump list. Pump control automatically calculates a suitable characteristic curve that runs through the nominal duty point.

Benefit:
If known, the desired duty point can be precisely specified.

Fields of application e.g.:
→ A pump in a consumer circuit with radiators or fan heaters in control mode Δp-v

3.6.4. Slope of the Δp-v characteristic curve

The additional function "Slope of the Δp-v characteristic curve" can be used together with Δp-v. A factor can be set on the pump to optimise the Δp-v control characteristic. The factor 50 % (1/2 H) is pre-set at the factory. In some installations with special pipe network characteristics, there may be inadequate or excessive supply. The factor reduces (< 50 %) or increases (> 50 %) the Δp-v delivery head at Q=0 m^3/h

Factor < 50 %: Δp-v characteristic curve becomes steeper.
Factor > 50 %: Δp-v characteristic curve becomes flatter.
Factor 100 % is equal to an Δp-c control.

Benefit:
The excessive or inadequate supply can be compensated by adjusting the factor.
→ In case of inadequate supply in the partial load range, the value must be increased.
→ In case of excessive supply in the partial load range, the value must be reduced.

This can save energy and reduce flow noise.

3.6.5. Q-Limit$_{Min}$ (minimum volume flow limit)

The Q-Limit$_{Min}$ function can be used in conjunction with all control modes except Dynamic Adapt plus and constant volume flow Q-const. The pump will not fall below the specified minimum volume flow limit within the permitted range, independent of the delivery head.

Benefit:
Compliance with the specified minimum volume of circulation water.

Fields of application e.g.:
→ Ensuring the minimum volume of circulation water in a heat generator

3.6.6. Q-Limit$_{Max}$ (maximum volume flow limit)

The Q-Limit$_{Max}$ limit can be used in conjunction with all control modes except Dynamic Adapt plus and constant volume flow Q-const. The specified maximum volume flow limit is not exceeded by the pump control within the permitted range, independent of the delivery head.

Benefit:
Limit of the maximum volume flow. Additional components such as differential pressure valves or mixers are not required.

Fields of application e.g.:
→ A pump in a heat generator circuit and a storage charge pump: Limit the maximum volume flow to boiler output in the event of low pipeline resistance
→ Local/district heat: Limit the maximum volume flow of the pump on the secondary side because the maximum permitted volume flow is available on the primary side (supply side) (return temperature is thus kept low)

3.6.7. Heating/cooling switchover

If the Wilo-Stratos MAXO is installed in an installation circuit used for both heating and cooling, the pump can switch between heating or cooling depending on the current application. This is achieved either by an external binary contact, through a building automation data item or by detecting the feed temperature. If the feed temperature is over 25 °C, for example, the pump runs in heating mode with the corresponding control mode setting (e.g. Dynamic Adapt plus). If the feed temperature is below 19 °C, for example, it operates in the applicable setting for the cooling mode (e.g. Δp-c). Between 19 °C and 25 °C, the pump starts up at regular intervals to identify whether cooling or heating is required. 19 °C and 25 °C are the preconfigured values, but other settings are possible.

Benefit:
The pump is individually adjusted to ensure optimal energy transfer in heating or cooling mode. The pump itself identifies the current application.

The heating/cooling quantity supplied by the pump is identified separately.

Fields of application e.g.:
- → A generator circuit pump downstream of a three-way valve that supplies a cold water generator and a heat generator
- → A pump in the consumer circuit of a reversible heat pump that both heats and cools
- → A consumer circuit pump that supplies both hot and cold water for concrete core activation or ceiling vents, for example

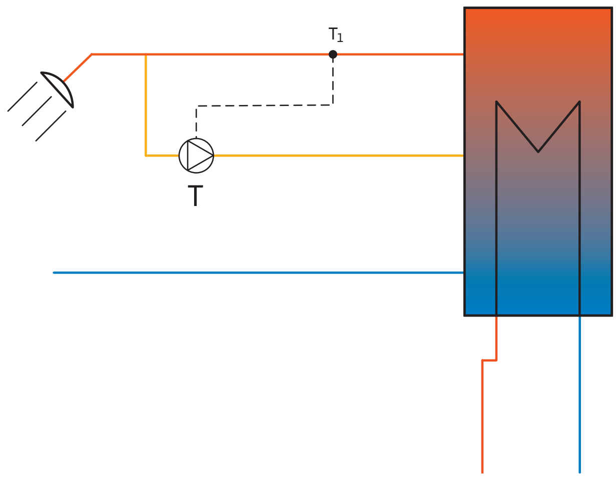
3.6.8. Detection of thermal disinfection

The domestic hot water circulator uses a sensor connected to the hot water tank or the hot water output line to detect when the hot water temperature exceeds a specified limit value. It detects that thermal disinfection has been started and thus continues to supply at full speed.

A pipe surface contact sensor mounted on the hot water discharge line of the tank must also be connected to the pump. This contact sensor can either be connected directly to the pump as a PT1000 sensor or as an active sensor with current- or voltage-controlled signal.

Benefit:
Reduction of rapid cooling of hot water in the pipe network and improvement of the thermal disinfection effect by ensuring proper flushing using a high volume flow.

Fields of application e.g.:
- → Domestic hot water circulator in hot water systems in which regular thermal disinfection is required



Temperature control of the domestic hot water circulator with detection of thermal disinfection

A pipe contact temperature sensor is described in section 3.9 Accessories.

3.7. Data collection

3.7.1. Heating/cooling quantity measurement

The heating/cooling quantity is measured through volume flow detection in the pump and temperature detection in the feed or return. The Wilo-Stratos MAXO has a fluid temperature sensor which can detect one of the two temperatures (depending on whether the pump is installed in the feed or return). As a result, only one further temperature sensor is required that is connected to the pump via one of the analogue inputs.

The use of a PT1000 AA as feed and return temperature sensor is recommended for recording the heating/cooling quantity, as this provides a higher temperature accuracy depending on the fluid temperature. The use of two external temperature sensors requires connection to the two analogue inputs of the pump.

An application-based pump configuration is conducted for heating and cooling respectively. The pump can switch over to heating or cooling either automatically or as instructed by an external signal. The heating and cooling quantity is identified separately based on the application.

Benefit:
An energy measurement for heating and cooling can be conducted without an additional energy meter. The measurement can be used for the internal distribution of heating and cooling costs or for system monitoring. However, as the heating and cooling quantity measurement is not calibrated, it cannot be used as the basis for billing.

Fields of application e.g.:
- → Internal billing of energy flows
- → System and energy monitoring
- → System optimisation

3.7.2. Historic pump data recording

The Wilo-Stratos MAXO is able to record and save a range of timestamped data relating to its operating time:

- → Delivery head
- → Volume flow
- → Speed
- → Feed and return temperature
- → Hall temperature (in case of hall temperature control)
- → Heating and cooling quantity
- → Electrical power consumption
- → Electric voltage
- → Module temperature
- → Operating hours
- → Number of venting processes
- → History of error messages

The historic data can be presented over a desired period, e.g. the last 4 weeks. Aspects such as the hydraulic behaviour of the hydraulic circuit being supplied or the current state of the pump can thus be analysed. The data can be read out via Smart Connect app via a Bluetooth connection.

3.8. Pump functions independent of the control mode

3.8.1. “Dual pump management”

The Wilo-Stratos MAXO can be operated either with two single pumps of identical type or as a twin-head pump variant with dual pump management.

The twin-head pump variant is fully wired-up upon delivery and is configured as a twin-head pump. Only one of the two pump modules has a fully functional LCD colour display. The second pump module is equipped with a 7-segment LED display.

If two single pumps in the Y-piece are operated as a twin-head pump, both single pumps must be set to dual pump mode on commissioning. Cabling between the pumps for twin-head pump operation must also be completed during installation and commissioning.

The following operating modes are possible due to the intelligent dual pump management system with one Wilo-Stratos MAXO-D twin-head pump or two Wilo-Stratos MAXO single pumps:

Main/standby operation
If the version-specific pump output is provided by one pump, the other pump remains available on standby for time-actuated switchover (24 hours of pure operating time) or fault-actuated switchover. Standby operation can be performed by all twin-head pumps and all single pumps (2 x identical type).

Parallel operation
If the version-specific pump output is provided by both pumps in parallel operation, power adjustments are made through synchronous operation of both pumps. Parallel operation can be performed by all twin-head pumps and all single pumps (2 x identical type).

3.8.2. Automatic venting of the pump

The Wilo-Stratos MAXO has automatic venting. The automatic pump venting function can be started while putting the pump into operation. This vents the pump hydraulics. All further pump adjustments can be made in parallel.

Venting of the entire distribution and consumer network must occur via the corresponding vent plugs.

3.8.3. Pump kick

In order to avoid impeller blockages when the pump is not operating for longer periods (e.g. an inactive heating system during summer), the pump regularly performs a pump kick in which it briefly starts up (factory setting). If the pump has no operational running time within a period of 24 hours, the pump kick is activated. The pump must have a constant voltage supply in order to carry out this function.

The time interval can be set on the pump between 1 and 24 hours.

3.8.4. Temperature sensor (internal)

A temperature sensor is installed in the suction channel of the pump housing. The sensor records either the feed or the return temperature, depending on the pump’s installation position. For the control modes T-const or ΔT-const the internal sensor can be used as actual value sensor. The temperature sensor is connected to the control module by means of a sensor cable. The fluid temperature is shown as a value in the display.

Notice:
The use of a PT1000 AA as feed and return temperature sensor is recommended for recording the heating/cooling quantity, as this provides a high temperature accuracy depending on the fluid temperature.

An immersion temperature sensor with suitable immersion sleeves is described in section 3.9 Accessories.

3.9. Accessories

In accordance with the application, its incorporation in other systems or the installation location, the following corresponding accessory components may be required:

- Diffusion-proof ClimaForm insulation for cold water application when cooling
- PT1000 AA immersion temperature sensor for heating/cooling
- PT1000 B pipe surface contact sensor to detect thermal disinfection in domestic hot water circulation
- Immersion sleeves for accommodating immersion temperature sensors
- Room user interface for hall temperature control
- Differential pressure sensor for the Δp-c index circuit evaluator
- CIF modules to connect to building automation via bus protocols

3.9.1. Thermal insulation for heating and domestic hot water circulation applications

The Wilo-Stratos MAXO single pump variants are equipped as standard with a thermal insulation shell for the prevention of heat losses through the pump housing. These are included in the Wilo-Stratos MAXO (-Z) on delivery and do not need to be ordered separately. This thermal insulation shell should only be used for fluid temperatures > 20 °C.

The insulating material used has the following properties:
- Environmental compatibility: easy to recycle
- Thermal resistance: up to 120 °C
- Heat transmission coefficient: 0.04 W/mK in accordance with DIN 52612
- Flammability: Class B2 in accordance with DIN 4102 (normal flammability)

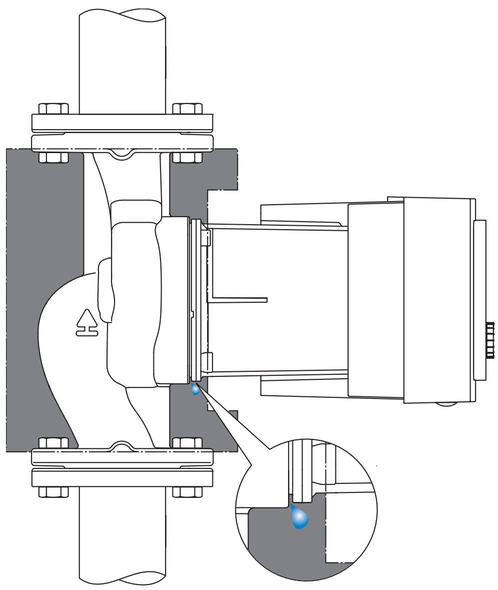
Normally flammable materials are permitted for use in heated rooms in Germany in accordance with fire prevention regulations as long as a minimum clearance of 20 cm is maintained between them and the fireplace.

3.9.2. Diffusion-proof insulation for cold water application when cooling

Wilo-Stratos MAXO single pumps can be insulated for use in cooling and air conditioning applications using Wilo cold water insulation shells (Wilo-ClimaForm) or any other commercially available, diffusion-proof insulation materials. There are no prefabricated cold water insulation shells for twin-head pumps. For this purpose, use commercially available, diffusion-proof insulation materials provided by the customer.

If the pump housing of the Wilo-Stratos MAXO is given diffusion-proof insulation on-site for cold water application with fluid temperatures < 20 °C with Wilo-ClimaForm, the insulation may not cover the drain labyrinth between pump housing and motor. This ensures that any condensate that has possibly accumulated in the motor can drain off freely through the condensate drain openings in the motor housing.

The cold water insulation shell ClimaForm has the following properties:
- Material: Elastomer material (AF/Armaflex)
- Colour: black
- Temperature resistance: -50 °C to +110 °C
- Steam diffusion resistance μ: ≥ 10000
- Fire rating: flame retardant, B-s3,d0 (in accordance with EN 13501-1)
- Thermal conductivity: 0.033 W/(m*K)
- Complies with RoHS and REACH
- Free from flame-retardant agent (HBCD)



Condensate drain opening in the motor housing

3.9.3. PT1000 AA immersion temperature sensor for heating/cooling with immersion sleeve

Immersion temperature sensor PT1000 AA for installation in an immersion sleeve is available for heating and cooling applications.

The connection to the Wilo-Stratos MAXO to detect the fluid temperature in the case of temperature-dependent pump control or for heating/cooling quantity measurement is made using either the AI 1 or AI 2 analogue inputs, which can be adjusted to accommodate connection type PT1000.

Technical data of the PT1000 AA:
→ Tolerance class AA in accordance with DIN EN 60751
→ Cable length 3 m

In order to install the immersion temperature sensor in the piping, immersion sleeves are available in two lengths as accessories:
→ Immersion sleeve with length of engagement 45 mm for pipe diameter of DN 25 to approx. DN 50
→ Immersion sleeve with length of engagement 100 mm for pipe diameter of approx. DN 65 to DN 100

Tolerances PT1000 AA	
Temperature in °C	Accuracy in °C
10	+/- 0.117
20	+/- 0.134
30	+/- 0.151
40	+/- 0.168
50	+/- 0.185
60	+/- 0.202
70	+/- 0.219
80	+/- 0.236
90	+/- 0.253

Technical data of the immersion sleeves:
→ Pipe connection G ½ with width across flats AF 21
→ PG 7 clamping ring screw connection with width across flats AF 13 to fix the temperature sensor in the immersion sleeve
→ Outer diameter of the measurement pipes 8 mm

3.9.4. PT1000 B pipe surface contact sensor to detect thermal disinfection

When used for domestic hot water circulation, the Wilo-Stratos MAXO-Z can detect when heating starts in the hot water tank for thermal disinfection purposes. To achieve this, a temperature sensor must be attached to the pipe at the tank's hot water outlet. An immersion temperature sensor is not necessary.

The connection to the Wilo-Stratos MAXO-Z to detect the hot water outlet temperature is made using either the AI 1 or AI 2 analogue inputs, which can be adjusted to accommodate connection type PT1000.

Technical data of the PT1000 B:
→ Tolerance class B in accordance with DIN EN 60751
→ Cable length 5 m

Tolerances PT1000 B	
Temperature in °C	Accuracy in °C
10	+/- 0.35
20	+/- 0.4
30	+/- 0.45
40	+/- 0.5
50	+/- 0.55
60	+/- 0.6
70	+/- 0.65
80	+/- 0.7
90	+/- 0.75

3.9.5. Room user interface for hall temperature control T-const

For the Wilo-Stratos MAXO's hall temperature control T-const, a room user interface can be connected to the pump to transmit the actual temperature value as passive PT1000 or as active current- or voltage-controlled signal.

Wilo does not offer a room user interface of its own that can be used to set the desired setpoint temperature in the hall. The following commercially available room user interfaces are examples of models that can be used for this purpose:

- → User interfaces in the WRF series produced by Thermokon with 0 – 10 V signal (e.g. WRF04 P TRV3, active potentiometer, item no. 208864)
- → User interface produced by Oventrop (accessory for Regtronic RH) with PT1000 (item no. 1152096)

The connection of the room user interface to the Wilo-Stratos MAXO is established using either the AI 1 or AI 2 analogue inputs, which can be adjusted to accommodate connection type PT1000 or a current- or voltage-controlled signal (0/2 – 10 V or 0/4 – 20 mA). When using a current- or voltage-controlled connection type, the transfer curve must be adjusted to the sensor's measurement range if necessary.

3.9.6. Differential pressure sensor for the Δp-c index circuit evaluator

A differential pressure sensor is connected to the Wilo-Stratos MAXO in order to facilitate the Δp-c index circuit evaluator. The distance between the Stratos MAXO and the hydraulically unfavourable location in the pipe network, where the desired differential pressure should be maintained, is usually considerable. Differential pressure sensors with the 4 – 20 mA signal are therefore recommended.

The differential pressure sensor is connected to the Wilo-Stratos MAXO using either the AI 1 or AI 2 analogue inputs, which can be adjusted to accommodate the 4 – 20 mA signal.

The following differential pressure sensors available from Wilo can be connected directly to the Wilo-Stratos MAXO for differential pressure-sensitive continuous speed control:

- → Differential pressure-sensor DDG 4 (4 – 20 mA) for a measurement range of 0 – 0.4 bar
- → Differential pressure-sensor DDG 10 (4 – 20 mA) for a measurement range of 0 – 1 bar
- → Differential pressure-sensor DDG 20 (4 – 20 mA) for a measurement range of 0 – 2 bar

3.9.7. CIF module for bus connection to building automation

The required, retrofittable interface module is used for the connection to building automation via a bus protocol. The CIF modules listed in the table are optionally available for various bus protocols:

CIF module types	BACnet	CANopen	LON	Modbus RTU	PLR
Line type	Bus cable, twisted in pairs, braided shield, 120 Ω characteristic impedance	CAN bus cable, twisted in pairs, shielded, 1 x 2 x 0.5 mm², 120 Ω characteristic imped-ance (line type B in accordance with TIA 485-A)	Twisted in pairs, shielded	Bus cable, twisted in pairs, braided shield, 120 Ω characteristic impedance	Twisted in pairs, shielded
Line length	1000 m	200 m	900 m (bus topol-ogy with max. 3 m spur line); 500 m (free topology, max. 250 m between communicating consumers)	1000 m	200 m
Spur line	Not permitted	Max. 10 m, max. total 50 m	See line length	Not permitted	Not permitted
Terminal cross-section	1.5 mm²	1.5 mm²	1.5 mm²	1.5 mm²	1.5 mm²
Interface	RS485 (TIA-485A), insulated	CAN in accordance with ISO 11898-2, insulated	TP/FT 10	RS485 (TIA-485A), insulated	Wilo specific, insulated
Speed	9600, 19200, 38400, 76800 kBit/s	125 kBit/s, constant	78 kBit/s, constant	2400, 9600, 19200, 38400, 115200 kBit/s	Constant
Format	Constant	-	-	- 8 data bits, -no/even/odd parity -1/2 stop bit (2 only without parity)	-
Protocol	BACnet MS/TP Version 1 Revision 4	CANopen in accordance with CiA DS301 V 4.02	LonMark Layers 1 – 6 Interoperability Guidelines 3.2	Modbus RTU	PLR
Profile	BACnet Smart Sensor, Smart Actuator (B SS, B SA)	-	Pump Controller: 8120	-	-
Data items as control commands to the pump	→ Setpoints for control modes Δp-v, Δp-c, n-const → Pump On/Off → Setback operation				
Data items as a signal from the pump	→ Actual delivery head value → Actual speed value → Actual volume flow value → Actual electricity consumption value → Actual electrical power value → Operating hours → Detailed error and status signals → Actual heating quantity value (from SW 1.03.21.01) → Actual cooling quantity value (from SW 1.03.21.01) → Actual feed temperature value (from SW 1.03.21.01) → Actual return temperature value (from SW 1.03.21.01) →				

Exact data points see data point description of the respective bus system (www.wilo.de/automation and www.wilo.com/automation)

The “smart boiler room” in the new building of the European Training Centre for the Housing and Real Estate Industry (Europäisches Bildungszentrum der Wohnungs- und Immobilienwirtschaft, EBZ) in Bochum is intended to show how energy-efficient technology can become even more energy-efficient – thanks to intelligent connectivity. An important part of the pioneering research project: the Wilo-Stratos MAXO, the pump that thinks for itself.

4. Installation

4.1. Hydraulic installation

4.1.1. Pipe installation

Screw-end pumps
Wilo-Stratos MAXO screw-end pumps are equipped with connecting threads in G 1 ½ or G 2 depending on their size, according to DIN EN ISO 228 Part 1. Gaskets are included in the scope of delivery. Threaded pipe unions with pipe thread in accordance with DIN EN 10226-1 must be ordered separately. The following screwed connections are available for Wilo-Stratos MAXO screw-end pumps:

Screwed connections with union inserts with female thread to connect to threaded pipes with Whitworth pipe thread DIN EN 10226-1 (pipe thread sealing in the thread)

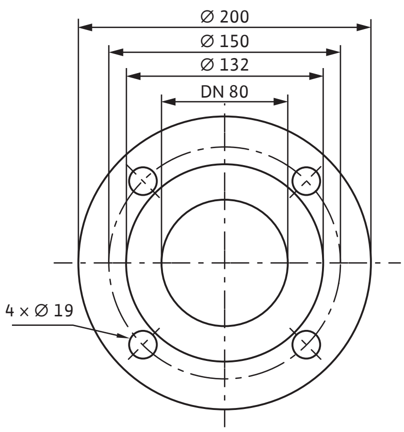
→ Rp 1 x G 1 ½
→ Rp 1 ¼ x G 2

Threaded adapters, Wilo-R:
For the length compensation of pipe adaptors, Wilo-R threaded adapters are available in various lengths and in thread sizes G 1 ½ and G 2 on the pump side and R 1 ½, R 2 and R 2 ¼ on the pipe side. These are also available in brass for drinking water screw-end pumps. See catalogue/accessories for details.

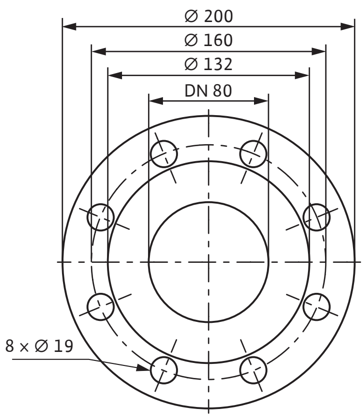
Brass screwed connections are available for Wilo-Stratos MAXO-Z screw-end pumps in domestic hot water circulation. Connection male thread R 1 and R 1 ¼ to the piping, pump connection in G 1 ½ and G 2.

Flange-end pumps
Wilo-Stratos MAXO flange-end pumps are configured in DN 32 to DN 100. The standard versions in nominal sizes DN 32 to DN 65 have combination flanges in PN 6/10.

In nominal sizes DN 80 and DN 100, the flange standard versions PN 6 and PN 10 are available. Special versions of pumps DN 32 to DN 100 are also available in PN 16.



Flange PN 6 for DN 80x

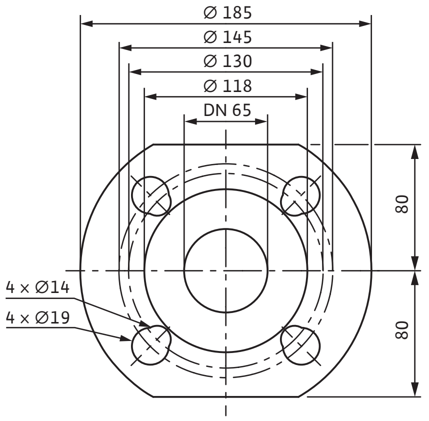


Flange PN 10 for DN 80

A detailed description of the installation and commissioning is documented in the installation and operating instructions associated with this product. This can be consulted amongst others on the Wilo website. All details on the individual pump types can be found here.

Combination flange pumps

Flange-end pumps with combination flanges can be mounted with counter flanges PN 6 and PN 16 in accordance with DIN or DIN EN up to and including DN 65. The installation of a combination flange with a combination flange is not permitted. Screws with a strength class of 4.6 or higher are to be used for the flange connections. The washers included in the scope of delivery must be installed between the screw/nut head and the combination flange.



Example combination flange PN 6/10 for DN 65

Flanged rings Wilo-RF:

The Wilo-RF flanged rings are – a few exceptions aside – intended for length compensation with PN 6 flanges. The piping has to be changed for length compensation with PN 10/16 flanges. Flanged rings on the pump side are available in G 1 ½ and G 2, while connections on the piping side are available from DN 25 to DN 50. See catalogue for details.

Flange-end pumps PN 6			
	DN 32	DN 40	DN 50
Screw diameter		M12	
Strength class		≥ 4.6	
Tightening torque		40 Nm	
Screw length	≥ 55 mm	≥ 60 mm	
	DN 65	DN 80	DN 100
Screw diameter		M16	
Strength class		≥ 4.6	
Tightening torque		95 Nm	
Screw length	≥ 60 mm	≥ 70 mm	

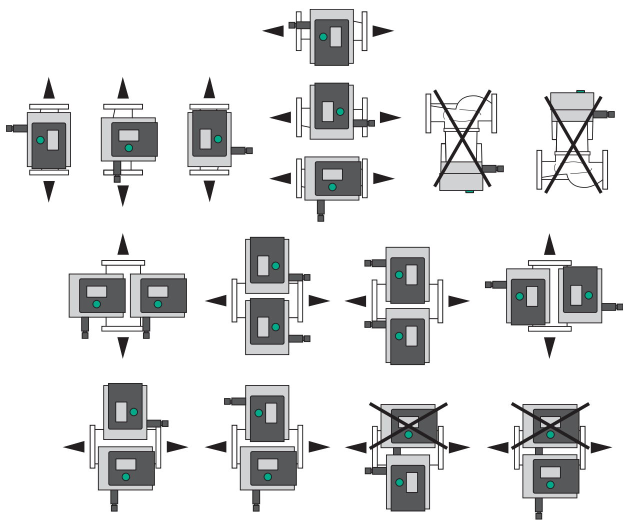
Flange-end pumps PN 6			
	DN 32	DN 40	DN 50
Screw diameter		M16	
Strength class		≥ 4.6	
Tightening torque		95 Nm	
Screw length	≥ 60 mm	≥ 65 mm	
	DN 65	DN 80	DN 100
Screw diameter		M16	
Strength class		≥ 4.6	
Tightening torque	95 Nm	95 Nm	
Screw length	≥ 65 mm	≥ 70 mm	

Installation in the feed of open systems

Branch off the safety feed ahead of the pump when installing in feed of open systems (EN 12828).

4.1.2. Permitted installation positions

The Wilo-Stratos MAXO can be installed in the positions listed below. Impermissible positions are also shown.

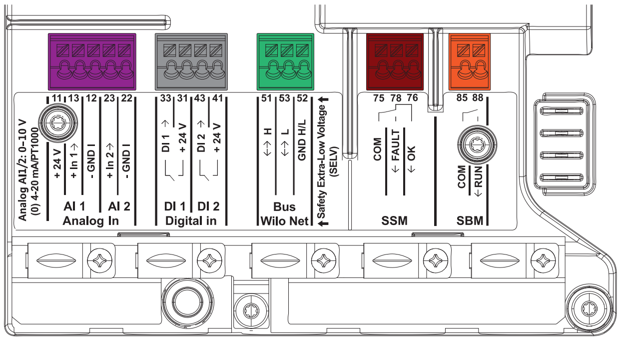


4.1.3. Installation dimensions

The pump dimensions must be considered when installing the Wilo-Stratos MAXO with distributors and in piping systems, so that the clearances around distribution outlets and with surrounding components are taken into account.

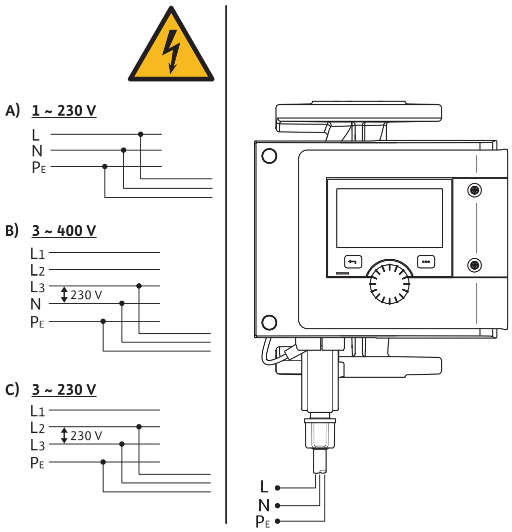
4.2. Electrical connections and interfaces

The Wilo-Stratos MAXO has a clearly-arranged terminal room, which is located behind the large display. The display is easily removed, enabling access to the terminal room. It contains all electrical cabling connections.



Terminal room of the Wilo-Stratos MAXO

4.2.1. Electrical mains connection



The pump can be connected to power supplies with the following voltage ratings:
1~ 230 V
3~ 400 V with neutral conductor
3~ 230 V
3~ 400 V without neutral conductor (upstream mains transformer)

- → The minimum back-up fuse must be 16 A, slow-blow or a circuit breaker with C characteristic.
- → For twin-head pumps, both motors must be separately connected and fused.
- → Connect to 230 V low-voltage networks. When connecting to IT networks (Isolé Terre electrical system), always make sure that the voltage between the live wires (L1-L2, L2-L3, L3-L1) does not exceed 230 V. In case of error (ground fault), the voltage between the live wire and PE must not exceed 230 V.
- → When switching the pump on or off using an external control device, deactivate any mains voltage pulse (e.g. burst-fired control)!
- → Switching the pump via triacs/solid-state relays must be examined on a case-by-case basis.
- → Make sure that the SELV lines have a maximum voltage of 24 V!
- → During deactivation with on-site power relay: Rated current ≥ 10 A, rated voltage 250 V AC. Irrespective of the rated current consumption of the pump, inrush peak currents of up to 10 A may occur when the power supply is activated!
- → The switching frequency must be taken into account:
- → Switching on/off via mains voltage ≤ 100/24 h
- → Switching on/off via Ext. Off, 0 – 10 V, or via bus communication ≤ 20/h (≤ 480/24 h)
- → For the electrical fuse protection of the Wilo-Stratos MAXO, the local legal installation provisions issued by the legislator and the provisions of the local energy supplier must be observed.
- → The leakage current of the Wilo-Stratos MAXO is $I_{eff} \leq 3.5$ mA
- → The electrical connection must be made via a fixed connecting cable equipped with a connector device or an all-pole switch with a contact opening width of at least 3 mm (VDE 0700/Part 1).

4.2.2. Motor protection

The standard integrated motor protection device reliably protects the pump, in all settings, against excess temperature, excess current and blocking. This has the following advantage:

No external motor protection switch is required.

The connection instructions of the local energy supply companies must be observed.

If, in the case of replacement, there is a motor protection switch in the electrical installation that cannot be bridged, then it is to be set to the maximum current specified on the rating plate.

4.2.3. Connection analogue inputs AI 1 and AI 2

The following signals can be connected to the analogue inputs:

- PT1000
- 0 – 10 V
- 2 – 10 V
- 0 – 20 mA
- 4 – 20 mA

They must be configured to the corresponding signal when the pump is commissioned.

The analogue input has a terminal to supply active sensors with 24 V DC.

- Maximum current load: 50 mA
- Electric strength: 30 V DC/24 V AC
- Analogue input load at (0) 4 – 20 mA: ≤ 300 Ω
- Load resistance at 0 – 10 V: ≥ 10 kΩ

Connection of external temperature sensors
A 2-wire PT1000 temperature sensor can for example be connected to one of the two analogue inputs, AI 1 or AI 2. In the settings menu of the Wilo-Stratos MAXO, the analogue input can be configured for the respective type of use, here PT1000 as actual value sensor. Furthermore, the position in the pipe network (e.g. feed sensor or return sensor) can be adjusted. A second temperature sensor can also be configured accordingly via the second analogue input.

If the temperature sensor or sensors is/are at a large distance from the pump, the fact that the line resistance will distort the measured values must be taken into account. As a result, the longer the supply line is to the sensor, the higher the measured temperatures become. In this case, it is recommended to use an active temperature sensor with voltage- or current-controlled signal.

Connection 0 – 10 V / 2 – 10 V – Contact
A 2-wire cable for an external 0 – 10 V / 2 – 10 V signal from e.g. a heat generator or an active sensor is connected to one of the two analogue inputs, AI 1 or AI 2. The input to be used can be freely selected. The selected analogue input is configured for its respective use as a voltage-controlled setpoint sensor via the display in the settings menu of the pump.

For the 2 – 10 V signal type, a value under 2 V can be detected as a cable break. The pump then runs at a previously specified emergency speed and reports a warning.

Connection 0 – 20 mA / 4 – 20 mA – Contact
A 2-wire cable for an external 0 – 20 mA / 4 – 20 mA signal from e.g. a differential pressure sensor is connected to one of the two analogue inputs, AI 1 or AI 2. The input to be used can be freely selected. The selected analogue input is configured for its respective use as a current-controlled setpoint sensor in the settings menu of the pump. For the 4 – 20 mA signal type, a value under 4 mA can be detected as a cable break. The pump then runs at a previously specified emergency speed and reports a warning.

4.2.4. Digital input connection DI 1 and DI 2

The pump can be controlled with the following functions via external potential-free contacts at the DI 1 or DI 2 digital inputs:

- External OFF
- External MAX
- External MIN
- External key lock
- External MANUAL
- Switching heating/cooling

In systems with a high switching frequency (> 100 on/off operations per day), on/off switching takes place via External OFF and not via the mains voltage. External OFF is recommended as the pump kick remains functional.

4.2.5. Connection of potential-free contact for SSM and SBM

If the pump transmits a collective fault signal (SSM) and a collective run signal (SBM) to the building management system, a 2-wire cable connects the potential-free contact to the SSM and SBM inputs. The outputs' behaviour is configured via the display in the settings menu of the pump:

- SSM as a potential-free changeover contact (signal only when error has occurred or when warning is given) or
- SBM as a potential-free normally open (NO) contact (signal for power supply, ready for operation or in operation, or motor running)

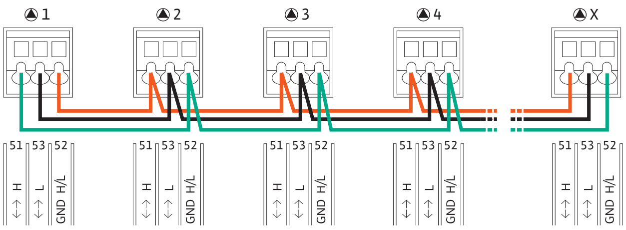
Contact load:
- Permitted minimum: SELV 12 V AC/DC, 10 mA
- Permitted maximum: 250 V AC, 1 A, AC 1 / 30 V DC, 1 A

4.2.6. Connection bus system Wilo Net

Wilo Net is a Wilo system bus intended for communication between Wilo products, e.g. to establish communication between two single pumps (installed in parallel in one y-pipe installation) as twin-head pumps (twin-head pump function) or several pumps in connection with the Multi-Flow Adaptation control mode or to establish the connection between gateway and pump.

In order to establish the Wilo Net connection, the three Wilo Net terminals (H, L, GND) must be wired with a communication cable from pump to pump. Incoming and outgoing cables are clamped in a terminal.

Possible cable for Wilo Net communication:
→ J-Y(St)Y 2x2x0.6 telecommunications cable



Pump	Wilo Net termination	Wilo Net address
Pump 1	switched on	1
Pump 2	switched off	2
Pump 3	switched off	3
Pump 4	switched off	4
Pump X	switched on	X

Observe the following for the bus topology:
The pumps communicating with one another are installed in series in a topology line. All bus participants must be assigned an individual Wilo Net address that is set in the Wilo-Stratos MAXO menu (Wilo Net setting). The bus must additionally be terminated at the first and last Wilo-Stratos MAXO in the topology line. This is configured in the menu of both of these pumps (Wilo Net setting). The termination must not be activated for all other pumps in the line.

Number of Wilo Net participants
In the Wilo Net, a maximum of 11 participants can communicate with each other, each individual node counts as a participant here. I.e., a twin-head pump consists of two participants. Integration of a Wilo Smart Gateway also requires a separate node.

Example 1: If a Multi-Flow Adaptation system is made up exclusively of twin-head pumps, this means a maximum of 5 twin-head pumps can communicate with each other via Wilo Net in the MFA network.

Example 2: The primary pump of a Multi-Flow Adaptation system is a twin-head pump and the whole system should be able to be remotely monitored via a gateway.

→ Primary twin-head pump = 2 participants (e.g. ID 1 and 2)
→ Wilo-Smart Gateway = 1 participant (e.g. ID 11)

A maximum of 8 pumps remain on the secondary side in the MFA system (ID 3 to 10).

In the Wilo Net settings, the Wilo Net ID address range is shown as adjustable from 1 – 126. Nevertheless, only the ID address range from 1 – 11 is available for a functioning Wilo Net connection between pumps and accessories (accordingly, a maximum of 11 participants can communicate in Wilo Net). Higher IDs mean that Wilo Net participants with higher IDs cannot communicate correctly with the other participants.

The smallest Wilo Net "communication network" consists of two participants (e.g. with twin-head pumps or two single pumps as twin-head pump). Usually the participants are then operated with ID 1 and ID 2. However, any other combination of IDs 1 to 11 is possible as long as both IDs are different.

4.2.7. Installation and cabling of CIF module

The CIF module with the requisite bus protocol to connect to the building automation is inserted into the designated slot in the terminal room of the Wilo-Stratos MAXO and wired-up accordingly.

4.2.8. Bluetooth radio interface

The Wilo-Stratos MAXO has a Bluetooth interface for connecting to mobile devices. Using the WiloSmart Connect app and a smartphone, you can operate and adjust the pump and read out pump data. Bluetooth is active by factory default and can, if required, be deactivated via the Settings / Device settings / Bluetooth menu.

Technical data:
→ Frequency band: 2400 MHz – 2483.5 MHz
→ Maximum radiated transmission power: < 10 dBm (EIRP)

Available additional control functions: Heating

Pre-defined applications in the settings assistant (heating)					
System type / control mode	**Setback operation**	**No-Flow Stop**	**Q-Limit$_{Max}$**	**Q-Limit$_{Min}$**	**Detection of disinfection**
Radiator					
Differential pressure Δp-v	x	x	x		
Dynamic Adapt plus	x				
Hall temperature T-const	x		x		
Underfloor heating					
Differential pressure Δp-c	x	x	x		
Dynamic Adapt plus	x				
Hall temperature T-const	x		x		
Ceiling heating					
Differential pressure Δp-c	x	x	x		
Dynamic Adapt plus	x				
Hall temperature T-const	x		x		
Fan heater					
Differential pressure Δp-v	x	x	x		
Dynamic Adapt plus	x				
Hall temperature T-const	x		x		
Hydraulic shunt					
Feed temperature T-const			x		
Return Δ-T			x	x	
Multi-Flow Adaptation				x	
Heat exchanger					
Feed temperature T-const			x		
Feed Δ-T			x	x	
Multi-Flow Adaptation				x	

Applications for the basic control modes (heating)					
System type / control mode	**Setback operation**	**No-Flow Stop**	**Q-Limit$_{Max}$**	**Q-Limit$_{Min}$**	**Detection of disinfection**
Basic control modes					
Differential pressure Δp-c	x	x	x	x	
Differential pressure Δp-v	x	x	x	x	
Index circuit Δp-c	x	x	x	x	
Dynamic Adapt plus	x				
Volume flow Q-const	x				
Multi-Flow Adaptation				x	
Temperature T-const	x	x	x	x	
Temperature ΔT-const	x	x	x	x	
Speed n-const	x	x	x	x	

X: available
X: fixed activation additional control functions
Notice: The additional control functions No-Flow Stop und Q-Limit$_{Min.}$ cannot be active simultaneously.

Available additional control functions: Drinking water

Pre-defined applications in the settings assistant (drinking water)					
System type / control mode	**Setback operation**	**No-Flow Stop**	**Q-Limit$_{Max}$**	**Q-Limit$_{Min}$**	**Detection of disinfection**
Drinking water (circulation)					
Temperature T-const			x	x	x
Clean water storage facility					
Charge pump ΔT			x	X (green)	
Storage facility charging temperature			x	X (green)	
Multi-Flow Adaptation					

Applications for the basic control modes (drinking water)					
System type / control mode	**Setback operation**	**No-Flow Stop**	**Q-Limit$_{Max}$**	**Q-Limit$_{Min}$**	**Detection of disinfection**
Basic control modes					
Differential pressure Δp-c		x	x	x	
Differential pressure Δp-v		x	x	x	
Index circuit Δp-c		x	x	x	
Volume flow Q-const					
Multi-Flow Adaptation				x	
Temperature T-const		x	x	x	
Temperature ΔT-const		x	x	x	
Speed n-const		x	x	x	

X: available
X (green): fixed activation additional control functions
Notice: The additional control functions No-Flow Stop und Q-Limit$_{Min.}$ cannot be active simultaneously.

Available additional control functions: Cooling

Pre-defined applications in the settings assistant (cooling)					
System type / control mode	**Setback operation**	**No-Flow Stop**	**Q-Limit$_{Max}$**	**Q-Limit$_{Min}$**	**Detection of disinfection**
Ceiling cooling					
Differential pressure Δp-v		x	x		
Dynamic Adapt plus					
Hall temperature T-const			x		
Underfloor cooling					
Differential pressure Δp-c		x	x		
Dynamic Adapt plus					
Hall temperature T-const			x		
Air-conditioning device					
Differential pressure Δp-c		x	x		
Dynamic Adapt plus	x				
Hall temperature T-const			x		
Hydraulic shunt					
Feed temperature T-const			x		
Return Δ-T			x	x	
Multi-Flow Adaptation				x	
Heat exchanger					
Feed temperature T-const			x		
Feed Δ-T			x	x	
Multi-Flow Adaptation				x	

Application for the basic control modes (cooling)					
System type / control mode	**Setback operation**	**No-Flow Stop**	**Q-Limit$_{Max}$**	**Q-Limit$_{Min}$**	**Detection of disinfection**
Basic control modes					
Differential pressure Δp-c		x	x	x	
Differential pressure Δp-v		x	x	x	
Index circuit Δp-c		x	x	x	
Dynamic Adapt plus					
Volume flow Q-const					
Multi-Flow Adaptation				x	
Temperature T-const		x	x	x	
Temperature ΔT-const		x	x	x	
Speed n-const		x	x	x	

X: available
X: fixed activation additional control functions
Notice: The additional control functions No-Flow Stop und Q-Limit$_{Min.}$ cannot be active simultaneously.

Available additional control functions: Basic control modes

Applications for the basic control modes					
System type / control mode	**Setback operation**	**No-Flow Stop**	**Q-Limit$_{Max}$**	**Q-Limit$_{Min}$**	**Detection of disinfection**
Basic control modes					
Differential pressure Δp-c	x	x	x	x	
Differential pressure Δp-v	x	x	x	x	
Index circuit Δp-c	x	x	x	x	
Dynamic Adapt plus	x				
Volume flow Q-const	x	x			
Multi-Flow Adaptation	x	x	x	x	
Temperature T-const	x	x	x	x	
Temperature ΔT-const	x	x	x	x	
Speed n-const	x	x	x	x	
PID control	x	x	x	x	

X: available
X: fixed activation additional control functions
Notice: The additional control functions No-Flow Stop und Q-Limit$_{Min.}$ cannot be active simultaneously.

Recommended applications: Standard boiler (hydraulic separation via shunt or heat exchanger)

	Secondary circuit				Primary circuit	
	Radiator	Underfloor heating	Ceiling heating	Fan heater	Hydraulic shunt	Heat exchanger
Pressure control						
Differential pressure Δp-c	+	++	++	+	+	+
Differential pressure Δp-v	++	+	+	++	-	-
Index circuit Δp-c	+	+	+	+	-	-
Dynamic Adapt plus	++	++	++	++	-	-
Temperature controller T-const						
Hall temperature	+	+	++	++	-	-
Primary feed temperature	-	-	-	-	-	-
Primary return temperature	+	+	+	+	+	+
Secondary feed temperature	-	-	-	-	+	+
Secondary return temperature	-	+	+	+	+	+
Temperature controller ΔT-const						
Primary and secondary feed	-	-	-	-	+	++
Primary and secondary return	-	-	-	-	++	++
Primary circuit feed and return	-	-	-	-	+	+
Secondary circuit feed and return	-	-/+*	-/++*	-	+	+
Flow rate control						
Volume flow Q-const	-	-/+*	-	-	+	+
Multi-Flow Adaptation	-	-	-	-	+	+
Speed n-const	+	-	+	+	+	+
more						
PID control	+	+	+	+	+	+

+/++: Stored in the settings assistant
++: Application recommended
+: Application possible
-: Application not recommended
* If no hydraulic control devices are used

Recommended applications: Energy value (hydraulic separation via shunt or heat exchanger)

	Secondary circuit				Primary circuit	
	Radiator	Underfloor heating	Ceiling heating	Fan heater	Hydraulic shunt	Heat exchanger
Pressure control						
Differential pressure Δp-c	+	++	++	+	+	+
Differential pressure Δp-v	++	+	+	++	–	–
Index circuit Δp-c	+	+	+	+	–	–
Dynamic Adapt plus	++	++	++	++	–	–
Temperature controller T-const						
Hall temperature	+	+	++	++	–	–
Primary feed temperature	–	–	–	–	–	–
Primary return temperature	+	+	+	+	+	+
Secondary feed temperature	–	–	–	–	+	+
Secondary return temperature	–	+	+	+	–	–
Temperature controller ΔT-const						
Primary and secondary feed	–	–	–	–	++	++
Primary and secondary return	–	–	–	–	+	+
Primary circuit feed and return	–	–	–	–	+	+
Secondary circuit feed and return	–	– / ++*	– / ++*	–	+	+
Flow rate control						
Volume flow Q-const	–	– / +*	–	–	+	+
Multi-Flow Adaptation	–	–	–	–	+	+
Speed n-const	+	+	+	+	+	+
more						
PID control	+	+	+	+	+	+

+/++: Stored in the settings assistant
++: Application recommended
+: Application possible
–: Application not recommended
* If no hydraulic control devices are used

Recommended applications: Primary circuit – Secondary circuit (hydraulically not separated)

	Radiator	Underfloor heating	Ceiling heating	Fan heater
Pressure control				
Differential pressure Δp-c	+	++	++	+
Differential pressure Δp-v	++	+	+	++
Index circuit Δp-c	+	++	++	+
Dynamic Adapt plus	++	++	++	++
Temperature controller T-const				
Hall temperature	++	+	++	++
Feed temperature	–	–	–	–
Return temperature	+	+	+	+
Feed and return	+	+	+	+
Temperature controller ΔT-const				
Primary and secondary feed	–	– / +*	–	+
Flow rate control				
Volume flow Q-const	+	+	+	+
Speed n-const	+	+	+	+
more				
PID control	+	+	+	+

+/++: Stored in the settings assistant
++: Application recommended
+: Application possible
–: Application not recommended
* If no hydraulic control devices are used energy value
(hydraulic separation via shunt or heat exchanger)

Recommended applications: Heat pump

	Secondary circuit				Primary circuit	
	Radiator	Underfloor heating	Ceiling heating	Fan heater	Hydraulic shunt	Heat exchanger
Pressure control						
Differential pressure Δp-c	+	++	++	+	+	+
Differential pressure Δp-v	++	+	+	++	-	-
Index circuit Δp-c	+	+	+	+	-	-
Dynamic Adapt plus	++	++	++	++	-	-
Temperature controller T-const						
Hall temperature	+	+	++	++	-	-
Primary feed temperature	-	-	-	+	-	-
Primary return temperature	+	+	+	+	-	-
Secondary feed temperature	-	-	+	+	+	+
Secondary return temperature	-	+	+	+	+	+
Temperature controller ΔT-const						
Primary and secondary feed	-	-	-	-	+	+
Primary and secondary return	-	-	-	-	++	+
Primary circuit feed and return	-	-	-	-	+	+
Secondary circuit feed and return	-	- / ++*	- / ++*	-	+	+
Flow rate control						
Volume flow Q-const	-	- / +*	-	+	+	+
Multi-Flow Adaptation	-	-	-	-	+	+
Speed n-const	+	+	+	+	+	+
more						
PID control	+	+	+	+	+	+

+/++: Stored in the settings assistant
++: Application recommended
+: Application possible
-: Application not recommended
* If no hydraulic control devices are used

Recommended applications: CHP plant

	Secondary circuit				Primary circuit	
	Radiator	Underfloor heating	Ceiling heating	Fan heater	Hydraulic shunt	Heat exchanger
Pressure control						
Differential pressure Δp-c	+	++	++	+	+	+
Differential pressure Δp-v	++	-	+	++	-	-
Index circuit Δp-c	+	+	+	+	-	-
Dynamic Adapt plus	++	++	++	++	-	-
Temperature controller T-const						
Hall temperature	+	+	++	++	-	-
Primary feed temperature	-	-	-	-	-	-
Primary return temperature	+	+	+	+	+	+
Secondary feed temperature	-	-	-	-	++	++
Secondary return temperature	+	+	+	+	-	-
Temperature controller ΔT-const						
Primary and secondary feed	-	-	-	-	+	++
Primary and secondary return	-	-	-	-	++	+
Primary circuit feed and return	-	-	-	-	+	+
Secondary circuit feed and return	-	-/++*	-/++*	-	+	+
Flow rate control						
Volume flow Q-const	-	-/+*	-	+	+	+
Multi-Flow Adaptation	-	-	-	-	+	+
Speed n-const	+	+	+	+	+	+
more						
PID control	+	+	+	+	+	+

+/++: Stored in the settings assistant
++: Application recommended
+: Application possible
-: Application not recommended
* If no hydraulic control devices are used

Recommended applications: District heat

	Secondary circuit				Primary circuit	
	Radiator	Underfloor heating	Ceiling heating	Fan heater	Hydraulic shunt	Heat exchanger
Pressure control						
Differential pressure Δp-c	+	++	++	+	+	+
Differential pressure Δp-v	++	-	+	++	-	-
Index circuit Δp-c	+	+	+	+	-	-
Dynamic Adapt plus	++	++	++	++	-	-
Temperature controller T-const						
Hall temperature	+	+	++	++	-	-
Primary feed temperature	-	-	-	-	-	-
Primary return temperature	+	+	+	+	+	+
Secondary feed temperature	-	-	-	-	-	-
Secondary return temperature	+	+	+	+	-	-
Temperature controller ΔT-const						
Primary and secondary feed	-	-	-	-	++	++
Primary and secondary return	-	-	-	-	+	+
Primary circuit feed and return	-	-	-	-	+	+
Secondary circuit feed and return	-	- / ++*	- / ++*	-	+	+
Flow rate control						
Volume flow Q-const	-	- / +*	-	+	+	+
Multi-Flow Adaptation	-	-	-	-	+	+
Speed n-const	+	+	+	+	+	+
more						
PID control	+	+	+	+	+	+

+/++: Stored in the settings assistant
++: Application recommended
+: Application possible
-: Application not recommended
* If no hydraulic control devices are used

Recommended applications: Refrigerating machine

	Secondary circuit			Primary circuit	
	Ceiling cooling	Underfloor cooling	Air-conditioning device	Hydraulic shunt	Heat exchanger
Pressure control					
Differential pressure Δp-c	++	++	+	+	+
Differential pressure Δp-v	-	-	++	-	-
Index circuit Δp-c	+	+	+	-	-
Dynamic Adapt plus	+	+	+	-	-
Temperature controller T-const					
Hall temperature	+	+	+	-	-
Primary feed temperature	-	-	-	-	-
Primary return temperature	-	-	-	++	++
Secondary feed temperature	-	-	-	++	++
Secondary return temperature	-	-	-	+	+
Temperature controller ΔT-const					
Primary and secondary feed	-	-	-	+	+
Primary and secondary return	-	-	-	+	+
Primary circuit feed and return	-	-	-	+	+
Secondary circuit feed and return	++	++	++	+	+
Flow rate control					
Volume flow Q-const	+	+	+	+	+
Multi-Flow Adaptation	-	-	-	+	+
Speed n-const	+	+	+	+	+
more					
PID control	+	+	+	+	+

+/++: Stored in the settings assistant
++: Application recommended
+: Application possible
-: Application not recommended
* If no hydraulic control devices are used

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The new Wilo-Assistant: The app for everyone.

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